Considering a Concave Local Demand Curve

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ISO New England, Markets Committee
Some general thoughts about local demand curves...

» Shifting any curve left or right shifts the equilibrium supply, and that shifts all performance measures (LOLE, % below various thresholds)

» The interaction between local and rest of system (ROS) in terms of shortfalls and reliability poses challenges
  › The Brattle modeling is very helpful in exploring this local/ROS interaction
  › This interaction drives toward a steeper local curve

» The Brattle modeling holds constant other critical assumptions that will be affected by the demand curve shape
  › Assumed equilibrium
  › Standard deviation of supply and demand shocks
  › Bidding behavior of suppliers and slope of supply curve
  › Actions of the ISO
Concave Curve Parameters

- I believe problems of market power are rampant in capacity auction markets
  - And even worse in local areas
  - Monitoring is important and helpful, but reducing incentives is important

- In balancing the need for a steep curve for local/ROS interaction, and a flat curve for market power, the concave approach provides the best option
  - Reduces market power at higher prices
  - Introduces unpredictability in price-response (since it depends on slope of demand curve and interaction with local/ROS), which reduces market power generally
  - Could produce more bidding below net CONE
  - Maintains reliability and addresses the ROS issues
Concave Curve

» Concave curve:
  › Matches ISO proposal below net CONE
  › Knee or cap at 96% of ISO proposal

» While modeled outcome is similar to ISO proposal, the change in slope will change bidding incentives
Market Power in Local Areas

» Break even analysis provides insight to market power
  › Size of portfolio where withholding 1 MW results in same profits, assuming no costs and no alternative revenues
  › Grossly understates incentive to withhold, given Performance Incentives, reconfiguration auctions and tacit cooperation

» Kink in Concave curve produces discontinuity and disincentive for high price bidding

» Heightened incentive for bidding below net CONE
Concave Curve Impacts ROS Market Power

- Congestion changes ROS:
  - Reduces market size
  - Changes slope of demand curve
  - Changes incentives to withhold

- Congestion combinations are difficult to predict

- All curves in graph are based on Concave curve only; both ISO and Concave curve identical below net CONE and break-even withholding line for ISO demand curve is continuous at higher prices

**Slopes of Demand Curves ($/KW-Month/100 MWs)**

<table>
<thead>
<tr>
<th></th>
<th>CT</th>
<th>NEMA</th>
<th>CT Congested</th>
<th>NEMA Congested</th>
<th>CT NEMA Congested</th>
<th>No Congestion</th>
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<tbody>
<tr>
<td><strong>ISO NE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.10</td>
<td>4.98</td>
<td>0.65</td>
<td>0.55</td>
<td>0.75</td>
<td>0.50</td>
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<tr>
<td><strong>NESCOE</strong></td>
<td>1.61</td>
<td>2.04</td>
<td>0.72</td>
<td>0.66</td>
<td>1.12</td>
<td>0.50</td>
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<tr>
<td><strong>Concave</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below Net Cone</td>
<td>2.10</td>
<td>4.98</td>
<td>0.65</td>
<td>0.55</td>
<td>0.75</td>
<td>0.50</td>
</tr>
<tr>
<td>Above Net Cone</td>
<td>1.09</td>
<td>1.46</td>
<td>0.92</td>
<td>0.76</td>
<td>2.51</td>
<td>0.50</td>
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## Local Performance Results

<table>
<thead>
<tr>
<th></th>
<th>Price</th>
<th>Quantity</th>
<th>Zonal Load Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>Standard Deviation</td>
<td>Frequency at Cap</td>
</tr>
<tr>
<td></td>
<td>($/kW-m)</td>
<td>($/kW-m)</td>
<td>(% of draws)</td>
</tr>
<tr>
<td><strong>NEMA/Boston</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISO-NE (1.0x No TTC)</td>
<td>12.2</td>
<td>4.1</td>
<td>18.9%</td>
</tr>
<tr>
<td>NESCO</td>
<td>12.2</td>
<td>4.1</td>
<td>18.6%</td>
</tr>
<tr>
<td>Concave</td>
<td>12.2</td>
<td>4.0</td>
<td>14.1</td>
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<tr>
<td><strong>Connecticut</strong></td>
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<td></td>
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<tr>
<td>ISO-NE (1.0x No TTC)</td>
<td>12.2</td>
<td>3.9</td>
<td>15.9%</td>
</tr>
<tr>
<td>NESCOE</td>
<td>12.2</td>
<td>4.0</td>
<td>19.0%</td>
</tr>
<tr>
<td>Concave</td>
<td>12.2</td>
<td>3.8</td>
<td>12.0%</td>
</tr>
</tbody>
</table>

## System Performance Results

<table>
<thead>
<tr>
<th></th>
<th>Price</th>
<th>Reliability</th>
<th>Zonal Load Cost</th>
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<td>Average</td>
<td>Standard Deviation</td>
<td>Frequency at Cap</td>
</tr>
<tr>
<td></td>
<td>($/kW-m)</td>
<td>($/kW-m)</td>
<td>(% of draws)</td>
</tr>
<tr>
<td>ISO-NE Proposal (1.0x No TTC)</td>
<td>11.1</td>
<td>3.8</td>
<td>6.3%</td>
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<tr>
<td>NESCOE</td>
<td>11.1</td>
<td>3.8</td>
<td>5.6%</td>
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<tr>
<td>CT Deep Concave</td>
<td>11.1</td>
<td>3.9</td>
<td>7.2%</td>
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Between August and October, ISO-NE changed recommendation (and Brattle modified model)

- LOLE of recommendation went from 0.100 to 0.120
- No material discussion of this change in LOLE in the presentations

The Concave curve has one extra outage over 200 years

- Better than 50% chance we will all be dead when it happens

Making decisions on the basis of such small differences is unreasonable

- It assumes a level of accuracy that is clearly untrue
- It assumes continued (and unchanging) use of the curve over long periods that is unwarranted

The analysis indicates the extra outage occurs in Connecticut
ISO-NE suggests the capped price when quantity is at TSA to provide maximum incentives before out-of-market actions might be taken. Modeling suggests clearing at TSA or below in 10% to 18% of draws. ISO-NE does not commit to circumstances in which it would take OOM action. No ISO actions are reflected in LOLE calculations. Customers have to pay for excessive prices and OOM actions.

But merely being below TSA in forward auction does not require OOM actions. No ISO commitment to actions, reconfiguration auctions, changes in load forecasts, other supply changes (auction commitment does not equal performance). A decision to procure OOM if below TSA is not a market based, nor probabilistically based (i.e., LOLE), decision.

Prices are high in any case; under the concave curve, the price at TSA is at 1.31 ($14.5) and 1.17 ($13.0) times net CONE for CT and NEMA, respectively.
What do Customers Want?

» In equilibrium:
  › Suppliers earn net CONE
  › Consumers pay for everything

» Customers also bear the cost of shortages

» Given the narrow scope of designing a local demand curve, I believe the Concave curve is the best option because it:
  › Reduces the incentive to withhold capacity at high prices
  › Reduces the ability to predict market outcomes, making it more difficult to exercise market power
  › Results in less excess capacity in equilibrium
  › Reduces the probability of very-low prices, supporting access to low cost financing for new generation
  › Has the same reliability performance in modeling (ISO and NESCOE options)