Local Market Power Mitigation Under Convergence Bidding

Eric Hildebrandt, Ph.D.
Department of Market Monitoring

Market Surveillance Committee Meeting
September 18, 2009
Local Market Power Mitigation under Nodal Convergence Bidding

- How to modify LMPM in IFM with virtual supply/demand bids?
- Is LMPM necessary in RUC under convergence bidding?
- Previous DMM documents/references:
Local Market Power Mitigation under Nodal Convergence Bidding

- Mitigation of virtual supply bids under LMPM provisions appears to be infeasible/highly problematic
  - No cost basis for setting Default Energy Bids (DEBs) for virtual bids
  - Approach based on previously submitted bids or market prices would highly problematic:
    - Could be circumvented, and/or
    - Would defeat concept of virtual bidding (bidding based on system/market expectations, risk mitigation, etc.)

- How to treat virtual bids in pre-IFM LMPM mitigation
  - Include virtual supply/demand (like other ISOs)?
  - Physical demand vs. demand forecast only?
  - Other Options:
    - Exclude virtual supply, but include virtual demand?
    - Another option may be to run pre-IFM AC run with bids for physical resources mitigated above their dispatch level in CC run.
## Pre-IFM Local Market Power Mitigation
### Range of Options

<table>
<thead>
<tr>
<th></th>
<th>Forecast Load</th>
<th>Physical Load Bids</th>
<th>Physical Supply Bids</th>
<th>Virtual Load Bids</th>
<th>Virtual Supply Bids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FERC Requirement (Release II)</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Option 1 (Initial proposal)</strong></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Option 2</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Option 3</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Option 4 (SCE recommendation)</strong></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Option 5?</td>
<td>✓</td>
<td>✓ (subject to mitigation)</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Illustrative Examples of Nodal Virtual Bidding Issues and Concerns

- Base Case
- Example 1: Virtual demand bidding by generators
- Example 2: Virtual supply bidding by generators/other participants
- Example 3: Real time uninstructed deviations

Note: All examples previously presented DMM documents listed on p.2
Base Case (no virtual bids)

<table>
<thead>
<tr>
<th>Unit</th>
<th>MW</th>
<th>DEB</th>
<th>Bid</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>200</td>
<td>$15</td>
<td>$35</td>
</tr>
<tr>
<td>2</td>
<td>200</td>
<td>$25</td>
<td>$45</td>
</tr>
<tr>
<td>3</td>
<td>200</td>
<td>$35</td>
<td>$55</td>
</tr>
<tr>
<td>4</td>
<td>200</td>
<td>$45</td>
<td>$65</td>
</tr>
<tr>
<td>5</td>
<td>200</td>
<td>$55</td>
<td>$75</td>
</tr>
<tr>
<td>6</td>
<td>200</td>
<td>$65</td>
<td>$145</td>
</tr>
<tr>
<td>7</td>
<td>200</td>
<td>$75</td>
<td>$145</td>
</tr>
</tbody>
</table>
Base Case (no virtual bids)

Demand (based on CAISO Forecast)

- Competitive Constraints (CC)
- All Constraints (AC)

Day Ahead Market Bid (Physical)

Competitive Constraints (CC)

- Unit 6
- Unit 7

All Constraints (AC)

- Unit 6
- Unit 7
- DEB (Physical)
Base Case (no virtual bids)

Demand (based on CAISO Forecast)

$160 Final Day Ahead
$150 Unit 7 Market Bids
$140 (After Mitigation)
$130
$120
$110
$100
$90
$80
$70
$60
$50
$40
$30
$20
$10

100 300 500 700 900 1,100 1,300 1,500 1,700

Competitive Constraints (CC)
All Constraints (AC)
Final Day Ahead Market Bids (After Mitigation)
DEB (Physical)
Base Case (no virtual bids)

Day Ahead Demand Curve (physical)

- Final Day Ahead Market Bids (After Mitigation)
- MCP = $65
- MCQ = 1,100 MW
- Unit 6
- Unit 7
- Unit 2
- Unit 1
- Unit 3
- Unit 4
- Unit 5
- Unit 7 DEB (Physical)
### Generator’s Net Revenues
#### Base Case (no virtual bids)

#### Day Ahead Market

<table>
<thead>
<tr>
<th>Unit</th>
<th>MW</th>
<th>DEB</th>
<th>MCP</th>
<th>Net</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>200</td>
<td>$15</td>
<td>$65</td>
<td>$10,000</td>
</tr>
<tr>
<td>2</td>
<td>200</td>
<td>$25</td>
<td>$65</td>
<td>$8,000</td>
</tr>
<tr>
<td>3</td>
<td>200</td>
<td>$35</td>
<td>$65</td>
<td>$6,000</td>
</tr>
<tr>
<td>4</td>
<td>200</td>
<td>$45</td>
<td>$65</td>
<td>$4,000</td>
</tr>
<tr>
<td>5</td>
<td>200</td>
<td>$55</td>
<td>$65</td>
<td>$2,000</td>
</tr>
<tr>
<td>6</td>
<td>100</td>
<td>$65</td>
<td>$65</td>
<td>$0</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>$75</td>
<td>$65</td>
<td>$0</td>
</tr>
</tbody>
</table>

**Total:** 1,100 MW, **Net Revenue:** $30,000
Example 2: Virtual Supply Bids by Generators

- Virtual supply bids by generators (or other participants) might also be used to circumvent LMPM

- This problem may be mitigated by:
  - Lower priced virtual supply bids from traders
  - Excluding virtual supply bids in pre-IFM LMPM runs
  - Since this would also create divergence in IFM vs. RT price, it may also be mitigated by authority to limit/suspend VB by participants whose bidding contributes to an unwarranted divergence of IFM and RT prices (e.g. as under MISO tariff)
Example 2a: Virtual Supply Bid by Generator

Demand (based on CAISO Forecast)

Competitive Constraints (CC)

All Constraints (AC)

Virtual Supply

Unit 6

Unit 7

Day Ahead Market Bids

Unit 6

Unit 7

DEB (Physical)

Unit 6

Unit 7

100 300 500 700 900 1,100 1,300 1,500 1,700 1,900

California ISO

Your Link to Power
Example 2b: Virtual Supply Bid by Generator

Demand (based on CAISO Forecast)

- Competitive Constraints (CC)
- All Constraints (AC)
- Virtual Supply
- Final Day Ahead Market Bids (After Mitigation)
- Unit 6
- Unit 7
- DEB (Physical)

Units:
- Unit 1
- Unit 2
- Unit 3
- Unit 4
- Unit 5
- Unit 6
- Unit 7

Prices:
- $160 Final Day Ahead
- $150 Unit 7 Market Bids
- $140 (After Mitigation)
- $130
- $120
- $110
- $100
- $90
- $80
- $70
- $60
- $50
- $40
- $30
- $20
- $10

Costs:
- $100 300 500 700 900 1,100 1,300 1,500 1,700 1,900
Example 2c: Virtual Supply Bid by Generator

Note: Additional demand not met in IFM is met in RTM. In this example, assume this demand is met by the Unit 6 with DEB $65, so that RTM MCP = $65.
Example 2a: Generator’s Net Revenues With Virtual Supply Bid by Generator

### Day Ahead Market

<table>
<thead>
<tr>
<th>Unit</th>
<th>MW</th>
<th>DEB</th>
<th>MCP</th>
<th>Net</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>200</td>
<td>$15</td>
<td>$135</td>
<td>$24,000</td>
</tr>
<tr>
<td>2</td>
<td>200</td>
<td>$25</td>
<td>$135</td>
<td>$22,000</td>
</tr>
<tr>
<td>3</td>
<td>200</td>
<td>$35</td>
<td>$135</td>
<td>$20,000</td>
</tr>
<tr>
<td>4</td>
<td>200</td>
<td>$45</td>
<td>$135</td>
<td>$18,000</td>
</tr>
<tr>
<td>5</td>
<td>200</td>
<td>$55</td>
<td>$135</td>
<td>$16,000</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>$65</td>
<td>$135</td>
<td>$0</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>$75</td>
<td>$135</td>
<td>$0</td>
</tr>
</tbody>
</table>

1,000 | $100,000

### RT

<table>
<thead>
<tr>
<th>Virtual Supply</th>
<th>DA MW</th>
<th>DA MCP</th>
<th>RT MCP</th>
<th>Net</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25</td>
<td>$135</td>
<td>$65</td>
<td>$1,750</td>
</tr>
</tbody>
</table>

Total | $101,750
Example 2b: With Lower Priced Virtual Supply Bid by Trader

- $160 Final Day Ahead
- $150 Unit 7 Market Bids
- $140 (After Mitigation)
- $130
- $120
- $110
- $100
- $90
- $80 Unit 7 DEB (Physical)
- $70
- $60 Unit 3
- $50 Unit 5
- $40 Unit 2
- $30 Unit 3
- $20 Unit 2
- $10
Example 2b: Generator’s Net Revenues after Additional Virtual Supply Bid by Trader

**Day Ahead Market**

<table>
<thead>
<tr>
<th>Unit</th>
<th>MW</th>
<th>DEB</th>
<th>MCP</th>
<th>Net</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>200</td>
<td>$15</td>
<td>$66</td>
<td>$10,200</td>
</tr>
<tr>
<td>2</td>
<td>200</td>
<td>$25</td>
<td>$66</td>
<td>$8,200</td>
</tr>
<tr>
<td>3</td>
<td>200</td>
<td>$35</td>
<td>$66</td>
<td>$6,200</td>
</tr>
<tr>
<td>4</td>
<td>200</td>
<td>$45</td>
<td>$66</td>
<td>$4,200</td>
</tr>
<tr>
<td>5</td>
<td>200</td>
<td>$55</td>
<td>$66</td>
<td>$2,200</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>$65</td>
<td>$66</td>
<td>$0</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>$75</td>
<td>$66</td>
<td>$0</td>
</tr>
</tbody>
</table>

1,000 $31,000

<table>
<thead>
<tr>
<th>Virtual Supply</th>
<th>DA MW</th>
<th>DA MCP</th>
<th>RT MCP</th>
<th>Net</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25</td>
<td>$66</td>
<td>$65</td>
<td>$25</td>
</tr>
</tbody>
</table>

**Total** $31,025

* Generator’s profits are just over base case of $30,000 due to small increase in DA MCP from $65 to $66 in this example.*
Is LMPM in RUC Needed under Nodal Convergence Bidding?

- If virtual supply “crowds out” physical supply in IFM, need for increased reliance on RUC.

- Current mitigation under this scenario:
  - RA requirements set to cover full requirements in local
  - RA unit have must-offer obligation with $0 RUC bid
  - Startup/min loads bids of all units subject to mitigation

- Potential additional mitigation in RUC
  - Add CC and AC run prior to RUC → units dispatched up in AC
  - RUC run subject to bid mitigation (per PJM)
  - May be needed especially if changes in start-up and minimum load bidding being considered are adopted.
  - May need provide for mitigation of RUC bids for non-RA units with local market power