Example Analysis Into High BOR Rate Days
PART I:

Summer 2012: High BOR Rate Days
Preliminary Findings

- CT LOC seems to be the main driver
- Running different CTs in DA and RT in different hours
- Trend seems to indicate larger make whole payments around the peak as opposed to during
- Potential causes need further investigation
  - More self-scheduling of CTs in RT
    - Need to be compared with DA committed CTs
  - Interchange between DA and RT is significantly different
# Highest 5 Days in July

<table>
<thead>
<tr>
<th>Date</th>
<th>Reliability Rate ($/MWh)</th>
<th>Base Deviations Rate ($/MWh)</th>
<th>CT LOC Credits (in millions)</th>
<th>% of OR Credits that are CT LOC Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 5</td>
<td>0.007</td>
<td>9.00</td>
<td>$3.9</td>
<td>76.6</td>
</tr>
<tr>
<td>July 6</td>
<td>0.024</td>
<td>11.42</td>
<td>$5.0</td>
<td>76.8</td>
</tr>
<tr>
<td>July 17</td>
<td>0.156</td>
<td>6.15</td>
<td>$1.8</td>
<td>52.7</td>
</tr>
<tr>
<td>July 18</td>
<td>0.316</td>
<td>8.21</td>
<td>$2.6</td>
<td>52.5</td>
</tr>
<tr>
<td>July 23</td>
<td>0.048</td>
<td>10.89</td>
<td>$4.5</td>
<td>84.4</td>
</tr>
</tbody>
</table>

- The 5 days above account for 2/3 of the LOC payments for the month

- June 20 was also a high day for the deviations rate at $7.20/MWh
  - On 6/20 – about 4,300 MW more CTs run in DA than RT at the peak
### Interchange Correlation Coefficients

<table>
<thead>
<tr>
<th>Date</th>
<th>RTO</th>
<th>NYIS</th>
<th>MISO</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 5</td>
<td>.09</td>
<td>.52</td>
<td>.51</td>
</tr>
<tr>
<td>July 6</td>
<td>.60</td>
<td>.14</td>
<td>.69</td>
</tr>
<tr>
<td>July 17</td>
<td>.17</td>
<td>.69</td>
<td>-.22</td>
</tr>
<tr>
<td>July 18</td>
<td>.13</td>
<td>.45</td>
<td>-.51</td>
</tr>
<tr>
<td>July 23</td>
<td>.50</td>
<td>.17</td>
<td>.11</td>
</tr>
<tr>
<td><strong>All</strong></td>
<td><strong>.27</strong></td>
<td><strong>.06</strong></td>
<td><strong>.27</strong></td>
</tr>
</tbody>
</table>

- DA RTO interchange is about 3.2 times more volatile than RT interchange.
- Combine that with the poor correlation from DA to RT and it will create scheduling differences between the two models.
Day-Ahead OR payments would indicate the Day Ahead Market is scheduling units uneconomically

*Other than July 6, 2012 where the DA OR rate was $.32/MWh, all other days were < $.07/MWh*

*NOTE:* The denominator for these charges are DA load + DECs + Load Response + Exports
  – Likely larger than the deviations that get charged in real-time
• Perfect Dispatch scores are the simplest metric
  – Look for uneconomic CT operation in real-time
  – PD Goal for 2012 is 78.88%
This BORCA process separates the TOTAL COST (credits) of BORs into eight (8) buckets.

Balancing Operating Reserve Cost Allocation

When is Unit Being Called On?

Reliability Analysis

Conservative Operations

Load - Reserves

RA BOR: Credits for Reliability A1

RA BOR: Credits for Deviations B1

RT BOR: Credits for Reliability A2

RT BOR: Credits for Deviations B2

Is Unit being called on for Tx Constraints <=345 kV?

No

RTO RA BOR: Credits for Reliability A1-T

Regional RA BOR: Credits for Reliability A1-R

RTO RA BOR: Credits for Deviations B1-T

Regional RA BOR: Credits for Deviations B1-R

Is Unit being called on for Tx Constraints <=345 kV?

Yes

RTO RT BOR: Credits for Reliability A2-T

Regional RT BOR: Credits for Reliability A2-R

RTO RT BOR: Credits for Deviations B2-T

Regional RT BOR: Credits for Deviations B2-R

Is LMP >= Offer for at least 4 intervals for at least an hour?

No

Operating Day
This BORGA process determines the six (6) rates for the ALLOCATION of the total costs.
Next Steps

- More analysis needed
  - Both DA and RT are running CTs where appropriate yet CT LOC payments have been high on peak days
  - Investigate hours prior to and following peak periods to determine the cause of additionally scheduled CTs in DA that are not run in RT
  - To what extent do the interchange differences impact how many CTs are run and where they are located?
    - More western imports in RT compared to DA may have the same impact on power balance but not on west-to-east transfers.
PART II:

Winter 2012-2013:
Balancing Operating Reserve Rates
• Balancing Operating Reserves are the dollars paid to generators that in real-time require some uplift payment to be made whole to their cost
• These generators must be scheduled by PJM and must be following PJM dispatch
• These charges are allocated to both load (regionally) and deviations depending on a set of rules
  – Time of the commitment
  – Reason for the commitment
  – Was the unit economic during the day
  – If committed for a constraint, what voltage level
• The actual per MWh allocation of the dollars
  – RTO, East, West
  – Load, Deviations

• Depending on when the unit was committed, whether or not the unit was economic and the constraint voltage level it was committed for will determine how the charge allocation goes
Causes of Recent High Charges

1. Running additional generation to support outages
   - Original dates for outage had to be pushed back due to Hurricane Sandy
   - This outage is required to support further work in the area which will also be delayed (due back 05/31/13)
   - Additional planned and unplanned outages
Causes of Recent High Charges (cont’d)

2. Primary fuel of additional generation being run is natural gas
   – Generation needed is in the northeastern part of the system
   – Gas prices in that area have been erratic
   – There have been periods where gas has been restricted in the area
3. Additional generation being run is relatively inflexible
   – Units cannot cycle from day to day and must be kept on through the overnight periods
   – PJM is running as few units as possible in the area but operational parameters limit flexibility
   – Limitations are based on unit type and operational capability
4. Additional generation is more often than not committed in the reliability analysis, not in Day Ahead
   – Prices in Day Ahead are not reflective of the real-time overloads on the facilities generation is being run for
   – PJM has committed this generation in Day Ahead when the units have been economic which has contributed to the erratic rate
These charges are currently being allocated to either:

- DA Load + Exports if the units are committed in DA and require a make whole payment
  - Socialized across RTO
- RT deviations if the units are committed in the reliability analysis for differences between DA and RT
  - East vs. RTO based on voltage level
This BORCA process separates the TOTAL COST (credits) of BORs into eight (8) buckets.
High BOR Rates

Reduction in total deviations has not helped with the allocation of the charges

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150,000

200,000

250,000

300,000

350,000

400,000

Avg East Deviations and Avg East Credits

Average East Deviations (MWh)

Linear (Average East Deviations (MWh))

Drop of about 50% since 2010
Avg East Deviations and Avg East Credits

- Average East Deviation Credits ($$)
- Average East Deviations (MWh)
- Linear (Average East Deviations (MWh))
• Having these units set price has been a challenge
• Other planned and unplanned outages in the area cause competing constraints that can see-saw generation in the area causing wider area control issues
• Other complicating factors:
  – Interchange with NY (PJM has issued TLRs on Readington-Roseland)
  – Maintaining the wheel between PS and ConEd
  – Actual constraint on Readington-Roseland
• Continue to look to minimize running out of merit generation
• Improve modeling of PAR controlled facilities in DA
• Improve RT and DA pricing performance