Operating Reserves

Operating reserves can be grouped into five categories:

- Day-Ahead
- Balancing
- Reactive Services
- Black Start Services
- Synchronous Condensing
Day-Ahead Charges

Millions (average per day)

- Day-Ahead Operating Reserves
- Unallocated Congestion
Day-Ahead Charges

• **Total Day-Ahead Operating Reserve Charges from Jan 2009 – Jun 2013:**
  • $462 million

• **From Day-Ahead Operating Reserve Credits (Not Black Start or Reactive):**
  • $442 million (96% of all DA OR Charges)

• **From Unallocated Congestion:**
  • $20 million (4% of all DA OR Charges)
    o 67% or $14 million since Jan 2013.
Day-Ahead Credits Concentration

Top 10: 69%
Others: 31%
Day-Ahead Top 10 Units Distribution

Top 10 Distribution: 102 units.
Unit 1 was in top 10 in 53 months out of 54 months.

©2013 www.monitoringanalytics.com
Day-Ahead Allocation Recap

- Charges are paid by:
  - Day-Ahead Demand Bids (Load)
  - Day-Ahead Exports
  - Day-Ahead Decrement Bids (DECs)

- Charges are allocated across the entire RTO. Each transaction pays the same rate per day across the entire system.
Basis for Day-Ahead Allocation

- 12-month Rolling Total Decrement Bids
- 12-month Rolling Total Day-Ahead Exports
- 12-month Rolling Total Day-Ahead Demand
### Day-Ahead Rate

#### Day-Ahead Rate (Excluding 13-Sep-2012 through 30-Nov-2012)

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Day-Ahead Rates</th>
<th>Day-Ahead Rates (Excluding 13-Sep-2012 through 30-Nov-2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>0.124</td>
<td>0.110</td>
</tr>
<tr>
<td>Min</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Max</td>
<td>1.100</td>
<td>0.601</td>
</tr>
<tr>
<td>St Dev</td>
<td>0.103</td>
<td>0.071</td>
</tr>
</tbody>
</table>
Operating Reserves

Operating reserves can be grouped into five categories:

• Day-Ahead
• Balancing
• Reactive Services
• Black Start Services
• Synchronous Condensing
Balancing Charges

Balancing operating reserves:

• Balancing (make whole)
  • Reliability
    ○ RTO, East or West
  • Deviations
    ○ RTO, East or West

• Lost Opportunity Cost (LOC)
• Canceled Resources
Balancing Charges

Millions (average per day)

- Balancing Operating Reserve (Make Whole)
- Lost Opportunity Cost
- Canceled Resources

©2013 www.monitoringanalytics.com
Balancing (BOR) Charges

• Total BOR Charges from Jan 2009 – Jun 2013:
  • $1,786 million

• From BOR Credits (make whole):
  • $1,211 million (68% of all BOR Charges)

• From LOC:
  • $555 million (31% of all BOR Charges)

• From Canceled Resources:
  • $20 million (1% of all BOR Charges)
    • $0.3 million after Jun-2012 (wind LOC Rule): Before wind LOC rule, LOC paid to wind units was categorized as canceled resources.
Balancing (Make Whole) Credits Concentration

Top 10: 53%
Others: 47%
Balancing Top 10 Units Distribution

Top 10 Distribution: 113 units.
Unit 1 was in top 10 in 51 months out of 54 months.
## Balancing Charges Allocation

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability Charges</td>
<td>$306</td>
<td>$31</td>
</tr>
<tr>
<td>RTO Share</td>
<td>39%</td>
<td>74%</td>
</tr>
<tr>
<td>East Share</td>
<td>22%</td>
<td>23%</td>
</tr>
<tr>
<td>West Share</td>
<td>39%</td>
<td>3%</td>
</tr>
<tr>
<td>Deviation Charges</td>
<td>$700</td>
<td>$173</td>
</tr>
<tr>
<td>RTO Share</td>
<td>82%</td>
<td>34%</td>
</tr>
<tr>
<td>East Share</td>
<td>13%</td>
<td>63%</td>
</tr>
<tr>
<td>West Share</td>
<td>4%</td>
<td>3%</td>
</tr>
</tbody>
</table>
Balancing Allocation Recap

- Reliability charges are paid by:
  - Real-time Load
  - Real-time Exports
- Reliability charges are allocated by region (RTO, East or West)

- Deviation charges are paid by:
  - Real-time deviations from day-ahead position
  - Deviations from desired output (units and DR)
- Deviation charges are allocated by region (RTO, East or West)
RTO Demand Deviations
12-month Rolling Totals

GWh

©2013 www.monitoringanalytics.com
RTO Supply Deviations
12-month Rolling Totals

GWh


IBT Purchase Only
Import Only
INC Only
Import with INC
IBT Purchase with INC
Import with IBT Purchase
## Balancing Rates

### Jan 2009 - Nov 2012

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Reliability</th>
<th>Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RTO</td>
<td>East</td>
</tr>
<tr>
<td>Average</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Maximum</td>
<td>1.61</td>
<td>3.08</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.08</td>
<td>0.17</td>
</tr>
</tbody>
</table>

### Dec 2012 - Jun 2013

<table>
<thead>
<tr>
<th>Statistics</th>
<th>Reliability</th>
<th>Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RTO</td>
<td>East</td>
</tr>
<tr>
<td>Average</td>
<td>0.05</td>
<td>0.03</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.80</td>
<td>2.89</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.09</td>
<td>0.21</td>
</tr>
</tbody>
</table>

### Average Rates

<table>
<thead>
<tr>
<th>Average Rates</th>
<th>Reliability</th>
<th>Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RTO</td>
<td>East</td>
</tr>
<tr>
<td>Jan 2009 - Nov 2012</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>Dec 2012 - Jun 2013</td>
<td>0.05</td>
<td>0.03</td>
</tr>
<tr>
<td>Difference</td>
<td>0.01</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Percentage</td>
<td>28%</td>
<td>(29%)</td>
</tr>
</tbody>
</table>
RTO Reliability Rate

- RTO Reliability Rate
- Monthly Average RTO Reliability Rate

$ per MWh

©2013 www.monitoringanalytics.com
East Reliability Rate

Monthly Average East Reliability Rate

$ per MWh
RTO Deviation Rate

Monthly Average RTO Deviation Rate

$ per MWh
East Deviation Rate

$ per MWh

East Deviation Rate

Monthly Average East Deviation Rate
West Deviation Rate

Monthly Average West Deviation Rate
Lost Opportunity Cost

Millions (average per day)
Lost Opportunity Cost Recap

• LOC is paid to units when:
  • Combustion turbine or diesel scheduled DA not called in RT. For purposes of this presentation, labeled as DA LOC.
  • Units reduced in real-time. For purposes of this presentation, labeled as RT LOC.

• LOC is paid by RTO deviations.

• Currently PJM posts one RTO Deviation Rate which combines the RTO Deviation Charges and the LOC Charges.
Lost Opportunity Cost

[Graph showing the trend of Lost Opportunity Cost from October 2011 to June 2013. The x-axis represents months from October 2011 to June 2013, while the y-axis represents millions (average per day) ranging from $0.0 to $1.0. The graph includes two lines: one for DA LOC and another for RT LOC.]
Lost Opportunity Cost

• LOC from Oct-2011 through Jun-2013: $253 million
  • Oct-2011: LOC calculations in settlement software were corrected to take into account “higher of price vs. cost offer” rule.

• DA LOC: $214 million (84%)
• RT LOC: $40 million (16%)
LOC Rate

Statistics

<table>
<thead>
<tr>
<th></th>
<th>LOC Rate ($/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>0.98</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.00</td>
</tr>
<tr>
<td>Maximum</td>
<td>17.37</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>1.35</td>
</tr>
</tbody>
</table>

Graph showing LOC Rate distribution with 95% percentile at 3.34, Median at 0.59, and 5% percentile at 0.06.