Operating reserves can be grouped into five categories:

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

[Line graph showing daily charges from January 2009 to May 2013, with two lines indicating Day-Ahead Operating Reserves and Unallocated Congestion.]

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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)
    - 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.
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

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

Millions (average per day)

Jan-09 to May-13

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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

Reliability: 28%
Deviations: 72%
Balancing Charges

RTO Reliability
East Reliability
West Reliability

RTO Deviations
East Deviations
West Deviations
## 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


- IBT Sale Only
- DEC Only
- Export Only
- Load Only
- Financial Combination with DEC
- Physical Combination with DEC
- Combination without DEC
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>RTO</th>
<th>East</th>
<th>West</th>
<th>RTO</th>
<th>East</th>
<th>West</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>0.04</td>
<td>0.04</td>
<td>0.09</td>
<td>0.82</td>
<td>0.23</td>
<td>0.11</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Maximum</td>
<td>1.61</td>
<td>3.08</td>
<td>1.03</td>
<td>13.37</td>
<td>5.18</td>
<td>3.78</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.08</td>
<td>0.17</td>
<td>0.10</td>
<td>0.90</td>
<td>0.56</td>
<td>0.28</td>
</tr>
</tbody>
</table>

### Dec 2012 - Jun 2013

<table>
<thead>
<tr>
<th>Statistics</th>
<th>RTO</th>
<th>East</th>
<th>West</th>
<th>RTO</th>
<th>East</th>
<th>West</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>0.05</td>
<td>0.03</td>
<td>0.00</td>
<td>0.77</td>
<td>2.77</td>
<td>0.13</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.01</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.80</td>
<td>2.89</td>
<td>0.13</td>
<td>10.23</td>
<td>32.88</td>
<td>2.10</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.09</td>
<td>0.21</td>
<td>0.02</td>
<td>1.16</td>
<td>5.75</td>
<td>0.37</td>
</tr>
</tbody>
</table>

### Average Rates

<table>
<thead>
<tr>
<th>Average Rates</th>
<th>RTO</th>
<th>East</th>
<th>West</th>
<th>RTO</th>
<th>East</th>
<th>West</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan 2009 - Nov 2012</td>
<td>0.04</td>
<td>0.04</td>
<td>0.09</td>
<td>0.82</td>
<td>0.23</td>
<td>0.11</td>
</tr>
<tr>
<td>Dec 2012 - Jun 2013</td>
<td>0.05</td>
<td>0.03</td>
<td>0.00</td>
<td>0.77</td>
<td>2.77</td>
<td>0.13</td>
</tr>
<tr>
<td>Difference</td>
<td>0.01</td>
<td>(0.01)</td>
<td>(0.09)</td>
<td>(0.04)</td>
<td>2.54</td>
<td>0.02</td>
</tr>
<tr>
<td>Percentage</td>
<td>28%</td>
<td>(29%)</td>
<td>(96%)</td>
<td>(5%)</td>
<td>1,122%</td>
<td>22%</td>
</tr>
</tbody>
</table>
RTO Deviation Rate

Monthly Average RTO Deviation Rate

$ per MWh
East Deviation Rate

Monthly Average East Deviation Rate

$ per MWh
West Deviation Rate

Monthly Average West Deviation Rate

$ per MWh
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 cost over time from October 2011 to June 2013, with the x-axis representing months and the y-axis representing millions (average per day). The graph includes two lines, one representing DA LOC and the other 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>LOC Rate ($/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
<tr>
<td>Standard Deviation</td>
</tr>
</tbody>
</table>

Rate

- 95 Percentile
- Median
- 5 Percentile

Statistical analysis of LOC Rate ($/MWh) indicates an average of 0.98, a minimum of 0.00, a maximum of 17.37, and a standard deviation of 1.35.

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