PJM Markets
2012 Year in Review

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Senior Vice President- Markets
Annual Meeting of Members
Significant Accomplishments / Challenges

**Industry Leadership**
- MOPR Dialogue
- CFTC Exemption Order

**Market Integrations**
- East Kentucky Power Cooperative

**Interregional Coordination**
- Implemented PJM/NYISO Congestion Management
- PJM/MISO JCM Discussions

**Market Implementations**
- Shortage Pricing
- Performance-based Regulation Market
- Demand Response
- Compensation Implementation

**Customer Service**
- Opened PJM CTC - 97%
- Customer Service Rating
- Learning Center Deployed

**Cost Allocation Challenges**
- FTR Underfunding
- Operating Reserves
PJM Evolution

**PJM Expansion History**

- 1927 – Started three utility power pool
- 1997 – Started RTO with eight TOs
- June 2002 – Allegheny Power joined
- May 2004 – ComEd joined
- October 2004 – AEP/Dayton joined
- May 2005 – Dominion joined
- January 2006 – Duquesne joined
- June 2011 – ATSI joined
- January 2012 – Duke OH/KY joined
- June 2013 – EKPC plans to join
Changing Fuel Mix in PJM Market

- Coal
- Gas
- Nuclear
- Total renewables
- Demand response
- Solar/ wind

Note: Adjusted to reflect integrations
• North NJ, temps in teens
• Pipeline constraint (firm)
• Gens behind LDC
• 2,000 MW curtailed

• Sandy line outages
• Out of merit dispatch
• Spot gas drove up regional power prices

• Increased Balancing Operating Reserve charges
Fuel Mix for 2012 Annual Electricity Production

- **Coal**: 42.3%
- **Nuclear**: 34.9%
- **Gas**: 19.1%
- **Oil**: 0.3%
- **Wind**: 1.6%
- **Water**: 0.8%
- **Solid Waste**: 0.5%
- **Methane**: 0.3%
- **Wood**: 0.1%
- **Solar**: 0.0%
- **Biomass**: 0.0%
- **Other**: 3.4%
PJM Market – Average Power Generation Emissions
Pounds Per MWh of Electricity Produced

PJM Average Emissions (lbs/MWh)

- **Carbon Dioxide**
- **Sulfur Dioxides**
- **Nitrogen Oxides**

<table>
<thead>
<tr>
<th>Year</th>
<th>CO$_2$</th>
<th>SO$_2$ and NO$_x$</th>
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<tbody>
<tr>
<td>2005</td>
<td>1,300</td>
<td>950</td>
</tr>
<tr>
<td>2006</td>
<td>1,250</td>
<td>1,000</td>
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<tr>
<td>2007</td>
<td>1,200</td>
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<td>2008</td>
<td>1,150</td>
<td>1,100</td>
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<tr>
<td>2009</td>
<td>1,110</td>
<td>1,150</td>
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<tr>
<td>2010</td>
<td>1,070</td>
<td>1,200</td>
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<tr>
<td>2011</td>
<td>1,030</td>
<td>1,250</td>
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<tr>
<td>2012</td>
<td>1,000</td>
<td>1,300</td>
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### Total Annual Billings (Billions)

<table>
<thead>
<tr>
<th>Year</th>
<th>Billings (Billions)</th>
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<tbody>
<tr>
<td>1999</td>
<td>$1.77</td>
</tr>
<tr>
<td>2000</td>
<td>$2.26</td>
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<tr>
<td>2001</td>
<td>$3.35</td>
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<tr>
<td>2002</td>
<td>$4.75</td>
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<td>2003</td>
<td>$6.93</td>
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<td>2004</td>
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<tr>
<td>2011</td>
<td>$35.89</td>
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<tr>
<td>2012</td>
<td>$29.18</td>
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### Number of Billing Accounts (2012 Avg. = 1,512)

<table>
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<tr>
<th>Month</th>
<th>Participants</th>
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<tbody>
<tr>
<td>Jan</td>
<td>1,391</td>
</tr>
<tr>
<td>Feb</td>
<td>1,315</td>
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<tr>
<td>Mar</td>
<td>1,407</td>
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<tr>
<td>Apr</td>
<td>1,415</td>
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<tr>
<td>May</td>
<td>1,481</td>
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<tr>
<td>Jun</td>
<td>1,572</td>
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<tr>
<td>Jul</td>
<td>1,520</td>
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<td>Aug</td>
<td>1,476</td>
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<tr>
<td>Sep</td>
<td>1,544</td>
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<tr>
<td>Oct</td>
<td>1,615</td>
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<tr>
<td>Nov</td>
<td>1,686</td>
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<tr>
<td>Dec</td>
<td>1,719</td>
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</table>
PJM Wholesale Cost Full-Year 2012 ($/MWh)

TOTAL: $47.77/MWh

* Values are PJM averages and do not reflect potential locational cost differences.
Impact of Performance Based Regulation

- Clearing Prices now accurately reflect real-time value
- Significantly lower “make-whole” payments
- Incenting high performing resources into the market
- After initially being higher, the cost of regulation per MW of load has settled within historical ranges of $0.20 to $0.35 per MW.
Other significant activities

- Prepared training and documentation processes for rigor of new NERC Standard (PER 005)
  - 40% of in-person content redesigned
  - 37% of online content redesigned
  - New application created to assist Members with their compliance

- Increased audit support to PJM and Members

57,537 CE hours issued in 2012

11.6% increase from 2011

CE Hours Awarded

Seminar Attendance

Customer Satisfaction

Special Training Delivered

*Introduced simulation training to governmental agencies