Transmission Expansion Advisory Committee
Meeting

2009 Market Efficiency Analysis
Input Assumptions

May 20, 2009
Market Simulation Input Data


- PROMOD IV model from Ventyx

- Underlying input data contained in PROMOD Powerbase (February 2009 update) including generating units and unit characteristics, fuel costs and emissions costs

- Powerflow Cases
  - 2009 power flow case to represent today’s “as-is” system
  - 2013 RTEP power flow case to represent future system
Key Input Parameters

- Fuel prices
- Load and energy
- Future generation scenario
- Emissions prices
- Transmission topology
- Carrying charge rate and discount rate
Figure 1 - Fuel Price Assumptions

- **OIL-L**
- **OIL-H**
- **GAS**
- **Coal**

Price ($/MMBtu)

Year

Load & Energy Input Data

- PJM zonal peak and zonal energy forecast from PJM 2009 Load Forecast Report
- Historical zonal hourly loads used to develop zonal hourly load shape

Table 1 – Forecast PJM Peak and Energy

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2012</th>
<th>2015</th>
<th>2018</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak (MW)</td>
<td>134,428</td>
<td>144,613</td>
<td>151,410</td>
<td>156,822</td>
<td>165,006</td>
</tr>
<tr>
<td>Energy (GWh)</td>
<td>712,236</td>
<td>766,257</td>
<td>800,420</td>
<td>829,620</td>
<td>871,619</td>
</tr>
</tbody>
</table>
Demand Response Input Data

- Modeled demand response quantities based on RPM auction results
- 2009 study year values are sum of ILR Forecasted Planning Period Parameters and DR (cleared and FRR) from 2009/10 BRA
- Value for study year 2012 based on DR (cleared and FRR) from 2012/13 BRA

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2012</th>
<th>2015</th>
<th>2018</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Response (MW)</td>
<td>2,940</td>
<td>7,536</td>
<td>7,536</td>
<td>7,536</td>
<td>7,536</td>
</tr>
</tbody>
</table>
Future Generation Scenarios

- generation model includes all existing in-service generation plus active queue generation with executed ISA minus expected future deactivations
- installed reserve requirement is met through 2013
- To meet installed reserve requirement for study years 2015, 2018 and 2023, 3,900 MW, 10,200 MW and 18,100 MW of new generation will be added to model, respectively
- New generation will be added to PJM regions in proportion to the regional location and regional generation type of future generation projects in Generation Interconnection Queues through Queue U
Figure 2 - PJM Market Efficiency Reserve Margin

Forecasted Summer Peak Net Internal Demand

- Reserve Requirement
- Existing + Queue with Signed ISA - Retirement

Year

MW


120,000 130,000 140,000 150,000 160,000 170,000 180,000 190,000 200,000

3,900 MW 10,200 18,100

18,100
## Table 2 – Location and Generator Type to Maintain Reserve Margin

<table>
<thead>
<tr>
<th>Region</th>
<th>Nuclear</th>
<th>Coal</th>
<th>Gas</th>
<th>Oil</th>
<th>Wind</th>
<th>Other Renewable</th>
<th>Total Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>AECO/DPL/JCPL/PECO/PSEG</td>
<td>0.3%</td>
<td>0.0%</td>
<td>23.1%</td>
<td>0.6%</td>
<td>1.0%</td>
<td>2.3%</td>
<td>27.4%</td>
</tr>
<tr>
<td>AEP/APS/COM/DAY/DUQ</td>
<td>0.4%</td>
<td>10.6%</td>
<td>12.5%</td>
<td>0.0%</td>
<td>14.3%</td>
<td>1.0%</td>
<td>38.8%</td>
</tr>
<tr>
<td>BGE/PEP</td>
<td>3.6%</td>
<td>0.0%</td>
<td>4.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>7.6%</td>
</tr>
<tr>
<td>DOM</td>
<td>0.8%</td>
<td>0.0%</td>
<td>6.6%</td>
<td>0.0%</td>
<td>0.1%</td>
<td>0.6%</td>
<td>8.1%</td>
</tr>
<tr>
<td>ME/PN/PPL</td>
<td>3.5%</td>
<td>0.2%</td>
<td>10.7%</td>
<td>1.7%</td>
<td>1.2%</td>
<td>0.7%</td>
<td>18.1%</td>
</tr>
</tbody>
</table>
Figure 3 - SO2 Emission Allowance Price Assumptions
Figure 4 - NOx Emission Allowance Price Assumptions

- CAIR Annual NOx
- CAIR Seasonal NOx
Figure 5 - CO2 Emission Assumptions
Transmission Topology and Constraints

• **Powerflow Cases**
  – 2009 power flow case to represent today’s “as-is” system
  – 2013 RTEP power flow case to represent future system

• **Thermal Constraints**
  – monitor/contingency pairs
  – NERC Book of Flowgates
  – Planning study results
  – Historical PJM congestion events
  – monitor/contingency list for “as-is” case posted on PJM web site under “Planning - RTEP Development – Market Efficiency”

• **Voltage Constraints**
  – PJM reactive interface limits
  – MW limits based on historical values for “as-is” case adjusted for future upgrade impacts in 2012 case
Discount rate and levelized carrying charge rate developed using information contained in TO Formula Rate sheets posted on PJM web site.

Discount rate based on weighted average after-tax embedded cost of capital (average weighted by TO total capitalization)

Discount rate = 7.73%

Levelized annual carrying charge rate based on weighted average net plant carrying charge (average weighted by TO total capitalization) levelized over an assumed 45 year life of project.

Levelized Annual Carrying Charge Rate = 19.8%
• PJM Board approval of input assumptions in June
• Begin analysis with regular updates to TEAC