Transmission Expansion Advisory Committee
Market Efficiency Update

November 3, 2016
Agenda

- 2016/2017 Market Efficiency Congestion Drivers
- Acceleration Analysis Status
- Next Steps
Market Efficiency Timeline

Year 0
- Develop Assumptions (Y1, Y5)
- Market Efficiency Analysis (Y1, Y5) (Accelerations and Modifications)
- Identify and evaluate Solution Options (Accelerations and Modifications)
- Final Review with TEAC and approval by Board

Year 1
- Develop Assumptions (Y1, Y5, Y8, Y11, Y15)
- Market Efficiency Criteria Analysis (Y1, Y5, Y8, Y11, Y15)
- Market Efficiency Analysis (Y1, Y5, Y8, Y11, Y15)
- Identify proposed solutions
- Update significant assumptions (Y0, Y4, Y7, Y10, Y14)
- Independent Consultant reviews of buildability
- Adjustments to solution options by PJM on analysis
- Develop Assumptions (Y1, Y5)
- Market Efficiency Analysis (Y1, Y5) (Accelerations and Modifications)
- Identify and evaluate Solution Options (Accelerations and Modifications)
- Final Review with TEAC and approval by Board
### 2016-2017 Market Efficiency Cycle Timeline

<table>
<thead>
<tr>
<th>Item</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long Term Proposal Window</td>
<td>Nov 1, 2016 – Feb 22, 2017</td>
</tr>
<tr>
<td>Analysis of Proposed Solutions</td>
<td>March 2017 - November 2017</td>
</tr>
<tr>
<td>Determination of Final Projects</td>
<td>December 2017</td>
</tr>
</tbody>
</table>
Market Efficiency Update

• Market Efficiency cases were posted on 11/01/2016
  – PROMOD cases, and supporting documentation were posted on Market Efficiency Web page

• Proposal window opened on November 1, 2016

• Proposal window will close on February 22, 2017

• Market Efficiency Questions
  – Send to the RTEP e-mail distribution (rtep@pjm.com) with “Market Efficiency” in the subject line header
Posted Files

- 2016/17 Market Efficiency Base Case
- Problem Statement and Recommended Congestion Drivers
- Base Congestion results
- Additional Files*
  - Market Efficiency Benefit/Cost Evaluation Spreadsheet and Example
  - Setup Instructions

* the ARR modeling files to be posted in the following days
Congestion Drivers
Simulated Base Case Congestion

- Includes congestion results for simulation years 2017, 2021, 2024 and 2027

- System congestion has declined due to RTEP enhancements, lower load forecast and fuel price impacts

- Base congestion results posted on Market Efficiency website at below link:
Recommended Congestion Drivers

• Market Efficiency Criteria:
  – Lower Voltage Facilities:
    • Minimum of $1 million congestion in both 2021 and 2024 study years.
    • Annual simulated congestion frequency of at least 25 hours in both 2021 and 2024 study years.
  – Regional Facilities:
    • Minimum of $10 million congestion in both 2021 and 2024 study years.
    • Annual simulated congestion frequency of at least 25 hours in both 2021 and 2024 study years.
  – Interregional facilities:
    • There will be no minimum threshold criteria for congestion or for frequency, since congestion is impacted by both regions.
Recommended Congestion Drivers

• Excepted facilities
  – Although Market Efficiency criteria are met, PJM may not recommend proposals for certain facilities due to exceptions

• Market Efficiency exceptions:
  – Nearby FSA Generator(s)
    • Congestion is significantly influenced by a FSA generator or a unique set of FSAs
  – Congestion already addressed
    • Majority of the congestion was already addressed in previous window(s)
  – Declining Congestion
    • Simulated congestion for future study years displays a declining trend
### Recommended Congestion Drivers

<table>
<thead>
<tr>
<th>Facility Name</th>
<th>AREA</th>
<th>TYPE</th>
<th>Frequency (Hours)</th>
<th>Market Congestion ($ Millions)</th>
<th>2024 Input Assumptions with 2021 Topology</th>
<th>Notes/Potential Upgrade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conastone to Graceton 230 kV</td>
<td>BGE</td>
<td>LINE</td>
<td>896</td>
<td>$55.1</td>
<td>931</td>
<td>$61.6</td>
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<tr>
<td>Graceton to Bagley 230 kV</td>
<td>BGE</td>
<td>LINE</td>
<td>1,131</td>
<td>$30.0</td>
<td>1,420</td>
<td>$43.5</td>
</tr>
<tr>
<td>Susquehanna to Harwood 230 kV</td>
<td>PPL</td>
<td>LINE</td>
<td>173</td>
<td>$3.7</td>
<td>193</td>
<td>$5.1</td>
</tr>
<tr>
<td>Bosserman to Olive 138 kV</td>
<td>AEP</td>
<td>LINE</td>
<td>5</td>
<td>$0.2</td>
<td>56</td>
<td>$1.7</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Interregional Constraint</td>
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</table>

**2021 Input Assumptions with 2021 Topology**

**2024 Input Assumptions with 2021 Topology**
Conastone to Graceton

- Area: BGE
- Voltage: 230 kV
- Market Congestion
  - 2017 ($mill): 55.1
  - 2021 ($mill): 61.6
Graceton to Bagley

- **Area**: BGE
- **Voltage**: 230 kV
- **Market Congestion**
  - 2017 ($mill): 30.0
  - 2021 ($mill): 43.5
Susquehanna to Harwood

- **Area:** PPL
- **Voltage:** 230 kV
- **Market Congestion**
  - 2017 ($mill): 3.7
  - 2021 ($mill): 5.1
Bosserman to Olive 138 kV

- Area: AEP
- Voltage: 230 kV
- Market Congestion
  - 2017 ($mill): 0.2
  - 2021 ($mill): 1.7
### Simulated Market Congestion Results

<table>
<thead>
<tr>
<th>Constraint</th>
<th>kV</th>
<th>FromArea</th>
<th>ToArea</th>
<th>Type</th>
<th>Historical</th>
<th>2017</th>
<th>2021</th>
<th>2024</th>
<th>2027</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRACETON TO CONASTON 230kV</td>
<td>230</td>
<td>BGE</td>
<td>BGE</td>
<td>PJM FG</td>
<td>$54.05</td>
<td>$55.07</td>
<td>$61.57</td>
<td>$62.91</td>
<td>Solicit</td>
<td></td>
</tr>
<tr>
<td>BAGLEY TO GRACETON 230kV</td>
<td>230</td>
<td>BGE</td>
<td>BGE</td>
<td>PJM FG</td>
<td>$23.34</td>
<td>$30.02</td>
<td>$43.52</td>
<td>$55.01</td>
<td>Solicit</td>
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<tr>
<td>AP SOUTH INTERFACE</td>
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<td></td>
<td>INTERFACE</td>
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<td>$34.22</td>
<td>$36.54</td>
<td>$31.93</td>
<td>$37.40</td>
<td>Previous window approved project</td>
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<tr>
<td>5004/5005 INTERFACE</td>
<td></td>
<td></td>
<td>INTERFACE</td>
<td></td>
<td>$25.15</td>
<td>$31.34</td>
<td>$19.94</td>
<td>$15.62</td>
<td>Declining congestion trend</td>
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<tr>
<td>AEP-DOM INTERFACE</td>
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<td></td>
<td>INTERFACE</td>
<td>Yes</td>
<td>$0.32</td>
<td>$3.39</td>
<td>$8.17</td>
<td>$14.67</td>
<td>Previous window approved project</td>
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<tr>
<td>Susquehanna to Harwood 230 kV</td>
<td>230</td>
<td>PLGRP</td>
<td>PLGRP</td>
<td>PJM FG</td>
<td>$3.70</td>
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<td>Solicit</td>
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<tr>
<td>CENTRAL INTERFACE</td>
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<td>INTERFACE</td>
<td></td>
<td>$4.39</td>
<td>$4.13</td>
<td>$3.14</td>
<td>$4.05</td>
<td>Congestion lower than threshold</td>
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<tr>
<td>28R11RINGA TO 28RED OAKA 230kV</td>
<td>230</td>
<td>JCPL</td>
<td>JCPL</td>
<td>PJM FG</td>
<td>$2.07</td>
<td>$3.42</td>
<td>$4.47</td>
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<td>Congestion driven by FSA Generator</td>
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<tr>
<td>28RED OAKB TO 28RAR RVR 230kV</td>
<td>230</td>
<td>JCPL</td>
<td>JCPL</td>
<td>PJM FG</td>
<td>$0.19</td>
<td>$1.94</td>
<td>$2.79</td>
<td>$4.29</td>
<td>Congestion driven by FSA Generator</td>
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<tr>
<td>Peach Bottom to Conastone 500 kV</td>
<td>500</td>
<td>BGE</td>
<td>PECO</td>
<td>PJM FG</td>
<td>$33.65</td>
<td>$1.11</td>
<td>$3.16</td>
<td>$1.13</td>
<td>Baseline project fixes congestion</td>
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<tr>
<td>Maple to Hoytdale 138 kV</td>
<td>138</td>
<td>FE-ATSI</td>
<td>FE-ATSI</td>
<td>PJM FG</td>
<td>$0.63</td>
<td>$1.22</td>
<td>$1.97</td>
<td>$3.27</td>
<td>Congestion driven by FSA Generator</td>
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</tr>
<tr>
<td>N Philadelphia 8 to Master 230kV</td>
<td>230</td>
<td>PECO</td>
<td>PECO</td>
<td>PJM FG</td>
<td>$0.58</td>
<td>$1.76</td>
<td>$0.43</td>
<td></td>
<td>Congestion lower than threshold</td>
<td></td>
</tr>
<tr>
<td>Deans TR 500/138 kV</td>
<td>500/138</td>
<td>PENELEC</td>
<td>NYZK</td>
<td>PJM FG</td>
<td>$0.98</td>
<td>$1.29</td>
<td>$1.73</td>
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<td>Congestion lower than threshold</td>
<td></td>
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<tr>
<td>Edwards Ferry to Dickerson Station &quot;D&quot; 230 kV</td>
<td>230</td>
<td>PEPCO</td>
<td>DOM</td>
<td>PJM FG</td>
<td>$2.06</td>
<td>$1.17</td>
<td>$1.02</td>
<td>$0.40</td>
<td>Declining congestion trend</td>
<td></td>
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<tr>
<td>Bosserman to Olive 138kV</td>
<td>138</td>
<td>AEP</td>
<td>AEP</td>
<td>M2M</td>
<td>$0.19</td>
<td>$1.74</td>
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<td>Solicit</td>
<td></td>
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</tbody>
</table>

**Notes:**

*Congestion shown for PJM constraints with average congestion for years 2021 and 2024 greater than $1 million*

*Bosserman – Olive included as market to market constraint*
Interregional Congestion

- Targeted Market Efficiency Projects (TMEP) are not included in the long term window

- Per PJM - MISO JOA, Interregional Proposals must be submitted to both PJM and MISO Regional Windows

- PJM and MISO will follow the effective JOA language when analyzing and recommending Interregional Proposals
# Market Efficiency - Sensitivities

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load Sensitivity</td>
<td>Plus or Minus 2%</td>
</tr>
<tr>
<td>Gas Sensitivity</td>
<td>Plus or Minus 20% of Henry Hub forecast</td>
</tr>
<tr>
<td>Potential FSA Sensitivity</td>
<td>To be decided</td>
</tr>
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</table>
Acceleration Analysis
Acceleration Analysis

• **Scope**
  – Determine which reliability upgrades, if any, have an economic benefit if accelerated or modified.

• **Study Years**
  – 2017 and 2021 set of economic input assumptions used to study impacts of approved RTEP projects

• **Process**
  – Compare market congestion for near term vs. future topology
  – Estimate economic impact of accelerating planned upgrades
Acceleration Analysis Status

- Finalized PROMOD modeling work for 2017 and 2021 AS-IS cases
- Preliminary PROMOD runs completed
- Currently identifying projects responsible for congestion reductions
- Acceleration analysis results to be presented at the December TEAC
## Milestone Schedule

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Schedule 2016 - 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>PJM Review for Acceleration Candidates</td>
<td>November-December</td>
</tr>
<tr>
<td>Proposal Window Closing</td>
<td>February 22, 2017</td>
</tr>
<tr>
<td>Base Case Update Significant Assumptions</td>
<td>March – April 2017</td>
</tr>
<tr>
<td>Project Analysis</td>
<td>March – November 2017</td>
</tr>
<tr>
<td>Final TEAC Review and Board Approval</td>
<td>December 2017</td>
</tr>
</tbody>
</table>
Questions?

Email: RTEP@pjm.com
Appendix A

Market Efficiency Data Posting
Market Efficiency Data Posting

• Market Efficiency Web Page located at

• Market Efficiency Case Files (posted on 11/01/2016)
  – Access requires CEII access approval (execute PJM CEII NDA and fill out PJM CEII Request Form)
    • Note: the access request must indicate “2016/17 RTEP Proposal Window”
  – Access requires Vendor (ABB) approval that the requester is a licensee of PROMOD confirmation
  – Access requires MISO CEII approval with access confirmed by PJM
  – No confidential data provided or used in analysis (i.e. actual bid data)
  – XML Format

• Market Efficiency Questions
  – Please send to the RTEP e-mail distribution (rtep@pjm.com) with “Market Efficiency” in the subject line header