Transmission Expansion Advisory Committee

June 14, 2012
Issues Tracking
Issues Tracking

- Open Issues
  - None

- New Issues
2012 RTEP Scenario Analysis
• Renewable Portfolio Standards (RPS)

• At-Risk generation

• High load forecast
2012 RTEP - Renewable Portfolio Standards Scenarios
Renewable Portfolio Standards (RPS)

- Status
  - RPS targets (MWh) update
  - Wind capacity factor update
  - Nameplate MW update
Renewable Portfolio Standards

• Overall Assumptions
  – Model the latest Renewable Portfolio Standards (RPS) state targets
    • Assume production from renewable wind
    • Update target PJM installed renewable MW requirements
    • Update installed reserve calculation

  – 2012 PJM Load Forecast Report
    • 15 Year Load Forecast
    • Include Demand Response (DR) and Energy Efficiency (EE)

  – Incorporate findings from 2011 RTEP RPS scenario studies
### 2027 RPS Study

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* Capacity factors based GE PRIS Task 2 Scenario Development - Final Report
** Assumes ~15,000 MW of DR
*** Assumes 38% for solar and 15% for wind
• Assumptions
  – Assume RPS supply from PJM resources
  – 7 GW Offshore
  – Study year: 2027

• Analysis
  – Reliability Analysis
    • Generator Deliverability (50/50 load level)
    • Common Mode Outage test (50/50 load level)
  – Market Efficiency Analysis
    • Security Constrained Optimal Power Flow (SCOPF)
    • Production cost simulation using PROMOD

• Result
  – Thermally overloaded facilities
  – Congestion $’s
  – Develop transmission overlay
### Renewable Resources

#### Solar

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<td><strong>Total</strong></td>
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<td>20,513</td>
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### Other Resources To Meet IRM

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* Generator Interconnection projects that are not yet in service and are modeled in the 2012 RTEP 2017 base case

** Based on amount of wind & solar projected in each PJM state in GE PRIS Task 2 Scenario Development - Final Report
• Assumptions
  – **Low GW Offshore**
  – Otherwise, same as RPS – Scenario #1 but with a low GW offshore assumption
  – The remainder of the state target RPS will be sourced from inland PJM resources
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* Generator Interconnection projects that are not yet in service and are modeled in the 2012 RTEP 2017 base case
** Based on amount of wind & solar projected in each PJM state in GE PRIS Task 2 Scenario Development - Final Report
• Assumptions
  – **RPS Source from Neighboring Entities**
  – Otherwise, same as RPS – Scenario #2 (low MW offshore)
  – The remainder of the state target RPS will be sourced from inland PJM resources

• Neighboring Entities
  – Assume 40% of the PJM RPS supplied from renewable wind in the Midwest ISO (MISO)
    • Assume DC injection points from MISO to PJM
    • Injection points to PJM to be determined
### RPS – Scenario #3

#### MODELED NAMEPLATE MW

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<td>UGI</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>OFFSHORE</td>
<td>0</td>
<td>1,521</td>
<td>0</td>
<td>1,521</td>
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<tr>
<td>MISO***</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>14,447</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>4,414</td>
<td>20,513</td>
<td>5,522</td>
<td>44,897</td>
</tr>
</tbody>
</table>

#### Other Resources To Meet IRM

<table>
<thead>
<tr>
<th></th>
<th>Natural Gas</th>
<th>Nuclear</th>
<th>Other (Coal, Diesel, Oil, etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>11,247</td>
<td>3,549</td>
<td>2,240</td>
</tr>
</tbody>
</table>

* Generator Interconnection projects that are not yet in service and are modeled in the 2012 RTEP 2017 base case

** Based on amount of wind & solar projected in each PJM state in GE PRIS Task 2 Scenario Development - Final Report

*** Assumes 38% capacity factor
2012 RTEP Scenario Analysis - At Risk Generation
At-Risk MW in addition to known Deactivation Notifications as of 6/6/2012
At-Risk Generation – Scenario #1

• Assumptions
  – Same as 2012 RTEP base except “at-risk” generation

• Analysis
  – Reliability Analysis
    • Generator Deliverability (50/50 load level)
    • Common Mode Outage test (50/50 load level)
    • N-1-1 outage test (50/50 load level)
    • Load Deliverability (90/10 load level)

• Result
  – Thermal overloads & voltage violations
2012 RTEP Scenario Analysis – High Load Forecast
PJM RTO – High Load Forecast

PJM RTO
Summer Peak Forecast

Baseline
High Economics
% Difference


135,000 140,000 145,000 150,000 155,000 160,000 165,000 170,000 175,000 180,000 185,000

0.0% 0.5% 1.0% 1.5% 2.0% 2.5% 3.0% 3.5% 4.0%

0.0% 0.5% 1.0% 1.5% 2.0% 2.5% 3.0% 3.5% 4.0%

Blue: Baseline
Red: High Economics
Dotted Green: % Difference
MAAC – High Load Forecast

PJM Mid-Atlantic Summer Peak Forecast

- Baseline
- High Economics
- % Difference

Forecast milestones for Baseline and High Economics are shown for each year from 2012 to 2022. The chart illustrates the expected growth in summer peak load for the PJM Mid-Atlantic region under different economic scenarios.
DOM VP
Summer Peak Forecast

- Baseline
- High Economics
- % Difference

Graph showing the summer peak forecast for DOM VP from 2012 to 2022, with lines representing baseline, high economics, and percentage difference.
2012 RTEP Status Update
2012 RTEP CETO Values

- **MAAC**
  - 2016 CETO from 2011 RTEP = 3620
  - 2017 CETO (current 2012 RTEP) = 1100

- **EMAAC**
  - 2016 CETO from 2011 RTEP = 6520
  - 2017 CETO (current 2012 RTEP) = 4260

- **DOMINION**
  - 2016 CETO from 2011 RTEP = 440
  - 2017 CETO (current 2012 RTEP) = 220

- Preliminary values

- Current CETO values are based on 2012 PJM Load Forecast Report

- Include cleared RPM generation
RTEP – 2017 Baseline Case Evaluation

- Baseline contingency analysis
- Generator deliverability test
- Common mode outage test
- Load Deliverability
- N-1-1
Stage 1A 10-Year ARR Analysis
Final Stage 1A 10-Year ARR analysis

- 10-year analysis on 2012/13 Stage 1A ARRs resulted in infeasibility on the following facilities.

<table>
<thead>
<tr>
<th>Constraint</th>
<th>Contingency</th>
<th>Zone</th>
<th>Planning Period of Post Contingency Violation</th>
</tr>
</thead>
<tbody>
<tr>
<td>122 BELV138 KV 12205 1</td>
<td>345L15616 Cherry Valley-Silver Lake 345 kV Line</td>
<td>COMED</td>
<td>2012/2013</td>
</tr>
<tr>
<td>122 BELV138 KV 15623 2</td>
<td>345L15616 Cherry Valley-Silver Lake 345 kV Line</td>
<td>COMED</td>
<td>2013/2014</td>
</tr>
<tr>
<td>122 BELV138 KV 15624 2</td>
<td>345L15616 Cherry Valley-Silver Lake 345 kV Line</td>
<td>COMED</td>
<td>2013/2014</td>
</tr>
<tr>
<td>12204 138 KV 12204 1</td>
<td>345L15616 Cherry Valley-Silver Lake 345 kV Line</td>
<td>COMED</td>
<td>2013/2014</td>
</tr>
<tr>
<td>12204 138 KV 12204 2</td>
<td>345L15616 Cherry Valley-Silver Lake 345 kV Line</td>
<td>COMED</td>
<td>2013/2014</td>
</tr>
<tr>
<td>138 SILV345 KV 15616</td>
<td>Actual</td>
<td>COMED</td>
<td>2013/2014</td>
</tr>
<tr>
<td>155 NELS345 KV 15502</td>
<td>345L15616 Cherry Valley-Silver Lake 345 kV Line</td>
<td>COMED</td>
<td>2013/2014</td>
</tr>
<tr>
<td>156 CHER138 KV 15624 1</td>
<td>345L15616 Cherry Valley-Silver Lake 345 kV Line</td>
<td>COMED</td>
<td>2013/2014</td>
</tr>
<tr>
<td>156 CHER138 KV TR81CT-S</td>
<td>345L15616 Cherry Valley-Silver Lake 345 kV Line</td>
<td>COMED</td>
<td>2013/2014</td>
</tr>
<tr>
<td>156 CHER345 KV TR81CT-P</td>
<td>345L15616 Cherry Valley-Silver Lake 345 kV Line</td>
<td>COMED</td>
<td>2013/2014</td>
</tr>
<tr>
<td>16914 138 KV 16914 1</td>
<td>345L15502 Nelson-Electric Jct 345 kV Line</td>
<td>COMED</td>
<td>2013/2014</td>
</tr>
<tr>
<td>83 GLIDD138 KV 15627Z1</td>
<td>345L15616 Cherry Valley-Silver Lake 345 kV Line</td>
<td>COMED</td>
<td>2013/2014</td>
</tr>
<tr>
<td>Breed-Wheatland 345 KV</td>
<td>Jefferson-Rockport (JEF-ROC1) 765 Line</td>
<td>M2M</td>
<td>2012/2013</td>
</tr>
<tr>
<td>282 ZION-16 WAUKE 138 KV 1609</td>
<td>345L2221 Zion-Pleasant Prairie 345 kV Line</td>
<td>M2M</td>
<td>2013/2014</td>
</tr>
<tr>
<td>282 ZION138 KV 1609 Z1</td>
<td>345L2221 Zion-Pleasant Prairie 345 kV Line</td>
<td>M2M</td>
<td>2013/2014</td>
</tr>
<tr>
<td>282 ZION138 KV 1609 Z2</td>
<td>345L2221 Zion-Pleasant Prairie 345 kV Line</td>
<td>M2M</td>
<td>2013/2014</td>
</tr>
<tr>
<td>LAKEVIE2-KENOSHA 138 KV 9341</td>
<td>345L2221 Zion-Pleasant Prairie 345 kV Line</td>
<td>M2M</td>
<td>2012/2013</td>
</tr>
<tr>
<td>LAKEVIE2-ZION 138 KV 28201</td>
<td>345L2221 Zion-Pleasant Prairie 345 kV Line</td>
<td>M2M</td>
<td>2012/2013</td>
</tr>
<tr>
<td>PLEAS PR-ZION345 KV 2221</td>
<td>345L15616 Cherry Valley-Silver Lake 345 kV Line</td>
<td>M2M</td>
<td>2012/2013</td>
</tr>
<tr>
<td>282 ZION138 KV 28201 Z2</td>
<td>345L2221 Zion-Pleasant Prairie 345 kV Line</td>
<td>M2M</td>
<td>2013/2014</td>
</tr>
</tbody>
</table>
Upgrades- Stage 1A 10-Year ARR analysis

• Market-to-Market Flowgates
  – MISO currently evaluating projects to reduce congestion on Breed-Wheatland 345 kV facility.
    • Anticipated fix between 2014 and 2018
  – MISO currently evaluating projects to reduce congestion on Oakgrove-Galesburg 138 kV facility.
    • Anticipated fix 2019
    • Further Review to be conducted
  – MISO Projects approved that will fix violations in the Zion, Pleasant Praire, Kenosha, and Lakeview area
    • Special Protection Schema might be available in 2012
    • Upgrades in 2014
Upgrades- Stage 1A 10-Year ARR analysis

• COMED Zone
  – Following projects were studied
    • New Byron-Wayne 345 kV circuit
    • New Byron-Cherry Valley-Pleasant Valley 345 kV circuit
    • New Byron-Cherry Valley 345 kV circuit
    • New Cherry Valley-Pleasant Valley 345 kV circuit
    • New Byron-Pleasant Valley 345 kV circuit
  – Byron-Wayne 345 kV is most optimal project to fix 10-Year ARR violations.
    • Eliminates all COMED violations
  – Byron-Cherry Valley-Pleasant Valley and similar combinations do not fix all 10-Year ARR violations and create additional violations.
• Construct a new Byron – Wayne 345 kV
  • Approximately 56 miles
    – ComEd owns 30 of 56 miles between Byron and Wayne
  • Project eliminates the need for multiple SPS schemes related to Byron.
    – 20 different SPS at Byron
    – This project will eliminate the need for 13 of them
    – Remaining 7 may be either eliminated or simplified pending additional analysis
• Network upgrade identified for an interconnection project is not required with Byron – Wayne project.
  – Customer will contribute approx $40 million provided they move forward
• Estimated Project Cost: $140 M
• Estimated in-service date: TBD
Generation Deactivation Notification (Retirements) Update
<table>
<thead>
<tr>
<th>Unit</th>
<th>Trans Zone</th>
<th>Requested Deactivation Date</th>
<th>PJM Reliability Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chesapeake 1 &amp; 2, Yorktown 1</td>
<td>DOM</td>
<td>12/31/2014</td>
<td>Reliability Analysis complete. Impacts identified. Upgrades expected to be completed by June 2015.</td>
</tr>
<tr>
<td>Chesapeake 3 &amp; 4</td>
<td>DOM</td>
<td>12/31/2015</td>
<td>Reliability Analysis complete. Impacts identified. Upgrades expected to be completed by June 2016.</td>
</tr>
<tr>
<td>Bergen 3; Burlington 8; National Park 1;</td>
<td>PSEG</td>
<td>6/1/2015</td>
<td>Reliability Analysis Complete. Impacts identified and expected to be resolved in three - four years. Working with affected TO to finalize upgrade schedule.</td>
</tr>
<tr>
<td>Mercer 3; Sewaren 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Armstrong 1 &amp; 2; Bayshore 2-4; Eastlake 4-</td>
<td>AP</td>
<td>9/1/2012</td>
<td>Reliability analysis complete. Impacts identified and expected to be resolved by June 2016. Further refinement of the reliability analysis, required upgrades, and generator deactivation schedule continues. Unit will deactivate as scheduled. See posting - FE Generator Deactivation Study Results and Required Upgrades.</td>
</tr>
<tr>
<td>5; R Paul Smith 3 &amp; 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ashtabula 5; Eastlake 1-3; Lake Shore 18</td>
<td>AP</td>
<td>9/1/2012</td>
<td>Reliability analysis complete. Impacts identified and expected to be resolved by June 2016. Further refinement of the reliability analysis, required upgrades, and generator deactivation schedule continues. Unit will continue to operate as upgrades to transmission system are constructed - estimated till June 1, 2015. See posting - FE Generator Deactivation Study Results and Required Upgrades</td>
</tr>
<tr>
<td>Walter C Beckjord 1</td>
<td>DEOK</td>
<td>5/1/2012</td>
<td>Reliability Analysis complete - no impacts identified.</td>
</tr>
<tr>
<td>Walter C Beckjord 2-6</td>
<td>DEOK</td>
<td>4/1/2015</td>
<td>Reliability Analysis complete - impacts identified - upgrades scheduled to be completed by June 2014</td>
</tr>
<tr>
<td>Unit</td>
<td>Trans Zone</td>
<td>Requested Deactivation Date</td>
<td>PJM Reliability Status</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
<td>----------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Albright 1-3; Rivesville 5 &amp; 6; Willow Island 1 &amp; 2</td>
<td>APS</td>
<td>9/1/2012</td>
<td>Reliability Analysis complete - impacts identified - upgrades scheduled to be completed by May 2013. Thus generator can be allowed to deactivate as scheduled on 9/1/2012 assuming all upgrades are still on track to be completed as scheduled.</td>
</tr>
<tr>
<td>New Castle 3-5; New Castle Diesels A &amp; B</td>
<td>ATSI</td>
<td>4/16/2015</td>
<td>Reliability Analysis complete - impacts identified - upgrades scheduled to be completed by June 2015. Thus generator can be allowed to deactivate as scheduled.</td>
</tr>
<tr>
<td>Portland 1 &amp; 2; Glen Gardner CT 1-8</td>
<td>MetEd</td>
<td>1/7/2015</td>
<td>Reliability Analysis complete - impacts identified - upgrades and operating procedures expected to be in place by May 2015 to allow generators to deactivate as scheduled.</td>
</tr>
<tr>
<td>Elrama 1-3</td>
<td>DUQ</td>
<td>6/1/2012</td>
<td>Reliability Analysis complete - impacts identified - upgrades scheduled to be completed by June 2014. Unit deactivated on June 1, 2012.</td>
</tr>
<tr>
<td>Elrama 4</td>
<td>DUQ</td>
<td>6/1/2012</td>
<td>Reliability Analysis complete - impacts identified - upgrades scheduled to be completed by June 2014. Evaluating options. Unit to be kept in service until October 1, 2012, pending analysis of outages required to implement required system upgrades</td>
</tr>
<tr>
<td>Shawville 1-4; Titus 1-3</td>
<td>PenElec</td>
<td>4/16/2015</td>
<td>Reliability Analysis complete - impacts identified - upgrades and operating procedures expected to be in place by May 2015 to allow generators to deactivate as scheduled.</td>
</tr>
<tr>
<td>Niles 1</td>
<td>ATSI</td>
<td>6/1/2012</td>
<td>Reliability Analysis complete - impacts identified - upgrades scheduled to be completed by June 2014. Evaluating options. Unit to be kept in service until October 1, 2012, pending analysis of outages required to implement required system upgrades</td>
</tr>
<tr>
<td>Unit</td>
<td>Trans Zone</td>
<td>Requested Deactivation Date</td>
<td>PJM Reliability Status</td>
</tr>
<tr>
<td>------------------------------</td>
<td>------------</td>
<td>-----------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Niles 2</td>
<td>ATSI</td>
<td>6/1/2012</td>
<td>Reliability Analysis complete - impacts identified - upgrades scheduled to be completed by June 2014. Unit deactivated on June 1, 2012.</td>
</tr>
<tr>
<td>Fisk Street 19, Crawford 7 &amp; 8</td>
<td>ComEd</td>
<td>12/31/2012</td>
<td>Reliability Analysis Complete. No impacts identified.</td>
</tr>
<tr>
<td>Conesville 3</td>
<td>AEP</td>
<td>12/31/2012</td>
<td>Reliability Analysis complete - impacts identified - upgrades scheduled to be completed by June 2014. PJM continues to finalize details of required upgrades and completion dates.</td>
</tr>
<tr>
<td>Big Sandy 1; Clinch River 3; Glen Lyn 5 &amp; 6; Kammer 1-3; Kanawha River 1 &amp; 2; Muskingum River 1-4; Pickway 5; Sporn 1-4; Tanner Creek 1-3</td>
<td>AEP</td>
<td>6/1/2015</td>
<td>Reliability Analysis complete - impacts identified - upgrades scheduled to be completed by June 2015.</td>
</tr>
<tr>
<td>Avon Lake 7 &amp; 9</td>
<td>ATSI</td>
<td>4/16/2015</td>
<td>Reliability Analysis complete - upgrades scheduled to be completed by May 2015.</td>
</tr>
<tr>
<td>Sewaren 1-4</td>
<td>PSEG</td>
<td>6/1/2015</td>
<td>Reliability Analysis complete. No impacts expected with PSEG contemplating re-use of Capacity Rights for a new generation project</td>
</tr>
<tr>
<td>Cedar 1 &amp; 2; Deepwater 1 &amp; 6; Missouri Ave CT B, C &amp; D</td>
<td>AE</td>
<td>5/31/2015</td>
<td>Reliability Analysis complete - impacts identified - upgrades scheduled to be completed by May 2015</td>
</tr>
<tr>
<td>Hutchings 1 &amp; 2</td>
<td>Dayton</td>
<td>6/1/2015</td>
<td>Reliability Analysis complete. No impacts identified.</td>
</tr>
<tr>
<td>Smart Paper (St. Clair)</td>
<td>DEOK</td>
<td>8/10/2012</td>
<td>Reliability Analysis complete. No impacts identified.</td>
</tr>
</tbody>
</table>
Smart Papers Holdings LLC Retirement Notifications
DEOK (Smart Papers) Deactivations – Status and Next Steps

Smart Papers – 25MWs

Requested deactivation date: 9/1/2012

• No impacts identified
Dayton Power & Light Retirement Notifications
Dayton (Dayton Power & Light) Deactivations
- Status and Next Steps

Hutchings 1 & 2
(50 & 48 MWs)

Requested deactivation date: 6/1/2015

- No impacts identified
GenOn Retirement Notifications (Update Titus 1-3)

* Approval of all upgrades in this section of the presentation will be sought from the PJM Board of Managers at their July 10th meeting.
Titus 1-3 (81MWs each)

Requested deactivation date: 4/16/2015
- CarTech - Riverview 69kV check 1 overloads for the loss of North Temple – Rosedale 69 KV
- Construct a new North Temple - Riverview - Cartech 69 kV line (4.7 miles) with 795 ACSR
- Estimated cost: $4.815M
- Expected in service date: 6/1/2015
• North Temple – Rosedale 69kV  ck 1 overloads for the loss of North Temple – Riverview 69 KV
• Construct a new North Temple - Riverview - Cartech 69 kV line (4.7 miles) with 795 ACSR
• Estimated cost: $4.815M
• Expected in service date: 6/1/2015
- Middletown Jct - Swatra Hill 69kV ck 1 overloads for the loss of Wood Street Tap – Middletown 69 KV
- Upgrade 4/0 Cu substation conductor at Middletown 69 kV substation
- Estimated cost: $31.2K
- Expected in service date: 6/1/2014
- MIDDLETN - WOODTP72 69kV ck 1 overloads for the loss of MIDDLETOWN JCT - SWATARA HILL 69 KV
- Upgrade 4/0 and 350 Cu substation conductors on Middletown Jct - Swatra Hill 69 kV line.
- Estimated cost: $15K
- Expected in service date: 6/1/2014
• Muhlenberg – Rosedale 69kV ck 1 overloads for the loss of North Temple – Riverview 69 KV
• Construct a new North Temple - Riverview - Cartech 69 kV line (4.7 miles) with 795 ACSR.
• Estimated cost: $4.815M
• Expected in service date: 6/1/2015
• Baldy - Lyons 69kV ck 1 overloads for the loss of East Topton – Lyons 69 KV
• Upgrade an OC protection relay at the Baldy 69 kV substation.
• Estimated cost: $53.7K
• Expected in service date: 6/1/2014
AEP Retirement Notifications

* Approval of all upgrades in this section of the presentation will be sought from the PJM Board of Managers at their July 10\textsuperscript{th} meeting.
Conesville 3

Requested deactivation date: 12/31/2012

Big Sandy 1; Clinch River 3; Glen Lyn 5 & 6; Kammer 1-3; Kanawha River 1 & 2; Muskingum River 1-4; Pickway 5; Sporn 1-4; Tanner Creek 1-3

Requested deactivation date: 6/1/2015
Assumptions:

- Mountaineer 765/345 kV transformer in service (b1948)
- (4) 765 kV breakers installed at Kammer (b1962)

Both also identified for previous deactivation studies
• Overload on Waterford – Muskingum River 345 kV line in generation deliverability and N-1-1 analysis involving a combination of outages including loss of Belmont – Kammer 765 kV and/or Marysville – Flatlick 765 kV line

• Proposed Solution: Reconductor or rebuild Sporn – Waterford – Muskingum River 345 kV line

• Estimated Project Cost: $200M

• Expected in-service date: 6/1/2015
• Overload on Don Marquis 345/138 kV #2 transformer for the loss of Don Marquis 345/138 kV #1 transformer and Don Marquis – North Fork 345 kV line.

• Proposed Solution: Loop Conesville – Bixby 345 kV Circuit into Ohio Central

• Estimated Project Cost: $15M

• Expected in-service date: 6/1/2015
• Address several overloads for various contingencies under generation deliverability and N-1-1 analysis including:
  – West Bellaire – Brues 138 kV line
  – Brues – Brues 2 138 kV line section
  – Bethlehem – County Line 138 kV line
  – Belpre – Degussa 138 kV line
  – Natirum – George Washington 138 kV line
  – Newcomerstown – South Coshocton
• Proposed Solution: Establish Burger 345/138 kV station
• Estimated Project Cost: $35M
• Expected in-service date: 6/1/2015
• Address several overloads for various contingencies under generation deliverability and N-1-1 analysis including:
  – Carbondale – Carbondale Tap 138 kV
  – Amos – Dalewood 138 kV
  – Chemical #1 – Ortin 138 kV
  – Amos – Poca 138 kV
  – Chemical #1 – Ortin 138 kV
  – Amos – Tackett Creek 138 kV
  – Cabin Creek – South Ridge 138 kV
  – Capitol – Chemical #2
  – Amos – Turner #2

• Proposed Solution: Rebuild Amos – Kanawah River 138 kV corridor

• Estimated Project Cost: $150M

• Expected in-service date: 6/1/2015
• Address overload on existing:
  – Muskingum River 345/138 kV transformers
• Proposed Solution: Add 345/138 kV Transformer at Muskingum River station
• Estimated Project Cost: $10M
• Expected in-service date: 6/1/2015
• 05MUSKNG - 05MUSKNG overloads for N-1-1, AEP_OHIO_NEW_B3_1 + 05MOUNTN_05BELMON_102
• Proposed Solution: Adjust tap settings for Muskingum River transformers
• Estimated Project Cost: $0.1 M
• Expected in-service date: 12/31/2013
• Address overload on existing:
  – Kanawah River 345/138 kV transformers
• Proposed Solution: Add 345/138 kV Transformer at Kanawha River station
• Estimated Project Cost: $10M
• Expected in-service date: 6/1/2015
• Address overload on existing:
  – North Crown City – Thiven 138 kV
  – Addison – Thiven 138 kV
  – North Crown City – Windsor 138 kV
• Proposed Solution: Add 345/138 kV Transformer at Sporn station
• Estimated Project Cost: $10M
• Expected in-service date: 6/1/2015
• Address overload on Tri State – Darrah 138 kV, and Tri State – Kenova 138 kV lines for N-1-1 analysis. Also, addresses overload on Tri State – Chadwick 138 kV for generation deliverability analysis.

• Proposed Solution: Terminate Tristate – Kyger Creek 345 kV line at Sporn

• Estimated Project Cost: $10M

• Expected in-service date: 6/1/2015
Hillview - Newcomerstown 138 kV line loads to 101.1% of its rating of 191 MVA for the single contingency '05KAMMER-05SCANTO-05SCANTE-765-345' followed by 'BASE CASE'.

**Proposed Solution:** Advance existing baseline project B1737 (Sag study of Newcomerstown - Hillview 138 kV line and upgrade terminal equipment).

- Estimated Project Cost: $0.2M
- Expected in-service date: 12/31/2012
• Ohio Central - Prep Plant Tap 138 kV line loads to 101.7% of its rating of 446 MVA for the single contingency '05KAMMER-05SCANTO-05SCANTE-765-345' followed by '02GALION-05OHIOCT-05MUSKNG-05OH-345-1N2' 

• Proposed Solution: Advance existing baseline project B1474 (Perform a sag study on the Ohio Central – Prep Plant tap 138 kV circuit) 

• Estimated Project Cost: $0.04 

• Expected in-service date: 12/31/2012
• Prep Plant Tap - Conesville East 138 kV line loads to 101.7% of its rating of 446 MVA for the single contingency of Kammer – South Canton 765 kV facility and associated equipment followed by '02GALION-05OHIOCT-05MUSKNG-05OH-345-1N2'
• Proposed Solution: Existing baseline project B1502 (Reconductor the Conesville East – Conesville Prep Plant Tap 138 kV section of the Conesville – Ohio Central)
• Estimated Project Cost: $2M
• Expected in-service date: 6/1/2013
• Cross Street - Madison 138 kV line loads to 105.6% of its rating of 167 MVA for the single contingency of Rockport – Jefferson 765 kV followed by the Desoto 345/138 kV transformer
• Proposed Solution: Existing baseline project B1039 (Perform a sag study for the Madison – Cross Street 138 kV line)
• Estimated Project Cost: $0.15
• Expected in service date: 6/1/2013
• Tiffin - Greenlawn overloaded for loss of Melmore to Tiffin
• Proposed Solution: Replace relay at Greenlawn
• Estimated Project Cost: $0.1M
• Expected in-service date: 5/1/2015
• Tanner Creek 345/138kV transformers #1 & 2 are overloaded N-1-1
• Proposed Solution: Replace both 345/138 kV transformers with one bigger transformer. Work is currently underway
• Estimated Project Cost: $10M
• Expected in-service date: 12/31/2013
• Amos 345/138kV transformers #7 & 8 are overloaded for several N-1-1 conditions
• Proposed Solution: Replace relay
• Estimated Project Cost: $0.2M
• Expected in-service date: 12/31/2014
Newcomerstown – South Coshocton overloaded for several conditions

Proposed Solution: Advance existing baseline b1867 from 2016, perform sag study

Estimated Project Cost: $0.4M

Expected in-service date: 12/31/2012
West Philo - Zanesville overloads for several N-1-1 conditions

- Proposed Solution: Perform sag study
- Estimated Project Cost: $0.5M
- Expected in-service date: 12/31/2012

• Proposed Solution: Install 3-138 kV breakers and a circuit switcher at Dorton station

• Estimated Project Cost: $3.0M

• Expected in-service date: 5/1/2015
• Ohio Central 345/138kV transformer overloads under several N-1-1 conditions
• Proposed Solution: Replace transformer, work currently underway
• Estimated Project Cost: $10M
• Expected in-service date: 12/31/2013
• West Bellaire & Brues overload for multiple N-1-1 conditions
• Proposed Solution: Advance existing baseline b1864; Add second West Bellaire - Brues 138 kV circuit
• Estimated Project Cost: $60M
• Expected in-service date: 5/1/2015
• Countyline – Robison Park overloads for N-1-1, 7289_B2_TOR10200000 + 5654_B2_TOR11837A_MO AB
• Proposed Solution: This line is being rebuild as part of an approved baseline project b1490- Rebuild Auburn - Robinson Park 138 kV as a Double Circuit Tower Line
• Estimated Project Cost: $32M
• Expected in service date: 5/1/2015 (no change of in service date)
• The Altavista (Dominion) - Skimmer Line overloads for N-1-1 under several conditions
• Proposed Solution: Rebuild 28 mile line
• Estimated Project Cost: $60M
• Expected in service date: 6/1/2015
Sporn-Rutland 138 kV line overloads for AEP_OHIO_NEW_C5_2

Proposed Solution: Perform a sag study of Sporn-Rutland 138 kV line

Estimated Project Cost: $0.05M

Expected in-service date: 12/31/2012
Reliability Analysis Update
• N-1-1 Voltage Violation:
  Voltage drop violation and potential loss of more than 300 MW load in the Atlantic 230 kV area for the loss of the Atlantic – Ocean View 230 kV circuits ‘X2024’ & ‘Y2025’.

• Proposed Solution:
  - Build a new 230 kV circuit from Larrabee to Oceanview (B2015).

• Estimated Project Cost: $ 78.333 M

• Expected IS Date: 6/1/2016
Operational Performance – High System Voltages
Operational Performance – High System Voltages

• High voltage in PJM Operations today
  – MAAC
  – Dominion

• Drivers
  – Low RTO load (less than 50% of summer peak)
  – Generation Outages

• Future
  – Generation retirements (and associated loss of reactive)
    • Over +7500 / - 2300 MVAR of reactive lost due to retirements associated with deactivation notifications received since 11/2011
  – Additional transmission due to peak load reliability violations

• Next Steps
  – Continue to evaluate operational data
  – Review and recommend reactive solution
    • Technology – shunt reactors, Location, Size, Configuration
Short Circuit
• The Elrama 138 kV breakers ‘#4-138SYNREA’ and ‘#3-138 SYN B’ are overstressed

• Proposed Solution: Replace Elrama 138 kV breakers ‘#4-138SYNREA’ and ‘#3-138 SYN B’ (b2013 & b2014)

• Estimated Project Cost: TBD

• Expected IS Date: 06/1/2013
The Essex 138 kV breakers ‘3PM,’ ‘1PM,’ ‘1BM,’ ‘4LM,’ & ’3LM’ are overstressed.

Proposed Solution: Install a reactor along the Kearny – Essex 138 kV line.

Estimated Project Cost: $7.5 M

Expected IS Date: 06/1/2013
The Sewaren 138 kV breakers ‘11P’ and ‘21P’ are overstressed.

- Proposed Solution: Replace Sewaren 138 kV breakers ‘11P’ and ‘21P’ (b2035-b2036)
- Estimated Project Cost: $500 K per breaker
- Expected IS Date: 06/1/2013
The PVSC 138 kV breakers ‘452’ and ‘552’ are overstressed.

Proposed Solution: Replace PVSC 138 kV breakers ‘452’ and ‘552’ (b2037-b2038)

Estimated Project Cost: $500 K per breaker

Expected IS Date: 06/1/2013
• The Bayonne 138 kV breaker ‘11P’ is overstressed
• Proposed Solution: Replace Bayonne 138 kV breaker ‘11P’ (b2039)
• Estimated Project Cost: $500 K
• Expected IS Date: 06/1/2013
Supplemental projects
BGE Transmission Zone

- **BGE Reliability:**
  - To meet BGE distribution system reliability standards as a result of expanding the Sandy Springs distribution substation.

- **Proposed Solution:**
  - Add two breakers at Sandy Springs 230 kV substation (S0428).

- **Estimated Project Cost:**
  - $2.0 M

- **Expected IS Date:**
  - 12/1/2014
Upgrades Reviewed at Previous TEAC Meetings*

* Approval of all upgrades in this section of the presentation will be sought from the PJM Board of Managers at their July 10th meeting.
• Generator Deliverability / Common Mode Violation

• The Waterford - Muskingum 345KV line is overloaded for various contingencies

• Perform a Sag study of 4 miles of the Waterford – Muskingum line (B1811.1) $16,000

• Rebuild 0.10 miles of Waterford – Muskingum 345kV with 1590 ACSR (B1811.2) $50,000

• Estimated Project Cost:
  – $0.016M (B1811.1)
  – $0.05M (B1811.2)

• Expected IS date: 6/1/2016
• Load Deliverability Violation

• The South Canton - Star 345kV line is overloaded for the loss of the Sammis - Star 345kV Line.

• Reconductor the AEP portion of South Canton – Star 345kV with 954 ACSR and upgrade terminal equipment at South Canton. (B1812)

• Estimated Project Cost: $0.8M

• Expected IS date: 6/1/2016
• N-1-1 Thermal Violation

• The loading on the Concord – Jackson Road 138 kV line can not be dispatched below normal rating after the loss of the Cook - East Elkhart – Hiple 345KV line and the East Elkhart 345/138KV transformer #2

• Recommended Solution: Install (3) 345 kV circuit breakers at East Elkhart station in ring bus designed as a breaker and half scheme. (B1817)

• Estimated Project Cost: $6M

• Expected IS date: 6/01/2016
• Proposed change to scope and associated cost

• Original:
  ✓ B1663: Install a new 765/138 kV transformer at Jackson Ferry substation
  ✓ B1663.1: Establish a new 10 mile double circuit 138 kV line between Jackson Ferry and Wythe
  ✓ Estimated Project Cost: $40M

• Continued on next slide…
AEP Transmission Zone

- Cost change and scope split change

- Original Scope:
  - B1663: Install a new 765/138 kV transformer at Jackson Ferry substation
  - B1663.1: Establish a new 10 mile double circuit 138 kV line between Jackson Ferry and Wythe
  - Estimated Project Cost: $40M

- New Proposed Scope:
  - Jackson’s Ferry 765 kV
    - Install two 765kV circuit breakers
    - Install breaker disconnect switches and associated bus work for the new 765kV breakers
    - Install new relays for the 765kV breakers at Jackson's Ferry (B1663.2)
    - Estimated project cost: $8M
  - Jackson’s Ferry 138 kV
    - Install a new 765/138kV 750 MVA transformer (4-250 MVA single phase units including a spare) Build a new ~14 mile 138kV double circuit from Jackson's Ferry to Wythe
    - Install 6 new 138kV breakers at Jackson’s Ferry
    - Install breaker disconnect switches and associated bus work for the new 138kV breakers at Jackson's Ferry
    - Install 2 new 138kV breakers at Wythe
    - Install breaker disconnect switches and associated bus work for new 138kV breakers at Wythe
    - Install new line relays for new 138kV line and 138kV breakers at Wythe and Jackson's Ferry (B1663) -$37M
  - Cancel B1663.1

- Expected IS Date: 6/1/2015
• Cost change and scope split

• Original scope:
  – b1659 Establish Sorenson 345/138 kV station as a 765/345 kV station - $85M

• New proposed scope:
  – Build approximately 14 miles of 765 kV line from existing Dumont - Marysville line (B1659.14)
    • Estimated Project Cost: $35M
  – Establish 765 kV yard at Sorenson and install four 765 kV breakers (B1659.13)
    • Estimated Project Cost: $20M
  – Sorenson 765/345 kV transformer and 345 kV work at Sorenson (B1659)
    • Estimated Project Cost: $45M

• Expected IS date: 6/1/2015
AEP Transmission Zone

- N-1-1 Thermal Violation
- Thermal Overloads:
  - County Road – Robison Park 138 kV for the loss of Butler – Woods Road 138 kV line and the Albion – Kendallville 138 kV line
  - Sorenson – Coventry 138 kV for the loss of Sorenson – Industrial Park 138 kV and Allen – Sorenson 345 kV and the Allen 345/138 kV transformer
  - Illinois Road – Sorenson 138 kV line can not be dispatched below normal rating for the loss of Allen – Sorenson 345 kV line
  - The Concord – Jackson Road 138 kV line can not be dispatched below normal rating for the loss of the Cook- Hiple 345kV line
  - Continued on next slide…
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Recommended Solution: Expand the Allen station by installing a second 345/138 kV transformer and adding four 138 kV exists by cutting in the Lincoln – Sterling and Milan – Timber Switch 138 kV double circuit tower line. (B1818)

Estimated Project Cost: $45M

Expected IS date: 6/1/2016
- N-1-1 Thermal Violations

- Thermal Overloads:
  - The GM Truck – McKinley 138 kV line is overloaded for the loss of Sorenson – Industrial Park 138 kV line plus Sorenson – McKinley 138 kV line
  - The Illinois Road – Industrial Park 138 kV line is overloaded for the loss of the Allen – Sorenson 345 kV line plus Coventry – Eagle Ridge- McKinley 138kV line or the loss of the Allen – Sorenson 345 kV line with Allen 345/138kV transformer plus Convetry – Eagle Ridge – McKinley 138 kV line
  - The Illinois Road – Sorenson 138 kV can not be dispatched below normal rating for loss of Allen – Sorenson 345 kV line or the loss of the Allen – Sorenson 345 kV line with Allen 345/138kV transformer
  - The Industrial Park – McKinley 138 kV for loss of Sorenson – Industrial Park 138 kV line plus Convoy – Robison Park 345 kV line plus Robison Park 345/138 kV transformer #5
  - The Coventry – Sorenson 138 kV line is overloaded for the loss of Allen – Sorenson 345 kV line plus Allen 345/138 kV transformer #1 or for the loss of Allen – Sorenson 345 kV line plus Sorenson – Industrial Park 138 kV line

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• Rebuild the Robison Park – Sorenson 138 kV line corridor as a 345 kV double circuit line with one side operated at 345 kV and one side at 138 kV. (B1819)

• Estimated Cost: $55M

• Expected IS date: 6/1/2016
AEP Transmission Zone

- **Project Scope Change for B1662**

- **Old scope:**
  - B1662 - Rebuild 4 miles of 46 kV line to 138 kV from Pemberton to Cherry Creek
  - B1662.1 - Circuit Breakers are installed at Cherry Creek (facing Pemberton) and at Pemberton (facing Tams Mtn. and Cherry Creek)
  - Old Estimated Project Cost: $5M

- **New scope:**
  - B1662 - Rebuild 4 miles of 46 kV line to 138 kV from Pemberton to Cherry Creek
  - B1662.1 - Install two 138kV breakers at Cherry Creek (facing Pemberton and Grandview Stations). Install 2 138kV breakers at Pemberton (facing Cherry Creek and Tams Mountain).
  - B1662.2 - Install 3 138kV breakers at Grandview Station (facing Cherry Creek, Hinton, and Bradley Stations).
  - B1662.3 - Remove Sullivan Switching Station (46kV).
  - New Estimated Project Cost: $8M

- **Expected IS date: 6/1/2015**
Project Scope Change for B1665

Old scope:
- B1665 - Install a second 138/69 kV transformer at Thelma station
- B1665.1 - Construct a single-circuit 69 kV line from West Paintsville to the new Paintsville station
- Cost estimate: $12M

New scope:
- B1665 - Install a second 138/69 kV transformer at Thelma station
- B1665.1 - Construct a single-circuit 69 kV line from West Paintsville to the Mayo Trail Station
- B1665.2 - Install new 7.2 MVAR, 46 kV bank at Kenwood Station.
- Cost estimate: $12.75M

Expected IS date: 6/1/2015
Project Scope Change for B1666

Old scope:
- Build an 8 breaker 138 kV station tapping both circuits of the Fostoria - East Lima 138 kV line
- Old Cost Estimate: $10M

New scope:
- Build new nine (9) breaker 138 kV station near Ohio Power Company’s Morrical Switch Station tapping both circuits of the Fostoria Central - East Lima 138 kV line.
- New Cost Estimate: $13.5M
- Expected IS date: 6/1/2015
AEP Transmission Zone

- Project Scope Change for B1429
  - Old scope: Perform a sag study on Fremont - Clinch River 138kV to allow for operation up to its conductor emergency ratings
  - New scope: Perform a sag study on Fremont - Clinch River 138kV and upgrade the risers with 1590ACSR. The new projected S/E is 310 MVA.
- Estimated Project Cost: $0.1M
- Expected IS date: 6/1/2015
Project Scope Change for B1444

Old scope: Perform electrical clearance studies on Clinch River – Clinchfield 138 kV line (a.k.a. sag studies) to determine if the emergency rating can be utilized.

New scope: Perform electrical clearance studies on Clinch River - Clinchfield 138 kV line (a.k.a. sag studies) and upgrade the risers at Clinch River 138kV substation with 1590 ACSR. The new projected S/E is 310 MVA.

Estimated Project Cost: 0.1M

Expected IS date: 6/1/2015
AEP Transmission Zone

- Project Replacement

- Withdrawal of B1739
  ✓ Old Scope: Perform a sag study of the Ohio Central - West Trinway 138 kV line
  ✓ Estimated Project Cost: $0.05M
  ✓ Expected IS date: 06/01/2016

- Replaced by B1901
  ✓ Rebuild the Ohio Central – West Trinway (4.84 miles) section of the Academia – Ohio Central 138 kV circuit. Upgrade the Ohio Central riser, Ohio Central switch and the West Trinway riser
  ✓ Estimated Project Cost: $8.64M
  ✓ Expected IS date: 06/01/2016
Project Scope Change for B1490.1-.4

Old scope:
- b1490.1-- Establish a new 138/69 kV Butler Center station
- b1490.2-- Build a new 14 mile 138 kV line from Auburn station to Woods Road station VIA Butler Center station
- b1490.3-- Replace the existing 40 MVA 138/69 kV transformer at Auburn station with a 90 MVA 138/69 kV transformer
- b1490.4 -- Improve the switching arrangement at Kendallville station
- Estimated Project Cost: $25M

New scope:
- 1490.1— Acquire station site for a future 345/138 kV station near Wilmington Tap Switch. Establish a new 69/12 kV distribution station near Cedar station.; Construct approximately 7 miles of 69 kV Double Circuit Tower Line to Butler Center Station by taping the Auburn – Kendallville 69 kV line. Retire Garrett 69 kV and Cedar 34.5 kV stations. Retire Garrett – Cedar 34.5 kV line. Transfer and consolidate distribution load from Cedar and Garrett Stations at the Butler Center Station. By pass Garrett Station on the Auburn – Kendallville 69 kV line.
- 1490.2-- Rebuild Auburn – Robison Park 138 kV as a Double Circuit Tower Line.
- B1490.3-- Replace Auburn 138-69/34.5 transformer with a 100 MVA bank.
- B1490.4-- Install a 138 kV circuit breaker on the Albion – Garrett North 138 kV line at Kendallville station towards Albion.
- Estimated Project Cost: $32M

Expected IS date: 6/1/2015
• N-1-1 Thermal Violation

• The Cave Spring1 – Roanoke2 138KV line is overloaded for various contingency pairs such as: the loss of Hancock1 – Matt Funk 138kV line and the Matt Funk – Hancock2 138kV line

• Perform a sag study for Hancock-Cave Spring - Roanoke 138 kV Circuit to see if any remedial action needed to reach the new SE ratings of 272MVA for Cave Spring – Hancock 138kV, 205MVA for Cave Spring –Sunscape 138KV, and 245 ROANO2-Sunscape 138kV (B1859)

• Estimated Project Cost: $0.04M

• Expected IS date: 06/01/2016
AEP Transmission Zone

- N-1-1 Thermal Violation
- The Crooksville – Spencer 138kV line is overloaded for the loss of the Kimberly – Poston 138kV line and the loss of the Muskingum – Waterfront 345kV line
- Perform a sag study on the Crooksville – Spencer Ridge section (14.3 miles) of the Crooksville – Poston – Strouds Run 138 kV circuit to see if any remedial action needed to reach the new SE rating of 175MVA (B1860)
- Estimated Project Cost: $0.06M
- Expected IS date: 06/01/2016
• N-1-1 Thermal Violation

• The Dale – West Canton 138kV line is overloaded for the loss of the Sammis – Star 345kV line and South Canton – Star 345kV line; The line can not be dispatched below normal rating for the loss of South Canton – Star 345kV line

• Reconductor 0.83 miles of the Dale-West Canton 138kV Tie-line and upgrade risers at West Canton 138kV(B1861)

• Estimated Project Cost: $1.7M

• Expected IS date: 06/01/2016
• N-1-1 Thermal Violation

• The Grant – Greentown 138kV line is overloaded for the loss of Dumont – Greentown 765kV line and the Hummel – Greentown 138KV line

• Perform a sag study on the Grant - Greentown 138 kV circuit and replace the relay CT at Grant 138kV station to see if any remedial action needed to reach the new ratings of 251/286MVA( B1862)

• Estimated Project Cost: $0.1M

• Expected IS date: 06/01/2016
AEP Transmission Zone

- N-1-1 Thermal Violation
- The Kammer1 – Caiman 138kV line is overloaded by various pairs of contingencies, such as for the loss of the Kammer – South Canton 765kV line with South Canton 765/345kV and 345/138kV transformers and the Kammer – West Bellaire – Tidd 345KV line
- Perform a sag study of the Kammer-Wayman SW 138kV line to see if any remedial action needed to reach the new SE rating of 284MVA(B1863)
- Estimated Project Cost: $0.6M
- Expected IS date: 06/01/2016
• N-1-1 Thermal Violation

• The Brues – West Bellaire 138kV line and Kammer2 – Ormet 138kV line are overload for various pairs of contingencies

• Add two additional 345/138kV Transformers at Kammer. (B1864.1)
• Add second West Bellaire-Brues 138kV Circuit (B1864.2)

• Estimated Project Cost: $60M
• Expected IS date: 06/01/2016
AEP Transmission Zone

- N-1 Thermal Violation
- The Kanawha – Carbondale 138 KV line is overload for the loss of the Mountaineer – Belmont 765kV line
- Perform a Sag study on the Kanawha – Carbondale 138 KV line to see if any remedial action needed to reach the new ratings of 251/335MVA (B1865)
- Estimated Project Cost: $0.07M
- Expected IS date: 06/01/2016
AEP Transmission Zone

• N-1-1 Thermal Violation

• The Clinch River – Lock Hart – Dorton 138kV line is overload for the loss of the Clinch River – Fremont 1 138kV line and the Clinch River – Clinchfield – Fletcher Ridge 138kV line

• Perform a sag study on the Clinch River – Lock Hart -Dorton 138kV line, Increase the Relay Compliance Trip Limit at Clinch River 138kV on the Clinch River – Dorton 138kV line to at least 310 and upgrade the risers at Clinch River with 1590ACSR (improve the emergency rating to 310 MVA) (B1866)

• Estimated Project Cost: $0.35M
• Expected IS date: 06/01/2016
AEP Transmission Zone

- N-1-1 Thermal Violation
- The Newcomerstown – South Coshocton 138kV line is overload for the loss of the Kammer-South Canton with South Canton 765/345kV and 345/138kV transformers and the Muskingum River – West Cambridge 138kV line
- Perform a sag study on the Newcomerstown- South Coshocton 138kV line to line to see if any remedial action needed to reach the new SE rating of 179MVA (B1867)
- Estimated Project Cost: $0.4M
- Expected IS date: 06/01/2016
AEP Transmission Zone

- N-1-1 Thermal Violation

- The East Lima – New Liberty 138kV line is overloaded for the loss of Fostoria 345/138kV transformer and the East Lima – North Findlay 138kV line

- Perform sag study of the East Lima – new Liberty 138kV line to see if any remedial action needed to reach the new SE rating of 219MVA(B1868)

- Estimated Project Cost: $0.1M

- Expected IS date: 06/01/2016
AEP Transmission Zone

- N-1-1 Thermal Violation

- The Ohio Central – South Coshocton 138kV line is overloaded for various pairs of contingencies, such as: for the loss of the Kammer - South Canton 765kV lien with South Canton 765/345kV and 345/138kV transformers and the Muskingum – West Cambridge 138kV line

- Perform a sag study of the Ohio Central – South Coshocton 138 kV circuit to see if any remedial action needed to reach the new SE ratings of to see if any remedial action needed to reach the new SE ratings of 250MVA (B1869)

- Estimated Project Cost: $0.07M

- Expected IS date: 06/01/2016
- N-1-1 Thermal Violation

- The Ohio Central 345/138kV transformer is overloaded for the loss of the Galion – Ohio Central 345kV line and North Newark – Sharp Road-West Mount Vernon 138kV line or the Kammer – South Canton 765kV line with South Canton 765/345kV and 345/138kV transformers

- Replace the Ohio Central transformer #1 345/138/12 kV 450 MVA for a 345/138/34.5 kV 675 MVA transformer (B1870)

- Estimated Project Cost: $8M

- Expected IS date: 06/01/2016
• N-1-1 Thermal Violation

• The Ohio Central – West Coshocton 138kV line is overloaded for the loss of and the loss of the Kammer – South Canton 765KV line with the South Canton 765/345 transformer #3 and South Canton 345/138kV transformer #4 and the loss of the Ohio Central – South Coshocton 138kV line

• Perform a sag study on the Ohio Central – West Coshocton 138KV line (improve the emergency rating of this line to 254 MVA)(B1871)

• Estimated Project Cost: $0.075M

• Expected IS date: 06/01/2016
AEP Transmission Zone

- N-1-1 Voltage Violation

- Low voltage magnitude at Osolo 138kV bus for the loss of the Beech Road – Twin Branch 138kV line and the loss of the East Elkhart 345/138kV transformer #2

- Addition of a 57.6 MVAr capacitor bank at East Elkhart 138 kV station in Indiana (B1872)

- Estimated Project Cost: $0.6M

- Expected IS date: 06/01/2016
AEP Transmission Zone

- N-1-1 Voltage Violation
- Low voltage magnitude at Johns Creek 138KV bus for the loss of the Sprigg -Stone – Johns Creek 138kV line and the loss of the Inez 138kV FACTS device
- Install two 138kV circuit breakers at Cedar Creek Station and primary side circuit switcher on the 138/69/46kV transformer (B1873)
- Estimated Project Cost: $2.5M
- Expected IS date: 06/01/2016
AEP Transmission Zone

- N-1-1 Voltage Violation
- Voltage drop violation at Adam, Bluff Point, Jay and Pennville 138kV buses for the loss of and the loss of Allen – Magely – R03 tap 138kV line and the Desoto – Jay 138kV line
- Install (2) 138 kV Circuit Breakers and (1) 138 kV Circuit Switcher at Magely 138kV Station in Indiana(B1874)
- Estimated Project Cost: $2M
- Expected IS date: 06/01/2016
• N-1-1 Voltage Violation and AEP Planning Criteria Violation

• Large Voltage Drop at Belva and McClung 138kV buses for the loss of the Bradley - Kincaid- Kanawha 138kV line and the loss of the Kanawha - Carbondale – Belva 138kV line; Various 69kV lines are overloaded for several single contingencies

• Build 25 miles of new 138kV line from Bradley Station through Tower 117 Station and terminating at McClung 138kV Station. Existing 69kV distribution transformers will be replaced with 138kV transformers. (B1875)

• Estimated Project Cost: $50M

• Expected IS date: 06/01/2016
• N-1-1 Voltage Violation

• Low voltage magnitude at Beech Jct and County Road 138kV bus for the loss of East Elkhart 345/138KV transformer #2 and the loss Beech Road–Twin Branch 138kV line;

• Install a 14.4 MVAr capacitor bank at Capital Avenue (AKA Currant Road) 34.5 kV bus (B1876 )

• Estimated Project Cost: $0.2M

• Expected IS date: 06/01/2016
AEP Transmission Zone

- N-1-1 Voltage Violation
- Large voltage drop at West Kingsport 138kV bus for the loss of the Industry Drive - West Kingsport - Nagel 138kV line and the loss the Indian Springs-North Bristol 138kV line or the Indian Springs – Edens Ridge-West Kingsport 138kV line or Indian Springs – North Bristol – Wolf Hills 138kV lines;
- Relocate 138kV Breaker G to the West Kingsport – Industry Drive 138 kV line and Remove 138 kV MOAB (B1877 )
- Estimated Project Cost: $0.25M
- Expected IS date: 06/01/2016
AEP Transmission Zone

- N-1-1 Thermal Violation

- The Lincoln – Robison Park 138kV line is overloaded for various contingency pairs

- Perform a Sag Study on the Lincoln – Robison Park 138kV line (Improve the emergency rating to 244 MVA). (B1878)

- Estimated Project Cost: $0.1M

- Expected IS date: 06/01/2016
- N-1-1 Thermal Violation

- The Hansonville – Meadowview 138kV line is overloaded for various contingency pairs

- Perform a Sag Study on the Hansonville – Meadowview 138kV line (Improve the emergency rating to 245 MVA). (B1879)

- Estimated Project Cost: $0.1M

- Expected IS date: 06/01/2016
AEP Transmission Zone

- N-1-1 Thermal Violation
- The Moseley – Roanoke 138kV line is overloaded for various contingency pairs;
- Rebuild the 15 miles of the Moseley – Roanoke 138kV line. This project would consist of rebuilding both circuits on the double circuit line. (B1880 )
- Estimated Project Cost: $30M
- Expected IS date: 06/01/2016
• **N-1-1 Thermal Violation**

• **East Side Lima – Sterling 138kV line** is overloaded for the loss of the Allen – Sorenson 345kV line with the Allen 345/138kV transformer and the loss of the Convoy – Rob Park 345kV line with the Rob Park 345/138kV transformer

• Replace existing 600 Amp switches, station risers and increase the CT ratios associated with breaker “G” at Sterling 138 kV Station. It will increase the rating to 296 MVA S/N and 384 MVA S/E. (B1881)

• Estimated Project Cost: $0.6M

• Expected IS date: 06/01/2016
AEP Transmission Zone

- Common Mode Violation

- The Randolph - Bluff Point 138kV line is overloaded for the tower outage of the Delaware – Modoc 138kV line and the Delaware – Selma Parker 138 kV line

- Perform a sag study on the Bluff Point – Randolph 138 kV line to see if any remedial action needed to reach the new SE rating of 255MVA. (B1882)

- Estimated Project Cost: $0.1M

- Expected IS date: 06/01/2016
- Common Mode Violation

- The Grant Tap - Deer Creek 138 kV line is overloaded for the loss of the Dumont – Greentown 765kV line with the breaker failure at Greentown 765kV

- Perform a sag study on from Strawton station - Fisher Body - Deer Creek 138kV line to see if any remedial action needed to reach the new SE rating of 250MVA (B1884)

- Estimated Project Cost: $0.08M

- Expected IS date: 06/01/2016
AEP Transmission Zone

- **AEP Voltage Criteria Violation**

- Low voltage violations on the Dennison-Miller SW 69kV line for the loss of the New Philadelphia 138/69kV Transformer.

- Establish a new 138/69kV source at Carrollton and construct two new 69kV lines from Carrollton to tie into the Dennison-Miller SW 69kV line and to East Dover 69kV Station respectively (B1887)

- **Estimated Project Cost:** $50M

- **Expected IS date:** 06/01/2013
AEP Transmission Zone

- **AEP Voltage Criteria Violation**

- Voltage at Cherry Pond, Blue Pennant, Sylvester, and Jarrels Creek 69kV Stations drop to 0.89 - 0.916 pu for the outage of the Sundial 138/69/46kV transformer.

- Install a 69kV line breaker at Blue Pennant 69kV Station facing Bim Station and a 14.4Mvar capacitor bank. (B1888)

- Estimated Project Cost: $1.8M

- Expected IS date: 03/01/2012
AEP Transmission Zone

- AEP Voltage Criteria Violation

- Low voltage levels at Hinton 138kV and surrounding buses to the east drop to .89pu. With an outage of the Glen Lyn – Hinton 138kV line.

- Install a 43.2 Mvar Capacitor Bank at Hinton 138kV Station (APCO WV). (B1889)

- Estimated Project Cost: $0.8M

- Expected IS date: 09/01/2012
• The Meadow Brook 138 kV breakers ‘MD-1’ and ‘MD-2’ are overstressed
• Proposed Solution: Replace Meadow Brook 138kV breakers ‘MD-1’ and ‘MD-2’ (b0347.33, b0347.34)
• Estimated Project Cost: $190 K per breaker
• Project IS Date: 6/1/2013
• N-1-1 thermal Violation
• The Millville - Old Chapel 138 kV line is overloaded for various 500kV contingency pairs

• Recondor 14.3 miles of 556 ACSR with 795 ACSR from Old Chapel to Millville 138kV and upgrade line risers at Old Chapel 138kV and Millville 138KV and replace 1200 A wave trap at Millville 138kV with a 1600 A wave trap. (B1835)

• Estimated Project Cost: $7.95M
• Expected IS date: 06/01/2016
• N-1-1 thermal Violation

• The Reid - Paramount 138 kV is overloaded for the loss of the Bedington - Doubs 500 kV line and the loss of either the Bedington - Nipetown 138 kV line or Reid - Nipetown 138 kV line

• Replace 1200 A wave trap with 1600 A wave trap at Reid 138kV SS. (B1836)

• Estimated Project Cost: $0.07M

• Expected IS date: 06/01/2016
• N-1-1 thermal Violation

• The Marlowe - Bedington 138 kV is overloaded for the loss of the Bedington - Doubs 500 kV line and the loss of either the Marlowe - Bedington - Cherry Run 138 kV line or the Bedington - Nipetown 138 kV line

• Replace 750 CU breaker risers at Marlowe 138kV with 795 ACSR and replace 1200 A wave traps with 1600 A wave traps at Bedington 138kV and Marlowe 138kV. (B1837)

• Estimated Project Cost: $0.1M

• Expected IS date: 06/01/2016
• N-1-1 thermal Violation

• The Bedington - Nipetown 138 kV line is overloaded for the loss of the Bedington - Doubs 500 kV line and the loss of the Marlow - Halfway 138 kV line

• Replace the 1200 A Bedington 138 kV line air switch and the 1200 A 138 kV bus tie air switch at Nipetown 138kV with 1600 A switches. (B1838)

• Estimated Project Cost: $0.1M

• Expected IS date: 06/01/2016
• **N-1-1 Voltage Violation**

• Voltage drop and Voltage Magnitude violations at Greene 138 kV, Grand Point 138kV, Guilford 138kV, Letterkenny 138kV buses and etc. for various contingency pairs

• Install Additional 33 MVAR Capacitors at Grand Point 138kV SS and Guilford 138kV SS. (B1839)

• Estimated Project Cost: $2M

• Expected IS date: 06/01/2016
• FE Transmission Facility Rating methodology

• Re-evaluation of active APS Zone baseline RTEP projects
<table>
<thead>
<tr>
<th>Upgrade ID</th>
<th>Required IS Date</th>
<th>Description</th>
<th>Cost Estimate (millions)</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>b1233.1</td>
<td>6/1/2015</td>
<td>Upgrade terminal equipment at Washington</td>
<td>0.05</td>
<td>Cancel</td>
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<tr>
<td>b1234</td>
<td>6/1/2015</td>
<td>Replace structures between Ridgeway and Paper city</td>
<td>0.75</td>
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<td>b1241</td>
<td>6/1/2015</td>
<td>Upgrade terminal equipment at Washington substation on the GE Plastics/DuPont terminal</td>
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<tr>
<td>b1384</td>
<td>6/1/2015</td>
<td>Reconductor approximately 2.17 miles of Bedington - Shepherdstown 138kV with 954 ACSR</td>
<td>1.75</td>
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<tr>
<td>b1389</td>
<td>6/1/2015</td>
<td>Reconductor Bens Run – St. Mary’s 138 kV with 954 ACSR</td>
<td>5.8</td>
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<tr>
<td>b1392</td>
<td>6/1/2015</td>
<td>Replace structures on the Belmont - Trissler 138kV line</td>
<td>0.5</td>
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<tr>
<td>b1393</td>
<td>6/1/2015</td>
<td>Replace structures on the Kingwood - Pruntytown 138kV line</td>
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<tr>
<td>b1238</td>
<td>6/1/2015</td>
<td>Install a 138 kV 44 MVAR capacitor at Edgelawn substation</td>
<td>1.2</td>
<td>Cancel</td>
</tr>
<tr>
<td>b0587</td>
<td>6/1/2013</td>
<td>AP portion of Tidd - Carnegie and Carnegie - Weirton with 954 ACSR</td>
<td>3.16</td>
<td>Cancel</td>
</tr>
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### APS Transmission Zone

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<tr>
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<tbody>
<tr>
<td>b0678</td>
<td>6/1/2013</td>
<td>Reconductor Glen Falls - Oak Mound 138kV line with 954 ACSR</td>
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<tr>
<td>b0679</td>
<td>6/1/2013</td>
<td>Reconductor Grand Point - Letterkenny 138kV line with 954 ACSR</td>
<td>2.1</td>
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<tr>
<td>b0680</td>
<td>6/1/2013</td>
<td>Reconductor Greene - Letterkenny 138kV line with 795 ACSS</td>
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<tr>
<td>b0685</td>
<td>6/1/2013</td>
<td>Replace the Ringgold #3 230/138 kV transformer with a larger transformer</td>
<td>5.8</td>
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<tr>
<td>b1023.2</td>
<td>6/1/2013</td>
<td>Rebuild the Whiteley-Franklin 138 kV circuit with double circuit using 954 ACSR</td>
<td>13</td>
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<tr>
<td>b1023.4</td>
<td>6/1/2013</td>
<td>Construct Braddock 138 kV breaker station that connects the Charleroi - Gordon 138 kV line, Washington - Franklin 138 kV line and the Washington - Vanceville 138 kV line including a 66 MVAR capacitor</td>
<td>15.1</td>
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<tr>
<td>b1171.1</td>
<td>6/1/2013</td>
<td>Install the second Black Oak 500/138kV transformer, two 138kV breaker, and related substation work</td>
<td>9.11</td>
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<tr>
<td>b1230</td>
<td>6/1/2013</td>
<td>Reconductor Willow-Eureka &amp; Eureka-St Mary 138kV lines</td>
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</tr>
<tr>
<td>Upgrade ID</td>
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<tr>
<td>b0533</td>
<td>6/1/2012</td>
<td>Reconductor Powell Mountain - Sutton 138 kV with 954 ACSR</td>
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<tr>
<td>b0572.2</td>
<td>6/1/2011</td>
<td>Reconductor William - Parsons - Loughs Lane 138 kV with 954 ACSR</td>
<td>10.15</td>
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</tr>
<tr>
<td>b1128</td>
<td>6/1/2014</td>
<td>Reconductor the Edgewater – Vasco Tap; Edgewater – Loyalhanna 138 kV lines with 954 ACSR</td>
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<tr>
<td>b1133</td>
<td>6/1/2014</td>
<td>Upgrade terminal equipment at Springdale</td>
<td>0.02</td>
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<tr>
<td>b1137</td>
<td>6/1/2014</td>
<td>Reconductor the Eastgate – Luxor 138 kV; Eastgate – Sony 138 kV line with 954 ACSR</td>
<td>5.8</td>
<td>Cancel</td>
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<tr>
<td>b1138</td>
<td>6/1/2014</td>
<td>Reconductor the King Farm – Sony 138 kV line with 954 ACSR</td>
<td>0.7</td>
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<tr>
<td>b1139</td>
<td>6/1/2014</td>
<td>Reconductor the Yukon – Waltz Mills 138 kV line with high temperature conductor</td>
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<tr>
<td>b1140</td>
<td>6/1/2014</td>
<td>Reconductor the Bracken Junction – Luxor 138 kV line with 954 ACSR</td>
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<tr>
<td>b1141</td>
<td>6/1/2014</td>
<td>Reconductor the Sewickley – Waltz Mills Tap 138 kV line with high temperature conductor</td>
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<tr>
<td>Upgrade ID</td>
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<td>Description</td>
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<td>Action</td>
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<td>b1143</td>
<td>6/1/2014</td>
<td>Reconductor the Youngwood – Yukon 138 kV line with high temperature cond</td>
<td>5.9</td>
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<tr>
<td>b1144</td>
<td>6/1/2014</td>
<td>Reconductor the Bull Creek Junction – Cabot 138 kV line with high temperature conductor</td>
<td>1.6</td>
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<td>b1145</td>
<td>6/1/2014</td>
<td>Reconductor the Lawson Junction – Cabot 138 kV line with high temperature conductor</td>
<td>1.6</td>
<td>Cancel</td>
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<tr>
<td>b1146</td>
<td>6/1/2014</td>
<td>Replace Layton - Smith 61 138 kV line structures to increase line rating</td>
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<tr>
<td>b1147</td>
<td>6/1/2014</td>
<td>Replace Smith – Yukon 138 kV line structures to increase line rating</td>
<td>0.3</td>
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<tr>
<td>b1148</td>
<td>6/1/2014</td>
<td>Reconductor the Loyalhanna – Luxor 138 kV line with 954 ACSR</td>
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<tr>
<td>b1149</td>
<td>6/1/2014</td>
<td>Reconductor the Luxor – Stony Springs Junction 138 kV line with 954 ACSR</td>
<td>1.7</td>
<td>Cancel</td>
</tr>
<tr>
<td>b1150</td>
<td>6/1/2014</td>
<td>Upgrade terminal equipment at Social Hall</td>
<td>0.02</td>
<td>Cancel</td>
</tr>
<tr>
<td>b1152</td>
<td>6/1/2014</td>
<td>Reconductor Grand Point – South Chambersburg</td>
<td>2.9</td>
<td>Cancel</td>
</tr>
<tr>
<td>b1386</td>
<td>6/1/2015</td>
<td>Reconductor Double Tollgate - Meadow Brook 138kV #2 with 1033 ACCR</td>
<td>9</td>
<td>Cancel</td>
</tr>
</tbody>
</table>
# APS Transmission Zone

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<tbody>
<tr>
<td>b1387</td>
<td>6/1/2015</td>
<td>Reconductor Double Tollgate - Meadow Brook 138kV #1 with 1033 ACCR</td>
<td>9</td>
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<tr>
<td>b1242</td>
<td>6/1/2015</td>
<td>Replace structures between Collins Ferry and West Run</td>
<td>0.35</td>
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</tr>
<tr>
<td>b1383</td>
<td>6/1/2015</td>
<td>Install 2nd 500/138 kV transformer at 502 Junction</td>
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<tr>
<td>b0677</td>
<td>6/1/2013</td>
<td>Reconductor Double Toll Gate – Riverton 138kV with 954 ACSR</td>
<td>2.7</td>
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<tr>
<td>b1235</td>
<td>6/1/2013</td>
<td>Reconductor the Albright - Black Oak AFA 138 kV line with 795 ACSS/TW</td>
<td>55</td>
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</tr>
</tbody>
</table>
• **Project Replacement**

• **Withdrawal of B1131:**
  - Upgrade Double Tollgate-Meadowbrook MDT Terminal Equipment
  - Estimated Project Cost: $0.03M
  - Expected IS Date: 06/01/2014

• **Replaced by B1826:**
  - Change the CT ratio at Double Toll Gate 138kV SS on MDT line.
  - Estimated Project Cost: $0.05M
  - Expected IS date: 06/01/2013
• **Project Withdrawal**

• **Withdrawal of B1129:**
  - Reconductor the East Waynesboro – Ringgold 138 kV line with 954 ACSR
  - Estimated Project Cost: $3M
  - Expected IS Date: 06/01/2014
• **Project Replacement**

• **Withdrawal of B1232:**
  - Reconductor Nipetown - Reid 138 kV with 1033 ACCR
  - Estimated Project Cost: $15M
  - Expected IS Date: 06/01/2015

• **Replaced by B1822:**
  - Replace the 1200 A wave trap, line risers, breaker risers with 1600 A capacity terminal equipment at Reid 138KV SS.
  - Estimated Project Cost: $0.1M
  - Expected IS date: 06/01/2015
• **Project Replacement**

• **Withdrawal of B1388:**
  - Reconductor Feagans Mill - Millville 138kV with 954 ACSR
  - Estimated Project Cost: $3.5M
  - Expected IS Date: 06/01/2015

• **Replaced by B1823:**
  - replace the 800A wave trap with a 1200A wave trap at Millville 138kV Substation.
  - Estimated Project Cost: $0.05M
  - Expected IS date: 06/01/2015
• Project Replacement

• Withdrawal of B0684:
  ✓ Reconductor Guilford - South Chambersburg 138kV line with 954 ACSR
  ✓ Estimated Project Cost: $3.5M
  ✓ Expected IS Date: 06/01/2013

• Replaced by B1824:
  ✓ Reconductor Grant Point - Guilford 138kV line approximately 8 miles of 556 ACSR with 795 ACSR.
  ✓ Estimated Project Cost: $3.75M
  ✓ Expected IS date: 06/01/2016
• Project Replacement

• Withdrawal of B0573:
  ✓ Cabot to Paradise Junction 138kV add a second 3.1 miles of 954 ACSR circuit
  ✓ Estimated Project Cost: $1.18M
  ✓ Expected IS Date: 06/01/2012

• Replaced by B1825:
  ✓ Replace the 800 Amp line trap at Butler 138kV Sub on the Cabot East 138kV Line.
  ✓ Estimated Project Cost: $0.05M
  ✓ Expected IS date: 06/01/2012
• **Project Replacement**

  • **Withdrawal of B1132:**
    ✓ Upgrade Double Tollgate-Meadowbrook MBG terminal equipment
    ✓ Estimated Project Cost: $0.03M
    ✓ Expected IS Date: 06/01/2014

  • **Replaced by B1827:**
    ✓ Change the CT ratio at Double Toll Gate 138kV SS on MBG line.
    ✓ Estimated Project Cost: $0.05M
    ✓ Expected IS date: 06/01/2013
• **Project Replacement**

• **Withdrawal of B1142:**
  - Reconductor the Bartonville – Stephenson 138 kV; Stonewall - Stephenson 138 kV line with 954 ACSR
  - Estimated Project Cost: $2.3M
  - Expected IS Date: 06/01/2014

• **Replaced by:**
  - B1902: Replace the wavetrap at Stonewall 138KV substation
  - Estimated Project Cost $0.05M
  - Expected IS Date: 06/01/2014

  and

  - B1828.1: Reconductor the Bartonville – Stephenson 3.03 mile 138 kV line of 556 ACSR with 795 ACSR; (Estimated Project Cost: $1.85M)
  - B1828.2: Reconductor the Stonewall – Stephenson 2.08 mile 138 kV line of 556 ACSR with 795 ACSR. (Estimated Project Cost: $1.25M)

  - Expected IS date: 06/01/2016
• **Project Replacement**

• **Withdrawal of B1151:**
  - Reconductor the Greenwood – Redbud 138 kV line with 954 ACSR
  - Estimated Project Cost: $2.3M
  - Expected IS Date: 06/01/2014

• **Replaced by B1829:**
  - Replace existing 138kV 556.5 ACSR substation conductor risers with 954 ACSR at the Redbud 138KV substation, including but not limited to the line side disconnect leads.
  - Estimated Project Cost: $0.05M
  - Expected IS date: 06/01/2016
• **Project Replacement**

  • **Withdrawal of B1385:**
    ✓ Reconductor Halfway – Paramount 138 kV with 1033 ACCR
    ✓ Estimated Project Cost: $4.75M
    ✓ Expected IS Date: 06/01/2015

  • **Replaced by B1830:**
    ✓ Replace 1200 A wave trap and 1024 ACAR breaker risers at Halfway 138KV substation, and replace 1024 ACAR breaker risers at Paramount 138kV substation
    ✓ Estimated Project Cost: $0.10M
    ✓ Expected IS date: 06/01/2016
- Project replacement

- Replace existing Monocacy – Ringgold – Carroll (MRC) with alternative upgrades

- Continued on next slide...
• Replace existing Monocacy – Ringgold – Carroll (MRC) with alternative upgrades continued…

• MRC Summary
  – b0675.1 Convert Monocacy - Walkersville 138 kV to 230 kV
  – b0675.2 Convert Walkersville - Catoctin 138 kV to 230 kV
  – b0675.3 Convert Ringgold - Catoctin 138 kV to 230 kV
  – b0675.4 Convert Catoctin - Carroll 138 kV to 230 kV
  – b0675.5 Convert portion of Ringgold Substation from 138 kV to 230 kV
  – b0675.6 Convert Catoctin Substation from 138 kV to 230 kV
  – b0675.7 Convert portion of Carroll Substation from 138 kV to 230 kV
  – b0675.8 Convert Monocacy Substation from 138 kV to 230 kV
  – b0675.9 Convert Walkersville Substation from 138 kV to 230 kV

• Recommended Solution to replace MRC with :
  – Replace relaying at the Mt. Airy substation on the Carroll - Mt.Airy 230 kV Line. (B1816.1) - $0.1M
  – Adjust control settings of all existing capacitors served by Potomac Edison’s Eastern 230 kV network to ensure that all units will be on during the identified N-1-1 contingencies. (B1816.2) - $0.05M
  – Replace existing unidirectional LTC controller on the No. 4, 230/138kV transformer at Carroll Substation with a bidirectional unit. (B1816.3) - $0.05M
  – Isolate & bypass the 138 kV reactor at Germantown Substation (B1816.4) - $0.05M
  – Replace SCCIR (Sub-conductor) at Hunterstown Substation on the No.1, 230/115 kV transformer. (B1816.5) - $0.1M
  – Replace 336.4 ACSR conductor on the Catoctin-Carroll 138 kV line (Section CUB) using 556.6 ACSR (26/7) or equivalent on existing structures (12.7 miles). Replace 800 A wave traps at Carroll and Catoctin with 1200 A units and replace 556.5 ACSR SCCIR (subconductor) line risers and bus taps at Carroll with 795 ACSR or equivalent. (B1816.6) - $4.3M

• Expected IS date: 6/1/2013
• IS Date Change

• B1297: Install a new Fulton 345/138 kV substation

• Old Expected IS date: 06/01/2013

• New Expected IS date: 06/01/2014

• Driver: the generator which drove the project is delayed in service
The Pleasant Valley 138kV breaker ‘194-B-3’ is overstressed.

Proposed Solution: Replace Pleasant Valley 138 kV breaker ‘194-B-3’ (b1814)

Estimated Project Cost: $180 K per breaker

Expected IS Date: 6/1/2015
• The West Ravenna 138kV breaker ’59-B-15’ is overstressed
• Proposed Solution: Replace West Ravenna 138 kV breaker 59-B-15 (b1815)
• Estimated Project Cost: $180 K per breaker
• Expected IS Date: 6/1/2015
The Ironville 138 kV breaker ‘33-B-13208’ is overstressed

Proposed Solution: Replace the Ironville 138 kV breaker ‘33-B-13208’ (b1820)

Estimated Project Cost: $180 K

Expected IS Date: 6/1/2016
• The Pumphrey 115 kV breakers '110524 DR' is overstressed
• Proposed Solution: Revise the reclosing for Pumphrey 115 kV breakers '110524 DR' (b1789)
• Expected IS Date: 06/1/2016
BGE Transmission Zone

- The Wagner 115 kV breakers are overstressed
- Proposed Solution: Rebuild Wagner 115kV substation to 80kA breakers (b1806)
- Estimated Project Cost: $5.8 M
- Expected IS Date: 12/1/2016
ComEd Transmission Zone

• Light Load Criteria Violation

• The H440 Tap – Stewart 138kV line is overloaded for the loss of P20 – Electrical Junction “Blue” 345 kV line

• Reconductor/Rebuild the 138 kV Line 16914 for 1.3 miles from Stewart to the H440 tap (B1885)

• Estimated Project Cost: $4.7M

• Expected IS date: 03/01/2014
ComEd Transmission Zone

- N-1-1 Thermal Violation
- One of Davis Creek Transformers 345/138kV TR82 and TR83 is overloaded for the loss of the Goodings – East Frankfort 345kV line + East Frankfort 345/138/34.5 transformer and the loss of the other one of the two transformers
- Install the 3rd 345/138kV transformer at TSS 86 Davis Creek(B1841)
- Estimated Project Cost: $15M
- Expected IS date: 06/01/2016
• **N-1-1 Thermal Violation**

• The Bedford Park – Clearing Tap 138KV line (Red) is overload for various contingency pairs

• Reconductor 0.6 miles of 138 kV line 5104 from TSS 115 Bedford Park to Clearing Tap. (B1842)

• Estimated Project Cost: $0.5M

• Expected IS date: 06/01/2016
ComEd Transmission Zone

- N-1-1 Thermal Violation
- The Blue Island – G3852 138KV Red line #7611 is overloaded for the loss of the Wallace–Beverly - Blue Island Blue138KV line (#L7612) and the Burnham – Wildwood 138KV line (#L17713)
- Replace 1200A line trap on 138 kV line 7611 at TSS 76 Blue Island 138kV(B1843)
- Estimated Project Cost: $0.06M
- Expected IS date: 06/01/2016
• N-1-1 Thermal Violation

• The line #10301 from TSS 103 Lisle to York Tap is overloaded for various contingency pairs

• Reconductor 2.1 miles of 138 kV line 10301 from TSS 103 Lisle to York Tap with ACSS(B1844)

• Estimated Project Cost: $1.5M

• Expected IS date: 06/01/2015
ComEd Transmission Zone

- **N-1-1 Thermal Violation**

- The line #10302 from TSS 103 Lisle to York Tap is overloaded for various contingency pairs

- Reconductor 2.4 miles of 138 kV line 10302 from TSS 103 Lisle to York Tap with ACSS(B1845)

- Estimated Project Cost: $2.5M

- Expected IS date: 06/01/2015
ComEd Transmission Zone

- N-1-1 Thermal Violation
- The Romeo – Will County 138kV line #1803 cannot be dispatched below normal rating for the loss of the Lisle-Woodridge - Bolingbrook – Romeoville – Will County 138kV Blue line (L1809)
- Upgrade 900 kcmil ACSR station conductor on 138 kV line 1803 at STA 18 Will County (B1846)
- Estimated Project Cost: $0.06M
- Expected IS date: 06/01/2016
- N-1-1 Thermal Violation
- The Crystal Lake – Silver Lake 138KV Blue line can not be dispatched below its normal rating for the loss of the Crystal Lake – Silver Lake 138KV Red line (#13809) and The Crystal Lake – Silver Lake 138KV Red line can not be dispatched below its normal rating for the loss of the Crystal Lake – Silver Lake Blue line (#13808)
- Add 230 MVAR of capacitors at TSS 141 Pleasant Valley (and close Silver Lake 138BT) (B1847)
- Estimated Project Cost: $7.0M
- Expected IS date: 06/01/2016
ComEd Transmission Zone

- N-1-1 Thermal Violation
- The Des Plaines 198 - Des Plaines 46 138KV Red line is overloaded for the loss of the TONNE-ITASC 138kV Red line (#4605) with SPOG and the loss of the Des Plaines 46 - Busse – Schaumburg – Landmeier 138kV Blue line (#4606) with SPOG
- Upgrade relays and wavetrap on 138 kv line 4605 at TSS 46 Des Plaines(B1848)
- Estimated Project Cost: $0.2M
- Expected IS date: 06/01/2016
ComEd Transmission Zone

- **N-1-1 Thermal Violation**

- The Leithton – South Liberty 138kV Blue line and the Liberty – South Liberty 138kV Blue line can not be redispatched below their normal ratings for the loss of the Prospect Heights 117 - Aptakisic 138KV Red line (#11704); The PH117 – PH 217 Red 138kV line can not be redispatched below its normal rating for the loss of the Prospect Heights117 – Prospect Heights 217-Wheeling – Buffalo Grove - Aptakisic - Leithton – South Liberty 138kV Blue line (#11708)

- Install 138 kV bus and 7 CBs at TSS 109 Aptakisic 138kV (B1849)

- Estimated Project Cost: $10M

- Expected IS date: 06/01/2016
• N-1-1 Thermal Violation

• The S. Elgin – Wayne Blue 138kV line is overloaded for various contingency pairs

• Upgrade 1113 ACSR station conductor on 138 kV line 7910 at TSS 144 Wayne 138kV(B1850)

• Estimated Project Cost: $0.15M

• Expected IS date: 06/01/2016
• N-1-1 Thermal Violation

• The S. Elgin – Wayne Red 138kV line is overloaded for various contingency pairs

• Reconductor station conductor on 138 kV line 7915 at TSS 144 Wayne 138kV (B1851)

• Estimated Project Cost: $0.10M

• Expected IS date: 06/01/2016
ComEd Transmission Zone

- Baseline Project Scope Change

- B0739:
  - Old Scope: Add 115.2 MVAR capacitor at Lombard 138 kV "Blue"
  - Old Expected IS Date: 06/01/2013

- New Scope: Add 115.2 MVAR capacitor at Burnham 138 kV "Blue"
- New Expected IS Date: 06/01/2014
ComEd Transmission Zone

• Baseline Project Delay

• B0738:

• Old Scope: Add 115.2 MVAR capacitor at Lombard 138 kV "Red"
• Old Expected IS Date: 06/01/2013

• New Scope: Add 115.2 MVAR capacitor at Burnham 138 kV "Red"
• New Expected IS Date: 06/01/2014
• N-1-1 Thermal Violation

• The Des Plaines 46–Higgins 138kV Blue line (#4607) can not be re-dispatched blow normal rating for the loss of the Ridgeland – Oak Park 138KV line (#19209) or the loss of the Natoma – Franklin Park 138kV line (#3705)

• Replace 7 138kV breakers at Natoma 138kV substation (B1903)

• Estimated Project Cost: $9.2M

• Expected IS date: 06/01/2016
DEOK Transmission Zone

- Project IS date change
- B1726: Create a ring at Fairfield 138 kV substation
  - b1726.1: Split Circuit 3886 (Willey - Mulhauser 138 kV) and land both ends in Fairfield
  - b1726.2: Close circuit 9787 (Willey - Mapleknoll - Mt Healthy - Finneytown - Terminal 138 kV)
- Original Expected IS date: 06/01/2016
- New Expected IS date: 06/01/2012
The Brambleton 230kV breakers ‘22702’ and ‘227T2094’ are overstressed.

Proposed Solution: Replace Brambleton 230 kV breakers '22702', and ‘227T2094’ (b1809-b1810)

Estimated Project Cost: $220 K per breaker

Expected IS Date: 4/30/2015
The Brambleton 230 kV breaker ‘2094T2095’ is overstressed

Proposed Solution: Replace Brambleton 230 kV breaker ‘2094T2095’ (b1698.6)

Estimated Project Cost: $220 K per breaker

Expected IS Date: 6/1/2016
Dominion Transmission Zone

- Existing PJM project (b1503)

- Original proposal:
  - Feed a new 230kV Waxpool Substation by 11/2013 with a new 230kV underground line of approximately 1.6 miles from NIVO to Waxpool Substation
  - Install a four-breaker 230kV ring bus at Waxpool
  - Install a new 230kV overhead line of approx. 2.1 miles from Waxpool to Shellhorn.

- Additional Violation:
  - For the N-1 loss of Line #2095 between Brambleton and Shellhorn Substations, Line #227 (Brambleton - Beaumeade) loads to 97% in 2014.
  - By 2016, Line #227 loads to 117% for the same contingency scenario.
Dominion Transmission Zone

- Existing PJM project (b1503) continued from previous slide.
- Proposed solutions given additional criteria violation.

- Proposed Solution:
  - Loop Line #2095 in and out of Waxpool approximately 1.5 miles.
  - Construct a new 230kV line from Brambleton to BECO Substation of approximately 11 miles with approximately 10 miles utilizing the vacant side of existing Line #2095 structures.
  - The new Brambleton - BECO line will relieve Line #2095 of Shellhorn Substation load and Greenway TX’s #2&3 load.
  - Estimated Project Cost: $39.7M
  - Expected In-Service Date: 6/1/2014
DPL Transmission Zone

• Operational Performance:
  Several substations in the DPL territory had experienced high voltage conditions during light load period in 2011.

• Proposed Solution:
  Install new variable reactors at New Castle 138kV, Cedar Creek 230kV, Indian River 138kV, Nelson 138kV, and Easton 69kV substations (B1899).

• Estimated Project Cost:
  $ 11 M

• Expected IS Date:
  Indian River & Nelson (12/31/2012)
  Cedar Creek (12/31/2013)
  New Castle & Easton (12/31/2014)
- Stability violation at Oyster Creek
- Proposed Solution:
  - Install a PSS at Oyster Creek generating station (B1807).
- Estimated Project Cost: $2.5 M
- Expected IS Date: 1Q 2013
JCP&L Transmission Zone

- FE Planning Criteria Violation:
  - Loss of the N.J.T. Red Bank - Red Bank 230kV (B2028) line w/ the Red Bank 230/34.5kV Transformer #1 overload the Red Bank 230/34.5 kV transformer #2.

- Proposed Solution:
  Eaton Crest 230/34.5 kV substation - Install new 125 MVA 230/34.5kV transformer with one (1) 230kV CB. Create a new 34.5kV CB straight bus to feed new radial lines to Locust Groove and Interdata/ Woodbine (B1853).

- Estimated Project Cost:
  $ 17.9 M

- Expected IS Date:
  6/1/2014
FE Planning Criteria Violation:

Readington - Somerset 34.5kV (I737) circuit is overloaded due to re-rating of the circuit.

Proposed Solution:
Readington I737 34.5kV Line - Parallel Existing 1250 CU UG cable (440 feet) (B1854).

Estimated Project Cost: $0.345 M

Expected IS Date: 6/1/2012
JCP&L Transmission Zone

- FE Planning Criteria Violation:

  - Loss of Atlantic - Oceanview 230kV (Y2025) line overloads the Red Bank - Poplar Tp 34.5kV (G59) line.

- Proposed Solution: Oceanview Substation - Relocate the H216 breaker from the A bus to the B bus (B1855).

- Estimated Project Cost: $0.092 M

- Expected IS Date: 6/1/2012
FE Planning Criteria Violation:

- Loss of Traynor - Madison 34.5kV (R96) line overloads the Madison - Madison Tp 34.5kV (N14) line.

Proposed Solution:
Madison Tp to Madison (N14) line - Upgrade limiting 250 Cu substation conductor with 795 ACSR at Madison Sub (B1856).

Estimated Project Cost: $0.078 M

Expected IS Date: 6/1/2012
FE Planning Criteria Violation:

Loss of Montville - Newton 34.5kV (L116) line overloads the Montville - Jacksonville Tap 34.5kV (M117) line.

Proposed Solution:
Montville Substation - Replace both the 397 ACSR and the 500 Cu substation conductors with 795 ACSR on the 34.5kV (M117) line (B1857).

Estimated Project Cost: $0.012 M

Expected IS Date: 6/1/2012
FE Planning Criteria Violation:

- Loss of the Montville - Newton (N2214) 230 kV line overloads the Newton - Mohawk 34.5 kV (Z702) line.

Proposed Solution:
Reconductor the Newton - Mohawk (Z702) 34.5 kV line {1.9 miles of 397 ACSR} (B1858).

- Estimated Project Cost: $ 0.710 M
- Expected IS Date: 6/1/2013
- Generator Deliverability thermal violation of either Chichester – Linwood 230 kV circuit for the loss of the parallel circuit

- Description: Add a 3rd 230kV transmission line between Chichester and Linwood substations and remove the Linwood SPS (B1900)

- Estimated Project Cost: $27M

- Projected In-Service Date: 6/1/2018
**PENELEC Transmission Zone**

- The Erie South 115 kV breaker ‘Union City’ is overstressed
- Proposed Solution: Replace the Erie South 115 kV breaker ‘Union City’ (b1821)
- Estimated Project Cost: $150 K
- Expected IS Date: 6/1/2016
• Stability violation at Susquehanna
• Proposed Solution:
  – Install power system stabilizer at Susquehanna units 1 and 2 (B1808.1 & B1808.3)
  – AVR and rectifier bank replacement (B1808.2 & B1808.4)
• Estimated Project Cost and IS Date:
  Total $12.49 M
• Expected In-Service Date:
  – 1Q 2012 to complete all PSS retrofits
  – 1Q 2015 to complete all AVR and rectifier bank replacement work
• PPL EU Reliability Principles and Practices:
  • Exceeds maximum allowable load drop guidelines for loss of Blooming Grove - Jackson 69 kV line; Loss of Peckville - Jackson 69 kV Line.
  • Recommended Solution: Add a 2nd 230/69 kV Transformer at North Pocono (NE/Pocono Reliability Project) (B1890).
  Estimated Project Cost: $10.6 M
  • Expected IS Date: 11/30/2017
PPL Transmission Zone

- PPL EU Reliability Principles and Practices:
- Overload on Lackawanna 230/69kV transformer #2; Voltage violations in the Lackawanna area for the loss of Stanton-Lackawanna 230 kV line with a breaker failure at Lackawanna; Loss of the Lackawanna-Scranton #2 69 kV line.
- Recommended Solution: Build a new 230-138 kV Yard at Lackawanna (138 kV Conversion from Lackawanna to Jenkins) (B1891).
- Estimated Project Cost: $20.5 M
- Expected IS Date: 05/31/2017
• PPL EU Reliability Principles and Practices:

• Overload on Lackawanna 230/69kV transformer #2; Voltage violations in the Lackawanna area for the loss of Stanton-Lackawanna 230 kV line with a breaker failure at Lackawanna; Loss of the Lackawanna - Scranton #2 69 kV line.

• Recommended Solution: Rebuild the Throop Taps for 138 kV operation (138 kV Conversion from Lackawanna to Jenkins) (B1892).

  Estimated Project Cost: $0.6 M

• Expected IS Date: 05/31/2017
PPL Transmission Zone

- **PPL EU Reliability Principles and Practices:**
  - Overload on Lackawanna 230/69kV transformer #2; Voltage violations in the Lackawanna area for the loss of Stanton-Lackawanna 230 kV line with a breaker failure at Lackawanna; Loss of the Lackawanna-Scranton #2 69 kV line.

- **Recommended Solution:**
  Swap the Stanton - Old Forge and Stanton - Brookside 69 kV circuits at Stanton (138 kV Conversion from Lackawanna to Jenkins) (B1893).

- **Estimated Project Cost:**
  $0.4 M

- **Expected IS Date:**
  05/31/2017
• PPL EU Reliability Principles and Practices:
  • Overload on the Stanton - Avoca 69 kV line pre-contingency.
  • Recommended Solution: Rebuild and re-conductor 2.5 miles of the Stanton-Avoca 69 kV line (B1894).
  • Estimated Project Cost: $2.4 M
  • Expected IS Date: 05/31/2017
• PPL EU Reliability Principles and Practices:
• Overload on the Stanton - Providence #1 69 kV line for the loss of Stanton 69 kV Bus Section No. 1.
• Recommended Solution: Rebuild and re-conductor 4.9 miles of the Stanton - Providence #1 69 kV line (B1895).
• Estimated Project Cost: $4.6 M
• Expected IS Date: 05/31/2017
PPL Transmission Zone

- PPL EU Reliability Principles and Practices:
  - Exceeds maximum allowable load drop guidelines for the loss of Monroe 230/138 kV Transformer.
- Recommended Solution: Install a 2nd 230/138 kV transformer and expand the 138 kV yard at Monroe. (B1896).
- Estimated Project Cost: $8.9 M
- Expected IS Date: 11/30/2014
PPL EU Reliability Principles and Practices:

Overload on Lackawanna 230/69kV transformer #2; Voltage violations in the Lackawanna area for the loss of Stanton - Lackawanna 230 kV line with a breaker failure at Lackawanna; Loss of the Lackawanna-Scranton #2 69 kV line.

Recommended Solution:
Build a new 230-138 kV Substation at Jenkins (138 kV Conversion from Lackawanna to Jenkins) (B1897).

Estimated Project Cost:
$21 M

Expected IS Date:
05/31/2017
PPL Transmission Zone

- PPL EU Reliability Principles and Practices:
  - Exceeds maximum allowable load drop guidelines for the loss of the Juniata - Richfield or Sunbury-Dauphin 69 kV line.
- Recommended Solution:
  Install a 69kV Tie Line between Richfield and Dalmatia Substations (B1898).
- Estimated Project Cost: $12.0 M
- Expected IS Date: 11/30/2012
**PSEG Transmission Zone**

- **B1155 Scope Change**
  - **Old Scope:**
    Build a new 230 kV circuit from Branchburg to Middlesex Sw. Rack. Build a new 230 kV substation at Middlesex by connecting the new and the existing circuits from Branchburg, plus the two 230 kV parallel circuits from Raritan River to Gillette (I-1023 and W-1037).
  - **New Scope:**
    Build a new 230 kV circuit from Branchburg – Bridgewater and reconfigure the Bridgewater 230 kV substation to breaker and half configuration.

- **Estimated Cost:** $125 M
- **Expected IS Date:** 6/1/2014
• Approval of all of the upgrades in the following sections will be sought from the PJM Board of Managers at their July 10th meeting.
  – GenOn Retirement Notifications
  – AEP Retirement Notifications
  – Upgrades Reviewed at Previous TEAC Meetings
Questions?

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