Interregional Planning Update
Scenario based planning approach is applied to identify the best fit transmission solutions

- **Future 1** – MISO state RPS mandates and PJM queue based generation expansion
- **Future 2** – meeting MISO and PJM state RPS mandates with internal wind (no additional PJM imports from MISO)
- **Future 3** – meeting MISO RPS mandates and goals, and PJM RPS mandates with 31% of PJM RPS targets from wind sited in MISO
MISO-PJM Planning Study Timeline

Sep 12 - Oct 12
Joint Scope Development

Jan 13 - Apr 13
Joint Futures Development
Generation Capacity Expansion

Jul 13 - Oct 13
Transmission Solution Ideas Solicitation
Seams Issues Refresh

Jun 14
Project Recommendation
If Justified

Sep 12

Dec 12

Mar 13

Jun 13

Sep 13

Dec 13

Mar 14

Jun 14

Oct 12 - Jan 13
Phase I Historical M2M Congestion Analysis

Apr 13 - Jul 13
Seams Congestion Issues Identification

Oct 13 - Jan 14
Cross-border Transmission Solution Evaluation

Feb 14 - Jun 14
Transmission Evaluation through Regional MTEP and RTEP processes
PJM-MISO Joint Planning Study

• Jointly evaluate cross-border transmission issues and identify opportunities for transmission expansion
• Phase I complete - identified historical border congestion
• Phase II complete – quantified future border congestion
• Ongoing evaluation of stakeholder proposed upgrades
• Completed WebEx and In-person at MISO January 16, 2013
• Project evaluations and re-evaluations underway
• February / March meeting date TBD
  – Discuss many comments received
  – Update on evaluations
• 2014 Work plan
  – Scenario development and analysis (www.eipconline.com)
    • Stakeholder process
    • Scenario Guidelines and Principles
    • Scenario Examples
• Important EIPC Dates
  – PJM stakeholder input through TEAC 2014 dates
    • January 9, February 6, March 6
  – EIPC Schedule update
    • Stakeholder input due January 31, 2014
    • Webinar March 25, 2014 (moved from February 26)
      – Review and discuss Scenarios
      – Drought Scenario suggested by EISPC
    • Post Scenarios April 4, 2014 (moved from March 28)
    • Begin Scenario modeling and analysis April 7, 2014 (Moved from March 31)
2014 RTEP Assumptions
(Continued from December 2013 & January 2014 TEAC)
• Case back from TO’s for final review

• PJM is exercising the case, performing a quality control check and benchmarking

• Machine list
  – 2019 RTEP machine is posted with today’s TEAC materials
  – Stakeholders are encouraged to examine the list and provide feedback to PJM
RTEP – 2019 Model Generation Assumptions

- Most FSA Generation modeled along with any associated network upgrades
- Units in suspension not used to back-off problems
- An existing generator and several FSA and ISA interconnection projects are not included in the Summer 2019 RTEP model
Queued generation with an FSA but not included in 2019 Summer RTEP base model:

- Q65 North Anna Nuclear 1594 MW
- X2-076 Carson - Wake 500 kV 1551 MW
  - Based on stakeholder feedback received at the 2/6/2014 TEAC meeting, this facility will be included in the model
- Y1-035/ Y1-036 East Lake 462 MW each = 924 MW total
- S57/S58 Collins “Rock Island Clean Line” 1500 MW/2000 MW = 3500 MW total
- U3-026 Collins “Rock Island Clean Line” 1500 MW
- X3-028 Breed 345 kV “Grain Belt Express” 3500 MW

ISA or existing units not included in the 2019 Summer RTEP base model:

- V3-017 Morgantown - Oak Grove 230 kV “CPV Maryland” 725 MW
- Oyster Creek Nuclear (existing unit)
• At-Risk generation
  – Consider at-risk factors
  – Perform reliability analysis

• State RPS Scenario Analysis
Generation Deactivation Update
• PJM recently completed retool analysis of the on-going need for RMR units in the ATSI zone
  – East Lake 1-3, Lake Shore 18, Ashtabula 5

• Analysis considered the upgrades and their expected in-service dates

• Upgrade assumptions noted on following slides
• Upgrade Assumptions
  – ATSI
  • B1281 - Build new Hayes 345/138 kV substation with new 138 kV lines to: Greenfield #1 & #2, and Avery
  • B1282 - Build Beaver - Hayes - Davis - Besse #2 345 kV line
  • B1283 - Loop the Chamberlin - Mansfield 345 kV line into the Hanna 345 kV substation
  • B1297 - Install a new Fulton 345/138 kV substation
  • B1913.4 - Convert Eastlake unit 4 to a synchronous condenser
  • B1913.5 - Convert Eastlake unit 5 to a synchronous condenser
  • B1921 - Install a 2nd 345/138 kV transformer at the Allen Junction station
  • B1922 - Install a 2nd 345/138 kV transformer at the Bayshore station
• Upgrade Assumptions Continued
  – PN
    • B1609 - Construct Four Mile Junction 230/115 kV substation. Loop the Erie South - Erie East 230 kV line, Buffalo Road - Corry East and Buffalo Road - Erie South 115 kV lines
    • B1769 - Install a 75 MVAR cap bank on the Four Mile 230 kV bus. FE is targeting ISD 12/31/14 with commissioning to start in Sept 2014
  – AP
    • B1941 - Loop the Homer City-Handsome Lake 345 kV line into the Armstrong substation and install a 345/138 kV transformer at Armstrong
• Upgrade Assumptions continued
  – AEP
    • B1500 - The North East Canton - Wagenhals 138kV circuit would need an
      electrical clearance study to determine if the emergency rating can be utilized
    • B1812 - Reconstruct the AEP portion of the South Canton - Harmon 345 kV with
      954 ACSR and upgrade terminal equipment at South Canton. 2014 expected
      overall tie-line ratings to be 1409/1742 MVA (SN/SE)
    • B1861 - Reconstruct 0.83 miles of the Dale - West Canton 138 kV Tie-line and
      upgrade risers at West Canton 138 kV
    • B1870 - Replace the Ohio Central transformer #1 345/138/12 kV 450 MVA for a
      345/138/34.5 kV 675 MVA transformer
    • B1972 - Replace disconnect switch on the South Canton 765/345 kV transformer
Reliability Must Run - RMR Update

• Updated analysis indicates that the need for East Lake 1, 2, 3, and Lake Shore 18 is no longer required for reliability starting on September 15, 2014.

• System reliability continues to indicate the need to retain Ashtabula 5

• PJM will update the website and cost allocations as required
Original upgrade:
- B1914 - Convert Lake Shore unit 18 to a synchronous condenser
- Original Estimated Project Cost: $20M

New Upgrade:
- Install SVC at Lake Shore
- Estimated Project Cost: $34.7M

Reason for the recommend change to the project:
The conceptual synchronous condenser costs now exceed that of an SVC due to significantly increased physical structure, lubrication/cooling systems and staffing requirements identified while establishing firm scope and pricing for the synchronous condenser

Projected in-service date: 6/1/2015
<table>
<thead>
<tr>
<th>Unit(s)</th>
<th>Transmission Zone</th>
<th>Requested Deactivation Date</th>
<th>PJM Reliability Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big Sandy unit 2 (800MW)</td>
<td>AEP</td>
<td>6/1/2015</td>
<td>Reliability analysis underway.</td>
</tr>
</tbody>
</table>

Big Sandy unit 2 (800MW)
Artificial Island Update
• 26 proposed solutions
• Approximate cost range of $100 M to $1,550 M
• Technology includes transmission at both 500 kV and 230 kV, new transformation, substations and associated equipment, additional circuit breakers, system reconfiguration, dynamic reactive, dynamic series compensation
• Diversity of project risk, requirements and timelines

<table>
<thead>
<tr>
<th>Project ID</th>
<th>TO</th>
<th>Cost ($)</th>
<th>Major Components</th>
<th>Supporting info</th>
</tr>
</thead>
<tbody>
<tr>
<td>P261_1A</td>
<td>Virgina Electric and Power Corp</td>
<td>$115</td>
<td>500 MVAR SVC near New Freedom</td>
<td>Two (2) 765 kV/500 MVAR SVCs near New Freedom</td>
</tr>
<tr>
<td>P261_1B</td>
<td>Virgina Electric and Power Corp</td>
<td>$166</td>
<td>New 500 kV station in Delaware</td>
<td>New 500 kV station in Delaware that taps existing Cedar Creek - Red Lion 345 kV and Cedar Creek - Red Lion 230 kV</td>
</tr>
<tr>
<td>P261_1C</td>
<td>Virgina Electric and Power Corp</td>
<td>$280</td>
<td>New 500 kV station near Hope Creek, new station in Delaware</td>
<td>Install new 500 kV line from Hope Creek - Red Lion</td>
</tr>
<tr>
<td>P261_1D</td>
<td>Transource</td>
<td>$210 - $240</td>
<td>Salem - Cedar Creek 345 kV</td>
<td>Two (2) 345 kV/345 MVAR SVCs near Salem Loop in Red Lion - Carneys 345 kV Cedar Creek.</td>
</tr>
<tr>
<td>P261_1E</td>
<td>Transource</td>
<td>$215 - $240</td>
<td>Salem - North Cedar Creek (new) 345 kV</td>
<td>Two (2) 345 kV/345 MVAR SVCs near Salem Loop in Red Lion - Carneys 345 kV Cedar Creek.</td>
</tr>
<tr>
<td>P261_1F</td>
<td>Transource</td>
<td>$223</td>
<td>Salem - Field Line 500 kV</td>
<td>New Salem - Hope Creek 500 kV line and new 500 kV station near Lumberton.</td>
</tr>
<tr>
<td>P261_1G</td>
<td>FirstEnergy</td>
<td>$270 - $394</td>
<td>New Freedom - Lumberton - North Strabane (new) 500 kV line</td>
<td>New Salem - Hope Creek 500 kV line and new 500 kV station near Lumberton.</td>
</tr>
<tr>
<td>P261_1A</td>
<td>PG&amp;E</td>
<td>$415</td>
<td>Salem - Cedar Creek 345 kV</td>
<td>New Salem - Hope Creek 500 kV line and new 500 kV station near Lumberton.</td>
</tr>
<tr>
<td>P261_1B</td>
<td>LG Power</td>
<td>$650.54 - $776.47</td>
<td>Salem - Silver Run (new) 345 kV, Salem 500/230 kV Transformer</td>
<td>New 500 kV station that taps existing Cedar Creek - Red Lion 345 kV and Cedar Creek - 230 kV</td>
</tr>
<tr>
<td>P261_1C</td>
<td>LG Power</td>
<td>$176</td>
<td>Salem - Field Line 500 kV</td>
<td>New Salem - Hope Creek 500 kV line and new 500 kV station near Lumberton.</td>
</tr>
<tr>
<td>P261_1D</td>
<td>Atlantic City</td>
<td>$192</td>
<td>500 kV HVDC Salem-Hope Creek - Cardif</td>
<td>500 kV HVDC at Salem-Hope Creek, New HVDC Station at Cardif and Salem</td>
</tr>
<tr>
<td>P261_1E</td>
<td>PEFC</td>
<td>$137</td>
<td>Salem-Hope Creek to Pass Bottom 500 kV</td>
<td>Existing FOV</td>
</tr>
<tr>
<td>P261_1F</td>
<td>PEFC</td>
<td>$177</td>
<td>Salem-Hope Creek to Pass Bottom 500 kV</td>
<td>Same as 7A with Loop into Kevington</td>
</tr>
<tr>
<td>P261_1G</td>
<td>PEFC</td>
<td>$177</td>
<td>Salem-Hope Creek to Pass Bottom 500 kV</td>
<td>Same as 7A with Loop into Kevington</td>
</tr>
<tr>
<td>P261_1H</td>
<td>PEFC</td>
<td>$803</td>
<td>Salem-Hope Creek to Pass Bottom 500 kV</td>
<td>Same as 7A with new FOV</td>
</tr>
<tr>
<td>P261_1I</td>
<td>PEFC</td>
<td>$850</td>
<td>New Freedom - Diamond (new) Salem-Hope Creek 500 kV lines</td>
<td>Existing FOV</td>
</tr>
<tr>
<td>P261_1J</td>
<td>PEFC</td>
<td>$850</td>
<td>New Freedom - Diamond (new) Salem-Hope Creek 500 kV lines</td>
<td>Same as 7A with Loop into Kevington and new Lumber 500 kV station</td>
</tr>
<tr>
<td>P261_1K</td>
<td>PEFC</td>
<td>$1,177</td>
<td>&quot;New Freedom,&quot; &quot;Diamond&quot; Salem-Hope Creek lines</td>
<td>New Freedom loop</td>
</tr>
<tr>
<td>P261_1L</td>
<td>PEFC</td>
<td>$1,177</td>
<td>&quot;New Freedom,&quot; &quot;Diamond&quot; Salem-Hope Creek lines</td>
<td>New Freedom loop</td>
</tr>
<tr>
<td>P261_1M</td>
<td>PEFC</td>
<td>$945</td>
<td>New Freedom - New Station on Brandenburg Loop 500 kV line (new)</td>
<td>Existing FOV</td>
</tr>
<tr>
<td>P261_1N</td>
<td>PEFC</td>
<td>$1,140</td>
<td>New Freedom - Diamond (new) Salem - Hope Creek, Red Lion 500 kV lines</td>
<td>Same as 7A with Hope Creek - Red Lion</td>
</tr>
<tr>
<td>P261_1O</td>
<td>PEFC</td>
<td>$1,140</td>
<td>New Freedom - Diamond (new) Salem - Hope Creek, Red Lion 500 kV lines</td>
<td>Same as 7A with Hope Creek - Red Lion</td>
</tr>
<tr>
<td>P261_1P</td>
<td>PEFC</td>
<td>$1,850</td>
<td>New Freedom - &quot;North,&quot; &quot;Diamond,&quot; Salem - Hope Creek, Red Lion 500 kV lines</td>
<td>Same as 7A with Hope Creek - Red Lion</td>
</tr>
<tr>
<td>P261_1Q</td>
<td>PEFC</td>
<td>$1,850</td>
<td>New Freedom - &quot;North,&quot; &quot;Diamond,&quot; Salem - Hope Creek, Red Lion 500 kV lines</td>
<td>Same as 7A with Hope Creek - Red Lion</td>
</tr>
</tbody>
</table>
Artificial Island Analytical Evaluation Recap

• Recap of Previous November 2013 TEAC Update
  – 230 kV Transmission Solutions
    • Assuming the same AI Voltage, observe the AI MVAr output and maximum angle swing
      – Less AI MVAr output means more MVAr margin.
      – Less angle swing correlates to a larger stability margin
    • Given the same AI MVAr output compare the maximum angle swing
      – Less angle swing correlates to a larger stability margin
  – SVC Locations
    • Evaluate the effectiveness of the SVC locations by observing AI MVAr output and maximum angle swing
      – Less angle swing correlates to a larger stability margin
Artificial Island Analytical Evaluation Recap

• Recap of Previous December 2013 TEAC Update
  – 500 kV Transmission Solutions
    • Assuming the same AI Voltage, observe the AI MVAr output and maximum angle swing
      – Less AI MVAr output means more MVAr margin.
      – Less angle swing correlates to a larger stability margin
    • Given the same AI MVAr output compare the maximum angle swing
      – Less angle swing correlates to a larger stability margin
  – TCSC
  – HVDC
  – SVC Locations
    • Evaluate the effectiveness of the SVC locations by observing AI MVAr output and maximum angle swing
      – Less angle swing correlates to a larger stability margin
Artificial Island Analytical Evaluation Recap

• Recap of Previous January 2014 TEAC Update
  – Discussed scope of limited proposal enhancements
  – Size & location of SVC components
  – Discussed the relative performance of the enhanced proposals
• Detailed simulation results to be posted to PJM.com

• Identification of all faults and results that have been evaluated for each proposal, as well as the enhancement scenarios
Artificial Island Project Evaluation:
Preliminary Line Constructability Analysis
• 17 mile 500kV line

• Parallels 5015 (Existing Red Lion – Hope Creek 500 kV)

• Proposing Entities:

<table>
<thead>
<tr>
<th>Company</th>
<th>Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS Power</td>
<td>PHI/Exelon</td>
</tr>
<tr>
<td>PSE&amp;G</td>
<td>Transource</td>
</tr>
<tr>
<td>Dominion Virginia</td>
<td>Power Company</td>
</tr>
</tbody>
</table>

Artificial Island to Red Lion Lines
Southern Delaware Crossing Lines

- Submarine or aerial line over the Delaware
- New or expansion of existing substation in Delaware
- Proposing Entities:

<table>
<thead>
<tr>
<th>Entity</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS Power</td>
</tr>
<tr>
<td>Transource</td>
</tr>
<tr>
<td>Dominion Virginia Power Company</td>
</tr>
</tbody>
</table>
### Constructability Review – Preliminary Findings

#### Artificial Island to Red Lion Projects

<table>
<thead>
<tr>
<th></th>
<th>Southern Delaware Line Crossing Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overhead River Crossing</td>
</tr>
</tbody>
</table>

#### Siting / Permitting

**Characteristics common to All**

- Delaware River Basin Commission approval required
- Delaware and New Jersey CPCNs required
- US Army Corp of Engineers Section 404 and 10 authorizations
- Multiple US Fish and Wildlife permits required
- National Marine Fisheries Service
<table>
<thead>
<tr>
<th>Artificial Island to Red Lion Projects</th>
<th>Southern Delaware Line Crossing Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overhead River Crossing</td>
<td>Submarine River Crossing</td>
</tr>
<tr>
<td>Rights of Way and Land Acquisition</td>
<td>New route</td>
</tr>
<tr>
<td>Route is adjacent to existing 5015 line</td>
<td>2.1 - 2.7 miles of the line is in Delaware (no Eminent Domain for transmission infrastructure)</td>
</tr>
<tr>
<td>1 commercial and 9 residential land owners along the New Jersey portion of the line route.</td>
<td>Land required for a new substation or expansion of Cedar Creek substation in Delaware</td>
</tr>
<tr>
<td>Minimal line distance in Delaware</td>
<td></td>
</tr>
</tbody>
</table>
### Siting / Permitting

<table>
<thead>
<tr>
<th>Artificial Island to Red Lion Projects</th>
<th>Southern Delaware Line Crossing Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overhead River Crossing</td>
<td>Submarine River Crossing</td>
</tr>
<tr>
<td>2.5 mile crossing of the Delaware river adjacent to the existing 5015 line crossing</td>
<td>3 - 5.7 mile crossing of the Delaware river as a new crossing</td>
</tr>
<tr>
<td>2.5 miles of the line crosses through the Supawna Meadows National Wildlife Refuge</td>
<td>Projects that include a new substation cross or parallel Delaware state route 9, which is classified as a “Scenic and Historic” highway</td>
</tr>
<tr>
<td>10 miles of the line dominated by estuarine and marine deepwater/wetlands</td>
<td>Projects that include a new substation cross or parallel Delaware state route 9, which is classified as a “Scenic and Historic” highway</td>
</tr>
</tbody>
</table>
Constructability Review – Preliminary Findings

<table>
<thead>
<tr>
<th>Artificial Island to Red Lion Projects</th>
<th>Southern Delaware Line Crossing Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overhead River Crossing</td>
<td>Submarine River Crossing</td>
</tr>
<tr>
<td><strong>Project Coordination Complexity</strong></td>
<td></td>
</tr>
<tr>
<td>• All proposals require significant reconfiguration of existing transmission infrastructure at Artificial Island</td>
<td>• Auto-transformer at or near Salem substation</td>
</tr>
<tr>
<td>• Significant line and substation equipment outages</td>
<td>• Submarine cable installation</td>
</tr>
<tr>
<td><strong>Project Schedule</strong></td>
<td></td>
</tr>
<tr>
<td>• 48 - 111 months</td>
<td>• 42 - 60 months</td>
</tr>
<tr>
<td><strong>Project Cost (millions)</strong>*</td>
<td></td>
</tr>
<tr>
<td>• $110 - $207</td>
<td>• $148 - $270</td>
</tr>
</tbody>
</table>

* cost provided by project sponsor
• Finalizing review by EOC to address:
  – Potential siting/permitting differentiators
  – Project complexity and outage needs
  – Proposed project cost and schedule accuracy
• Next Steps
  – Continue analytical studies
  – Finalize the constructability studies
  – Finalize individual project sponsor evaluations
• September 12th TEAC
  – Update analytical progress
• October, November, and December TEAC meetings
  – Update analytical progress
  – Update feasibility study progress
• January 2014
  – Update analytical progress
  – Constructability criteria discussion
• 2014
  – Recommend solution to PJM TEAC
  – Recommend solution to PJM Board
Reliability Analysis Update
• **Recommended Change to Existing Approved Baseline Project**
• **Project B2184 - Tarboro 230kV breaker cost increase**
• **Reason for change: Reliability improvements and necessary construction increased cost from $2.5M to $3.9M:**
  - Installation of 230kV breakers on high side of both transformers instead of circuit switchers
  - Installation of 115kV breaker at 55T105 instead of installing sectionalizing scheme
  - Replacement of A-frame in station with a 230kV backbone to accommodate new breaker
• **Estimated cost $3.9M**
• **Projected IS Date: Dec 2014**
NERC Category B Violation (DVP Analysis)

Problem:
- In 2016 summer an outage of the Fredericksburg to Ladysmith 230 kV line (Line #2090) with Surry 230kV Generation off-line results in the Elmont to Four Rivers 230kV (Line #2032) loading to above 94% of the emergency rating. This overload also occurs in the 2018 RTEP analysis for Category C contingencies.

Proposed Solution:
- Uprate the summer emergency rating of Line #2032 to 1195 MVA by replacing the 230kV line switches at Hanover Substation with 3000a switches and replacing the Line #2032 wave traps at Four Rivers and Elmont with 3000a wave traps.

Estimated cost $ 0.25 M

Projected IS Date: May 2016
Dominion Transmission Zone

Problem: Loading on radial Line #2086 (Remington CT-Warrenton 230 kV) is projected to exceed 100 MW by Summer 2017. Existing load on NOVEC’s radial 115 kV Gainesville-Wheeler line exceeds 110 MW. Loss of Gainesville Substation results in over 300 MW being dropped.

Potential Solutions:
A) Construct a 230kV OH line approx. 9 miles from Warrenton to Wheeler Substation. Convert NOVEC’s Gainesville-Wheeler line (approx 6 miles) to 230kV. Bypass Gainesville and utilize Line #124 (Gainesville-Loudoun) to complete a Remington CT-Warrenton-Wheeler-Loudoun networked line. Constructing this Option A underground (UG) would be approx 8 miles between Warrenton and Wheeler.

B) Wreck-and-rebuild existing Line #2086 (Remington CT – Warrenton 230 kV) (approx. 12 miles) as a double-circuit 230kV line to resolve the Line #2086 criteria violation. Wreck-and-rebuild NOVEC’s Gainesville-Wheeler line (approx. 6 miles) as a double-circuit 230kV line. Terminate one line at Gainesville to create a new Gainesville-Wheeler line. Bypass Gainesville with the other line and utilize Line #124 (Gainesville-Loudoun) to create a 230kV Loudoun-Wheeler line.

C) Wreck-and-rebuild existing Line #2086 (Remington CT – Warrenton 230 kV) (approx. 12 miles) as a double-circuit 230kV line to resolve the Line #2086 criteria violation. Construct a new 230kV line approx. 6 miles from NOVEC’s Wheeler Substation to a new 230kV switching station in the Vint Hill area. Convert NOVEC’s Gainesville-Wheeler line (approx. 6 miles) to 230kV. Bypass Gainesville and utilize Line #124 to complete a Vint Hill-Wheeler-Loudoun 230kV networked line.
Dominion Transmission Zone

Warrenton-Wheeler-Gainesville 230kV Reliability Project

<table>
<thead>
<tr>
<th>Alternative Solutions</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) Warrenton-Wheeler OH (or UG)</td>
<td>$86M ($168M)</td>
</tr>
<tr>
<td>B) Double-circuit Remington CT-Warrenton + Double-circuit Gainesville-Wheeler</td>
<td>$94M</td>
</tr>
<tr>
<td>C) Double-circuit Remington CT-Warrenton + New 230kV Wheeler-Vint Hill Line</td>
<td>$101-105M</td>
</tr>
</tbody>
</table>

Recommended Solution:
C) Wreck-and-rebuild existing Line #2086 (approx. 12 miles) as a double-circuit 230kV line. Construct a new 230kV line approx. 6 miles from NOVEC’s Wheeler Substation to a new 230kV switching station in the Vint Hill area. Convert NOVEC’s Gainesville-Wheeler line (approx. 6 miles) to 230kV. Bypass Gainesville and utilize Line #124 to complete a Vint Hill-Wheeler-Loudoun 230kV networked line.

Estimated Project Cost: $105 M

Projected IS Date: 6/1/2017

Notes:
1) Solution A is not recommended due to routing and permitting constraints associated with OH facilities through historical battlefields, conservation easements, and governmental land along the route. The cost estimate for Solution A is based on the assumption of being able to obtain a “buildable” route.
2) Solution B is not recommended since its potential long-term impact is not as robust as Proposed Solution C
3) The cost variations for Proposed Solution C are due to the multiple routes studied.
4) The cost estimates shown for the various solutions include the purchase of the NOVEC line.
Supplemental Projects
• Supplemental Project

• Replace CB 1395 at Todhunter 345kV with the new 362 kV, 3000A, 50kA Circuit Breaker; Replace live parts on switches 1391A and 1395B at Todhunter 345KV for uprate to 3000A (S0683)

• Estimated cost: $0.3M

• Projected IS Date: 6/1/2014
• Supplemental Project
• Install Optical Ground Wire to improve reliability. This provides strength, lightning protection and a potential communications path for high speed relaying.
• Proposed Solution:
  – Install OPGW (Optical Ground Wire) on the K-2263 (Cedar Grove to Athenia Sw) and F-2206 (Roseland to Williams) OH 230 kV Circuits (S0651).
• Estimated Project Cost: $2.3856 M
• Expected IS Date: 6/30/2015
• Supplemental Project
• Install Optical Ground Wire to improve reliability. This provides strength, lightning protection and a potential communications path for high speed relaying.
• Proposed Solution:
  – Install OPGW (Optical Ground Wire) on the Y-2225 (Hudson to Hoboken) and X-2250 (Bergen to Belleville) OH 230 kV Circuits (S0652).
• Estimated Project Cost: $2.28 M
• Expected IS Date: 6/30/2015
• **Supplemental Project**
• **Install Optical Ground Wire to improve reliability.** This provides strength, lightning protection and a potential communications path for high speed relaying.
• **Proposed Solution:**
  - Install OPGW on the OPGW (Optical Ground Wire) S-2219 (Dean’s to Metuchen) OH 230 kV Circuit (S0653).
• **Estimated Project Cost:**
  - $2.625 M
• **Expected IS Date:**
  - 6/30/2015
• Supplemental Project
• Install Optical Ground Wire to improve reliability. This provides strength, lightning protection and a potential communications path for high speed relaying.
• Proposed Solution:
  – Install OPGW on the OPGW (Optical Ground Wire) U-2221 (Roseland to Readington) OH 230 kV Circuit (S0654).
• Estimated Project Cost: $5.271 M
• Expected IS Date: 6/30/2015
• Supplemental Project
• Install Optical Ground Wire to improve reliability. This provides strength, lightning protection and a potential communications path for high speed relaying.
• Proposed Solution:
  – Install OPGW on the OPGW (Optical Ground Wire) A-2227 (Essex Sw to Hudson Sw) OH 230 kV Circuit (S0655).
• Estimated Project Cost: $1.3146 M
• Expected IS Date: 6/30/2015
• Supplemental Project
• Install Optical Ground Wire to improve reliability. This provides strength, lightning protection and a potential communications path for high speed relaying.
• Proposed Solution:
  – Install OPGW on the OPGW (Optical Ground Wire) X-2276 (Aldene Sw to Westfield) OH 230 kV Circuit (S0656).
• Estimated Project Cost: $0.5691 M
• Expected IS Date: 6/30/2015
• Supplemental Project
• To improve reliability due to age and condition of the capacitor.
• Proposed Solution:
  – Replace Deans 230 kV capacitors and circuit switchers (S0657).
• Estimated Project Cost: $ 5.0 M
• Expected IS Date: 6/30/2015
Supplemental Project

To improve reliability due to failure of the Branchburg 500/230 kV single phase transformer.

Proposed Solution:
- Replace the 500/230 kV Branchburg 500-3 Transformer – Phase C (S0659).

Estimated Project Cost: $8.25 M

Expected IS Date: 6/30/2015
• Supplemental Project
• To improve reliability due to and increase the rating of the Waldwick spare PAR.
• Proposed Solution:
  – Upgrade Waldwick 230 kV UG pipe cable (S0661).
• Estimated Project Cost: $ 4.8 M
• Expected IS Date: 6/30/2014
• Continue Artificial Island evaluation

• Complete quality control check of 2019 Summer RTEP power flow case
• March 2013 – PJM, along with stakeholder input, developed and posted requirements for the pre-qualification submittal information

• April 2013 – PJM, along with stakeholder input, developed and presented the pre-qualification evaluation criteria

• To date, PJM has received 18 submittals and all have been processed and posted
• It appeared that some entities were not aware of the evaluation criteria presented at the PC meeting in April 2013. This added to time needed to review and assess the qualifications.

• Some proposing entities required additional time to determine what confidential information needed to be redacted in order to be posted.

• Concerns with confidentiality of financial data resulted in delays in processing.
Proposal Window Process

- 04/29/13 Artificial Island window opened; RFP documents made available on PJM.com
- 06/28/13 Artificial Island window closed
- 26 project proposals received from 7 different entities
- Sept / Oct – PJM met with proposers
- Technical analysis ongoing
  - Updates provided at TEAC meetings
• 08/12/13 Market Efficiency window opened and RFP documents posted on PJM.com
• 09/26/13 Market Efficiency window closed
• 38 project proposals received from 10 different entities
• Technical analysis ongoing
  – Updates provided at TEAC meetings
• RFP format and content

• Window length
  – Announcement versus actual window opening date and duration

• Load flow cases and data for performing analysis
  – Data updates

• Data submission process and tools
• Project proposals varied considerably in level of detail provided

• Some proposing entities required additional time to determine what confidential information needed to be redacted in order to post project proposals
• Would a template be preferable?
  – Online Form - Consistency, easy to update, confidential
• What information should be considered confidential?
• How does PJM make it easier to pre-qualify? What process improvements are needed?
  – Timing
  – Status
  – Updates
• Should CEII process be part of pre-qualification?
• **RFP Notification process**
  – What’s the preferred timing for announcement? 30 days before window?
  – What’s the preferred method? E-mail, posting, TEAC?
  – Should there be window status updates? 15 days until window close?

• **RFP Window**
  – Are the default window durations the appropriate length? Should they be more definitive?
• RFP Format
  – What information/requirements are missing?
  – Would a template/form help with submission?
  – Should clarification questions be shared among proposers? If so, what is the format?
  – What level of detail is needed for requirements?
  – Can the requirements be altered during RFP process?
  – What level of routing, permitting and construction design detail is appropriate at RFP stage?
• What has worked well?
• What is still missing from the process?
• What, other than items on previous slides, should be changed?
• Other suggestions or improvements?
Questions?

Email: RTEP@pjm.com
• 2/6/2014 v1
  – Original version distributed to PJM TEAC
• 2/6/2014 v2
  – Added an Interregional Planning Update.
  – Added an Order 1000 Feedback Discussion.
• 2/7/2014 v3
  – Slide 11 – Based on stakeholder feedback, updated the excluded generation list
  – Slide 57 – Updated typographical error, the case year is 2019