Transmission Expansion Advisory Committee

July 10, 2013
Issues Tracking
• Open Issues
  – None

• New Issues
2013 RTEP Scenario Analysis Update
At-Risk Generation Update

• Data available to PJM
  – Known deactivations (status known, not considered at-risk)
  – Generation Owner survey
  – Projected retrofits and associated eDart outage tickets
  – Economics
• Perform analysis of an at-risk generation case when upgrades are proposed for the 2013 RTEP analysis of 2018
2013 RTEP Baseline Update
High Voltage in PJM Operations Analysis
• Determined potential reactor locations
  – from historical PI data and high voltage alarm data

• Modeled and simulated reactors in several operational cases to determine the potential magnitude that is necessary to control high voltage

• Also simulated high voltage conditions and reactors in a planning case to determine system needs beyond the operational cases
High Voltage Locations in PJM Operations Cases

- 5 snapshot cases from PJM Operations evaluated
Proposed Final Solutions*

*This is only a visual depiction and may not show all recommended RTEP upgrades
<table>
<thead>
<tr>
<th>Upgrade ID</th>
<th>Description</th>
<th>TO</th>
<th>In Service Date</th>
<th>Cost Estimate ($M)</th>
</tr>
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<tbody>
<tr>
<td>b2227</td>
<td>50 MVAR shunt reactor at Mickleton 230 kV and relocate Mickleton #1 230 69 kV transformer</td>
<td>AEC</td>
<td>6/1/2016</td>
<td>7.6</td>
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<td>b2228</td>
<td>+150/-100 MVAR SVC at Cedar 230 kV</td>
<td>AEC</td>
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<td>b2229</td>
<td>Install a 300 MVAR reactor at Dequine 345 kV</td>
<td>AEP</td>
<td>12/1/2016</td>
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<td>b2230</td>
<td>Replace existing 150 MVAR reactor at Amos 765 kV substation on Amos – N. Proctorville - Hanging Rock with 300 MVAR reactor</td>
<td>AEP</td>
<td>6/1/2016</td>
<td>5</td>
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<td>b2231</td>
<td>Install 765 kV reactor breaker at Dumont 765 kV substation on the Dumont - Wilton Center line</td>
<td>AEP</td>
<td>12/1/2015</td>
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<td>b2232</td>
<td>Install 765 kV reactor breaker at Marysville 765 kV substation on the Marysville - Maliszewski line</td>
<td>AEP</td>
<td>6/1/2015</td>
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<td>b2233</td>
<td>Change transformer tap settings for the Baker 765/345 kV transformer</td>
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<td>6/1/2016</td>
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<td>b2239</td>
<td>50 MVAR reactor at Saddlebrook 230 kV</td>
<td>PSEG</td>
<td>6/1/2015</td>
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<td>50 MVAR reactor at Athenia 230 kV</td>
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<td>b2241</td>
<td>50 MVAR reactor at Bergen 230 kV</td>
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<td>b2242</td>
<td>50 MVAR reactor at Hudson 230 kV</td>
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<td>b2243</td>
<td>Two 50 MVAR reactors at Stanley Tce 230 kV</td>
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<td>b2234</td>
<td>2x130 MVAR reactor at West Wharton 230 kV</td>
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<td>150 MVAR shunt reactor at Alburtis 500 kV</td>
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<td>b2238</td>
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<td>PPL</td>
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<td>b2279</td>
<td>Add two 100 MVAR reactors at Dickerson Station H and two 100 MVAR reactors at Brighton 230 kV substation</td>
<td>PEPCO</td>
<td>6/1/2016</td>
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</tbody>
</table>

* PJM estimate
• Next Steps
  – Evaluation complete
  – PJM Board Approval
Additional & Temporary Bath County SPS
Development of Bath County SPS

- Existing Bath County/Cloverdale SPS currently in PJM Operations (see Manual 03) to control thermal/voltage

- Additional temporary SPS under development for the planned outage of Dooms – Lexington 500 kV “555 line”
Development of Bath County SPS

- Dooms – Lexington 500 kV outage anticipated in September 2014

- Temporary SPS purpose is to control stability for a range of pumping / generating / condensing combinations at Bath County

- In-service date coincident with anticipated Dooms – Lexington 500 kV outage
Additional & Temporary Bath County SPS

• Install temporary Bath County SPS (B2281)

• Required in-service date: 9/1/2014

• Estimated project cost: $1.5 M
• Evaluation of 2018 Summer
  – Base case
  – Generator Deliverability
  – Load Deliverability
• Preliminary results
  – West
  – South
  – MAAC
• Next Steps
• Analysis for all areas complete
  – 25 of 27 LDAs passed the load deliverability test with no potential issues
  – No thermal issues identified in any test

• Potential Voltage Violations
  – Voltage violations in the Penelec transmission zone resulting from the Penelec and Western MAAC load deliverability tests
• Potential Voltage Violations
• 2018 Summer
  – Potential baseline and Load deliverability voltage violations
• Several voltage magnitude and voltage drop violations in the Penelec transmission zone
• Common Mode Outage Violation:
• The Upper Pittsgrove – Landis 138 kV circuit is overloaded for line fault with stuck breaker at Churchtown contingency, resulting in the loss of the Churchtown – Chambers and Churchtown – Orchard 230 kV circuits.

• Proposed Solution:
  – Rebuild 9.7 miles of circuit 1406 (Upper Pittsgrove – Landis 138 kV) and an upgrade of the Landis terminal equipment (B2283).

• Estimated Project Cost:
  – $ 11.2 M

• Expected IS Date:
  – 6/1/2018
• Common Mode Outage Violation:
  • The New Church – Piney Grove 138 kV circuit is overloaded for multiple line fault stuck breaker contingencies.

• Proposed Solution:
  – Build a new 138kV line from Piney Grove – Wattsville.

• Estimated Project Cost:
  – $ TBD

• Expected IS Date:
  – 6/1/2018
PPL Transmission Zone

- Common Mode Outage Violation:
  - The Frackville – Siegfried 230 kV circuit is overloaded for the Montour – Susquehanna 230 kV tower line contingency.
- Proposed Solution:
  - Rebuild the Siegfried-Frackville 230 kV line (B2282).
- Estimated Project Cost:
  - $ 84.5 M
- Expected IS Date:
  - 6/1/2018
• Common Mode Outage Violation:
  • The Oak Grove (053) – Bowie (043) 230 kV circuit is overloaded for the tower contingency of T133TAP – Aquasco – Oak Grove 230 kV and Oak Grove – Bowie – Burtonsville 230 kV.

• Proposed Solution:
  – Upgrade the Oak Grove (053) – Bowie (043) 230 kV circuit ‘23065’.

• Estimated Project Cost:
  – $ TBD

• Expected IS Date:
  – 6/1/2018
PEPCO Transmission Zone

- Common Mode Outage Violation:
  - The Oak Grove – T133TAP 230 kV circuit is overloaded for the tower outage of T133TAP – Aquasco – Oak Grove 230 kV and Oak Grove – Bowie – Burtonsville 230 kV.
- Proposed Solution:
  - Upgrade the Oak Grove – T133TAP 230 kV circuit ‘23065’.
- Estimated Project Cost:
  - $ TBD
- Expected IS Date:
  - 6/1/2018
• Common Mode Outage Violation:
  The Oak Grove (054) – Bowie (044) 230 kV circuit is overloaded for the
tower contingency of Oak Grove – Bowie 230 kV and Oak Grove –
T133TAP (7PEPCO) tower line contingency.

• Proposed Solution:
  – Upgrade the Oak Grove (054) – Bowie (044) 230 kV circuit
    ‘23153’.

• Estimated Project Cost:
  – $ TBD

• Expected IS Date:
  – 6/1/2018
• Common Mode Outage Violation:
  • The Aquasco – Oak Grove 230 kV circuit is overloaded for the tower contingency of Oak Grove – Bowie 230 kV and Oak Grove – T133TAP 230 kV.

• Proposed Solution:
  – Upgrade the Aquasco – Oak Grove 230 kV circuit ‘23153’.

• Estimated Project Cost:
  – $ TBD

• Expected IS Date:
  – 6/1/2018
• Common Mode Outage Violation:
  • The Burches Hill – Talbert (068) 230 kV circuit is overloaded for the tower contingency of Oak Grove – Talbert (068) 230 kV and Oak Grove – Talbert (066) 230 kV.

• Proposed Solution:
  – Upgrade the Burches Hill – Talbert (068) 230 kV circuit ‘23081’.

• Estimated Project Cost:
  – $ TBD

• Expected IS Date:
  – 6/1/2018
PEPCO Transmission Zone

- Generation Deliverability Violation:
  - The Chalk Point – T133TAP 230 kV circuits #1 and #2 are overloaded for several single contingencies.

- Proposed Solution:
  - Upgrade the Chalk Point – T133TAP 230 kV circuits 1 (23063) and 2 (23065).

- Estimated Project Cost:
  - $ TBD

- Expected IS Date:
  - 6/1/2018
• Common Mode Outage Violation:
  The V3-017 – Hawkins Gate 230 kV circuit is overloaded for the tower outage of V3-017 – Talbert (066) 230 kV and V3-017 – Talbert (068) 230 kV.

• Proposed Solution:
  – Upgrade the V3-017 – Hawkins Gate 230 kV circuit ‘23084’.

• Estimated Project Cost:
  – $ TBD

• Expected IS Date:
  – 6/1/2018
Short Circuit Upgrades
The Charles 138kV breaker ‘919’ is overstressed

Proposed Solution: Revising the reclosing of Charles 138kV breaker ‘919’ to 15 sec (b2278)

Estimated Project Cost: TBD

Expected IS Date: 6/1/2014
• The USAP 138kV breaker ‘XFMR’ is overstressed
• Proposed Solution: Replace the USAP 138kV breaker ‘XFMR’ (b2280)
• Estimated Project Cost: TBD
• Expected IS Date: 6/1/2014
JCPL Transmission Area


- Estimated Project Cost: $60K per breaker

- Expected IS Date: 6/1/2014
PSE&G Transmission Zone - Northern NJ
Short Circuit
PSEG Transmission Zone Short Circuit

- **PSEG Short Circuit Issue**
  - 2012 RTEP identified several busses in PSEG zone where the fault currents exceed 80 kA
  - A number of alternatives evaluated including rebuilding stations to 90 kA standard, installing current limiting reactors, splitting the system
Simulations indicate overdutied breakers over 80 kA at:
- Hudson
- Essex
- Kearny
PJM is evaluating alternative solutions

- Double circuit 345 kV Solution
  - Isolate Hudson 230 kV from the 138 kV at Marion and 345 kV at Farragut
  - Convert the 138 kV buses and transmission facilities on the path from Linden to Bergen to double circuit 345 kV

- Other solutions considered
  - Double circuit 230 kV Solution
    - Isolate Hudson 230 kV from the 138 kV at Marion and 345 kV at Farragut
    - Convert the 138 kV buses and transmission facilities on the path from Linden to Bergen to double circuit 230 kV
  - Other configurations

- Hudson #2 generation location assumption
  - Existing Hudson 230 kV or converted Marion 230 kV or 345 kV station?
• Recent stakeholder proposal to build parallel 700 MW HVDC converter stations

• Associated Stakeholder PJM queue request for 400 MW withdrawal from Hudson to New York
• Double circuit 345 kV Solution
• Existing baseline projects included in the scope
PSEG Transmission Zone Short Circuit

- Assumptions
  - Hudson 230 kV bus tie status
  - Hudson #2 generation location
    - Hudson 230 kV or Marion 345 kV
  - Queued Generation
    - ISA
      - T44/T42 (in-service), T107 (under construction)
    - Impact Study
      - X2-050 (660 MW at Essex 230 kV) & Y2-105 (50 MW at Eagle Point 230 kV)
PSEG Transmission Zone Short Circuit

• Updated Analysis since June TEAC Meeting
  – The system was evaluated for thermal and voltage performance for the 345 kV option
  – No potential issues were identified
## Solution Alternatives

### Baseline Performance*

<table>
<thead>
<tr>
<th>Location</th>
<th>Breaker Capacity</th>
<th>No Solution</th>
<th>HVDC Solution</th>
<th>Double Circuit 345 kV Alternative</th>
<th>Double Circuit 345 kV (w/ Hudson #2 at Marion 345 kV) Alternative</th>
<th>Double Circuit 230 kV Alternative</th>
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</thead>
<tbody>
<tr>
<td>Essex 230kV</td>
<td>80</td>
<td>80.4</td>
<td>72.9</td>
<td>72.3</td>
<td>68.3</td>
<td>74.2</td>
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<td>Hudson 1-6 230kV</td>
<td>80</td>
<td>75.7</td>
<td>62.6</td>
<td>67.8</td>
<td>61.8</td>
<td>71.4</td>
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<td>Hudson 7-12 230kV</td>
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<td>66</td>
<td>67.8</td>
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<td>Kearny 230kV</td>
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<td>74.1</td>
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<td>Marion 1 138kV</td>
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<tr>
<td>NJT Meadow 230kV</td>
<td>75.598</td>
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<td>71.4</td>
<td>71.2</td>
<td>67.7</td>
<td>73.6</td>
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<tr>
<td>Bayway 138 kV</td>
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<td>Bergen 230 kV</td>
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<td>65.9</td>
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<td><strong>81.1</strong></td>
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*Includes all existing and ISA generation

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*PJM TEAC 7/10/2013*
### Solution Alternatives

#### Baseline + Queued Generation Performance**

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**Includes all existing and ISA generation as well as X2-050 (660 MW at Essex 230 kV) & Y2-105 (50 MW at Eagle Point 230 kV)
Solution Alternatives Evaluation

• HVDC back to back facilities at Hudson
  – Evaluation of additional configurations for both short circuit and thermal impacts

• 345 kV Conversion Alternative
• Next Steps

  – Refine cost analysis
  – Additional load flow analysis
  – Coordination with NYISO
Supplemental Projects
• Supplemental Project

• Rebuild Valley – Dooms 500 kV

• Projected IS Date: 12/1/2021

• Estimated Project Cost: $60 M
• Supplemental Project

• Rebuild Mt. Storm – Valley 500 kV

• Projected IS Date: 6/1/2021

• Estimated Project Cost: $200 M
• Supplemental Project

• Rebuild Dooms – Cunningham 500 kV

• Projected IS Date: 5/1/2018

• Estimate Project Cost: $100 M
Dominion Transmission Zone

- Supplemental Project
- Rebuild Cunningham – Elmont 500 kV
- Projected IS Date: 5/1/2018
- Estimate Project Cost: $155 M
Deactivation Analysis Update
Deactivation Update

• Updated Deactivation Notices by NRG
  – The requested deactivation date for Portland units 1 and 2 (401 MWs in MetEd area) has changed from January 7, 2015 to June 1, 2014.
  – The requested deactivation date for Titus units 1, 2, and 3 (243 MWs in MetEd area) has changed from April 16, 2015 to September 1, 2013.
• The Northwood 230/115 kV transformer is overloaded for the N-1-1 loss of the Martins Creek – Portland 230 kV line followed by the loss of the Morris Park 230 kV bus.

• Previously Approved Solution: Northwood 230/115 kV Transformer upgrade (b2002).

• Cost Estimate: $4.0 M

• Original Required IS Date: 6/1/2015

• Revised Required IS Date: 6/1/2014
The following BES contingency causes several 69 kV lines in the Reading 69 kV system to become severely overloaded, which could cause potential tripping of those lines and cascading on the Reading 69 kV system resulting in a potential load loss of over 300 MW.

- A fault with stuck breaker ‘B1’ at South Reading 230 kV will result in the loss of the entire South Reading 230 kV bus.

Previously Approved Solution: Rebuild the North Temple - Riverview - Cartech 69 kV line (b2023).

- Cost Estimate: $4.82 M
- Original Required IS Date: 6/1/2015
- Revised Required IS Date: 6/1/2014
- Projected IS Date: 6/1/2015
Deactivation Update: New Deactivation Notifications

- Piney Creek NUG
  - PenElec Transmission Zone
  - 31 MW
  - Notification received: 6/25/2013
  - Anticipated deactivation date: 4/12/2013
  - Reliability analysis underway

- Koppers NUG
  - PPL Transmission Zone
  - 8 MW
  - Notification received: 7/1/2013
  - Anticipated deactivation date: 9/30/2013
  - Reliability analysis underway
PJM Deactivation Notifications 2012 - 2013
Artificial Island RTEP Proposal Window
Artificial Island Proposal Window Timeline

**Announcement**
(Presented at 7/10/2013 TEAC)
- Announce window and potential timeline
- Request CEII/NDA submittals from anticipated participants
- Request Designated Entity Pre-Qualification

**PSS/E v32 Case Development**
Initial PSS/E v32 case created
- Benchmarking in Progress
- Develop and benchmark critical system condition cases

**Open Window**
(4/29/2013 - 60 Day Duration)
- Open the "Artificial Island" RTEP Proposal Window
- Complete problem statement available
- Analytical files available

**Coordinate with Window Participants and Receive Solution Proposals**
- Coordination VIA www.pjm.com
- Data, Information
- Questions & Answers

**Proposal Window Closed on 6/28/2013**

**PJM Evaluates Solution Proposals**
Artificial Island Proposal Window Status

- Window opened on 4/29/2013
- Closed on 6/28/2013

- 26 individual proposals
- 7 entities

- Project Naming Convention
- Project Identification Taxonomy: 2013_1-1A
• All information at this point is provided by the project sponsors
  – Sponsoring Entity
  – Cost Estimate
  – Mileage
  – Routing
Artificial Island Area Network

KEY
- Gen Bus

Diagram:
- Gen Bus: Peach Bottom, Rock Springs, Keeney, Red Lion, Hope Creek, Salem
- Smithburg: to Branchburg, Deans, East Windsor
- New Freedom: 5014, 5025, 5036, 5015, 5037

Network connections and labels.
Artificial Island Proposals
## Artificial Island Proposals

<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>P2013_1-1A</td>
<td>Virginia Electric Power Comp</td>
<td>$133</td>
<td>500 MVAR SVC near New Freedom</td>
<td>Two (2) Thyristor Controlled Series Compensation (TSCC) Devices near New Freedom</td>
</tr>
<tr>
<td>P2013_1-1B</td>
<td>Virginia Electric Power Comp</td>
<td>$126</td>
<td>New 500 kV from Salem - a new station in Delaware</td>
<td>New 500/230 kV station in Delaware that taps existing Cedar Creek - Red Lion 230kV and Calanza - Red Lion 230kV</td>
</tr>
<tr>
<td>P2013_1-1C</td>
<td>Virginia Electric Power Comp</td>
<td>$182</td>
<td>New 500 kV from Hope Creek - a new station in Delaware</td>
<td>New 500/230 kV station in Delaware that taps existing Cedar Creek - Red Lion 230kV and Calanza - Red Lion 230kV, New Salem - Hope Creek 500 kV line</td>
</tr>
<tr>
<td>P2013_1-2A</td>
<td>Transource</td>
<td>$213-$269</td>
<td>Salem - Cedar Creek 230 kV</td>
<td>Two (2) 500/230 Transformers near Salem, Loop in Red Lion - Calanza 230 to Cedar Creek</td>
</tr>
<tr>
<td>P2013_1-2B</td>
<td>Transource</td>
<td>$165-$208</td>
<td>Salem - North Cedar Creek (new) 230 kV</td>
<td>Two (2) 500/230 Transformers near Salem and Loop in Red Lion - Calanza 230 and Red Lion - Cedar Creek 230 kV</td>
</tr>
<tr>
<td>P2013_1-2C</td>
<td>Transource</td>
<td>$123-$156</td>
<td>Salem - Red Lion 500 kV</td>
<td>New Salem - Hope Creek 500 kV line and new 500/230 station east of Lumberton</td>
</tr>
<tr>
<td>P2013_1-2D</td>
<td>Transource</td>
<td>$788-$994</td>
<td>New Freedom - Lumberton - North Smithsburg (New) 500 kV</td>
<td>New Salem - Hope Creek 500 kV line and new 500/230 station east of Lumberton</td>
</tr>
<tr>
<td>P2013_1-3A</td>
<td>First Energy</td>
<td>$452.3(1)</td>
<td>New Freedom Smithburg 500 kV line with a loop into Larrabee, Hope Creek - Red Lion 500 kV line</td>
<td>Two (2) new 500/230 transformers at Larrabee</td>
</tr>
<tr>
<td>P2013_1-4A</td>
<td>PHI Exelon</td>
<td>$475</td>
<td>Peach Bottom - Kenoey - Red Lion - Salem 500 kV</td>
<td>Remove Kenoy - Red Lion 230 kV - Reconfigure 230 around Hay Road - Reconnector Harmonic-Chaplet 138 kV</td>
</tr>
<tr>
<td>P2013_1-5A</td>
<td>LS Power</td>
<td>$116.3M-$148.3M</td>
<td>Salem - Silver Run (new) 230 kV, Salem 500/230 kV Transformer</td>
<td>New 230 kV station that taps existing Cedar Creek - Red Lion 230kV and Calanza - Red Lion 230kV</td>
</tr>
<tr>
<td>P2013_1-5B</td>
<td>LS Power</td>
<td>$170</td>
<td>Salem - Red Lion 500 kV</td>
<td>New 230 kV station that taps existing Cedar Creek - Red Lion 230kV and Calanza - Red Lion 230kV</td>
</tr>
<tr>
<td>P2013_1-6A</td>
<td>Atlantic Wind</td>
<td>$1,012</td>
<td>220 kV HVDC Salem/Hope Creek - Cardiff</td>
<td>SVC at Salem/Hope Creek; New HVDC Stations at Cardiff and Salem</td>
</tr>
<tr>
<td>P2013_1-7A</td>
<td>PSE &amp;G</td>
<td>$1,371</td>
<td>Salem-Hope Creek to Peach Bottom 500 kV</td>
<td>Existing ROW</td>
</tr>
<tr>
<td>P2013_1-7B</td>
<td>PSE &amp;G</td>
<td>$1,372</td>
<td>Salem-Hope Creek to Peach Bottom 500 kV</td>
<td>Same as 7A with Loop into Keney</td>
</tr>
<tr>
<td>P2013_1-7C</td>
<td>PSE &amp;G</td>
<td>$1,372</td>
<td>Salem-Hope Creek to Peach Bottom 500 kV</td>
<td>Same as 7A with Loop into Red Lion</td>
</tr>
<tr>
<td>P2013_1-7D</td>
<td>PSE &amp;G</td>
<td>$1,372</td>
<td>Salem-Hope Creek to Peach Bottom 500 kV</td>
<td>Same as 7A with New ROW</td>
</tr>
<tr>
<td>P2013_1-7E</td>
<td>PSE &amp;G</td>
<td>$852</td>
<td>New Freedom - Deans &amp; Salem - Hope Creek 500 kV lines</td>
<td>Existing ROW</td>
</tr>
<tr>
<td>P2013_1-7F</td>
<td>PSE &amp;G</td>
<td>$875</td>
<td>New Freedom - Smithburg and Salem-Hope Creek 500 kV lines</td>
<td>Same as 7F with a loop into a new Larrabee 500 kV station</td>
</tr>
<tr>
<td>P2013_1-7G</td>
<td>PSE &amp;G</td>
<td>$1,034</td>
<td>New Freedom - Smithburg and Salem-Hope Creek 500 kV lines</td>
<td>Same as 7F with a loop into a new Larrabee 500 kV station</td>
</tr>
<tr>
<td>P2013_1-7H</td>
<td>PSE &amp;G</td>
<td>$1,177</td>
<td>New Freedom - Whidbey and Salem - Hope Creek 500 kV lines</td>
<td>Northern Route</td>
</tr>
<tr>
<td>P2013_1-7I</td>
<td>PSE &amp;G</td>
<td>$1,363</td>
<td>New Freedom - Whidbey and Salem - Hope Creek 500 kV lines</td>
<td>Same as 7H with the Southern Route</td>
</tr>
<tr>
<td>P2013_1-7J</td>
<td>PSE &amp;G</td>
<td>$912</td>
<td>New Freedom - New Station on Branchburg - Ebray 500 kV line (5547 Junction) and Salem - Hope Creek 500 kV line</td>
<td>Existing ROW</td>
</tr>
<tr>
<td>P2013_1-7K</td>
<td>PSE &amp;G</td>
<td>$1,060</td>
<td>New Freedom - Deans &amp; Salem - Hope Creek - Red Lion 500 kV lines w/ Hope Creek - Red Lion (new)</td>
<td>Same as 7E with Hope Creek - Red Lion</td>
</tr>
<tr>
<td>P2013_1-7L</td>
<td>PSE &amp;G</td>
<td>$1,250</td>
<td>New Freedom - Smithburg &amp; Salem - Hope Creek - Red Lion 500 kV lines w/ Hope Creek - Red Lion (new)</td>
<td>Same as 7E with Hope Creek - Red Lion</td>
</tr>
<tr>
<td>P2013_1-7M</td>
<td>PSE &amp;G</td>
<td>$1,548</td>
<td>New Freedom - Whidbey (North) &amp; Salem - Hope Creek - Red Lion 500 kV lines w/ Hope Creek - Red Lion (new)</td>
<td>Same as 7E with Hope Creek - Red Lion</td>
</tr>
<tr>
<td>P2013_1-7N</td>
<td>PSE &amp;G</td>
<td>$1,283</td>
<td>New Freedom - a new station on the Branchburg/Ebray 500 kV line (5547 Junction) &amp; Salem-Hope Creek - Red Lion 500 kV lines w/ Hope Creek - Red Lion (new)</td>
<td>Same as 7E with Hope Creek - Red Lion</td>
</tr>
</tbody>
</table>
• Install a HVDC converter station near the Artificial Island
  – Install a SVC at the new Artificial Island HVDC station
• Install a HVDC converter station near the existing Cardiff 230 kV
• Install a 320 kV HVDC facility from the new Artificial Island HVDC station and the new HVDC station near Cardiff 230 kV
• Cost: $1,012 M
• P2013_1-1A
  – Install a 500 MVAR SVC and 2 Thyristor Controlled Series Compensation (TCSC) devices near New Freedom
  – Cost: $133M
• P2013_1-1B
  – Install a new 500 kV line from Salem 500 kV to a new station in Delaware
  – Install a new station in Delaware that taps the existing Red Lion - Cartanza 230 kV and Red Lion - Cedar Creek 230 kV lines
  – Cost: $126M
• P2013_1-1C
  – Install a new 500 kV line from Hope Creek 500 kV to a new station in Delaware
  – Install a new 500 kV line from Hope Creek 500 kV to Red Lion
  – Install a new Salem – Hope Creek 500 kV line
  – Cost: $202M
• Install a new, New Freedom – Smithburg 500 kV line with a loop into Larrabee 500 kV
• Install 2 new 500/230 Transformers at Larrabee
• Install a Hope Creek – Red Lion 500 kV line
• Cost: $452.3*
  – *Cost submitted by project sponsor does not reflect entire project.
• **P2013_1-5A**
  – Install a new Salem - Silver Run 230 kV line with a 500/230 kV transformer at Salem
  – Install a new 230 kV station that taps the existing Red Lion - Cedar Creek 230 kV and Red Lion - Cartanza 230 kV lines
  – Cost: $116.3-$148.3M

• **P2013_1-5B**
  – Install a new Salem – Red Lion 500 kV line
  – Cost: $170M
• Install a new Peach Bottom – Keeney – Red Lion – Salem 500 kV line
• Remove existing Keeney - Red Lion 230 kV circuit
• Reconfigure the existing 230 kV line from Hay Road – Red Lion (23020) to terminate at Keeney instead of Red Lion
• Re-conductor the Harmony – Chapel Street 138 kV line
• Cost: $475M
• **P2013_1-2A**
  - Install a new Salem-Cedar Creek 230 kV line w/ 2 new 500/230 kV XFMR at Salem + Loop Red Lion – Cartanza 230 kV line into Cedar Creek
  - Cost:$213-$269M

• **P2013_1-2B**
  - Install a new Salem- North Cedar Creek 230 kV line w/ 2 new 500/230 kV Transformer at Salem + Loop Red Lion – Cartanza and Red Lion – Cedar Creek 230 kV lines
  - Cost:$165-$208M

• **P2013_1-2C**
  - Install a new Salem – Red Lion 500 kV line
  - Cost:$123-$156M

• **P2013_1-2D**
  - Install a new, New Freedom – Lumberton – North Smithburg (new) 500 Kv line with new 500/230 sub east of Lumberton + New Hope Creek – Salem 500 kV line
  - Cost:$788M-$994M
• P2013_1-7E
  - Install a new New Freedom–Deans 500 kV line
  - Install a new Salem-Hope Creek 500 kV line
  - Cost: $692M

• P2013_1-7F
  - Install a new New Freedom-Smithburg 500 kV line
  - Install a new Salem-Hope Creek 500 kV line
  - Cost: $879M

• P2013_1-7G
  - Install a new New Freedom-Smithburg 500 kV line w/ loop into Larrabee 500 sub
  - Install a new Salem-Hope Creek 500 kV line
  - Cost: $1,034M

• P2013_1-7H
  - Install new New Freedom-Whitpain 500 kV line (Northern Route)
  - Install a new Salem-Hope Creek 500 kV line
  - Cost: $1,177M

• P2013_1-7I
  - Install new New Freedom-Whitpain 500 kV line (Southern Route)
  - Install a new Salem-Hope Creek 500 kV line
  - Cost: $1,353M

• P2013_1-7J
  - Install a new New Freedom-5017 Jct. 500 kV line
  - Install a new Salem-Hope Creek 500 kV line
  - Cost: $915M
• P2013_1-7A
  – Install a new Salem/Hope Creek-Peach Bottom 500 kV line (Existing ROW)
  – Cost:$1,371M

• P2013_1-7B
  – Install a new Salem/Hope Creek-Peach Bottom 500 kV line (Loop into Keeney)
  – Cost:$1,372M

• P2013_1-7C
  – Install a new Salem/Hope Creek-Peach Bottom 500 kV line (Loop into Red Lion)
  – Cost:$1,372M

• P2013_1-7D
  – Install a new Salem/Hope Creek-Peach Bottom 500 kV line (New ROW)
  – Cost:$1,372M
- **P2013_1-7K**
  - Install new New Freedom-Deans 500 kV line
  - Install a new Salem-Hope Creek-Red Lion 500 kV line
  - Cost: $1,066M

- **P2013_1-7L**
  - Install new New Freedom-Smithburg 500 kV line
  - Install a new Salem-Hope Creek-Red Lion 500 kV line
  - Cost: $1,250M

- **P2013_1-7M**
  - Install new New Freedom-Whitpain North (new) 500 kV line
  - Install a new Salem-Hope Creek-Red Lion 500 kV line
  - Cost: $1,548M

- **P2013_1-7N**
  - Install new New Freedom-5017 Jct. 500 kV line
  - Install a new Salem-Hope Creek-Red Lion 500 kV line
  - Cost: $1,289M
AI Proposal Evaluation Methodology

• Performance with respect to AI Window scope of work
  – Stability & Voltage
• Evaluation Methodology
• Next Steps
  – Thermal studies
  – Short Circuit studies
Artificial Island Proposal Window Next Steps

- Coordinating additional Questions & Answers with project sponsors
- Evaluation of solution alternatives
RTEP Next Steps

- Continue Artificial Island evaluation
- Continue to resolve 2013 RTEP criteria violations
- Initiate N-1-1 analysis
- Follow up sensitivity and scenario analysis to support NYISO border modeling discussion at previous PC meetings
Questions?

Email: RTEP@pjm.com
• 7/9/2013 – Original version distributed to PJM TEAC

• 7/10/2013 – Version presented to PJM TEAC
  – Updated slide 67 – Artificial Island Proposal Summary slide with updated LS Power project cost and description and Dominion Project Description
  – Updated slide 69 - Dominion Project Proposal Description
  – Updated slide 71 - LS Power Project Proposal Description
  – Updated slide 79 – Next Steps
  – Updated slide 12 – Changed PJM West to MAAC

• 7/11/2013 – Updated with stakeholder feedback
  – Updated slide 11 – Noted that the map is a depiction and not all RTEP reactive upgrades are on the map
  – Updated slide 39 – Added the overdutied locations to the map