Transmission Expansion Advisory Committee

April 11, 2013
Issues Tracking
• Open Issues
  – None

• New Issues
2013 RTEP Analytical Approach
• 2013 RTEP Power Flow Model
  – 2018 power flow case - Final benchmarking underway

• Analytical Approach
  – Baseline contingency analysis, generator deliverability & common mode outage testing, load deliverability, N-1-1
2012 RTEP RPS Scenario State Information
## 2012 RTEP RPS1 Off Shore Wind Scenario – model year 2027

<table>
<thead>
<tr>
<th>State</th>
<th>Load Energy (MWH)</th>
<th>Total Renewable Production by State</th>
<th>% of Load Served by Renewables</th>
<th>RPS Requirements by State</th>
<th>Percentage of State Requirements met Internally</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>14,980,080</td>
<td>0</td>
<td>0.0%</td>
<td>20.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>DE</td>
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<td>5,774,227</td>
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<td>135.0%</td>
</tr>
<tr>
<td>IN</td>
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<td>19,156,499</td>
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<td>714.8%</td>
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<tr>
<td>IL</td>
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<tr>
<td>MD</td>
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<tr>
<td>MI</td>
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<td>10.0%</td>
<td>44.3%</td>
</tr>
<tr>
<td>NC</td>
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<td>1,612,648</td>
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<tr>
<td>NJ</td>
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<tr>
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<tr>
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# 2012 RTEP RPS2 On Shore Wind Scenario – model year 2027

<table>
<thead>
<tr>
<th>State</th>
<th>Load Energy (MWH)</th>
<th>Total Renewable Production by State</th>
<th>% of Load Served by Renewables</th>
<th>RPS Requirements by State</th>
<th>Percentage of State Requirements met Internally</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC</td>
<td>14,980,080</td>
<td>0</td>
<td>0.0%</td>
<td>20.0%</td>
<td>0.0%</td>
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<tr>
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<tr>
<td>IN</td>
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</tr>
<tr>
<td>KY</td>
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<td>0.0%</td>
</tr>
<tr>
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<tr>
<td>NC</td>
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<td>1,612,648</td>
<td>25.9%</td>
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<td>207.0%</td>
</tr>
<tr>
<td>NJ</td>
<td>99,940,703</td>
<td>10,538,424</td>
<td>10.5%</td>
<td>23.9%</td>
<td>44.2%</td>
</tr>
<tr>
<td>OH</td>
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<tr>
<td>PA</td>
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<tr>
<td>TN</td>
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<tr>
<td>VA</td>
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</tr>
<tr>
<td>WV</td>
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<td>3,764,364</td>
<td>9.9%</td>
<td>25.0%</td>
<td>39.7%</td>
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</tbody>
</table>
## 2012 RTEP RPS Wind Scenario Comparison – model year 2027

<table>
<thead>
<tr>
<th>State</th>
<th>RPS Requirements</th>
<th>% of Load served by Wind and Solar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>RPS 1 (7GW)</td>
</tr>
<tr>
<td>DC</td>
<td>20.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>DE</td>
<td>25.0%</td>
<td>33.8%</td>
</tr>
<tr>
<td>IN</td>
<td>10.0%</td>
<td>71.5%</td>
</tr>
<tr>
<td>IL</td>
<td>25.0%</td>
<td>28.4%</td>
</tr>
<tr>
<td>KY</td>
<td>-</td>
<td>0.0%</td>
</tr>
<tr>
<td>MD</td>
<td>20.0%</td>
<td>4.2%</td>
</tr>
<tr>
<td>MI</td>
<td>10.0%</td>
<td>4.4%</td>
</tr>
<tr>
<td>NC</td>
<td>12.5%</td>
<td>25.9%</td>
</tr>
<tr>
<td>NJ</td>
<td>23.9%</td>
<td>19.9%</td>
</tr>
<tr>
<td>OH</td>
<td>12.5%</td>
<td>8.0%</td>
</tr>
<tr>
<td>PA</td>
<td>18.0%</td>
<td>4.7%</td>
</tr>
<tr>
<td>TN</td>
<td>-</td>
<td>0.0%</td>
</tr>
<tr>
<td>VA</td>
<td>12.0%</td>
<td>5.0%</td>
</tr>
<tr>
<td>WV</td>
<td>25.0%</td>
<td>9.6%</td>
</tr>
</tbody>
</table>
Generation Deactivation Notification (Retirements) Update
Deactivation Update

• B. L. England
  – Requested deactivation of 5/1/14 for unit 1
  – Requested deactivation of 10/1/15
  – Owner intends to transfer CIRs to Y1-001 request
  – No reliability issues identified

• Big Sandy 1
  – Deactivation notice withdrawn on 3/8/13
• The Lake Lynn - Lardin 138 kV line #1 is overloaded for the loss of the Lake Lynn - Lardin 138 kV line #2.
• The Lake Lynn - Lardin 138 kV line #2 is overloaded for the loss of the Lake Lynn - Lardin 138 kV line #1.
• Proposed Solution: Reconductor both Lake Lynn - Lardin 138 kV circuits (b2120).
• Cost Estimate: $22.9 M
• Required IS Date: 6/1/2015.
Northern NJ Short Circuit
PSEG Transmission Zone

• 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
  – Original recommendation from October 2012 TEAC: Construct HVDC back to Back facility at Hudson
PJM is evaluating an alternative solution

Alternative 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

Thermal, voltage, short circuit, feasibility evaluation is underway
Artificial Island RTEP Proposal Window
• Communication
  – PJM.com
  – Currently all communication through email to RTEP@pjm.com
  – Upon the opening of the Artificial Island window, an email will be sent to the PC and TEAC email distribution lists and also posted to PJM.com
  – PJM will distribute information to the registered Artificial Island RTEP Window participants VIA email or posting to the secure PJM.com page with an email notification to go retrieve the information
• Security
  – All CEII will be encrypted using PGP encryption
  – CEII will be distributed using a self extracting (*.exe) encrypted file
    • From a user perspective, this is similar to the familiar self extracting ZIP file, but the user will be asked for a security code.
      – E.g. PJM posts the files to the secure Artificial Island window section of PJM.com. Users download “Artificial Island Information (CEII).exe” to their local environment
      – Once downloaded, the user will be prompted for a security code
    • Security codes, per PJM Policy, are required to be distributed through a contextless email message.
      – E.g. PJM distributes the security code that will be used to access the CEII by the Artificial Island Window participants in the “Artificial Island Information (CEII).exe” file.
Artificial Island Proposal Window Timeline
Updated for 4/11/2013 TEAC

Announcement
(Presented at 3/7/2013 TEAC)
• Announce window and potential timeline
• Request CEII/NDA submittals from anticipated participants
• Request Designated Entity Pre-Qualification

PSS/E v32 Case Development
(Initial case complete, pending benchmarking)
• Initial PSS/E v32 case created
• Benchmarking in Progress
• Develop and benchmark critical system condition cases

Open Window
(Anticipated 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

Close Proposal Window
(Estimated 6/28/2013)
• Dependent on timing of window opening

PJM Evaluates Solution Proposals
Critical Path to Window Opening

• PSS/E v32 Model development

• Model benchmarking

• Problem Statement Parameters
Artificial Island Submittal Requirement Preview

• Problem statement status: Under development
  – To be released on PJM.com with Artificial Island CEII

• Anticipated Parameters
  – System voltage limits
  – Stability
  – Minimize / eliminate the Artificial Island Operating Guide
Artificial Island Submittal Requirement Preview

• Technical Report
  – Include assumptions and calculations demonstrating the efficacy of the project
    • Report should include information about the origin of power flow case and any modifications, station single line drawings and results of any sensitivity studies
  
• Modeling information such as conductor type, calculated impedances, contingency files, *.idev files and dynamic files
Artificial Island Submittal Requirement Preview

• Proposal shall include:
  – Modeling information, including solved power flow models and description of solution
  – Documentation of performance
    • Voltage, Angle
    • Need for additional operating guide
  – Estimated schedule
  – Estimated cost
Artificial Island Submittal Requirement Preview

• Sponsoring entity information
  – Company name, contact information etc.

• Project Description
  – Include scope, interconnection points, configuration (e.g. overhead, underground, AC/DC etc.), ROW, high level project schedule including CPCN, engineering, construction start, and in-service date
  – Project cost estimate
• See Today’s Planning Committee Presentations
  – Pre-Qualification Submittal
  – CEII & NDA Requirements
  – Window timeline
Artificial Island Case Development

- PJM coordinating development and benchmark of critical system condition cases to the current case
  - Cases will be available in PSS/E v32.1.1 (*.sav format)
  - Power flow case and dynamics data file
  - Other environment files (.snp, .dll and .rsp)
Next Steps

• Complete Artificial Island RTEP Windows models and open window

• Finalize 2013 RTEP scenario scope

• Recommend solution package for High Voltage in PJM Operations
Reliability Analysis Update
• **N-1-1 Stability Violation**

  • Darby Generation instability for an N-1-1 outage condition

  • Build a new 345 kV station adjacent to Adkins Station and Darby Generating Plant, tapping the Beatty – Atlanta 345 kV line and the Bixby – Don Marquis (future Biers Run) 345 kV line. Loop the Adkins - Atlanta 345 kV line into the new 345kV station. (B2266)

• Estimated Project Cost: $26.6M

• Projected IS Date: 06/01/2016
- N-1-1 Thermal Violation

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

- Proposed Solution: Replace 1000 Cu Substation Conductor and 1200 Amp Wave Trap at Marlowe (b2267)

- Estimate Project Cost: TBD

- Required IS Date: 6/1/2017
• N-1-1 Thermal Violation

• Overload of the Double Toll Gate – Riverton 138kV circuit due to various N-1-1 contingency combinations

• Proposed Solution: Reconductor 6.8 Miles of 138kV 336ACSR with 336ACSS from Double Toll Gate to Riverton. (b2268)

• Estimate Project Cost: TBD

• Required In-Service Date: 6/1/2017
• N-1-1 Thermal Violation:
  • The Susquehanna-Jenkins 230 kV circuit is overloaded for multiple N-1-1 contingencies.
  
• Proposed Solution:
  - Rebuild approximately 23.7 miles of the Susquehanna-Jenkins 230 kV circuit. This upgrade replaces a temporary SPS scheme that is already planned to mitigate the violation until this longer term solution is implemented (B2269).

• Estimated Project Cost:
  - $109.5 M

• Expected IS Date:
  - 11/30/2019
Supplemental Projects
• PHI Reliability criteria:
  • Improves reliability due to performance of power carrier scheme that has been deteriorating over the last several years.

• Proposed Solution:
  – Replace existing front line electromechanical relays at both Milford and Steele 230 kV substations on the 23076 line with microprocessor relays (S0568).

• Estimated Project Cost:
  – $ 0.6 M

• Expected IS Date:
  – 12/31/2015
Supplemental Project

- Replace the Collier 1-3 345kV bus tie breaker and the Collier 2-3 345kV bus tie breaker at Collier 345kV substation (S0567)
- Estimated Project Cost: $2M
- Projected IS Date: 12/31/2013
• PHI Reliability Criteria:
• Improves reliability due to age and condition of equipments.
• Proposed Solution:
  – Rebuild approximately 10 miles of an existing 230 kV double circuit tower line extending from Burtonsville to Takoma substation (S0569).
• Estimated Project Cost:
  – $ 34 M
• Expected IS Date:
  – 6/1/2015
• PSE&G Reliability Criteria:
  • Improves reliability at switching station due to age and condition of equipments.

• Proposed Solution:
  – Replace Hope Creek 500 kV Section 3-4 LDV Breaker and associated equipments (S0296.1).

• Estimated Project Cost:
  – $ 5.0 M

• Expected IS Date:
  – 12/01/2013
Next Steps
Questions?

Email: RTEP@pjm.com
• 4/11/2013 – Original version presented to PJM TEAC
• 4/15/2013 – Revised with comments received during and after the TEAC meeting
  – Slide 30 – Update of project description: Replace “Construct a new 345 kV double circuit line to the new station from Adkins 345 kV station" sentence with "Loop the Adkins - Atlanta 345 kV line into the new station"