Reliability Analysis Update

Transmission Expansion Advisory Committee
August 8, 2019
• The following definitions explain the basis for excluding flowgates and/or projects from the competitive planning process and designating projects to the incumbent Transmission Owner.

• Flowgates/projects excluded from competition will include the underlined language on the corresponding slide.
  
  – **Immediate Need Exclusion:** Due to the immediate need of the violation (3 years or less), the timing required for an RTEP proposal window is infeasible. As a result, the local Transmission Owner will be the Designated Entity. - Operating Agreement, Schedule 6 § 1.5.8(m)
  
  – **Below 200kV Exclusion:** Due to the lower voltage level of the identified violation(s), the driver(s) for this project are excluded from the competitive proposal window process. As a result, the local Transmission Owner will be the Designated Entity - Operating Agreement, Schedule 6 § 1.5.8(n)
  
  – **FERC 715 (TO Criteria) Exclusion:** Due to the violation need of this project resulting solely from FERC 715 TO Reliability Criteria, the driver(s) for this project are excluded from the competitive proposal window process. As a result, the local Transmission Owner will be the Designated Entity - Operating Agreement, Schedule 6 § 1.5.8(o)
  
  – **Substation Equipment Exclusion:** Due to identification of the limiting element(s) as substation equipment, the driver(s) for this project are excluded from the competitive proposal window process. As a result, the local Transmission Owner will be the Designated Entity - Operating Agreement, Schedule 6 § 1.5.8(p)
2019 RTEP Analysis Update
May 22, 2019
– Preliminary 2024 results posted
  • Summer Baseline and N-1 Thermal
  • Summer Generator Deliverability

July 3, 2019
– 2019 Proposal Window No.1 opened

Friday, September 6, 2019
– 2019 Proposal Window No.1 closes
Overview of 2024 Results
Total of 136 flowgates identified

- 102 to be included in the window
  - 63 in the PJM Mid-Atlantic Region
  - 33 in PJM West Region
  - 6 in the PJM South Region

- 34 flowgates excluded
  - 9 due to the below 200 kV exclusion
  - 25 due to the substation equipment exclusion

- 19 require additional review
2024 Summer conditions
• 67 included violations
  • 45 baseline and single contingency
  • 6 generation deliverability
• 16 N-1-1
2024 Winter conditions
- 22 included violations
- 6 generation deliverability
- 16 N-1-1
2024 Light Load conditions
• 13 N-1 Voltage Drop violations
<table>
<thead>
<tr>
<th>Voltage</th>
<th>Region</th>
<th>Window Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>TBD</td>
</tr>
<tr>
<td>69 kV</td>
<td>PMJ MA</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>PMJ South</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>PMJ West</td>
<td>12</td>
</tr>
<tr>
<td>115 kV</td>
<td>PMJ MA</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>PMJ South</td>
<td>1</td>
</tr>
<tr>
<td>138 kV</td>
<td>PMJ MA</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>PMJ West</td>
<td>29</td>
</tr>
<tr>
<td>230 kV</td>
<td>PMJ South</td>
<td>6</td>
</tr>
<tr>
<td>345 kV</td>
<td>PMJ West</td>
<td>4</td>
</tr>
<tr>
<td>Grand Total</td>
<td>19</td>
<td>102</td>
</tr>
</tbody>
</table>

![Graph with data points for different voltages and regions]

Exclusions:
- _TBD -
- Excluded - Substation Equipment
- Excluded - Below 200 kV
- Included -
102 flowgates are window eligible
63 Eligible Flowgates
  • 5 Thermal
  • 6 Generation Deliverability
  • 52 Voltage

6 Flowgates Excluded from Window
  • 4 Below 200kV
  • 2 Substation Equipment
### PJM Mid-Atlantic Region

<table>
<thead>
<tr>
<th>Voltage Class</th>
<th>Criteria Test</th>
<th>Included</th>
<th>Below 200 kV Exclusion</th>
<th>Substation Equipment Exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>69 kV</td>
<td>GD</td>
<td>6</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>N1-T</td>
<td>5</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>N1-VD</td>
<td>29</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>N1-VM</td>
<td>17</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>115 kV</td>
<td>N2-T</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>138 kV</td>
<td>N1-VD</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N1-VM</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td></td>
<td><strong>63</strong></td>
<td><strong>4</strong></td>
<td><strong>2</strong></td>
</tr>
</tbody>
</table>

#### 2019 RTEP Proposal Window 1 – Mid-Atlantic Results

- **Voltage Classes:** 69 kV, 115 kV, 138 kV
- **Tests:** GD, N1-T, N1-VD, N1-VM
- **Criteria:** Included, Excluded
- **Substation Equipment Exclusion:** Below 200 kV

Graph illustrating the distribution of included, excluded, and substation equipment exclusion across different voltage classes and criteria tests.
6 Eligible Flowgates
  • On the 230 kV system
  • 2 Generation Deliverability
  • 4 Thermal

7 Flowgates Pending Review
  • 6 Thermal
  • 1 Generation Deliverability
# 2019 RTEP Proposal Window 1 – South Results

## PJM South Region

<table>
<thead>
<tr>
<th>Voltage Class</th>
<th>Proposal Window Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria Test</td>
<td>Included</td>
</tr>
<tr>
<td>69 kV</td>
<td>6</td>
</tr>
<tr>
<td>N2-T</td>
<td>6</td>
</tr>
<tr>
<td>115 kV</td>
<td>1</td>
</tr>
<tr>
<td>GD</td>
<td>1</td>
</tr>
<tr>
<td>230 kV</td>
<td>6</td>
</tr>
<tr>
<td>GD</td>
<td>2</td>
</tr>
<tr>
<td>N1-T</td>
<td>1</td>
</tr>
<tr>
<td>N2-T</td>
<td>3</td>
</tr>
</tbody>
</table>

Grand Total: 6, 7

![Bar Chart](chart.png)
33 Eligible Flowgates
• All on the 230 kV system
• All 4 Thermal
28 Excluded Flowgates
• 5 Below 200 kV
• 23 Substation Equipment

12 Flowgates Pending Review
• 6 Thermal
• 1 Generation Deliverability
# 2019 RTEP Proposal Window 1 – West Results

## PJM West Region

<table>
<thead>
<tr>
<th>Voltage Class Criteria Test</th>
<th>Included</th>
<th>Below 200 kV Exclusion</th>
<th>Substation Equipment Exclusion</th>
<th>TBD</th>
</tr>
</thead>
<tbody>
<tr>
<td>69</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N2-T</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>138</td>
<td>29</td>
<td>5</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>GD</td>
<td>3</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N1-T</td>
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<td>8</td>
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<td>N2-T</td>
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<tr>
<td>N2-VD</td>
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<tr>
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<tr>
<td>345</td>
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<tr>
<td>GD</td>
<td>4</td>
<td>4</td>
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<tr>
<td><strong>Grand Total</strong></td>
<td><strong>33</strong></td>
<td><strong>5</strong></td>
<td><strong>23</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

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[Diagram showing distribution of excluded, substation equipment exclusion, and TBD for various voltage classes and equipment types.]
Dominion End of Life Criteria
Process Stage: First Review

Criteria: End of Life

Assumption Reference: FERC 715

Model Used for Analysis: 2018 Series 2023 Summer RTEP

Proposal Window Exclusion: FERC 715 (TO Criteria)

Problem Statement:
The 500 kV Line #569, from Loudoun to Morrisville, is approximately 32 miles long and 1.3 miles of this line is constructed on CORTEN structures. A third party study (Quanta) has determined that these structures are at the end of their useful life. Reliability studies indicate that retiring Line #569 will result in thermal overloads in accordance with P6 NERC criteria violations.

Proposed Solution:
Rebuild the 1.3 mile section of Line #569 with single-circuit 500 kV structures at the current 500 kV standard. This will increase the rating of Line #569 to 3424 MVA.

Alternative: No feasible alternatives.

Estimated Project Cost: $4.5 M

Required In-Service Date: As Soon As Possible

Projected In-Service Date: 12/31/2024

Project Status: Conceptual
First Review

Baseline Reliability Projects
Re-evaluation of the B1690 (MCRP) Project
B1690 (MCRP) project timeline:

- The B1690 was initially proposed – 3Q of 2011.
- The B1690 filing with the New Jersey Board of Public Utilities – 3Q of 2016
- B1690 Evidentiary Hearings with the New Jersey Office of Administrative Law – 2Q - 3Q of 2017
- New Jersey Office of Administrative Law decision – 1Q of 2018
- New Jersey Board of Public Utilities decision – 2Q of 2018
- PJM Re-evaluation of need – 3Q of 2018 (presented at September 2018 TEAC)
- PJM and FirstEnergy development of Alternatives – 4Q 2018 through 1Q 2019
- FirstEnergy meetings with Federal, State, and Local stakeholders – 2Q through 3Q of 2019
Process Stage: First Review
Criteria: PJM and FirstEnergy Planning Criteria
Assumption Reference: Voltage Drop, Voltage Magnitude, and Loss of Load
Model Used for Analysis: 2018 Series 2021 and 2023 Summer RTEP
Proposal Window Exclusion: Immediate Need

Problem Statement:
• Several JCP&L 34.5 kV lines severely overloaded for the towerline outage loss of Atlantic – Red Bank 230 kV (T2020 & S1033) circuits requiring dynamic cascade analysis.
  • FirstEnergy performed dynamic cascade analysis
  • The dynamic cascade analysis resulted in tripping significant number of 34.5 kV lines and loss of >520 MW load due to voltage collapse.

Existing Facility Rating: N/A
Continued on next slide…
Proposed Solution:
Construct seven new 34.5 kV circuits on existing pole lines (total of 53.5* miles):

- Oceanview to Allenhurst 34.5 kV (4.0 Miles) – b1690.1
- Atlantic to Red Bank 34.5 kV (12.0 Miles) – b1690.2
- Freeneau to Taylor Lane 34.5 kV (6.5 Miles) – b1690.3
- Keyport to Belford 34.5 kV (6.0 Miles) – b1690.4
- Red Bank to Belford 34.5 kV (5.0 Miles) – b1690.7
- Werner to Clark Street (7.0 Miles) – b1690.8
- Atlantic to Freeneau (13.0 Miles) – b1690.9

Rebuild/Reconductor two 34.5 kV circuits (total of 5.5 miles):

- Atlantic to Camp Woods Switch Point (3.5 Miles) – b1690.5
- Allenhurst to Elberon (2.0 Miles) – b1690.6

Install 2nd 115-34.5 kV Transformer at Werner Substation – b1690.10

Estimated Project Total Cost: $175M

Alternatives:
1. 230 kV Transmission Line with Steel Monopoles:
   - Along Garden State Parkway - Estimated Cost $284M
   - Along NJ Route 35 - Estimated Cost $329M
2. 34.5 kV Transmission Line construction with:
   - Remedial Action Scheme (RAS) - Estimated Cost $303M
   - Battery Installations - Estimated Cost $401M

Required In-Service: Immediate Need

Project Status: Conceptual

* - 44.1 miles will be converting existing single circuit to double circuit 34.5 kV construction; 9.4 miles will be adding 34.5 kV circuit to existing distribution pole lines
• Preliminary discussion of proposals received
Questions?
• TEAC meetings are the following Thursdays in 2019
  • 1/10, 2/7, 3/7, 4/11, 5/16, 6/13, 7/11, 8/8, 9/12, 10/17, 11/14, 12/12.
• V1 – 08/01/2019 – Original slides posted
• V2 – 08/02/2019 – Added Reliability Analysis slides #4 through #16