Reliability Analysis Update

Transmission Expansion Advisory Committee
February 8, 2018
2018 RTEP Analysis Update
Transmission Service Update
Agreement Changes Included in 2018 RTEP

• Linden VFT
  – Previous agreements:
    • VFT
      – 2017 RTEP 330 MW FTWRs (withdrawal) and 315 MW Capacity Transmission Injection Rights
    • HTP
      – 2017 RTEP 320 MW FTWRs (withdrawal) and 353 MW NFTWRs (withdrawal)
  – Current agreement:
    • VFT
      – 2018 RTEP 330 MW NFTWRs (withdrawal) and 315 MW Capacity Transmission Injection Rights
    • HTP
      – 2018 RTEP 0 MW FTWRs and 673 MW NFTWRs (withdrawal)

• RTEP modeling impact observations
• Next Steps
  – Evaluate updated parameters as part of the 2018 RTEP
PSE&G FERC 715 Local Criteria - Equipment Assessment

Roseland – Branchburg – Pleasant Valley Corridor
PSE&G’s FERC 715 Transmission Owner criterion addresses equipment condition assessments
- PSE&G assessed the condition of the Roseland to Branchburg to Pleasant Valley 230 kV circuits.
• Refer to PSE&G criteria:

**VII. EQUIPMENT ASSESSMENT AND STORM HARDENING**

http://www.pjm.com/~/media/planning/planning-criteria/PSE&G-planning-criteria.ashx

– Roseland to Branchburg is approximately 30 miles of 230 kV circuit and the average structure age is approximately 90 years.
– Branchburg to Pleasant Valley is approximately 22 miles of 230 kV circuit and the average structure age is approximately 90 years.
– Parallel to Roseland-Branchburg 500kV corridor
– The terrain is variable and includes rural, National Wildlife Refuge and municipalities
– This facility also serves 240 MVA sub-transmission load in adjacent territory (JCP&L)
Problem:

PSE&G FERC 715 local Transmission Owner Criteria

- Equipment condition assessment for the entire corridor
- Equipment has reached its end of life
Solution Alternatives Considered

1. Remove and retire the 230 kV corridor without replacing

2. Install new parallel circuit on new right-of-way and remove existing 230 kV corridor

3. Replace the existing 230 kV single-circuit corridor with new dual-circuit structures and initially string one 230 kV circuit
Remove and Retire Discussion

- Reliability Analysis Result and consequences for the Remove and Retire Option
  - PJM performed reliability analysis without the Roseland – Branchburg – Pleasant Valley 230 kV on the 2022 RTEP summer basecase.
  - Removing the circuit causes severe voltage issue on the JCPL 34.5 kV network system:
    - The voltage for Fourteen 34.5 kV stations dropped by > 40%, with a new value of less than 0.65 pu.
    - The voltage for Ten 34.5 kV stations dropped by 20-40%, with a new value less than 0.62-0.80 pu.
    - The voltage for Ten 34.5 kV stations dropped by 5-20%, with a new value less than 0.82-0.91 pu.
  - The following analysis also show further voltage issues:
    - N-1 analysis resulted in several thermal and severe voltage issue on the JCPL 34.5 kV system.
    - N-1-1 voltage analysis resulted in wide spread voltage violation.
    - Working on the N-1-1 thermal analysis.
  - This is a very poor alternative from a system reliability performance perspective.
Recommended Solution: Roseland - Branchburg – PV Corridor:

Recommended solution:

- Replace the existing Roseland – Branchburg – Pleasant Valley 230 kV corridor with new structures.

**Estimated Project Cost:** $546 M

**Required IS date:** 2018

**Projected IS date:** 6/1/2022

**Project status:** Engineering
Short Circuit Projects Update
Problem: Short Circuit
- The Twin Branch 345kV breaker “JM” is overstressed

Immediate Need:
- Due to the immediate need, the timing required for an RTEP proposal window is infeasible. As a result, the local Transmission Owner will be the Designated Entity.

Alternatives Considered:
- Due to the immediate need of the project no alternatives were considered

Recommended Solution:
- Replace the Twin Branch 345kV breaker “JM” with 63 kA breaker (B2988)

Estimated Project Cost: $2M

Required IS Date: 10/1/2020
Projected IS Date: 6/1/2020
Supplemental Projects
First Review
Supplemental Project

Problem Statement:

Equipment Material/Condition/Performance/Risk:
Jefferson 765KV Breakers A and A2 are 1983 PK style Air Blast breakers which have a history of failing violently and are an AEP documented safety concern. Due to the age, fault operations and safety issues with these breakers replacement is required. Old breakers are PK-8D ACB 3000A 41kA models with 44 and 30 fault operations respectively.

Potential Solution:
Remove and Replace Jefferson 765KV CB A and A2 with 4000A 50kA breakers.

Estimated Cost: $5.7M

Alternatives:
No viable cost-effective alternatives could be identified.

Projected In-service: 5/1/2018

Project Status: Under Construction
Problem Statement:
• Two 230 kV oil circuit breakers at Howard and two oil circuit breakers at Jericho Park are at risk of poor performance, environmental concerns, and parts availability issues.

Potential Solution:
• Replace two breakers at Howard 230 kV and two breakers at Jericho Park 230 kV with new 63 kA rated gas circuit breakers
• Estimated Cost: $1.308 M

Alternative Solution:
• No feasible alternatives

Expected In-Service: 12/1/2018

Status: Engineering
Problem Statement:
• Calvert Cliffs is planning to add an additional (third) plant service transformer to:
  • Improve reliability in case of a plant service transformer failure
  • Further protect against loss of offsite power sources
  • Improve operational flexibility during maintenance outages

Potential Solution:
• Connection of the new plant service transformer requires modification to the BGE 500 kV switchyard, including the addition of four breakers in a new 500 kV bay
• Two additional breakers will be installed for the current plant service transformers

Alternative Solution:
• Not Applicable. The project is generator driven and funded.

Expected In-Service: 9/30/2020

Project Status: Engineering
Supplemental Project

Problem Statement:
Lisle 345kV bus is currently configured as two separate straight buses with no line breakers and one transformer high side breakers
• A line fault will trip 345-138kV transformer on the same bus
• A transformer fault will trip the 345kV transmission line on the same bus for three of the four transformers

Potential Solution:
Install a 345kV red/blue bus tie and breaker
Close the new and existing red/blue bus ties creating a large hybrid ring bus
• Each bus contains a transmission line and a transformers
Install four 345kV line breakers
Install two 345kV high side transformer breakers
• Third transformer high side breaker will be installed with the transformer is replaced

Estimated Cost: $30M

Alternatives:
• Rebuild Lisle 345kV as a breaker and a half using GIS equipment
  • Not enough land for open air construction
  Estimated Cost of $45M + land purchase

Projected In-service: 12/31/2019

Project Status: Engineering
Supplemental Project

Problem Statement:
Wayne 345-138kV auto-transformer 84
• Westinghouse 7-million series shell form
• Susceptible to static electrification
• Cannot be re-blocked
• Acoustic testing show high vibration and sharp increases in frequencies associated with looseness in the core assembly.
• Low ability to withstand through fault
Transformer 84 shares a bus position with 345kV line 14419 (Wayne-Aurora E.C.)
Tertiary cap banks no longer allowed.
Tertiary cap bank failures stress the 345-138kV transformers and have caused transformer failures in the past.

Potential Solution:
Replace Wayne 345-138kV transformer
Finish ring bus on red 345kV bus - Install two 345kV breakers
Retire Tertiary cap bank
Install 138kV cap bank

Estimated Cost: $15M

Alternatives:
• No feasible alternatives

Projected In-service: 12/31/2019

Project Status: Engineering
Supplemental Projects – Second Review
Previously Presented: 1/11/2018

Problem Statement:
Equipment Material/Condition/Performance/Risk:
CB’s J2, K2, and L1 at Twin Branch are all PK-type air blast breakers installed in the late 60’s or early 70’s. These four breakers are showing significant signs of deterioration. Drivers include age, number of fault operations, and a lack of available repair parts.
Breakers J2 and L1 are PK 3000A 41kA models. Breaker K2 is a PK 3000A 50kA model.

Selected Solution:
Remove and replace 345kV circuit breakers L1, K2 and J2 with 5000A 63kA models. (S1464)

Estimated Transmission Cost: $6.4 M

Alternatives:
No viable cost effective alternates were identified

Projected In-service: 6/1/2020

Project Status: Engineering
2018 RTEP Next Steps
Upcoming TEAC Meetings

2018

- TEAC meetings are the following Thursdays in 2018
- 1/11, 2/8, 3/8, 4/5, 5/3, 6/7, 7/12, 8/9, 9/13, 10/11, 11/8, 12/13
Questions?
Revision History

• V1 – 2/2/2018 – Original Slides Posted
• V2 – 2/5/2018 – Slide #4 – Transmission Service - updated with improved descriptions
• V3 – 2/6/2018 – Slide #15 – Add AEP supplemental for Jefferson breakers
• V4 – 2/20/2018 – Slide #13 – Add Projected IS Date
• V5 – 3/1/2018 – Slides #13 and #21 – Change Projected IS Date to 6/1/2020