



Transmission Expansion Advisory Committee (TEAC) Recommendations to the PJM Board

PJM Staff Whitepaper
Oct. 2018

For Public Use



Executive Summary

On July 31, 2018, the PJM Board of Managers approved changes to the Regional Transmission Expansion Plan (RTEP), totaling \$629.23 million, primarily to resolve baseline reliability criteria violations.

Since then, PJM has identified additional baseline reliability criteria violations and the transmission system enhancements needed to solve them, at an estimated cost of \$201.5 million. In addition, two previously approved baseline projects have been canceled and one has increased in scope, resulting in a net cost increase of \$13.37 million. This yields an overall RTEP net increase of \$214.9 million. With these changes, the RTEP will include \$36,922 million of transmission enhancements since the first Board approvals in 2000.

PJM seeks Board Reliability Committee consideration and full Board approval of the additional baseline projects summarized in this white paper.

The additional baseline projects are summarized in the following paper and were presented for the Board Reliability Committee's consideration and for recommendation to the full Board for approval. At the October 2018 meeting, the PJM Board approved the updated RTEP as requested.



October 2018 Baseline Reliability Recommendations

A key dimension of PJM's RTEP process is the baseline reliability evaluation, necessary before subsequent interconnection requests can be analyzed. Baseline analysis identifies system violations to reliability criteria and standards. PJM then develops transmission system enhancements to solve those identified violations and reviews them with stakeholders through the Transmission Expansion Advisory Committee (TEAC) and Subregional RTEP committees prior to recommendation to the Board. Baseline reliability transmission enhancement costs are allocated to PJM load.

Baseline Reliability Projects Summary

A summary of baseline projects with estimated costs equal to or greater than \$5 million is provided below. A complete listing of all recommended projects and their associated cost allocations is included in Attachment A (for allocation to a single zone) and Attachment B (for allocation to multiple zones). Projects with estimated costs less than \$5 million typically include transformer replacements, line reconductoring, breaker replacements, and upgrades to terminal equipment, including relay and wave trap replacements.

Mid-Atlantic Region System Upgrades

- PSE&G Transmission Zone
 - Construct two (2) new 69/13 kV substations in the Doremus area and relocate Doremus load to the new substations – PSEG TO Criteria Violation– \$155 million
- RECO Transmission Zone
 - Install 69 kV underground transmission line from Harings Corner Substation terminating at Closter Substation (about 3 miles). – RECO TO Criteria Violation – \$22 million

Western Region System Upgrades

- No baseline projects have been identified in PJM's western region with estimated costs equal to or greater than \$5 million.

Southern Region System Upgrades

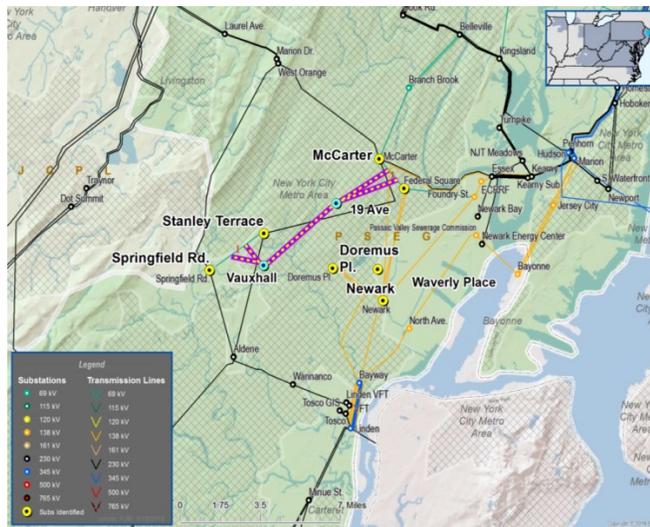
- Dominion Transmission Zone
 - Rebuild the New Road-Middleburg 115 kV line with single circuit steel structures to current 115 kV standards with a minimum summer emergency rating of 261 MVA. – Dominion End-of-Life Criteria Violation - \$ 13.8 million
 - Re-conductor the Pleasant View–Ashburn–Beaumeade 230 kV line with a minimum rating of 1,200 MVA and upgrade terminal equipment. – Generator Deliverability Violation - \$10 million

In addition to the projects noted above with estimated costs equal to or greater than \$5 million, PJM is also recommending four projects totaling \$740,000 that include breaker replacements, upgrades to disconnect leads and load transfers. Following is a more detailed description of the larger-scope projects PJM is recommending to the Board. A description of the criteria driving the need for the project and the required in-service date are also provided.

**Baseline Project b3025: New Doremus Area Line and Substations
PSE&G Transmission Zone**

Doremus Place Substation – shown on **Map 1** – is supplied by two underground 138 kV circuits and supplies almost 45,000 customers with load in excess of 120 MVA. An N-1-1 event would cause a complete loss of electric supply to the station for more than 24 hours. Also, most of the equipment at 19th Avenue Substation is more than 60 years old and must be replaced. These issues at Doremus and 19th Avenue are violations of PSE&G’s FERC Form No. 715 Section VII Transmission Owner Criteria. The criteria require condition assessments that include evaluation of physical condition, age, electrical parameters and performance. The criteria also require that PSE&G provide redundant facilities to meet substation needs; this can include two independent supplies.

Map 1: Doremus Area Substations



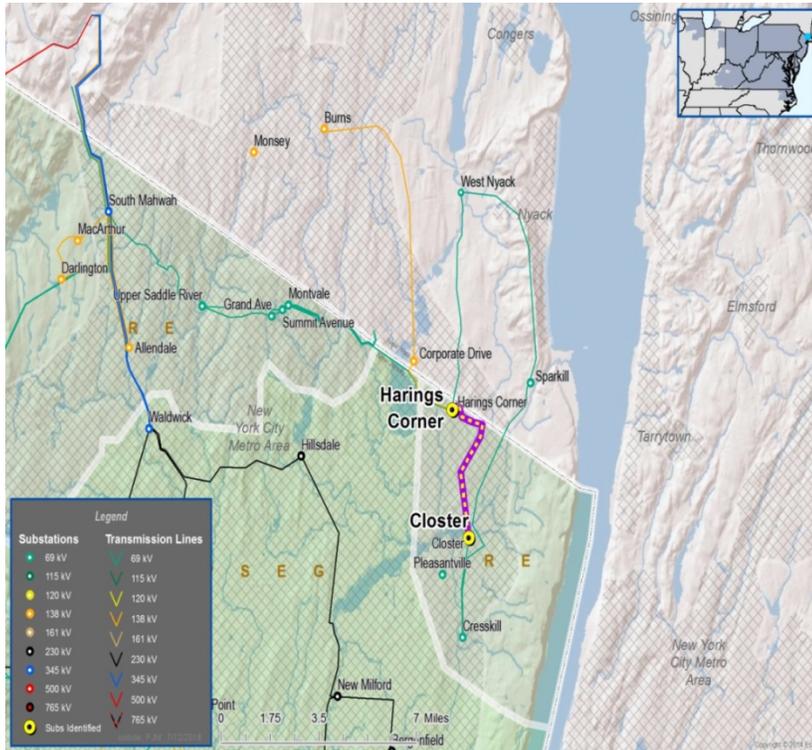
The recommended solution – Baseline Project b3025 – to address the PSE&G criteria violations is to construct two new 69/13 kV substations in the Doremus area and relocate Doremus load to the new substations. These new 69/13 kV substations, located at Vauxhall and 19th Avenue will be configured with ring busses. Additionally, this project includes the construction of a 69 kV line between Stanley Terrace, Springfield Road, McCarter, Federal Square, and the two new substations (Vauxhall and 19th Ave) which incorporates portions which are existing 69kV facilities as well as some which is new 69kV structures and conductor. This Immediate Need project has an estimated cost of \$155 million. The local transmission owner, PSE&G, will be designated to complete this work.

**Baseline Project b3029: New Harings Corner–Closter 69 kV Line
Rockland Electric Company (RECO) Transmission Zone**

RECO FERC 715 Transmission Owner Criteria include requirements to address all N-1 criteria violations on 69 kV facilities. This analysis has identified an overload of the Closter–Harings Corner 69 kV line – shown on **Map 2** – for

the loss of the Orangeburg–West Nyack 69 kV line. This overload would require load shedding of more than 9,000 customers to lower the Closter–Harings Corner 69 kV line power flow below its normal rating.

Map 2: Harings Corner–Closter 69 kV Line Area

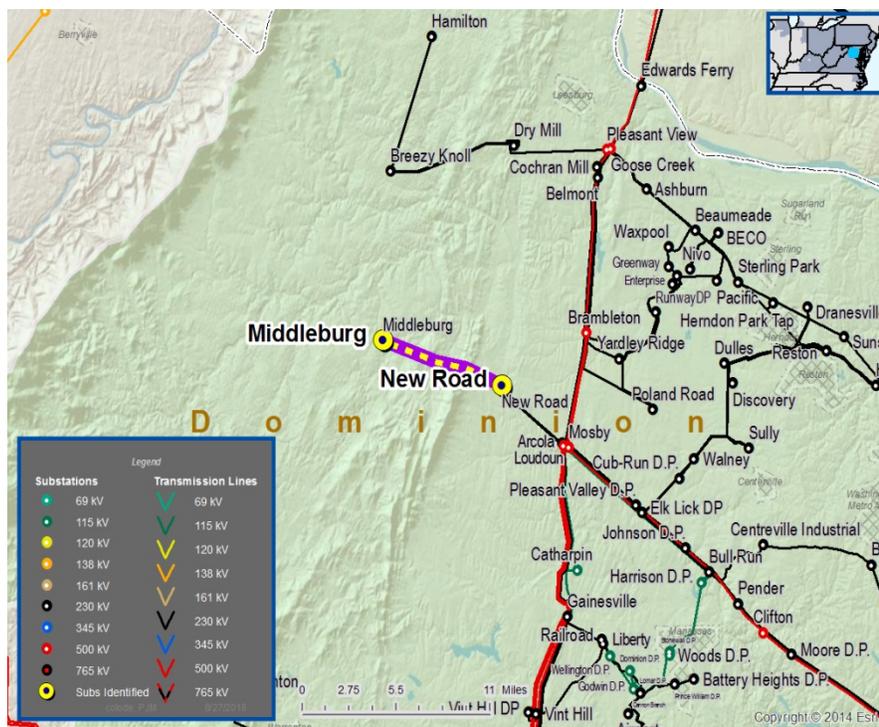


The recommended solution – Baseline Project b3029 – to address the loss of Orangeburg–West Nyack 69 kV line is to install approximately 3 miles of 69 kV underground transmission line from Harings Corner Substation to Closter Substation. This work will also require Closter substation reconfiguration to accommodate the new underground line from Harings Corner and to loop-in the existing Sparkill-Cresskill 69 kV line into the Closter Substation. This Immediate Need project is estimated to cost \$22 million. The local transmission owner, RECO, will be designated to complete this work.

Baseline Project b3018: Rebuild New Road–Middleburg 115 kV Line Dominion Transmission Zone

Dominion FERC Form No. 715 “End-of-Life” Transmission Owner Criteria require equipment condition assessments. Specifically, Dominion’s end-of-life evaluation of the New Road-Middleburg 115 kV line revealed that it must be rebuilt to current standards. This 5.8 mile long radial line was constructed on wood H-frame structures in 1953 and serves over 9,000 customers. Industry guidelines indicate that equipment life for wood structures is 35-55 years, equipment life for conductors and connectors is 40-60 years, and equipment life for porcelain insulators is 50 years.

Map 3: New Road–Middleburg 115 kV line Area

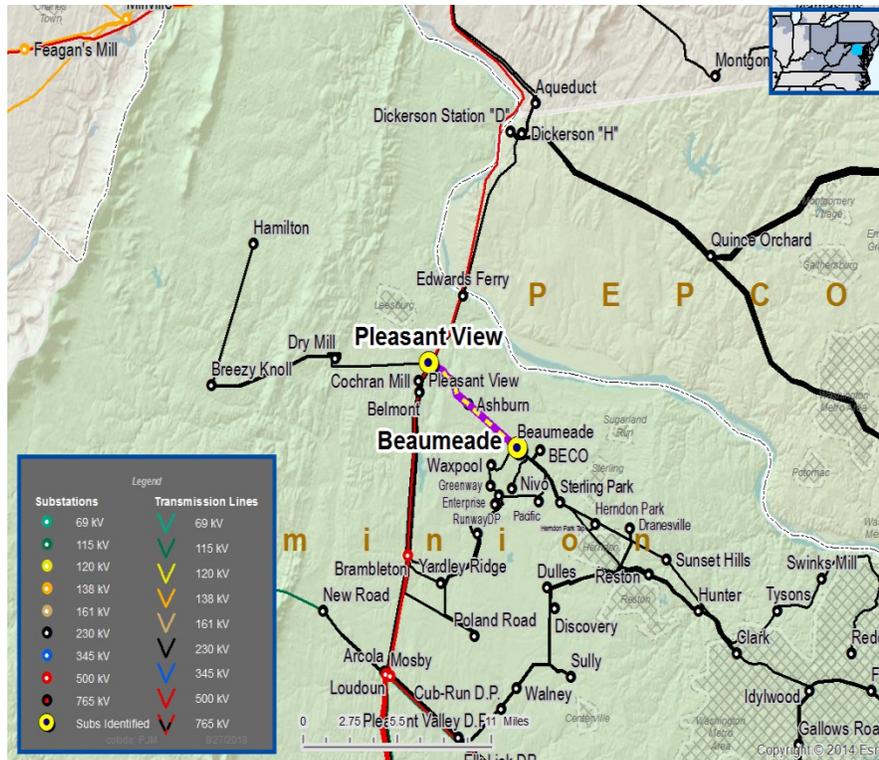


The recommended solution – Baseline Project b3018 – to address the End-of-Life criteria violation is to rebuild the New Road-Middleburg 115 kV line with single circuit steel structures to meet current 115 kV standards with a minimum summer emergency rating of 261 MVA. PJM and Dominion also evaluated installing double circuit steel structures with provisions for a second circuit. However, load growth in the area is expected to be minimal, and does not justify the increased cost. The estimated cost for this Immediate Need project is \$13.8 million. Based on their FERC 715 TO Criteria, the local transmission owner, Dominion, will be designated to complete this work.

Baseline Project b3026: Reconductor Pleasant View-Ashburn-Beaumeade 230 kV Line Dominion Transmission Zone

PJM Generator Deliverability analysis has identified a thermal violation on the Pleasant View-Ashburn 230 kV line for the single contingency loss of the Beaumeade-Belmont 230 kV line, shown on **Map 4**.

Map 4: Pleasant View-Ashburn-Beaumeade 230 kV Line Area



The recommended solution – Baseline Project b3026 – to address the Generator Deliverability violation is to re-conductor the entire Pleasant View–Ashburn–Beaumeade 230 kV line using a higher capacity conductor, with a minimum rating of 1,200 MVA, consistent with other recent 230 kV projects in northern Virginia. Additional terminal equipment work is also required at the Pleasant View, Ashburn and Beaumeade substations to facilitate the reconductoring. PJM and Dominion also evaluated re-conductoring the line using a conductor with a lower rating of 1,047 MVA. But based on load expectations for this portion of the system, the larger conductor was warranted. This Immediate Need project has an estimated cost of \$10 million. This project is considered immediate need as the first occurrence of the violation appears in the 2021 study year.

The local transmission owner, Dominion, will be designated to complete this work.



Changes to Previously Approved Projects

PJM is cancelling two AEP projects – baseline projects b2790, install a 3 MVAR, 34.5kV capacitor bank at Caldwell substation and b2798, install a 14.4 MVAR capacitor bank and replace a ground switch with a circuit switcher at West Hicksville station - totaling \$1.7 million because they are no longer needed to solve reliability criteria violations in light of updated impedances and load modeling, eliminating the previously identified violations.

Additionally, the scope of one Dominion project – baseline project b2960, to replace fixed series capacitors on 500kV Line #547 at Lexington substation and on 500kV Line #548 at Valley substation - has increased based on updated cost estimates for required project elements from the transmission owner assigned for construction of the project. The attendant \$15.1 cost increase for this project, originally identified as requiring mitigation under Dominion's end of life criteria, is being driven by refined, detailed cost estimate updates associated with the fixed series capacitor bank devices, materials, construction, engineering, and land acquisition and development. All these changes yield a net RTEP increase of \$13.37 million.

Review by the Transmission Expansion Advisory Committee (TEAC)

Project needs and recommended solutions as discussed in this report were reviewed with stakeholders throughout 2018, most recently at the June 2018 TEAC and Subregional RTEP Committee meetings. Written comments were requested to be submitted to PJM to communicate any concerns with project recommendations. No comments have been received as of the date of this white paper.

Cost Allocation

Preliminary cost allocations for the projects being recommended are shown Attachment A (for allocation to a single zone) and Attachment B (for allocation to multiple zones).

Cost allocations were calculated in accordance with the Schedule 12 of the Open Access Transmission Tariff (OATT). Baseline reliability project allocations are calculated using a distribution factor methodology that allocates cost to the load zones that contribute to the loading on the new facility. Baseline projects required exclusively to address local transmission owner FERC Form No. 715 planning criteria are allocated to the local transmission owner zone. The allocations will be filed at the FERC 30 days following approval by the Board.

Board Approval

The PJM Board Reliability Committee endorsed the new baseline reliability projects and associated cost allocations and recommend to the full Board, approval of the baseline projects to be included in PJM's RTEP.

The baseline projects will be incorporated into the published RTEP after approval by the PJM Board. The RTEP will be published on PJM's website

Reliability Project Single Zone Allocations

Upgrade ID	Description	Cost Estimate (\$M)	Trans Owner	Cost Responsibility	Required IS Date
b3018	Rebuild Line #49 between New Road and Middleburg substations with single circuit steel structures to current 115kV standards with a minimum summer emergency rating of 261 MVA.	\$13.80	Dominion	Dominion	12/31/2021
b3022	Replace Saxton 115kV breaker 'BUS TIE' with a 40kA breaker	\$0.21	PENELEC	PENELEC	6/1/2020
b3023	Replace West Wharton 115kV breakers 'G943A' and 'G943B' with 40kA breakers	\$0.40	JCPL	JCPL	6/1/2020
b3025	Construct two (2) new 69/13kV stations in the Doremus area and relocate the Doremus load to the new stations	\$155.00	PSEG	PSEG	6/1/2018
b3025.1	Install a new 69/13 kV station (Vauxhall) with a ring bus configuration	\$0.00	PSEG	PSEG	6/1/2018
b3025.2	Install a new 69/13 kV station (19th Ave) with a ring bus configuration	\$0.00	PSEG	PSEG	6/1/2018
b3025.3	Construct a 69kV network between Stanley Terrace, Springfield Road, McCarter, Federal Square, and the two new stations (Vauxhall & 19th Ave)	\$0.00	PSEG	PSEG	6/1/2018
b3026	Re-conductor Line #274 (Pleasant View – Ashburn – Beaumeade) with a minimum rating of 1200 MVA. Also upgrade terminal equipment.	\$10.00	Dominion	Dominion	6/1/2021
b3028	Upgrade substation disconnect leads at William 138 kV Substation	\$0.0285	APS	APS	6/1/2021

Upgrade ID	Description	Cost Estimate (\$M)	Trans Owner	Cost Responsibility	Required IS Date
b3029	Install 69 kV underground transmission line from Harings Corner Station terminating at Closter Station (about 3 miles).	\$22.00	RECO	RECO	5/31/2020
b3029.1	Reconfigure Closter Station to accommodate the UG transmission line from Harings Corner Station	\$0.00	RECO	RECO	5/31/2020
b3029.2	Loop in the existing 751 Line (Sparkill - Cresskill 69 kV) into Closter 69 kV station	\$0.00	RECO	RECO	5/31/2020
b3031	Transfer load off of the Leroy Center-Mayfield Q2 138 kV line by reconfiguring the Pawnee Substation primary source, via the existing switches, from the Leroy Center-Mayfield Q2 138 kV line to the Leroy Center-Mayfield Q1 138 kV line.	\$0.10	ATSI	ATSI	6/1/2021