



Transmission Expansion Advisory Committee (TEAC)

Recommendations to the PJM Board

PJM Staff Whitepaper
October 2019



Executive Summary

On July 29, 2019, the PJM Board of Managers approved changes to the Regional Transmission Expansion Plan (RTEP), totaling \$327.8 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 \$265.6 million. In addition, three previously approved baseline projects have been canceled, resulting in a net cost decrease of \$35.8 million. Scope changes to existing projects will result in a net increase of \$16.25 million. This yields an overall RTEP net increase of \$246.05 million, for which PJM is recommending Board approval. With these changes, RTEP projects will total \$39,079.01 million since the first Board approvals in 2000.

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



October 2019 Baseline Reliability Recommendations

A key dimension of PJM's RTEP process is 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 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.

FERC Form No. 715 Transmission Owner Criteria-Driven Enhancements

AEP Transmission Zone:

- Rebuild the Jay-Pennville 138 kV line as double circuit 138/69 kV, including a new 9.8-mile single circuit 69 kV line from near Pennville station to North Portland station. Install three 69 kV breakers at the Jay 138/69/34.5 kV substation and add a low side breaker on the Jay transformer 2. Install two 69 kV breakers at North Portland 69 kV substation: \$43.4M.
- Replace approximately 0.7 miles of the existing 1960s vintage Beatty-Galloway 69kV underground cable with 4000 kcmil XLPE Cable: \$5.3M.

Dominion Transmission Zone:

- Rebuild the Clubhouse-Lakeview 230 kV line with single circuit wood pole equivalent structures: \$27M.
- Rebuild Hathaway-Rocky Mount and Hathaway-Nash-Rocky Mount 230 kV lines with double circuit steel structures: \$13M.

Baseline Load Growth Deliverability & Reliability-Driven Enhancements

JCPL Transmission Zone:

- Monmouth County Reliability Project: In the area of Red Bank, NJ: Convert 44.1 miles of existing single circuit 34.5 kV to double circuit 34.5 kV, and add 9.4 miles of 34.5 kV circuit to existing poles: \$175M.

PJM is also recommending two projects totaling \$1.9 million that include work required to complete the deactivation of two generators whose individual cost estimates are less than \$5 million each.

A more detailed description of the larger-scope projects that PJM is recommending to the Board is provided below:

Baseline Project b3130: Monmouth County Reliability Project –Red Bank, NJ Area

JCPL Transmission Zone

At the February 2019 TEAC meeting, PJM recommended the cancellation of the b1690 project (build a new third 230 kV line into the Red Bank 230 kV substation), which was previously approved by the PJM Board of Managers for inclusion in the RTEP to address voltage violations identified in the Red Bank, NJ area. The project was canceled as a result of the proceedings from the New Jersey Board of Public Utilities.

PJM worked closely with JCPL to re-evaluate the voltage violations, and after confirming the validity of the violations, developed alternative solutions.

Several alternatives were evaluated to replace the canceled b1690 project, including alternate 230 kV lines, battery installations and a Remedial Action Scheme (RAS). These alternatives were determined to be less cost effective than the proposed solution.

Map 1: MCRP – Red Bank, NJ Area



The recommended solution – Baseline Project b3130 (which fully replaces b1690) – addresses the voltage drop, voltage magnitude and potential loss of load reliability criteria violations when fully completed. The solution constructs seven new 34.5 kV circuits on existing pole lines for a total of 53.5 miles (44.1 miles will be converting existing single circuit to double circuit 34.5 kV construction, and 9.4 miles of 34.5 kV will be added to existing distribution poles). The Atlantic-Camp Woods and Allenhurst-Elberon 34.5 kV lines will be reconducted and a second 115/34.5 kV transformer will be installed at Werner substation. The recommended solution addresses the baseline needs in the area and is the most cost effective in response to the actions by the New Jersey Board of Public Utilities. The project is an immediate-need project with an estimated cost of \$175 million, and has projected in-service dates between June 2021 and July 2026. The local transmission owner, JCPL, will be designated to complete this work.

Dominion Transmission Zone End-of-Life Rebuilds

There are two baseline projects recommended for approval in the Dominion Transmission zone. The projects include complete and partial rebuilds of 230 kV lines due to the violation of Dominion’s FERC Form No. 715 filed end-of-life criteria, Section C.2.9, regarding age and facility condition. Both projects are immediate need, and the projected in-service dates are provided below. Industry guidelines indicate the following equipment life:

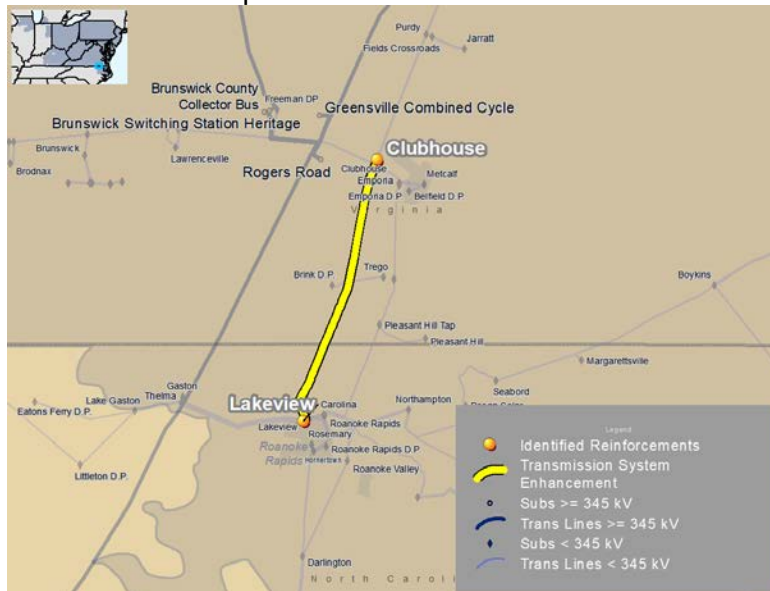
- Wood structures: 35–55 years
- Conductor and connectors: 40–60 years
- Porcelain insulators: 50 years

The lines and structures identified under Dominion’s end-of-life criteria show sufficient deterioration, indicating they have reached the end of their useful service life.

Baseline Project b3121: Rebuild Clubhouse-Lakeview 230 kV Line

The Clubhouse-Lakeview 230 kV line is about 18-miles long and was constructed on wooden H-frame structures in 1962. These towers have reached their end of life based on industry guidelines. Reliability studies indicate that retiring this line will result in thermal overloads in accordance with P1, P2, P4, P6 and P7 NERC criteria violations. There is also an operational performance need for this line, as generator AB2-100 would be left unserved if the line were retired.

Map 2: Clubhouse-Lakeview 230 kV

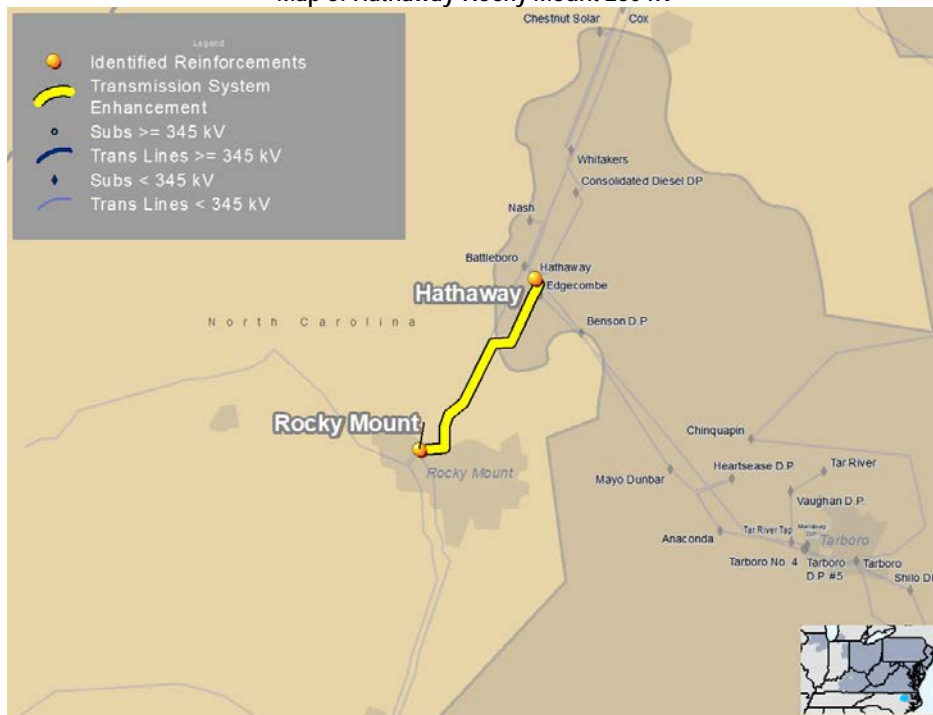


The recommended solution is to rebuild the Clubhouse-Lakeview 230 kV line with single circuit wood pole equivalent structures at the current 230 kV standard, with a minimum rating of 1047 MVA (Existing Rating = 399 MVA). The estimated cost for this project is \$27 million, and the projected in-service date is December 2024. The local transmission owner, Dominion, will be designated to complete this work.

Baseline Project b3122: Rebuild Hathaway-Rocky Mount 230 kV Line

The line section from Hathaway-Nash-Rocky Mount (Duke Energy Progress) and Hathaway-Rocky Mount 230 kV lines (approximately 4.1-miles each) was constructed on Cor-ten lattice-type double circuit towers in the 1960s. These towers have been shown to have inherent corrosion problems that continuously deteriorate the steel members. These lines have been identified to be rebuilt as part of Dominion's end-of-life criteria. The line provides service to Nash and City of Rocky Mount #4 substations with approximately 16 MW and 54 MW tapped load. Reliability studies indicate that retiring Hathaway-Nash-Rocky Mount 230 kV lines will overload the Battleboro-Rocky Mount 115 kV line for the loss of the Everetts-Greenville 230 kV circuit.

Map 3: Hathaway-Rocky Mount 230 kV



The recommended solution is to rebuild Hathaway-Rocky Mount (Duke Energy Progress) and Hathaway-Nash-Rocky Mount 230 kV lines with double circuit steel structures, using double circuit conductor at current 230 kV standards, with a minimum rating of 1047 MVA (Existing Rating = 478 MVA). The estimated cost for this project is \$13 million, and the projected in-service date is December 2024. The local transmission owner, Dominion, will be designated to complete this work.

Transmission Owner Criteria Projects

Of the \$265.6 million of the new recommended baseline transmission system enhancements, approximately \$88.7 million is driven by transmission owner planning criteria, which makes up 33.4 percent of the new project cost estimates. All but one of the detailed project descriptions provided above are driven by the local transmission owner planning criteria.



Changes to Previously Approved Projects

PJM recommends that the Board cancel the following projects:

- Baseline project b1772 (Reconductor approximately 16 miles from Nelson to Electric Junction 345 kV and replace associated terminal equipment) is recommended for cancellation, as this work has been completed as a network upgrade (n2092).
- Baseline project b1773 (Reconductor approximately 12.51 miles of East Frankfort-Crete 345 kV line) is recommended for cancellation, as this work has been completed as a network upgrade (n2089).
- Baseline project b1774 (Install new suspended dead ends and install a new pole on the Crete-St. John 345 kV line) is recommended for cancellation, as this work has been completed as a network upgrade (n2088).

These changes yield a net RTEP decrease of \$35.8 million.

PJM is modifying the scope/cost of the following projects:

- Baseline project b2794 (Construct a new 138/69/34 kV station and a 34 kV circuit from the new station to Decliff 34 kV station, with 556 ACSR conductor (51 MVA rating)). This project requires additional transmission-line length upon detailed evaluation, increasing the line length from 4 miles to 5.5 miles, with escalation in labor costs. The station site selection also resulted in an increase in required civil/land mitigation costs, additional remote-end relaying upgrades required to accommodate the new source/relays, and ROW and property costs exceeding original estimates. The corresponding work has increased the total cost of this project from \$12.65M to \$28.9M.

These changes yield a net RTEP increase of \$16.25 million.



Review by the Transmission Expansion Advisory Committee (TEAC)

Project needs and recommended solutions as discussed in this report were reviewed with stakeholders during 2019, most recently at the August 2019 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 this whitepaper publication date.

Cost Allocation

Cost allocations for recommended projects are shown in Attachment A (for allocation to a single zone) and Attachment B (for allocation to multiple zones).

Cost allocations were calculated in accordance with 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. The allocations will be filed at FERC 30 days following approval by the Board.

Board Approval

The PJM Board Reliability Committee was requested to endorse the new baseline reliability projects and associated cost allocations, and recommend to the full Board approval of the projects in this whitepaper 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.

Attachment A – Reliability Project Single-Zone Allocations

Upgrade ID	Description	Cost Estimate (\$M)	Trans Owner	Cost Responsibility	Required IS Date
b3119.1	Rebuild the Jay – Pennville 138 kV line as double circuit 138/69 kV. Build a new 9.8 mile single circuit 69 kV line from near Pennville station to North Portland station	\$38.10	AEP	AEP	6/1/2022
b3119.2	Install three (3) 69 kV breakers to create the “U” string and add a low side breaker on the Jay transformer 2	\$3.40	AEP	AEP	6/1/2022
b3119.3	Install two (2) 69 kV breakers at North Portland station to complete the ring and allow for the new line.	\$1.90	AEP	AEP	6/1/2022
b3121	Rebuild Clubhouse-Lakeview 230 kV Line #254 with single-circuit wood pole equivalent structures at the current 230 kV standard with a minimum rating of 1047 MVA.	\$27.00	Dominion	Dominion	6/1/2019
b3122	Rebuild Hathaway-Rocky Mount (Duke Energy Progress) 230 kV Line #2181 and Line #2058 with double circuit steel structures using double circuit conductor at current 230 kV standards with a minimum rating of 1047 MVA.	\$13.00	Dominion	Dominion	6/1/2019
b3127	At Bay Shore 138 kV station: Install new switchyard power supply to separate from existing generating station power service, separate all communications circuits, and construct a new station access road.	\$1.50	ATSI	ATSI	12/31/2021
b3128	Relocate 34.5 kV lines from generating station roof R. Paul Smith 138 kV station	\$0.40	AP	AP	12/31/2021
b3130	Construct seven new 34.5 kV circuits on existing pole lines (total of 53.5 miles), Rebuild/Reconductor two 34.5 kV circuits (total of 5.5 miles) and install a 2nd 115/34.5 kV transformer (Werner)	\$175.00	JCPL	JCPL	6/1/2016
b3130.1	Construct a new 34.5 kV circuit from Oceanview to Allenhurst 34.5 kV (4.0 Miles)	\$0.00	JCPL	JCPL	6/1/2016

b3130.2	Construct a new 34.5 kV circuit from Atlantic to Red Bank 34.5 kV (12.0 Miles)	\$0.00	JCPL	JCPL	6/1/2016
b3130.3	Construct a new 34.5 kV circuit from Freneau to Taylor Lane 34.5 kV (6.5 Miles)	\$0.00	JCPL	JCPL	6/1/2016
b3130.4	Construct a new 34.5 kV circuit from Keyport to Belford 34.5 kV (6.0 Miles)	\$0.00	JCPL	JCPL	6/1/2016
b3130.5	Construct a new 34.5 kV circuit from Red Bank to Belford 34.5 kV (5.0 Miles)	\$0.00	JCPL	JCPL	6/1/2016
b3130.6	Construct a new 34.5 kV circuit from Werner to Clark Street (7.0 Miles)	\$0.00	JCPL	JCPL	6/1/2016
b3130.7	Construct a new 34.5 kV circuit from Atlantic to Freneau (13.0 Miles)	\$0.00	JCPL	JCPL	6/1/2016
b3130.8	Rebuild/Reconductor the Atlantic - Camp Woods Switch Point (3.5 Miles) 34.5 kV circuit	\$0.00	JCPL	JCPL	6/1/2016
b3130.9	Rebuild/Reconductor the Allenhurst - Elberon (2.0 Miles) 34.5 kV circuit	\$0.00	JCPL	JCPL	6/1/2016
b3130.10	Install 2nd 115/34.5 kV Transformer at Werner Substation	\$0.00	JCPL	JCPL	6/1/2016
b3210	Replace approx. 0.7 miles Beatty - Galloway 69 kV line with 4000 kcmil XLPE cable	\$5.30	AEP	AEP	6/1/2023

Attachment B – Reliability Project Multi-Zone Allocations

None.