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

PJM Staff White Paper

PJM Interconnection
February 2024

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Contents

I. Executive Summary

On December 8, 2023, the PJM Board of Managers approved changes to the Regional Transmission Expansion Plan (RTEP), totaling a net increase of $5,085.85 million for baseline projects, to resolve baseline reliability criteria violations, address changes to existing projects and project cancellations. The RTEP approved by the PJM Board of Managers in December 2023 also included a net increase of $138.13 million for network upgrades to address new projects with signed ISAs and project cancellations.

Since then, PJM has identified new baseline reliability criteria violations, and the transmission system enhancements needed to resolve them, at an estimated cost of $186.29 million. Scope changes to an existing project will result in a net increase of $24.15 million. Cancellation to existing projects will result in a net decrease of $66.04 million. This yields an overall RTEP net increase of approximately $144.4 million to resolve baseline criteria violations, for which PJM is recommended Board approval. PJM is also providing an update for RTEP generation and merchant transmission network upgrades. PJM has identified $1,094.87 million in new network upgrades. Additionally, $45.07 million in previously identified network upgrades will be canceled as a result of updates to analysis performed for project withdrawals in the New Services Queue. This yields an overall RTEP net increase of approximately $1,049.8 million associated with RTEP generation and merchant transmission network upgrades. Altogether, the changes result in an overall RTEP net increase of approximately $1,194.20 million. With these changes, RTEP projects will total approximately $49,453.0 million since the first Board approvals in 2000.

PJM sought Reliability and Security Committee consideration and full Board approval of the RTEP baseline projects summarized in this white paper.

On February 28, 2024, the Board approved the addition of RTEP baseline projects as well as other changes to the RTEP as summarized in this paper.

II. Baseline Project Recommendations

A key dimension of PJM's RTEP process is baseline reliability evaluation, which is necessary before subsequent interconnection requests can be analyzed. Baseline analysis identifies system violations to reliability criteria and standards, determines the potential to improve the market efficiency and operational performance of the system, and incorporates any public policy requirements. PJM then develops transmission system enhancements to resolve identified violations and reviews them with stakeholders through the Transmission Expansion Advisory Committee (TEAC) and Subregional RTEP Committees prior to submitting its recommendation to the Board. Baseline transmission enhancement costs are allocated to PJM responsible customers.

III. Baseline Reliability Projects Summary

A summary of baseline projects with estimated costs equal to or greater than $10 million is provided below. Projects with estimated costs less than $10 million typically include, by way of example, transformer replacements, line reconductoring, breaker replacements and upgrades to terminal equipment, including relay and wave trap replacements. A complete listing of all recommended projects and their associated cost allocations is included in Attachment A (allocations to a single zone) and Attachment B (allocations to multiple zones).

A. AEP Transmission Zones

- Baseline project b3786.1 – Abert-Reusens 69 kV Rebuild: $14.4 million

B. APS Transmission Zone

- Baseline project b3796 – Belmont 765/500 kV Transformer Replacement: $42.05 million

C. DPL Transmission Zone

- Baseline project b3846.1 -.3 – Vienna-Mardela 69 kV Rebuild: $21.38 million

D. PENELC Transmission Zones

- Baseline project b3791 – North Meshoppen-Mehoopany Line No. 1 115 kV Rebuild: $17.4 million
- Baseline project b3792 – North Meshoppen-Mehoopany Line No. 2 115 kV Rebuild: $17.7 million

E. PSEG Transmission Zone

- Baseline project b3794.1 -.2 – Waldwick 345 kV and 230 kV Shunt Reactor Replacements: $29.6 million

PJM also recommends regional baseline projects totaling $43.76 million, whose individual cost estimates are less than $10 million. The projects include, but are not limited to, a shunt reactor installation, breaker installation and replacements, a 230 kV line reconductor, a 46 kV line rebuild, a CCVT installation, terminal limiting equipment replacements, a substation reconfiguration, a less than 1-mile 69 kV underground cable rebuild and relay upgrades.

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

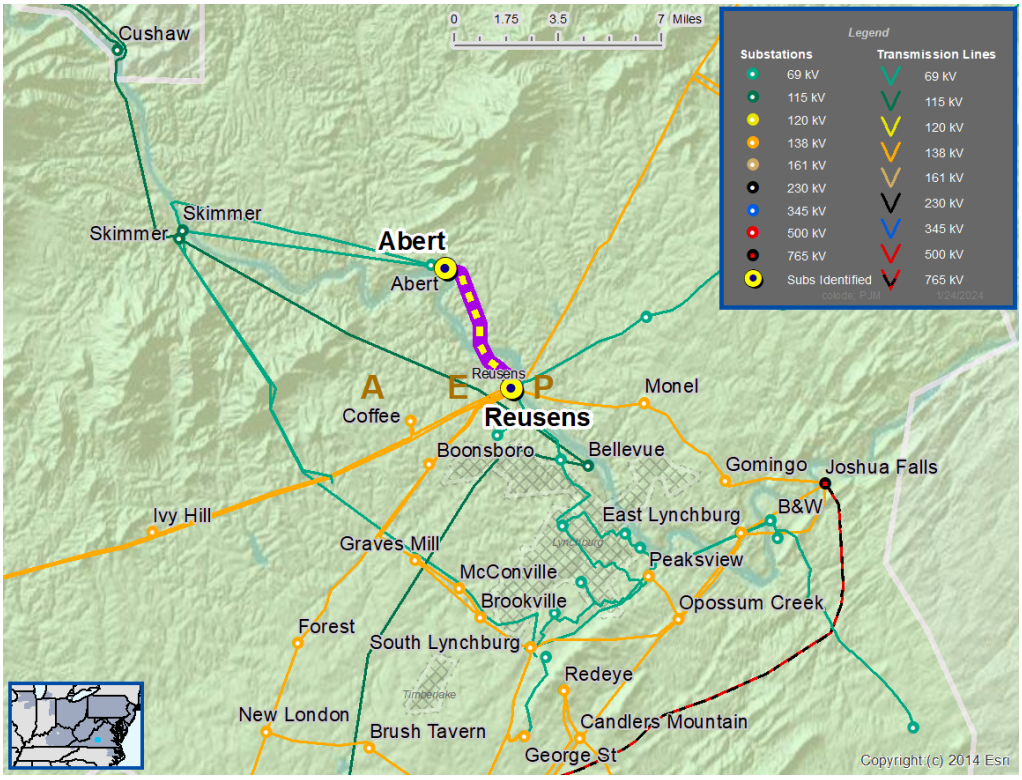
F. *Baseline Reliability Project Details*

Baseline Project b3786.1: Abert-Reusens 69 kV Rebuild

AEP Transmission Zone

In the 2028 RTEP summer case, the Abert-Reusens 69 kV line is overloaded for multiple N-1 outages. The flowgates were posted as part of the 2023 RTEP Window 1 but was excluded from competition due to the below 200 kV exclusion.

Map 1. b3786.1: Abert-Reusens 69 kV



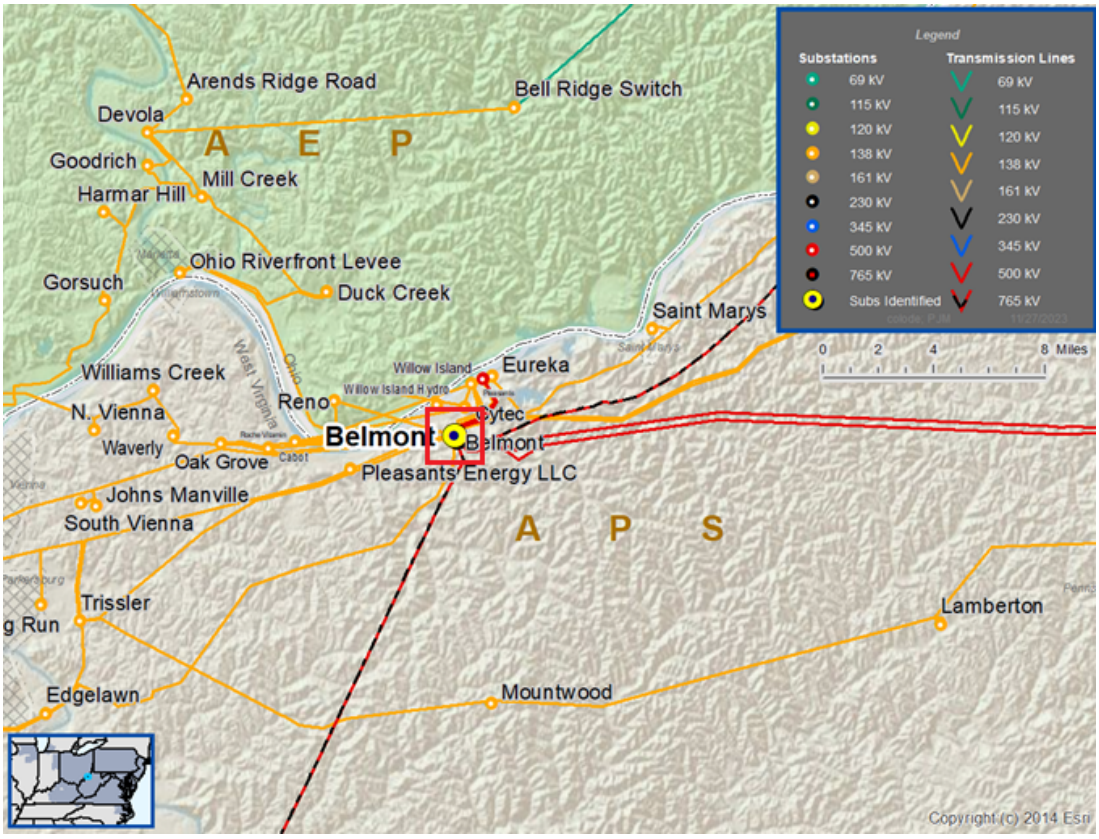
The recommended solution is to rebuild approximately 4.5 miles of 69 kV line between Abert and Reusens substations and update line relay settings at Reusens and Skimmer substations. The estimated cost for this project is $14.4 million. This project has a required and projected in-service date of June 2028, and the local transmission owner, AEP, will be designated to complete this work.

Baseline Project b3796: Belmont 765/500 kV Transformer Replacement

APS Transmission Zone

In the 2028 RTEP summer case, the Belmont 765/500 kV transformer is overloaded under one N-1 and multiple N-2 outages. The flowgates were posted as part of the 2023 RTEP Window 1, and PJM received six proposals, two from FirstEnergy and four from Transource, to address the flowgates.

Map 2. b3796 – Belmont 765/500 kV Transformer



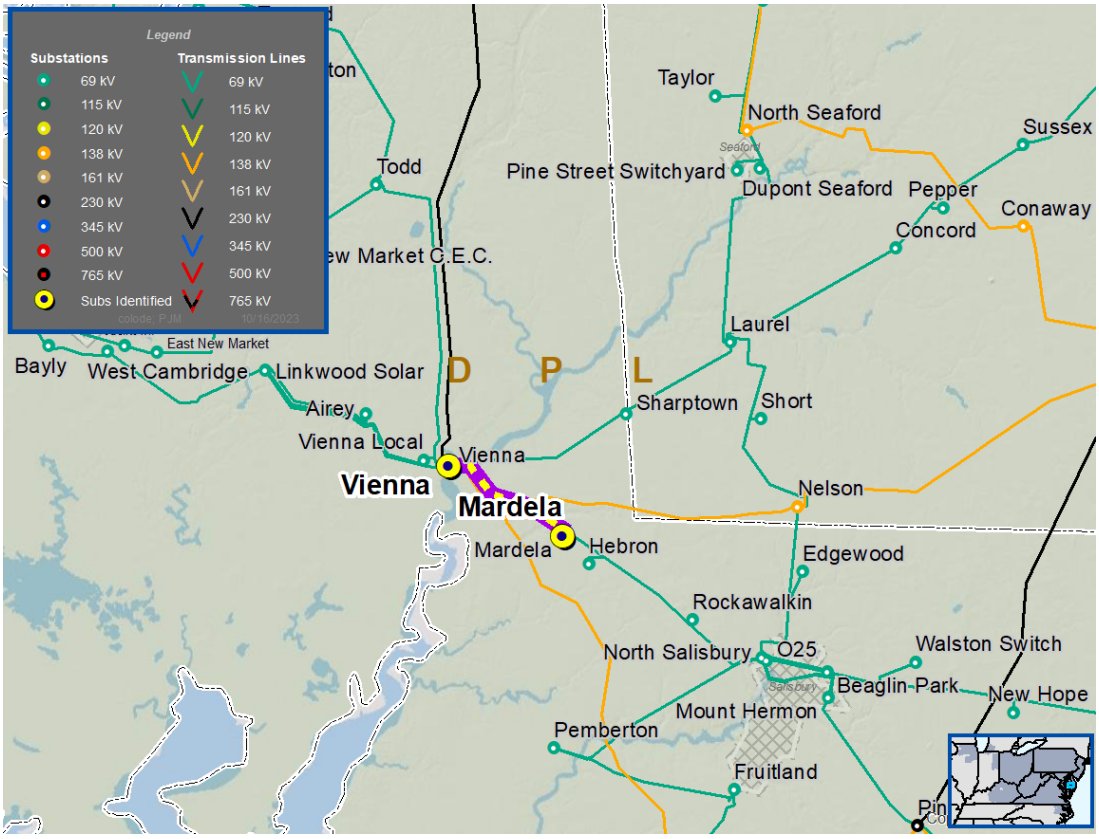
The recommended solution is to replace the Belmont 765/500 kV transformer No. 5 with a new transformer bank, consisting of three single-phase transformers and a spare transformer. The project will also replace 500 kV disconnect switches at the Belmont substation. The estimated cost for this project is $42.05 million. This project has a required and projected in-service date of June 2028, and the local transmission owner, APS, will be designated to complete this work.

Baseline Project b3846.1-.3: Vienna-Mardela 69 kV Rebuild

DPL Transmission Zone

In the 2028 RTEP summer case, the Vienna-Mardela 69 kV line is overloaded under multiple N-2 outages. The flowgates were posted as part of the 2023 RTEP Window 1 but was excluded from competition due to the below 200 kV exclusion.

Map 3. b3846.1-.3: Vienna-Mardela 69 kV



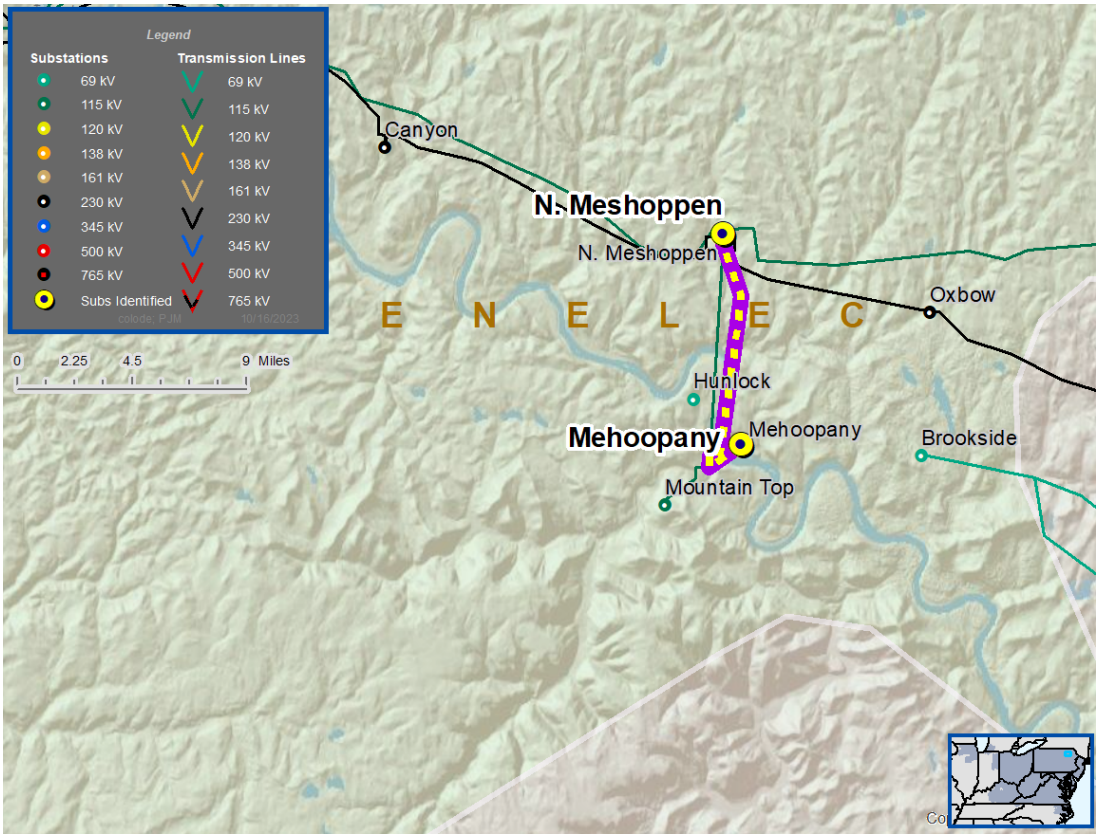
The recommended solution is to rebuild 6.25 miles of 69 kV circuit 6708 (Vienna-Mardela) with new single pole steel structures and with 954 ACSR conductor. This new rebuild will be from the dead-end structure on the east side of the Nanticoke River to the Mardela tap. The project also includes upgrading a disconnect switch at Vienna and three disconnect switches at Mardela to increase ratings of the existing Vienna-Mardela transmission facility. The estimated cost for this project is $21.38 million. This project has a required and projected in-service date of June 2028, and the local transmission owner, DPL, will be designated to complete this work.

Baseline Projects b3791 & b3792: North Meshoppen-Mehoopany No. 1 and No. 2 115 kV Rebuild

PENELEC Transmission Zone

In the 2028 RTEP summer case, the North Meshoppen-Mehoopany 115 kV line No. 1 and No. 2 segments are overloaded under one N-1 and multiple N-2 outages. The flowgates for both line segments were posted as part of the 2023 RTEP Window 1, and PJM received one proposal for each set of flowgates.

Map 4. b3791 & b3792: North Meshoppen-Mehoopany 115 kV



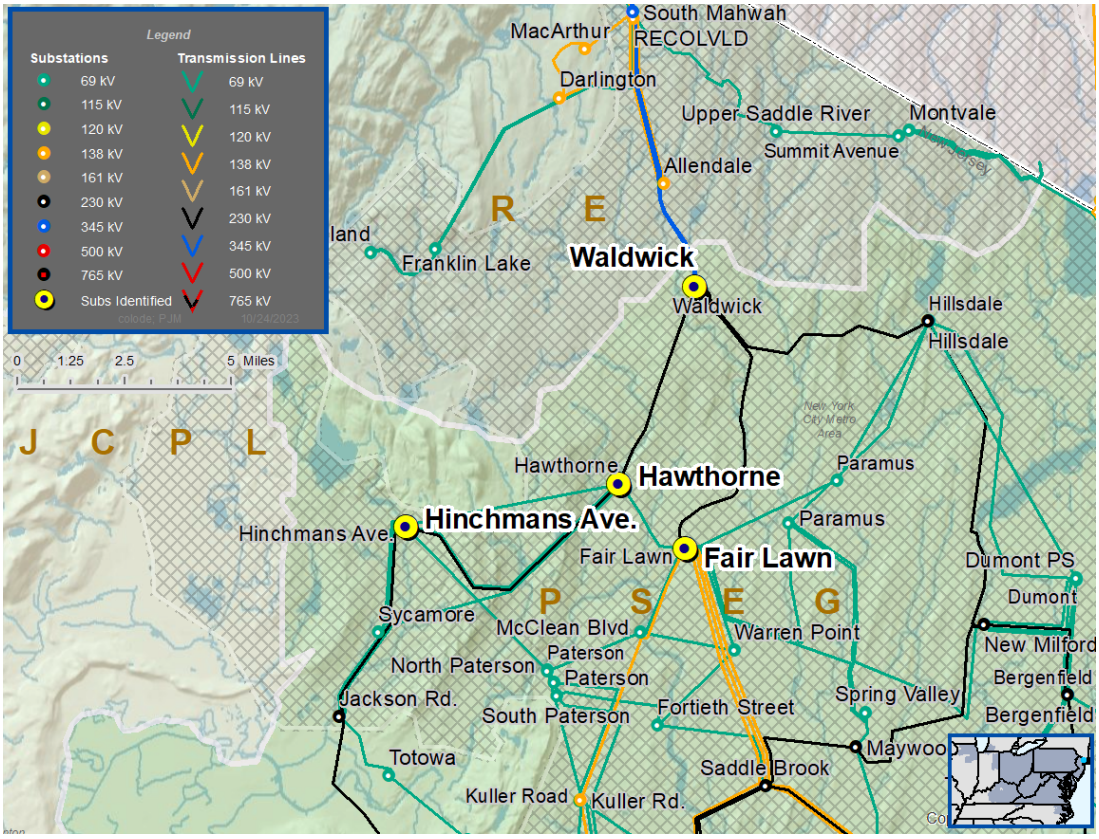
The recommended solutions are to rebuild the North Meshoppen-Mehoopany 115 kV line No. 1 and No. 2 with 795 ACSR 26/7 STR conductors and to upgrade terminal equipment to meet or exceed the transmission line ratings. The estimated cost to rebuild North Meshoppen-Mehoopany 115 kV line No. 1 is $17.4 million, and the estimated cost to rebuild North Meshoppen-Mehoopany 115 kV line No. 2 is $17.7 million. These projects have a required and projected in-service date of June 2028, and the local transmission owner, MAIT, will be designated to complete this work.

Baseline Project b3794.1-.2: Waldwick 345 kV and 230 kV Shunt Reactor Replacements

PSEG Transmission Zone

In the 2028 RTEP light load case, Hinchmans, Hawthorne, Waldwick and Fairlawn 230 kV and Waldwick 345 kV buses are observing high voltage violations under one N-1 and multiple N-2 outages. The flowgates were posted as part of the 2023 RTEP Window 1, and PJM received one proposal to address the flowgates.

Map 5. b3794.1-.2: Hinchmans, Hawthorne, Waldwick and Fairlawn 230 kV and Waldwick 345 kV



The recommended solution is to replace the existing 230 kV 50 MVAR and 345 kV 100 MVAR fixed shunt reactors at Waldwick switching station with 230 kV 150 MVAR and 345 kV 150 MVAR variable shunt reactors. The estimated cost for this project is $29.6 million. This project has a required and projected in-service date of June 2028, and the local transmission owner, PSEG, will be designated to complete this work.

IV. Transmission Owner Criteria Projects

Of the $186.29 million of new recommended baseline transmission system enhancements, approximately $35.82 million is driven by transmission owner planning criteria, which makes up approximately 19% of the new project cost estimates.

V. Changes to Previously Approved Projects

Scope/Cost Changes

The following scope/cost modifications were recommended:

New Jersey State Agreement Approach Project:

The New Jersey Board of Public Utilities requested prebuild provisions around the Larrabee station for civil work to minimize disturbance to the shoreline and in the vicinity of the Larrabee substation. This has resulted in a scope addition for baseline project b3737.22 [Larrabee Collector station scope of the New Jersey State Agreement Approach (SAA) project]. Additional scope includes prebuild extension work, such as duct banks, to accommodate four HVDC circuits from the prebuild point of demarcation to each offshore wind generator's converter station area on the Larrabee Collector station property. Three sets of AC collector lines with a combined total of 12 230 kV AC circuits that will run from each offshore wind generator's converter station area to the Larrabee Collector station AC interface will also be added. The previous cost for b3737.22 was $193.3 million, and the updated cost is $216.3 million, resulting in a cost increase of $23 million.

The following New Jersey SAA project scope is no longer required due to the approved higher capacity, more holistic system upgrades identified and approved for the Brandon Shores deactivation project, and the 2022 RTEP Window 3 project. This results in a net cost decrease of $31.85 million:

- Baseline b3737.46: Installation of new breaker at Graceton 230 kV to terminate a new 230 kV line from the new greenfield North Delta station – $1.55 million
- Baseline b3737.48: PECO's portion of the new North Delta-Graceton 230 kV line by rebuilding 4.1 miles of the existing Cooper-Graceton 230 kV line to double circuit – $18.82 million
- Baseline b3737.49: Brining the Cooper-Graceton 230 kV line "in and out" of North Delta – $1.56 million
- Baseline b3737.56: BGE's portion of the new North Delta-Graceton 230 kV line by rebuilding 2.16 miles of the existing Cooper-Graceton 230 kV line to double circuit – $9.92 million

All of the changes noted above result in a net cost decrease of $8.85 million for the New Jersey SAA project.

Brandon Shores Deactivation Project:

Brandon Shores 1 and 2 are coal units in the BGE zone with a total of approximately 1,282 MW capacity. The deactivation of these units causes widespread voltage violations in neighboring areas (PEPCO, METED, PPL, PECO, APS, Dominion). In July 2023, the PJM Board approved baseline b3780 to address the majority of the identified violations from the Brandon Shores deactivation study. In December 2023, baseline b3780.3 (construction of 500/230 kV West Cooper substation) was canceled with the approval of the 2022 RTEP Window 3 solution. PJM has since

worked with the transmission owners to identify the following additional scope originally imbedded in the canceled baseline b3780.3 that is still required for the Brandon Shores deactivation:

- Baseline b3780.14: New 230 kV line from Cooper to North Delta – $3.6 million
- Baseline b3780.15: Loop Peach Bottom-Conastone 500 kV (5012) line into North Delta – $7.86 million
- Baseline b3780.16: Termination for New 230 kV line from Cooper to North Delta – $0.47 million
- Baseline b3780.17: Terminations for Peach Bottom-Conastone 500 kV (5012) line – $1.1 million

All of the changes noted above result in a net cost increase of $13.03 million for the Brandon Shores deactivation project.

2023 RTEP Window 3 Project:

In December 2023, the PJM Board approved baseline b3800 to address the 2022 RTEP Window 3 violations. Through detailed project review following project approval, FirstEnergy and Exelon have provided updated cost estimates for the following scope:

- Baseline b3800.2: Break the existing TMI-Peach Bottom 500 kV line and reterminate into adjacent Otter Creek 500 kV switchyard – Estimated cost has increased from $7.03 million to $18.3 million, resulting in an increase of $11.27 million.
- Baseline b3800.45: North Delta 500 kV termination for the Rock Springs 500 kV line (5034/5014 line) – Estimated cost has decreased from $10.2 million to $0.8 million, resulting in a decrease of $9.4 million.

Additionally, through detailed project review following project selection, Exelon has identified the following additional scope required at Peach Bottom 500 kV:

- Baseline b3800.52: Reconfigure Peach Bottom North and South yards to allow for termination of 500 kV lines from Peach Bottom to North Delta – $7.86 million.

All of the changes noted above result in a net cost increase of $9.73 million for the 2022 RTEP Window 3 project.

Accelerations

PJM's acceleration analysis determines which reliability projects, if any, have an economic benefit if accelerated or modified. The analysis utilized the most recent 2027 Market Efficiency base case available at the time to study the impacts of approved RTEP reliability projects, and identified the following two projects that result in congestion benefits if accelerated:

- Baseline b3694.8: Partial wreck and rebuild 10.34 miles of 230 kV line No. 249 (Carson-Locks) and upgrade of terminal equipment at Carson and Locks substations, if accelerated, results in an estimated annual congestion benefit of $1.8 million. This project will be accelerated from June 2026 to June 2025. While there is no cost to accelerate the project, Dominion has provided a more detailed engineering cost estimate, resulting in a net cost increase of $10.24 million.
- Baseline b3729: Upgrade of dead-end structures on Conowingo-Colora 230 kV line, installation of cable shunts and replacement of the existing insulator bells, if accelerated, results in an estimated annual

congestion benefit of $0.8 million. This project will be accelerated from June 2027 to June 2026, and does not result in any additional cost.

Cancellations

The following cancellations were recommended:

- Baseline b3017.1-.3 (Glade-Warren 230 kV line rebuild) is no longer required with Beaver Valley 1 and 2 deactivation request rescinded. The project was placed on hold, as the base case used to perform interconnection queue studies included the upgrades. Per the latest study, the upgrades are no longer needed for the interconnection queue and will be canceled, yielding a net decrease of $33.4 million.
- Baseline b3162 (new 230 kV Stevensburg switching station) is no longer required, as revised load allocations in the area caused the reliability violations to be resolved within the study time frame. This cancellation and yields a net decrease of $22 million.
- Baseline b3710 (reconductor of two 138 kV lines from Yukon to AA2-161 interconnection project) is no longer required due to the interconnection queue AA2-161 withdrawal. This cancellation and yields a net decrease of $10.64 million.

All of the changes noted above result in a net decrease of $66.04 million.

VI. Interconnection Queue Projects

Throughout 2023, PJM has continued to study new service customer requests that are submitted into the interconnection queue. These studies evaluate the impact of the new service request and include an evaluation of new generation interconnections, increases in generation at existing stations, long-term firm transmission service requests and merchant transmission interconnection requests.

A portion of the network upgrades associated with these projects were presented to the PJM Board in December 2023. The remaining upgrades are shown in Attachment C to this report. New projects with signed ISAs, project scope changes and project cancellations have resulted in a net increase of $1,049.80 million for network upgrades. The cost for the network upgrades associated with these interconnection projects is the responsibility of the developer.

VII. Review by the Transmission Expansion Advisory Committee (TEAC)

Project needs and recommended solutions as discussed in this report were reviewed with stakeholders during 2023 and 2024, most recently at the January 9, 2024, TEAC meeting. Written comments were requested to be submitted to PJM to communicate any concerns with project recommendations. No comments have been received as of this white paper publication date.

VIII. 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), and Attachment C (for Interconnection Network Upgrades).

Cost allocations are calculated in accordance with Schedule 12 of the Open Access Transmission Tariff. 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.

IX. Board Approval

The PJM Reliability and Security Committee is requested to endorse the additions and changes to the RTEP proposed in this white paper and recommended to the full Board for approval the new projects and changes to the existing RTEP projects as detailed in this white paper. The RTEP is published annually on PJM's website.

On February 28, 2024, the Board approved the addition of RTEP baseline projects as well as other changes to the RTEP as summarized in this paper.

Attachment A – Reliability Project Single-Zone Allocations

Upgrade ID	Description	Cost Estimate ($M)	TO	Cost Responsibility	Required In-Service Date
b3785.1	Replace existing 3000A wave trap at Mountaineer 765 kV, on the Belmont-Mountaineer 765 kV line, with a new 5000 A wave trap.	$0.46	AEP	AEP (100.00%)	6/1/2028
b3786.1	Rebuild ~4.5 miles of 69 kV line between Abert and Reusens substations. Update line settings at Reusens and Skimmer.	$14.40	AEP	AEP (100.00%)	6/1/2028
b3787.1	Install a CCVT on three-phase stand and remove the single phase existing CCVT on the 69 kV Coalton to Bellefonte line exit. The existing CCVT is mounted to lattice on a single-phase CCVT stand, which will be replaced with the three-phase CCVT stand. The line riser between line disconnect and line takeoff is being replaced. This remote end work changes the MLSE of the line section between Coalton-Princess 69 kV line section.	$0.00	AEP	AEP (100.00%)	12/1/2028
b3788.1	Replace AEP-owned station takeoff riser and breaker BB risers at OVEC-owned Kyger Creek station.	$0.41	AEP	AEP (100.00%)	6/1/2028
b3788.2	Replace OVEC-owned breaker AA risers, bus work, and breaker AA disconnect switches at OVEC-owned Kyger Creek station.	$0.75	OVEC	OVEC (100.00%)	6/1/2028
b3789.0	A 69 kV, 60 MVAR shunt reactor will be installed at the Salt Springs substation. The reactor terminal will be connected to the existing 69 kV bus, and an independent-pole operation, 1200A circuit breaker will be installed for reactor switching.	$5.45	ATSI	ATSI (100.00%)	6/1/2028
b3790.0	Replace the overdutied Olive 345 kV circuit breaker "D" with a 5000A 63 kA circuit breaker. Reuse existing cables and a splice box to support the circuit breaker install.	$1.08	AEP	AEP (100.00%)	6/1/2028
b3791.0	Rebuild the North Meshoppen-Mehoopany No. 1 115 kV line with 795 ACSR 26/7 STR conductor. Upgrade terminal equipment to exceed transmission line ratings.	$17.40	PENELEC	PENELEC (100.00%)	6/1/2028
b3792.0	Rebuild the North Meshoppen-Mehoopany No. 2 115 kV line using 795 ACSR 26/7 STR conductor, and upgrade terminal equipment to exceed the transmission line rating.	$17.70	PENELEC	PENELEC (100.00%)	6/1/2028
b3793.1	Reconductor Silver Run-Cedar Creek 230 kV line. Reconductor 8.8 miles of 230 kV circuit with 1594-	$7.68	DPL	DP&L (100.00%)	6/1/2028

Upgrade ID	Description	Cost Estimate ($M)	TO	Cost Responsibility	Required In-Service Date
	T11/ACCR "Lapwing" conductor and replace all insulators with high-temp. hardware.				
b3793.2	Replace three (3) standalone CTs, disconnect switch, stranded bus and rigid bus to achieve higher rating at Cedar Creek.	$0.45	DPL	DPL (100.00%)	6/1/2028
b3793.3	Replace three (3) 1-1590 ACSR jumpers and one (1) air disconnect switch at Silver Run.	$0.58	DPL	DPL (100.00%)	6/1/2028
b3794.1	Replace existing Waldwick 230 kV 50 MVAR fixed shunt reactor with a 230 kV 150 MVAR variable shunt reactor.	$13.60	PSEG	PSEG (100.00%)	6/1/2028
b3794.2	Replace existing Waldwick 345 kV 100 MVAR fixed shunt reactor with a 345 kV 150 MVAR variable shunt reactor.	$16.00	PSEG	PSEG (100.00%)	6/1/2028
b3810.0	Add three 345 kV circuit breakers to Cherry Valley substation.	$7.75	ComEd	ComEd (100.00%)	6/1/2028
b3836.1	Rebuild approximately 1.7 miles of line on the Chemical-Washington Street 46 kV circuit.	$7.60	AEP	AEP (100.00%)	6/1/2028
b3837.1	Replace existing 34.5 kV, 25 kA circuit breaker B at West Huntington station with new 69 kV, 40 kA circuit breaker.	$0.36	AEP	AEP (100.00%)	6/1/2028
b3838.1	Replace breaker A and B at Timken station with 40 kA breakers.	$1.20	AEP	AEP (100.00%)	6/1/2028
b3839.1	Replace 69 kV breaker C at Haviland station with a new 3000A 40 kA breaker.	$0.40	AEP	AEP (100.00%)	6/1/2028
b3840.1	Replace structures 382-66 and 382-63 on Darrah-East Huntington 34.5 kV line to bypass 24th Street station. Retire structures 1 through 5 on 24th Street 34.5 kV extension. Retire 24th Street station. Remove conductors from BASF tap to BASF.	$1.80	AEP	AEP (100.00%)	6/1/2028
b3843.1	Rebuild the underground portion of the Ohio University-West Clark 69 kV line, approximately 0.65 miles.	$4.60	AEP	AEP (100.00%)	6/1/2028
b3844.1	Replacement of relays at Macdade, Printz and Morton to increase rating limits of transmission relay equipment. Line protection relays will be upgraded with latest standard relays used across the PECO system.	$1.40	PECO	PECO (100.00%)	12/31/2026
b3845.1	Add a second breaker next to Nottingham 895 circuit breaker to eliminate stuck breaker contingency.	$1.28	PECO	PECO (100.00%)	5/31/2028

Upgrade ID	Description	Cost Estimate ($M)	TO	Cost Responsibility	Required In-Service Date
b3846.1	Rebuild 6.25 miles of 69 kV circuit 6708 (Vienna-Mardela) with new single pole steel structures and with 954.0 45/7 "Rail" conductor. This new rebuild will be from the dead-end structure on the east side of the Nanticoke River to the Mardela tap.	$18.63	DPL	DPL (100.00%)	5/31/2028
b3846.2	Upgrade disconnect switch at Vienna to increase ratings of existing Vienna-Mardela transmission facility.	$1.00	DPL	DPL (100.00%)	5/31/2028
b3846.3	Upgrade three disconnect switches at Mardela to increase ratings of existing Vienna-Mardela transmission facility.	$1.75	DPL	DPL (100.00%)	5/31/2028

Attachment B – Reliability Project Multi-Zone Allocations

Upgrade ID	Description	Cost Estimate ($M)	TO	Cost Responsibility	Required In-Service Date
b3780.14	Reconfigure Cooper transmission feeds by establishing new Cooper-North Delta 230 kV line and rerouting existing transmissions lines by Cooper.	$3.60	PECO	DPL (38.25%)/PECO (61.75%)	6/1/2025
b3780.15	Cut in 5012 Peach Bottom-Conastone 500 kV line into North Delta 500/230 kV substation by rebuilding 5012 between new terminal at Peach Bottom South and North Delta on single circuit structures and terminating at North Delta.	$7.86	PECO	Load-Ratio Share Allocation: AEC (1.65%)/AEP (14.29%)/APS (5.82%)/ATSI (7.49%)/BGE (4.01%)/ComEd (14.06%)/Dayton (2.03%)/DEOK (3.21%)/Dominion (13.89%)/DPL (2.55%)/DL (1.59%)/EKPC (2.35%)/JCPL (3.59%)/ME (1.81%)/OVEC (0.06%)/PECO (5.11%)/PENELEC (1.73%)/PEPCO (3.68%)/PPL (4.43%)/PSEG (5.99%)/RE (0.24%)/Neptune (0.42%) DFAX Allocation: AEC (11.03%)/BGE (37.40%)/DPL (22.90%)/PEPCO (28.67%)	6/1/2025
b3780.16	Terminate new Cooper-North Delta 230 kV line (Transource Scope) at North Delta 230 kV.	$0.47	Transource	DPL (38.25%)/PECO (61.75%)	6/1/2025
b3780.17	Cut in 5012 Peach Bottom-Conastone 500 kV line into North Delta 500/230 kV substation by rebuilding 5012 between new terminal at Peach Bottom South and North Delta on single circuit structures and terminating at North Delta (Transource Scope).	$1.10	Transource	Load-Ratio Share Allocation: AEC (1.65%)/AEP (14.29%)/APS (5.82%)/ATSI (7.49%)/BGE (4.01%)/ComEd (14.06%)/Dayton (2.03%)/DEOK (3.21%)/Dominion (13.89%)/DPL (2.55%)/DL (1.59%)/EKPC (2.35%)/JCPL (3.59%)/ME (1.81%)/OVEC (0.06%)/PECO (5.11%)/PENELEC (1.73%)/PEPCO (3.68%)/PPL (4.43%)/PSEG (5.99%)/RE (0.24%)/Neptune (0.42%) DFAX Allocation: AEC (11.03%)/BGE (37.40%)/DPL (22.90%)/PEPCO (28.67%)	6/1/2025

Upgrade ID	Description	Cost Estimate ($M)	TO	Cost Responsibility	Required In-Service Date
b3796.0	Replace the Belmont 765/500 kV transformer No. 5 with a new transformer bank consisting of three single-phase transformers and an additional single phase spare transformer. The project will also replace 500 kV disconnect switches at the Belmont substation.	$42.05	APS	Load-Ratio Share Allocation: AEC (1.65%)/AEP (14.29%)/APS (5.82%)/ATSI (7.49%)/BGE (4.01%)/ComEd (14.06%)/Dayton (2.03%)/DEOK (3.21%)/Dominion (13.89%)/DPL (2.55%)/DL (1.59%)/EKPC (2.35%)/JCPL (3.59%)/ME (1.81%)/OVEC (0.06%)/PECO (5.11%)/PENELEC (1.73%)/PEPCO (3.68%)/PPL (4.43%)/PSEG (5.99%)/RE (0.24%)/Neptune (0.42%) DFAX Allocation: AEP (0.28%)/APS (0.15%)/Dayton (0.10%)/DEOK (0.18%)/DL (6.57%)/Dominion (92.68%)/EKPC (0.04%)	6/1/2028
b3800.52	Reconfigure Peach Bottom North and South yards to allow for termination of 500 kV lines from Peach Bottom to North Delta. North Delta 500 kV termination for the new Peach Bottom-North Delta 500 kV line.	$7.86	PECO	Load-Ratio Share Allocation: AEC (1.65%)/AEP (14.29%)/APS (5.82%)/ATSI (7.49%)/BGE (4.01%)/ComEd (14.06%)/Dayton (2.03%)/DEOK (3.21%)/Dominion (13.89%)/DPL (2.55%)/DL (1.59%)/EKPC (2.35%)/JCPL (3.59%)/ME (1.81%)/OVEC (0.06%)/PECO (5.11%)/PENELEC (1.73%)/PEPCO (3.68%)/PPL (4.43%)/PSEG (5.99%)/RE (0.24%)/Neptune (0.42%) DFAX Allocation: AEC (11.03%)/BGE (37.40%)/DPL (22.90%)/PEPCO (28.67%)	6/1/2027

Attachment C – Interconnection Network Upgrades

Upgrade ID	Description	Cost ($M)	Required In-Service Date
n104.1	Construct a new three (3) circuit breaker 138 kV station, Snowhill, physically configured in a breaker-and-a-half bus arrangement but operated as a ring bus.	$6.54	12/1/2021
n104.2	Connect Snowhill 138 kV station to existing transmission circuit; update remote end protective relay settings.	$0.81	12/1/2021
n104.3	Replace protective relays at Strawton 138 kV station.	$0.20	12/1/2021
n104.4	Install two (2) fiber-optic paths to facilitate relaying between Snowhill, Deer Creek and Strawton 138 kV stations.	$0.24	12/1/2021
n104.5	Replace three (3) structures, six (6) spans of conductor along the Deer Creek-Makahoy 138 kV circuit.	$0.63	12/1/2021
n4655	Reconfigure the Albright 138 kV substation to a breaker-and-a-half configuration.	$20.70	9/25/2017
n4783	To mitigate the (ACE) Cardiff 230/138 kV bus (from bus 227900 to bus 227934 Ckt 1) overload, substation reinforcements will be required at Cardiff.	$0.60	5/29/2019
n5583	Install 138 kV revenue metering at the Ohio Central substation.	$0.25	11/1/2017
n5865	Install attachment facility line, line disconnect switch, and associated hardware to accept the interconnection customer generator lead line terminating at the AD2-163 interconnection switching station. Install customer-owned revenue metering at the AD2-163 facility.	$0.50	12/1/2021
n5866	Install 138 kV three-breaker ring bus generation interconnection at AD2-163 interconnection substation.	$11.16	12/1/2021
n5986	Settings changes will need to be reviewed; the estimated cost for relay setting review/revision for AD1-130 is $25,000.	$0.03	12/31/2019
n5987	Install new 115 kV three-breaker ring bus substation.	$3.88	9/30/2019
n5988	Loop the 962 (Hunterstown-Lincoln) 115 kV circuit into substation.	$0.47	9/30/2019
n5989	Revenue metering – engineering oversight of specification and design of new revenue metering that will be installed by power producer (interconnection customer) at their location (AD1-020) and connected to the new ring bus station on the Hunterstown-Lincoln line. Coordinate FE MV90 access to the new meter.	$0.00	9/30/2019
n5990	Replace one (1) existing shield wire with optical ground wire (OPGW) on the Hunterstown-Lincoln 115 kV circuit between the proposed AD1-020 ring bus and Lincoln substation, approximately 1.6 miles.	$0.50	9/30/2019
n5991	Replace one (1) existing shield wire with OPGW on the Hunterstown-Lincoln 115 kV circuit between the proposed AD1-020 ring bus and Hunterstown substation, approximately 1.0 miles.	$0.32	9/30/2019
n5992	Install new line relaying and capacitor-voltage transformers (CVT) for the AD1-020 interconnection at Hunterstown substation.	$0.26	9/30/2019
n5993	Install new line relaying and capacitor-voltage transformers (CVT) for the AD1-020 interconnection at Lincoln substation.	$0.26	9/30/2019
n5994	Install estimated MPLS router at new AD1-020 interconnection substation to support new RTU.	$0.15	9/30/2019

Upgrade ID	Description	Cost ($M)	Required In-Service Date
n6023	Rebuild the AB2-135 TAP-Church 69 kV circuit, including the installation of new poles and a new disconnect switch.	$6.60	6/1/2020
n6032	Perform AC1-173 relay settings – convert two-terminal gen lead to three-terminal gen lead (n5648).	$0.06	10/31/2019
n6033	Perform AC1-173 fiber system modifications (n5474).	$0.01	10/31/2019
n6049	Expand existing bay and install one (1) 345 kV circuit breaker, physical structures, protection and control equipment, communications equipment, and associated facilities at the Sullivan 345 kV switching station.	$2.22	12/31/2020
n6070	Reinforcements to increase the emergency rating of the Delco tap to Mickleton 230 kV line require the replacement of substation equipment, including substation bus at Mickleton substation. The estimate to perform this work is $905,000 and will take 18 months to complete.	$0.91	11/1/2017
n6124.1	Reconductor/rebuild 2.78 miles of ACSR ~ 336/556 six-wire conductor on the 05EDAN 1-05DANVL2 138 kV line.	$4.28	6/1/2021
n6124.2	Reconductor/rebuild 0.03 miles of ACSR ~ 1351.5 ~ 45/7 ~ DIPPER - conductor section 3 on the 05EDAN 1-05DANVL2 138 kV line.	$0.04	6/1/2021
n6124.3	Reconductor/rebuild 0.03 miles of ACSR ~ 1351.5 ~ 45/7 ~ DIPPER - conductor section 1 on the 05EDAN 1-05DANVL2 138 kV line.	$0.04	6/1/2021
n6145	Construct a 34.5 line tap/connection and 2-34.5 kV load-break switches with SCADA control at tap location, including one span of 34.5 kV line to the point of interconnection at Gilbert-Morris Park (A27) 34.5 kV generation interconnection. [One (1) 34.5 kV switch on the generator lead line and the span of 34.5 kV circuit are considered attachment facilities.]	$0.07	12/1/2019
n6146	Construct a 34.5 line tap/connection and 2-34.5 kV load-break air switches with SCADA control at tap location, including one span of 34.5 kV line to the point of interconnection at Gilbert-Morris Park (A27) 34.5 kV generation interconnection. [The one (1) switch on the main circuit next to the tap is considered a non-direct connection cost.] Estimated installation of 700 MHz radio system (70% penetration of FE territory) to support the (3) SCADA switch replacements. Assumed SCADA work is included in this cost. Provide and install 34.5 kV instrument transformer package and bi-directional 4G cell meter at AE1-243 site (new battery facility).	$0.82	12/1/2019
n6147	Revise remote relay and metering settings on the Morris Park 34.5 kV terminal at Gilbert substation.	$0.04	12/1/2019
n6148	Revise remote relay and metering settings on the Gilbert 34.5 kV terminal at Morris Park substation.	$0.04	12/1/2019
n6233	Replace two (2) poles and associated PSE&G standard conductor. Install two (2) new poles as H-frame for STATCOM equipment. Install and commission STATCOM equipment. Relocate branch recloser to new poles.	$0.40	12/10/2019
n6236	Build new structures to cut and loop the line into AC1-043 115 kV switching station.	$1.43	10/2/2019

Upgrade ID	Description	Cost ($M)	Required In-Service Date
n6280	Upgrade will be to mitigate sag on ComEd portion of line. A preliminary estimate is $4.5M with an estimated construction timeline of 24 months.	$2.47	11/30/2021
n6287.2	Add two breakers in the Trowbridge 230 kV substation to accommodate AD1-074/75/76.	$4.00	6/1/2020
n6314	Rebuild Shawboro-Elizabeth City 230 kV line No. 2021.	$15.42	6/1/2020
n6329	Perform a sag study on the Pipe Creek-05GRNTTA 138 kV line.	$0.02	12/1/2021
n6330	Perform a sag study on the AD2-071 tap-Pipe Creek 138 kV line.	$0.03	12/1/2021
n6342	To mitigate the (ACE) Cardiff-New Freedom 230 kV line (from bus 227900 to bus 219100 ckt 1) overload, it will require increasing the emergency rating of the Cardiff to New Freedom 230 kV line by rebuilding the circuit. The rebuild will include the installation of new poles, foundations, insulators and conductor. New Ratings: 796/932/932	$105.00	6/1/2022
n6378	Rebuild 6.42 miles of 115 kV line 91 from AE2-092 tap to Sherwood with 2-636 ACSR.	$16.05	10/1/2026
n6385	Replace 230/115 kV transformer TX No. 1 at New Road substation.	$4.90	11/30/2020
n6437	Rebuild 20.57 miles of 230 kV line 2034 from Cashie to Earleys with 2-636 ACSR.	$30.86	11/15/2020
n6472	Construct a new 230 kV substation with a three-position ring bus.	$16.47	10/31/2019
n6496	Increase the maximum operating temperature of the Summershade-Edm. JB Galloway Jct 69 kV line section 266 MCM conductor to 212F (~7.9 miles).	$0.53	4/30/2024
n6587	Reconductor the Oyster Creek-Cedar 230 kV line (JCP&L portion only ~0.1 miles. AE portion ~14 miles). Upgrade terminal equipment at Oyster Creek. Additionally, AE would need to replace their section of the limiting conductor and provide estimates for their replacement.	$2.82	6/1/2023
n6679	Install AC1-033 new line section for interconnection at Kewanee.	$4.00	12/1/2021
n6712	Install AC2-195 ADSS fiber from the new AC2-195 interconnection substation to the anticipated ADSS cable near the intersection of Marion Williamsport Road and N Main Street proposed for PJM queue position AB2-131. The assumed route is a combination of aerial ADSS (0.87 miles) and underground bore (0.14 miles).	$0.17	12/31/2020
n6728	To mitigate the (ACE) Cedar Oyster Creek 230 kV line (from bus 227955 to bus 206302 ckt 1) overload, it will require increasing the emergency rating of the Cedar to Oyster Creek 230 kV line by rebuilding the circuit. The rebuild will include the installation of new poles, foundations, insulators and conductor. In addition, various terminal reinforcements are required at Cedar.	$27.00	2/28/2026
n6786	Build a three-breaker 115 kV substation at the existing Kings Dominion DP substation.	$5.30	12/31/2019
n6787	Build new structures to cut and loop the transmission line into the new Kings Dominion 115 kV ring bus substation.	$0.50	12/31/2020
n6788	Modify protection and communication work to support interconnection of the new Kings Dominion DP three-breaker ring bus substation.	$0.20	12/31/2020

Upgrade ID	Description	Cost ($M)	Required In-Service Date
n6894	Design, install and test/commission MPLS equipment to provide SCADA transport at New Sulphur City 138 kV substation.	$0.25	9/30/2020
n6922	Install new line position for AF1-287 generator interconnection at Edinboro South.	$0.78	3/1/2021
n6923	Primary point of interconnection is to connect directly to the Edinboro South No. 1 34.5 kV bus and 34.5 kV GOAB to interconnect queue project AF1-287. Install 34.5 kV metering in customer's facilities. The customer is responsible to build their own line from their site to PENELEC's existing facilities.	$0.07	3/1/2021
n6924	Review nameplates and customer drawing at AF1-287 sub.	$0.05	3/1/2021
n6950	Tap the Martinsville-Wilmington 69 kV line and install a three-way phase switch to interconnect the AD2-031 project. (One switch covering the generator lead line is considered an attachment facility.)	$0.22	9/1/2019
n6951	Tap the Martinsville-Wilmington 69 kV line and install a three-way phase switch to interconnect the AD2-031 project (two network switches of the three-way switch are considered direct connection facilities).	$0.45	9/1/2019
n6952	Install a new 69 kV breaker at Martinsville substation. This will include the installation of all physical structures, P&C equipment, communications equipment, metering equipment and associated facilities.	$1.61	9/1/2019
n6953	Perform protection system changes at Wilmington substation.	$0.01	9/1/2019
n7009	Install line exit take-off structure, foundations, disconnect switch and associated equipment at ring bus substation at new AE1-101 138 kV switchyard.	$0.64	10/1/2022
n7024	Install line exit take-off structure, foundations, disconnect switch and associated equipment at ring bus substation at new AD1-068 138 kV switchyard.	$0.68	10/1/2022
n7025	Construct a new three-breaker ring bus on the 138 kV line between Albright and Garrett.	$6.93	10/1/2022
n7026	Loop the Albright-Garrett 138 kV line to create the interconnection for AD1-068 three-breaker ring bus (Afton substation), approximately 6.4 miles from Albright substation.	$0.62	10/1/2022
n7027	Replace wave trap and line tuner at Albright. Add anti-islanding relaying. Change carrier frequency and adjust relay settings. Change line name.	$0.31	10/1/2022
n7028	Replace wave trap and line tuner at Garrett. Add anti-islanding and replace line relaying. Change carrier frequency and adjust relay settings.	$0.39	10/1/2022
n7033	Reconductor the AD2-066 tap-Mazon 138 kV line.	$32.20	9/1/2020
n7084	Install line exit take-off structure, foundations, disconnect switch and associated equipment at ring bus substation qt new AE1-071 115 kV switchyard.	$0.69	11/2/2021
n7164.2	Replace relaying (RT, WT, MT, ZR, OR) at Karns City substation.	$0.46	12/31/2022
n7180	Rebuild 7.2 miles of 230 kV line 235 from Prince EDW to Farmville with 2-636 ACSR.	$10.80	12/31/2022

Upgrade ID	Description	Cost ($M)	Required In-Service Date
n7181	Rebuild 5.7 miles of 230 kV line 235 from Briery to Prince EDW with 2-636 ACSR.	$8.55	12/31/2023
n7243.1	Install 138 kV revenue metering.	$0.25	12/31/2021
n7243.2	Construct a new three (3) circuit breaker 138 kV switching station.	$6.00	12/31/2021
n7243.3	Construct facilities to loop the existing Madison-Tanners Creek 138 kV line into the proposed 138 kV interconnection switching station.	$1.00	12/31/2021
n7243.4	Modify relays and/or settings at the Madison 138 kV substation.	$0.25	12/31/2021
n7243.5	Modify relays and/or settings at the Tanners Creek 138 kV substation.	$0.25	12/31/2021
n7245.1	Construct 345 kV revenue metering.	$0.43	9/30/2023
n7245.2	Construct generator lead first span exiting the POI station, including the first structure outside the fence.	$0.69	9/30/2023
n7245.3	Construct a three (3) circuit breaker 345 kV station physically configured and operated as a ring bus including associated protection and control equipment, 345 kV line risers and SCADA.	$12.47	9/30/2023
n7245.4	Install two (2) structures, two (2) spans of conductor; connect Bokes Creek 345 station to existing transmission circuit; update remote end protective relay settings.	$1.90	9/30/2023
n7245.6	Install two (2) fiber-optic paths to the AEP telecom network to facilitate SCADA connectivity at the Boke Creek station; includes telecom upgrades at the Marysville 345 kV substation.	$0.18	9/30/2023
n7261.2	Perform project management, commissioning, environmental, forestry, real estate and right of way at AE1-185.	$0.18	4/1/2021
n7262	Appropriate terminal equipment upgrades required to accommodate higher generation output at Farmingdale 34.5 kV.	$0.01	6/1/2023
n7263	Appropriate terminal equipment upgrades required to accommodate higher generation output at Bennett 34.5 kV.	$0.01	6/1/2023
n7264	Perform required review of relay settings/protection settings at X4-031 34.5 kV.	$0.02	6/1/2023
n7272	Install a 600A gang-operated switch on a new pole to tap the McConnellsburg-Mercersburg 34.5 kV line.	$0.04	12/31/2021
n7273	Provide 34.5 kV Meter Package at LSBP solar facility connection.	$0.01	12/31/2021
n7278	Perform project management, environmental, forestry, real estate and right of way.	$0.06	12/31/2021
n7287	Install of gen tie line connecting Payne station to the IPP generator.	$0.11	9/28/2017
n7288	Install dual fiber telecom from Payne to the IPP station.	$1.73	9/28/2017
n7301	Install new three-breaker 138 kV ring bus for AD2-157 interconnect at Bubbling Springs: Transmission owner will design, furnish and construct the new 138 kV line terminal and take-off structure. This work will include, but not be limited to, installation of a 138 kV line exit take-off structure, foundations, disconnect switch and associated equipment to accommodate the termination of the 138 kV generator lead line.	$0.58	12/31/2020

Upgrade ID	Description	Cost ($M)	Required In-Service Date
n7302	Install new three-breaker 138 kV ring bus for AD2-157 interconnect at Bubbling Springs: A new three-breaker ring bus substation, Bubbling Springs 138 kV, will be constructed along the Gore-Hampshire 138 kV line to interconnect the AD2-157 solar project with the Potomac Edison transmission system. The point of interconnection will be at the TO-owned dead-end structure inside the substation yard where the generator lead line terminates.	$5.23	12/31/2020
n7305	Install fiber from AD2-157 to Gore for communication transport.	$0.29	12/31/2020
n7306	Perform estimated SCADA work at Gore, French Mill and Meadow Brook substations to support updated relay settings. Estimated in-sub fiber run to customer-built fiber to support communications to AD2-157 substation.	$0.11	12/31/2020
n7337	Direct injection cost into Bedington substation to interconnect queue project AE2-333. This includes project management.	$1.07	12/1/2022
n7338	Install (1) in-sub fiber run from Bedington control house to developer-built fiber run to support communications to AE2-333. Perform SCADA work at Bedington to support breaker and relay installations.	$0.06	12/1/2022
n7348	Cut and loop in line 23009 to new 230 kV three-position ring bus substation, occupying two of those positions. The third position will accommodate interconnection of the customer facility.	$2.73	12/1/2023
n7355	Perform protection setting changes at East Lima, RP Mone and Maddox Creek.	$0.05	9/28/2017
n7359	Loop the Jackson-TMI 230 kV line into the new AE2-211 ring bus substation.	$0.78	6/30/2022
n7360	Modify relay settings at Jackson.	$0.06	6/30/2022
n7361	Modify relay settings at Three Mile Island.	$0.06	6/30/2022
n7364	Modify line settings at Hardin switch.	$0.08	9/28/2017
n7365	Modify remote end settings at Gunn Road.	$0.02	9/28/2017
n7366	Modify remote end settings at East Lima.	$0.02	9/28/2017
n7375	Tap the Martinsville-Wilmington 69 kV line and install a three-way phase switch to interconnect the AD2-031 project (two network switches of the three-way switch are considered direct connection facilities).	$0.45	9/1/2019
n7376	Install a new 69 kV breaker at Martinsville substation. This will include the installation of all physical structures, P&C equipment, communications equipment, metering equipment and associated facilities.	$1.61	9/1/2019
n7377	Install protection system changes at Wilmington substation.	$0.01	9/1/2019
n7383	Perform relaying upgrades at TSS 100 Shady Oaks substation including: Install a SEL-411L as current differential line protection on L94701 and make the existing primary relay, SEL-311L, the secondary relay. Modify L16901 circuit breaker and L13901 circuit breaker tripping to accommodate new topology. Install load rejection logic such that transfer trip is initiated on both primary and secondary relaying to TSS 946 GSG-6 Wind Farm if L94701 circuit breakers are open at TSS 100 Shady Oaks.	$0.41	12/31/2020

Upgrade ID	Description	Cost ($M)	Required In-Service Date
n7423	Install harmonic measurement equipment and provide harmonic measurement data to IC for the completion of a 12-month Harmonic Study for the interconnection of AE1-104.	$0.00	10/1/2024
n7502	Convert Hebron 69 kV substation to a five (5)-position ring bus. The ring bus will consist of positions for a new terminal and take-off tower for line 6708, a new terminal and take-off tower for line 6775, an existing terminal for transformer T2, a new terminal for transformer T1, and a new terminal for AC2-023.	$4.84	11/1/2025
n7529	Construct a new 230 kV three-breaker ring bus looping in the Bear Rock-Johnstown 230 kV line to provide interconnection facilities for AE2-224 interconnection sub.	$1.03	3/29/2019
n7530	Design, install and test/commission MPLS equipment for SCADA transport at AE2-224 sub.	$0.22	3/29/2019
n7531	Loop the Bear Rock-Johnstown 230 kV line into the new AE2-224 interconnection substation.	$0.97	3/29/2019
n7532	Upgrade line terminal at Johnstown substation.	$0.43	3/29/2019
n7533	Upgrade line terminal at Lewistown substation.	$0.22	3/29/2019
n7534	Upgrade line terminal at Raystown substation.	$0.37	3/29/2019
n7535	Install nameplates, drawings, relay settings and relay upgrade at Altoona substation.	$0.73	3/29/2019
n7536	Upgrade line terminal at Bear Rock substation.	$0.45	3/29/2019
n7586	Rebuild 7.62 miles of 230 kV line 2104 from Cranes Corner to Stafford with 2-795 ACSR 150 C at dom-282.	$11.43	12/21/2020
n7832	Install 69 kV revenue meter, generator lead transmission line span from the South Cumberland 69 kV station to the point of interconnection, including the first structure outside the South Cumberland 69 kV station, and extend dual fiber-optic from the point of interconnection to the South Cumberland 69 kV station control house.	$0.77	9/28/2018
n7833	Expand the South Cumberland 69 kV station, including the addition of one (1) 69 kV circuit breaker, installation of associated protection and control equipment, 69 kV line risers, and supervisory control and data acquisition (SCADA) equipment.	$0.79	9/28/2018
n7842	Revenue Metering Installation Oversight for the new 138 kV substation for AE2-318	$0.19	3/30/2019
n7843	New 138 kV Station Oversight for the new 138 kV substation for AE2-318	$0.21	3/30/2019
n7844	Modify Ford-Cedarville 138 kV T-Line Loop In/Out for AE2-318 interconnection	$1.17	3/30/2019
n7845	Perform remote protection and communication work at Ford and Cedarville substations to accommodate the interconnection switching substation.	$0.72	3/30/2019
n7846	Install distribution line extension for station power.	$0.19	3/30/2019

Upgrade ID	Description	Cost ($M)	Required In-Service Date
n7854.1	Rearrange line No. 65 to loop into and out of the new three-breaker AE1-155 115 kV switching station. Line 65 is an existing 115 kV line that runs from Northern Neck substation to Harmony Village substation. AE1-155 provides for the construction of a new substation located in the existing line 65 right-of-way between existing structures 65/498 and 65/499 in Farnham, VA.	$1.07	9/15/2022
n7854.2	Build a three-breaker AE1-155 115 kV switching station. The facilities identified provides for the initial construction of a new 115 kV three-breaker ring substation between structures 65/498 and 65/499.	$5.41	9/15/2022
n7854.3	Perform remote protection and communication work. Additional work is required at Northern Neck, Rappahannock and Harmony Village substations. Drawing work, relay resets and field support necessary to change the line 65 destinations at Garner DP, Lancaster, Ocran and White Stone substations will also be completed.	$0.32	9/15/2022
n7879	Perform Marysville 345 kV protection settings change.	$0.02	3/20/2018
n7880	Perform Marysville 345 kV protection settings change.	$0.02	3/20/2018
n7882	Tap the Milton – Millville 69 kV line, MOLBAB switch, poles, structure and foundations for AE2-059 interconnection.	$0.60	3/5/2021
n7883	Complete MILT-MVIL line modifications to tie in the new AE2-059 attachment facilities. This includes connecting the conductors and OPGW from the MILT-MVIL line to the new tap structure.	$0.07	3/5/2021
n7884	Perform short-circuit study, review IC engineering package and remote end work at the Milton 69 kV substation.	$0.12	3/5/2021
n7904	Construct a new three (3) circuit breaker AD2-179 138 kV station.	$4.37	11/1/2020
n7905	Install 138 kV revenue meter, generator lead transmission line first span exiting the point of interconnection station, including the first structure outside the fence.	$1.78	3/28/2018
n7906	Modify Claytor-Glen Lyn 138 kV No. 2 Ckt T-line for AD2-179 new station cut in and install OPGW to Morgans Cut substation.	$1.50	11/1/2020
n7907	Upgrade line protections and controls at the Glen Lyn 138 kV station.	$0.50	3/28/2018
n7908	Replace the Claytor 138 kV station remote end Circuit Breaker “A” line relays with a dual carrier system and implement required settings. Install breaker controls and a second line trap.	$0.42	11/1/2020
n7954	Install a new 115 kV overhead transmission line from Endless Caverns substation.	$1.42	10/31/2023
n7955	Perform required additional work at Endless Caverns including adding a new 115 kV bay, relocating bus No. 3 cap bank, relocating 115 kV line 118, and relocating transformer No. 5 tap position. Control enclosure CE1 will be expanded to the North by 10’ to allow room for new relaying panels to be installed with project and battery and charger replaced as well.	$3.38	10/31/2023
n7962	Install 138 kV revenue meter, generator lead transmission line span from the Fostoria Central 138 kV station to the point of interconnection, including the first four structures outside the Fostoria Central 138 kV station, and extend dual fiber-optic from the point of interconnection to the Fostoria Central 138 kV station control house.	$1.49	8/1/2017

Upgrade ID	Description	Cost ($M)	Required In-Service Date
n7963	Expand the Fostoria Central 138 kV station, including the addition of one (1) 138 kV circuit breaker, installation of associated protection and control equipment, 138 kV line risers, and supervisory control and data acquisition (SCADA) equipment.	$0.85	8/1/2017
n7972	Split line No. 65 between Northern Neck substation and Rappahannock substation. The AD2-074/AF1-042 substation will be built in line with line 65 approximately halfway between existing structures 65/541 and 65/542. This location is approximately 5.4 miles to the southeast of Garner DP. The final location of the substation is subject to change but shall remain within the same vicinity. The portion of the 65 line between the Northern Neck substation and the AD2-074/AF1-042 substation will be assigned a new line number and the structures will be renumbered accordingly.	$0.97	5/31/2025
n7973	Build a three-breaker AD2-074/AF1-042 115 kV switching station. The objective of this project is to build a 115 kV, three-breaker ring bus to support the new solar farm built by Waller Solar I, LLC. The site is located along Dominion Energy's existing 115 kV, 65 line from Northern Neck substation to Rappahannock substation. The cut line will consume two of the positions in the ring bus. The third position will be for the 115 kV feed from Waller Solar I, LLC collector station for the new solar farm.	$5.44	5/31/2025
n7974	Perform remote protection and communication work. Additional work to be required at Harmony Village, Rappahannock, Northern Neck and Garner DP, Lancaster, Ocran & White Stone substations.	$0.32	5/31/2025
n8010	ComEd will be responsible to perform design, procurement and construction to revise remote terminal.	$0.32	12/31/2020
n8011	ComEd will be responsible to perform design, procurement and construction to revise remote terminal to TSS 987 Beason instead of TSS 188 Mount Pulaski.	$0.31	12/31/2020
n8012	ComEd will be responsible for performing design, procurement and construction to build L18806 and L98704 from the cut-in location to TSS 987 Beason. New conductor will match existing conductor rating.	$5.56	12/31/2020
n8013	Engineering and construction oversight for TSS 987 Beason performed by IC.	$1.32	12/31/2020
n8023	Upgrade relays at remote ends.	$0.20	11/1/2021
n8024	Modify line No. 0762 AE1-179 South Millville-Newport 69 kV.	$1.80	11/1/2021
n8025	Install new communication equipment at new ring bus substation.	$0.20	11/1/2021
n8038	Review area relay settings and modify generator lead protection and control scheme to 2-terminal, including fiber jumper and wiring changes.	$0.06	11/30/2019
n8040.1	Construct a new 138 kV three-position ring bus substation.	$8.71	9/30/2021
n8040.2	Cut and loop in 1405 transmission line to the new 138 kV three-position ring bus substation, occupying two of those positions. The third position will accommodate the interconnection of the customer facility.	$0.25	9/30/2021
n8040.3	Install a new lead line (no longer than 500 feet) from the point of interconnection to the new 138 kV ring bus substation.	$0.25	9/30/2021

Upgrade ID	Description	Cost ($M)	Required In-Service Date
n8042.1	Convert the East New Market 69 kV substation from a four (4)-position line bus to a six (6)-position ring bus.	$11.34	7/15/2026
n8042.2	Modify lines 6715 and 6719 to align with their new take-off positions at East New Market 69 kV substation.	$1.26	7/15/2026
n8043.1	Install (2) new 230 kV breakers at Oyster Creek 230 kV substation for (1) new point of interconnection connection to AE1-020 (AE2-000) at Oyster Creek substation.	$5.77	6/1/2023
n8043.2	Perform relay settings changes at Manitou substation.	$0.12	6/1/2023
n8044.1	Construct a new 69 kV ring bus.	$8.71	6/30/2022
n8044.2	Cut in transmission line 0716 to the new 69 kV three-position ring bus substation, occupying two of those positions. The third position will accommodate interconnection of the customer facility.	$0.25	6/30/2022
n8044.3	Install protective relaying at the new 69 kV three-position ring bus substation.	$0.25	6/30/2022
n8045.1	Construct three-breaker 138 kV switching station.	$6.49	12/22/2023
n8045.2	Install two (2) new structures, four (4) spans of conductor to the Creek Walker 138 kV interconnection switching station, associated protection and control equipment, and fiber to interconnect to existing transmission circuit. Modify/replace relay settings.	$0.82	12/22/2023
n8045.3	Replace protective relays at Edison 138 kV station.	$0.23	12/22/2023
n8045.4	Install two (2) fiber-optic paths to facilitate relaying between Creek Walker and Edison 138 kV stations.	$0.64	12/22/2023
n8048.1	Upgrade the line relaying equipment at Robinson substation to prevent islanding.	$0.64	12/31/2021
n8048.2	Upgrade the line relaying equipment at Washington Courthouse substation to prevent islanding.	$0.40	12/31/2021
n8049	Build a new 115 kV solar farm to interconnect into the Suffolk station project AE2-104; provides for the construction of one new 115 kV interconnect into Suffolk substation. The objective of this project is to add one new line position and one new 115 kV breaker installed at Suffolk substation to support the new 49 MW solar farm built by Switchgrass Solar I, LLC. Additional modifications will be required to accommodate this additional infrastructure.	$3.35	12/30/2024
n8051	Cut and loop in 13712 transmission line to the AE2-093, 138 kV three-position ring bus substation, occupying two of those positions.	$6.22	12/31/2025
n8058	Modify relay settings.	$0.02	6/1/2020
n8060.1	Replace existing revenue meter CTs at Hardin switch 345 kV station.	$0.24	3/20/2018
n8060.2	Update protective relay settings at the Hardin, East Lima and Gunn Road 345 kV station.	$0.12	3/20/2018
n8061.1	Install fiber from Bartonville substation to backbone for relaying communications transport.	$0.25	11/15/2022
n8061.2	Loop the Bartonville-Meadow Brook 138 kV into the new Long Creek substation.	$1.21	11/15/2022
n8061.3	Install new structure per the Bartonville-Meadow Brook 138 kV line estimate.	$0.52	11/15/2022

Upgrade ID	Description	Cost ($M)	Required In-Service Date
n8061.4	Retune single-frequency line trap and replace line tuner on Stephenson line.	$0.23	11/15/2022
n8061.5	Retune single-frequency line trap and replace line tuner for Bartonville and Stonewall lines.	$0.49	11/15/2022
n8061.6	Replace line relaying, modify nameplates and drawings for line name change.	$0.36	11/15/2022
n8061.7	Replace line relying, retune single frequency line trap and replace line tuner on Stephenson line.	$0.53	11/15/2022
n8061.8	Interconnection customer will construct a new three-breaker ring bus substation along the Bartonville-Meadow Brook 138 kV transmission line to electrically interconnect the customer facility with the transmission system.	$0.67	11/15/2022
n8064.1	Review protection relay settings at the Flatlick 765 kV station.	$0.05	3/31/2020
n8067.1	Update protective relay settings at the Hardin, East Lima and Gunn Road 345 kV station.	$0.12	3/20/2018
n8068.1	Update protective relay settings at the Hardin, East Lima and Gunn Road 345 kV station.	$0.12	3/21/2019
n8070.1	Rearrange line No. 2034 to loop into and out of the new three-breaker AD1-022/023 230 kV switching station.	$1.42	6/1/2019
n8070.2	Perform remote protection and communication work. Additional protection and communication work to be required at Cashie, Earleys and Trowbridge 230 kV substations.	$3.38	6/1/2019
n8073	Install relaying at Kewanee for the new bay position. Conduct a detailed review of the IC relay settings.	$0.60	12/31/2019
n8082	The Colonial Trail substation was built with four 230 kV circuit breakers in a ring breaker configuration with an ability to expand to a six-breaker ring configuration. The previous projects (AB2-134 and AC1-216) have connected two solar generation to this substation. This project (AD1-025) will install a fifth 230 kV circuit breaker to accommodate a third generator interconnection point.	$0.56	9/30/2019
n8090.1	Install one (1) new 138 kV circuit breaker, one (1) new box bay, one (1) new line connection; update remote end protective relay settings at the Valley 138 kV station.	$0.91	12/1/2022
n8090.2	Install six (6) structures, seven (7) spans of conductor in the existing Hartford-Valley 138 kV right of way.	$1.11	12/1/2022
n8090.3	Expand the Valley 138 kV station yard, fence and control house.	$0.47	12/1/2022
n8092	Replace protective relays, wave trap and CCVT at Highland 69 kV station.	$0.53	9/1/2019
n8099	Perform fiber installation to Wilmington and Martinsville tap.	$0.85	9/1/2019
n8103.1	Build a three-breaker AE1-103 115 kV switching station. The objective of this project is to build a 115 kV, three-breaker ring bus to support the new 40 MW solar farm built by Aquasan Network Inc. The site is located along Dominion Energy's existing 115 kV line 68 from Holland substation to Union Camp substation. The cut line will consume two of the positions in the ring bus. The third position will be for the 115	$5.94	6/25/2024

Upgrade ID	Description	Cost ($M)	Required In-Service Date
	kV feed from Aquasan Network Inc. collector station for the new 40 MW solar farm.		
n8103.2	Perform remote protection and communication work.	$0.34	6/25/2024
n8103.3	Rearrange line No. 68 to loop into and out of the new three-breaker AE1-103 115 kV switching station. Project AE1-103 will tap into Dominion's line No. 68 between Holland and Union Camp substations. The new substation will be located off the main line between structures 68/98 and 68/99 in Isle of Wight County, Virginia.	$2.40	6/25/2024
n8104.1	Build a new three (3) circuit breaker 138 kV station, Snowhill, physically configured in a breaker-and-a-half bus arrangement but operated as a ring bus.	$6.54	12/1/2021
n8104.2	Connect Snowhill 138 kV station to existing transmission circuit; update remote end protective relay settings.	$0.81	12/1/2021
n8104.3	Replace protective relays at Strawton 138 kV station.	$0.20	12/1/2021
n8104.4	Install two (2) fiber-optic paths to facilitate relaying between Snowhill, Deer Creek and Strawton 138 kV stations.	$0.24	12/1/2021
n8109.1	Build a three-breaker 115 kV switching station.	$5.46	2/28/2025
n8109.2	Rearrange line No. 98 to loop into and out of the new three-breaker 115 kV switching station.	$1.80	2/28/2025
n8109.3	Perform remote station work at Lunenburg 115 kV substation.	$0.14	2/28/2025
n8109.4	Perform remote station work at Butcher Creek 115 kV substation.	$0.02	2/28/2025
n8116.1	Install one new 230 kV interconnect at Harmony Village station.	$3.83	4/1/2025
n8116.2	Relocate existing 230 kV Lanexa line 2016.	$2.61	4/1/2025
n8116.3	Perform remote station work at Lanexa 230 kV substation.	$0.09	4/1/2025
n8117.1	Build a three-breaker AE2-27 115 kV switching station. The objective of this project is to build a 115 kV, three-breaker ring bus to support the new 120 MW solar farm built by Torch Clean Energy. The site is located along Dominion Energy's existing 115 kV, 100 line from Locks substation to Chesterfield 115 kV substation. The cut line will consume two of the positions in the ring bus. The third position will be for the 115 kV feed from Torch Clean Energy Collector station for the new 120 MW solar farm.	$6.79	12/1/2022
n8117.2	Perform remote protection and communication work.	$1.40	12/1/2022
n8117.3	Rearrange line No. 100 to loop into and out of the new three-breaker AE2-027 115 kV switching station. The following estimate is for the construction of a new substation connection on transmission line 100 between Harrowgate substation and Locks substation. The line connection will require the installation of two (2) backbone structures, two (2) static pole structures, and two (2) DDE H-frame structures.	$0.68	12/1/2022

Upgrade ID	Description	Cost ($M)	Required In-Service Date
n8120.1	Build a new three (3) circuit breaker 230 kV station, Firefly 230 kV station, physically configured and operated as a ring bus.	$7.10	6/1/2020
n8120.2	Install TLine cut-in and dead-end structure.	$1.51	6/1/2020
n8120.3	Remove remote end tie line metering.	$0.04	6/1/2020
n8120.4	Install 230 kV Duke tie line meter.	$0.40	6/1/2020
n8120.5	Update relay settings, engineering drawings, equipment labels at Roxboro (DEP) 230 kV station.	$0.12	6/1/2020
n8123.1	AE2-019 provides for the initial construction of one new 230 kV interconnect into New Road substation. To facilitate the addition of the attachment facility for the new 230 kV line, the 230 kV bus No. 1 will need to be partially relocated at the point of interconnect. Also, to keep the station design standard, with the addition of the interconnect, a 230 kV motor-operated disconnect switch will need to be added on the high side of transformer No. 1. In addition to the MOAB, three-phase CCVTs on 115 kV bus No. 1, a single-phase CCVT on 230 kV bus No. 1, and a single-phase CCVT on 230 kV bus No. 2 will be installed.	$2.55	11/30/2020
n8123.2	Perform remote protection and communication work.	$0.08	11/30/2020
n8127.1	Engineering oversight of proposed Riverstone 138 kV station for AE1-108 interconnection.	$0.47	9/12/2018
n8127.2	Perform Bremo-Scottsville 138 kV T-Line cut-in and fiber installation.	$0.55	9/12/2018
n8127.3	Upgrade line protection and controls at the Scottsville 138 kV station.	$0.04	9/12/2018
n8127.4	Install 138 kV extension line from Bremo-Scottsville 138 kV circuit tap to the proposed Riverstone 138 kV station.	$1.25	9/12/2018
n8130.1	Install 138 kV revenue meter, generator lead transmission line span from the new Rocky Ford 138 kV station to the point of interconnection, and extend dual fiber-optic from the point of interconnection to the new 138 kV station control house.	$0.98	9/24/2018
n8130.2	Install new 138 kV three-breaker ring bus station along the Ebersole-Fostoria Central No. 2 138 kV line; install associated protection and control equipment, line risers, switches, jumpers, and supervisory control and data acquisition (SCADA) equipment.	$6.16	9/24/2018
n8130.3	Cut in Ebersole-Fostoria Central No. 2 138 kV T-line.	$0.84	9/24/2018
n8130.4	Replace protective relays at Ebersole and Fostoria Central 138 kV stations.	$0.38	9/24/2018
n8130.5	Install two (2) fiber-optic paths to facilitate relaying between Rocky Ford, Ebersole and Fostoria Central 138 kV stations.	$0.24	9/24/2018
n8131.1	Complete DANV-COLU 2 line modifications to tie in the new AE2-110 attachment facilities. This includes connecting the conductors and OPGW from the MILT-MVIL line to the new tap structure. Install (1) MOLBAB just north of the AE2-110 tap point.	$0.28	12/31/2021

Upgrade ID	Description	Cost ($M)	Required In-Service Date
n8131.2	Rearrange line No. 2199 to loop into and out of the new three-breaker AE1-153 230 kV switching station. Project AE1-153 will tap into Dominion's line No. 2199 between Remington and Gordonsville substations between transmission structures 2199/144 and 2199/145. The transmission line shall connect to the substation within the existing line right of way. Installation of the substation shall require the line to be renumbered from the new substation to Remington substation. The existing line segment between the new substation to Gordonsville substation shall remain line 2199.	$0.14	12/31/2021
n8133.1	Relay settings need to be updated at TSS 951 Aurora Energy Center L95102. Connect new meters into the SCADA system at TSS 951 Aurora Energy Center.	$0.29	6/1/2024
n8133.2	Relay settings need to be updated at TSS 144 Wayne L14403.	$0.23	6/1/2024
n8133.3	Relay settings need to be updated at TSS 111 Electric Junction L11103.	$0.22	6/1/2024
n8135	Review relay settings and change the carrier frequency at the Greene 345 kV station.	$0.02	6/1/2022
n8136	Review relay settings and change the carrier frequency at the Madison 345 kV station.	$0.02	6/1/2022
n8143	Perform design, procurement and construction to expand 138 kV ESS H-445 Twombly Road substation.	$12.30	12/15/2018
n8150	Expand the Circleville 138 kV station, including the addition of one (1) 138 kV circuit breaker, installation of associated protection and control equipment, line risers, switches, jumpers, a 16' x 12' expansion DICM, and supervisory control and data acquisition (SCADA) equipment.	$1.55	1/31/2017
n8165.1	Modifications to the Acahela-Jackson 69 kV line to tie in the AE2-175 attachment facilities.	$0.10	10/31/2021
n8165.2	Perform relay modifications and remote end work.	$0.14	10/31/2021
n8165.3	Perform relay modifications and remote end work.	$0.14	10/31/2021
n8167.1	Rearrange line No. 2056 to loop into and out of the new three-breaker AD1-056/AD1-057 230 kV switching station.	$1.71	8/14/2017
n8167.2	Build a three-breaker AD1-056/AD1-057 230 kV switching station.	$7.19	8/14/2017
n8167.3	Perform remote protection and communication work at Hathaway 230 kV and Hornertown 230 kV substations.	$0.07	8/14/2017
n8169.1	Construct Millikan 138 kV station. Install associated line protection and control equipment, line risers, switches, jumpers and SCADA at the Millikan 138 kV station.	$6.49	12/31/2022
n8169.2	Install two (2) structures, two (2) spans of conductor; connect Millikan 138 kV station to existing transmission circuit; update remote end protective relay settings.	$0.76	12/31/2022
n8169.3	Install two (2) fiber-optic paths to facilitate relaying between Millikan, Kenzie Creek and Colby tap 138 kV stations.	$0.20	12/31/2022
n8170.1	Construct Fritts 138 kV three-breaker station, associated line protection and control equipment, line risers, switches, jumpers and SCADA at the proposed Fritts 138 kV station.	$5.53	12/31/2022

Upgrade ID	Description	Cost ($M)	Required In-Service Date
n8170.2	Install two (2) structures, two (2) spans of conductor; connect Fritts 138 kV station to existing transmission circuit; update remote end protective relay settings at Deer Creek 138 kV station.	$0.64	12/31/2022
n8170.3	Install two (2) fiber-optic paths to facilitate ICON relaying between Fritts and Gaston 138 kV stations.	$0.29	12/31/2022
n8170.4	Replace protective relays at Gaston 138 kV station.	$0.28	12/31/2022
n8176.1	Install one (1) new 345 kV circuit breaker and associated equipment; update protective relay settings; and install jumpers for Sorenson & Tanners Creek 345 kV line reterminations.	$2.18	10/31/2021
n8176.2	Reterminate the Desoto-Tanners Creek and Desoto-Sorenson 345 kV circuits in the Desoto 345 kV "B" string.	$0.50	10/31/2021
n8177.1	Install new 138 kV three-breaker ring bus station along the East Leipsic-Richland 138 kV line. Install a Drop-In Control Module (DICM) and other associated line protection and control equipment, line risers, switches, jumpers, and supervisory control and data acquisition (SCADA) equipment.	$5.90	12/31/2021
n8177.2	Perform final connection of the East Leipsic-Richland 138 kV to the Lammer 138 kV station, and update protective relay settings at East Leipsic 138 kV station.	$0.70	12/31/2021
n8177.3	Install one (1) fiber-optic path to facilitate relaying between Lammer, East Leipsic, and Yellow Creek 138 kV stations.	$0.77	12/31/2021
n8177.4	Update protective relays settings at Richland 138 kV station.	$0.00	12/31/2021
n8178.1	Install new 138 kV three-breaker ring bus station along the Axton-Danville No. 1 138 kV line. Install a Drop-In Control Module (DICM) and other associated line protection and control equipment, line risers, switches, jumpers, and supervisory control and data acquisition (SCADA) equipment.	$4.70	5/31/2022
n8178.2	Perform final connection of the Axton-Danville No. 1 138 kV line to the Lendlease 138 kV station; update remote end protective relay settings.	$1.26	12/31/2021
n8178.3	Install one (1) fiber-optic path to facilitate relaying between Lendlease and Axton 138 kV stations.	$0.76	12/31/2021
n8178.4	Replace protective relays.	$0.24	12/31/2021
n8178.5	Extend two (2) new fiber-optic connections from the AE2-140 proposed Lendlease 138 kV station into AEP's existing fiber-optic network to facilitate SCADA network connectivity.	$0.18	12/31/2021
n8179	Install one (1) new 138 kV circuit breaker and associated equipment, and update protective relay settings at the Cole 345 kV station.	$1.56	12/31/2021
n8181.1	Complete COLU-SCOT line modifications to tie in the new AE2-241 attachment facilities. This includes replacing existing structure (grid # 34537N30614) with a new high pole of a high-low tap structure with a foundation and reframe/modify existing structures on each side of the new tap structure if required.	$0.05	3/5/2021
n8181.2	Perform relay modifications and remote end work.	$0.11	3/5/2021
n8186	Update protective relay settings at Fritts 138 kV station.	$0.05	12/31/2022

Upgrade ID	Description	Cost ($M)	Required In-Service Date
n8189.1	Construct new 345 kV TSS 918 Dana substation with three 345 kV circuit breakers arranged in breaker-and-a-half configuration.	$31.27	12/31/2021
n8189.2	Upgrade existing System 1 and System 2 line protection for 345 kV L0303.	$0.59	12/31/2021
n8189.3	Upgrade existing System 1 and System 2 line protection for 345 kV L91815, formerly L0303.	$0.38	12/31/2021
n8189.4	Transmission line cut in: install new line facilities required to connect 345 kV L0303 and 345 kV L91815 into TSS 918 Dana substation.	$9.79	12/31/2021
n8189.5	Install diverse fiber paths from TSS 918 Dana to TSS 908 Mole Creek and from TSS 918 Dana to TSS 98 Nevada.	$4.55	12/31/2021
n8189.6	Install one fiber cable to station 3 Powerton.	$30.58	12/31/2021
n8190	Rearrange lines 167, 168 and 2126 and reroute lines 25 and 1020 at Trowbridge substation and route developer transmission line into Trowbridge substation.	$3.17	6/1/2020
n8195.1	Oversee self-build of TSS 905 Essex construction.	$3.46	9/30/2020
n8195.2	Cut in tap into TSS 905 at Essex transmission line (L2002, L11212).	$20.14	9/30/2020
n8195.3	Perform design, procurement and construction to upgrade existing System 1 and System 2 line protection for 345 kV L90505.	$0.83	9/30/2020
n8195.4	Perform design, procurement and construction to upgrade existing System 1 and System 2 line protection for 345 kV L2002.	$0.83	9/30/2020
n8195.5	Perform design, procurement and construction to upgrade existing System 1 and System 2 line protection for 345 kV L90506.	$0.83	9/30/2020
n8195.6	Perform design, procurement and construction to install a new fiber path between TSS 905 Essex and STA. 20 Braidwood.	$3.14	9/30/2020
n8195.7	Perform design, procurement and construction to install a new fiber path between TSS 905 Essex and TSS 86 Davis Creek.	$8.83	9/30/2020
n8195.8	Perform design, procurement and construction to install a new fiber path between TSS 905 Essex and TSS 93 Loretto.	$10.81	9/30/2020
n8200.1	Construct a new three (3) circuit breaker 69 kV station physically configured and operated as a ring bus.	$3.78	12/15/2021
n8200.2	Install three (3) dead-end structures, four (4) spans of conductor; connect point of interconnection station to existing transmission circuit; update remote end relay settings.	$1.29	12/15/2021
n8202	Increase the maximum operating temperature of the 266 MCM ACSR conductor in the McKinney Corner tap-Knob Lick 69 kV line section to 212 degrees F (12.53 miles).	$0.72	4/30/2024
n8212.1	Expand the Stockton 138 kV station into a four-breaker ring bus arrangement.	$7.14	12/31/2022
n8212.2	Perform transmission line work at Axton-Martinsville; Martinsville remote end settings.	$0.45	12/31/2022
n8212.3	Install a new ICON at the Axton 138 kV station with connectivity to the Stockton 138 kV station. Replace the existing relays at the Axton 138 kV station.	$0.25	12/31/2022
n8212.4	Install Stockton 138 kV circuit switcher.	$0.20	12/31/2022

Upgrade ID	Description	Cost ($M)	Required In-Service Date
n8214.1	Cut and loop the L7423 138 kV line into the new TSS 922 Kentville Rd. interconnection substation.	$1.91	12/31/2019
n8214.2	Install dual 87L/SEL-411L current differential scheme via direct fiber. Upgrade L7423 circuit breaker from 25/SEL-279H and 50/2BF SEL-251C to 50BF/25/79 SEL-451. Install SEL-3350 RTAC with redundant RST-2228 switch architecture (Master, Master Aux A/B, Aux A/B switches). Install SEL-3620 port servers as needed for IED that must be connected serially over the available 3350 RTAC ports. Remove any PLC equipment on L7423 including wave trap, line tuner etc.	$1.91	12/31/2019
n8214.3	Construct a new breaker-and-a-half substation, 138 kV TSS 922 Kentville Rd., approximately 0.13 miles south of existing TSS74 Kewanee, which will interconnect via existing 138 kV L7423.	$20.33	12/31/2019
n8214.4	Perform relaying coordination and oversight.	$0.03	12/31/2019
n8214.5	Line 7423 138 kV will require two single-mode fiber paths from TSS 74 Kewanee to TSS 922 Kentville Rd., approximately 0.4 miles. These will be used for 138 kV L7423 System 1 and System 2 relay scheme using direct-on-fiber connections. At least one of these two fiber paths will need to be built per ESP 5.8.1 and 5.8.2 to determine the fiber count and construction. The second single-mode fiber path will require a minimum of 48 fibers. Both of these cables will be owned and maintained by ComEd. These fibers must be built in physically diverse paths from each other. Fiber paths are assumed to be installed underground for an approximate distance of 1000' per fiber path. Fiber count and construction for this fiber path will be determined by ComEd standards.	$1.10	12/31/2019
n8215.1	Construct new three-breaker 138 kV station in a breaker-and-a-half configuration.	$6.47	10/31/2022
n8215.2	Install two (2) structures, two (2) spans of conductor; connect proposed 138 kV station to existing transmission circuit; update remote end protective relay settings at Bluff Point 138 kV station.	$0.88	10/31/2022
n8215.3	Install two (2) fiber-optic paths to facilitate relaying between the Randolph and Proposed 138 kV stations.	$1.20	10/31/2022
n8215.4	Replace protective relays; install ICON at Randolph 138 kV station.	$0.19	10/31/2022
n8222.1	Build new control house and all associated communications and relaying for reconfiguration at Cardiff 230 kV substation.	$25.00	12/1/2029
n8223	Expand existing TSS 86 Davis Creek substation.	$0.68	9/30/2020
n8226.1	Rearrange line No. 15 to loop into and out of the new three-breaker AE1-149 115 kV switching station.	$1.38	12/1/2021
n8226.2	Build a three-breaker AE1-149 115 kV switching station.	$7.04	12/1/2021
n8226.3	Perform remote protection and communication work.	$0.64	12/1/2021
n8232	Install diverse UG/ADSS fiber-optic cable path.	$0.37	11/1/2020
n8233	Add addition at Morgans Cut station circuit breaker and perform associated work.	$1.26	11/1/2020

Upgrade ID	Description	Cost ($M)	Required In-Service Date
n8258.1	Rearrange line No. 91 to loop into and out of the new three-breaker AE2-092 230 kV switching station.	$2.51	3/1/2022
n8258.2	Perform remote protection and communication work.	$0.59	3/1/2022
n8258.3	Build a three-breaker AE2-092 230 kV switching station.	$1.06	3/1/2022
n8310	Replace the equipment for the 2310 line termination at New Freedom switching station including A-frame structure, line disconnect switch, relays and associated equipment.	$2.73	6/1/2029
n8315	Install harmonic measurement equipment and collect data for a harmonic study. Provide data and report to interconnection customer and PJM.	$0.30	6/1/2029
n8329.1	Build a new ring bus three-breaker-and-a-half configuration.	$20.68	9/1/2020
n8329.2	Cut and loop L7713 138 kV line to new sub.	$4.07	9/1/2020
n8329.3	Modify relay settings based on the new line topology.	$0.03	9/1/2020
n8329.4	Modify relay settings based on the new line topology.	$0.49	9/1/2020
n8329.5	Install fiber cable in existing right of way.	$2.65	9/1/2020
n8333	Mitigate overvoltage condition at fault clearing at AD1-031.	$0.00	6/15/2027
n8341.1	Modify the Mifflintown tap 69 kV line to tie in the AF2-361 attachment facilities.	$0.10	12/31/2022
n8341.2	Perform relay modifications scope of work at Juniata substation.	$0.24	12/31/2022
n8341.3	Perform relay modifications scope of work at Dauphin substation.	$0.24	12/31/2022
n8342	Install harmonic measurement equipment and collect data for a harmonic study. Provide data and report to interconnection customer and PJM.	$0.40	12/31/2024
n8351.1	Modify the Millville tap 69 kV line to tie in the AF1-226 attachment facilities.	$0.28	3/5/2021
n8351.2	Perform relay modification work for IC and remote end.	$0.14	3/5/2021
n8362.1	New 345 kV, TSS 964 Clear Creek substation to accommodate AD2-100 and AD2-131.	$32.00	12/31/2021
n8362.2	Modify the Kincaid-Pana 345 kV transmission line to tie in the interconnection substation.	$6.50	12/31/2021
n8362.3	Perform relay and fiber upgrades to STA 21 Kincaid.	$0.80	12/31/2021
n8362.4	ComEd coordination with Ameren for relay and fiber upgrades to Ameren's Pana substation.	$0.70	12/31/2021
n8362.5	Install two physically diverse 48-count single-mode fiber cables per ComEd standards from TSS 964 Clear Creek substation to STA 21 Kincaid.	$107.80	12/31/2021
n8362.6	Install two physically diverse 48-count single-mode fiber cables per ComEd standards from TSS 964 Clear Creek substation to Ameren's Pana substation.	$41.30	12/31/2021
n8372.1	Transmission Line (L0303) Cut-in for AE1-163 interconnection. Tap into TSS 915 Dee Mac Road.	$11.12	11/30/2021
n8372.2	Upgrade existing System 1 and System 2 line protection for existing L9150.	$0.38	11/30/2021
n8372.3	Install one (1) 48-count single-mode fiber cable and upgrade existing System 1 and System 2 line protection for existing L0303.	$0.61	11/30/2021

Upgrade ID	Description	Cost ($M)	Required In-Service Date
n8372.4	Perform fiber installation between TSS915 Dee Mac Rd. and existing ComEd facilities.	$0.17	11/30/2021
n8434.2	Install one new bay box, expand the control house, and reterminate the existing 138/12 kV transformer. Install associated line protection and control equipment, line risers, switches, jumpers and SCADA.	$0.77	6/30/2021
n8442.3	Review relay settings at Chester substation.	$0.08	12/17/2021
n8442.4	Review relay settings at Pohatcong Mountain.	$0.08	12/17/2021