



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

PJM Staff White Paper

PJM Interconnection
July 2023

For Public Use

This page is intentionally left blank

Contents

I.	Executive Summary	1
II.	Baseline Project Recommendations	1
III.	Baseline Reliability Projects Summary	1
	A. APS, BGE, PECO & PEPCO Transmission Zones	1
	B. Baseline Reliability Project Details	2
IV.	Changes to Previously Approved Projects	5
	Scope/Cost Changes	5
	Cancellations	6
V.	Review by the Transmission Expansion Advisory Committee (TEAC)	6
VI.	Cost Allocation	6
VII.	Board Approval	7
	Attachment A – Reliability Project Single-Zone Allocations	8
	Attachment B – Reliability Project Multi-Zone Allocations	9
	Attachment C – Multi-Driver Project Cost Allocation	14

I. Executive Summary

On April 4, 2023, the PJM Board of Managers approved changes to the Regional Transmission Expansion Plan (RTEP), totaling a net decrease of \$85.45 million for baseline projects, to resolve baseline reliability criteria violations and address changes to existing projects.

Since then, PJM has identified new baseline reliability criteria violations, and the transmission system enhancements needed to solve them, at an estimated cost of \$795.61 million. Scope changes to an existing project will result in a net increase of \$134.1 million. Cancellation to an existing project will result in a net decrease of \$4.69 million. This yields an overall RTEP net increase of \$925.02 million, for which PJM recommended Board approval. With these changes, RTEP projects will total approximately \$43,034.13 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 July 12, 2023, 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 solve 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. 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). 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. Also included is a scope change to the first Multi-Driver Project PJM determined to address reliability and market efficiency needs.

A. APS, BGE, PECO & PEPCO Transmission Zones

- Baseline Projects b3780 & b3781 – Brandon Shores Generation Deactivation Reinforcements: \$785.8 million

PJM also recommended regional baseline projects totaling \$9.81 million, whose individual cost estimates are less than \$10 million. The projects include, but are not limited to, modification to existing lines, installation of new 230 kV lines, and necessary substation work associated with the deactivation of Sammis 5, 6 and 7 units.

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

B. Baseline Reliability Project Details

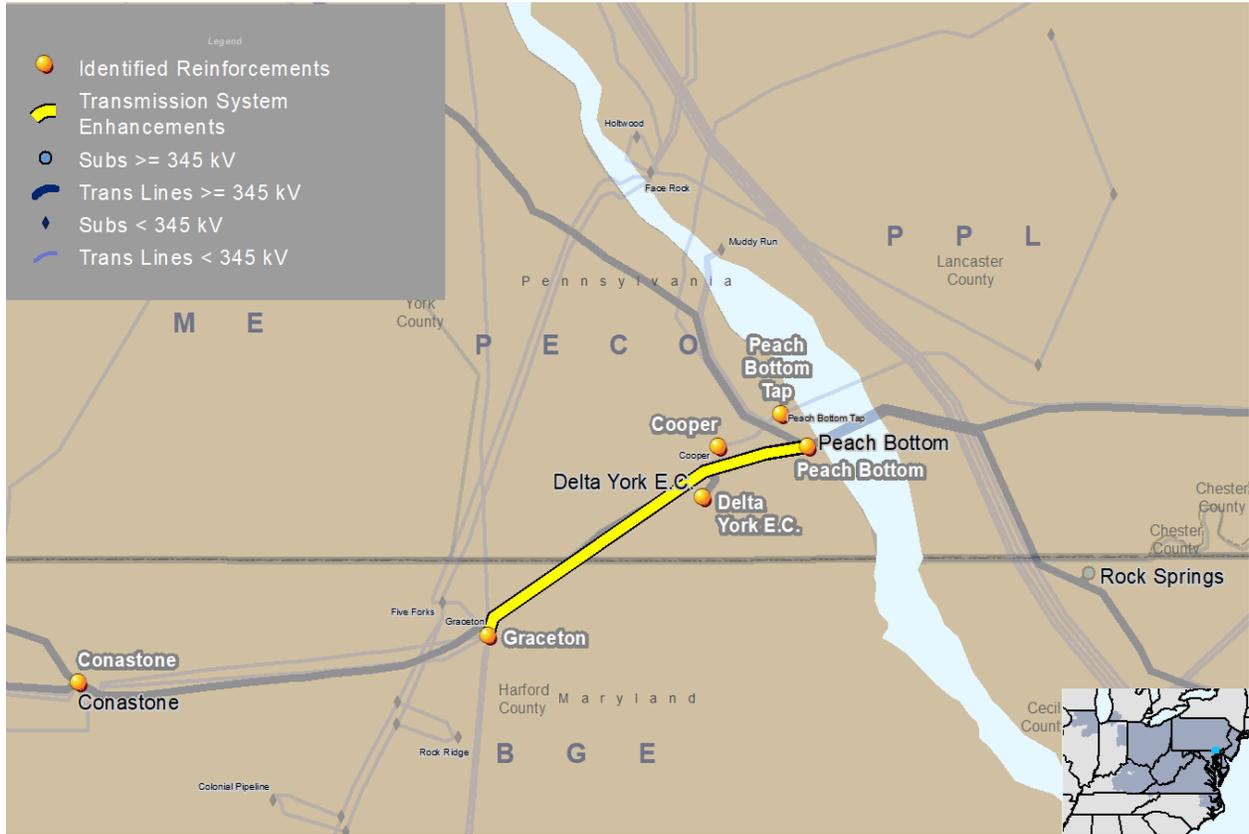
Baseline Project b3780 & b3781 – Brandon Shores Generation Deactivation Reinforcements

APS/BGE/PECO/PEPCO Transmission Zones

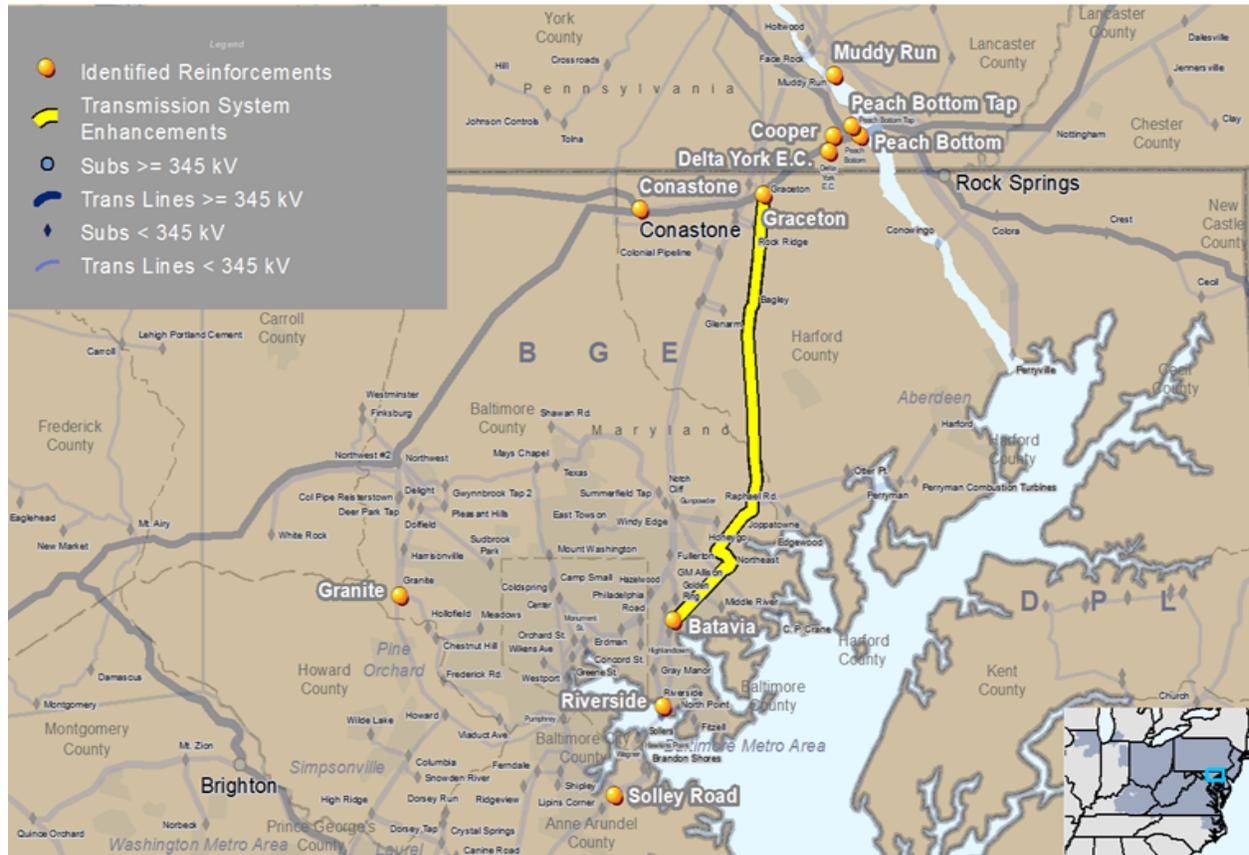
Brandon Shores 1 and 2 are coal units in the BGE zone with a total of approximately 1,282 MW capacity, and have requested to deactivate on June 1, 2025. The deactivation of these units will cause widespread voltage violations in neighboring areas (PEPCO, ME, PPL, PECO, APS and Dominion). The deactivation also results in thermal violations for the following facilities:

- BGE Transmission Zone
 - Five Rock-Rock Ridge 1 115 kV
 - Five Rock-Rock Ridge 2 115 kV
 - Rock Ridge-Colonial Pipeline 1 115 kV
 - Rock Ridge-Colonial Pipeline 2 115 kV
 - Colonial Pipeline-Glenarm 1 115 kV
 - Colonial Pipeline-Glenarm 2 115 kV
 - Chestnut Hill 7-Frederick Road 7 115 kV
 - Chestnut Hill 8-Frederick Road 8 115 kV
- APS Transmission Zone
 - Doubs Transformer 3 500/230 kV
 - Bethel-Riverton 138 kV
- PEPCO Transmission Zone
 - Dickerson-Dickerson H 230 kV

Map 1. b3780.1-4, .8, .10-12: Brandon Shores Generation Deactivation 500 kV Reinforcements



Map 2. b3780.5-7, .9, .13 & b3781: Brandon Shores Generation Deactivation 230 kV Reinforcements



500 kV Reinforcements

The recommended solution includes upgrades at Peach Bottom North substation to add three 500 kV breakers to form a breaker-and-a-half bay; construction of a new Peach Bottom-Graceton 500 kV line; construction of new West Cooper 500 kV and expansion of Graceton 500 kV substations; and installations of a 350 MVAR capacitor at Conastone 500 kV, a 350 MVAR statcom and a 350 MVAR capacitor at Brighton 500 kV, and a 250 MVAR capacitor at Burchess Hill 500 kV. The estimated cost for the 500 kV reinforcements is \$333 million. This project is an immediate-need project and has a projected in-service date of December 2028. The local transmission owners, BGE, PECO and PEPCO, will be designated to complete this work.

230 kV Reinforcements

The recommended solution includes the construction of new Solley Road and Granite 230 kV substations, each with 350 MVAR statcoms, construction of a new Batavia Road 230 kV substation, and construction of a Graceton-Batavia Road 230 kV double circuit line. The existing double circuit line from Northeast-Riverside 230 kV will tie into the new Batavia Road 230 kV substation, and the Batavia Road-Riverside 230 kV will be reconducted. The project will also replace 230 kV line drops to Doubs transformer No. 3. The estimated cost for the 230 kV reinforcements is \$452.8 million. This project is an immediate-need project, and the majority of the components have a projected in-service date of December 2028. The local transmission owners, APS and BGE, will be designated accordingly to complete this work.

IV. Changes to Previously Approved Projects

Scope/Cost Changes

The following scope/cost modifications were recommended:

State Agreement Approach (SAA)

MOAD's Project Scope

- Baseline project b3737.22 has undergone a scope/cost increase. Constructing the Larrabee Collector station AC switchyard, and procuring and preparing land adjacent to the AC switchyard, resulted in cost increase of \$72.2 million. Additional cost and scope for the MOAD pre-build infrastructure evaluation study increases the cost by \$0.29 million.

JCPL Transmission Zone Additional Scope

- The following additional scope is required to accommodate the new 500/230 kV lines:
 - Baseline project b3737.53 requires removing approximately 7.7 miles of existing E83 line along the Larrabee-Smithburg ROW that is not in service. This results in a cost increase of \$8.47 million.
 - Baseline project b3737.54 will remove the existing H2008 Larrabee-Smithburg No. 2 230 kV transmission line. This results in a cost increase of \$8.47 million.
- Baseline b3737.55 at Middlesex 230 kV substation replaces a 2000A circuit switcher at Middlesex Switch point for the Lake Nelson I 1023 230 kV. This results in a cost increase of \$0.53 million.

PECO Transmission Zone Scope Update

- Baseline project b3737.51 that replaces four 63 kA circuit breakers with 80 kA is no longer needed due to a case correction, resulting in a cost decrease of \$5.6 million.
- Additional cost increases not impacting the New Jersey SAA project's scope of work were also reported, totaling an increase of \$42.98 million.
- The net cost increase for the New Jersey SAA project is \$127.34 million.

Multi-Driver Project

AEP Transmission Zone Modified Solution

- Baseline project b3775.6 includes sag study mitigation work on the Dumont-Stillwell 345 kV line. More detailed engineering costs were provided for this scope of work, and the description is being modified to clarify two structure replacements and modification to a third structure. Baseline project b3775.7, which upgrades the limiting element at the Stillwell or Dumont substation to increase the rating of the Stillwell-Dumont 345 kV line to match the conductor rating, included AEP and NIPSCO project components. The Stillwell (NIPSCO) scope of work was separated out into a separate new sub-ID b3775.11. The total estimated cost increase for the multi-driver project is \$3.78 million.

Reliability Projects

DL Transmission Zone

- Baseline b3717 included project scope required for the deactivation of the Cheswick 1 unit. Cheswick 1 deactivated on March 31, 2022. FirstEnergy recently informed PJM of necessary work associated with the existing baseline projects with Duquesne Light. Additional relay and transmission line work (a new transmission structure and necessary tower work to handle the change in tension at Cheswick 138 kV substation) is needed at Springdale 138 kV substation. This results in a cost increase of \$3 million.

PSEG Transmission Zone

- In April 2013, PJM sought proposals to improve operational performance on bulk electric system facilities in the southern New Jersey, Artificial Island area, site of PSE&G's Salem 1 and 2 and Hope Creek 1 nuclear generating units. Based on the latest study, PJM Planning and PJM Ops determined that the tap setting changes for Salem and Hope Creek units' step-up transformers are no longer required. This results in a cost decrease of \$0.02 million.
- All of the scope/cost changes described in this section yield a net RTEP increase of \$134.1 million.

Cancellations

The following cancellation was recommended:

- Baseline project b3305 (replacement of Pumphrey 230/115 kV transformer) is no longer needed based on a retool analysis performed by PJM. The project had an estimated cost of \$4.69 million.

This change yields a net RTEP decrease of \$4.69 million.

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

Project needs and recommended solutions as discussed in this report were reviewed with stakeholders during 2023, most recently at the June 2023 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.

VI. 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 Multi-Driver Project).

Cost allocations are 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 no later than 30 days following approval by the Board.

VII. 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 to recommend to the full Board for approval the new projects and changes to the existing RTEP projects as detailed in this white paper. On July 12, 2023, the Board approved the addition of RTEP baseline projects as well as other changes to the RTEP as summarized in this paper. The RTEP is published annually on PJM's website.

Attachment A – Reliability Project Single-Zone Allocations

Upgrade ID	Description	Cost Estimate (\$M)	TO	Cost Responsibility	Required In-Service Date
b3717.3	Relay work at Springdale 138 kV	\$1	APS	APS	12/31/2024
b3717.4	Transmission line work – a new transmission structure and necessary tower work to handle the change in tension at Cheswick 138 kV	\$2	APS	APS	1/1/2025
b3777	Disconnect and remove three 345 kV breakers, foundations and associated equipment from Sammis substation. Remove nine 345 kV CVTs. Remove two 345 kV disconnect switches. Install new 345 kV bus work and foundations. Install new fencing. Remove and adjust relaying at Sammis substation.	\$2.10	ATSI	ATSI	6/1/2023
b3779	Cut existing 230 kV line #2183 and extend from Poland Road substation to Evergreen Mills substation. Approximately 0.59 miles of new line will be built from the cut-in to the Evergreen Mills substation. Cut and extend the existing 230 kV line #2183 creating a new line #2210 from Brambleton substation to be terminated at Evergreen Mills substation. Approximately 0.59 miles of new line will be built from the cut-in to the Evergreen Mills substation.	\$7.71	Dominion	Dominion	6/1/2027
b3780.5	Build Solley Road substation + Statcom. New STATCOM rating: 350 MVAR Add 4x 230 kV breakers bays.	\$109	BGE	BGE	12/31/2028
b3780.6	Build Granite substation + Statcom. New STATCOM rating: 350 MVAR Add 4x 230 kV breaker bays.	\$91	BGE	BGE	12/31/2028
b3780.7	Build Batavia Road substation. Add 4x 230 kV breaker bays.	\$36	BGE	BGE	12/31/2028
b3780.9	Graceton to Batavia Road 230 kV double circuit pole line New rating: 1331 MVA SN/ 1594 MVA SE	\$195	BGE	BGE	12/31/2028
b3781	Replace line drops to Doubs transformer 3. New transformer rating: 721MVA SN /862 MVA SE	\$0.80	APS	APS	12/31/2025

Attachment B – Reliability Project Multi-Zone Allocations

Note: The cost allocation for project b3737 (New Jersey SAA project) will be in accordance with OATT Schedule 12 Appendix C.

Upgrade ID	Description	Cost Estimate (\$M)	TO	Cost Responsibility	Required In-Service Date
b3737.53	Remove the existing E83 line 115 kV (not in-service) to accommodate the new 500 kV/230 kV lines (~ 7.7 miles).	\$8.47	JCPL	AEC (13.55%) / JCPL (31.74%) / PSEG (52.60%) / RE (2.11%)	12/31/2027
b3737.54	Remove the existing H2008 Larrabee-Smithburg No. 2 230 kV to accommodate the new 500 kV/230 kV lines.	\$8.47	JCPL	AEC (13.55%) / JCPL (31.74%) / PSEG (52.60%) / RE (2.11%)	12/31/2027
b3737.55	Middlesex substation 230 kV – Replace the 2000A circuit switcher at Middlesex switch point for the Lake Nelson I1023 230 kV exit.	\$0.53	JCPL	AEC (13.55%) / JCPL (31.74%) / PSEG (52.60%) / RE (2.11%)	6/1/2029
b3737.56	Build a new North Delta-Graceton 230 kV line by rebuilding 6.26 miles of the existing Cooper-Graceton 230 kV line to double circuit. Cooper-Graceton is jointly owned by PECO & BGE. This subproject is for BGE's portion of the line rebuild, which is 2.16 miles.	\$9.92	BGE	AEC (13.55%) / JCPL (31.74%) / PSEG (52.60%) / RE (2.11%)	6/1/2029
b3737.59	Windsor to Clarksville subproject: Upgrade terminal equipment at Windsor 230 kV.	\$1.58	JCPL	AEC (13.55%) / JCPL (31.74%) / PSEG (52.60%) / RE (2.11%)	6/1/2029
b3737.60	Perform a Pre-build Infrastructure evaluation study in alignment with the NJBPU Solicitation Guidance Document requirements.	\$0.29	MAOD	AEC (13.55%) / JCPL (31.74%) / PSEG (52.60%) / RE (2.11%)	6/2/2023

Upgrade ID	Description	Cost Estimate (\$M)	TO	Cost Responsibility	Required In-Service Date
b3780.1	Peach Bottom North upgrades – substation work Add 3x 500 kV breakers to form a breaker-and-a-half bay.	\$33	PECO	Load-Ratio Share Allocation: AEC (1.65%) / AEP (13.68%) / APS(5.76%) / ATSI (8.04%) / BGE(4.11%) / ComEd (13.39%) / Dayton(2.12%) / DEOK (3.25%) / DL(1.71%) / DPL (2.60%) / Dominion(13.32%) / EKPC (1.89%) / JCPL(3.86%) / ME(1.90%) / NEPTUNE*(0.42%) / OVEC (0.08%) / PECO(5.40%) / PENELEC (1.78%) /PEPCO (3.67%) / PPL (4.72%) /PSEG (6.39%) / RE (0.26%) DFAX Allocation: ATSI (0.02%) / BGE (28.40%) / Dominion (33.36%) / DPL (0.02%) / JCPL (6.36%) / Neptune (0.73%) / PECO (0.01%) / PEPCO (17.90%) / PSEG (12.69%) / RE (0.51%)	12/31/2027
b3780.2	Peach Bottom to Graceton (PECO) – New 500 kV transmission line New rating: 4503 MVA SN/ 5022 MVA SE	\$48	PECO	Load-Ratio Share Allocation: AEC (1.65%) / AEP (13.68%) / APS(5.76%) / ATSI (8.04%) / BGE(4.11%) / ComEd (13.39%) / Dayton(2.12%) / DEOK (3.25%) / DL(1.71%) / DPL (2.60%) / Dominion(13.32%) / EKPC (1.89%) / JCPL(3.86%) / ME(1.90%) / NEPTUNE*(0.42%) / OVEC (0.08%) / PECO(5.40%) / PENELEC (1.78%) /PEPCO (3.67%) / PPL (4.72%) /PSEG (6.39%) / RE (0.26%) DFAX Allocation: ATSI (0.02%) / BGE (28.40%) / Dominion (33.36%) / DPL (0.02%) / JCPL (6.36%) / Neptune (0.73%) / PECO (0.01%) / PEPCO (17.90%) / PSEG (12.69%) / RE (0.51%)	12/31/2027

Upgrade ID	Description	Cost Estimate (\$M)	TO	Cost Responsibility	Required In-Service Date
b3780.3	West Cooper substation (3 breaker ring + transformer, control house + substation build, reconfigure Cooper distribution station feed) New transformer rating: 1559 MVA SN/ 1940 MVA SE	\$60	PECO	DPL (41.52%) / PECO (58.48%)	12/31/2028
b3780.4	Peach Bottom to Graceton (BGE) – transmission work New rating: 4503 MVA SN/ 5022 MVA SE	\$17	BGE	Load-Ratio Share Allocation: AEC (1.65%) / AEP (13.68%) / APS(5.76%) / ATSI (8.04%) / BGE(4.11%) / ComEd (13.39%) / Dayton(2.12%) / DEOK (3.25%) / DL(1.71%) / DPL (2.60%) / Dominion(13.32%) / EKPC (1.89%) / JCPL(3.86%) / ME(1.90%) / NEPTUNE*(0.42%) / OVEC (0.08%) / PECO(5.40%) / PENELEC (1.78%) /PEPCO (3.67%) / PPL (4.72%) /PSEG (6.39%) / RE (0.26%) DFAX Allocation: ATSI (0.03%) / BGE (28.40%) / Dominion (33.36%) / DPL (0.02%) / JCPL (6.36%) / Neptune (0.73%) / PEPCO (17.90%) / PSEG (12.69%) / RE (0.51%)	12/31/2028
b3780.8	Graceton 500 kV expansion Add 3x 500 kV breaker bays, 2x 500/230 kV auto transformer, 1x 500 kV caps. New transformer rating: 1559 MVA SN / 1940 MVA SE New capacitor rating: 250 MVAR	\$82	BGE	BGE (81.92%) / PEPCO (18.08%)	12/31/2028

Upgrade ID	Description	Cost Estimate (\$M)	TO	Cost Responsibility	Required In-Service Date
b3780.10	Install new Conastone capacitor. New capacitor rating: 350 MVAR	\$15	BGE	Load-Ratio Share Allocation: AEC (1.65%) / AEP (13.68%) / APS(5.76%) / ATSI (8.04%) / BGE(4.11%) / ComEd (13.39%) / Dayton(2.12%) / DEOK (3.25%) / DL(1.71%) / DPL (2.60%) / Dominion(13.32%) / EKPC (1.89%) / JCPL(3.86%) / ME(1.90%) / NEPTUNE*(0.42%) / OVEC (0.08%) / PECO(5.40%) / PENELEC (1.78%) /PEPCO (3.67%) / PPL (4.72%) /PSEG (6.39%) / RE (0.26%) DFAX Allocation: BGE (100.00%)	12/31/2027
b3780.11	Brighton Statcom and capacitor New STATCOM rating: 350 MVAR New capacitor rating: 350 MVAR	\$63	PEPCO	Load-Ratio Share Allocation: AEC (1.65%) / AEP (13.68%) / APS(5.76%) / ATSI (8.04%) / BGE(4.11%) / ComEd (13.39%) / Dayton(2.12%) / DEOK (3.25%) / DL(1.71%) / DPL (2.60%) / Dominion(13.32%) / EKPC (1.89%) / JCPL(3.86%) / ME(1.90%) / NEPTUNE*(0.42%) / OVEC (0.08%) / PECO(5.40%) / PENELEC (1.78%) /PEPCO (3.67%) / PPL (4.72%) /PSEG (6.39%) / RE (0.26%) DFAX Allocation: PEPCO (100.00%)	12/31/2028

Upgrade ID	Description	Cost Estimate (\$M)	TO	Cost Responsibility	Required In-Service Date
b3780.12	Burchess Hill Cap New capacitor rating: 250 MVAR	\$15	PEPCO	Load-Ratio Share Allocation: AEC (1.65%) / AEP (13.68%) / APS(5.76%) / ATSI (8.04%) / BGE(4.11%) / ComEd (13.39%) / Dayton(2.12%) / DEOK (3.25%) / DL(1.71%) / DPL (2.60%) / Dominion(13.32%) / EKPC (1.89%) / JCPL(3.86%) / ME(1.90%) / NEPTUNE*(0.42%) / OVEC (0.08%) / PECO(5.40%) / PENELEC (1.78%) /PEPCO (3.67%) / PPL (4.72%) /PSEG (6.39%) / RE (0.26%) DFAX Allocation: PEPCO (100.00%)	12/31/2027
b3780.13	Batavia Road to Riverside 230 kV reconductor New rating: 1941 MVA SN / 2181 MVA SE	\$21	BGE	BGE (51.24%) / PEPCO (48.76%)	12/31/2026

Attachment C – Multi-Driver Project Cost Allocation

Upgrade ID	Description	Cost Estimate (\$M)	TO	Cost Responsibility	Required In-Service Date
b3775.11	Upgrade the limiting element at Stillwell substation to increase the rating of the Stillwell-Dumont 345 kV line to match conductor rating.	\$1.78	AEP	Market Efficiency Driver: (52.75%) AEC (0.87%) /AEP (24.07%) /APS (3.95%) /BGE (4.30%) /Dayton (3.52%) /DEOK (5.35%) /Dominion (20.09%) /DPL (1.73%) /DL (2.11%) /ECP (0.17%) /EKPC (1.73%) /ATSI (11.04%) /HTP (0.07%) /JCPL (1.98%) /ME (1.63%) /NEPTUNE (0.43%) /OVEC (0.07%) /PECO (3.59%) /PENELEC (1.68%) /PEPCO (3.91%) /PPL (3.64%) /PSEG (3.93%) /RE (0.14%) Reliability Driver: (47.25%) AEP (12.38%) / ComEd (87.62%)	12/1/2026