



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

PJM Staff White Paper

PJM Interconnection
December 2022

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Contents

I.	Executive Summary	1
II.	Baseline Project Recommendations	1
III.	Baseline Reliability Projects Summary	1
	A. AE, BGE, JCPL, PECO, PPL & PSEG Transmission Zones	2
	B. ATSI Transmission Zone	2
	C. AEP Transmission Zone	2
	D. APS Transmission Zone	2
	E. PPL Transmission Zone	2
	F. Baseline Reliability Project Details	2
	Baseline Project b3737: NJ SAA Project	2
	Baseline Project b3720: Abbe-Johnson 69 kV Rebuild	8
	Baseline Project b3721: Avery-Hayes 138 kV Rebuild and Reconductor	9
	Baseline Project b3723: George Washington-Kammer 138 kV Rebuild	10
	Baseline Project b3726: Black Oak 500 kV Substation Improvements	11
	Baseline Project b3730: Lackawanna 500/230 kV Transformer Improvements	12
IV.	Transmission Owner Criteria Projects	12
V.	Interconnection Queue Projects	13
VI.	Changes to Previously Approved Projects	14
	Scope/Cost Changes	14
	AEP Transmission Zone	14
VII.	These changes yield a net RTEP increase of \$3.32 million. Review by the Transmission Expansion Advisory Committee (TEAC)	14
VIII.	Cost Allocation	14
IX.	Board Approval	14
	Attachment A – Reliability Project Single-Zone Allocations	15
	Attachment B – Reliability Project Multi-Zone Allocations	16
	Attachment C – Interconnection Queue Projects With System Impact Study Reports Issued	23
	Attachment D – Interconnection Network Upgrades	41

I. Executive Summary

On Oct. 4, 2022, the PJM Board of Managers approved changes to the Regional Transmission Expansion Plan (RTEP), totaling a net increase of \$642.83 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 \$1,147.72 million. Scope changes to an existing project will result in a net increase of \$3.32 million. This yields an overall RTEP net increase of \$1,151.04 million, for which PJM recommended Board approval. PJM is also providing the annual update of RTEP generation and merchant transmission network upgrades in this white paper. PJM has identified \$322.74 million in new network upgrades and an approximately \$20.75 million decrease due to scope changes for projects with an Interconnection Service Agreement (ISA). Additionally, PJM recommended the cancellation of \$77.01 million in previously identified network upgrades as a result of updates to analysis performed for project withdrawals in the New Services Queue. This yields an overall RTEP net increase of \$224.98 million, for which PJM recommended Board approval. Altogether, the changes result in an overall RTEP net increase of approximately \$1,376.02 million. With these changes, RTEP projects will total approximately \$41,549.8 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 December 6, 2022, 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 reliability 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.

A. AE, BGE, JCPL, PECO, PPL & PSEG Transmission Zones

- Baseline project b3737 – NJ SAA Project: \$1,064.36 million

B. ATSI Transmission Zone

- Baseline project b3720 – Abbe-Johnson 69 kV rebuild: \$10.9 million
- Baseline project b3721 – Avery-Hayes 138 kV rebuild and reconductor: \$10.4 million

C. AEP Transmission Zone

- Baseline project b3723 – George Washington-Kammer 138 kV rebuild: \$18.3 million

D. APS Transmission Zone

- Baseline project b3726 – Black Oak 500 kV substation improvements: \$17.37 million

E. PPL Transmission Zone

- Baseline project b3730 – Lackawanna 500/230 kV transformer improvements: \$10.7 million

PJM also recommended projects totaling \$15.69 million, whose individual cost estimates are less than \$10 million. The projects include, but are not limited to, a 69 kV line rebuild, breaker bushing upgrades, meter replacements and bus work inside a substation, circuit switcher installation and replacements, a disconnect switch replacement and 230 kV line upgrades to increase the maximum operating temperature of the line.

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

F. Baseline Reliability Project Details

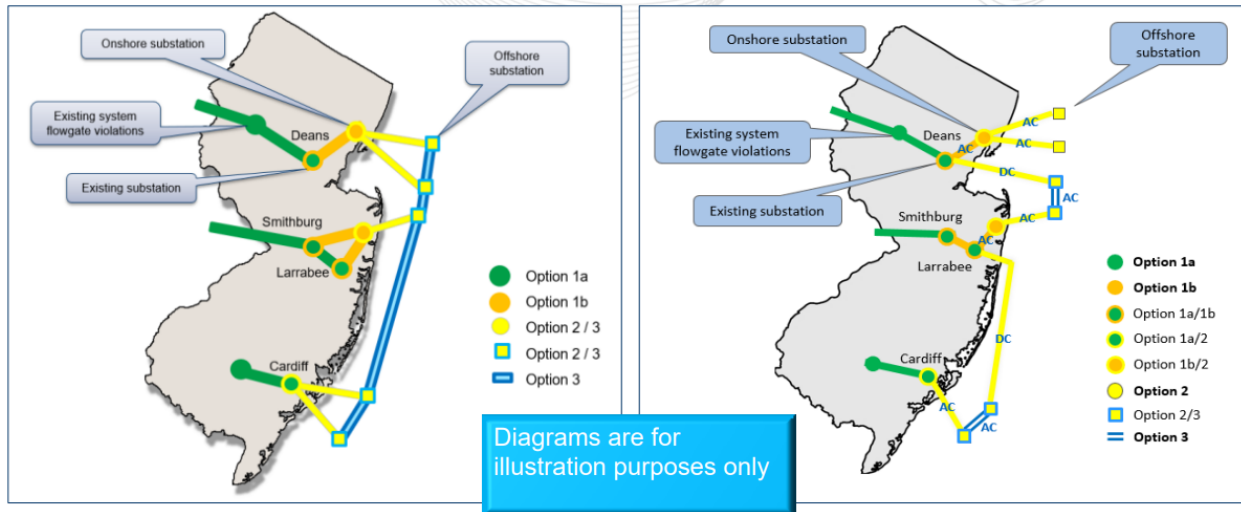
Baseline Project b3737: NJ SAA Project

AE, BGE, JCPL, PECO, PPL & PSEG Transmission Zones

As part of the 2021 State Agreement Approach (SAA) Proposal Window to support New Jersey offshore wind, PJM received proposals to meet New Jersey's goal of interconnecting up to 7,500 MW of offshore wind. The proposals were categorized into four options according to the function and location of the proposal. Altogether, PJM received a diverse set of 80 proposals.

- **Option 1a proposals:** Onshore transmission upgrades to resolve potential reliability criteria violations on PJM facilities in accordance with all applicable planning criteria (PJM, NERC, SERC, RFC and local Transmission Owner criteria)
- **Option 1b proposals:** Onshore new transmission connection facilities
- **Option 2 proposals:** Offshore new transmission connection facilities
- **Option 3 proposals:** Offshore new transmission network facilities

Figure 1. Potential Options for the NJ Offshore Wind Transmission Solution



Concepts depicted are for illustration purposes only.

Details of new lines and facilities are to be provided by sponsors in proposals to meet objectives of this solicitation.

PJM worked with the NJ BPU to create offshore wind injection scenarios involving various combinations of the submitted Option 1b and Option 2 proposals. Each scenario contained the awarded solicitation No. 1 for 1,100 MW and solicitation No. 2 for 2,658 MW. While the scope for the submission of proposals did not allow alternative point of injections (POIs) for solicitation No. 1, it did allow alternative POIs for solicitation No. 2. As a result, each scenario contained identical considerations for solicitation No. 1, and the scenario creation focused on selecting combinations of submitted Option 1b and Option 2 proposals that together enable the transmission system to reliably deliver approximately 6,400 MW of additional offshore wind.

After the comprehensive reliability analysis and all other evaluations were complete, the NJ BPU selected Scenario 18a as the SAA Project. Scenario 18a uses JCPL Option 1b proposals 453.1–18, 24, 26–29 to interconnect 3,742 MW of offshore wind to central New Jersey, including 1,200 MW to Larrabee 230 kV, 1,200 MW to Atlantic 230 kV and 1,342 MW to Smithburg 500 kV. It also uses a portion of Mid-Atlantic Offshore Development (MAOD) proposal 551 to construct the Larrabee 230 kV AC Collector station and procure land adjacent to the MAOD AC switchyard for future HVDC converters.

The interconnection of the remaining 1,148 MW of solicitation No. 2 (Ocean Wind 2) offshore wind, 1,510 MW of solicitation No. 2 (Atlantic Shores 1) offshore wind, and the interconnection of the entire 1,100 MW of solicitation No. 1 (Ocean Wind 1) offshore wind are assumed to be the responsibility of the offshore wind developers.

JCPL Option 1b proposal 453.1–18, 24, 26–29 involves the following components:

- Rebuild the G1021 Atlantic-Smithburg 230 kV line from the Larrabee substation to the Smithburg substation as a double circuit 500/230 kV line
- Expand Smithburg 500 kV into a three-breaker ring bus for the offshore wind generation interconnection

- Expand Larrabee 230 kV with a new breaker-and-a-half layout, reterminating Larrabee to Lakewood 230 kV into the new terminal and constructing approximately 1,000 feet of new 230 kV line from the Larrabee station to an offshore wind 230 kV converter station
- Expand the Atlantic 230 kV bus and converting the substation to a new double-breaker bus with line exists for the offshore wind generators
- Construct new approximately 11.6-mile line from Atlantic substation to the offshore wind 230 kV converter station at Larrabee
- MAOD proposal 551 (partial) involves constructing the Larrabee 230 kV AC Collector station and procuring land adjacent to the MAOD AC switchyard for future HVDC converters. The below tables show a summary of costs by option components and the SAA Capability created by the selected SAA project:

Table 1. Scenario 18 Cost Summary

Scenario ID	Total (MW)	SAA (MW)	Proposing Entities	Option 1b		Option 2		Option 1a	TOTAL
				Proposal IDs	Cost Estimate (\$M)	Proposal IDs	Cost Estimate (\$M)	Cost Estimate (\$M)	Cost Estimate (\$M)
18a	6,400	3,742	JCPL, MAOD	453.1-18,24,27-29	\$428	551 (partial)	\$121	\$515	\$1,064

Table 2. Point of Interconnection & Associated Injected Amounts

Location	State	Transmission Owner	SAA Capability	MFO	MW Energy	MW Capacity
Larrabee Collector station 230 kV – Larrabee	NJ	MAOD	1,200	1,200	1,200	360
Larrabee Collector station 230 kV – Atlantic	NJ	MAOD	1,200	1,200	1,200	360
Larrabee Collector station 230 kV – Smithburg	NJ	MAOD	1,342	1,342	1,342	402.6
Smithburg 500 kV	NJ	JCPL	1,148	1,148	1,148	327

The tables below show the Option 1b, 2 and 1a component cost estimates:

Table 3. Scenario 18a Option 1b Component Cost Estimates

Proposing Entity	Proposal IDs	Components	Proposal Cost (\$M)
JCPL	453.1	Atlantic 230 kV substation – Convert to double-breaker double-bus	\$31.47
	453.2	Freneau substation – Update relay settings	\$0.03
	453.3	Smithburg substation – Update relay settings	\$0.03
	453.4	Oceanview substation – Update relay settings	\$0.04
	453.5	Red Bank substation – Update relay settings	\$0.04
	453.6	South River substation – Update relay settings	\$0.03
	453.7	Larrabee substation – Update relay settings	\$0.03
	453.8	Atlantic substation – Install line terminal	\$4.95
	453.9	Larrabee substation – Reconfigure substation	\$4.24
	453.10	Larrabee substation: 230 kV equipment for direct connection	\$4.77
	453.11	Lakewood Gen substation – Update relay settings	\$0.03
	453.12	G1021 (Atlantic-Smithburg) 230 kV	\$9.68
	453.13	R1032 (Atlantic-Larrabee) 230 kV	\$14.50
	453.14	New Larrabee Converter-Atlantic 230 kV	\$17.07
	453.15	Larrabee-Oceanview 230 kV	\$6.00
	453.16	B54 Larrabee-South Lockwood 34.5 kV line transfer	\$0.31
	453.17	Larrabee Converter-Larrabee 230 kV new line	\$7.52
	453.18	Larrabee Converter-Smithburg No. 1 500 kV line (new asset)	\$150.35
	453.24	G1021 Atlantic-Smithburg 230 kV	\$62.85
	453.26	D2004 Larrabee-Smithburg No1 230 kV	\$44.77
453.27	Smithburg substation 500 kV expansion	\$5.81	
453.28	Larrabee substation	\$0.86	
453.29	Smithburg substation 500 kV 3-breaker ring	\$62.44	
Total			\$427.82

Table 4. Scenario 18a Option 2 Component Cost Estimates

Component Descriptions	In-Service Date (ISD)	Cost (\$M)
MAOD		
Proposal ID 551		
<p>Construct the AC switchyard portion of MAOD proposal 551, composed of a 230 kV 3 x breaker-and-a-half substation with a nominal current rating of 4000A and four single phase 500/230 kV 450 MVA autotransformers to step up the voltage for connection to the Smithburg substation. AC switchyard design and site preparation shall be suitable for expansion to a 230 kV 4 X 230 kV breaker-and-a-half substation and seven single phase 500/230 kV 450 MVA autotransformers to step up voltage for connection of two circuits to Smithburg substation.</p>	ISD to be aligned with NJBPU solicitation schedule and related JCPL Proposal 453 project work	<p>\$121.10</p> <p><i>Note: This cost represents a partial scope of MAOD proposal #551. It excludes other owners' costs, permitting, commercial and financial fees, and will require further evaluation to refine the estimate.</i></p>
<p>Procure land adjacent to the MAOD AC switchyard, which is a portion of the MAOD proposal 551, and prepare the site for construction of future AC to DC converters for future interconnection of DC circuits from offshore wind generation. Land should be suitable to accommodate installation of four individual converters to accommodate circuits with equivalent rating of 1400 MVA at 400 kV. MAOD will commit to work with NJBPU and staff, PJM, the relevant transmission owners, and all future developers to lease or otherwise make land access available for construction of converters by those developers to support the integration of OSW generators to achieve the OSW goals of New Jersey.</p>	ISD to be aligned with NJBPU solicitation schedule and related JCPL Proposal 453 project work	

Table 5. Scenario 18a Option 1a Component Cost Estimates

Proposing Entity	Proposal IDs	Components	Proposal Cost (\$M)
JCPL	17.4–17.11	Convert the six-wired East Windsor-Smithburg E2005 230 kV line (9.0 mi.) to two circuits. One a 500 kV line and the other a 230 kV line.	\$206.48
JCPL	17.18	Add third Smithburg 500/230 kV	\$13.40
PPL	330	Reconductor Gilbert-Springfield 230 kV	\$0.38
JCPL	17.16	Reconductor Clarksville-Lawrence 230 kV	\$11.45
PSEG	PPT 3/11/2022	Upgrade Lake Nelson I 230 kV	\$3.80

Proposing Entity	Proposal IDs	Components	Proposal Cost (\$M)
JCPL	17.19	Reconductor Kilmer I-Lake Nelson I 230 kV	\$4.42
PSEG	PPT 2/4/2022	Upgrade Lake Nelson W 230 kV	\$0.16
JCPL	Email 12/30/2021	Additional reconductoring required For Lake Nelson I-Middlesex 230 kV	\$3.30
PSEG	180.3, 180.4, 180.7	Linden & Bergen subprojects	\$30.45
PSEG	PPT 2/4/2022	Upgrade Greenbrook W 230 kV	\$0.12
JCPL	Email 2/11/2022	Reconductor small section of Raritan River-Kilmer I 230 kV (n6201)	\$0.20
JCPL	Email 2/11/2022	Replace substation conductor at Kilmer & reconductor Raritan River-Kilmer W 230 kV (n6202)	\$25.88
JCPL	Email 2/11/2022	Reconductor Red Oak A-Raritan River 230 kV (n6203)	\$11.05
JCPL	Email 2/11/2022	Reconductor Red Oak B-Raritan River 230 kV (n6204)	\$3.90
AE	127.10	Reconductor Richmond-Waneeta 230 kV	\$16.00
PSEG	180.5, 180.6	Windsor to Clarksville subproject	\$5.77
AE	127.1	Upgrade Cardiff-Lewis 138 kV	\$0.10
AE	127.3	Upgrade Cardiff-New Freedom 230 kV	\$0.30
AE	127.2	Upgrade Lewis No. 2-Lewis No. 1 138 kV	\$0.50
CNTLM	229	One additional Hope Creek-Silver Run 230 kV submarine cables and rerate plus upgrade line	\$61.20
Transource	63	North Delta Option A	\$109.68
PECO	Incumbent TO	Replace four Peach Bottom 500 kV breakers	\$5.60
BGE	Incumbent TO	Upgrade one Conastone 230 kV breaker	\$1.30
TOTAL			\$515.44

The total estimated cost for this project is \$1,064.36 million, with various required in-service dates ranging from December 2027 through June 2030 to align with New Jersey's solicitation schedule. The designated entities that proposed the projects and the local transmission owners, AE, BGE, JCPL, LS Power, MAOD, PECO, PPL, PSEG and Transource, will be designated to complete this work.

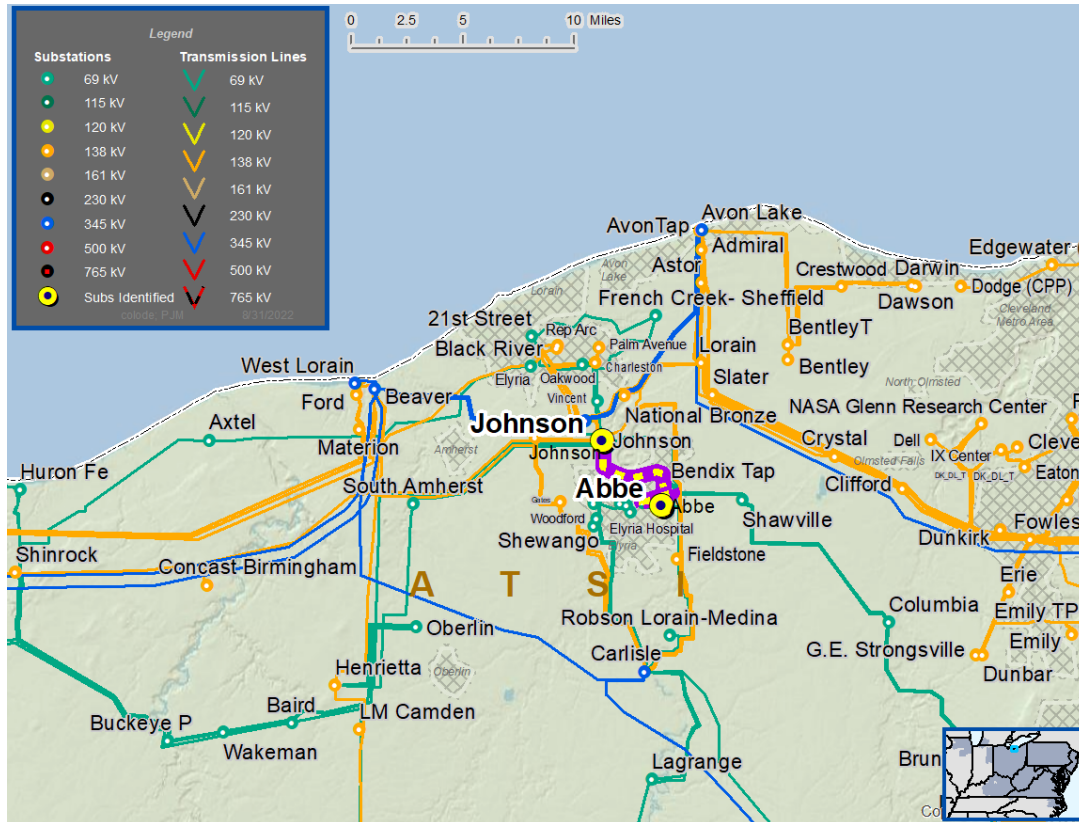
For additional details regarding the NJ SAA project, please refer to the Nov. 4, 2022, special TEAC presentation and the reports posted with the meeting materials: <https://pjm.com/committees-and-groups/committees/teac.aspx>

Baseline Project b3720: Abbe-Johnson 69 kV Rebuild

ATSI Transmission Zone

In the 2027 RTEP summer case, the Abbe-Johnson 69 kV line is overloaded for an N-1 outage combination. The flow gate was posted as part of 2022 RTEP Window 1 but was excluded from competition due to the below 200 kV exclusion.

Map 1. b3720 – Abbe-Johnson 69 kV



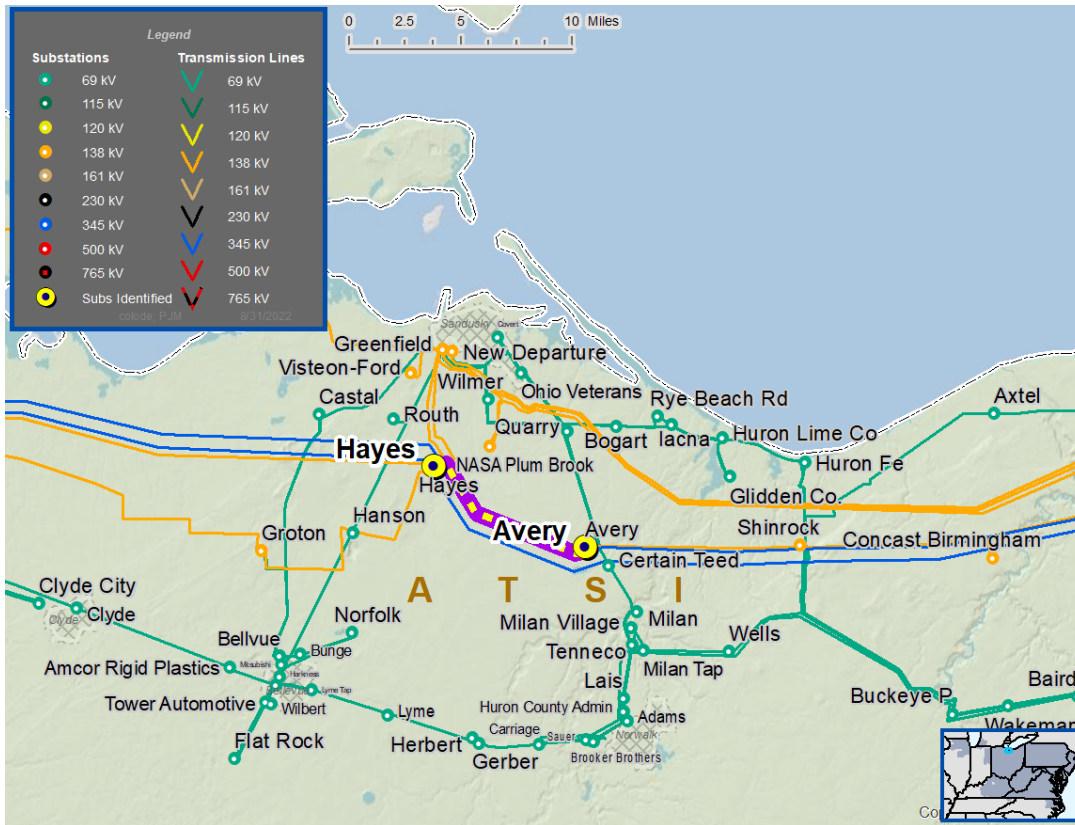
The recommended solution is to rebuild the Abbe-Johnson No. 2 69 kV line (approx. 4.9 miles) with 556 kcmil ACSR conductor. The project will also replace three disconnect switches (A17, D15 and D16), replace line drops and revise relay settings at Abbe substation; replace one disconnect switch (A159), replace line drops and revise relay settings at Johnson substation; and replace two motor-operated airbreak disconnect switches (A4 & A5), one disconnect switch (D9) and line drops at Redman substation. The estimated cost for this project is \$10.9 million. This project has a required in-service date of June 2027 and a projected in-service date of June 2026. The local transmission owner, ATSI, will be designated to complete this work.

Baseline Project b3721: Avery-Hayes 138 kV Rebuild and Reconductor

ATSI Transmission Zone

In the 2027 RTEP summer case, the Avery-Hayes 138 kV line is overloaded for an N-2 outage. The flow gate was posted as part of 2022 RTEP Window 1 but was excluded from competition due to the below 200 kV exclusion.

Map 2. b3721 – Avery-Hayes 138 kV



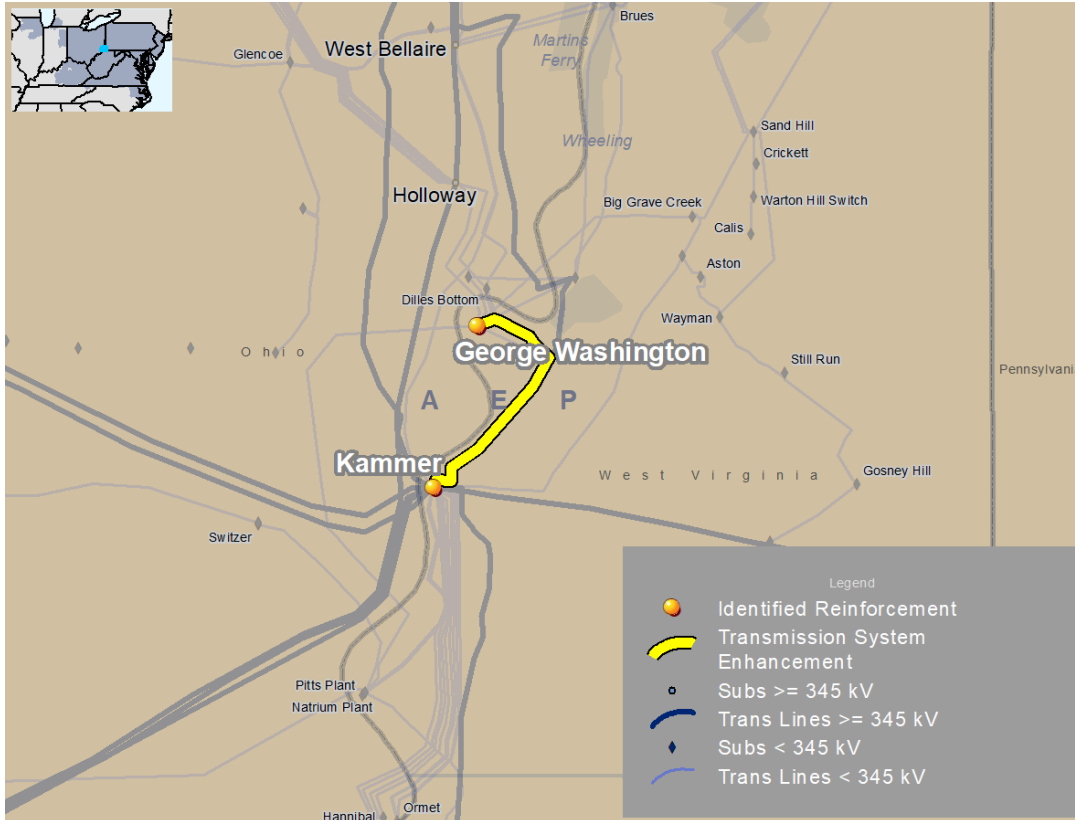
The recommended solution is to rebuild and reconductor the Avery-Hayes 138 kV line (approx. 6.5 miles) with 795 kcmil 26/7 ACSR. The estimated cost for this project is \$10.4 million, with a required and projected in-service date of June 2027. The local transmission owner, ATSI, will be designated to complete this work.

Baseline Project b3723: George Washington-Kammer 138 kV Rebuild

AEP Transmission Zone

In the 2027 RTEP summer case, the George Washington-Kammer 138 kV line is overloaded for an N-2 outage. The flow gate was posted as part of 2022 RTEP Window 1 but was excluded from competition due to the below 200 kV exclusion.

Map 3. b3723 – George Washington-Kammer 138 kV



The recommended solution is to rebuild the George Washington-Kammer 138 kV line (6.7 miles of total upgrade scope). The project will also remove the existing six-wired steel lattice towers and supplement the right-of-way as needed. The estimated cost for this project is \$18.3 million. This project has a required in-service date of June 2027 and a projected in-service date of June 2024. The local transmission owner, AEP, will be designated to complete this work.

Baseline Project b3726: Black Oak 500 kV Substation Improvements

APS Transmission Zone

In the 2027 RTEP summer and winter case, there are several voltage drop violations at the Black Oak 500 kV substation for N-1 outage combinations. The flow gates were posted as part of 2022 RTEP Window 1, and PJM received one proposal to address the flow gates.

Map 4. b3726 – Black Oak 500 kV



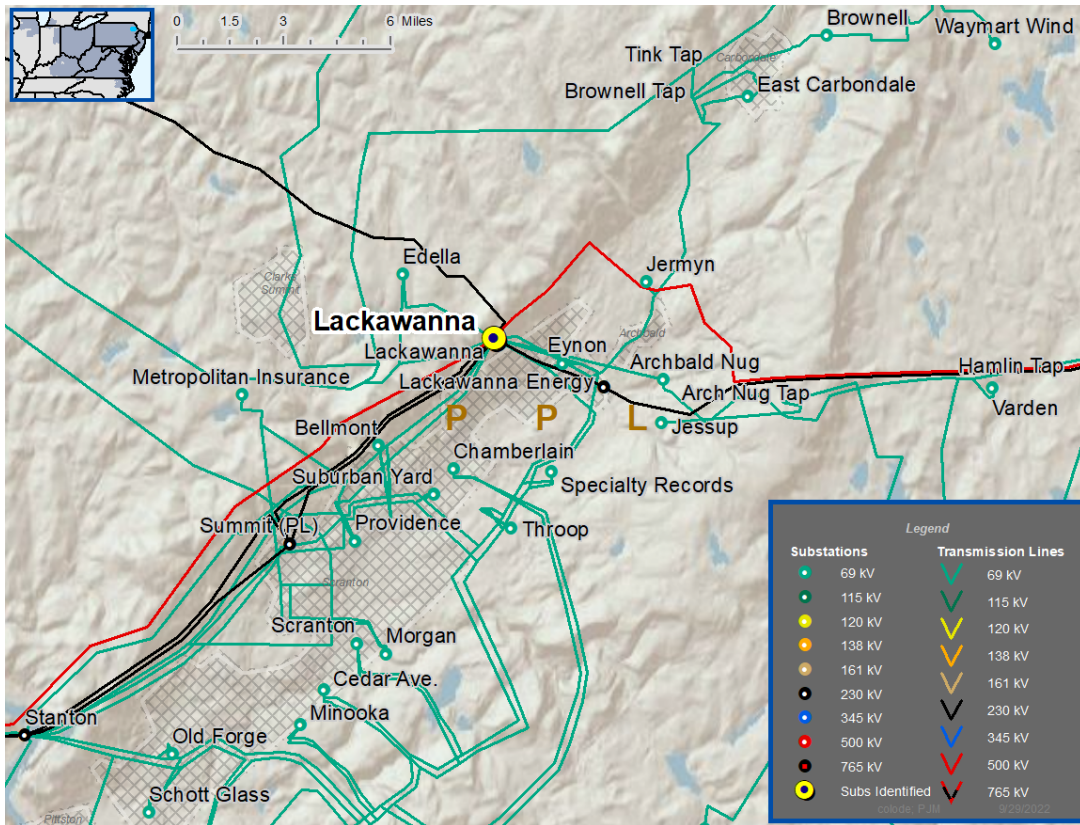
The recommended solution is to install two new 500 kV 50 kA breakers on the existing open SVC string to create a new bay position, and relocate and reterminate facilities as necessary to move the 500 kV SVC into the new bay position. The project will also install a 500 kV 50 kA breaker on the 500/138 kV No. 3 transformer, and upgrade relaying at Black Oak substation. The estimated cost for this project is \$17.37 million, with a required and projected in-service date of June 2027. The local transmission owner, APS, will be designated to complete this work.

Baseline Project b3730: Lackawanna 500/230 kV Transformer Improvements

PPL Transmission Zone

In the 2027 RTEP summer case, the Lackawanna No. T3 transformer is overloaded for an N-2 outage. The flow gate was posted as part of 2022 RTEP Window 1, and PJM received three proposals to address the flow gate.

Map 5. b3730 – Lackawanna 500/230 kV



The recommended solution is to reterminate the Lackawanna T3 and T4 500/230 kV transformers on the 230 kV side to remove them from the 230 kV buses and bring them into dedicated bay positions that are not adjacent to one another. The estimated cost for this project is \$10.7 million. This project has a required in-service date of June 2027 and a projected in-service date of January 2026. The local transmission owner, PPL, will be designated to complete this work.

IV. Transmission Owner Criteria Projects

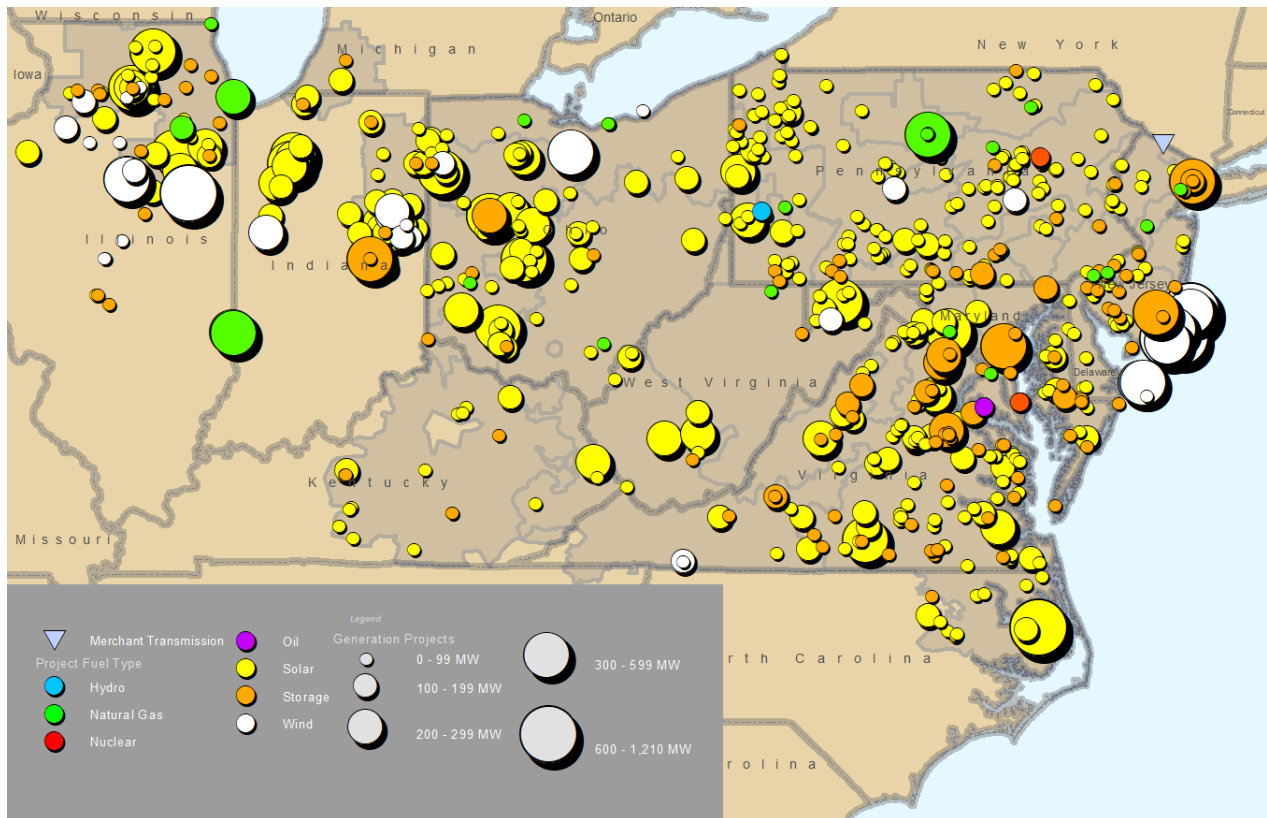
Of the \$1,147.72 million of new recommended baseline transmission system enhancements, approximately \$17.98 million is driven by transmission owner planning criteria, which makes up approximately 2% of the new project cost estimates.

V. Interconnection Queue Projects

Throughout 2022, PJM has continued to study new services requests that are submitted into our interconnection queue. These studies evaluate the impact of the new services requests 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.

These studies were last reviewed with the Board Reliability Committee in December of 2021. Since that time, PJM has completed 403 new System Impact Studies, and 287 service requests have withdrawn. New projects with signed ISAs, project scope changes and project cancellations have resulted in a net increase of \$224.98 million for network upgrades. The map below shows the locations of the new units associated with the completed interconnection System Impact Studies along with the fuel type and relative size. A listing of the projects with recently completed impact studies is provided in Attachment C to this white paper. A listing of the network upgrades associated with these projects is shown in Attachment D to this report. The cost for the network upgrades associated with these interconnection projects is the responsibility of the developer.

Map 6. Completed Interconnection System Impact Studies



VI. Changes to Previously Approved Projects

Scope/Cost Changes

The following scope/cost modification was recommended:

AEP Transmission Zone

- Baseline project b3104 (sag study to increase the Summer Emergency rating on the Polaris-Westerville 138 kV line to 310 MVA) has undergone a scope/cost increase. This project was driven by the Conesville unit 4 deactivation, and after LIDAR was completed, it was determined that the full scope of work is required in order to meet the desired ratings noted. The scope includes: ten structure replacements, three distribution poles modifications, re-sag two spans of existing conductor and one existing street light relocation. The total cost of the project has increased from \$0.5 million to \$3.82 million, yielding an RTEP increase of \$3.32 million.

VII. These changes yield a net RTEP increase of \$3.32 million. Review by the Transmission Expansion Advisory Committee (TEAC)

Project needs and recommended solutions as discussed in this report were reviewed with stakeholders during 2022, most recently at the November 2022 TEAC meetings. Written comments were requested to be submitted to PJM to communicate any concerns with project recommendations. No comments have been received as of this 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).

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 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. On December 6, 2022, 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
b3719	Replace the two existing 1200A Bergen 138 kV Circuit Switchers with two (2) 138 kV Disconnect Switches to achieve a minimum summer normal device rating of 298 MVA and a minimum summer emergency rating of 454 MVA.	\$1.20	PSEG	PSEG	12/31/2022
b3720	<ul style="list-style-type: none"> Rebuild the Abbe-Johnson #2 69 kV line (approx. 4.9 miles) with 556 kcmil ACSR conductor. Replace three disconnect switches (A17, D15 & D16) and line drops and revise relay settings at Abbe. Replace one disconnect switch (A159) and line drops and revise relay settings at Johnson. Replace two MOAB disconnect switches (A4 & A5), one disconnect switch (D9), and line drops at Redman. 	\$10.90	ATSI	ATSI	6/1/2027
b3721	<ul style="list-style-type: none"> Rebuild and reconductor the Avery-Hayes 138 kV line (approx. 6.5 miles) with 795 kcmil 26/7 ACSR. 	\$10.40	ATSI	ATSI	6/1/2027
b3722	<ul style="list-style-type: none"> Rebuild the existing Darrah-Barnett 69 kV line, approximately 2.8 miles and replace a riser at Darrah station. 	\$6.98	AEP	AEP	12/1/2027
b3723	<ul style="list-style-type: none"> Rebuild the George Washington – Kammer 138 kV circuit, except for 0.1-mile of previously-upgraded T-line outside each terminal station (6.7 miles of total upgrade scope). Remove the existing 6-wired steel lattice towers and supplement the right-of-way as needed. 	\$18.30	AEP	AEP	6/1/2027
b3724	<ul style="list-style-type: none"> Install 138 kV circuit switcher on the high-side of Transformer #2 at Roanoke station (previously proposed as a portion of s2469.7, posted in 2021 AEP local plan). 	\$0.10	AEP	AEP	6/1/2027
b3725	<ul style="list-style-type: none"> Replace the 1600A bus disconnect switch at Goodings Grove on L11622 Elwood-Goodings Grove 345 kV. 	\$0.50	ComEd	ComEd	12/1/2027
b3726	<ul style="list-style-type: none"> Install two new 500 kV breakers on the existing open SVC string to create a new bay position. Relocate & Reterminate facilities as necessary to move the 500 kV SVC into the new bay position and Install a 500 kV breaker on the 500/138 kV #3 transformer. Upgrade relaying at Black Oak substation. 	\$17.37	AP	AP	6/1/2027
b3729	<ul style="list-style-type: none"> To increase the Maximum Operating Temperature of DPL Circuit 22088 (Colora-Conowingo 230 kV), install cable shunts on each phase, on each side of four (4) dead-end structures and replace existing insulator bells. 	\$0.26	DPL	DPL	6/1/2027

Upgrade ID	Description	Cost Estimate (\$M)	TO	Cost Responsibility	Required In-Service Date
b3730	<ul style="list-style-type: none"> Reterminate the Lackawanna T3 and T4 500/230 kV transformers on the 230 kV side to remove them from the 230 kV buses and bring them into dedicated bay positions that are not adjacent to one another. 	\$10.70	PPL	PPL	6/1/2027
b3748	<ul style="list-style-type: none"> Replace four Clifty Creek 345 kV 3000A switches with 5000 A 345 kV switches. 	\$0.85	AEP	AEP	6/1/2027

Attachment B – Reliability Project Multi-Zone Allocations

Note: The cost allocation for project b3737 (NJ SAA project) will be in accordance with OATT Schedule 12 Appendix C subject to FERC approval.

Upgrade ID	Description	Cost Estimate (\$M)	TO	Cost Responsibility	Required In-Service Date
b3728.1	Upgrade two Breaker bushings on the 500 kV Line 5012 (Conastone-Peach Bottom) at Conastone substation.	\$2.00	BGE	Load-Ratio Share Allocation: AEC (1.67%) / AEP (13.94%) / APS (5.64%) / ATSI (8.02%) / BGE (4.12%) / ComEd (13.46%) / Dayton (2.12%) / DEOK (3.37%) / DL (1.76%) / DPL (2.55%) / Dominion (12.97%) / EKPC (1.81%) / JCPL (3.92%) / ME (1.95%) / NEPTUNE* (0.24%) / OVEC (0.07%) / PECO (5.39%) / PENELEC (1.84%) / PEPCO (3.71%) / PPL (4.78%) / PSEG (6.40%) / RE (0.27%) DFAX Allocation: APS (3.98%) / ATSI (0.03%) / BGE (20.98%) / DL (0.01%) / Dominion (32.06%) / DPL (0.02%) / JCPL (7.05%) / Neptune (0.81%) / PEPCO (17.70%) / PPL (2.72%) / PSEG (14.07%) / RE (0.57%)	12/1/2027
b3728.2	Replace 4 meters and bus work inside Peach Bottom substation on the 500 kV Line 5012 (Conastone-Peach Bottom).	\$3.80	PECO	Load-Ratio Share Allocation: AEC (1.67%) / AEP (13.94%) / APS (5.64%) / ATSI (8.02%) / BGE (4.12%) / ComEd (13.46%) / Dayton (2.12%) / DEOK (3.37%) / DL (1.76%) / DPL (2.55%) / Dominion (12.97%) / EKPC (1.81%) / JCPL (3.92%) / ME (1.95%) / NEPTUNE* (0.24%) / OVEC	12/1/2027

Upgrade ID	Description	Cost Estimate (\$M)	TO	Cost Responsibility	Required In-Service Date
				(0.07%) / PECO (5.39%) / PENELEC (1.84%) / PEPCO (3.71%) / PPL (4.78%) / PSEG (6.40%) / RE (0.27%) DFAX Allocation: APS (3.94%) / ATSI (0.03%) / BGE (20.78%) / DL (0.01%) / Dominion (31.75%) / DPL (0.02%) / JCPL (6.99%) / Neptune (0.80%) / PECO (0.98%) / PEPCO (17.52%) / PPL (2.69%) / PSEG (13.93%) / RE (0.56%)	
b3737.1	Larrabee substation – Reconfigure substation.	\$4.24	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.2	Larrabee substation – 230 kV equipment for direct connection.	\$4.77	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.3	Lakewood Generator substation – Update relay settings on the Larrabee 230 kV line.	\$0.03	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.4	B54 Larrabee-South Lockwood 34.5 kV line transfer.	\$0.31	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.5	Larrabee Collector station-Larrabee 230 kV new line.	\$7.52	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.6	Larrabee Collector station-Smithburg No. 1 500 kV line (new asset). New 500 kV line will be built double circuit to accommodate a 500 kV line and a 230 kV line.	\$150.35	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	12/31/2027
b3737.7	Rebuild G1021 Atlantic-Smithburg 230 kV line between the Larrabee and Smithburg substations as a double circuit 500 kV/230 kV line.	\$62.85	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	12/31/2027
b3737.8	Smithburg substation 500 kV expansion to 4-breaker ring.	\$68.25	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	12/31/2027

Upgrade ID	Description	Cost Estimate (\$M)	TO	Cost Responsibility	Required In-Service Date
b3737.9	Larrabee substation upgrades.	\$0.86	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2030
b3737.10	Atlantic 230 kV substation – Convert to double-breaker double-bus.	\$31.47	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2030
b3737.11	Freneau substation – Update relay settings on the Atlantic 230 kV line.	\$0.03	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2030
b3737.12	Smithburg substation – Update relay settings on the Atlantic 230 kV line.	\$0.03	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2030
b3737.13	Oceanview substation – Update relay settings on the Atlantic 230 kV lines.	\$0.04	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2030
b3737.14	Red Bank substation – Update relay settings on the Atlantic 230 kV lines.	\$0.04	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2030
b3737.15	South River substation – Update relay settings on the Atlantic 230 kV line.	\$0.03	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2030
b3737.16	Larrabee substation – Update relay settings on the Atlantic 230 kV line.	\$0.03	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2030
b3737.17	Atlantic substation – Construct a new 230 kV line terminal position to accept the generator lead line from the offshore wind Larrabee Collector station.	\$4.95	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2030
b3737.18	G1021 (Atlantic-Smithburg) 230 kV upgrade.	\$9.68	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2030
b3737.19	R1032 (Atlantic-Larrabee) 230 kV upgrade.	\$14.50	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2030
b3737.20	New Larrabee Collector station-Atlantic 230 kV line.	\$17.07	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2030
b3737.21	Larrabee-Oceanview 230 kV line upgrade.	\$6.00	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2030

Upgrade ID	Description	Cost Estimate (\$M)	TO	Cost Responsibility	Required In-Service Date
b3737.22	Construct the Larrabee Collector station AC switchyard, composed of a 230 kV 3 x breaker and a half substation with a nominal current rating of 4000 A and four single phase 500/230 kV 450 MVA autotransformers to step up the voltage for connection to the Smithburg substation. Procure land adjacent to the AC switchyard, and prepare the site for construction of future AC to DC converters for future interconnection of DC circuits from offshore wind generation. Land should be suitable to accommodate installation of four individual converters to accommodate circuits with equivalent rating of 1400 MVA at 400 kV.	\$121.10	MAOD	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	12/31/2027
b3737.23	Rebuild the underground portion of Richmond-Waneeta 230 kV.	\$16.00	AEC	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.24	Upgrade Cardiff-Lewis 138 kV by replacing 1590 kcmil strand bus inside Lewis substation.	\$0.10	AEC	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	12/1/2027
b3737.25	Upgrade Lewis No. 2-Lewis No. 1 138 kV by replacing its bus tie with 2000 A circuit breaker.	\$0.50	AEC	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	12/1/2027
b3737.26	Upgrade Cardiff-New Freedom 230 kV by modifying existing relay setting to increase relay limit.	\$0.30	AEC	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	12/1/2027
b3737.27	Rebuild approximately 0.8 miles of the D1018 (Clarksville-Lawrence 230 kV) line between Lawrence substation (PSEG) and structure No. 63.	\$11.45	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029

Upgrade ID	Description	Cost Estimate (\$M)	TO	Cost Responsibility	Required In-Service Date
b3737.28	Reconductor Kilmer I-Lake Nelson I 230 kV.	\$4.42	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.29	Convert the six-wired East Windsor-Smithburg E2005 230 kV line (9.0 mi.) to two circuits. One a 500 kV line and the other a 230 kV line.	\$206.48	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.30	Add third Smithburg 500/230 kV transformer.	\$13.40	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	12/31/2027
b3737.31	Additional reconductoring required for Lake Nelson I-Middlesex 230 kV.	\$3.30	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.32	Rebuild Larrabee-Smithburg No. 1 230 kV.	\$47.77	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	12/31/2027
b3737.33	Reconductor Red Oak A-Raritan River 230 kV.	\$11.05	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.34	Reconductor Red Oak B-Raritan River 230 kV.	\$3.90	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.35	Reconductor small section of Raritan River-Kilmer I 230 kV.	\$0.20	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.36	Replace substation conductor at Kilmer and reconductor Raritan River-Kilmer W 230 kV.	\$25.88	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.37	Add a third set of submarine cables, rerate the overhead segment, and upgrade terminal equipment to achieve a higher rating for the Silver Run-Hope Creek 230 kV line.	\$61.20	LS POWER	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	12/31/2028
b3737.38	Linden subproject: Install a new 345/230 kV transformer at the Linden 345 kV Switching station, and relocate the Linden-Tosco 230 kV (B-2254) line from the Linden 230 kV to the existing	\$24.92	PSEG	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029

Upgrade ID	Description	Cost Estimate (\$M)	TO	Cost Responsibility	Required In-Service Date
	345/230 kV transformer at Linden 345 kV.				
b3737.39	Bergen subproject: Upgrade the Bergen 138 kV ring bus by installing a 80 kA breaker along with the foundation, piles, and relays to the existing ring bus, install breaker isolation switches on existing foundations and modify and extend bus work.	\$5.53	PSEG	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.40	Windsor to Clarksville subproject: Create a paired conductor path between Clarksville 230 kV and JCPL Windsor Switch 230 kV.	\$4.28	JCPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.41	Windsor to Clarksville subproject: Upgrade all terminal equipment at Windsor 230 kV and Clarksville 230 kV as necessary to create a paired conductor path between Clarksville and JCPL East Windsor Switch 230 kV.	\$1.49	PSEG	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.42	Upgrade inside plant equipment at Lake Nelson I 230 kV.	\$3.80	PSEG	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.43	Upgrade Kilmer W-Lake Nelson W 230 kV line drop and strain bus connections at Lake Nelson 230 kV.	\$0.16	PSEG	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.44	Upgrade Lake Nelson-Middlesex-Greenbrook W 230 kV line drop and strain bus connections at Lake Nelson 230 kV.	\$0.12	PSEG	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.45	Reconductor 0.33 miles of PPL's portion of the Gilbert-Springfield 230 kV line.	\$0.38	PPL	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2030

Upgrade ID	Description	Cost Estimate (\$M)	TO	Cost Responsibility	Required In-Service Date
b3737.46	Install a new breaker at Graceton 230 kV substation to terminate a new 230 kV line from the new greenfield North Delta station	\$1.55	BGE	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	12/31/2028
b3737.47	Build a new greenfield North Delta station with two 500/230 kV 1500 MVA transformers and nine 63 kA breakers (four high side and five low side breakers in ring bus configuration).	\$76.27	Transource	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	12/31/2028
b3737.48	Build a new North Delta-Graceton 230 kV line by rebuilding 6.07 miles of the existing Cooper-Graceton 230 kV line to double circuit.	\$28.74	PECO	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	12/31/2028
b3737.49	Bring the Cooper-Graceton 230 kV line "in and out" of North Delta by constructing a new double-circuit North Delta-Graceton 230 kV (0.3 miles) and a new North Delta-Cooper 230 kV (0.4 miles) cut-in lines.	\$1.56	PECO	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	12/31/2028
b3737.50	Bring the Peach Bottom-Delta Power Plant 500 kV line "in and out" of North Delta by constructing a new Peach Bottom-North Delta 500 kV (0.3 miles) cut-in and cut-out lines.	\$1.56	PECO	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.51	Replace four 63 kA circuit breakers "205," "235," "225" and "255" at Peach Bottom 500 kV with 80 kA.	\$5.60	PECO	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029
b3737.52	Replace one 63 kA circuit breaker "B4" at Conastone 230 kV with 80 kA.	\$1.30	BGE	AEC (13.64%) / JCPL (31.98%) / PSEG (52.17%) / RE (2.21%)	6/1/2029

Attachment C – Interconnection Queue Projects With System Impact Study Reports Issued

Merchant Transmission Requests

	Project Name	Rights Requested	Transmission Owner
AF1-088	Sullivan 345 kV	1000 F/1000 NFTIR/1000 F/1000 NFTWR	AEP
AF1-200	Plano 345 kV	2035 F/NFTIR/2100 NF/TWR	ComEd
AF2-008	Sullivan 345 kV	500 FTIR/1000 NFTIR	AEP

Generation Interconnection Requests

Queue Position	Transmission Owner	Fuel Type	MW Energy	MW Capacity
AA1-111	JCPL	Natural Gas	463	463
AB1-087	AEC	Natural Gas	575	550
AB1-088	AEP	Natural Gas	575	550
AB1-092	JCPL	Natural Gas	41	17
AB2-120	Dominion	Solar	100	38
AB2-130	Dominion	Solar	85	32.3
AB2-132	BGE	Wind; Storage	0	2.2
AB2-135	Dominion	Solar	64	29.9
AB2-136	Dominion	Solar	51.1	24.8
AB2-172	Dominion	Solar	50	19
AB2-185	Dominion	Solar	8	5.6
AC1-008	ATSI	Nuclear	6.3	19.2
AC1-033	BGE	Wind	100.8	13.1
AC1-074	DPL	Solar	80	56
AC1-189	Dayton	Solar	80	53.4
AC2-012	Dayton	Solar	150	57
AC2-017	ATSI	Nuclear	11.1	11.1
AC2-075	DPL	Solar	20	13.3
AC2-141	Dayton	Solar	240	168.2
AC2-154	BGE	Solar	50	19
AC2-156	BGE	Solar	20	7.6
AC2-157	AEP	Solar	200	76
AC2-186	Dominion	Solar	10	3.8
AC2-187	Dominion	Solar	20	7.6
AC2-188	Dominion	Solar	20	7.6
AC2-195	APS	Solar	99.96	62.1
AD1-013	BGE	Solar	40	15.4
AD1-016	BGE	Solar	20	7.6



Queue Position	Transmission Owner	Fuel Type	MW Energy	MW Capacity
AD1-039	BGE	Natural Gas	102.7	112.7
AD1-043	AEP	Solar	120	45.6
AD1-067	BGE	Wind	5.725	1.1
AD1-070	AEP	Solar	205	36
AD1-081	APS	Solar	20	13.2
AD1-087	Dayton	Solar	64.2	43.7
AD1-097	JCPL	Natural Gas	67	34.8
AD1-098	BGE	Solar	100	57.8
AD1-100	BGE	Wind	850	150
AD1-101	AEP	Solar	49.9	18.96
AD1-103	APS	Wind	500.4	65.052
AD1-115	Dayton	Solar	50	19
AD1-118	APS	Natural Gas	60	60
AD1-119	AEP	Solar	49.9	18.96
AD1-129	ComEd	Solar	12.5	7.5
AD1-133	ComEd	Solar	300	180
AD1-148	ComEd	Wind	0	36.3
AD2-038	ComEd	Wind	150	26.4
AD2-048	DPL	Solar	70	46.7
AD2-055	JCPL	Natural Gas	44	35
AD2-060	ComEd	Solar	20	20
AD2-112	AEP	Natural Gas; Other	20	50.4
AD2-131	ComEd	Storage	50	8.3
AD2-133	JCPL	Wind	100.33	18
AD2-134	ComEd	Wind	108.33	21.7
AD2-163	ATSI	Solar	180	120.7
AD2-180	AEP	Wind	110	15.08
AD2-214	ComEd	Solar	68	40.8
AE1-001	ATSI	Nuclear	28.1	7.1
AE1-007	ComEd	Solar	20	7.6
AE1-020	DPL	Offshore Wind	816	229.3
AE1-044	DEOK	Solar	200	111.7933
AE1-064	AEP	Solar	102.1	67.3
AE1-071	ME	Solar	100.1	62.1
AE1-087	Dominion	Storage	20	16
AE1-104	AEC	Offshore Wind	432	121.4
AE1-107	Dominion	Solar	53.1	31

Queue Position	Transmission Owner	Fuel Type	MW Energy	MW Capacity
AE1-108	AEP	Solar	149.5	89.7
AE1-109	AEP	Solar	20	8.7
AE1-113	ComEd	Wind	300	66
AE1-130	AEP	Solar	83	55.3
AE1-138	EKPC	Solar	22	13.2
AE1-144	DPL	Solar; Storage	120	80.2
AE1-146	AEP	Solar	120	81.8
AE1-163	ComEd	Wind	350	49
AE1-183	ATSI	Solar	20	12
AE1-207	AEP	Solar	160	67.2
AE1-208	AEP	Solar	130	55
AE1-209	AEP	Wind	100	13
AE1-210	AEP	Wind	100	13
AE1-245	AEP	Wind	150	19.5
AE1-250	AEP	Solar; Storage	150	90
AE2-024	DPL	Offshore Wind	882	155.23
AE2-025	DPL	Offshore Wind	445.2	78.36
AE2-030	AEP	Solar	18	7.56
AE2-193	ATSI	Solar	120	50.4
AE2-211	EKPC	Solar	55	23.1
AE2-217	ATSI	Solar	180	108
AE2-221	ComEd	Solar	300	180
AE2-222	AEC	Offshore Wind	300	85.424
AE2-226	APS	Solar	99	59.4
AE2-251	AEC	Offshore Wind	1200	337.2
AE2-285	ATSI	Solar	50	30
AE2-290	AEP	Solar	100	60
AE2-303	ComEd	Solar	49.9	30
AE2-309	APS	Solar; Storage	19.84	16.66
AE2-333	APS	Solar	100	60
AF1-014	DEOK	Solar	19.9	7.2
AF1-022	APS	Solar	14	8.4
AF1-078	ComEd	Solar	45	18.9
AF1-099	APS	Solar; Storage	126.5	75.9
AF1-147	DL	Solar	100	60
AF1-148	AEP	Solar; Storage	159	95.4
AF1-223	AEP	Solar	150	90



Queue Position	Transmission Owner	Fuel Type	MW Energy	MW Capacity
AF1-236	DL	Solar	1210	459.8
AF1-282	ComEd	Solar	100	60
AF1-283	ComEd	Solar	130	78
AF1-304	ME	Solar; Storage	100	60
AF2-001	ME	Solar	20	12
AF2-002	ME	Solar	10	6
AF2-004	ATSI	Natural Gas	33	33
AF2-005	ATSI	Natural Gas	8	8
AF2-006	PENELEC	Solar	20	12
AF2-010	ME	Solar	77	46
AF2-013	DL	Storage	100	100
AF2-014	AEP	Solar	150	90
AF2-016	AEC	Storage	300	120
AF2-018	AEP	Solar	200	133.9
AF2-019	AEC	Storage	40	40
AF2-020	AEC	Storage	20	8
AF2-021	AEC	Storage	20	8
AF2-023	AEC	Storage	50	20
AF2-024	AEC	Storage	50	20
AF2-025	AEC	Storage	20	20
AF2-027	ComEd	Storage	50	20
AF2-029	APS	Storage	20	8
AF2-030	EKPC	Storage	20	8
AF2-031	ComEd	Storage	20	8
AF2-032	ComEd	Solar	20	13.6
AF2-033	Dayton	Storage	20	8
AF2-034	ComEd	Solar; Storage	20	10.8
AF2-035	DL	Solar	80	48
AF2-037	DL	Solar	94	56.4
AF2-038	JCPL	Storage	20	8
AF2-039	ME	Solar	13.5	8.1
AF2-040	Dominion	Storage	75	75
AF2-041	ComEd	Solar	300	180
AF2-042	Dominion	Solar	500	300
AF2-046	Dominion	Solar	150	99.8
AF2-047	Dominion	Solar	150	99.8
AF2-048	AEP	Solar	70	46.6



Queue Position	Transmission Owner	Fuel Type	MW Energy	MW Capacity
AF2-049	Dominion	Solar	60	34.5
AF2-050	ME	Solar	50	30
AF2-051	ME	Solar	50	33
AF2-054	Dominion	Solar	19.9	11.94
AF2-055	JCPL	Storage; Solar	50	30
AF2-056	PENELEC	Solar	50	33
AF2-057	Dominion	Storage	20	20
AF2-059	AEP	Solar	20	8.4
AF2-060	Dominion	Storage	9	9
AF2-061	Dominion	Storage	40	40
AF2-063	Dominion	Solar	150	90
AF2-065	Dominion	Solar	150	76.5
AF2-066	ComEd	Solar	80	48
AF2-067	ComEd	Solar	40	24
AF2-068	AEP	Solar	150	90
AF2-069	ComEd	Wind	9.3	2.2
AF2-075	APS	Solar	50	30
AF2-076	Dominion	Solar	50	30
AF2-077	Dominion	Solar	20	12
AF2-078	AEP	Solar; Storage	200	120
AF2-079	ComEd	Solar	165	99
AF2-080	Dominion	Solar	70	48.5
AF2-081	Dominion	Solar	80	56
AF2-082	PENELEC	Solar	55	33
AF2-083	AEP	Solar	150	100
AF2-084	ComEd	Solar	42	28.1
AF2-086	PENELEC	Solar	19.6	11.8
AF2-088	ME	Solar	6.5	3.9
AF2-090	DPL	Solar	110	73.6
AF2-091	Dominion	Solar	34	14.3
AF2-092	ME	Solar	12	7.2
AF2-094	AEP	Solar; Storage	40	26.4
AF2-095	ComEd	Solar; Storage	200	136
AF2-102	EKPC	Solar	3	1.8
AF2-105	AEP	Solar	100	60
AF2-106	AEP	Solar	150	90
AF2-107	AEP	Solar	50	32.3

Queue Position	Transmission Owner	Fuel Type	MW Energy	MW Capacity
AF2-108	Dominion	Solar; Storage	10	10
AF2-110	Dominion	Solar	20	7.72
AF2-112	APS	Solar	17	11.4
AF2-115	Dominion	Solar	25	15
AF2-116	APS	Solar	20	13.3
AF2-117	APS	Solar	70	46.67
AF2-119	Dominion	Solar	80	48
AF2-120	Dominion	Solar	62	37.2
AF2-121	ME	Solar	20	12
AF2-122	AEP	Solar	107.7	64.62
AF2-123	ATSI	Solar	49	20.58
AF2-124	JCPL	Solar	120	50.4
AF2-125	AEP	Solar	54	35.5
AF2-126	ATSI	Solar	51	34
AF2-127	AEP	Solar	38	24.9
AF2-128	ComEd	Wind	79.5	13.992
AF2-129	ATSI	Solar	20	12
AF2-130	ME	Solar	20	12
AF2-132	AEP	Solar	300	180
AF2-133	AEP	Solar	300	180
AF2-134	AEP	Solar	100	60
AF2-136	Dominion	Solar	0	0
AF2-137	AEP	Solar	500	210
AF2-138	DPL	Solar	19.8	8.32
AF2-139	EKPC	Solar	8.8	3.7
AF2-140	PENELEC	Natural Gas	0	30
AF2-141	ME	Storage	0	8
AF2-142	ComEd	Solar	150	90
AF2-143	ComEd	Solar	150	90
AF2-144	Dominion	Solar; Storage	17	10.2
AF2-146	ME	Solar	20	12
AF2-148	ME	Solar	13.5	8.1
AF2-149	AEP	Solar	80	32
AF2-150	ATSI	Solar	88	36.96
AF2-152	PENELEC	Oil	2	2
AF2-153	PENELEC	Oil	2	2
AF2-154	PENELEC	Natural Gas	5	5

Queue Position	Transmission Owner	Fuel Type	MW Energy	MW Capacity
AF2-155	PENELEC	Natural Gas	13	13
AF2-156	PENELEC	Natural Gas	2	2
AF2-157	PENELEC	Natural Gas	0	1
AF2-158	PENELEC	Natural Gas	4	4
AF2-159	PENELEC	Natural Gas	2	2
AF2-160	Dayton	Natural Gas	3.5	3.5
AF2-162	AEP	Solar	45	30
AF2-164	ODEC	Solar	80	48
AF2-165	OVEC	Solar	20	12
AF2-166	PECO	Solar	20	12
AF2-168	PPL	Natural Gas; Solar; Other	5	0
AF2-171	Dominion	Solar	150	90
AF2-173	AEP	Solar	200	84
AF2-174	AEC	Solar	11	4.62
AF2-175	EKPC	Solar	3	1.8
AF2-176	ATSI	Solar	60	36
AF2-177	AEP	Wind	200	26
AF2-183	ComEd	Storage	80	32
AF2-186	AEP	Solar	45	18.9
AF2-187	ATSI	Solar	130	78
AF2-188	AEP	Solar	112	67.2
AF2-189	AEP	Solar	150	90
AF2-191	AEP	Solar	110	66
AF2-193	Dominion	Offshore Wind	440	119
AF2-194	Dominion	Offshore Wind	440	119
AF2-196	Dominion	Offshore Wind	30	9
AF2-198	AEP	Storage	22.4	8.96
AF2-199	ComEd	Solar	100	60
AF2-200	ComEd	Solar	200	120
AF2-203	PENELEC	Solar	20	12
AF2-204	AEP	Solar; Storage	110	72
AF2-205	AEP	Solar	200	120
AF2-207	Dominion	Storage	50.4	20.16
AF2-208	DPL	Storage	100.8	40.32
AF2-209	AEP	Solar; Storage	140	95.4
AF2-210	Dayton	Solar	200	120

Queue Position	Transmission Owner	Fuel Type	MW Energy	MW Capacity
AF2-211	AEP	Solar	100	60
AF2-212	ComEd	Solar	150	90
AF2-213	EKPC	Storage	81.2	32.48
AF2-222	Dominion	Solar	167	100
AF2-223	AEP	Solar; Storage	200	120
AF2-224	AEP	Solar	100	42
AF2-225	ComEd	Solar	150	63
AF2-226	ComEd	Storage	50	20
AF2-227	PENELEC	Solar	63.75	38.25
AF2-228	PENELEC	Solar	61	36.6
AF2-229	PECO	Solar	20	10.9
AF2-232	PENELEC	Solar; Storage	40	24
AF2-233	PENELEC	Solar; Storage	20	12
AF2-234	PENELEC	Solar; Storage	40	24
AF2-235	PECO	Solar	10	6
AF2-238	PECO	Solar	20	12
AF2-239	PENELEC	Solar	20	11.1
AF2-240	PENELEC	Solar	7	3.78
AF2-241	PENELEC	Solar	20	11.3
AF2-242	Dominion	Solar	80	45
AF2-243	PENELEC	Solar	15	9
AF2-247	PPL	Solar	5	2.1
AF2-248	DPL	Solar	7.2	3.4
AF2-249	DPL	Storage	3	0.6
AF2-251	PENELEC	Nuclear	50	0
AF2-252	ComEd	Storage	50	20
AF2-259	Dominion	Solar	25	15
AF2-260	DPL	Solar	85	53
AF2-263	ComEd	Solar	98	58.8
AF2-266	Dominion	Storage	50	50
AF2-274	APS	Solar; Storage	3	0
AF2-275	APS	Solar; Storage	3	0
AF2-276	APS	Solar; Storage	3	0
AF2-291	AEP	Solar	100	60
AF2-292	APS	Solar; Storage	1.17	0
AF2-293	APS	Solar; Storage	1.17	0
AF2-294	PENELEC	Solar	20	12

Queue Position	Transmission Owner	Fuel Type	MW Energy	MW Capacity
AF2-295	APS	Solar	20	12
AF2-296	PENELEC	Solar	20	12
AF2-297	Dominion	Solar	80	48
AF2-298	Dayton	Solar	49.9	29.9
AF2-299	Dominion	Solar	25	15
AF2-300	Dominion	Solar	20	12
AF2-302	AEP	Solar	20	12
AF2-303	Dominion	Solar; Storage	100	100
AF2-304	Dominion	Solar; Storage	89	89
AF2-305	ComEd	Wind	0	9.2
AF2-306	DPL	Storage	26	26
AF2-308	DPL	Storage	28	28
AF2-309	DPL	Solar	70	42
AF2-310	APS	Solar; Storage	20	20
AF2-311	APS	Solar	100	55
AF2-313	DPL	Solar	19.9	12.7
AF2-314	APS	Solar	10	6
AF2-315	PENELEC	Nuclear	50	0
AF2-316	APS	Solar	150	82.7
AF2-317	ComEd	Wind	0	15.68
AF2-318	PENELEC	Solar	20	12
AF2-319	ComEd	Storage	50	20
AF2-322	ATSI	Solar	199.67	119.802
AF2-325	DPL	Solar	10	4.2
AF2-328	AEP	Solar	75	45
AF2-329	ComEd	Storage	42.2	42.2
AF2-331	PENELEC	Solar	50	30
AF2-332	PENELEC	Solar	50	30
AF2-333	PENELEC	Solar	20	12
AF2-334	PEPCO	Solar	20	12
AF2-335	AEP	Solar	100	60
AF2-336	PENELEC	Solar	20	12
AF2-337	PENELEC	Solar	20	12
AF2-338	PENELEC	Solar	20	12
AF2-339	PENELEC	Solar	20	12
AF2-341	ATSI	Solar	20	12
AF2-342	ATSI	Solar	20	12

Queue Position	Transmission Owner	Fuel Type	MW Energy	MW Capacity
AF2-343	ATSI	Solar	20	12
AF2-344	ATSI	Solar	20	12
AF2-345	ATSI	Solar	20	12
AF2-346	ComEd	Solar	75	45
AF2-349	ComEd	Solar	300	180
AF2-350	ComEd	Solar	100	60
AF2-351	ComEd	Storage	20	8
AF2-352	ComEd	Storage	50	20
AF2-356	APS	Solar	175	105
AF2-357	APS	Solar	24	14.4
AF2-358	DPL	Solar	100	60
AF2-359	AEP	Solar	125	75
AF2-361	PEPCO	Solar	85	35
AF2-363	ComEd	Solar	81.4	48.84
AF2-364	ComEd	Solar	81.4	48.84
AF2-365	DPL	Solar	50	30
AF2-370	AEP	Storage	0	20
AF2-371	AEP	Solar	84	50.4
AF2-375	AEP	Solar	129.6	77.76
AF2-376	AEP	Storage	50	20
AF2-377	AEP	Storage	50	20
AF2-378	DPL	Solar	2.65	1.11
AF2-380	APS	Solar	15	9
AF2-382	AEP	Solar	75	45
AF2-383	EKPC	Solar; Storage	20	20
AF2-384	Dayton	Solar; Storage	20	20
AF2-385	DPL	Solar	75	47.8
AF2-387	DPL	Solar	100	66.6
AF2-388	AEP	Wind	200	35.2
AF2-393	ComEd	Storage	60	60
AF2-394	ComEd	Storage	40	40
AF2-395	AEP	Natural Gas	51.1	89.6
AF2-397	Dominion	Solar; Storage	130	78
AF2-398	APS	Solar	3	1.9
AF2-403	Dominion	Storage	0	8
AF2-404	Dominion	Storage	0	0
AF2-405	PENELEC	Storage	10	10

Queue Position	Transmission Owner	Fuel Type	MW Energy	MW Capacity
AF2-407	AEP	Storage	300	300
AF2-408	AEP	Storage	80	80
AF2-409	DPL	Storage	100	100
AF2-414	PPL	Storage	300	300
AF2-415	PPL	Storage	150	150
AF2-416	PPL	Storage	10	10
AF2-417	PEPCO	Solar	20	12
AF2-418	PEPCO	Solar	20	12
AF2-421	PEPCO	Solar	20	12
AF2-424	PEPCO	Solar	20	12
AF2-425	PEPCO	Solar	20	12
AF2-426	APS	Solar; Storage	1.17	0
AF2-433	PEPCO	Solar	20	12
AF2-434	PEPCO	Solar	20	12
AF2-436	PENELEC	Natural Gas	1.5	1.5
AF2-438	PEPCO	Solar	20	12
AF2-439	PENELEC	Solar	50	26
AF2-440	AEP	Solar	50	25
AF2-444	PEPCO	Solar	19.8	11.8
AF2-445A	PEPCO	Solar	19.8	11.8
AG1-001	AEC	Solar	31	11.78
AG1-003	AEP	Solar; Storage	400	226
AG1-004	AEP	Storage	200	200
AG1-007	Dominion	Solar	9.4	6
AG1-009	Dominion	Storage	0	0
AG1-010	Dominion	Storage	0	0
AG1-012	APS	Solar; Storage	0	0
AG1-013	Dominion	Storage	0	0
AG1-014	Dominion	Storage	0	0
AG1-015	Dominion	Storage	0	0
AG1-017	AEP	Wind	16.64	2.93
AG1-018	APS	Solar	8	3.2
AG1-019	Dominion	Storage	100	100
AG1-021	Dominion	Solar	20	12
AG1-022	AEP	Solar	20	12
AG1-023	Dominion	Solar	75	15
AG1-024	AEP	Solar	85	35.7

Queue Position	Transmission Owner	Fuel Type	MW Energy	MW Capacity
AG1-025	AEP	Solar	20	8.4
AG1-027	Dominion	Solar	127.5	82.11
AG1-028	Dominion	Storage	0	0
AG1-029	APS	Solar	30	13.6
AG1-031	Dominion	Solar	20	8.4
AG1-033	PENELEC	Solar	5	3.2
AG1-034	AEP	Solar	127.5	53.55
AG1-037	Dominion	Solar	5	3
AG1-038	Dominion	Solar	45	18.9
AG1-039	ATSI	Solar	56	23.52
AG1-040	PENELEC	Solar	20	12
AG1-041	PENELEC	Solar	12	7.2
AG1-043	Dominion	Solar	60	36
AG1-044	ComEd	Storage	0.5	0
AG1-045	APS	Solar; Storage	36	18
AG1-047	AEP	Solar	100	60
AG1-049	AEP	Solar	0	17.6
AG1-050	PPL	Storage	20	20
AG1-051	ATSI	Storage	20	20
AG1-052	EKPC	Storage	20	20
AG1-053	JCPL	Storage	20	20
AG1-054	ATSI	Solar	40	25.2
AG1-057	Dominion	Storage	20	20
AG1-059	APS	Solar	100	60
AG1-060	PPL	Wind	174.8	25.7
AG1-063	ATSI	Storage	2.5	0.7
AG1-064	Dominion	Storage	19.1	8
AG1-065	Dominion	Storage	19.1	8
AG1-066	AEP	Solar	80	48
AG1-067	DPL	Solar	38	24.8
AG1-068	ATSI	Solar	49.9	30.5
AG1-070	DPL	Solar; Storage	45	32.7
AG1-071	DPL	Solar; Storage	55	37.5
AG1-072	DPL	Storage	50	50
AG1-076	AEP	Solar	0	46
AG1-077	PENELEC	0	0	0
AG1-079	DPL	Solar	1.5	0

Queue Position	Transmission Owner	Fuel Type	MW Energy	MW Capacity
AG1-080	PPL	Solar	19.9	10.7
AG1-084	Dominion	Solar; Storage	17.5	10.5
AG1-085	Dominion	Solar; Storage	17.5	10.5
AG1-086	Dayton	Solar; Storage	17.5	10.5
AG1-088	AEC	Storage	0	0
AG1-089	AEP	Storage	30	12
AG1-091	AEP	Solar	50	32.4
AG1-092	AEP	Storage	0	0
AG1-094	PENELEC	Natural Gas	35.3	0
AG1-095	APS	Solar	16	10.6667
AG1-097	APS	Solar	0	13
AG1-100	PENELEC	Solar	20	12
AG1-101	APS	Solar	10	6.7
AG1-102	Dominion	Storage	19	6.16
AG1-103	AEC	Storage	0	0
AG1-104	ATSI	Storage	300	120
AG1-107	AEP	Solar	150	85.7
AG1-109	AEP	Storage	0	25
AG1-110	AEC	Storage	0	20
AG1-112	APS	Storage	0	10
AG1-113	PENELEC	Storage	0	3.6
AG1-114	PENELEC	Storage	0	10
AG1-115	PPL	Storage	0	100
AG1-116	AEC	Storage	0	0
AG1-117	AEC	Storage	0	0
AG1-125	AEP	Solar	400	234.9
AG1-126	AEP	Solar	400	234.9
AG1-129	AEC	Solar	51	30.6
AG1-130	PPL	Storage	5	2
AG1-131	Dominion	Solar	25.6	15.36
AG1-132	Dayton	Natural Gas	20	20
AG1-133	Dominion	Solar	128	76.8
AG1-134	Dominion	Solar	100	60
AG1-135	Dominion	Solar	60	36
AG1-136	AEP	Storage	100	40
AG1-137	Dominion	Storage	100	40
AG1-138	PENELEC	Solar	5	4.75

Queue Position	Transmission Owner	Fuel Type	MW Energy	MW Capacity
AG1-139	PENELEC	Solar	5	4.75
AG1-140	PENELEC	Solar	2.62	1.7
AG1-141	APS	Solar	5	2.8
AG1-142	APS	Solar	2.5	1.4
AG1-143	Dominion	Storage	200	80
AG1-145	Dominion	Solar	20	12
AG1-146	Dominion	Solar	30	18
AG1-147	Dominion	Solar	70	42
AG1-148	PPL	Natural Gas	5	0
AG1-149	DPL	Storage	3	3
AG1-151	Dominion	Storage	100	100
AG1-152	Dominion	Storage	100	40
AG1-153	Dominion	Storage	75	30
AG1-154	Dominion	Storage	50	20
AG1-155	AEP	Storage	20	8
AG1-156	PPL	Solar	60	39.5
AG1-157	PPL	Solar	7.37	0
AG1-158	JCPL	Solar	16	0
AG1-159	Dominion	Storage	0	0
AG1-160	Dominion	Storage	75	30
AG1-162	AEP	Solar	33.4	17.6
AG1-164	PPL	Solar	20	12
AG1-165	PPL	Solar	20	12
AG1-166	Dominion	Solar	20	12
AG1-167	Dominion	Solar	20	12
AG1-168	Dominion	Solar	20	12
AG1-169	Dominion	Solar	20	12
AG1-170	Dominion	Solar	20	12
AG1-182	APS	Solar	100	65.21
AG1-183	Dominion	Solar	50	35.52
AG1-186	APS	Solar	0	34.79
AG1-187	Dominion	Storage	0	14.48
AG1-190	PPL	Solar	13.2	5.5
AG1-191	EKPC	Solar	15.4	6.5
AG1-193	PENELEC	Solar	20	12
AG1-194	AEP	Solar; Storage	200	104
AG1-195	Dominion	Solar; Storage	150	150

Queue Position	Transmission Owner	Fuel Type	MW Energy	MW Capacity
AG1-196	Dominion	Solar; Storage	150	150
AG1-197	PENELEC	Solar	15	9
AG1-198	PENELEC	Solar	12	7.2
AG1-200	PPL	Solar	3.984	1.7
AG1-202	PENELEC	Solar	10	6.6
AG1-203	PENELEC	Solar	10	6.5
AG1-205	PENELEC	Solar	10	6.5
AG1-207	Dayton	Storage	85	85
AG1-209	Dominion	Storage	7	2.8
AG1-210	Dominion	Storage	10	4
AG1-213	Dominion	Storage	10	4
AG1-214	Dominion	Storage	19	7.6
AG1-215	Dominion	Storage	14	5.6
AG1-218	AEP	Solar	250	150
AG1-219	AEP	Solar; Storage	75	39.5
AG1-221	Dominion	Storage	50	20
AG1-223	EKPC	Solar	15.4	6.47
AG1-227	PPL	Solar	20	12
AG1-228	PPL	Solar	20	12
AG1-231	Dayton	Solar	20	12
AG1-232	AEP	Solar	135	81
AG1-237	AEP	Wind	200	26
AG1-239	ATSI	Solar	150	90
AG1-246	APS	Solar	7.5	4.9
AG1-251	ATSI	Solar	3.88	1.9
AG1-253	PENELEC	Solar	4	2.7
AG1-254	AEC	Solar; Storage	38	25.3
AG1-255	AEC	Solar; Storage	55	36.7
AG1-256	Dominion	Storage	20	8
AG1-257	APS	Solar	19.9	8.3
AG1-259	PPL	Solar	19.9	8.3
AG1-260	PPL	Solar	19.9	8.3
AG1-263	PPL	Storage	20	8
AG1-267	PPL	Storage	20	8
AG1-268	PPL	Storage	80	40.8
AG1-277	PPL	Solar; Storage	40	32
AG1-278	PPL	Solar; Storage	20	15.42

Queue Position	Transmission Owner	Fuel Type	MW Energy	MW Capacity
AG1-279	PPL	Solar; Storage	20	15.42
AG1-280	PENELEC	Solar	20	12
AG1-281	PENELEC	Solar	20	12
AG1-282	Dominion	Solar	20	12
AG1-283	PPL	Solar	30	18
AG1-290	ATSI	Storage	20	4
AG1-291	Dayton	Hydro	16.8	13.5
AG1-296	PENELEC	Solar	10	6.5
AG1-299	AEC	Solar	3	1.8
AG1-300	AEC	Solar	3	1.8
AG1-303	PENELEC	Solar	44	26.4
AG1-305	Dominion	Solar	118	70.8
AG1-307	APS	Solar; Storage	80	56
AG1-308	PENELEC	Solar	19.9	8.3
AG1-311	AEP	Solar; Storage	99	69.4
AG1-315	APS	Solar	2	0.84
AG1-317	PENELEC	Storage	1	0.3
AG1-318	DPL	Storage	1	0.3
AG1-322	Dominion	Solar; Storage	70	70
AG1-323	Dayton	Solar; Storage	40	40
AG1-324	AEP	Solar; Storage	45	31.5
AG1-327	APS	Solar	35	23.1
AG1-330	PPL	Solar; Battery	5	4.5
AG1-335	ATSI	Solar	4	2.7
AG1-336	PPL	Solar; Storage	5	3.8
AG1-337	PPL	Solar; Storage	5	3.7
AG1-338	PENELEC	Solar	5	4.4
AG1-344	Dominion	Solar	20	12
AG1-345	Dominion	Solar	8	4.8
AG1-346	Dominion	Solar	20	12
AG1-348	EKPC	Solar	19.8	8.316
AG1-349	AEP	Solar	260	156
AG1-352	DPL	Solar	50	30
AG1-360	DPL	Solar	8.75	0
AG1-362	PPL	Solar	5	3.2
AG1-363	APS	Solar; Storage	300	220
AG1-365	AEP	Solar	100	60



Queue Position	Transmission Owner	Fuel Type	MW Energy	MW Capacity
AG1-366	AEP	Storage	50	20
AG1-368	AEP	Solar	100	60
AG1-369	AEP	Solar	49.9	29.94
AG1-373	ComEd	Storage	0	10
AG1-377	PENELEC	Solar	20	12
AG1-378	PENELEC	Solar	20	12
AG1-382	PENELEC	Solar	20	12
AG1-383	Dominion	Solar	20	15.43
AG1-386	APS	Solar; Storage	20	15.42
AG1-388	Dominion	Solar	20	12
AG1-393	Dominion	Solar	20	12
AG1-394	Dominion	Solar	20	12
AG1-397	DPL	Solar; Storage	9.972	4.1882
AG1-398	ComEd	Wind	0	7.33
AG1-405	DPL	Solar	57	34.2
AG1-406	DPL	Storage	22	22
AG1-410	AEP	Solar	300	180
AG1-412	Dominion	Storage	200	80
AG1-415	APS	Solar	50	25
AG1-416	APS	Solar; Storage	125	91
AG1-417	AEP	Solar	50	30
AG1-418	AEP	Solar	50	30
AG1-419	JCPL	Solar	50	21
AG1-420	APS	Solar	70	42
AG1-421	Dominion	Solar	200	120
AG1-422	Dominion	Storage	50	50
AG1-424	AEP	Solar	100	60
AG1-436	AEP	Solar	125	75
AG1-447	AEP	Storage	55	55
AG1-448	AEP	Storage	55	55
AG1-453	AEP	Solar	140	84
AG1-454	AEP	Storage	50	50
AG1-456	AEP	Storage	30	30
AG1-460	ComEd	Storage	30	12
AG1-461	DPL	Solar	30	19.5
AG1-465	JCPL	Storage	100	40
AG1-466	Dominion	Solar	14	8.4

Queue Position	Transmission Owner	Fuel Type	MW Energy	MW Capacity
AG1-467	Dominion	Solar	15.6	9.36
AG1-468	AEP	Solar	14	8.4
AG1-469	Dominion	Solar	15.6	9.36
AG1-471	DPL	Solar	60	36
AG1-476	AEC	Natural Gas; Other	0	33.1
AG1-478	ComEd	Solar; Storage	19.9	15.9
AG1-481	PENELEC	Solar; Storage	15.53	15.53
AG1-483	PENELEC	Solar; Storage	542.5	542.5
AG1-484	JCPL	Solar; Storage	20	20
AG1-485	Dayton	Storage	55	55
AG1-486	JCPL	Storage	15	15
AG1-487	EKPC	Solar; Storage	20	20
AG1-489	ATSI	Solar; Storage	175	145
AG1-490	ATSI	Solar; Storage	125	105
AG1-495	EKPC	Solar	19.8	8.316
AG1-498	PPL	Solar	8.8	3.7
AG1-499	AEC	Solar	10	6
AG1-501	ATSI	Natural Gas	11.3	10
AG1-504	PPL	Solar	68	41.1
AG1-507	ComEd	Natural Gas	296	296
AG1-508	AEP	Wind	63.3	9.3
AG1-509	AEP	Wind	105.4	15.5
AG1-510	EKPC	Solar; Storage	20	12
AG1-511	EKPC	Solar; Storage	50	30
AG1-512	ComEd	Storage	40	16
AG1-513	ComEd	Storage	10	4
AG1-514	APS	Storage	10	4
AG1-515	APS	Storage	10	4
AG1-516	APS	Storage	10	4
AG1-517	APS	Natural Gas	0	0
AG1-518	Dominion	Solar; Storage	50	50
AG1-519	Dominion	Solar	20	12
AG1-520	PENELEC	Solar; Storage	4	0
AG1-527	APS	Solar	215	129
AG1-528	AEP	Solar	225	135
AG1-532	Dominion	Solar	13.5	8.1
AG1-533	APS	Solar	40	24

Queue Position	Transmission Owner	Fuel Type	MW Energy	MW Capacity
AG1-534	Dominion	Storage	200	200
AG1-535	ComEd	Storage	85	85
AG1-537	Dominion	Storage	75	32
AG1-538	Dominion	Storage	75	32
AG1-541	Dominion	Storage	75	32
AG1-545	Dominion	Solar; Storage	20	14
AG1-551	Dominion	Solar	20	13.1
AG1-554	AEP	Solar	49.99	32.7
AG1-555	AEP	Solar; Storage	120	88.4
AG1-558	Dominion	Solar; Storage	20	13.3
AG1-562	AEP	Solar	250	150
AG1-563	EKPC	Solar	0	0.7
AG2-135	PPL	Storage	0.28	0
Y3-013	ComEd	Natural Gas	0	90
Z1-035	ATSI	Offshore Wind	18	2.34

Attachment D – Interconnection Network Upgrades

Upgrade ID	Description	Cost Estimate (\$M)	Required In-Service Date
n7382	Replace two (2) 138 kV circuit breakers (452A and 452B) at B.L. England to upgrade them to a 3000A rating.	\$1.47	10/1/2025
n5604	Upgrade line protection and controls at the Smith Mountain 138 kV substation to coordinate with the new 138 kV switching station.	\$0.12	12/13/2019
n6034	Expansion of College Corner 138 kV substation and installation of associated protection and control equipment.	\$3.00	7/1/2019
n6035	Modify 138 kV Revenue Metering at College Corner 138 kV substation	\$0.25	7/1/2019
n6939	AEP shall install one (1) 34.5 kV circuit breaker at AEP's existing Capital Avenue 34.5 kV substation.	\$0.82	1/0/1900
n6940	AEP shall Install 34.5 kV revenue metering at the Capital Avenue 34.5 kV substation.	\$0.29	1/0/1900
n6941	AEP shall extend one span of 34.5 kV transmission line for the generation-lead going to the Customer Facility. AEP will build and own the first transmission line structure outside of the Capital Avenue 34.5 kV substation, to which AEP's transmission line conductor will attach.	\$0.24	1/0/1900
n6942	AEP shall install a fiber-optic connection from the Customer Facility's telecom equipment to AEP's Capital Avenue 34.5 kV control house.	\$0.12	1/0/1900

Upgrade ID	Description	Cost Estimate (\$M)	Required In-Service Date
n7268	Construct an exit Span and 1st Structure to Gen Lead Line at Delano 138 kV substation.	\$0.52	5/5/2016
n7269	To accommodate the interconnection at AEP's existing Delano 138 kV station, the station will have to be expanded by adding two 138 kV circuit breakers, extending the 138 kV bus #1 and #2, and adding a new circuit breaker string.	\$3.18	5/5/2016
n7270	Install metering at Delano 138 kV station	\$0.48	5/5/2016
n7282	Modify and expand the existing Payne 69 kV station including one 69 kV circuit breaker installation.	\$0.65	9/28/2017
n7283	Upgrade line protection and controls at the Payne 69 kV station.	\$0.27	9/28/2017
n7284	Install 69 kV Revenue Metering at Payne 69 kV substation.	\$0.32	9/28/2017
n7285	Perform relay and remote end work at Haviland 69 kV station.	\$0.20	9/28/2017
n7286	Perform relay and remote end work at South Hicksville 69 kV station.	\$0.10	9/28/2017
n7371	New 138 kV station oversight.	\$0.47	2/16/2017
n7372	Biers Run-Circleville 138 kV T-Line Cut-In and Fiber installation.	\$0.79	2/16/2017
n7373	Upgrade line protection and controls at the Biers Run 138 kV station.	\$0.04	2/16/2017
n7374	Upgrade line protection and controls at the Circleville 138 kV substation.	\$0.04	2/16/2017
n7452	Install 138 kV Revenue Meter, generator lead transmission line span from the Nottingham 138 kV station to the Point of Interconnection, including the first structure outside the Nottingham 138 kV station, and extend dual fiber-optic from the Point of Interconnection to the Nottingham 138 kV station control house.	\$0.98	3/29/2019
n7453	Expand Nottingham 138 kV station, including the addition of two 138 kV circuit breakers, installation of associated protection and control equipment, 138 kV line risers, and supervisory control and data acquisition (SCADA) equipment.	\$1.24	3/29/2019
n7489	Install 69 kV metering at the Continental 69 kV station. Construct line from the Continental 69 kV station to the Point of Interconnection. Install dual fiber telecommunications from the Continental 69 kV station to the Customer Facility collector station.	\$0.40	9/21/2017
n7490	Expand Continental 69 kV station, including the addition of one 69 kV circuit breaker, installation of associated protection and control equipment, 69 kV line risers, switches, jumpers, and supervisory control and data acquisition (SCADA) equipment.	\$1.00	9/21/2017
n7508	Install a new 345-138 kV 450 MVA transformer, 138 kV circuit breaker, 345 kV circuit breaker, two 3-pole turning structures, monopole transition structure, 345 kV rigid bus conductor, and Discontinuous Inductor Current Mode (DICM) expansion.	\$7.91	1/0/1900

Upgrade ID	Description	Cost Estimate (\$M)	Required In-Service Date
n7671.1	Install 138 kV metering at the Axton 138 kV station. Construct generator lead transmission line from the Axton 138 kV station to the Point of Interconnection. Install dual fiber telecommunications from the Axton 138 kV station to the Customer Facility collector station.	\$2.39	8/31/2018
n7671.2	Expand Axton 138 kV station, including the addition of two 138 kV circuit breakers, extending the south 138 kV Bus #1, installation of associated protection and control equipment, 138 kV line risers, switches, jumpers, and supervisory control and data acquisition (SCADA) equipment.	\$1.41	8/31/2018
n7953	Modify relay settings at Buckskin 69 kV substation.	\$0.05	12/31/2021
n5794	Construct a 138 kV three-breaker ring bus interconnection substation.	\$4.67	12/31/2018
n5795	Meadow Brook-Strasburg 138 kV Line Loop: Cut and loop into the new AD1-155 138 kV interconnection switchyard. Cut will take place 2.25 mi from Meadow Brook and 7.11 mi from Strasburg.	\$0.70	12/31/2020
n5796	Meadow Brook 138 kV substation: Replace Strasburg line tuner with wide band tuner. Add DTT, change carrier frequency and modify relay settings. SCADA work to support relay installation.	\$0.15	12/31/2020
n5797	Strasburg 138 kV substation: Replace Meadow Brook line tuner with wide band tuner. Add DTT, change carrier frequency and modify relay settings. SCADA work to support relay installation.	\$0.15	12/31/2020
n5798	Fiber Communication: Install ADSS fiber from AD1-155 control to FirstEnergy fiber backbone about 0.5 mi to support communication backhaul.	\$0.14	12/31/2020
n6893	New Sulphur City 138 kV substation: Engineering and construction oversight.	\$0.54	9/30/2020
n6895	Kelso Gap-Parr Run 138 kV Line Loop to new Sulphur city 138 kV Interconnection substation including project management, environmental, forestry, real estate and right-of-way.	\$1.66	9/30/2020
n6896	Elk Garden 138 kV substation: Modify drawings and nameplates.	\$0.03	9/30/2020
n6897	Parr Run 138 kV substation: Install new relay protection panel. Wave trap and line tuner will be returned. Anti-islanding transmitter will be replaced.	\$0.41	9/30/2020
n6898	Kelso Gap 138 kV substation: Replace transfer trip receiver. Wave trap and line tuner will be returned. Anti-islanding transmitter will be installed.	\$0.45	9/30/2020
n6899	AD2-180 Generation substation: Oversight of specification and installation of metering system. Includes nameplate, drawing review and energization support.	\$0.02	9/30/2020
n7010	Construct a new 3-breaker ring bus on the 138 kV line between Guilford and McConnellsburg.	\$6.12	10/1/2022
n7011	Loop the Guilford-McConnellsburg 138 kV line into new AE1-101 ring bus.	\$0.83	10/1/2022

Upgrade ID	Description	Cost Estimate (\$M)	Required In-Service Date
n7012	McConnellsburg: Replace breaker, wave trap, arresters, relaying.	\$0.68	10/1/2022
n7013	Guilford: Replace breaker, wave trap, arresters, relaying	\$0.68	10/1/2022
n7249	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.	\$0.39	1/0/1900
n7250	Revenue metering – engineering oversight of specification and design of new revenue metering that will be installed by power producer (interconnection customer) at their location (AD1-125) and connected to the new ring bus station at the Baker substation. Coordinate FE MV90 access to the new meter.	\$0.00	1/0/1900
n7251	Reconfigure Baker substation into a 138 kV three-breaker ring bus configuration. Reterminate the existing 138/34.5 kV Transformer 1 and add new AD1-125 generation interconnection line @ Baker.	\$3.55	1/0/1900
n7252	Upgrade carrier equipment for anti-islanding and add CCVT @ Hardy.	\$0.56	1/0/1900
n7253	Upgrade carrier equipment for anti-islanding @ Junction.	\$0.28	1/0/1900
n7254	Upgrade carrier equipment for anti-islanding @ North Petersburg.	\$0.33	1/0/1900
n7255	Upgrade carrier equipment for anti-islanding at Seneca Caverns 138 kV.	\$0.33	1/0/1900
n7256	Upgrade carrier equipment for anti-islanding William 138 kV.	\$0.28	1/0/1900
n7257	Reterminate the Baker-Hardy 138 kV line into the expanded Baker substation at Baker-Hardy 138 kV line.	\$0.21	1/0/1900
n7258	Install fiber from the Baker control house to connect with the fiber ran from the generator site. Estimated SCADA work at Baker, Hardy, Junction, North Petersburg, Seneca Caverns and William substations to support interconnection requirements.	\$0.21	1/0/1900
n7259	Project Management, Environmental, and Forestry.	\$0.27	1/0/1900
n7274	Tap the McConnellsburg – Mercersburg 34.5 kV Line, install two manual 1200A gang operated line switches on the existing McConnellsburg-Mercersburg 34.5 kV Line, for the LSBP solar facility (AD1-061) at McConnellsburg-Mercersburg 34.5 kV Line Tap.	\$0.10	12/31/2021
n7275	Estimated SCADA work at McConnellsburg & Mercersburg substations to support relay replacements and updated relay settings.	\$0.07	12/31/2021
n7276	Install new relaying on the Mercersburg 34.5 kV line for the LSPB Solar interconnection (AD1-061) at McConnellsburg 34.5 kV.	\$0.32	12/31/2021
n7277	Review and revise relay settings at Mercersburg 34.5 kV.	\$0.01	12/31/2021

Upgrade ID	Description	Cost Estimate (\$M)	Required In-Service Date
n7378	McConnellsburg substation: Install a 138 KV breaker for the AD2-009 generation interconnection. This line item also includes project management and environmental tasks.	\$0.37	6/30/2019
n7379	Cherry Run: Replace one 1200A wavetrapp and line tuner with one 2000A wideband wavetrapp and line tuner.	\$0.32	6/30/2019
n7380	Guilford: Replace one 1200A wavetrapp and line tuner with one 2000A wideband wavetrapp and line tuner.	\$0.32	6/30/2019
n7381	Estimated SCADA work at McConnellsburg, Cherry Run, & Guilford substations to support relay installations, wave trap installations, and updated relay settings. Estimated in-sub fiber run to from McConnellsburg control house to developer ran fiber for communications to AD2-009.	\$0.11	6/30/2019
n6707	AC2-195 Interconnection Switchyard including SCADA, metering and project management.	\$7.31	12/31/2020
n6708	Loop the Galion-Roberts South 138 kV circuit into the proposed 3-breaker ring bus near towers 3825 & 3826. @ Galion-Roberts South 138 kV Loop.	\$0.68	12/31/2020
n6709	Install mid-span structure to raise height of Galion-Roberts North 138 kV to permit loop of Galion-Roberts 138 kV South to the new interconnection substation for AC2-195.	\$0.11	12/31/2020
n6710	Galion substation – Upgrade line relaying for Roberts 138 kV line exit and rename for new AC2-195 PJM station.	\$0.21	12/31/2020
n6711	Roberts substation – Upgrade line relaying for Galion 138 kV line exit and rename for new AC2-195 PJM station.	\$0.21	12/31/2020
n6713	Dual Rail substation – Change nameplates, revise engineering drawings and settings.	\$0.02	12/31/2020
n6714	Hamilton substation – Change nameplates, revise engineering drawings and settings.	\$0.02	12/31/2020
n7312	Maysville: Extend the Maysville 69 kV bus. Install one 69 kV circuit breaker.	\$0.82	6/30/2022
n7313	Estimated SCADA work at Maysville substation to support breaker and relay installations. Estimated in-sub fiber run from Maysville control house to developer ran fiber build for communications and control to AE2-285 Generation Interconnection.	\$0.06	6/30/2022
n7314	Sharon 69 kV: Modify relay settings.	\$0.10	6/30/2022
n7315	Dilworth 69 kV: Modify relay settings.	\$0.10	6/30/2022
n7316	McDowell 69 kV: Modify relay settings.	\$0.10	6/30/2022
n7317	Masury 69 kV: Modify relay settings.	\$0.10	6/30/2022

Upgrade ID	Description	Cost Estimate (\$M)	Required In-Service Date
n7318	<p>AD2-163: OPTION TO BUILD: Install a 138 kV three-breaker ring bus on the East Springfield Broadview-Tangy line to provide interconnection facilities for 200MW of solar generation.</p> <p>Modify drawings and nameplates for FE standards.</p> <p>Project Management, Environmental, Real Estate, and Right of Way.</p>	\$0.86	12/1/2021
n7319	<p>SCADA/Fiber Communication: Estimated SCADA work at Tangy, Broadview, Bellepoint, and Mill Creek substations to support relay and wavetrap installations. Estimated installation of Cellular system to support RTU installation at AD2-163. Assumed SCADA work is included in this cost. Estimated one in-sub fiber run from AD2-163 substation control house to developer built fiber run to support communications and control to generator site.</p>	\$0.19	12/1/2021
n7320	Broadview Tangy 138 kV Line Loop: Cut the Broadview-Tangy 138 kV line and terminate the line inside the proposed AD2-163.	\$0.77	12/1/2021
n7321	Tangy 138 kV: Line terminal upgrade.	\$0.40	12/1/2021
n7322	Bellepoint 138 kV: Line terminal upgrade.	\$0.22	12/1/2021
n7323	Millcreek 138 kV: Line terminal upgrade.	\$0.29	12/1/2021
n7324	Broadview 138 kV: Line terminal upgrade.	\$0.40	12/1/2021
n5756	Mitigate sag limitation on the AB1-122 Tap-Dresden; R 345 kV line.	\$1.49	6/1/2021
n6778	Install Fiber Optics Cable OPGW 2 miles TSS 939 Mulberry to Sta 12 Dresden.	\$0.54	2/1/2022
n6804	Engineering Oversight for TSS 909 Deer Creek 345 kV.	\$1.92	12/31/2018
n6805	P&C upgrades at Brokaw 345 kV for AB2-070.	\$0.08	12/31/2018
n6806	P&C upgrades at TSS 188 Mt. Pulaski 345 kV for AB2-070.	\$0.15	12/31/2018
n6807	Loop 18806 into TSS 909 Deer Creek 345 kV.	\$2.88	12/31/2018
n6808	Upgrade TSS 95 Chestnut 345 kV Communications for AB2-070.	\$0.17	12/31/2018
n6809	Upgrade Wapella 345 kV Communications for AB2-070.	\$0.17	12/31/2018
n7417	Review and Modify the line L11904 relay settings at Lena 138 kV to accommodate the interconnection of the AD2-172/AE2-035 Projects.	\$0.17	5/19/2020
n7471	AE2-206 138 kV interconnection switching station – Construct a new 138 kV switching station to interconnect the Customer Facility.	\$4.01	11/30/2021

Upgrade ID	Description	Cost Estimate (\$M)	Required In-Service Date
n7472	Construct a new loop-in tap line from Dayton's existing East Sidney-Quincy 138 kV line to the new AE2-206 138 kV interconnection switching station.	\$1.10	11/30/2021
n7473	Shelby 138 kV substation – Modify relay settings.	\$0.02	11/30/2021
n7474	Logan 138 kV substation – Modify relay settings.	\$0.02	11/30/2021
n7476	Construct a new 345 kV switching station to interconnect the AE2-221 Customer Facility.	\$6.88	12/31/2021
n7477	Construct a new loop-in tap line from Dayton's existing Clinton-Stuart 345 kV line to the new AE2-221 345 kV interconnection switching station.	\$1.99	12/31/2021
n7478	Modify relay settings at Clinton 345 kV substation.	\$0.02	12/31/2021
n7479	Modify relay settings at Stuart 345 kV substation.	\$0.02	12/31/2021
n7482	Construct a new four-breaker ring bus 69 kV switching station to interconnect the Customer Facility.	\$3.93	6/1/2023
n7483	Construct a new loop-in tap line from Dayton's existing Honda East Liberty-East Liberty Union REA-Honda Marysville Union REA 69 kV line to the new AE2-303 69 kV interconnection switching station.	\$2.15	6/1/2023
n7484	Modify relay settings at Honda East Liberty 69 kV substation.	\$0.02	6/1/2023
n7485	Modify relay settings at Honda Marysville 69 kV substation.	\$0.02	6/1/2023
n7486	Modify relay settings at Peoria 69 kV substation.	\$0.02	6/1/2023
n7487	Construct a four circuit breaker ring bus 69 kV substation. This includes the installation of all physical structures, protection and control equipment, communications equipment, and associated facilities at the Woodstock 69 kV substation.	\$3.28	12/1/2022
n7488	Re-route transmission circuits at the Woodstock 69 kV substation.	\$0.66	12/1/2022
n7952	Washington CH 69 kV substation – Modify relay settings.	\$0.02	12/31/2021
n6655	Build a three-breaker 115 kV substation at the AC2-112 facility.	\$6.25	10/31/2018
n6656	Build new structures to cut and loop the transmission line into AC2-112 115 kV substation.	\$1.10	10/31/2018
n6657	Modify protection and communication work to support interconnection of new AC2-112 generator.	\$0.12	10/31/2018
n6695	Build a three-breaker 230 kV substation at the AD1-033 facility.	\$6.80	12/31/2020
n6696	Build new structures to cut and loop the transmission line into AD1-033 230 kV substation.	\$1.80	12/31/2020
n6697	Modify protection and communication work to support interconnection of new AD1-033 generator.	\$0.20	12/31/2020

Upgrade ID	Description	Cost Estimate (\$M)	Required In-Service Date
n6704	Build a three-breaker 115 kV substation at the AD1-041 facility.	\$5.90	12/23/2019
n6705	Build new structures to cut and loop the transmission line into AD1-041 115 kV substation.	\$1.60	12/23/2019
n6706	Modify protection and communication work to support interconnection of new AD1-041 generator.	\$0.20	12/23/2019
n5726	Install circuit breaker and associated substation equipment at Ahsokie 34.5 substation.	\$0.39	12/30/2016
n5727	Install a new circuit at Ahsokie 34.5 kV substation.	\$0.13	12/30/2016
n6055	Replace wave trap at North Anna substation for Midlothian-North Anna 500 kV line #576. This will increase emergency rating by 31% to 3424 MVA. Estimated to 12–16 months to engineer and construct.	\$0.30	10/1/2019
n6072	Build a three-breaker ring bus at the new AC1-105 substation.	\$5.23	7/31/2018
n6073	Build new structures to cut and loop the line into AC1-105 115 kV switching station.	\$1.19	7/31/2018
n6074	Modify protection and communication work to support interconnection of new AC1-105 generator.	\$0.18	7/31/2018
n6083	Construct a three-breaker ring bus for AC1-076 interconnection substation.	\$5.12	4/30/2018
n6084	Line 115 kV modifications for Locust Grove-Paytes 115 kV line.	\$2.02	4/30/2018
n6085	Install metering and associated protection equipment at the AC1-076 Interconnection substation.	\$0.49	4/30/2018
n6086	Relay modifications for 115 kV Oak Green, Unionville, Locust Grove and Spotsylvania substations.	\$0.16	4/30/2018
n6118	Upgrading the breaker leads, switch and 1 span of line at DVP's Battleboro 115 kV terminal will bring the rating to 398 MVA (will still be limited by terminal equipment at Rocky Mount 115 kV Duke substation).	\$0.10	1/0/1900
n6217	This network upgrade is an advancement cost to the baseline – The line can be uprated from 2598 MVA to 2914 MVA normal and emergency by replacing a wave trap.2914/2914/3351	\$0.02	3/1/2023
n6252	Expand the Chickahominy 230 kV substation with a new bay for AC1-164	\$5.00	10/1/2019
n6282	Construction of new substation connection on Transmission Line 1015 between South Justice Branch and Scotland Neck substation into the new AC1-098_099 three-breaker ring bus	\$1.13	6/1/2019
n6283	Remote protection and communication work at Earleys, Scotland Neck and South Justice Branch 115 kV substations.	\$0.15	6/1/2019

Upgrade ID	Description	Cost Estimate (\$M)	Required In-Service Date
n6325	Modify protection and communication to support interconnection of new AC1-042 generator.	\$0.25	10/1/2019
n6326	Build new structures to cut and loop the line into AC1-042 69 kV substation	\$0.84	10/1/2019
n6371	Rebuild 7.46 miles of 115 kV Line 198 from Spotsylvania to Todds Tavern DP with 768 ACSS.	\$9.70	1/0/1900
n6372	Rebuild 1.34 miles of 115 kV Line 198 from Ni River DP to Chancellor with 768 ACSS.	\$1.74	1/0/1900
n6373	Rebuild 5.07 miles of 115 kV Line 198 from Todds Tavern DP to Ni River DP with 768 ACSS.	\$6.59	1/0/1900
n6468	Modify protection and communication work to support interconnection of new AC1-208 generator.	\$0.15	12/1/2019
n6469	Build new structures to cut and loop the line #81 into AC1-208 115 kV substation.	\$1.80	12/1/2019
n6470	Build a three-breaker 115 kV substation at the AC1-208 facility.	\$5.30	12/1/2019
n6618	Rebuild Line #55 (Tarboro-Anaconda 115 kV) and associated 230 kV work on towers shared with 230 kV line 229.	\$14.05	12/31/2022
n6618.1	Split the 115 kV bus at Hathaway into two separate buses with a 115 kV line on each bus and close the tie switch between line 55 & 80. Line #1001 is opened at Battleboro thus making line #1001 radial from Chestnut substation.	\$0.02	12/31/2022
n6635	Install transfer trip from the #2076 line to Sanders DP to trip the AD2-073 facility.	\$0.00	1/0/1900
n6644	Build a three-breaker ring bus at the new AC1-034 115 kV substation.	\$5.30	12/15/2020
n6645	Install new structures to cut and loop the line into AC1-034 switching station.	\$1.29	12/15/2020
n6646	Modify protection and communication work to support interconnection of new AC1-034 generator.	\$0.08	12/15/2020
n6647	Create a new bay position at the Septa 500 kV substation for the interconnection of the AC1-161 project.	\$1.50	10/1/2019
n6651	Build a three-breaker 230 kV substation at the AC2-100 facility.	\$6.25	3/7/2019
n6652	Build new structures to cut and loop the transmission line into AC2-100 115 kV substation.	\$1.10	3/7/2019
n6653	Modify protection and communication work to support interconnection of new AC2-100 generator	\$0.12	3/7/2019
n6730	Expand the AB2-161 115 kV ring-bus substation by one breaker position to accommodate the interconnection of the AD1-082 project.	\$0.60	12/31/2019

Upgrade ID	Description	Cost Estimate (\$M)	Required In-Service Date
n6749	Build a three-breaker 115 kV substation at the AC2-079 facility.	\$5.24	12/31/2019
n6750	Build new structures to cut and loop the transmission line into AC2-079 115 kV substation.	\$2.00	12/31/2019
n6751	Modify protection and communication work to support interconnection of new AC2-079 generator.	\$0.23	12/31/2019
n6753	Build a three-breaker 230 kV substation at the AD2-160 facility.	\$6.20	12/31/2020
n6755	Modify protection and communication work to support interconnection of new AD2-160 generator.	\$0.19	12/31/2020
n6900	Build a three-breaker 115 kV substation at the AD2-085 facility.	\$5.40	11/30/2021
n6901	Build new structures to cut and loop the transmission line into AD2-085 115 kV substation.	\$1.10	11/30/2021
n6902	Modify protection and communication work to support interconnection of new AD2-085 generator.	\$0.28	11/30/2021
n6903	Build a three-breaker 115 kV substation at the AC2-012 facility.	\$5.60	12/31/2019
n6904	Build new structures to cut and loop the transmission line into AC2-012 115 kV substation.	\$1.90	12/31/2019
n6905	Modify protection and communication work to support interconnection of new AC2-012 generator.	\$0.24	12/31/2019
n7247	Endless Caverns substation: Install a transfer trip panel to send CB'w L5T128 & 12852 breaker positions on Line 128 to Strasburg via Edinburg substation on Line 152.	\$0.06	12/31/2020
n7248	Edinburg substation: Install a transfer trip panel to receive Endless Caverns CB's L5T128 & 12852 breaker positions on Line 128 and send those breaker positions along with Edinburg CB's 12812, L412, & L312 to Strasburg substation on Line 152.	\$0.07	12/31/2020
n7437	Re-arrange line #2137 to loop into and out of the new three-breaker AF1-147 230 kV switching station.	\$2.42	6/1/2023
n7438	Build a three-breaker AF1-147 230 kV switching station.	\$7.73	6/1/2023
n7439	Remote protection and communication work at AF1-147 230 kV station.	\$0.08	6/1/2023
n7440	Remote protection and communication work at 230 kV Poland Rd station.	\$0.22	6/1/2023
n7441	Remote protection and communication work at 230 kV Shellhorn station.	\$0.05	6/1/2023
n7442	Remote protection and communication work at 230 kV Sojourner station.	\$0.14	6/1/2023

Upgrade ID	Description	Cost Estimate (\$M)	Required In-Service Date
n7873	Construct a new three-breaker ring substation AE2-029. The facilities identified provides for the initial construction of a new 115 kV three-breaker ring substation near Transmission Structure 119/413 in Rockingham County, Virginia.	\$5.63	12/30/2022
n7874	Re-arrange line #119 to loop into and out of the new three-breaker AE2-029 115 kV switching station. This project will connect line number 119 to a new 115 kV switching station located off the main line 119 between structures 119/412 and 119/414. This project is located in Rockingham County, Virginia.	\$2.45	12/30/2022
n7875	Remote protection and communication work. AE2-029 provides for the installation of Line #118 Islanding Transfer Trip scheme to send Islanding Transfer Trip to AE2-029 Generator Interconnection substation via Merck No. 5 substation. This project is Indirect Network Upgrade for the AE2-029 Generator Interconnect project.	\$0.07	12/30/2022
n7876	Remote protection and communication work. AE2-029 provides for the installation of Line #272 Islanding Transfer Trip scheme to work with the new AE2-029 Generator Interconnect substation. This project is the Non-Direct Connect for the AE2-029 Generator Interconnect project.	\$0.07	12/30/2022
n7877	Remote protection and communication work AE2-029 provides for drawing work, relay resets, and field support necessary to change Line #119 destination from Merck No. 5 substation to AE2-029 Generator Interconnect. The Line Relay Panel will be replaced with the Line Current Differential via Fiber Optics and the Wave Trap removed. Islanding Transfer Trip will be installed to receive from Dooms 230 kV substation on Line 272 via PLC and send to AE2-2029 G.I. on Line 119 via fiber. Fiber Optics will need to be installed on the 119 Line between Grottoes and AE2-029. This project is the Non-Direct Connect for the AE2-029 Generator Interconnect Project.	\$0.22	12/30/2022
n7878	Remote protection and communication work. AE2-029 provides for drawing work, relay resets, and field support necessary to change Line 119 destination from Grottoes substation to AE2-029 Generator Interconnect. Islanding Transfer Trip will be installed to receive from Endless Caverns substation on Line 118 via PLC and send to AE2-029 G.I. on Line 119 via PLC. The control enclosure will need a 10' expansion to install the Islanding Transfer Trip panel.	\$0.38	12/30/2022
n6928	Install an additional 138 kV circuit breaker (CB 135), 138 kV line disconnect switch, 138 kV CCVTs (P7), and new protection & control relaying at Carville 138 kV substation.	\$1.09	6/3/2024
n6995	Cut and loop in Church-Kent 69 kV transmission line to new AB2-135 69 kV substation.	\$2.82	1/0/1900

Upgrade ID	Description	Cost Estimate (\$M)	Required In-Service Date
n7000	Cut and loop in West Cambridge-Bayly 69 kV circuit to new AB2-136 69 kV substation.	\$2.82	12/30/2022
n7424	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
n8050	Install new seventh position on the 69 kV six-position ring bus at the Todd substation. Replace the Preston to Todd 69 kV Line 6716 terminal disconnect switches with 2000A switches. Replace 600A Disconnect Switch at the Todd substation.	\$1.39	12/31/2018
n8053	Build one new position and relocate one position onto the 69 kV Chestertown substation bus. Convert the existing four-position ring bus arrangement to a five-position ring bus. Relocate transmission and distribution lines on the west side of the Chestertown substation yard further to the west.	\$3.56	5/1/2018
n8057	Perform a Relay Coordination Study and adjust relays at the 230 kV Silver Run substation.	\$0.10	6/1/2024
n5860	Install a 69 kV switch structure at the point of demarcation, revenue metering, and attachment facility line/bus and associated hardware to accept the Interconnection Customer generator lead line/bus terminating at the AD2-072 Interconnection switching station.	\$0.25	12/1/2021
n5861	Build 69 kv switching station along the Van Arsdell-Mercer Industrial 69 kV line.	\$2.00	12/1/2021
n5862	Van Arsdell-Mercer Industrial 69 kV line: Install a line loop to the proposed AD2-072 interconnection switching station.	\$0.70	12/1/2021
n5863	Adjust remote, relaying, and metering settings at Van Arsdell-69 kV sub.	\$0.05	12/1/2021
n5864	Adjust remote, relaying, and metering settings at Mercer Industrial 69 kV sub.	\$0.05	12/1/2021
n6731	Install OPGW fiber from on the Van Arsdell-Clay Lick Junction-South Anderson 69 kV line, which is approximately 5.1 miles in length.	\$0.44	12/1/2021
n6732	Marion County 161kV substation: Install necessary equipment (a 161 kV isolation switch structure and associated switch, plus interconnection metering, fiber-optic connection and telecommunications equipment, circuit breaker and associated switches, and relay panel) to accept the IC's generator lead line/bus.	\$1.19	6/1/2022
n6913	EKPC to install necessary equipment (a 69 kV isolation switch structure and associated switch, plus interconnection metering, fiber-optic connection and telecommunications equipment, circuit breaker and associated switches, and relay panel) at the new South Lancaster Switching station to accept the IC generator lead line/bus.	\$1.14	3/26/2019

Upgrade ID	Description	Cost Estimate (\$M)	Required In-Service Date
n6914	EKPC to construct a new 69 kV switching station (South Lancaster Switching) to facilitate connection of the Turkey Creek Solar generation project.	\$3.41	3/26/2019
n6915	EKPC to design and construct facilities (~250 feet) to loop the existing Tommy Gooch-Garrard County 69 kV line section into the new South Lancaster 69 kV switching substation.	\$0.24	3/26/2019
n6916	EKPC to upgrade relays and modify relay settings at Garrard County substation for existing line to South Lancaster 69 kV switching substation.	\$0.10	3/26/2019
n6917	EKPC to modify relay settings at Liberty Junction substation for existing line to South Lancaster 69 kV Switching substation.	\$0.01	3/26/2019
n6918	EKPC to design and install OPGW in the Garrard County-South Lancaster 69 kV line section (1.9 miles).	\$0.28	3/26/2019
n5853	F734 Flemington-Lebanon 34.5 kV Line Tap: Construct a line tap to the customer Point of Interconnection (POI) on the F734 East Flemington-Lebanon 34.5 kV line.	\$0.21	3/29/2019
n5854	East Flemington substation: Revise relay settings and install 700 MHz radio system to support SCADA switch installation.	\$0.09	3/29/2019
n5855	Lebanon substation: Revise relay settings and install 700 MHz radio system to support SCADA switch installation.	\$0.09	3/29/2019
n5856	F734 Flemington-Lebanon 34.5 kV line switches: Replace existing double circuit pole with three-way tap pole. Install two switch structures. Includes project management and environmental. Also includes nameplates and review of AD2-213 customer drawings.	\$0.95	3/29/2019
n6675	Manitou-Pleasant Plains 34.5 kV line – Install new tap structures and conductor to AE1-142 POI.	\$0.46	7/31/2020
n6912	T748 Flemington-Glen Gardner 34.5 kV Reconfigure: Install two single circuit tangent structures on the T748 Fleming-Glen Gardner 34.5 kV line to accommodate a new line tap to a customer POI on the F734 East Flemington-Lebanon 34.5 kV line.	\$0.13	3/29/2019
n6984	AE1-060 Generator Lead Termination (Kittatinny-Newton (E707) 34.5 kV Line Tap): Install (3) 34.5 kV load-break air switches with SCADA control on the Kittatinny-Newton (E707) 34.5 kV line. Install 34.5 kV metering in customer's facilities and build single span to point of interconnection with customer.	\$0.12	8/31/2019
n6985	SCADA Communication: Estimated installation of (3) 700 MHz radio systems (70% penetration of FE territory) to support the SCADA switch replacements. Assumed SCADA work is included in this cost.	\$0.10	8/31/2019
n6986	Kittatinny substation: Review/ revise relay settings on the Newton (E707) 34.5 kV line exit.	\$0.03	8/31/2019

Upgrade ID	Description	Cost Estimate (\$M)	Required In-Service Date
n6987	Newton substation: Review/ revise relay settings on the Kittatinny (E707) 34.5 kV line exit.	\$0.03	8/31/2019
n7463	Update relay settings at remote substations (Gilbert, Morris Park) 34.5 kV	\$0.02	9/30/2021
n6886	Installation of one span of 69 kV circuit from the Point of Interconnection to the tap point at or near MAIT structure #838-175 on the Lyons-Moselem 69 kV line.	\$0.17	4/1/2020
n6887	Install 69 kV dead-end structure and associated hardware. Install two motor-operated, Supervisory Control and Data Acquisition controlled (SCADA controlled) air break switches at the tap point or near MAIT structure #838-175 on the Lyons-Moselem 69 kV line.	\$0.46	4/1/2020
n6888	At AD2-115 substation, install a 700 Mhz or cellular radio system to support SCADA switch operation.	\$0.05	4/1/2020
n6889	Project management, construction management and environmental at Lyons-Moselem 69 kV.	\$0.26	4/1/2020
n6890	Tap the South Troy-Athens 34.5 kV line (distribution circuit 00517-63) near pole STS-17961 and install a span of 34.5 kV line to the Point of Interconnection with the Interconnection Customer including a new Supervisory Control and Data Acquisition (SCADA) recloser.	\$0.10	11/30/2021
n6891	South Troy 34.5 kV substation: Adjust remote relay and metering settings on the Athens 34.5 kV terminal.	\$0.01	11/30/2021
n6979	Upgrade/adjust relaying as generation expansion at Eagle Valley 115 kV.	\$0.09	1/0/1900
n6980	Eldorado-Westfall 46kV line loadability increase for the AD2-133 System Upgrade @ Eldorado substation.	\$0.17	1/0/1900
n6981	Eldorado-Westfall 46kV line loadability increase for AD2-133 System Upgrade @ Westfall substation.	\$0.23	1/0/1900
n6982	Estimated SCADA work at Eldorado & Westfall substations to support relay installations 46 kV.	\$0.05	1/0/1900
n7001	At new AE1-129 115 kV Switchyard: Install line exit take-off structure, foundations, disconnect switch and associated equipment at ring bus substation.	\$0.69	9/30/2021
n7002	Construct a new 3-breaker ring bus on the 115 kV (977) line between Middletown Junction and Zions View.	\$5.89	9/30/2021
n7003	Loop the Middletown Junction-Smith Street (977) 115 kV line into new AE1-129 ring bus ~6.4 miles from Middletown Junction.	\$1.05	9/30/2021
n7004	Middletown Junction 115 kV: Replace limiting equipment at line terminal: trap, tuner, CVT, relaying.	\$0.41	9/30/2021

Upgrade ID	Description	Cost Estimate (\$M)	Required In-Service Date
n7005	Smith Street 115 kV: Replace limiting equipment at line terminal: trap, tuner, CVT, relaying.	\$0.65	9/30/2021
n7085	Construct a new 3-breaker ring bus on the 115 kV line between Roxbury and Shade Gap.	\$6.65	11/2/2021
n7086	Loop the Roxbury-Shade Gap 115 kV line into new AE1-071 ring bus.	\$0.67	11/2/2021
n7087	Roxbury 115 kV: Install Hybrids and 1 DTT UPLC transmitter.	\$0.26	11/2/2021
n7088	Lewistown 115 kV: Install Hybrids and 1 DTT UPLC transmitter. Replace wave trap and line tuner.	\$0.36	11/2/2021
n7089	Shade Ga 115 kV: Install Hybrids and 1 DTT UPLC transmitter.	\$0.30	11/2/2021
n7261.1	AE1-185 Supervisory Control and Data Acquisition (SCADA)/Fiber Communication. Estimated installation of 700 MHz radio system (70% penetration of FE territory) to support the SCADA switch installations.	\$0.10	4/1/2021
n7261.3	AE1-185 Generator Lead Termination: Tap the Hokes-Jackson (79) 69 kV line to the new developer substation.	\$1.11	4/1/2021
n7261.4	Hokes 69 kV substation: Update relay settings.	\$0.08	4/1/2021
n7261.5	Jackson 69 kV substation: Update relay settings.	\$0.08	4/1/2021
n7333	AE1-196 Supervisory Control and Data Acquisition (SCADA)/Fiber Communication. Estimated installation of two 700 MHz radio system (70% penetration of FE territory) to support the SCADA switch installations. SCADA work included.	\$0.10	4/1/2021
n7334	Hokes-Jackson 69 kV Line Switches: At Hokes-Jackson seventy-nine 69 kV line structure 79-142, install two SCADA controlled disconnect switches, one each on either side of the tap. Includes project management, commissioning, environmental, forestry, real estate, and right of way.	\$0.73	4/1/2021
n7335	Hokes 69 kV substation: Update relay settings.	\$0.09	4/1/2021
n7336	Jackson 69 kV substation: Update relay settings.	\$0.09	4/1/2021
n7454	Estimated installation of 700 MHz radio systems (70% penetration of FE territory) to support SCADA Switches. Assumed SCADA work is included in this cost.	\$0.12	6/30/2023
n7455	Tap the Andover (Maysville) 69 kV line at or near structure 137. Install two 69 kV line switches with SCADA. @ Dilworth-Maysville 69 kV Tap.	\$0.92	6/30/2023

Upgrade ID	Description	Cost Estimate (\$M)	Required In-Service Date
n7456	Update relay settings at Dilworth 69 kV.	\$0.10	6/30/2023
n7457	Update relay settings at Maysville 69 kV.	\$0.10	6/30/2023
n7458	Update relay settings at Sharon 69 kV.	\$0.10	6/30/2023
n6026	Install one span of Attachment Facility line from the Point of Interconnection (POI) to the tap point at the Hokes-Grantley 69 kV Line.	\$0.20	4/1/2020
n6027	Install two switches at the tap point at the Hokes-Grantley 69 kV Line	\$0.40	4/1/2020
n6028	Estimated installation of 700 MHz radio system at Hokes and Grantley 69 kV (70% penetration of FE territory) to support the SCADA switch replacements. Assumed SCADA work is included in this cost.	\$0.05	4/1/2020
n6253	New Line Terminal Equipment 115 kV: Install radial equipment from ring bus terminal to the point of interconnection including revenue metering.	\$0.41	9/30/2019
n6254	Fiber – ADSS fiber installation to AD1-020 interconnection substation.	\$0.24	9/30/2019
n6255	New AD1-020 Switchyard – Install 115 kV six-breaker ring bus interconnection station for new customer generation addition. Includes Project Management and Construction Management.	\$4.30	9/30/2019
n6256	SCADA Communication – Estimated MPLS router at new AD1-020 Interconnection substation to support new RTU.	\$0.34	9/30/2019
n6257	Hunterstown-Lincoln Line Loop – Loop the Hunterstown-Lincoln 115 kV circuit into the proposed 3-breaker ring bus between structures #78/79 and #80/81.	\$0.47	9/30/2019
n6258	Lincoln substation – Upgrade line relaying for Hunterstown 115 kV line exit and rename for new AD1-020 PJM station.	\$0.26	9/30/2019
n6259	Hunterstown substation – Upgrade line relaying for Lincoln 115 kV line exit and rename for new AD1-020 PJM station.	\$0.26	9/30/2019
n7881	Replace 32 transmission structures along the Dearborn-Pierce 345 kV line.	\$17.00	12/31/2021
n6717	Philipsburg 34.5 kV substation – Adjust remote relay and metering settings.	\$0.04	9/1/2021
n6726	Dubois 34.5 kV substation. Adjust remote relay and metering settings.	\$0.04	6/1/2022
n6727	Curwensville 34.5 kV substation. Adjust remote relay and metering settings.	\$0.04	6/1/2022
n6745	East Towanda 34.5 kV substation. Adjust remote relay and metering settings.	\$0.01	3/31/2020
n6746	New Albany 34.5 kV substation. Adjust remote relay and metering settings.	\$0.01	3/31/2020
n6747	Wyalusing 34.5 kV substation. Adjust remote relay and metering settings.	\$0.01	3/31/2020
n6748	Oxbow 34.5 kV substation. Adjust remote relay and metering settings.	\$0.01	3/31/2020

Upgrade ID	Description	Cost Estimate (\$M)	Required In-Service Date
n7242.1	Construct Attachment Facilities including: 69 kV circuit from the Milton-AE2-042 69 kV line to the Point of Interconnection. One Motor Operated Load Break Air Break Switch, and associated poles, structures, and foundations.	\$0.35	6/30/2022
n7242.2	Add a second circuit (Milton-AE2-042 69 kV line), to the existing Milton-Millville line structures, and modify the new Milton-AE2-042 69 kV circuit to tie in the Attachment Facilities.	\$0.64	6/30/2022
n7242.3	Modify the Milton 69 kV substation relays.	\$0.28	6/30/2022
n7885	Install a 69 kV tap line, MOLBAB Switch, Poles, structure, and foundations for AE2-060.	\$0.55	3/5/2021
n7886	Complete MIFF line modifications to tie in the new AE2-060 Attachment Facilities. This includes replacing existing steel monopole structure (grid # 10248S44679) with a new steel monopole single circuit tap structure with a foundation and reframe the structures on each side of the tap from suspension to tension.	\$0.06	3/5/2021
n7887	Short Circuit Study, Review IC Engineering Package, and Remote End Work at the Juniata 69 kV substation.	\$0.17	3/5/2021
n7891	69 kV tap line, MOLBAB Switch, Poles, structure, and foundations for AE2-133.	\$0.94	3/5/2021
n7892	Complete SUNB-MIDD 1 line modifications to tie in the new AE2-133 Attachment Facilities. This includes connecting the conductors and OPGW from the MILT-MVIL line to the new tap structure. Reframe the two existing structures on each side of the tap.	\$0.10	3/5/2021
n7893	Short Circuit Study, Review IC Engineering Package, and Remote End Work at the Sunbury 69 kV substation.	\$0.11	3/5/2021
n6234	Replacement of two poles and associated PSE&G standard conductor Installation of two new poles as H-frame for STATCOM equipment Installation and commissioning of STATCOM equipment Relocation of branch recloser to new poles at Deptford 13 kV.	\$0.41	12/10/2019