



Reliability Analysis Update

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PJM Transmission Planning

Transmission Expansion Advisory Committee
July 9, 2024

- 2024 Window 1 Updates
- 2023 Window 2 Projects 2nd Read
- 2022 Window 3 Scope Changes



2024 RTEP Window 1 Updates

Baseline Reliability Projects

Progress and Timeline Update & Assumptions

- Current schedule
 - Targeting open 2024 RTEP proposal Window 1 on July 12th, 2024
 - 60 day window
 - Solutions to be brought forward to the TEAC starting Oct 2024 and through Jan 2025
 - Board approvals in Nov 2024 and Feb 2025
- Solutions identified in 2023 Window 2 are included in the model
- 2022 Window 3 scope change for 502 Jct-Woodside-Aspen 500 kV & Doubs Corridor Project is included in model



2023 RTEP 2028 W2 vs 2024 RTEP 2029 W1 PJM System-Wide Needs Evolution Summary

Load and Gen Dispatch – Summer (2028 to 2029)

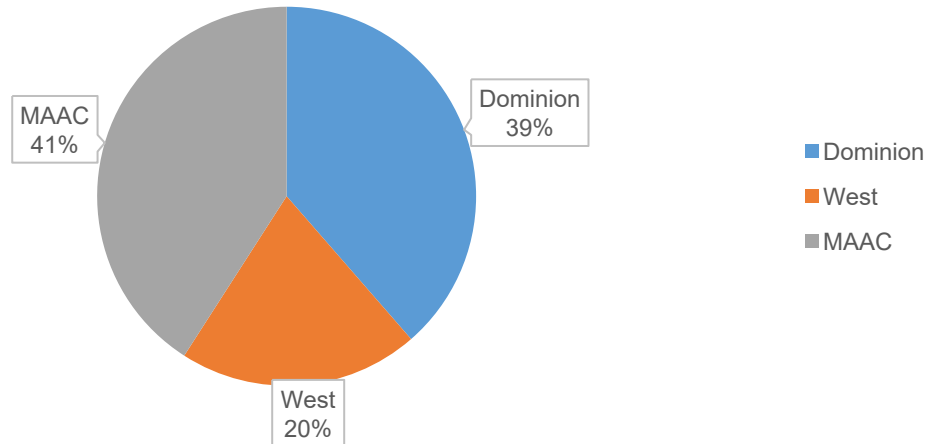
Load

PJM	MW Increase Load
Dominion	2,536
West	1,347
MAAC	2,689
Grand Total	6,571

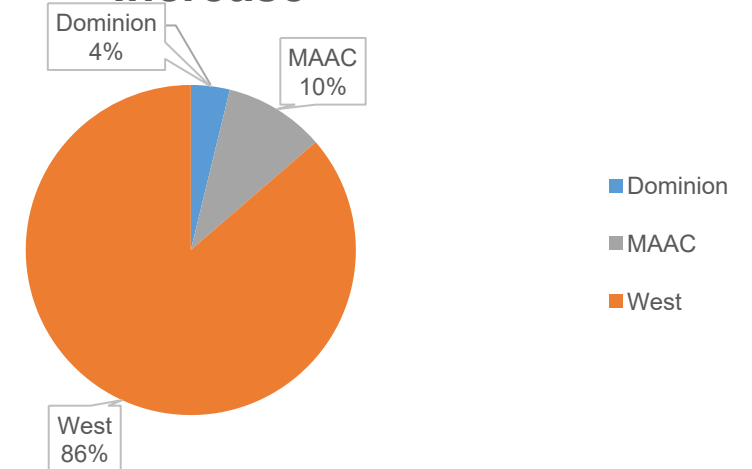
Generation

PJM	MW Increase Gen Dispatch
Dominion	322
West	7,317
MAAC	835
Grand Total	8,475

Year Over Year Load Increase



Year Over Year Gen Dispatch Increase



Most of the additional generation required to meet load growth 2028 vs 2029 is sourced from PJM West

Load and Gen Dispatch – Winter (2028 to 2029)

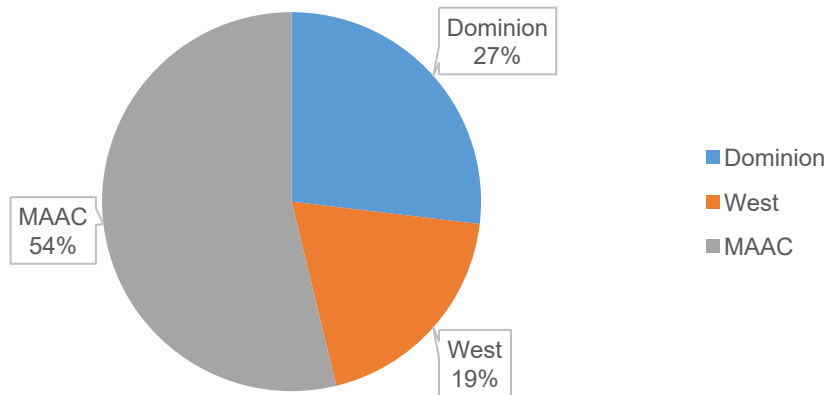
Load

Row Labels	MW Increase Load
Dominion	2,704
West	1,945
MAAC	5,410
Grand Total	10,059

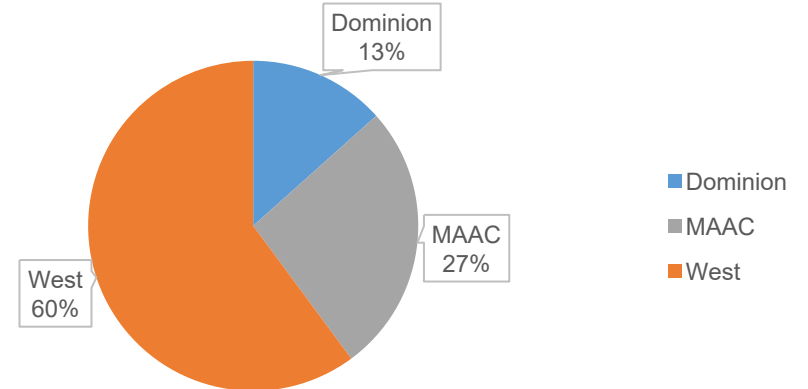
Generation

Row Labels	MW Increase Gen Dispatch
Dominion	1,611
West	7,233
MAAC	3,185
Grand Total	12,029

Year Over Year Load Increase



Year Over Year Gen Dispatch Increase



Most of the additional generation required to meet load growth 2028 vs 2029 is sourced from PJM West

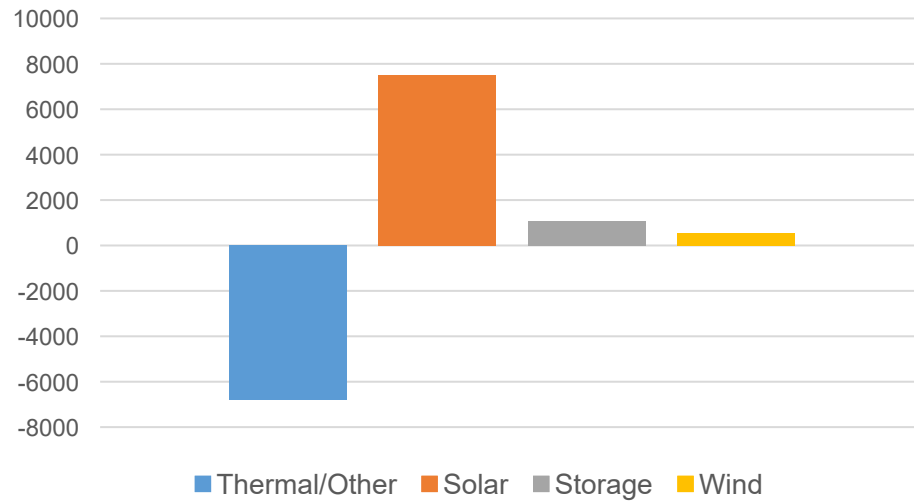


Generation Pmax Tables: 2028W2 versus 2029W1

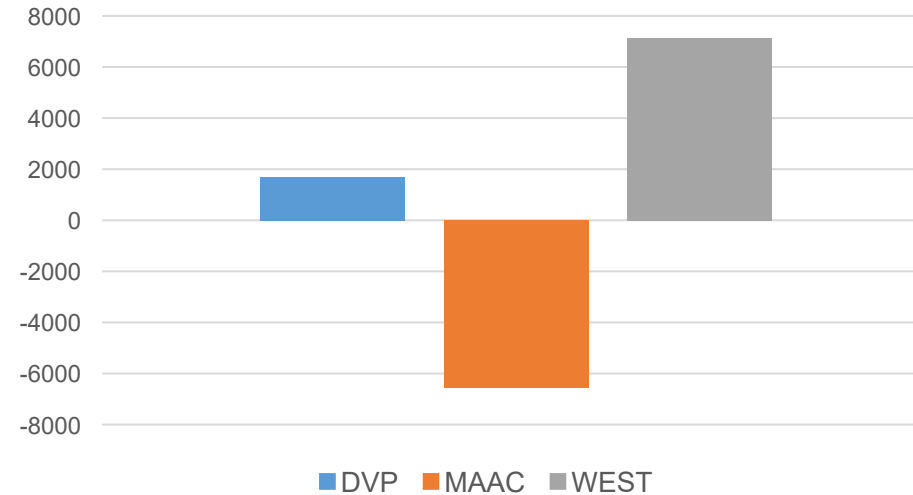
Increase in Pmax (MW) from 2028W2 to 2029W1

	Thermal/Other	Solar	Storage	Wind	Totals
DVP	62	1372	380	-111	1702
MAAC	-6310	677	200	-1113	-6547
WEST	-567	5446	497	1757	7132
Totals	-6816	7496	1077	532	2288

Increase in Pmax (MW) by Fuel Type



Increase in Pmax (MW) by Region





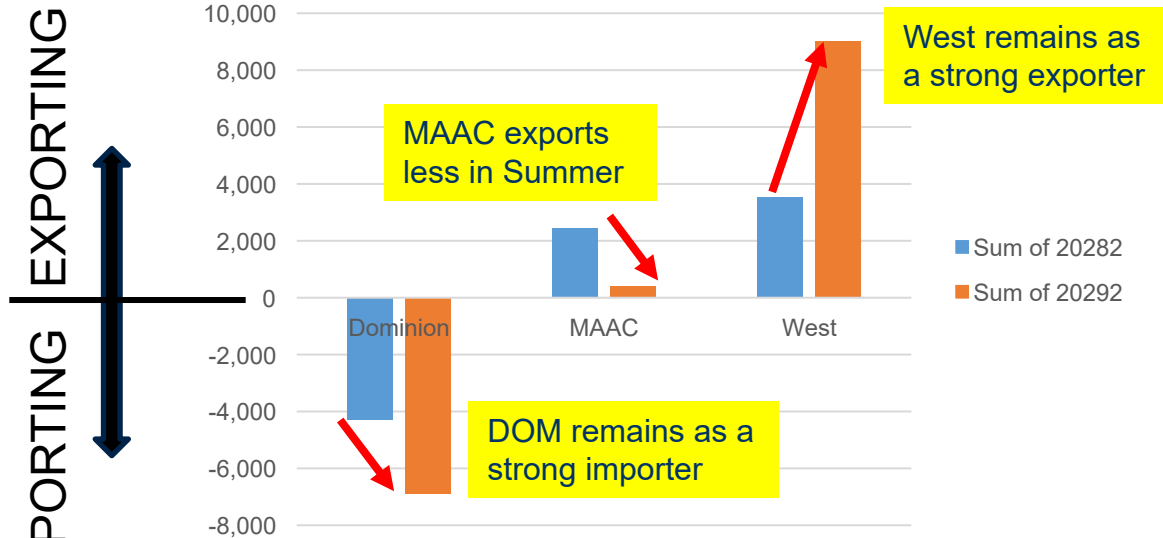
Area Interchange - Ties (2028 vs 2029)

SUMMER

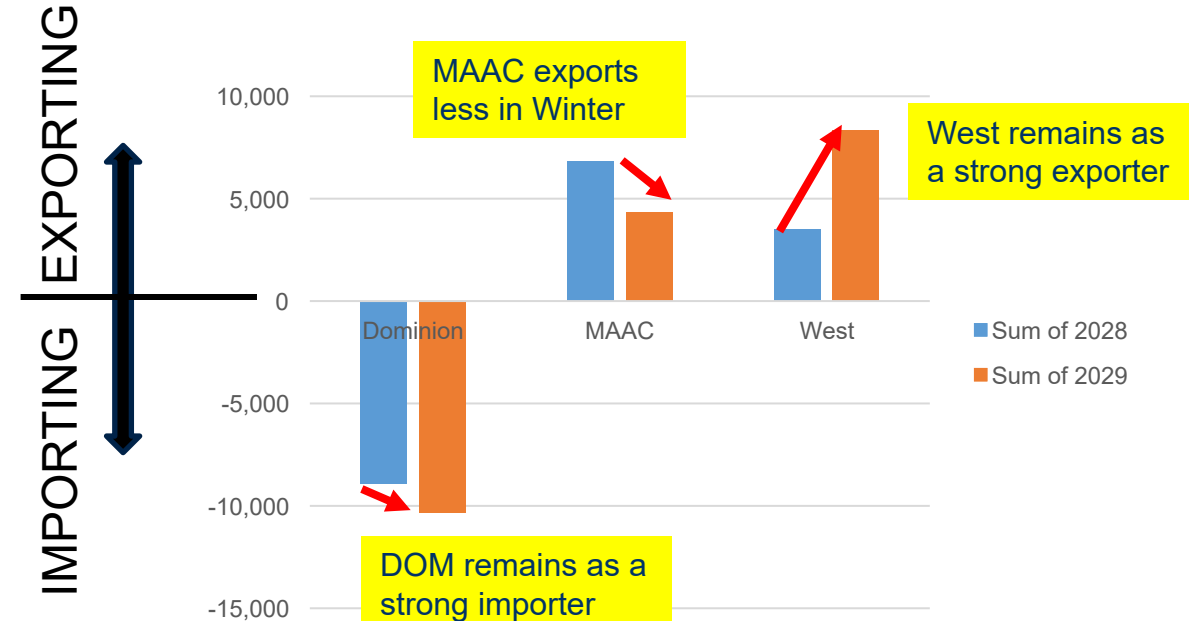
Row Labels	MW FLOW 2028	MW FLOW 2029	MW Change
Dominion	-4,279	-6,887	-2,608
West	3,532	9,021	5,489
MAAC	2,446	403	-2,044
Grand Total	1,700	2,537	837

WINTER

Row Labels	Sum of 2028	Sum of 2029	Sum of MW Increase
Dominion	-8,900	-10,315	-1,415
MAAC	6,825	4,328	-2,497
West	3,501	8,343	4,842
Grand Total	1,426	2,356	929

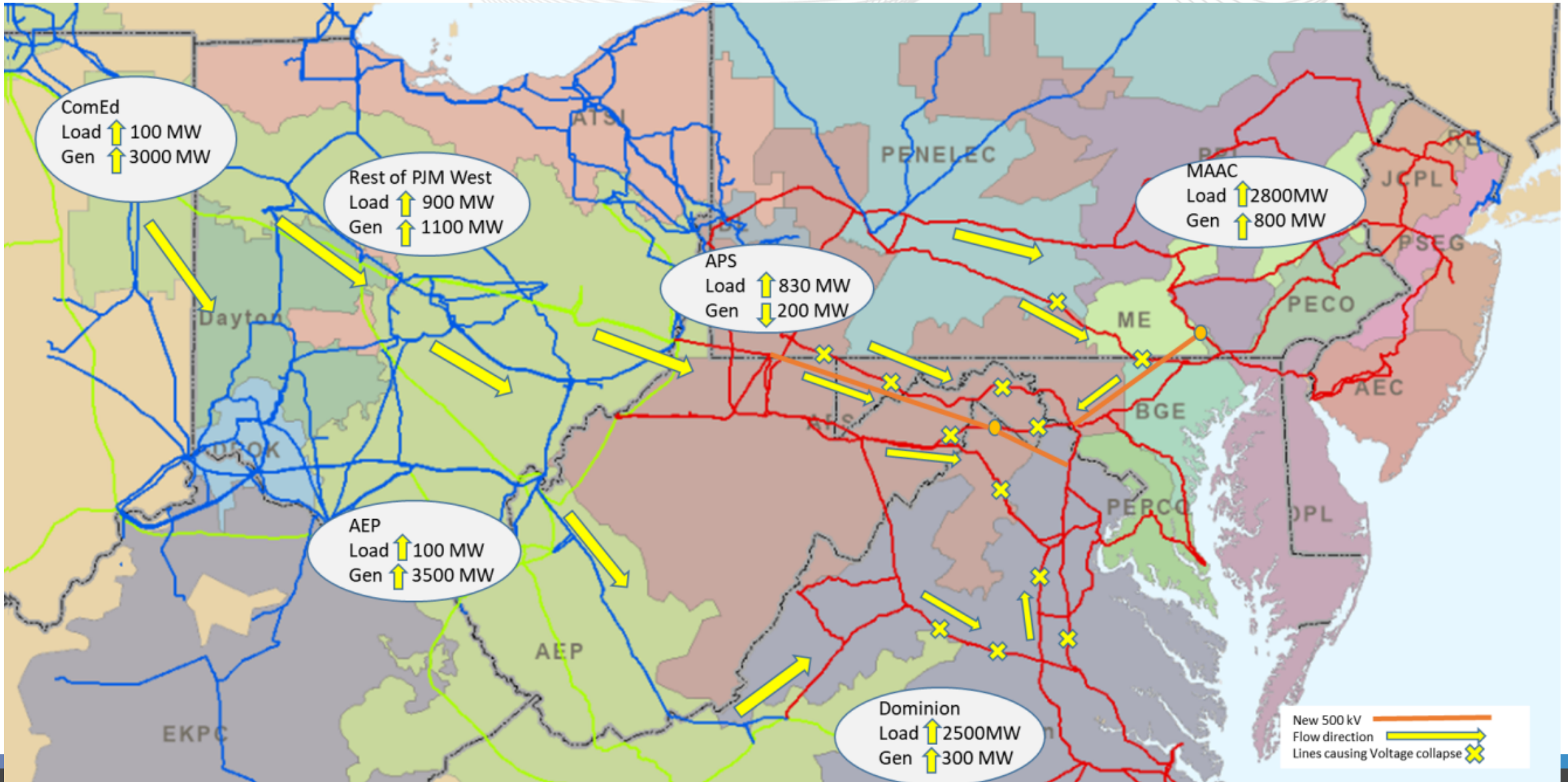


Need for continued reinforcement of West/APS-DOM transfer path

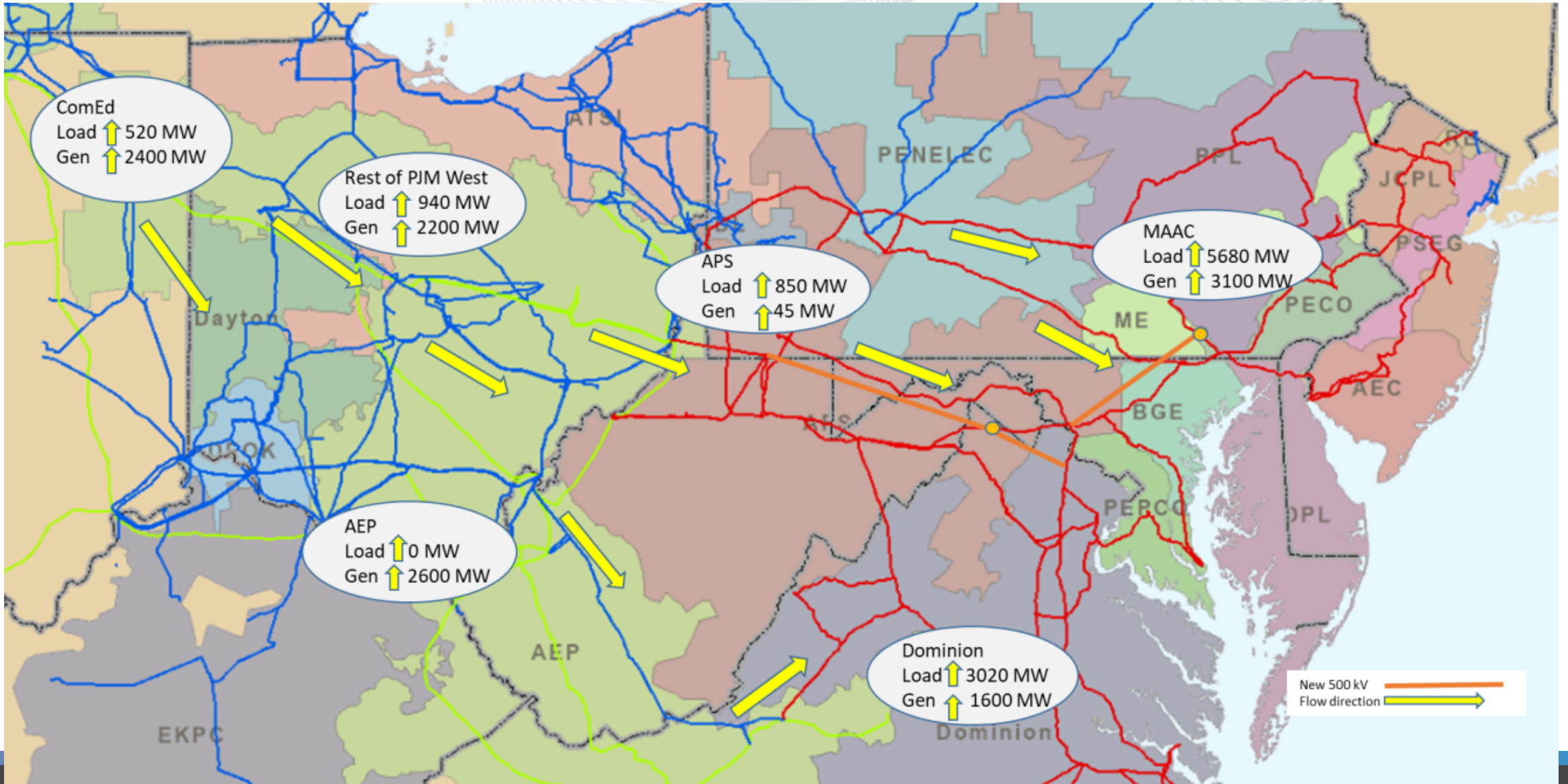


Consistent need for high West/APS – MAAC transfer capability

2028 RTEP W2 vs 2029 RTEP W1 Summer comparison



2028 RTEP W2 vs 2029 RTEP W1 Winter comparison



- Heavy transmission interface flows West-East driven by load increase in Dominion/East and sourced generation in both Western and Eastern PJM
- PJM earlier identified need for additional West-East reinforcement is materializing earlier – higher anticipated load in MAAC/Dominion
- Proposed reinforcement through 2022W3 and 2023W1/W2 performing well
- Additional upgrades within AEP and ComEd will be needed to support West-East interface bulk flows



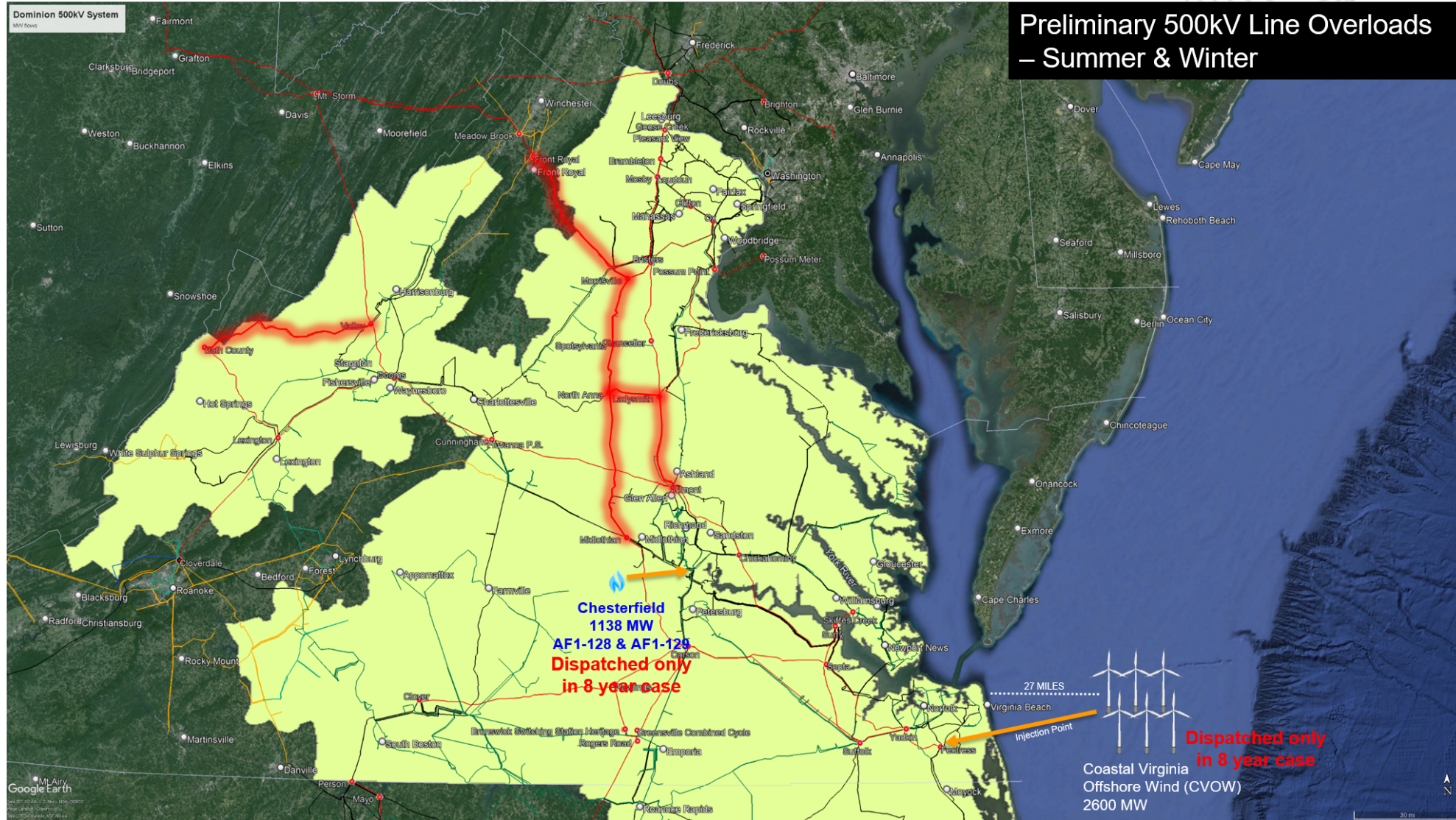
2032 (8-Year) RTEP Model

- Right size solutions of the 5-Year RTEP needs
- Check/Confirm impact of “forecast” generation on transmission needs identified in the 5-Years model
 - Model reasonably anticipated generation “forecast” in Dominion
 - Confirm whether forecast resources available in the west supports needed West-East transfers
 - Evaluate whether forecast generation offsets regional path transfer need (DOM and MAAC resources)



Certainty of Transmission Need against Generation Forecast

- The need for West-East transfer path will rely on net import capability into Dominion/APS/Eastern PJM – relies on both internal zone load and gen development
- The 5-year model will confirm the need for West-East path reinforcement – requirement exceeds the inherent remnant transfer capability offered by 2022W3 reinforcements
- The 8-year (2032) model will have
 - ~4500MWs of additional load in Dominion compared to the 5-year case
 - Expect the impact of CVOW OSW + Chesterfield Generation to not offset the 2029-32 load growth, let alone the need already identified in 2029 (5-Year model).
- Resource requirements to satisfy load serving adequacy are expected to develop heavily in western PJM compared to eastern PJM



- AEP is forecasting load growth in the next 5 to 8 years (up to 2032)
- Forecast update submissions ongoing and will be captured part of the 2025 PJM Load Forecast (to be published in Dec 2024/ Jan 2025)
- PJM will bring forward additional information regarding load and generation assumptions to the August TEAC.
- This sensitivity analysis to be conducted by PJM will focus on ensuring selection of the right solutions out of 2024W1 RTEP – will not introduce new needs/solutions.

- PJM will open the competitive transmission window on July 12th 2024 (5-Year RTEP model)
- 8-Year model will be posted around July 26th 2024
- AEP/Western Load growth sensitivity model (to inform selection of needed transmission) will be posted around August 9th
- 2024W1 RTEP will be running for 60 days and targeting PJM Board Approvals (Nov 2024 and Feb 2025)
 - TEAC 1st and 2nd reads to span between Oct 2024 and Jan 2025

2023 RTEP Window 2 Second Review

Baseline Reliability Projects



AEP Transmission Zone: Baseline 2023 RTEP Window 2 Clusters 4 & 6

Process Stage: Recommended Solution – Second Read

Criteria: Summer/Winter Generator Deliverability

Assumption Reference: 2023 RTEP assumptions

Model Used for Analysis: 2028 RTEP cases

Proposal Window Exclusion: None

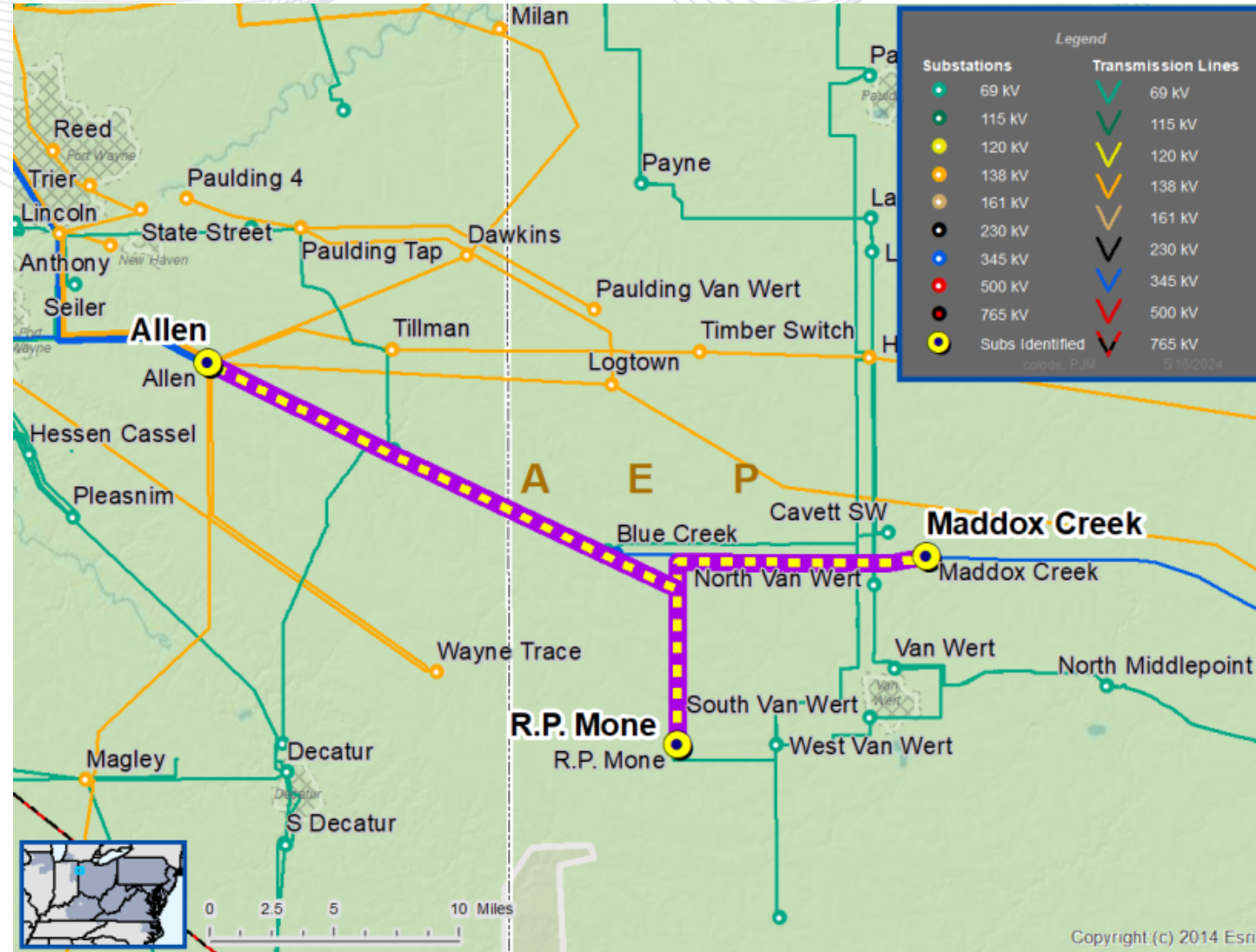
Problem Statement:

Cluster 4: 2023W2-GD-S170, 2023W2-GD-S142, 2023W2-GD-W213, 2023W2-GD-W58

In 2028 RTEP summer and winter cases, the R.P. Mone – Maddox Creek 345 kV line is overloaded in generator deliverability test for both N-1 and N-2 outages

Cluster 6: 2023W2-GD-W12

In 2028 RTEP winter cases, the Allen – R.P. Mone 345kV line is overloaded in generator deliverability test for a N-1 outage





AEP Transmission Zone: Baseline 2023 RTEP Window 2 Clusters 4 & 6

- As part of the 2023 RTEP Window #2, projects listed in the table below were proposed to address the violations in cluster 4, 6 or 4&6
- 7 total proposals submitted: all Upgrades from the same proposing entity - AEP

Proposal ID #	Cluster	Project Description	Total Cost (\$M)	Analysis Summary
561	Cluster 4	Reconductor the 9.4 mile 345 kV line between RP Mone and Maddox Creek stations.	16.719	Solves the target FGs, causes overload on Maddox -E. Lima 345kV line, increases the loading on Allen - RP Mone line
957	Cluster 4	Rebuild the 9.4 mile 345 kV line between RP Mone and Maddox Creek stations.	39.034	Solves the target FGs, causes overload on Maddox -E. Lima 345kV line, increases the loading on Allen - RP Mone line
683	Cluster 6	Mitigate three clearance issues on Allen - RP Mone 345 kV line to allow line to operate to conductor's designed rating.	0.450	Solves the target FG. Margin is not big though (93.4%)
169	Cluster 6	Reconductor approximately 18.6 miles of 345 kV line between Allen and RP Mone stations.	32.486	Solves the target FG, increases the loading on the RPMORE-Maddox, causes overload on the Maddox - E Lima 345KV line
819	Cluster 6	Rebuild approximately 18.6 miles of 345 kV line between Allen and RP Mone stations.	49.875	Solves the target FG, increases the loading on the RPMORE-Maddox, causes overload on the Maddox - E Lima 345KV line
11	4 & 6	Install 345 kV Phase Shifting Transformer at East Lima station on line towards Fostoria Central.	40.301	Solves the target FGs ,causes overload on E. Lima transformer #2, W. Fremont - Fremont AEP/ATSI 138KV tie
334	4 & 6	String the open positions of the 345 kV line between Maddox Creek and Sorenson stations to establish a new 345 kV circuit between the two stations (42.6 miles). Reconductor the existing conductors on the line. Perform station work at Maddox Creek, Sorenson, and East Lima stations.	134.397	Solves the target FGs



AEP Transmission Zone: Baseline 2023 RTEP Window 2 Clusters 4 & 6

R.P. Mone – Maddox Creek 345kV line (in AEP EOL list)

- 9.4 miles of Paper Expanded (PE) Conductor originally installed in 1955
- All but one of the existing structures on the line were originally installed in 1955

Allen – R.P. Mone 345kV line (in AEP EOL list)

- 24.6 miles of Paper Expanded (PE) Conductor originally installed in 1955 and 1968
- All but two of the existing structures on the line were originally installed in 1955 or 1968

Options	Proposal #169 (Allen – R.P. Mone reconductor) Proposal #561 (R.P. Mone – Maddox Creek reconductor) Portion of Proposal #334 (Station work at E. Lima & Maddox Creek)	Proposal #819 (Allen – R.P. Mone rebuild) Proposal #957 (R.P. Mone – Maddox Creek rebuild) Portion of Proposal #334 (Station work at E. Lima & Maddox Creek)	Proposal #334
Cost (\$M)	52.766	92.470	134.397
EOL factors	Partially addresses the EOL issues for both Allen - RP Mone and RP Mone - Maddox Creek 345kV circuits	Addresses the EOL issues for both Allen - RP Mone and RP Mone - Maddox Creek 345kV circuits	Partially addresses the EOL issues for both Allen - RP Mone and RP Mone - Maddox Creek 345kV circuits



AEP Transmission Zone: Baseline 2023 RTEP Window 2 Clusters 4 & 6

Recommended Solution:

- Proposal #819: Rebuild Allen –R.P. Mone 345kV line (18.6 miles). **(B3851.1) Estimated Cost: \$49.875M**
- Proposal #957: Rebuild R.P. Mone – Maddox Creek 345kV line (9.4 miles) **(B3851.2) . Estimated Cost: \$39.034M**
- Portion of Proposal #334:
 - Replace breakers 'B1' and 'B' at Maddox Creek. **(B3851.3) Estimated Cost: \$1.8M**
 - Replace two 345kV breakers 'M' and 'M2' at East Lima Station. **(B3851.4) Estimated Cost: \$1.761M**

Total Estimated Cost: \$92.470 M

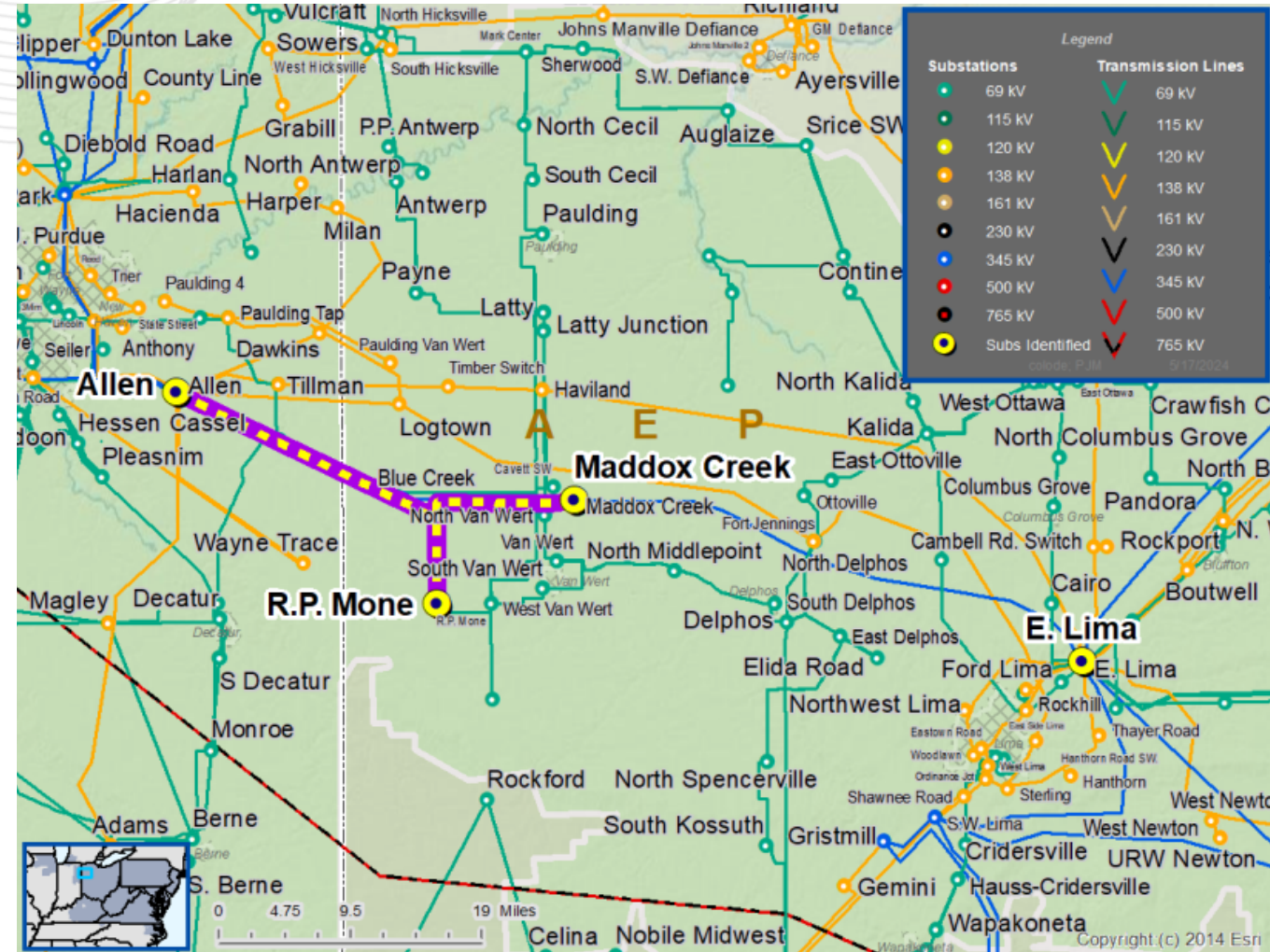
Required IS Date: 6/1/2027

Projected IS Date: 6/1/2027

Previously Presented: 6/4/2024

Facility Ratings:

Branch	Existing Facility Ratings SN/SE/WN/WE (MVA)	Preliminary Facility Ratings SN/SE/WN/WE (MVA)
Allen – RP Mone 345kV	897/897/1138/1138	1677/1737/1737/1737
RP Mone – Maddox 345kV	897/1301/1138/1452	1676/1868/2022/2219
Maddox – E. Lima 345 kV	1188/1539/1506/1737	1916/2246/2425/2672





AEP Transmission Zone: Baseline 2023 RTEP Window 2 Clusters 2, 3 & 5

Process Stage: Recommended Solution – Second Read

Criteria: Summer/Winter Generator Deliverability, N-1-1

Assumption Reference: 2023 RTEP assumptions

Model Used for Analysis: 2028 RTEP cases

Proposal Window Exclusion: None

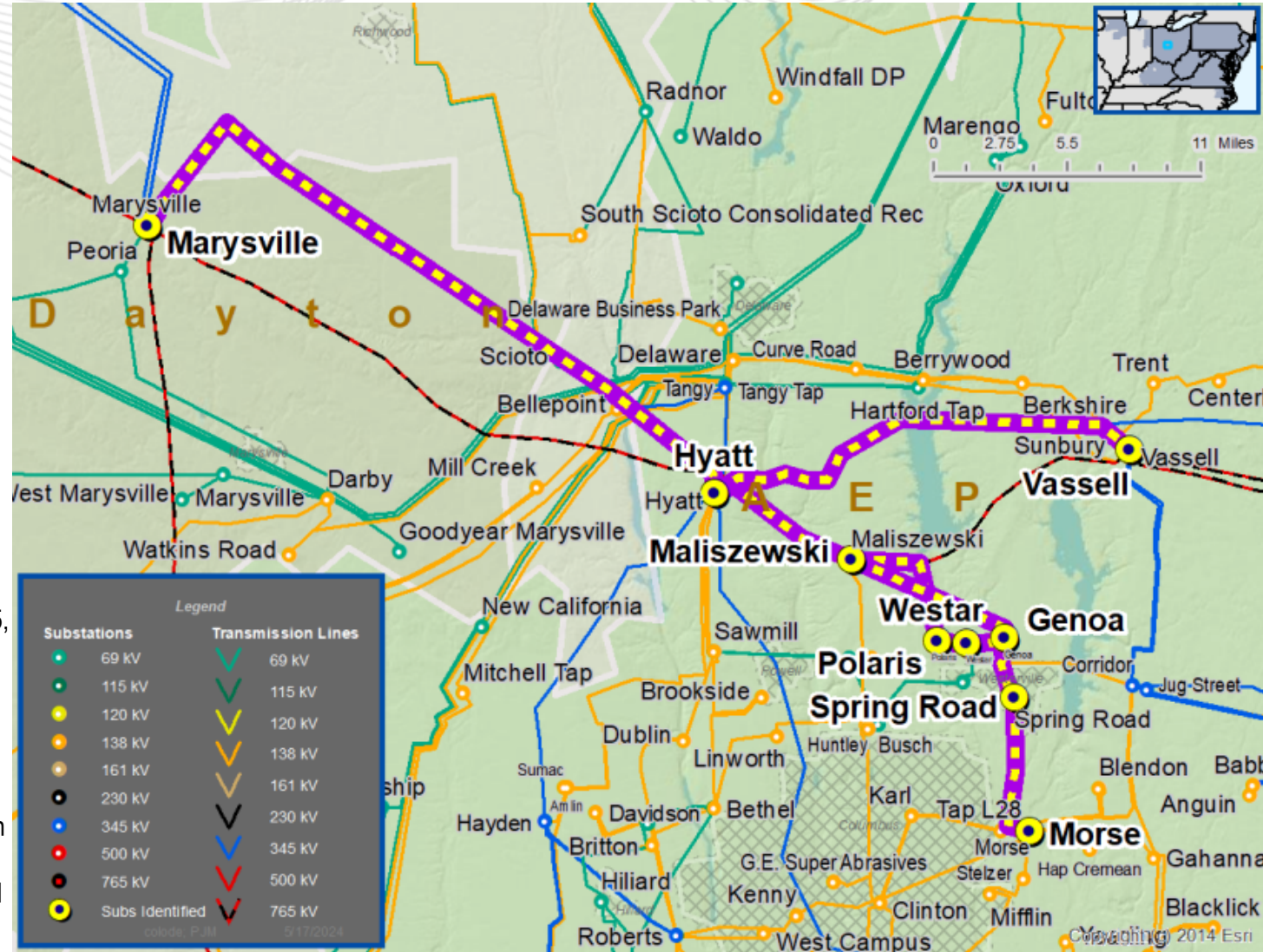
Problem Statement:

Cluster 3: 2023W2-GD-S186, 2023W2-GD-S141, 2023W2-N2-WT1, 2023W2-N2-ST4, 2023W2-N2-ST2, 2023W2-N1-ST15, 2023W2-N2-ST1, 2023W2-N2-ST30, 2023W2-N2-ST31, 2023W2-N2-WT4, 2023W2-N2-ST7, 2023W2-N2-ST28, 2023W2-N2-ST39, 2023W2-N2-ST37, 2023W2-N2-ST48, 2023W2-N2-ST46

In 2028 RTEP summer case, the **Genoa – Westar 138 kV** line is overloaded in generator deliverability test for N-2 outages; and in 2028 RTEP summer and winter cases, the Genoa – Westar 138 kV line is overloaded in N-1-1 test for multiple contingency pairs

Cluster 5: 2023W2-N2-ST6, 2023W2-N2-ST5, 2023W2-N1-ST14, 2023W2-GD-S165, 2023W2-N1-ST13, 2023W2-N2-ST3, 2023W2-GD-S135, 2023W2-N2-ST32, 2023W2-N2-ST43, 2023W2-N2-ST22, 2023W2-N2-ST44, 2023W2-N2-ST40, 2023W2-N2-WT5, 2023W2-N2-ST8, 2023W2-N2-WT3, 2023W2-N2-ST17, 2023W2-N2-ST49, 2023W2-N2-ST18, 2023W2-N2-ST13, 2023W2-N2-ST25, 2023W2-N2-ST47, 2023W2-N2-ST24

In 2028 RTEP summer case, the **Maliszewski – Polaris 138 kV** line is overloaded in generator deliverability test and basecase analysis test for N-2 outages; and in 2028 RTEP summer and winter cases, the Maliszewski – Polaris 138 kV line is overloaded in N-1-1 test for multiple contingency pairs





AEP Transmission Zone: Baseline 2023 RTEP Window 2 Clusters 2, 3 & 5

Problem Statement (Conti.):

Single floaters:

2023W2-N2-ST50, 2023W2-N2-ST9, 2023W2-N2-ST16, 2023W2-N2-ST34, 2023W2-N2-ST45

In 2028 RTEP summer case, the **Genoa – Spring Road 138 kV** line is overloaded in N-1-1 test for multiple contingency pairs.

2023W2-N2-ST11, 2023W2-N2-ST41, 2023W2-N2-WT8, 2023W2-N2-ST10, 2023W2-N2-WT7, 2023W2-N2-ST36, 2023W2-N2-ST12, 2023W2-N2-ST23, 2023W2-N2-ST14

In 2028 RTEP summer and winter cases, the **Polaris – Westar 138kV** line is overloaded in N-1-1 test for multiple contingency pairs.

Cluster 2: All of the above (cluster 3 & 5, and single floaters), plus

2023W2-N1-ST21, 2023W2-N1-ST20, 2023W2-N1-ST23, 2023W2-N1-ST22, 2023W2-N1-ST25, 2023W2-N1-ST24, 2023W2-N1-ST27, 2023W2-N1-ST26, 2023W2-N1-ST19, 2023W2-N2-ST33, 2023W2-N2-ST38, 2023W2-N2-ST35, 2023W2-GD-S170, 2023W2-N1-ST10, 2023W2-N1-ST12, 2023W2-N1-ST16, 2023W2-N1-ST18, 2023W2-N1-ST17, 2023W2-N1-ST1, 2023W2-N2-ST21, 2023W2-N1-ST3, 2023W2-N1-ST2, 2023W2-N2-ST20, 2023W2-N1-ST5, 2023W2-N1-WT1, 2023W2-N1-ST4, 2023W2-N1-ST7, 2023W2-N1-WT3, 2023W2-N1-ST6, 2023W2-N1-WT2, 2023W2-N2-ST29, 2023W2-N2-ST27, 2023W2-N2-ST26, 2023W2-GD-S4, 2023W2-GD-S3, 2023W2-N2-WT6, 2023W2-GD-W154, 2023W2-GD-W155, 2023W2-GD-W153, 2023W2-GD-W156, 2023W2-GD-S115, 2023W2-GD-S114, 2023W2-N2-ST42, 2023W2-GD-S6, 2023W2-GD-W162, 2023W2-GD-W165, 2023W2-GD-W163, 2023W2-GD-W164, 2023W2-GD-S122, 2023W2-GD-S121, 2023W2-GD-S123, 2023W2-GD-S126, 2023W2-GD-S125, 2023W2-GD-S116, 2023W2-GD-W59, 2023W2-GD-W58, 2023W2-N1-WT10, 2023W2-N1-WT13, 2023W2-N1-WT14, 2023W2-N1-WT11, 2023W2-N1-WT12, 2023W2-GD-W213, 2023W2-N2-WT2, 2023W2-GD-W214, 2023W2-N2-ST3, 2023W2-GD-W217, 2023W2-GD-W215, 2023W2-GD-W216, 2023W2-GD-S127, 2023W2-N1-ST9, 2023W2-N1-WT5, 2023W2-N1-ST8, 2023W2-N1-WT4, 2023W2-N1-WT7, 2023W2-N1-WT6, 2023W2-N1-WT9, 2023W2-N1-WT8, 2023W2-N2-ST11, 2023W2-N2-ST19, 2023W2-N2-ST15, 2023W2-GD-W19, 2023W2-GD-W25

In 2028 RTEP summer and winter cases, **Maliszewski transformer 765/138KV transformer and Maliszewski 138kV series reactor bypass** are overload in generator deliverability test and basecase analysis test for N-1 and N-2 outages.

In 2028 RTEP Summer case, the **Morse – Spring Road 138kV** line, the **Marysville – Hyatt 345kV** line, the **Hyatt – Vassell 345kV** line, the **Hyatt – Maliszewski #2 138kV** line, the **Genoa – Maliszewski 138kV #2** line are overloaded in N-1-1 test for multiple contingency pairs.



AEP Transmission Zone: Baseline 2023 RTEP Window 2 Clusters 2, 3 & 5

- As part of the 2023 RTEP Window #2, projects listed in the table below were proposed to address the violations in Cluster 2
- 3 total proposals submitted from 3 different entities
 - 2 Greenfields
 - 1 Upgrades
- Both greenfield proposals identified with cost containment

Proposal ID	Proposing Entity	Project Type	Project Description	Cost As Proposed (\$M)
117	AEP	UPGRADE	Connect and energize a second 765/345 kV bank at Vassell station. Replace 765 kV breaker D at Maliszewski station.	33.729
27	CNTLTM	GREENFIELD	1) new 765/345kV Barron substation, 2) A new double circuit 345kV transmission line from the new Barron Substation to the existing Hayden Substation, 3) Splitting the existing Conesville - Hyatt 345kV single circuit line and looping it into the existing Vassel substation, 4) Sag studies for the Genoa - Westar and Genoa - Spring Road 138kV transmission lines to increase their ratings, 5) Reconductoring the existing Maliszewski - Polaris and Polaris - Westar 138kV transmission lines.	203.830
343	TRANSRC	GREENFIELD	Jester greenfield 765/345kV station approximately 18.5 miles south of Marysville 765kV and 12 miles west of Hayden 345kV station; Reroute Hyatt – West Millersport 345kV line and loop into Corridor 345kV substation; Rebuild Kenny – Roberts 138kV circuit.	229.311



AEP Transmission Zone: Baseline 2023 RTEP Window 2 Clusters 2, 3 & 5

- As part of the 2023 RTEP Window #2, projects listed in the table below were proposed to address the violations in clusters 3, 5 and single floaters partially overlapped with Cluster 2
- 6 total proposals, all are upgrades from AEP
- None of the 6 proposals identified with cost containment

Cluster	Proposal ID	Project Description	Cost As Proposed (\$M)
3	596	Mitigate clearance issues on Westar - Genoa 138 kV line to allow line to operate to conductor's designed rating	2.815
3	729	Rebuild the approximately 2 mile 138 kV line between Westar and Genoa stations..	8.789
5	188	Reconductor the 2.8 mile 138 kV line between Maliszewski and Polaris stations.	7.231
5	340	Rebuild the 2.8 mile 138 kV line between Maliszewski and Polaris stations.	8.884
-	426	Mitigate clearance issues on Genoa - Spring Rd SW 138 kV line. Replace a station riser at Genoa station.	3.461
-	92	Rebuild the majority of the 3.7 mile 138 kV line between Polaris and Westar stations. Replace station equipment at Polaris station.	12.196



AEP Transmission Zone: Baseline 2023 RTEP Window 2 Clusters 2, 3 & 5

Proposal ID	Reliability Evaluation Results	Cost As Proposed (\$M)	Cost Adjustment *(\$M)	Total Cost (\$M)
117	Solves all the target issues with good margin. No new reliability violations identified.	33.729	0	33.729
27	Solves all the target issues with good margin. Causes overload on the Kenny – Roberts 138KV circuit. The following components are not needed and can be removed. 4) Sag studies for the Genoa - Westar and Genoa - Spring Road 138kV transmission lines to increase their ratings, 5) Reconductoring the existing Maliszewski - Polaris and Polaris - Westar 138kV transmission lines.	203.830	+49.860 -6.644	247.046
343	Solves all the target issues with good margin. No new reliability violations identified.	229.311	0	229.311

* Cost adjustment associated with scope additions or removals



AEP Transmission Zone: Baseline 2023 RTEP Window 2 Clusters 2, 3 & 5

Proposal ID	Cost Estimate Risks	Cost Containment Risks	Schedule Risk	Constructability Risks	Use of Existing ROW & Brownfield	Outage Coordination Risks
343	Low	Medium	Medium-High	Medium-High	High	Medium
27	Low	Low	Medium-High	Medium-High	High	Medium
117	Low	High	Low	Low	Low	Low



AEP Transmission Zone: Baseline 2023 RTEP Window 2 Clusters 2, 3 & 5

Recommended Solution: Proposal #117

Connect and energize a second 765/345 kV bank at Vassell station.

(B3852.1) Estimated Cost: \$30.829M

Replace 765 kV breaker D at Maliszewski station. **(B3852.2)**

Estimated Cost: \$2.900M

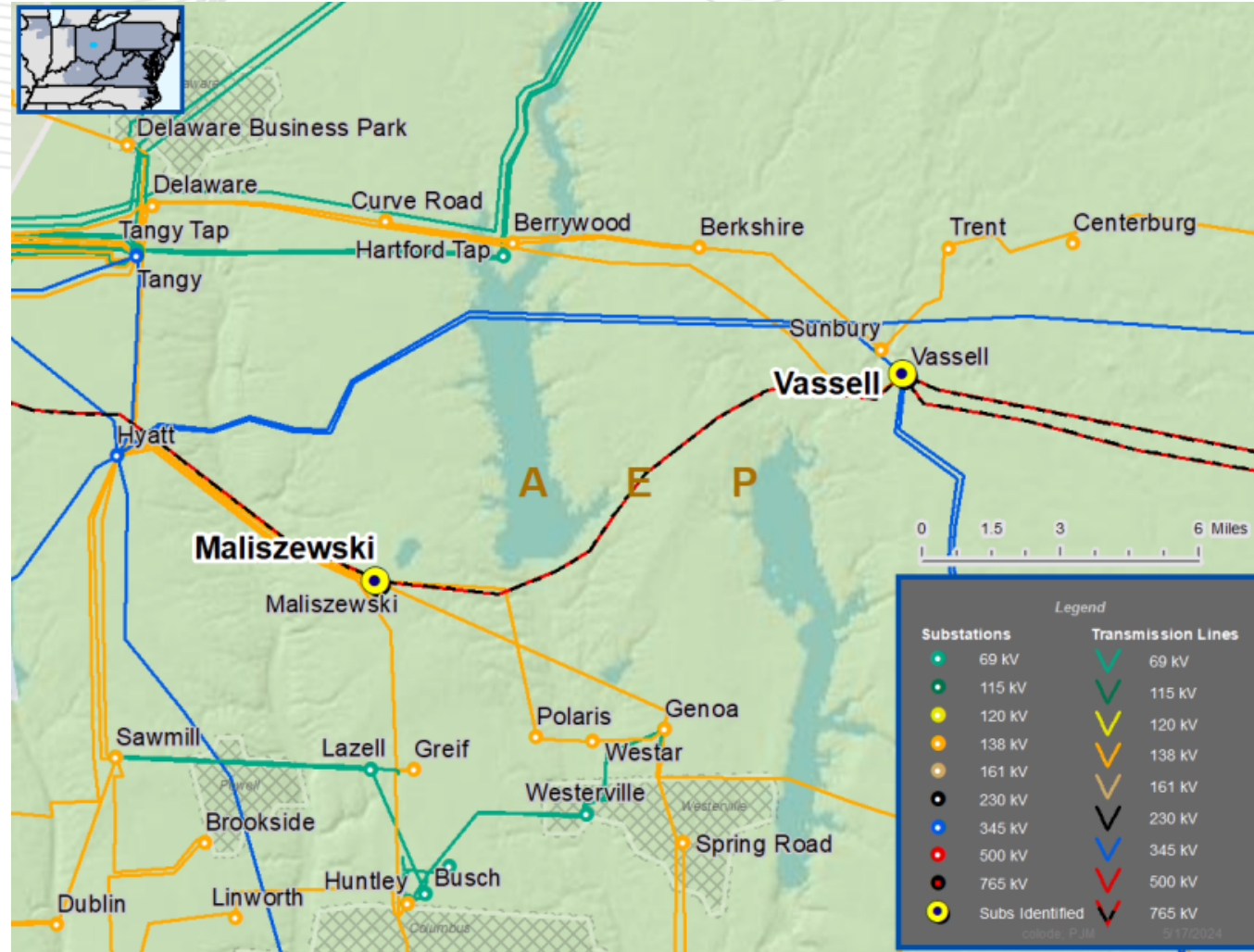
Total Estimated Cost: \$33.729 M

Required IS Date: 6/1/2027

Projected IS Date: 6/1/2027

Previously Presented: 6/4/2024

Facility Ratings:



Branch	Existing Facility Ratings SN/SE/WN/WE (MVA)	Preliminary Facility Ratings SN/SE/WN/WE (MVA)
Vassell 765/345 Transformer #2	-	2855/2897/2897/2897
Maliszewski – Marysville 765KV	4047/4142/4484/4961	4047/4571/4484/4961



PSEG Cluster 1 Evaluation and Recommended Solution

Process Stage: Second Review

Criteria: Summer N-1-1 Thermal violation

Assumption Reference: 2028 RTEP assumption

Model Used for Analysis: 2028 RTEP cases

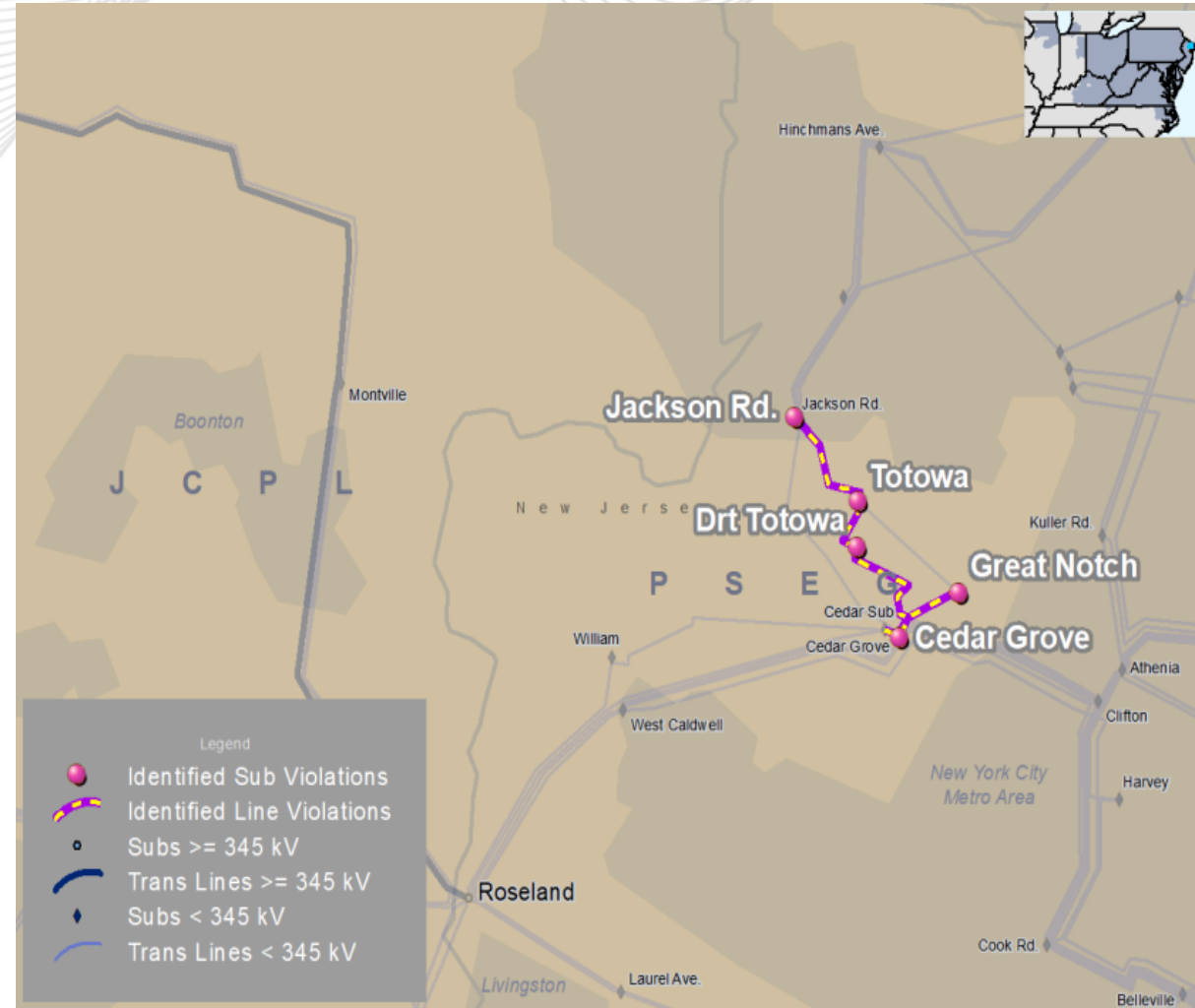
Proposal Window Exclusion: No

Problem Statement:

- PSEG N-1-1 thermal violation in the Northern New Jersey (Cedar Grove and Jackson area). Four 69 kV lines overloaded for several N-1-1 contingency combinations.

Violations were posted as part of the 2023 Window 2:

2023W2-PSEG-T1	2023W2-PSEG-T6	2023W2-PSEG-T11
2023W2-PSEG-T2	2023W2-PSEG-T7	2023W2-PSEG-T12
2023W2-PSEG-T3	2023W2-PSEG-T8	2023W2-PSEG-T13
2023W2-PSEG-T4	2023W2-PSEG-T9	2023W2-PSEG-T14
2023W2-PSEG-T5	2023W2-PSEG-T10	2023W2-PSEG-T15





PSEG Cluster 1 Evaluation and Recommended Solution

2023 Window 2 Cluster 1 Proposals

- Four projects proposed by Two Entities
 - 1 – 69 kV new line, partial overhead and partial underground
 - 2 – 230 kV new underground lines
 - 1 – 345 kV new underground construction and 230 kV operation

Proposal ID	Proposing Entity	Project Description	Estimated Cost (M)
2023-W2-998	PSEG	New 69 kV from Cedar Grove - Jackson Rd (3.73mi OH, 1.2mi - UG) and new 69kV from I-633 top to Jackson Rd (0.8mi OH, 1.2mi - UG)	60.6
2023-W2-496	PSEG	4 miles New 230kV XLPE Circuit using (230kV rated 3500kcmil cable) from Jackson Road 230kV Station to Cedar Grove 230kV Station	78.9
2023-W2-627	PSEG	4 miles New 230kV XLPE Circuit using (345kV rated 5000kcmil cable) from Jackson Road 230kV Station to Cedar Grove 230kV Station	84.6
2023-W2-716	PPL Translink	Build a 7.6 mile 230kV underground circuit using (345kV rated 5000kcmil cable) from the JCPL Montville Substation to the PSEG Jackson Rd Substation.	211.1

Proposal ID 998:

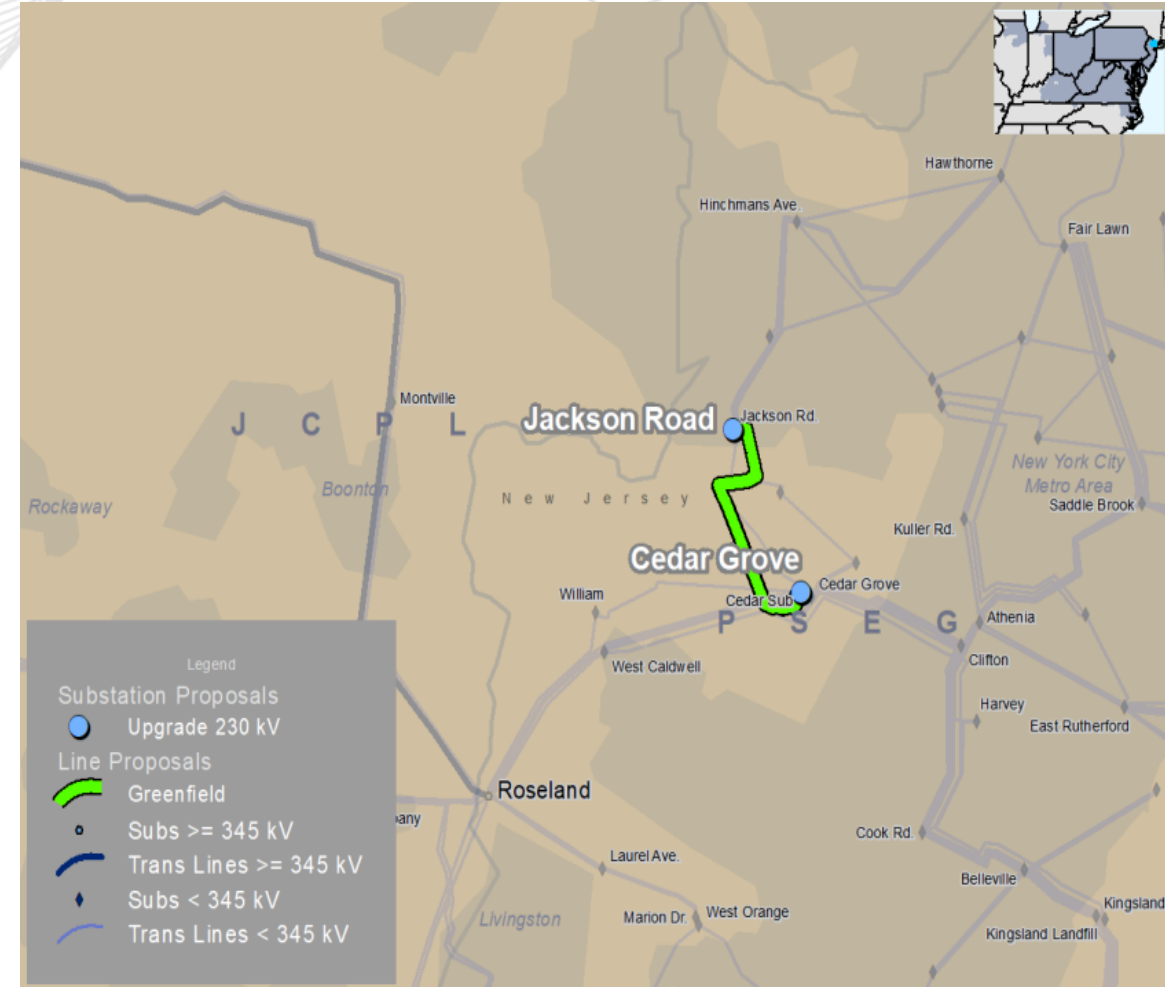
- Build new direct 69kV connection from Jackson Road to Cedar Grove (approximately 4.5 mi). This circuit will have both underground and overhead portions
- Replace (3) 72.5kV 40kA breakers with (3) 72.5 kV 63kA breakers. For the new 69kV line between Cedar Grove and Jackson Road. Replace the existing overhead termination structure with an underground termination structure. Replace line relay for the new 69kV line and the new extension
- For the new 69kV line between Cedar Grove and Jackson Road, installing a new UG termination structure. Replace line relay for the new 69kV line and the new extension
- Reroute a Portion of the existing N-664 underground and Tap into the existing I-633 creating a 3-ended circuit
- Reroute approximately 0.5 miles of the existing E-759 69kV line near the intersection of Vreeland Ave and Riverview Drive underground back to Jackson Road

Proposed Facility Rating: 95SN/131SE, 128WN/155WE MVA

Estimated Cost: \$60.6 M

Required In-Service: 6/1/2028

Projected In-Service: 6/1/2028





PSEG Cluster 1 Evaluation and Recommended Solution Proposal 2023-W2-496

Proposal ID 496:

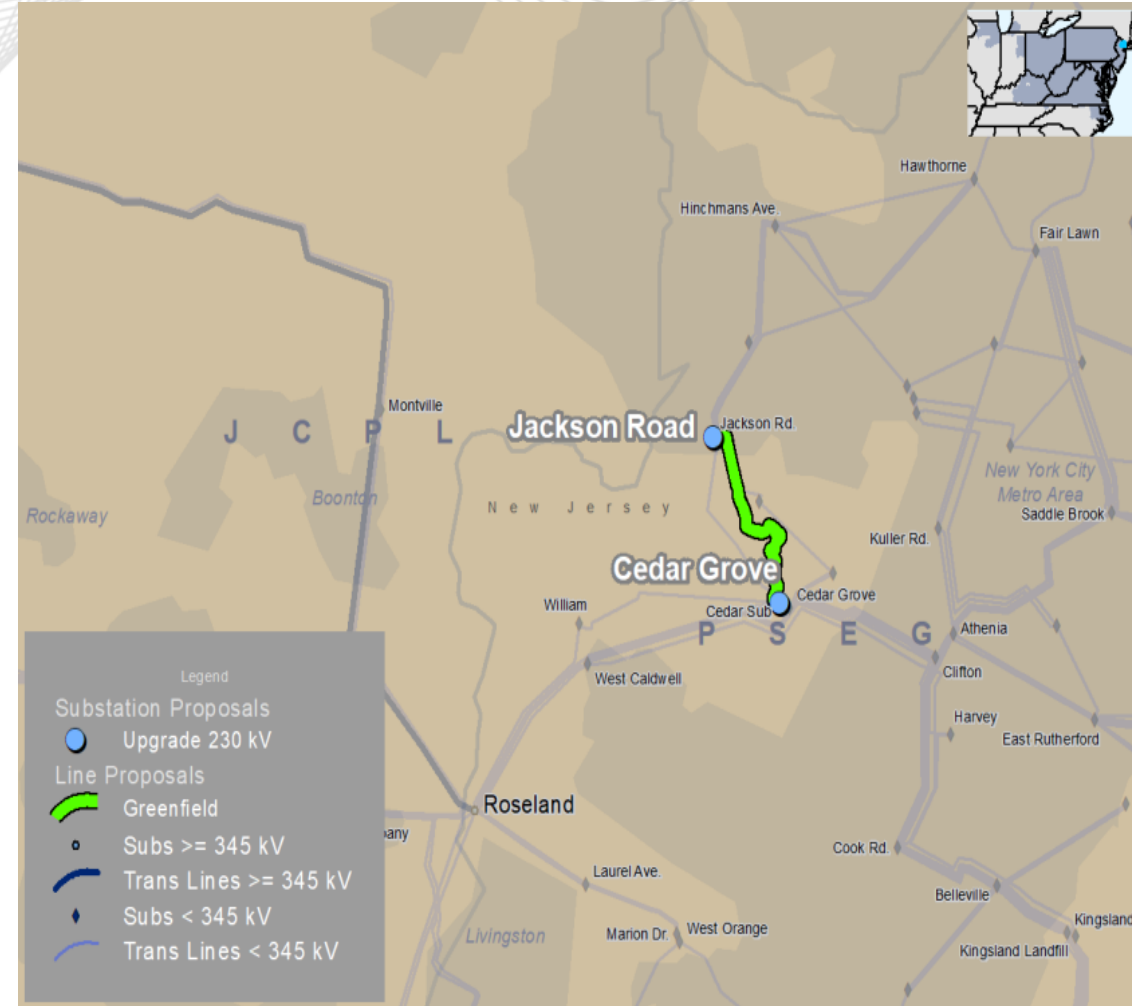
- Build 4 miles New 230kV XLPE Circuit using (230kV rated 3500kcmil cable) from Jackson Road 230kV Station to Cedar Grove 230kV Station
- Expand a new 230kV bay at the existing Cedar Grove with one line position by adding two 230kV circuit breaker and associated disconnect switches
- Replace the existing HPFF termination structure with a new XLPE termination structure to connect to spare GIS bay position circuit breaker and associated disconnect switches

Proposed Facility Rating: 457SN/677SE, 492WN/700WE MVA

Estimated Cost: \$78.9 M

Required In-Service: 6/1/2028

Projected In-Service: 6/1/2028





PSEG Cluster 1 Evaluation and Recommended Solution Proposal 2023-W2-627

Proposal ID 627:

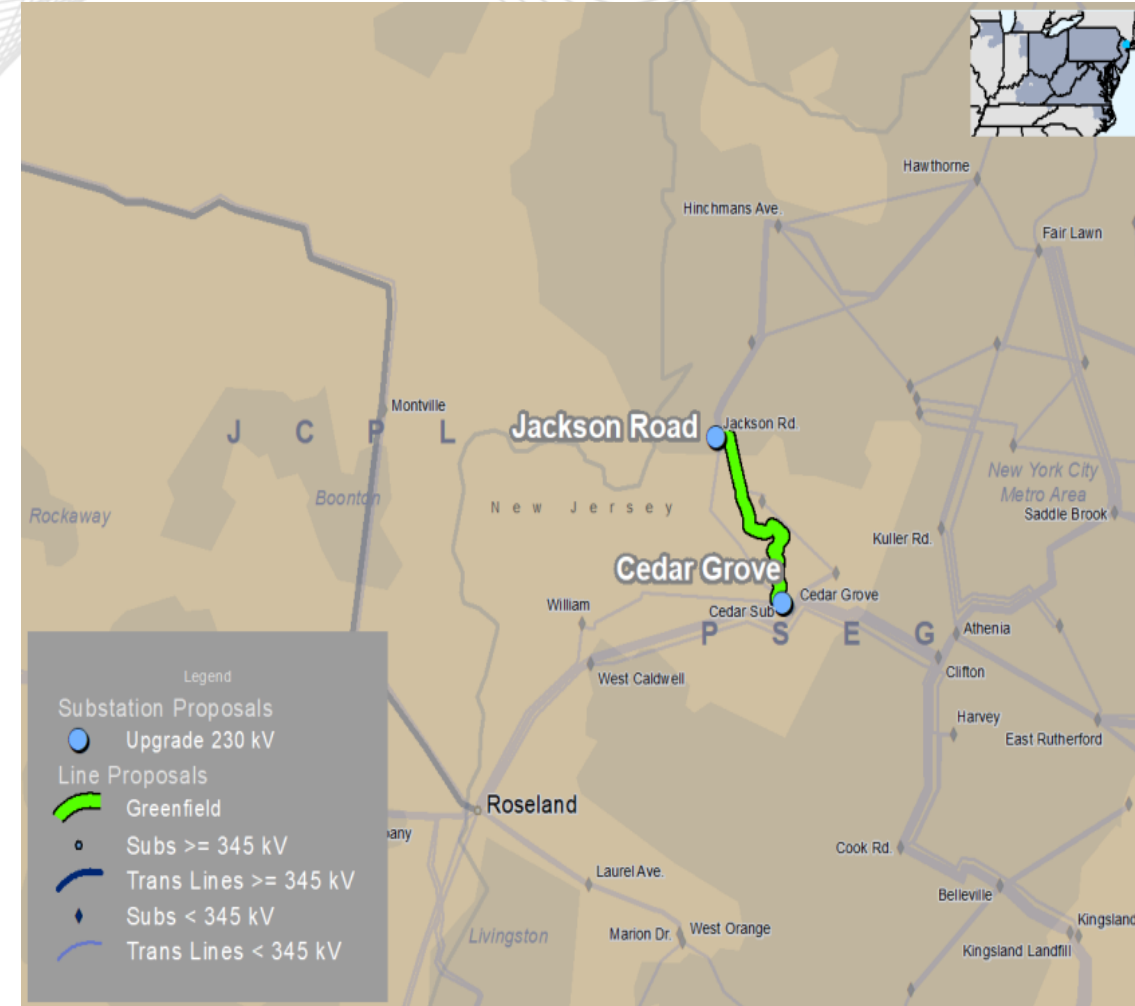
- Build 4 miles New 230kV XLPE Circuit using (345kV rated 5000kcmil cable) from Jackson Road 230kV Station to Cedar Grove 230kV Station
- Expand a new 230kV bay at the existing Cedar Grove Station with one line position by adding two 230kV circuit breakers and associated disconnect switches
- Replace the existing HPFF termination structure with a new XLPE termination structure to connect to spare GIS bay position

Proposed Facility Rating: 512SN/796SE, 552WN/821WE MVA

Estimated Cost: \$84.6 M

Required In-Service: 6/1/2028

Projected In-Service: 6/1/2028



Proposal ID 716:

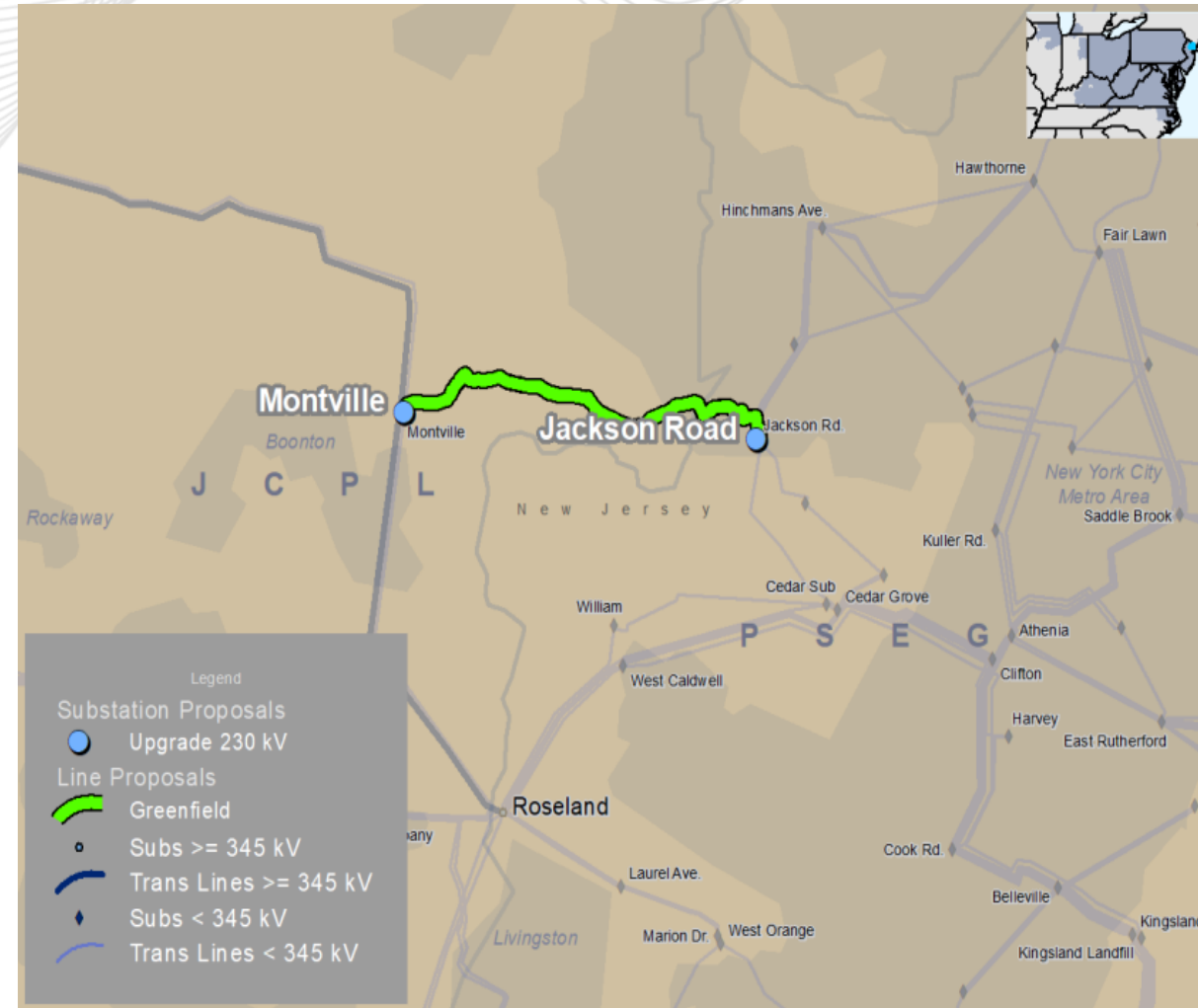
- Build a 7.6 mile 230 kV underground circuit using (345kV rated 5000kcmil cable) from the JCPL Montville Substation to the PSEG Jackson Rd Substation
- Expand the Montville 230 kV to a breaker and a half configuration by adding one new bay on the west side of the yard to terminate the new line
- At Jackson Rd, terminate the new line in the open bay position next to transformer 40

Proposed Facility Rating: 624SN/830SE, 659WN/850WE MVA

Estimated Cost: \$211.1 M

Required In-Service: 6/1/2028

Projected In-Service: 6/1/2028





PSEG Cluster 1 Evaluation and Recommended Solution

2023 Window 2 Cluster 1 Proposals study

PJM evaluated all four Proposals:

- Performed the DNH analysis to ensure the proposals solve the identified violations and don't cause a harm to the system
- Evaluated the proposals for their performance in future load growth

Proposals Performance Comparison:

Proposal ID	2023-W2-998	2023-W2-496	2023-W2-627	2023-W2-716
Address all Cluster 1 Violations	Y	Y	Y	Y
Provides Margin for Future Needs	N	Y	Y	N
Future Expandability	N	N	Y	Y



PSEG Cluster 1 Evaluation and Recommended Solution

Proposal ID	Proposing Entity	Project Type	Project Description	Cost As Proposed (\$M)
998	PSEG	UPGRADE	New 69 kV from Cedar Grove - Jackson Rd (3.73mi OH, 1.2mi - UG) and new 69kV from I-633 top to Jackson Rd (0.8mi OH, 1.2mi - UG)	60.6
496	PSEG	GREENFIELD	4 miles New 230kV XLPE Circuit using (230kV rated 3500kcmil cable) from Jackson Road 230kV Station to Cedar Grove 230kV Station	78.9
627	PSEG	GREENFIELD	4 miles New 230kV XLPE Circuit using (345kV rated 5000kcmil cable) from Jackson Road 230kV Station to Cedar Grove 230kV Station	84.6
716	PPL Translink	GREENFIELD	Build a 7.6 mile 230 underground circuit using (345kV rated 5000kcmil cable) from the JCPL Montville Substation to the PSEG Jackson Rd Substation	211.1

Proposal ID	Cost Estimate Risks	Cost Containment Risks	Schedule Risk	Constructability Risks	Use of Existing ROW & Brownfield	Outage Coordination Risks
998	Low	High	Medium	Medium	Medium-High	Low
496	Low	Low	Medium-High	Medium	Medium-High	Low
627	Low	Low	Medium-High	Medium	Medium-High	Low
716	Low	Medium-High	High	High	High	Low

Process Stage: Second Review

Criteria: Summer N-1-1 Thermal violation

Problem Statement:

- PSEG N-1-1 thermal violation in the Northern New Jersey (Cedar Grove and Jackson area). Four 69 kV lines overloaded for several N-1-1 contingency combinations.

Recommended Solution:

Proposal ID 627:

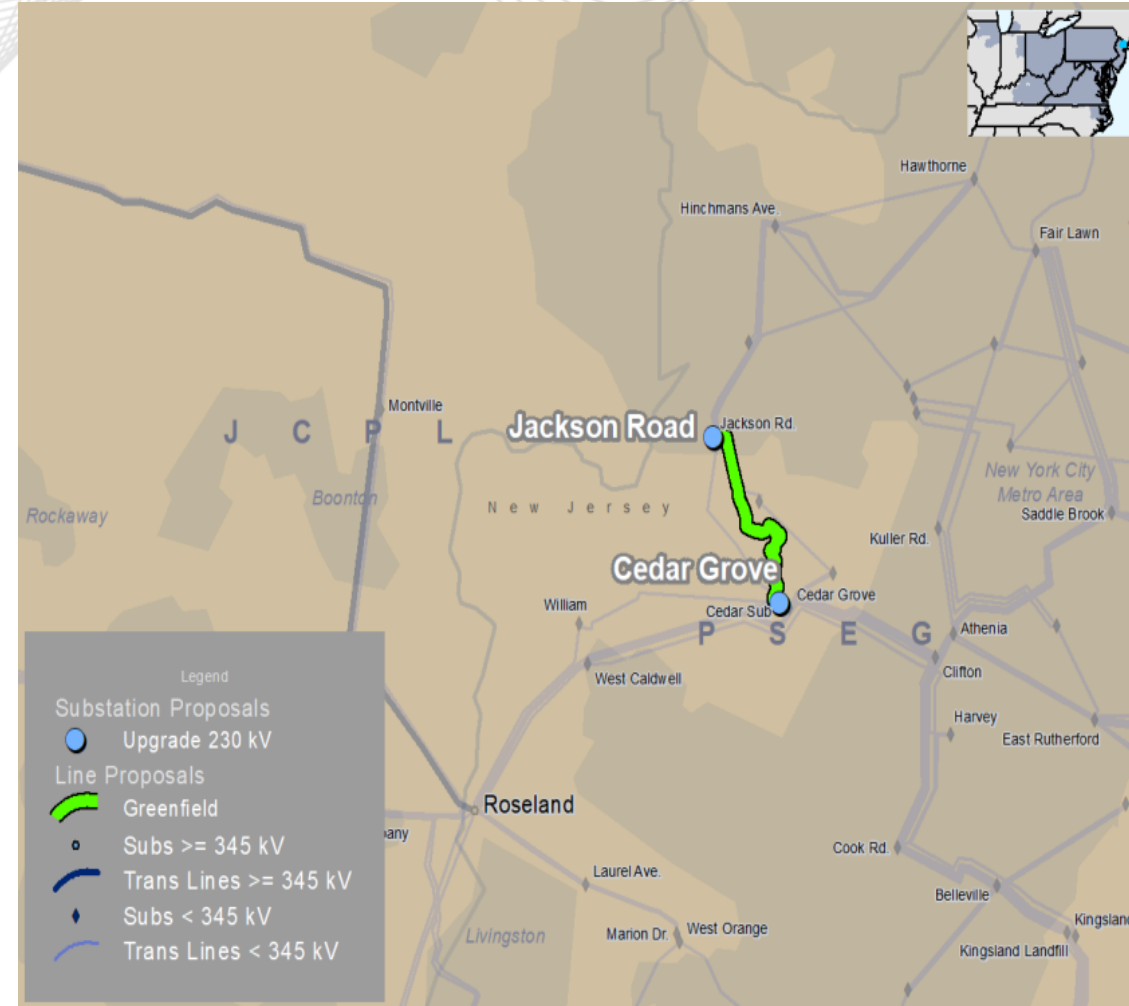
- Build 4 miles New 230kV XLPE Circuit using (345kV rated 5000kcmil cable) from Jackson Road 230kV Station to Cedar Grove 230kV Station (**b3855.1**)
- Expand a new 230kV bay at the existing Cedar Grove Station with one line position by adding two 230kV circuit breakers and associated disconnect switches (**b3855.2**)
- Replace the existing HPFF termination structure with a new XLPE termination structure to connect to spare GIS bay position at Jackson 230kV (**b3855.3**)

Proposed Facility Rating: 512SN/796SE, 552WN/821WE MVA

Estimated Cost: \$84.6 M

Required In-Service: 6/1/2028

Projected In-Service: 6/1/2028





2022 Window 3 Upgrades – Scope Changes / Cancellations Baseline Reliability Projects



2022 RTEP Window 3 Solution: 502 Jct-Woodside-Aspen 500 kV & Doubs Corridor Projects

502 Jct – Woodside – Aspen 500 kV RTEP Projects

NextEra Scope

- **b3800.102:** New 500 kV line from existing 502 Junction substation to New Stonewall/Woodside substation (bypass Black Oak) - \$315.64M
- **b3800.106 – b3800.110:** Woodside substation adjacent to existing Stonewall 138 kV substation - \$80.01M
- **b3800.113, b3800.115, b3800.117:** Woodside reactive components, and NEET scope for Doubs to Bismark line terminations into Woodside - \$45.24M
- **b3800.119:** New 500 kV transmission line from Woodside substation to Aspen substation (in DOM zone). (NEET Portion) - \$71.72M

Total NextEra Cost Estimate: \$512.61M

FE Scope

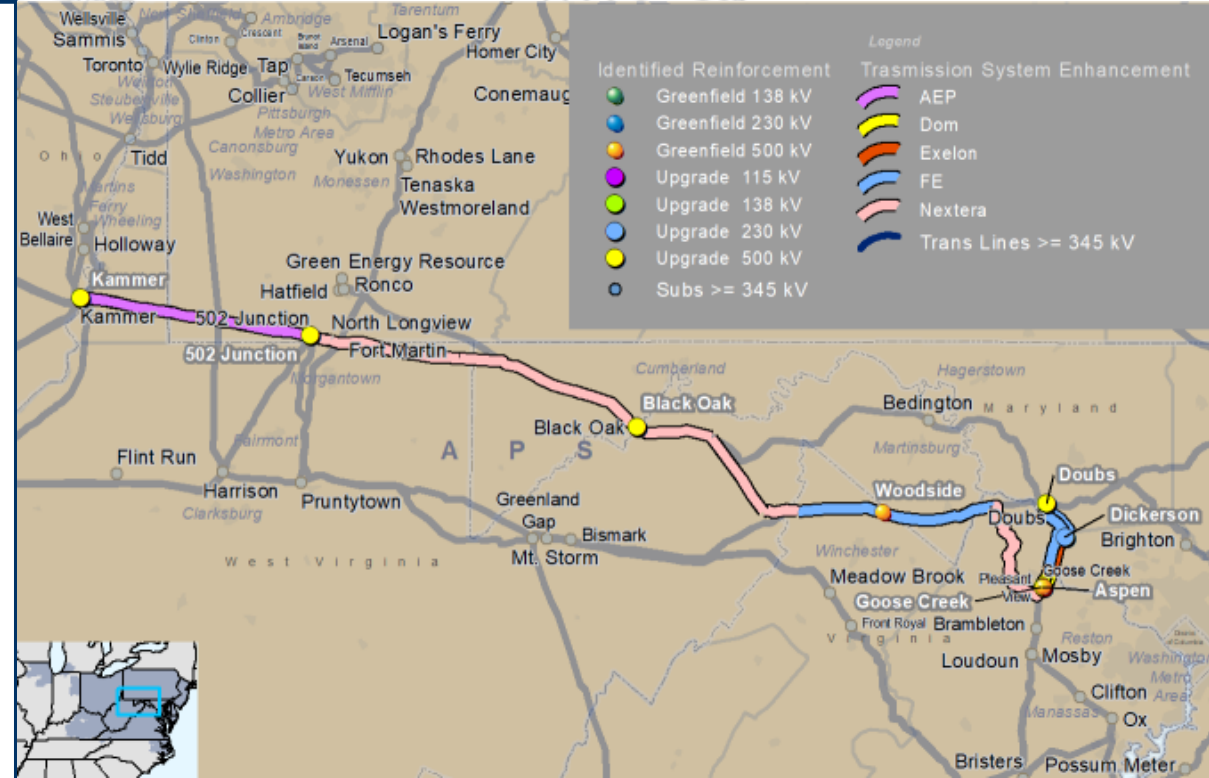
- **b3800.101:** 502 Junction substation two 500 kV circuit breaker expansion - \$30.60M
- **b3800.103:** Rebuild ~16 miles of the Gore-Stonewall 138 kV line with 500 kV overbuild - \$151.72M
- **b3800.104:** Rebuild ~15 miles of the Stonewall-Millville 138 kV line with 500 kV overbuild - \$136.93M
- **b3800.105:** Rebuild ~6 miles of the Millville-Doubs 138 kV line with 500 kV overbuild - \$52.35M
- **b3800.111, b3800.112, b3800.114 :** Woodside-Stonewall 138 kV lines 1&2 and Stonewall 138 kV substation two 138 kV breaker expansion - \$20.89M
- **b3800.116:** FE scope for terminating Doubs to Bismark line into Woodside 500 kV substation \$0.06M

Total FE Cost Estimate: \$392.55M

Dominion Scope

- **b3800.118:** DOM scope for terminating Doubs to Bismark line into Woodside 500 kV substation - \$5.10M
- **b3800.120:** Terminate new NextEra 500 kV line from Woodside into Aspen substation. Include a portion of the Aspen 500 kV substation build - \$30.49M

Total DOM Cost Estimate: \$35.59M



NOTE: This map is only intended to illustrate the general electrical connectivity of the projects, and should not be relied upon for exact geographical substation locations or line routes.



2022 RTEP Window 3 Solution: 502 Jct-Woodside-Aspen 500 kV & Doubs Corridor Projects

Doubs Corridor RTEP Projects

FE Scope

b3800.122: Rebuild 500 kV line #514 from Doubs-Goose Creek 500 kV line using double circuit 500kV/230kV towers (APS Portion) – \$103.27M

b3800.123: Doubs substation work to re-terminate rebuilt Doubs-Goose Creek, and terminate new Doubs – Aspen 500 kV - \$31.7M

b3800.124 – b3800.127: FE Portion of new Doubs to Aspen 500 kV line installed by rebuilding existing 230 kV circuits between Doubs and Dickerson H using 500/230 kV structures; the existing 230 kV circuits will be underbuilt on the new 500/230 kV structures (APS Portion) – \$99.99 M

Total FE Cost Estimate: \$234.96M

Exelon (PEPCO) Scope

b3800.243, b3800.244: Exelon Portion of new Doubs to Aspen 500 kV line installed by rebuilding 7.26 miles of existing 230 kV circuits between Dickerson Station H and Edwards Ferry on 500/230 kV structures; the existing 230 kV circuits will be underbuilt on new 500/230 kV structures (Exelon Portion) \$55.8M

b3800.245: Reconfigure Dickerson H 230 kV Substation and upgrade terminal equipment - \$10.58M

Total Exelon Cost Estimate: \$66.38M

Dominion Scope

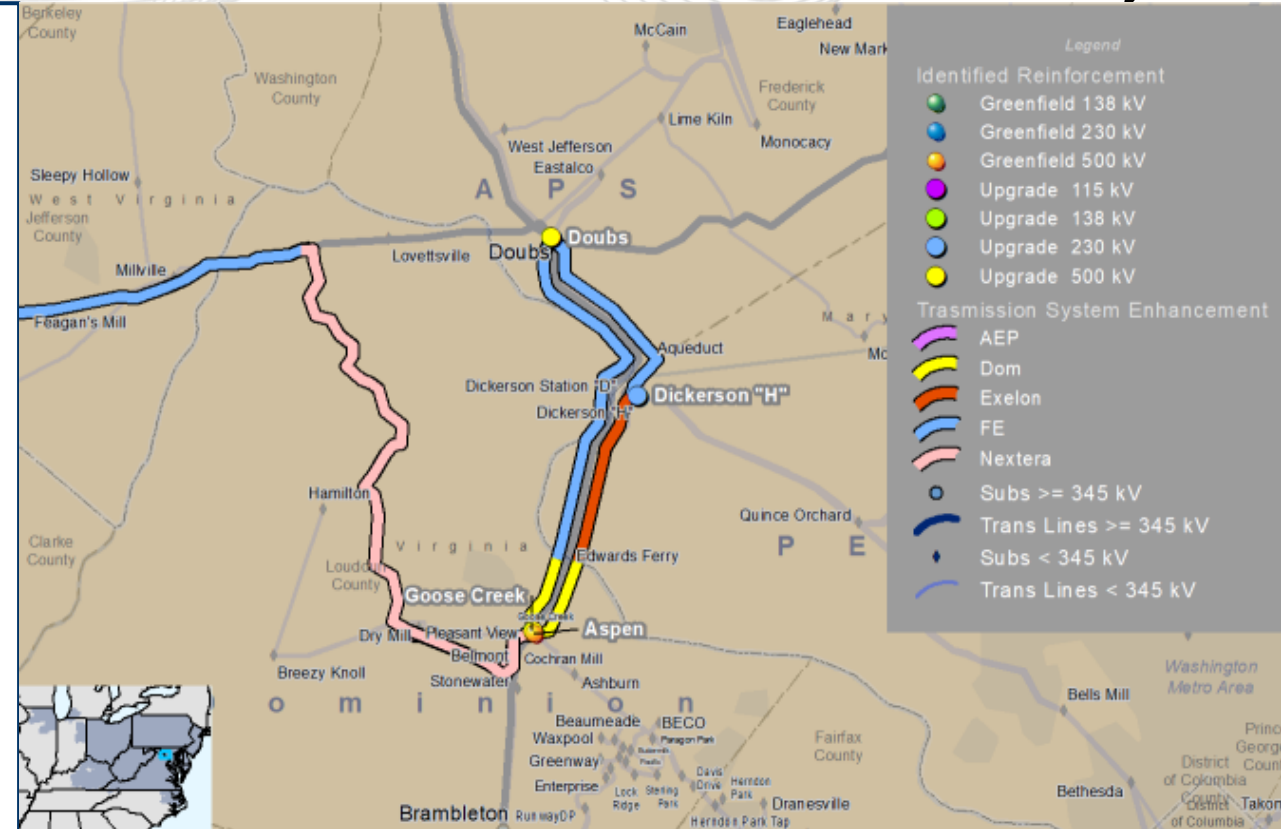
b3800.239: Wreck and rebuild 230kV Line #203 between Pleasant View and structure 203/15 using double circuit 500/230kV structures – \$6.87M

b3800.240: Construct a new 500kV Line between Doubs and new substation Aspen - \$41.68M

b3800.241: Rebuild 500kV line #514 from Doubs – Goose Creek using double circuit 500kV/230kV towers

b3800.230 – b3800.238, b3800.242: Various Substation Upgrades to address relay resets, overloaded breakers and terminal equipment limitations - \$13.74M

Total DOM Cost Estimate: \$78.40M



NOTE: This map is only intended to illustrate the general electrical connectivity of the projects, and should not be relied upon for exact geographical substation locations or line routes.



Scope Changes: 502 Jct-Woodside-Aspen 500 kV & Doubs Corridor Projects

502 Jct – Woodside – Aspen 500 kV Project Scope Changes

Rationale for Scope Changes:

The line section from Woodside to Aspen will be rerouted from the originally proposed greenfield line route to an alternate route within existing transmission line rights of way along the Doubs Corridor containing the rebuilt Doubs – Goose Creek and the new Doubs – Aspen 500 kV lines. This reroute is the outcome of successful collaboration between NextEra and the incumbent Transmission Owners to determine the most feasible route and minimize area impact for the new Woodside to Aspen 500 kV line segment.

As part of this change, the new 500 kV line from Woodside will now terminate into Goose Creek substation due to space constraints within the Corridor and also to minimize unnecessary line crossings.

Revised NextEra Scope

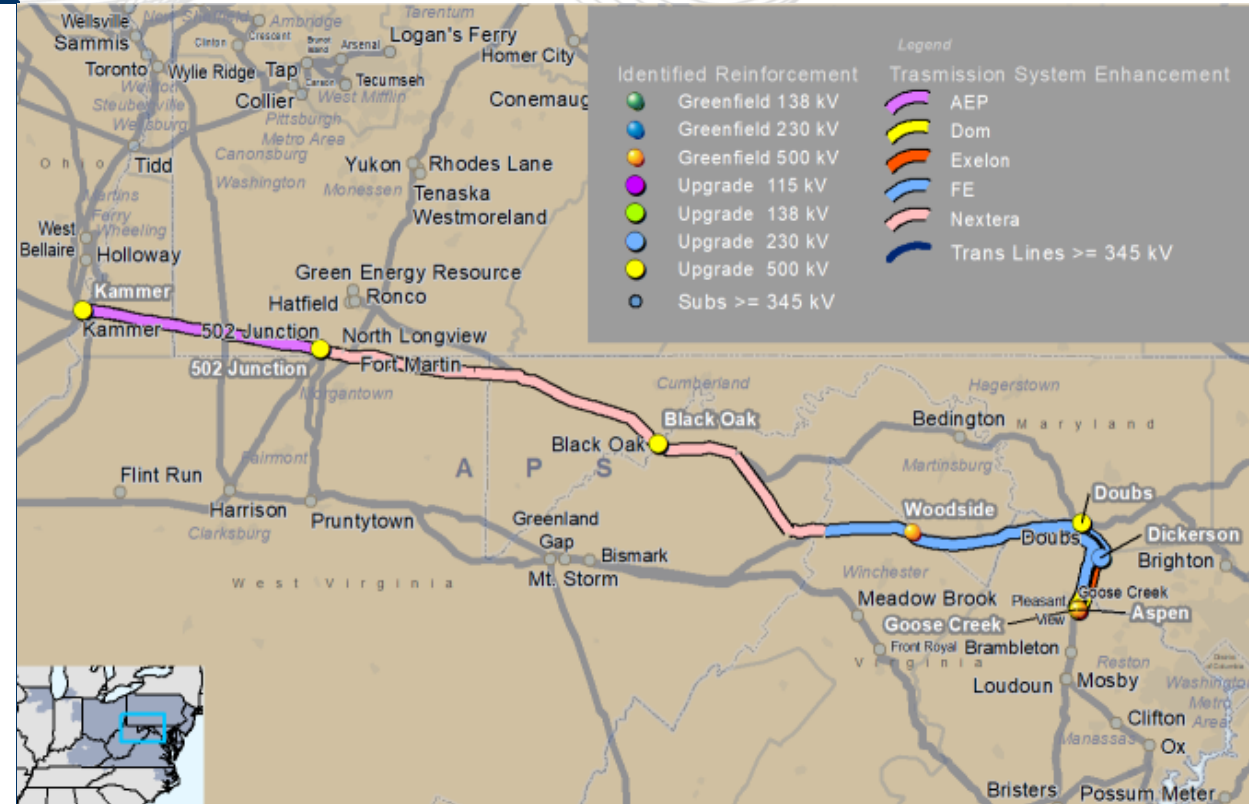
- **Cancel b3800.119:** New 500 kV transmission line from Woodside substation to Aspen substation (in DOM zone) (NEET Portion) - \$71.72M

Revised NextEra Total Cost: \$440.89M, Delta: -\$71.72M

Revised FE Scope

- **Scope Change for b3800.105:** Rebuild Millville-Doubs 138 kV for ~16 miles from structure MVF1-39 to structure MVF1-101 (outside of Doubs Substation) with 500 kV overbuild - \$147.45M
- **New Baseline Project b3800.128:** Construct 500 kV Line from existing structure MVF1-101 on the Doubs – Millville 138 kV Line, around Doubs Substation, and into the entrance of the Doubs – Goose Creek Corridor. (~2 miles) - \$13.20M
- **New Baseline Project b3800.129:** Construct new Woodside – Goose Creek 500 kV line for ~15 miles on single circuit monopole structures within the Doubs – Goose Creek Corridor. (FE Portion) - \$115.30M

Revised FE Total Cost: \$616.15, Delta: +\$223.60M



NOTE: This map is only intended to illustrate the general electrical connectivity of the projects, and should not be relied upon for exact geographical substation locations or line routes.

502 Jct – Woodside – Aspen 500 kV Project Scope Changes (cont.)

Revised DOM Scope

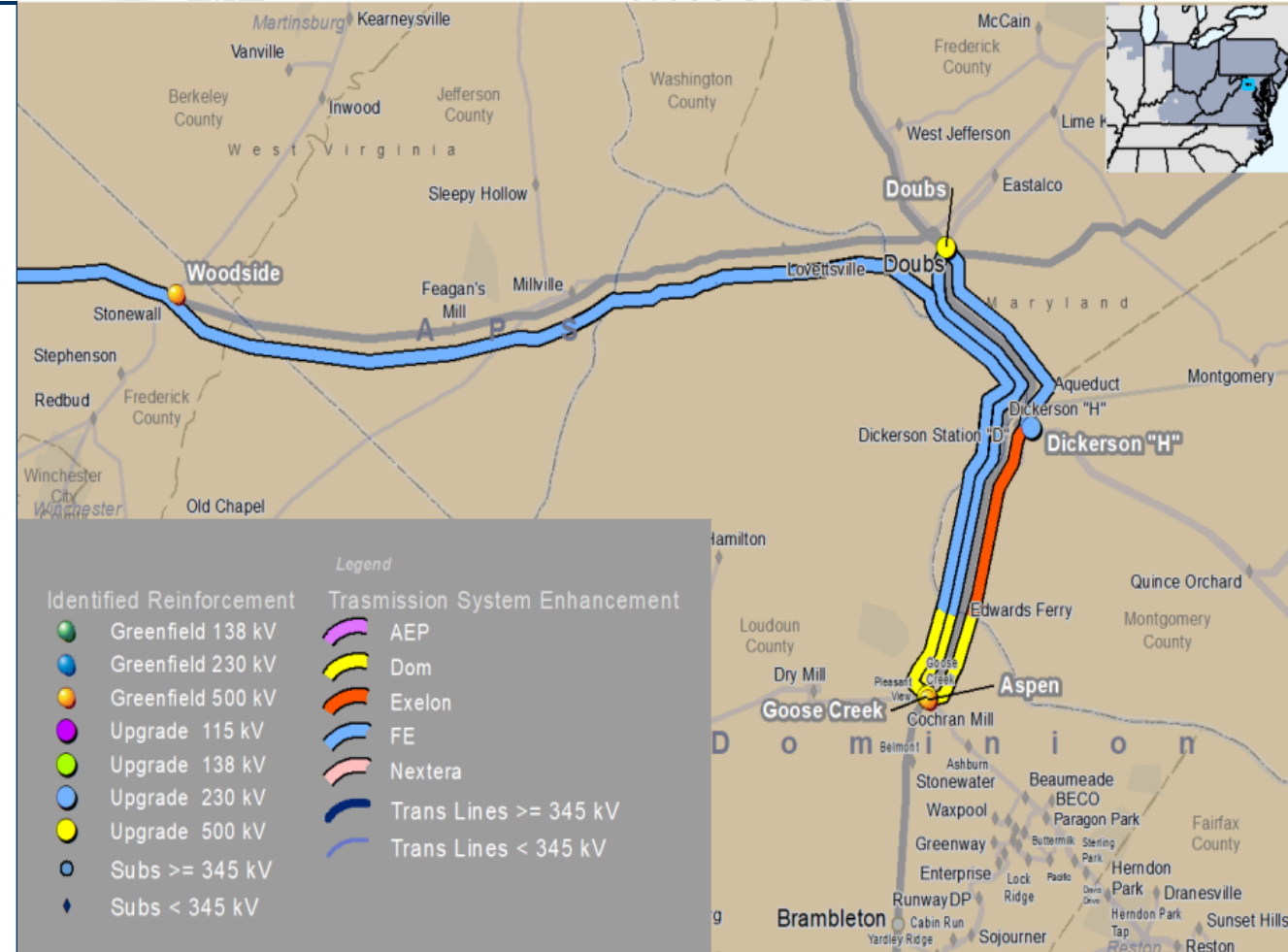
- **Scope Change for b3800.120:** Terminate new NextEra 500 kV line from Woodside into **Goose Creek substation. The Goose Creek 500kV cap bank will be moved to Aspen substation.** - \$30.49M (No Cost Change)
- **New Baseline Project b3800.375:** Construct new Woodside – Goose Creek 500 kV line for ~3 miles on single circuit monopole structures within the Doubs – Goose Creek Corridor. (DOM Portion) - \$15.60M
- **Revised DOM Total Cost: \$51.19, Delta: +\$15.60M**

Net Cost Change to 502 Jct – Woodside – Aspen Projects: +\$167.48M

Doubs Corridor RTEP Project Impacts

- No significant scope/cost changes to the approved FE, Exelon and Dominion projects in Doubs Corridor beyond considerations to ensure sufficient space for the new Woodside – Goose Creek 500 kV line within the Corridor.

Net Cost Change to Doubs Corridor RTEP Projects: \$0



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Reliability Analysis Update



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Version No.	Date	Description
1	7/3/2024	<ul style="list-style-type: none">Original slides posted
2	7/9/2024	<ul style="list-style-type: none">Number of proposals received listed on slide 27 corrected from 7 to 6.

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