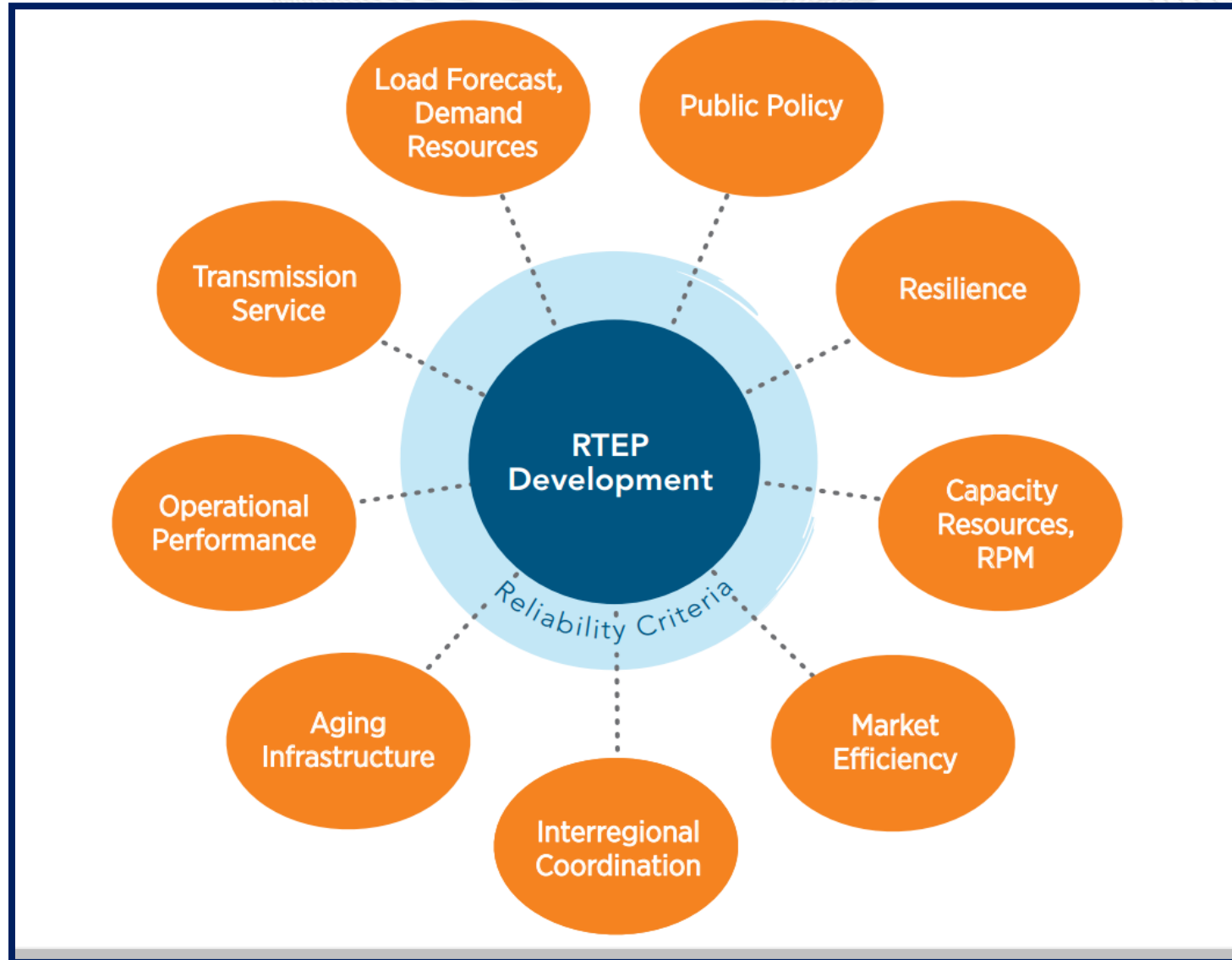


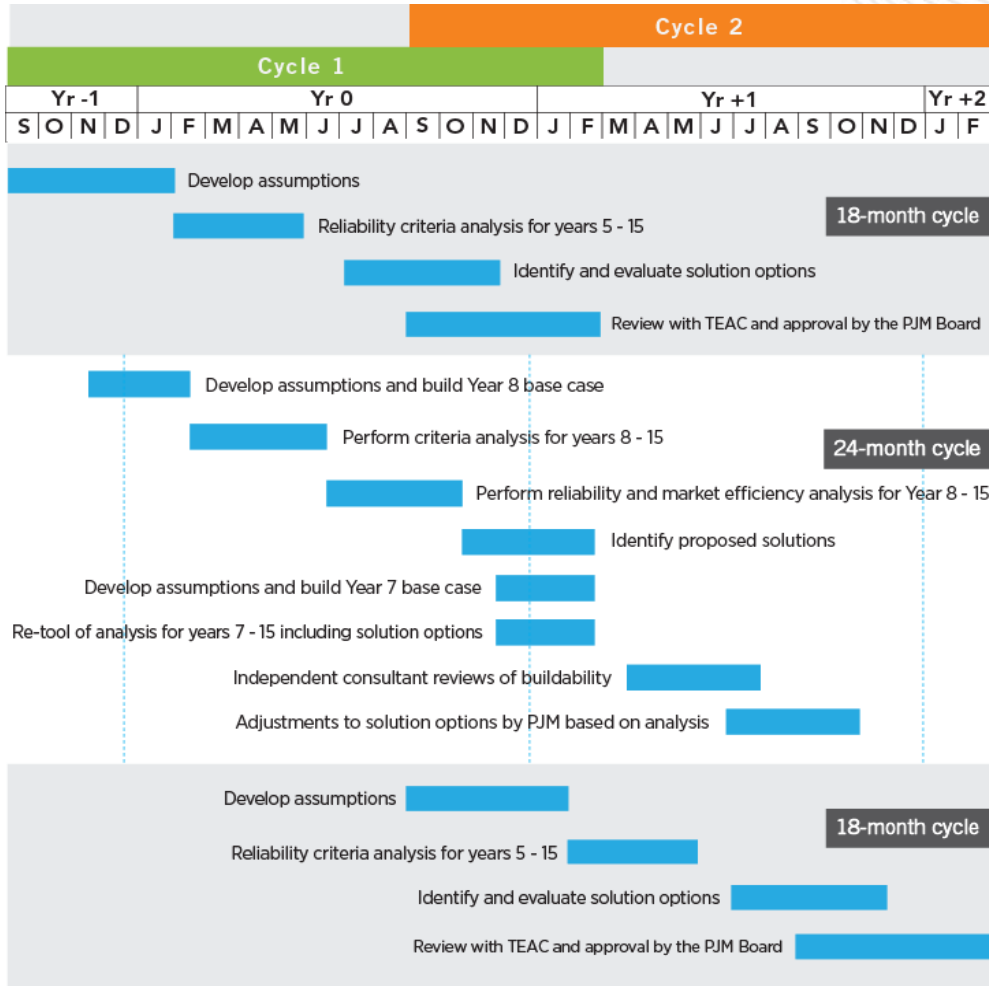
PJM Regional Transmission Expansion Planning (RTEP) Process

Nebiat Tesfa, Transmission Planning
IPSAC December 8, 2023

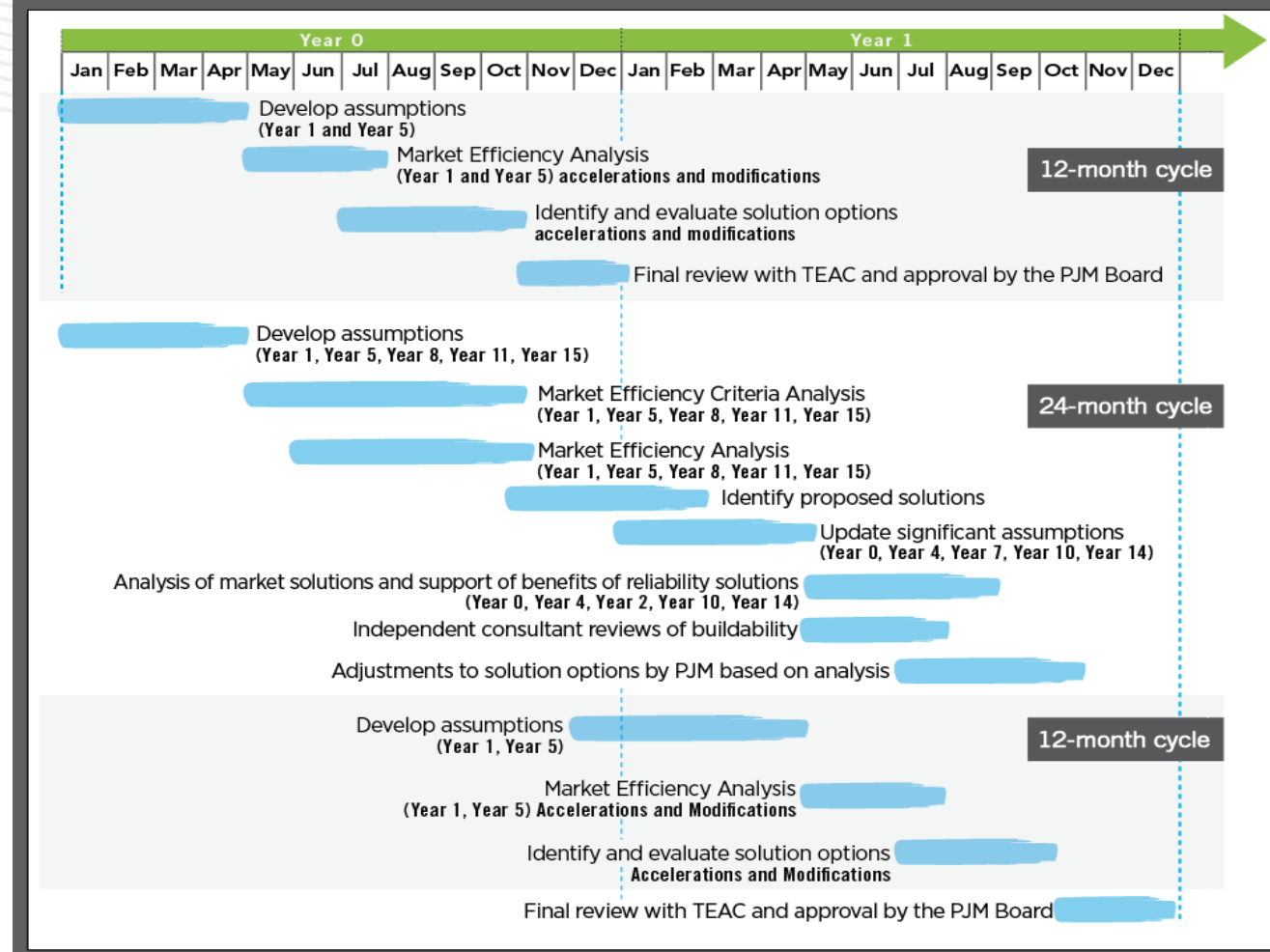
- Planning Committee (PC)
 - <http://www.pjm.com/committees-and-groups/committees/pc.aspx>
- Transmission Expansion Advisory Committee (TEAC)
 - <http://www.pjm.com/committees-and-groups/committees/teac.aspx>
- Interregional Planning
 - <http://www.pjm.com/planning/interregional-planning.aspx>
- Services and Requests
 - <http://www.pjm.com/planning/services-requests.aspx>
- RTEP Development
 - <http://www.pjm.com/planning/rtep-development.aspx>
- Manual 14B
 - <http://www.pjm.com/-/media/documents/manuals/m14b.ashx>



PJM's 2-year Reliability



PJM's 2-year Market Efficiency



2023 RTEP Update

- The 2023 RTEP Assumptions were presented at the May IPSAC meeting. Refer to
- <https://www.pjm.com/-/media/committees-groups/committees/teac/2023/20230110/item-07---2023-rtep-assumption.ashx>
- Baseline Projects –Projects that are driven by reliability criteria violations, operational performance issues, congestion constraints and public policy.
- Supplemental Projects – Projects that are not required to address system reliability, operational performance or economic criteria. Supplemental projects are planned according to the Tariff Attachment M-3 process.

- Per the PJM Operating Agreement, multiple proposal windows were conducted for all reliability needs that were not Immediate Need reliability upgrades or were otherwise ineligible to go through the window process.
- 2 FERC Order 1000 proposal windows opened during the 2023 RTEP cycle
 - 2022 RTEP Window 3 - 60 day window – extended by 36 days
 - 2023 RTEP Window 1 - 60 day window

2023 Reliability RTEP Window 1 Update

- Window opened on 7/24/2023
- Window closed on 9/22/2023
- The 2023 Window 1 was conducted to address Reliability violations identified in the 2028 RTEP studies.
- For this Window, PJM sought technical solutions, also called proposals, to resolve potential reliability criteria violations on facilities identified in accordance with all applicable planning criteria (PJM, NERC, SERC, RFC, and Local Transmission Owner criteria).
- 20 total proposals submitted from 9 different entities (7 Incumbents & 2 Non Incumbents)
 - 7 Greenfields
 - 13 Upgrades
- Cost Estimates: Approximate range from \$1.08 M – \$1,300 M
- 5 proposals with Cost Containment
- The evaluation for the Window 1 proposed projects is in progress and is expected to be completed by the end of December 2023 and board approved in February 2024.

2022 Reliability RTEP Window 3 Update

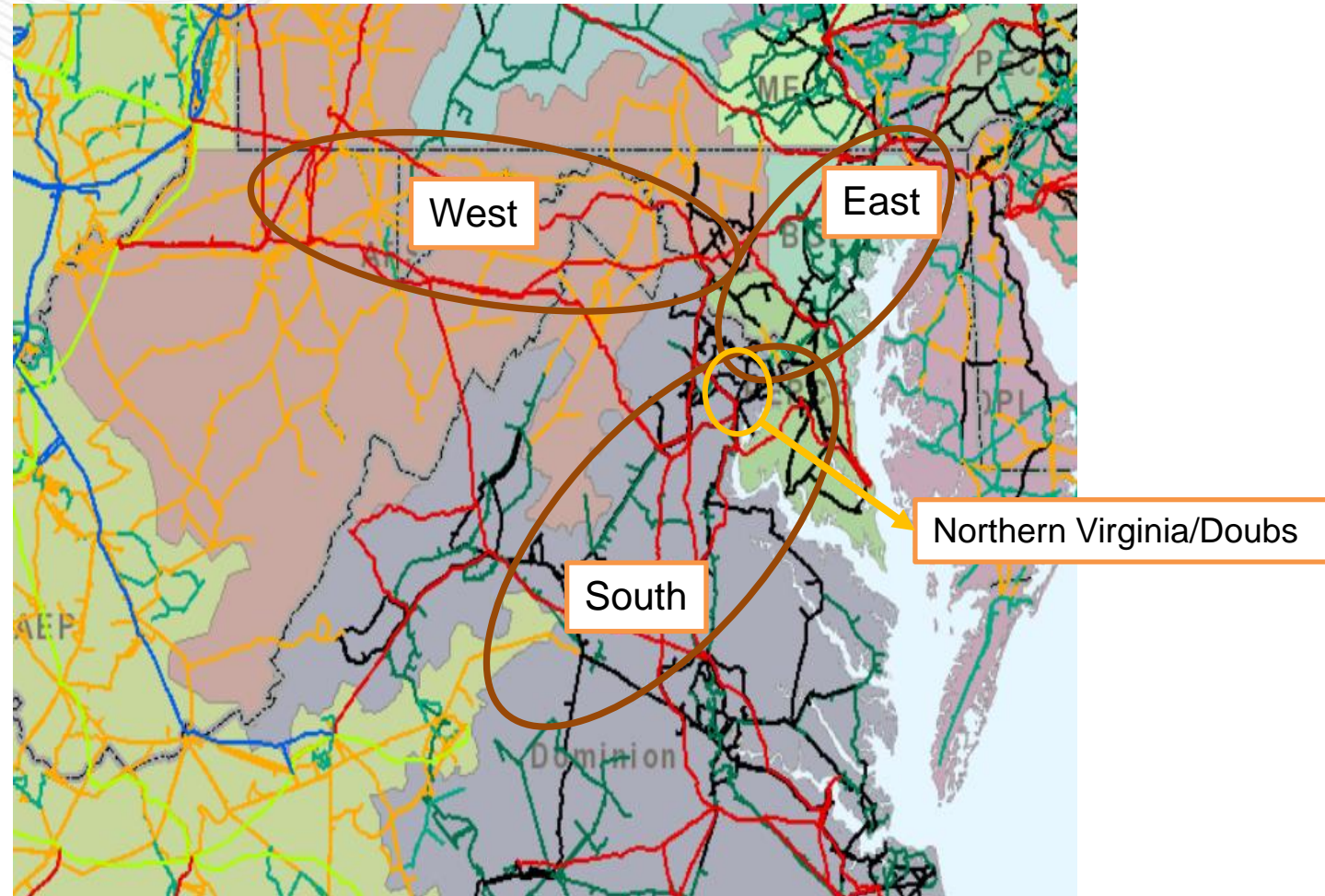
- 2022 Window 3 was opened February 24, 2023 and closed May 31, 2023.
- The Window was open to address reliability needs in the Dominion and APS zones primarily associated with Data Center Load forecasts (up to 7,500 MWs by 2027-28)
 - 72 Proposals were received from 10 entities
 - 6 are Incumbent, 4 Non Incumbent
 - 22 Projects are upgrades, while 50 are Greenfield
 - 44 Proposals have Cost Containment Commitments
 - Majority of the proposals offered 500 kV reinforcements. A couple of entities proposed 765 kV as well as HVDC solutions
 - Cost range: \$7M - \$6.2B – Total cost: \$54.4 billion

Proposal Evaluation:

PJM in evaluating the proposals attempted to:

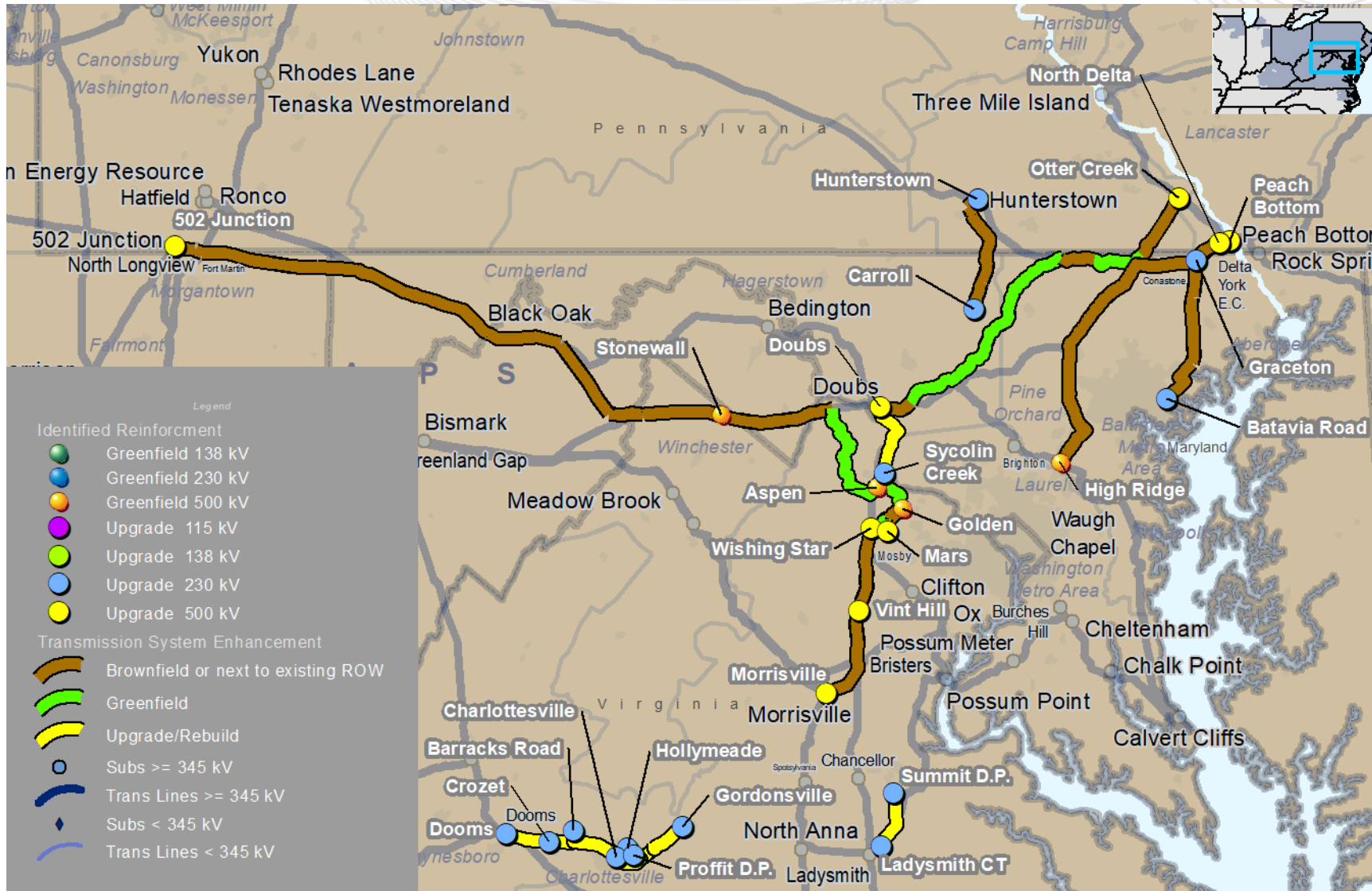
- Develop robust, holistic and expandable solutions that address the 2027-28 baseline violations associated with:
 - Local constraints: resulting from directly serving data center loads in APS / Dominion
 - Regional constraints resulting from imports into load center areas (500 kV primarily):
 - Needed reactive power VAR reinforcements, both static and dynamic as necessary.
 - Address reliability impacts due to the deactivation of 11GWs of generation.
- Adhere to all applicable planning criteria, including PJM, NERC, SERC, RFC and Local Transmission Owner Criteria.

- Proposals were grouped in 4 main clusters (East, West, South and Dominion)
- Each cluster included proposals by different entities in the same need area and/or addressing the same local/regional needs
- Scenarios were developed and tested:
 - First; address regional needs
 - Next; scenarios were refined (building new scenarios) to cover local needs
 - Scenarios were further refined using more effective proposal components as demonstrated through performance



- PJM evaluated the proposals on both 2027 and 2028 RTEP cases
 - Initial screening was conducted for all proposals on 2027 RTEP cases
- Scenarios developed by combining proposals and/or components
 - 100 scenarios developed and evaluated
- The results indicate all scenarios/combinations address the need identified in the 2027 case to a varying degree
- 2028 Robustness test was utilized to further assess the merit of all proposals
 - 2028 evaluations indicated need for further regional transfer reinforcements (beyond those offered for 2027)
 - Account for major deactivations in the study area
 - Account for higher regional transfers as a result of block dispatch and new gen deliverability test

Major Proposals Selected in 2022 Window 3



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.

- PJM evaluated various combinations of the proposals/components and identified the most efficient and cost effective solutions.
- The Recommended solution consists of Regional and local projects including:
- **East Cluster:** Three new/rebuild 500 kV transmission lines
 - Build new North Delta – High Ridge 500 kV line.
 - Rebuild 5012 (existing Peach Bottom – Conastone) 500 kV line on single circuit structures within existing ROW and cut into North Delta 500 kV and Gracetone 500 kV stations.
 - Build new Otter Creek – Doubs 500 kV line
- **West Cluster:** One 500 kV line
 - One 500 kV line (502J – Woodside – Aspen 500 kV)
 - 800 MVAR reactive (STATcom and capacitor)

- **South Cluster:**
 - Build a new 500kV line from Morrisville – Vint Hill – Wishing Star (approximately 36.3 miles) while maximizing the use of existing ROW within this corridor.
 - Install 230kV, 500kV shunt cap banks (static devices) as well as STATCOMs (dynamic devices) and associated equipment to address the reactive power needs of the system (≈ 1400 MVAR)
- **Northern Virginia/Doubs Cluster:**
 - Rebuild 500kV Line #514 Doubs – Goose Creek
 - Construct a new 500kV Line between Doubs and a new substation called Aspen
 - Construct new double-circuit 500/230 kV lines from Aspen to Golden to Mars substation

- **Local Upgrades:**

- In addition to the regional solutions, several local upgrades identified
 - Build several new 230 kV lines
 - Install six 500/230 kV and two 500/138 kV new transformers
 - Rebuild/reconductor several 230 kV lines
 - Several new reactive devices, including STATcom and capacitors

For more 2022 window 3 information, see link below:

TEAC Presentation Material:

<https://www.pjm.com/-/media/committees-groups/committees/teac/2023/20231205/20231205-item-15---reliability-analysis-update-2022-window-3.ashx>

Analysis Report Document:

<https://www.pjm.com/-/media/committees-groups/committees/teac/2023/20231205/20231205-2022-rtep-window-3-reliability-analysis-report.ashx>

Cluster	Proposal Cost (\$M)
East	\$1,443.12
West	\$940.85
Northern VA	\$1,404.8
South	\$1,279.35
Local	\$11.59
Short Circuit	\$63.27
Total	\$5,142.98

2023 RTEP M-3 Projects Update

- Development of Supplemental Projects:
 - PJM coordinated the Supplemental projects planning as described in the Tariff, Attachment M-3.
 - PJM received/presented 397 Supplemental Needs from 1/1/2023 to 10/30/2023
 - Solutions were proposed for 164 of the 397 projects
 - 106 projects completed all necessary reviews and the projects will be integrated into the 2024 Regional Transmission Expansion Plan.
 - Prior to 2023 projects:
 - Needs presented prior to 2023
 - Solution proposed and presented for 111 Needs from previous years
 - 84 projects completed all necessary reviews and the projects will be integrated into the 2023 Regional Transmission Expansion Plan.



RTEP Projects Electrically Near the PJM-NYISO Interface in 2023

Process Stage: Second Review

Criteria: Summer Generation Deliverability

Assumption Reference: 2028 RTEP assumption

Model Used for Analysis: 2028 RTEP Summer cases

Proposal Window Exclusion: NO

Problem Statement: The North Meshoppen - Mehoopany #1 115 kV Line is overloaded for multiple line fault stuck breaker contingencies as well as a single contingency.

Violations were posted as part of the 2022 Window 1: FG# - IPD-S22, FG# - IPD-S23 and FG# - IPD-S25

Existing Facility Rating: 133SN/160E MVA

Proposed Facility Rating: 232SN/282E, 263WN/334WE

Recommended Solution: Proposal ID MATLIT 746

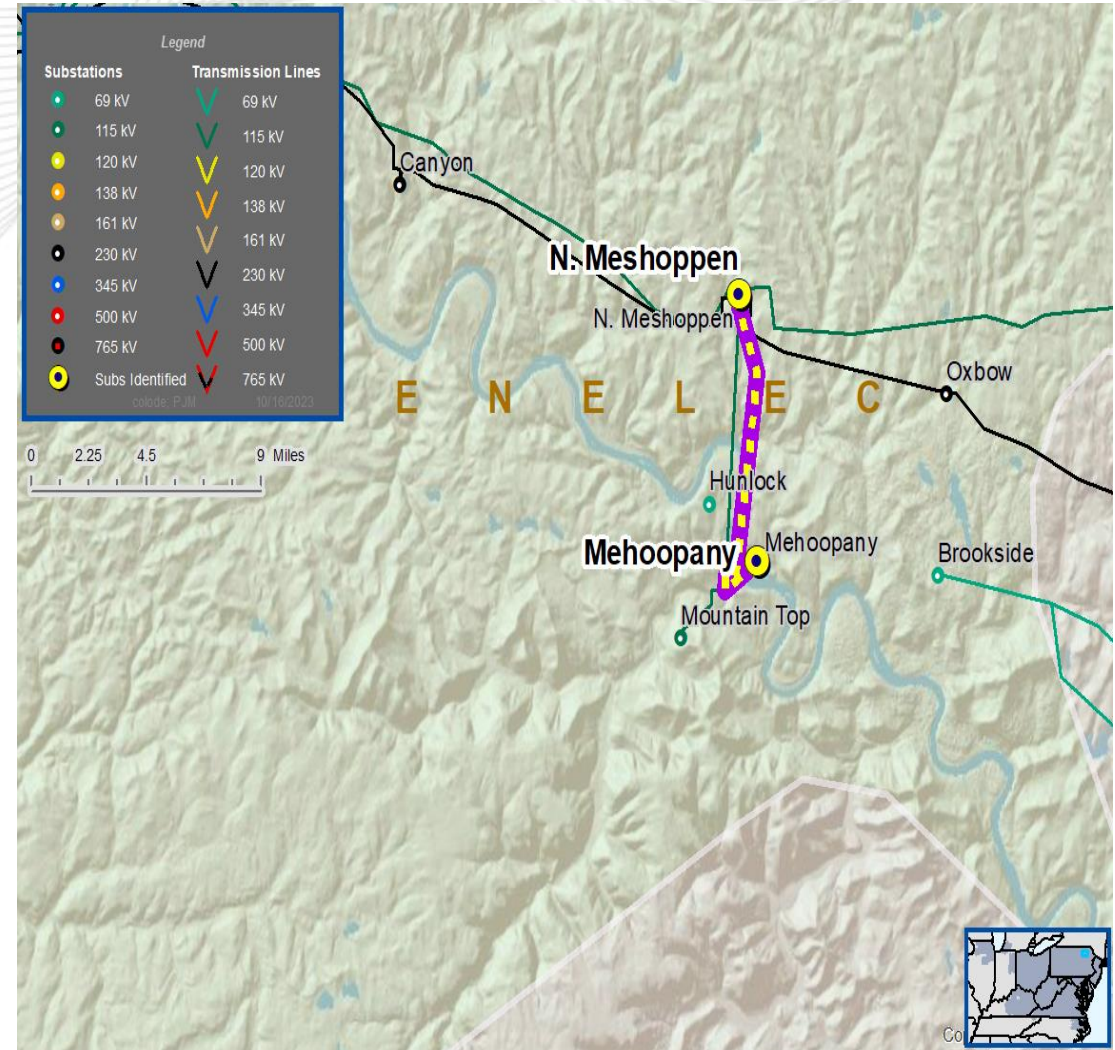
Rebuild the North Meshoppen - Mehoopany #1 115 kV Line with 795 ACSR 26/7 STR conductor. Upgrade terminal equipment to exceed transmission line ratings. **(b3791)**

Estimated Cost: \$17.4M

Alternatives

- None

Required In-Service: 6/1/2028



Process Stage: Second Review

Criteria: Summer Generation Deliverability

Assumption Reference: 2028 RTEP assumption

Model Used for Analysis: 2028 RTEP Summer cases

Proposal Window Exclusion: NO

Problem Statement: The North Meshoppen - Mehoopany #2 115 kV Line is overloaded for multiple line fault stuck breaker contingencies as well as a single contingency.

Violations were posted as part of the 2022 Window 1: FG# - IPD-S20, FG# - IPD-S21 and FG# - IPD-S24

Existing Facility Rating: 133SN/160E MVA

Proposed Facility Rating: 232SN/282E, 263WN/334WE

Recommended Solution: Proposal ID MATLIT 158

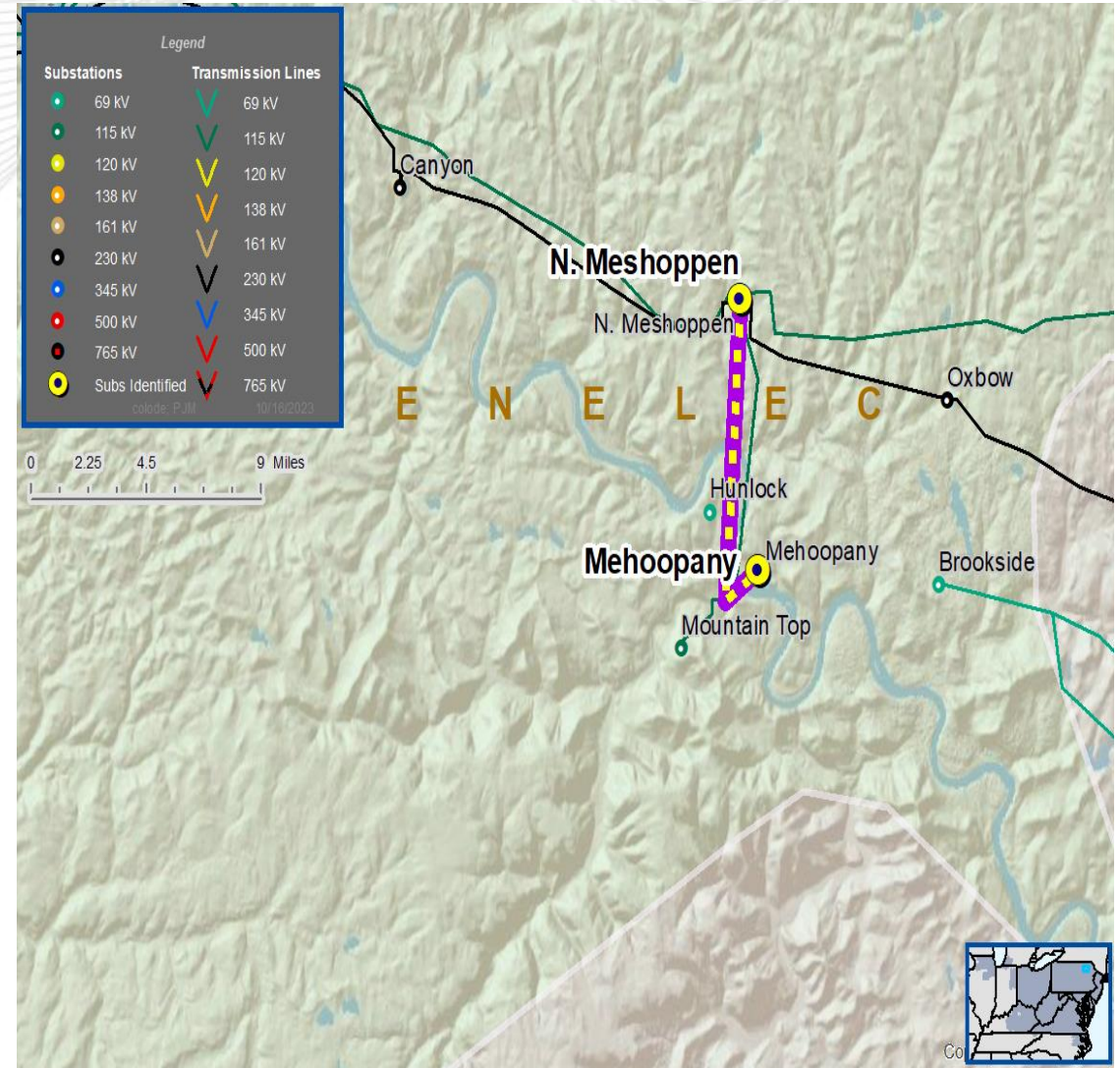
Rebuild the North Meshoppen - Mehoopany #2 115 kV Line using 795 ACSR 26/7 STR conductor and upgrade terminal equipment to exceed the transmission line rating. **(b3792)**

Estimated Cost: \$17.7M

Alternatives

- None

Required In-Service: 6/1/2028



Process Stage: Second Review

Criteria: Light Load Baseline Voltage

Assumption Reference: 2028 RTEP assumption

Model Used for Analysis: 2028 RTEP Summer case

Proposal Window Exclusion: No

Problem Statement: High voltage issue on multiple stations around Waldwick vicinity for several contingencies.

Violations were posted as part of the 2023 Window 1: FG#s

2023W1-N1-LLVM13	2023W1-N1-LLVM17	2023W1-N1-LLVM21	2023W1-N1-LLVM25	2023W1-N1-LLVM29	2023W1-N1-LLVM33
2023W1-N1-LLVM14	2023W1-N1-LLVM18	2023W1-N1-LLVM22	2023W1-N1-LLVM26	2023W1-N1-LLVM30	2023W1-N1-LLVM34
2023W1-N1-LLVM15	2023W1-N1-LLVM19	2023W1-N1-LLVM23	2023W1-N1-LLVM27	2023W1-N1-LLVM31	2023W1-N1-LLVM35
2023W1-N1-LLVM16	2023W1-N1-LLVM20	2023W1-N1-LLVM24	2023W1-N1-LLVM28	2023W1-N1-LLVM32	2023W1-N1-LLVM36
2023W1-N1-LLVM37	2023W1-N1-LLVM38				

Recommended Solution:

- Replace existing 230kV 50MVAR fixed shunt reactor with a 230kV 150MVAR variable shunt reactor. (B3794.1)
- Replace existing 345kV 100MVAR fixed shunt reactor with a 345kV 150MVAR variable shunt reactor. (B3794.2)

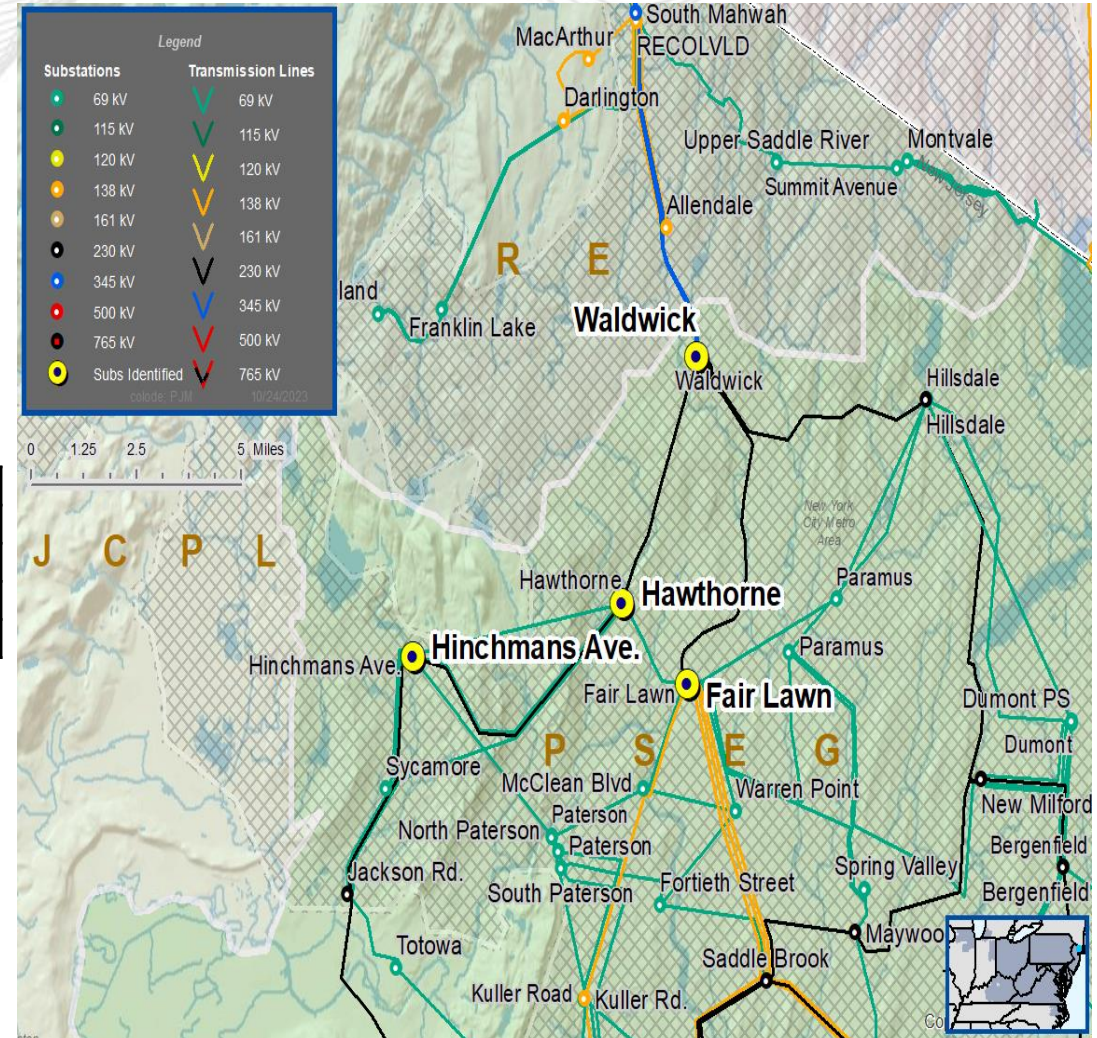
Estimated Cost: \$29.6 M

Alternatives

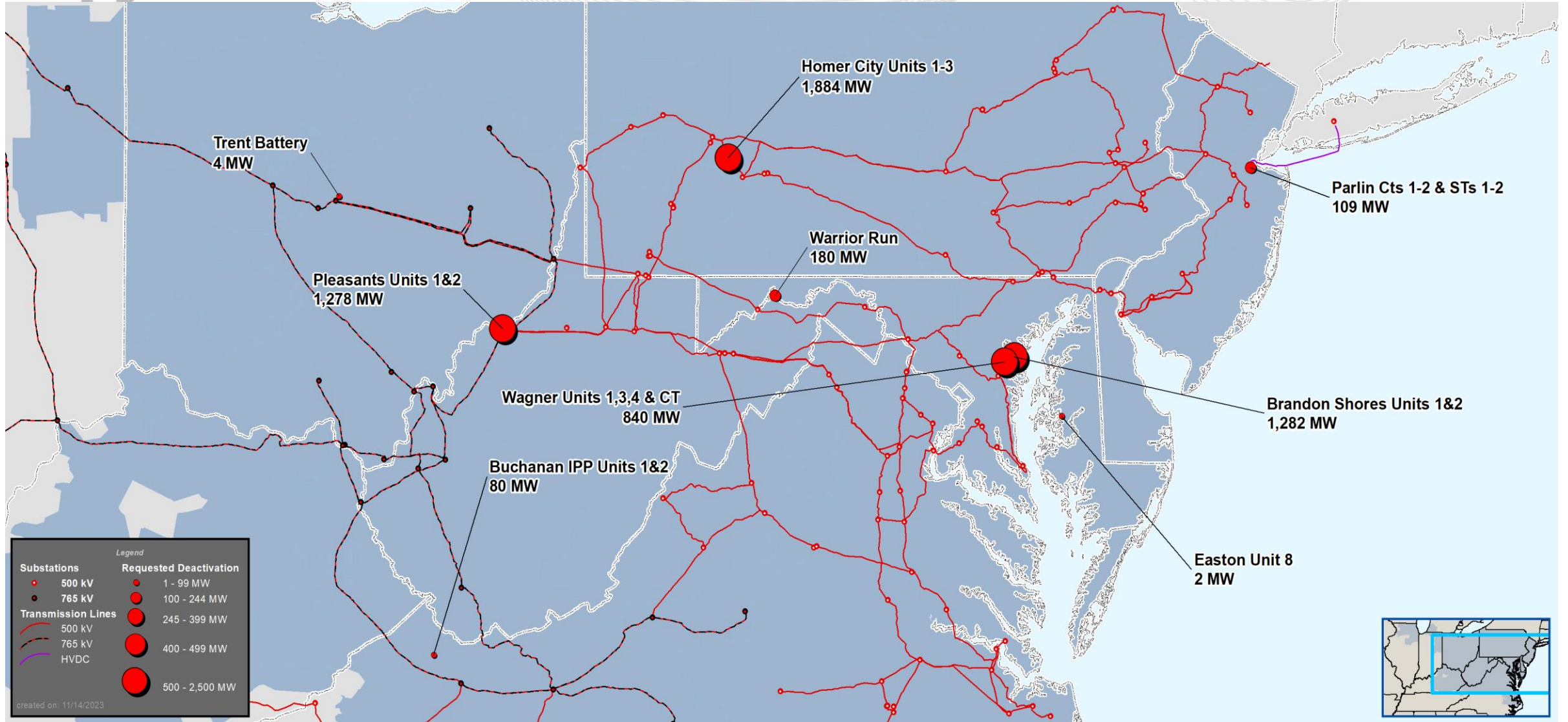
- None

Required In-Service: 6/1/2028

Projected In-service: 6/1/2028



Generation Deactivation Notification Update (Between 4/1/2023 and 11/1/2023)





Deactivation Status

Unit(s)	Fuel Type	Transmission Zone	Requested Deactivation Date	PJM Reliability Status
Wagner 1 (126 MW)	Natural Gas	BGE	6/1/2025	Reliability analysis underway
Wagner 3 (305 MW)	Coal	BGE	6/1/2025	Reliability analysis underway
Wagner 4 (397 MW)	Oil	BGE	6/1/2025	Reliability analysis underway
Wagner CT 1 (13 MW)	Diesel	BGE	6/1/2025	Reliability analysis underway
Warrior Run (180 MW)	Coal	DPL	6/1/2024	Reliability analysis underway
Trent Battery Storage (4 MW)	Battery	Dominion	1/1/2024	Reliability analysis underway
Brandon Shores 1 and 2 (1282 MW)	Coal	BGE	6/1/2025	Reliability issue identified

Unit Name	Fuel Type	Transmission Zone	Actual Deactivation Date	PJM Reliability Status
Parlin NUG (108.7 MW)	Natural Gas	JCPL	10/31/2023	Reliability analysis complete; no impacts identified
Homer City 1 Unit 1,2 & 3 (1884 MW)	Coal	Penelec	7/1/2023	Reliability analysis complete; no impacts identified
Easton Diesel Unit 8 (2 MW)	Diesel	DPL	10/1/2023	Reliability analysis complete; no impacts identified

Unit Name	Fuel Type	Transmission Zone	Withdrawn Date	PJM Reliability Status
Pleasants Unit 1 and 2 (1278 MW)	Oil	APS	8/30/2023	Reliability analysis complete; no impacts identified
Buchanan 1 and 2 (80MW)	Oil	AEP	6/9/2023	Reliability analysis complete; no impacts identified



PJM Market Efficiency Update

Nick Dumitriu

Principal Engineer, PJM Market Simulation

- Back in January, PJM posted a preliminary ME Base Case:
 - Included the reliability upgrades from the 2022 Window 1 and 2022 Multi-Driver Window.
 - Preliminary case was posted on the [ME secure page](#).
- Updated Market Efficiency Assumptions [whitepaper](#) posted with the July TEAC materials.
 - Summarizes Market Efficiency input assumptions presented at TEAC meetings March through July.
 - Whitepaper included for consideration by the PJM board at the July meeting.
- Updates to the Market Efficiency Base Case will be posted as necessary.

- PJM delayed the opening of the 2022/2023 Long-Term Window until the reliability violations for the 2022 Window 3 (Dominion data center loads) are addressed.
 - Some 138 kV ComEd constraints binding independently of the Dominion data center load issue were also identified and posted as reliability violations in the 2023 RTEP Window 1.
- Schedules for the 2023 Acceleration and 2023 Reevaluation analyses may also be impacted.
- PJM will reassess congestion once a solution for the 2023 RTEP Window 1 is selected and provide additional details to stakeholders at future TEAC meetings.

Questions?

