# PJM Regional Transmission Expansion Plan (RTEP) Process

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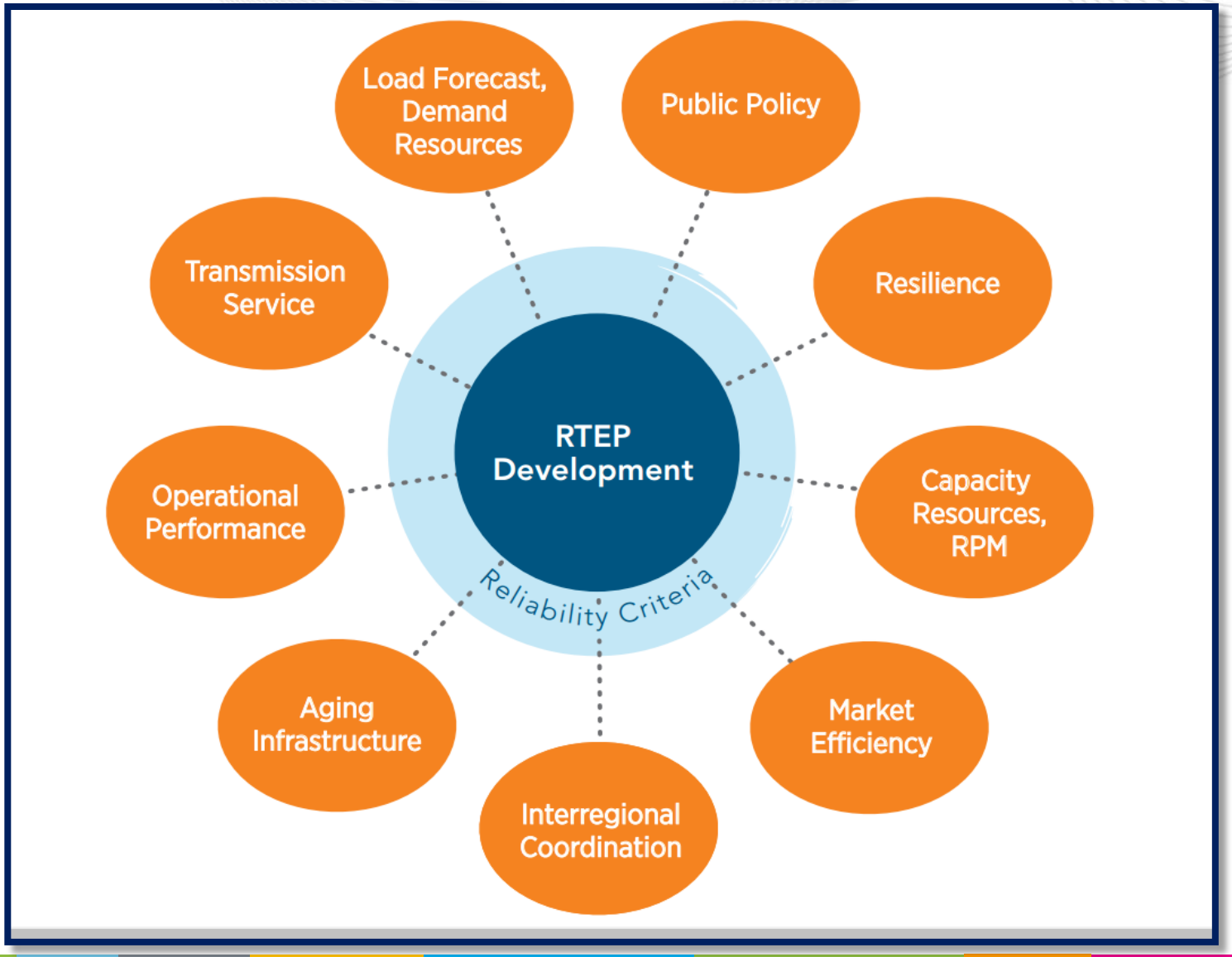
Transmission Planning

IPSAC – December 6, 2024

# PJM Planning Links

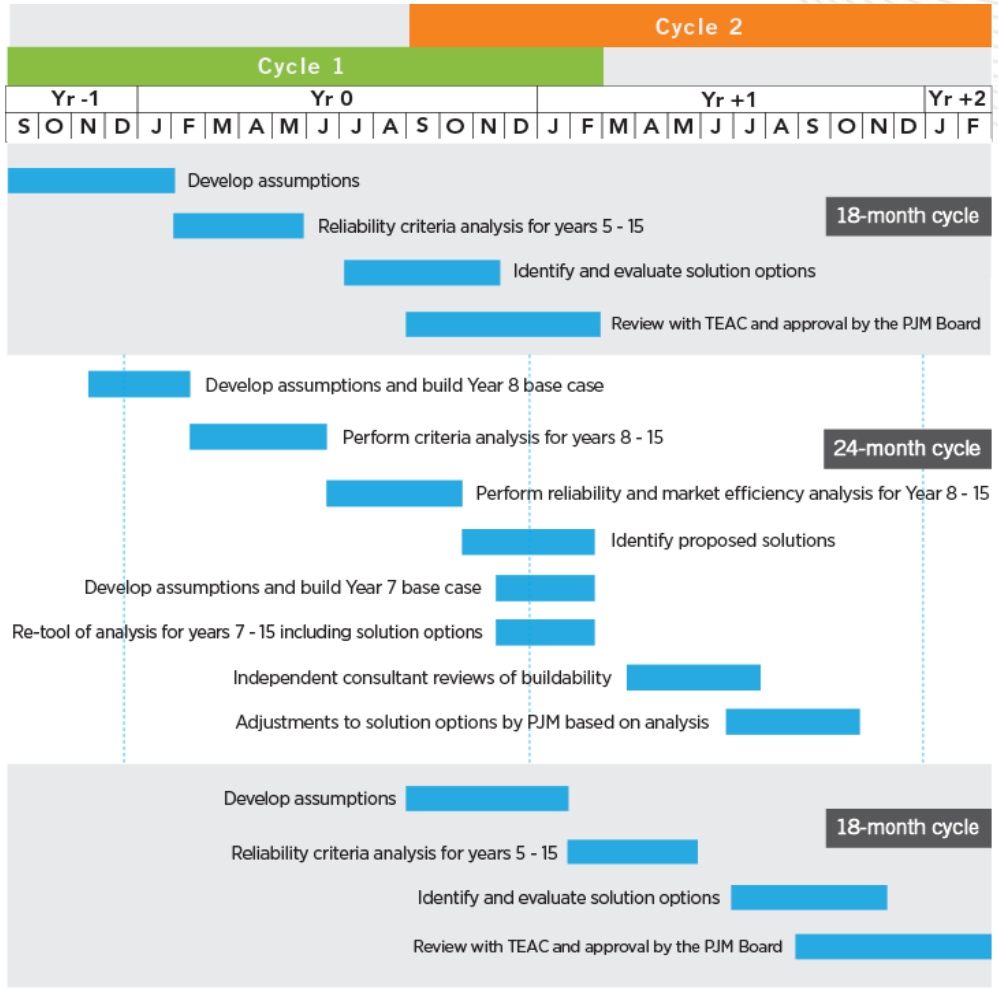
- Planning Committee (PC)
  - http://www.pjm.com/committees-and-groups/committees/pc.aspx
- Transmission Expansion Advisory Committee (TEAC)
  - http://www.pjm.com/committees-and-groups/committees/teac.aspx
- Interregional Planning
  - http://www.pjm.com/planning/interregional-planning.aspx
- Services 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

# System Expansion Drivers

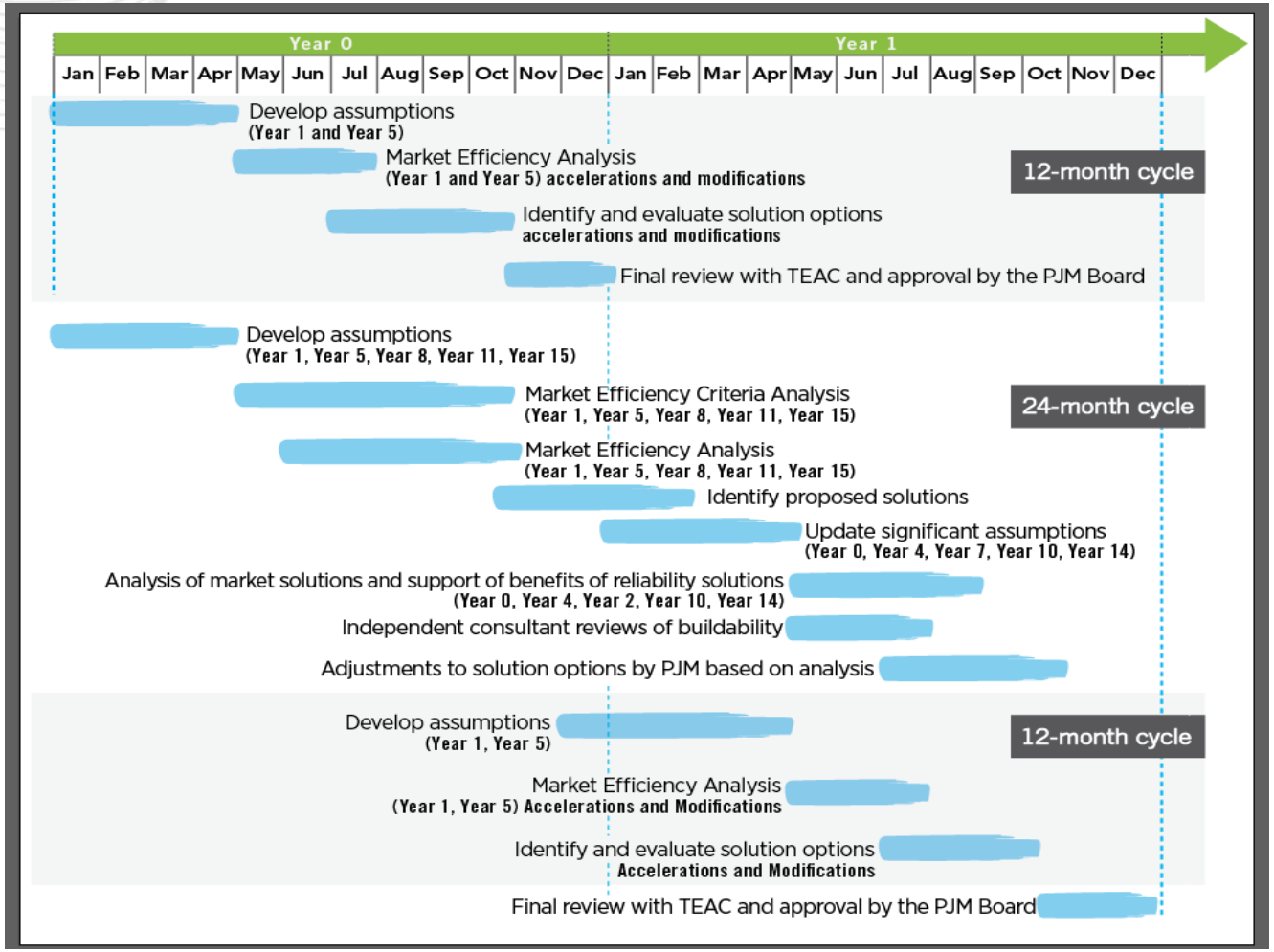


# Planning Cycles

## PJM's 2-year Reliability




## PJM's 2-year Market Efficiency



# 2024 Regional Transmission Expansion Plan (RTEP) Updates

# RTEP Process

- The 2024 RTEP Assumptions were presented at the May IPSAC meeting. Refer to

  https://www.pjm.com/-/media/committees-groups/committees/teac/2024/20240109/20240109-item-13---2024-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.

# FERC 1000 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 2024 RTEP cycle
  - 2023 Window 2 - 30 day window
  - 2024 RTEP Window 1 - 60 day window

# 2023 Reliability RTEP Window 2 Update

# 2023 Reliability Proposal Window 2

- 2023 Window 2 opened on March 6, 2023 and closed April 5, 2023.
- The Window was open to address the following reliability needs:
  - AEP zone load increase, primarily associated with Data Center Load Forecast (Up to 3000 MW by 2028)
  - Remaining issues not addressed by 2023 Window 1 - Dominion 500 kV circuit End of Life and PSEG local N-1-1
- PJM Received 21 total Proposals

  Five Entities submitted proposals (3 Incumbent, 3 Non Incumbent)

  15 Projects are upgrades, while 6 are Greenfield

  Cost range: $0.449 - $229 Million – Total cost: $1.34 billion

See link for detail TEAC presentation: https://www.pjm.com/-/media/committees-groups/committees/teac/2024/20240604/20240604-item-16---reliability-analysis-update.ashx

# 2023 Reliability Proposal Window 2

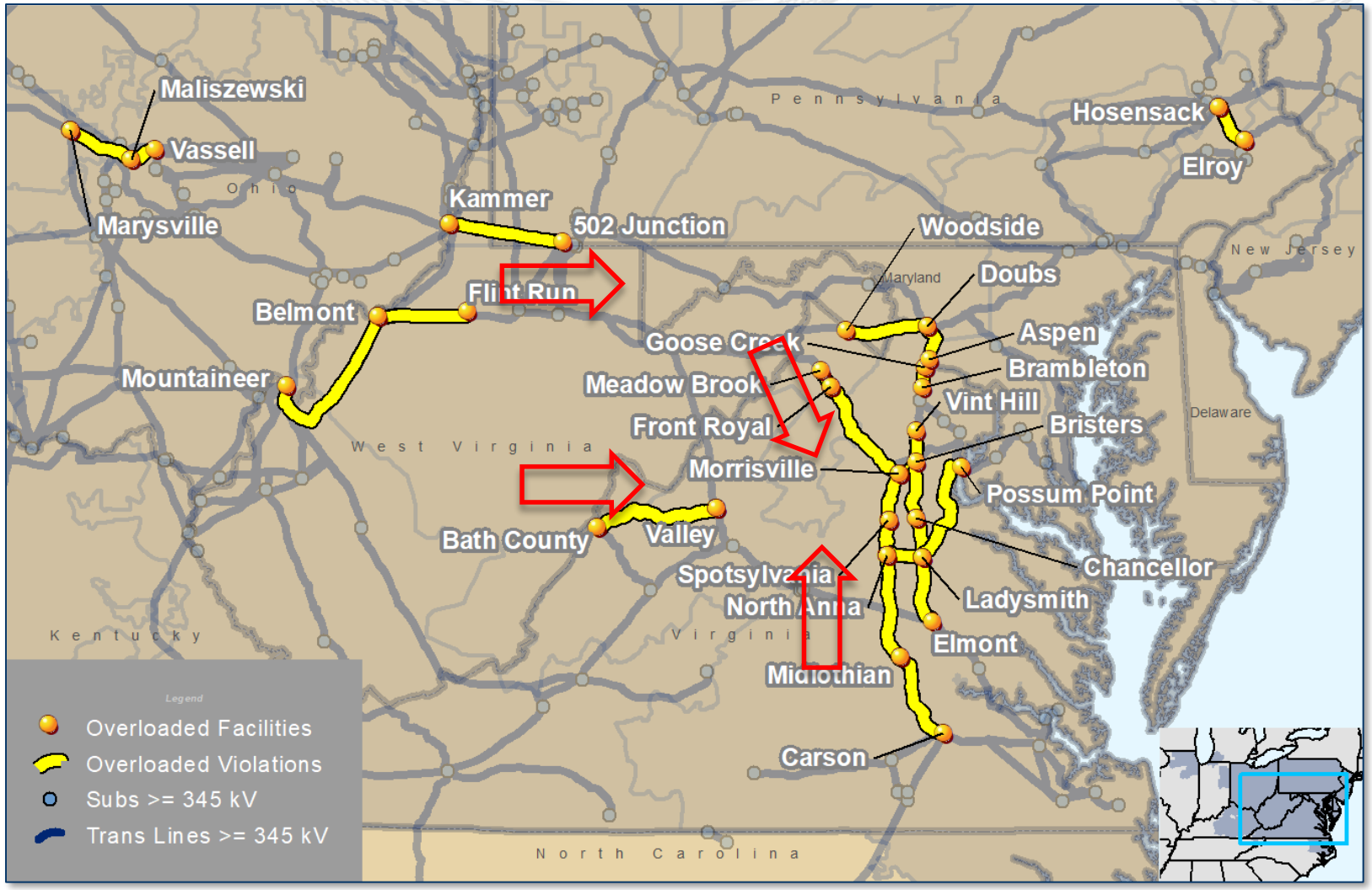
- 2023 Window 2 Proposals Evaluation and Result
  - **Dominion** – One project proposed to address the End Of Life violation.
    - Rebuild approximately 13.51 miles of 500 kV line #588 (Yadkin – Fentress 500 kV) for estimated cost of $80 M
  - **PSEG** – 4 projects by two Entities proposed to address the PSEG local violations, with a cost ranging from $61 M to $211 M
    - PJM selected the following project for estimated cost of $84.5 M
      - ➢Build 4 miles New 230kV XLPE Circuit using (345kV rated 5000kcmil cable) from Jackson Road 230kV Station to Cedar Grove 230kV Station
  - **AEP** - 16 projects by 3 Entities proposed to address the AEP violations, with a cost ranging from $0.449 M to $229 M
    - PJM selected the following project for estimated cost of $126.17 M
      - ➢Connect and energize a second 765/345 kV bank at Vassell station and Replace 765 kV breaker D at Maliszewski station. Cost $33.7 M
      - ➢Rebuild Allen –R.P. Mone (18.6 miles) and R.P. Mone – Maddox Creek (9.4 miles) 345kV lines. Replace two 345 kV breakers at Maddox Creek and two 345 kV breakers at East Lima Stations. Cost $92.47 M

# 2024 Reliability RTEP Window 1 Update

# 2024 Reliability Window 1 Needs

- 2024 Window 1 Needs:
  - Heavy transmission interface flows west to east driven by load increase in Dominion/East. PJM earlier identified need for additional west-east reinforcement is materializing earlier – higher forecasted load in MAAC/Dominion/APS.
    - 10 GW and 15 GW of load increase for 2029 and 2032 respectively between the 2022 LF and 2024 LF
    - The load growth is attributed primarily to data centers and some electrification/EV loads.
  - In addition to regional transfer requirements, there are load pockets that need to be addressed in AEP, ATSI, ComEd, Dominion, PECO, BGE and PPL transmission zones.
    - Primarily due to shift in generation flow as a result of overall system load increase and +2 GW of generation deactivations.
  - The eight-year RTEP (2032) scenarios mainly focus on right-sizing solutions.
    - Long-lead transmission needs (capture long-lead items).
    - Check/confirm impact of “forecast” generation on transmission needs identified in the five-year model.
    - PJM will also be considering robustness of the solutions in view of the anticipated 2025 PJM Load Forecast.

# 2024 RTEP Window 1 Needs: 500 kV & 765 kV



# 2024 Reliability Proposal Window 1

- 2024 Window 1 opened on July 15, 2024 and closed September 17, 2024.
- The 2024 Window 1 was conducted to address Reliability violations identified for the year of 2029 to 2032 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).
  - 88 unique and 6 combined proposals submitted from 16 different entities (10 Incumbents & 6 Non Incumbents)
    - 40 Greenfields
    - 48 Upgrades
  - Cost Estimates for the unique proposals: Approximate range from $0.12 M – $2.84 B
  - 43 proposals with Cost Containment
  - Several proposals offered 765 kV and/or 500 kV reinforcements.
- The evaluation for the Window 1 proposed projects is in progress and is expected to be completed by the end of December 2024 and board approved in February 2025.

# 2024 Reliability Proposal Window 1

Proposal Evaluation in Progress:

PJM in evaluating the proposals attempts to:

- Develop robust, holistic and expandable solutions that address the baseline violations identified in 2029 and 2032 regional issues associated with:
  - Local constraints: resulting from local load growth across PJM zones
  - Heavy transmission interface flows West-East driven by load increase in Dominion/East and sourced generation in both Western and Eastern PJM
  - Needed reactive power VAR reinforcements, both static and dynamic as necessary.
  - Address reliability impacts due to the deactivation of >2GWs of generation.
- Adhere to all applicable planning criteria, including PJM, NERC, SERC, RFC and Local Transmission Owner Criteria.

# 2024 RTEP M-3 Projects Update

# 2024 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 460 Supplemental Needs from 10/30/2023 to 10/30/2024
    - Solutions were proposed for 230 of the 460 needs
    - 178 of the proposed 230 Solutions completed all necessary reviews and the projects will be integrated into the 2025 Regional Transmission Expansion Plan.
  - PJM received/presented Supplemental needs from prior to 10/30/2024:
    - 169 Solutions were proposed/presented after 10/30/2024 for Needs presented prior to 10/30/2024
    - 148 of these 169 Solutions completed all necessary reviews and the projects will be integrated into the 2025 Regional Transmission Expansion Plan.
    - Additionally, 163 Solutions presented prior to 10/30/2024 completed all necessary reviews and the projects will be integrated into the 2025 Regional Transmission Expansion Plan

# RTEP Projects Electrically Near the PJM-NYISO Interface in 2024

# Penelec Transmission Zone M-3 Process
# Niles Valley 115 kV Ring Bus

**Need Number:** PN-2023-005

**Process Stage:** Solution Meeting 02/15/2024

**Previously Presented:** Need Meeting 07/20/2023

**Project Driver:**
*Operational Flexibility and Efficiency*

**Specific Assumption Reference:**

Add/Expand Bus Configuration

- Eliminate simultaneous outages to multiple network elements

System Performance Projects

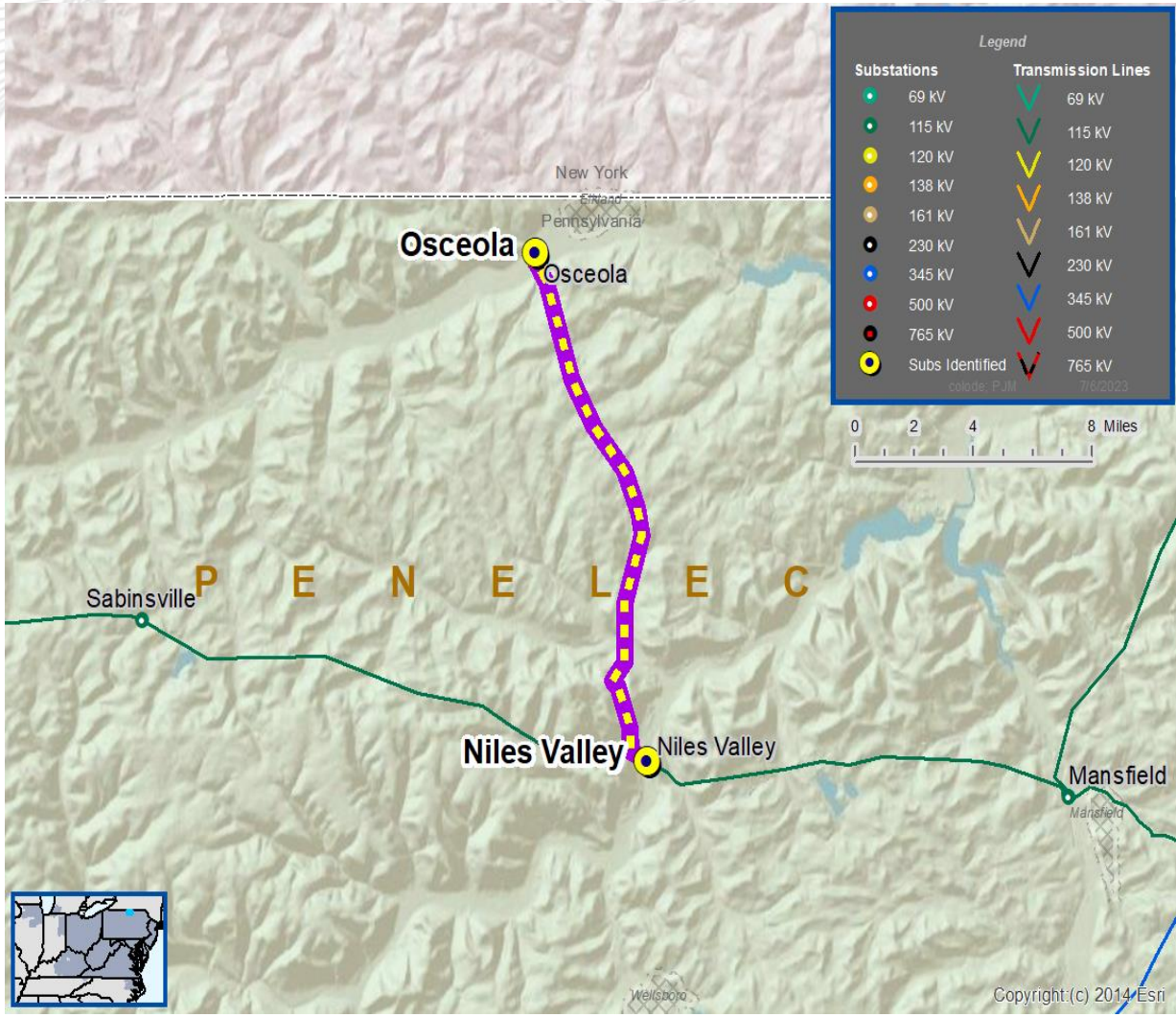
- Substation/line equipment limits

System Performance Projects Global Factors

- Load and/or customers at risk on single transmission line

**Problem Statement:**

- Niles Valley Substation serves approximately 30 MW of load and 331 customers, including one large electric distribution company (Wellsboro).
- An additional 12 MW of load and 2,746 customers are served radially from Niles Valley at Osceola Substation.
- The existing Niles Valley Substation contains two networked 115 kV lines, two radial 115 kV lines, two 115-34.5 kV transformers, and one 115 kV capacitor bank.
- There are straight busses separated by a bus tie breaker. The distribution transformers do not have high side protection devices. During breaker maintenance (a potential two day outage), the Wellsboro 115 kV service point would be interrupted with no backup service (26 MVA of load).



# Penelec Transmission Zone M-3 Process
# Niles Valley 115 kV Ring Bus

**Need Number:** PN-2023-005

**Process Stage:** Solution Meeting 02/15/2024

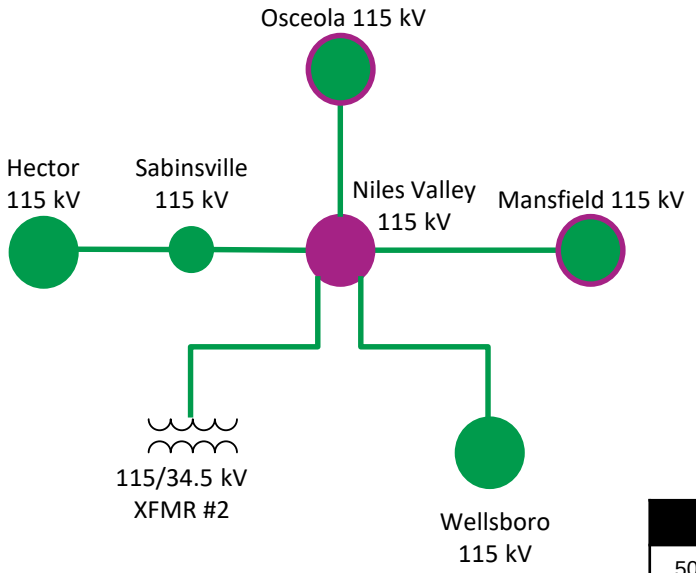
**Proposed Solution:**

At Niles Valley Substation:

- Construct a 115 kV, six breaker ring bus
- Remove Niles Valley No. 1 115-34.5 kV Transformer
- Remove the 115 kV bypass switch between the Wellsboro and Mansfield line exits (s2835) upon ring bus completion
- Adjust relay settings

**Transmission Line Ratings:**

- Niles Valley – Sabinsville/Hector 115 kV Line:
  - Before Proposed Solution:
    - 147/191 MVA SN/SE
    - 211/237 MVA WN/WE
  - After Proposed Solution:
    - 202/245 MVA SN/SE
    - 228/290 MVA WN/WE
- Niles Valley – Mansfield 115 kV Line:
  - Before Proposed Solution:
    - 147/174 MVA SN/SE
    - 181/190 MVA WN/WE
  - After Proposed Solution:
    - 202/245 MVA SN/SE
    - 228/290 MVA WN/WE

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| 345 kV | |
| 230 kV | |
| 138 kV | |
| 115 kV | |
| 69 kV | |
| 46 kV | |
| 34.5 kV | |
| 23 kV | |
| New | |

# Penelec Transmission Zone M-3 Process
# Niles Valley 115 kV Ring Bus

**Need Number:** PN-2023-005

**Process Stage:** Solution Meeting 02/15/2024

**Transmission Line Ratings (continued):**

- Niles Valley – Wellsboro 115 kV Line:
  - Before Proposed Solution:
    - 147/191 MVA SN/SE
    - 211/237 MVA WN/WE
  - After Proposed Solution:
    - 232/282 MVA SN/SE
    - 263/334 MVA WN/WE
- Niles Valley – Osceola 115 kV Line:
  - Before Proposed Solution:
    - 147/191 MVA SN/SE
    - 211/237 MVA WN/WE
  - After Proposed Solution:
    - 232/282 MVA SN/SE
    - 263/334 MVA WN/WE

**Alternatives Considered:**

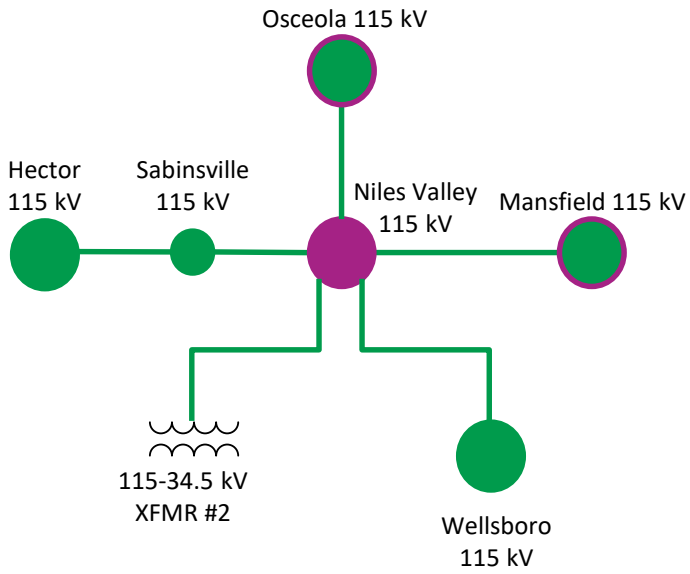
Maintain existing substation configuration with elevated risk of customer outages under contingency conditions.

**Estimated Project Cost:** $16.0M

**Projected In-Service:** 11/04/2028

**Project Status:** Engineering

**Model:** 2023 RTEP model for 2028 Summer (50/50)

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| 115 kV | |
| 69 kV | |
| 46 kV | |
| 34.5 kV | |
| 23 kV | |
| New | |

# Penelec Transmission Zone M-3 Process
# Warren – Falconer 115 kV Line: New Customer

**Need Number:** PN-2023-007

**Process Stage:** Solution Meeting – 02/15/2024

**Previously Presented:** Need Meeting – 07/20/2023

**Project Driver:**

*Customer Service*

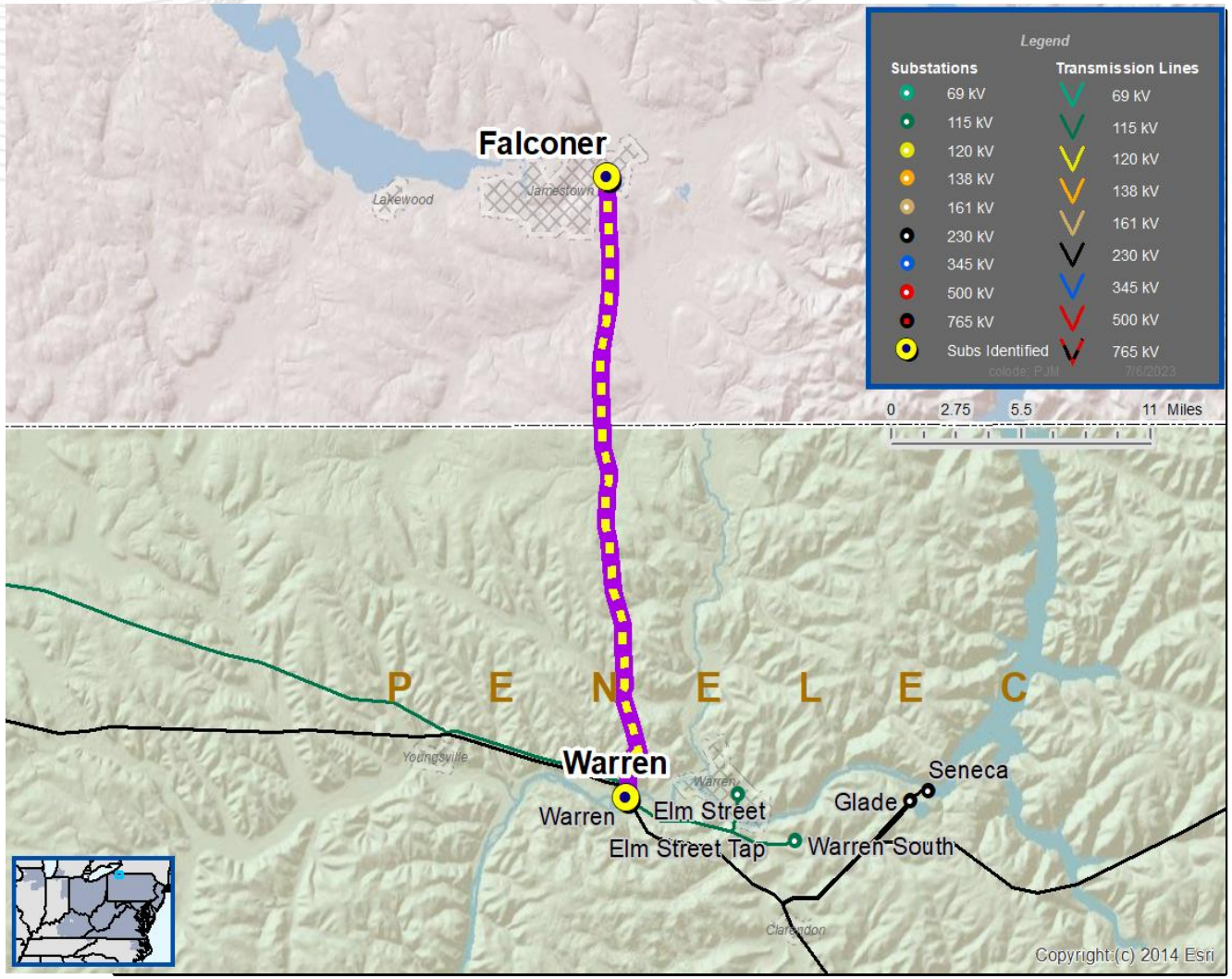
**Specific Assumption Reference:**

New customer connection requests will be evaluated per FirstEnergy's "Requirements for Transmission Connected Facilities" document and "Transmission Planning Criteria" document.

**Problem Statement:**

New Customer Connection – A customer requested 115 kV service with an anticipated load of 22.4 MVA near the Warren – Falconer 115 kV Line.

Requested in-service date is 12/31/2024.



# Penelec Transmission Zone M-3 Process
# Warren – Falconer 115 kV Line: New Customer

**Need Number:** PN-2023-007

**Process Stage:** Solution Meeting – 02/15/2024

**Proposed Solution:**

Provide 115 kV service from the Warren – Falconer 115 kV Line:

- Tap the Warren – Falconer 115 kV Line, install switches and build approximately 190 ft of transmission line from the tap point to customer substation
- Install one 115 kV revenue metering package at customer substation
- Adjust relay settings at Warren Substation
- Operate disconnect switch towards Falconer Substation as normally open

**Alternatives Considered:**

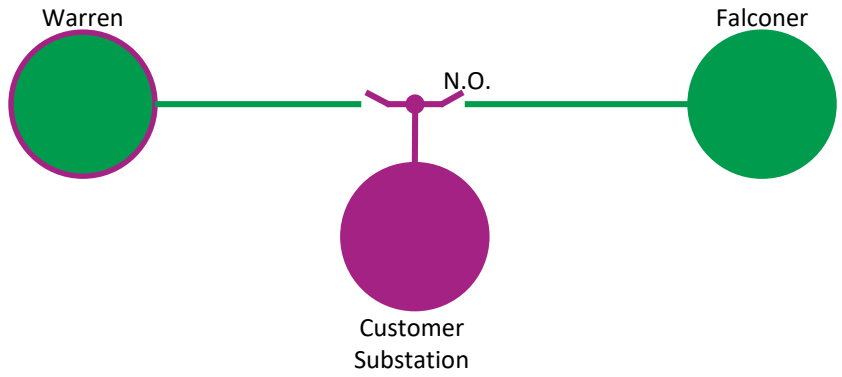
No feasible alternatives considered due to proximity of customer load to Warren – Falconer 115 kV Line.

**Estimated Project Cost**: $1.5M

**Projected In-Service:** 04/28/2027

**Project Status:** Engineering

**Model**: 2023 RTEP model for 2028 Summer (50/50)

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| 230 kV | |
| 138 kV | |
| 115 kV | |
| 69 kV | |
| 46 kV | |
| 34.5 kV | |
| 23 kV | |
| New | |

# Penelec Transmission Zone M-3 Process
## East Sayre – East Towanda 115 kV Line: New Customer

**Need Number:** PN-2023-012

**Process Stage:** Solution Meeting – 02/15/2024

**Previously Presented**: Need Meeting – 10/19/2023

**Project Driver(s):**

*Customer Service*

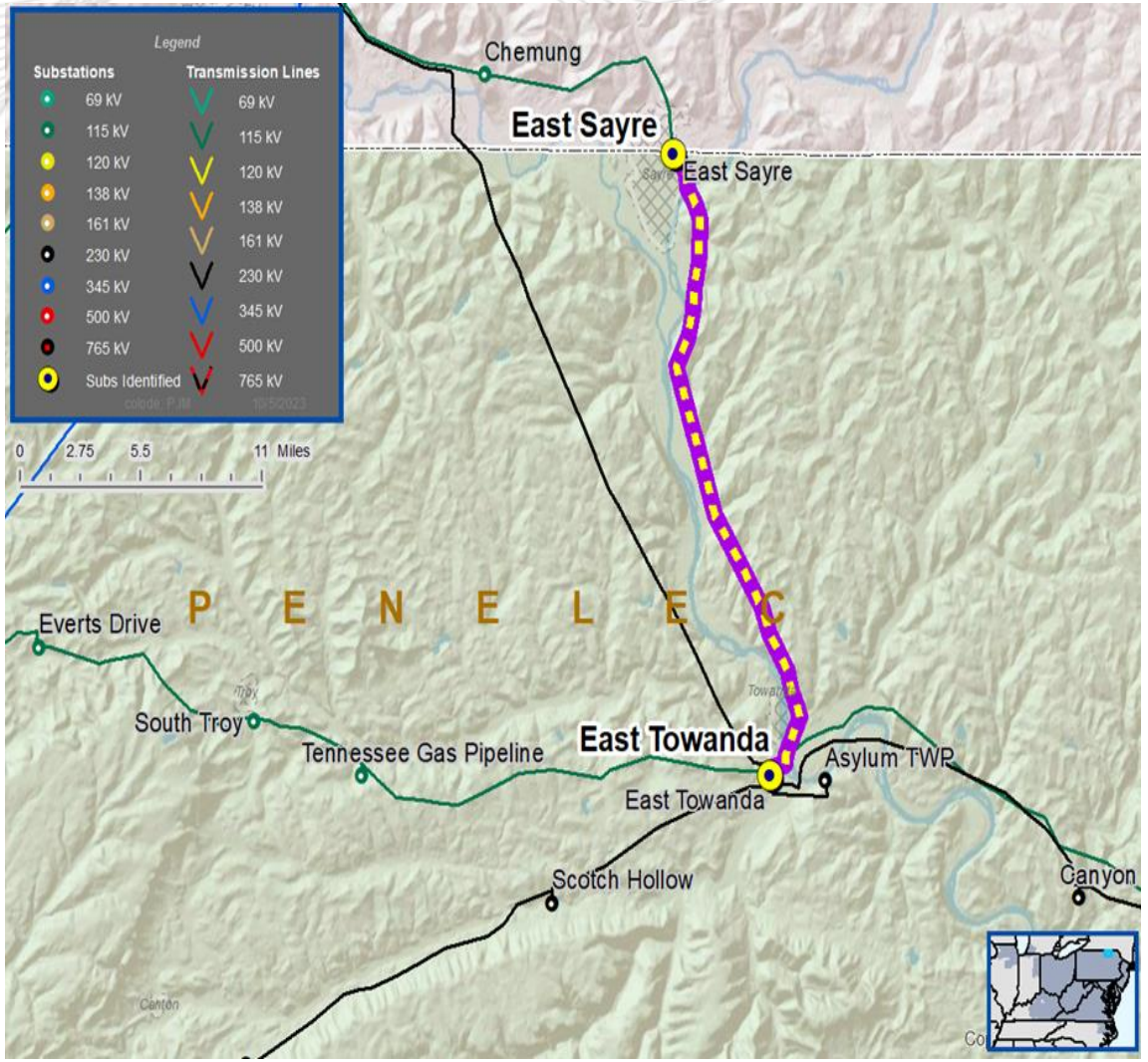
**Specific Assumption Reference(s)**

New customer connection request will be evaluated per FirstEnergy's "Requirements for Transmission Connected Facilities" document and "Transmission Planning Criteria" document.

**Problem Statement**

New Customer Connection – A customer requested a new 115 kV delivery point near the East Sayre-East Towanda 115 kV Line. The anticipated load of the new customer connection is 20 MVA.

Requested in-service date is 08/30/2024



# Penelec Transmission Zone M-3 Process
## East Sayre – East Towanda 115 kV Line: New Customer

**Need Number:** PN-2023-012

**Process Stage:** Solution Meeting – 02/15/2024

**Proposed Solution:**

Provide 115 kV service from the East Sayre – East Towanda 115 kV Line:

- Tap the East Sayre – East Towanda 115 kV Line, install switches and build approximately 250 feet of transmission line to the customer substation
- Install three 115 kV motor-operated disconnects with SCADA
- Install one wave trap

**Alternatives Considered:**

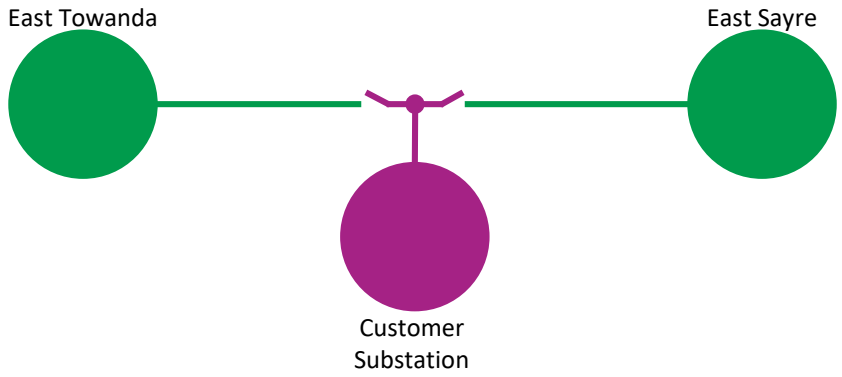
No feasible alternatives considered due to proximity of customer load to East Sayre – East Towanda 115 kV Line.

**Estimated Project Cost:** $1.67M

**Projected In-Service:** 09/30/2025

**Project Status:** Engineering

**Model:** 2023 RTEP model for 2028 Summer (50/50)

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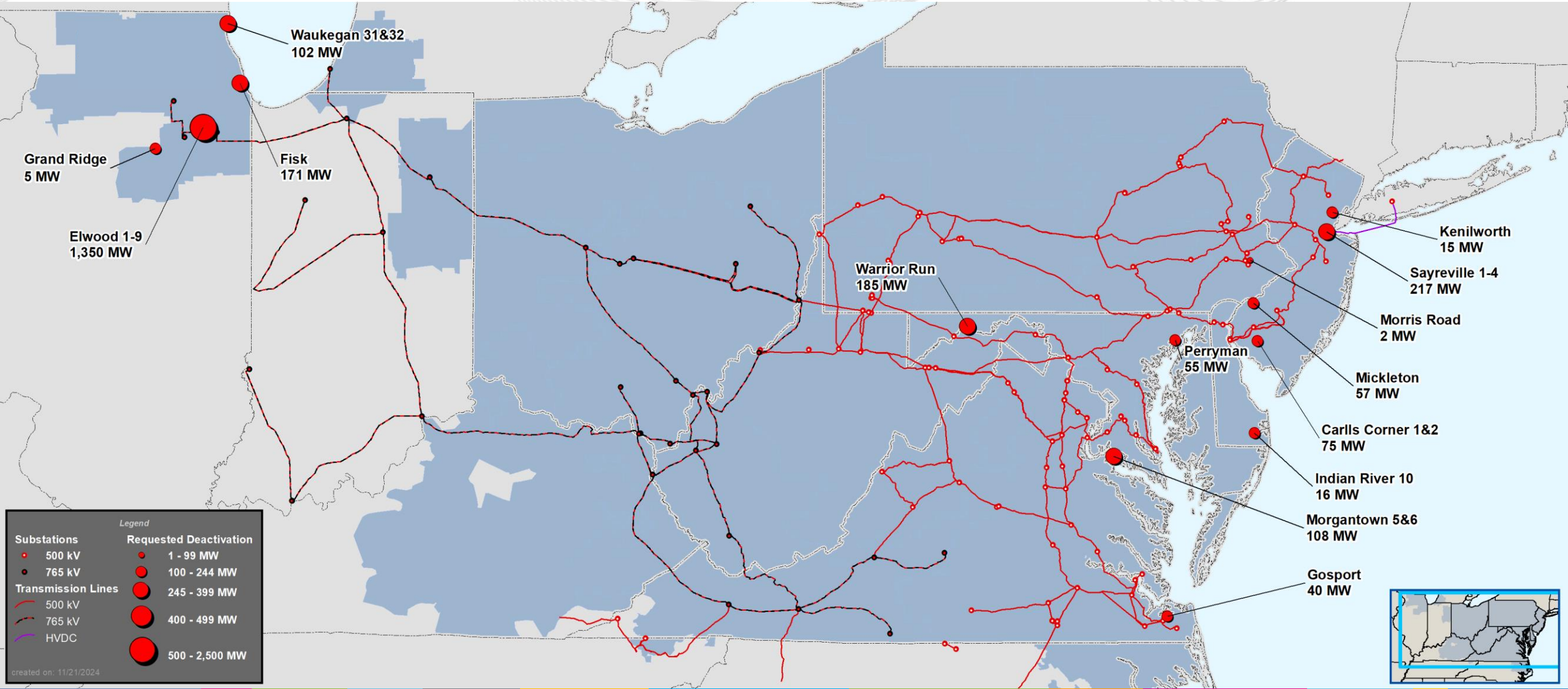
| 115 kV | |
| 69 kV | |
| 46 kV | |
| 34.5 kV | |
| 23 kV | |
| New | |

# Generation Deactivation Notification Update (Between 4/1/2024 and 11/1/2024)

https://www.pjm.com/planning/service-requests/gen-deactivations

# Retirements



# Deactivation Status: Recently Announced

| Unit(s) | Capacity (MW) | Fuel Type | Transmission Zone | Requested Deactivation Date | PJM Reliability Status |
|---|---|---|---|---|---|
| Kenilworth | 15 | Natural Gas | PSEG | 9/13/2024 | Reliability analysis underway |
| Fisk (CT31, CT32, CT33, CT34) | 170.7 | Oil | ComEd | 7/22/2024 | Reliability analysis underway |
| Indian River CT10 | 16.1 | Oil | DPL | 7/22/2024 | Reliability analysis underway |
| Waukegan (CT31, CT32) | 101.4 | Oil | ComEd | 7/22/2024 | Reliability analysis underway |

# Deactivation Status: Recently Announced

| Unit(s) | Capacity (MW) | Fuel Type | Transmission Zone | Requested Deactivation Date | PJM Reliability Status |
|---|---|---|---|---|---|
| Perryman 6 Unit 1 | 54.9 | Natural Gas | BGE | 7/20/2024 | Reliability analysis underway |
| Morris Road 1 D | 2 | Oil | PECO | 7/17/2024 | Reliability analysis underway |
| Elwood (CT1, CT2, CT3, CT4, CT5, CT6, CT7, CT8, CT9) | 1350 | Natural Gas | ComEd | 5/29/2024 | Reliability analysis complete; no impacts identified |

# Deactivation Status: Recently Deactivated

| Unit(s) | Capacity (MW) | Fuel Type | Transmission Zone | Actual Deactivation Date | PJM Reliability Status |
|---|---|---|---|---|---|
| Grand Ridge IV Battery | 4.5 | Storage | ComEd | 10/1/2024 | Reliability analysis complete; no impacts identified |
| Warrior Run 2 BT | 5 | Battery | APS | 10/1/2024 | Reliability analysis complete; no impacts identified |
| Gosport 1 F | 40 | Biomass | Dominion | 7/15/2024 | Reliability analysis complete; no impacts identified |
| Carlls Corner (CT1, CT2) | 74.5 | Natural Gas | ACE | 6/1/2024 | Reliability analysis complete; no impacts identified |

# Deactivation Status: Recently Deactivated

| Unit(s) | Capacity (MW) | Fuel Type | Transmission Zone | Actual Deactivation Date | PJM Reliability Status |
|---|---|---|---|---|---|
| Mickleton CT1 | 57.2 | Natural Gas | ACE | 6/1/2024 | Reliability analysis complete; no impacts identified |
| Morgantown (CT5, CT6) | 108 | Oil | PEPCO | 6/1/2024 | Reliability analysis complete; no impacts identified |
| Sayreville (CT1, CT2, CT3, CT4) | 216.9 | Natural Gas | JCPL | 6/1/2024 | Reliability analysis complete; no impacts identified |
| Warrior Run | 180 | Coal | APS | 6/1/2024 | Reliability analysis complete; upgrades expected to be completed in future, but interim operating measures identified and unit can deactivate as scheduled |

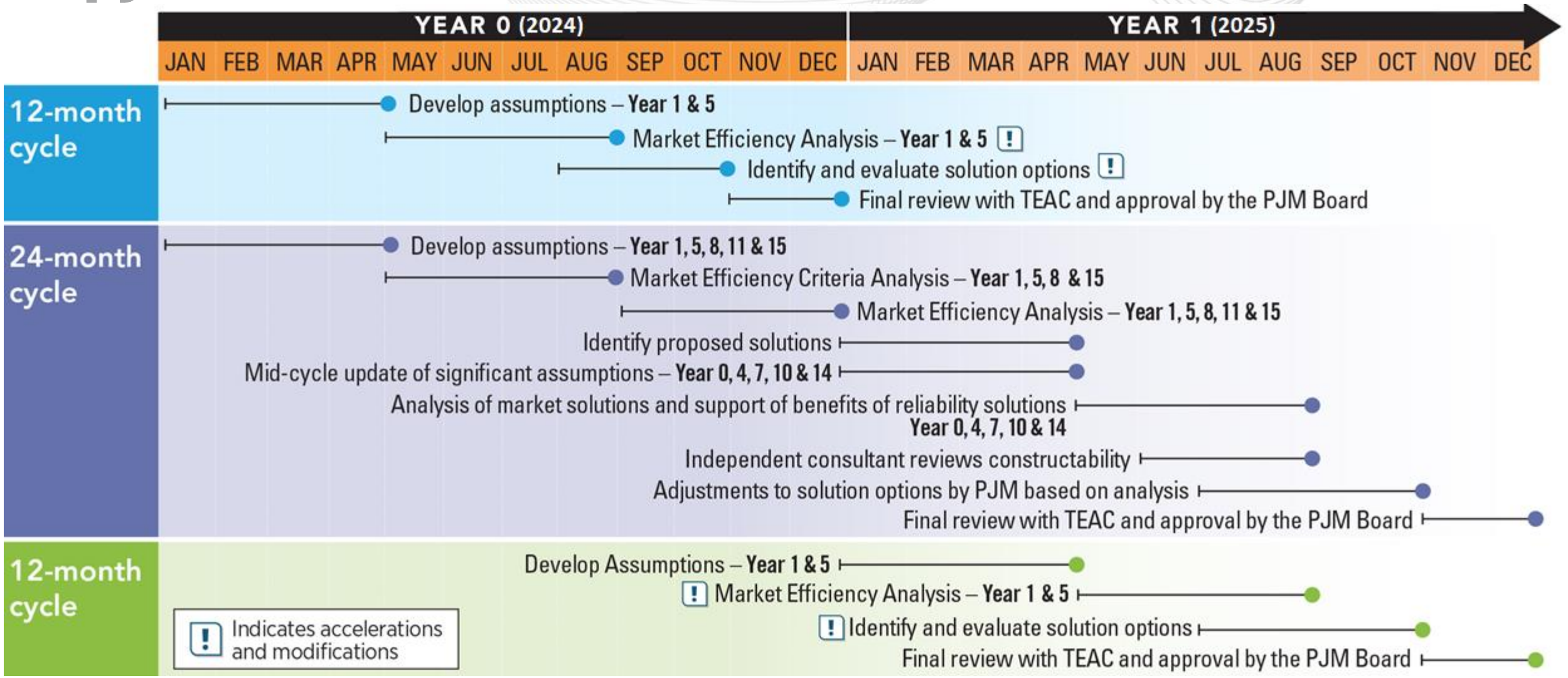
# PJM Market Efficiency Update

Nick Dumitriu

Manager, PJM Market Simulation

# 2024/25 Market Efficiency Cycle

# 2024/25 Market Efficiency Timeline



# 2024/25 ME Cycle Assumptions Overview

- Simulations performed using PROMOD IV v11.5, engine “I”.
- Study Years for the 2024/25 ME Cycle
  - 2025, 2029, 2032, 2035, and 2039.
- PROMOD Database posted on ME secure page (2029, 2032 modeled years)
  - Fall 2023 Data Release from Hitachi Energy
    - Fuel/Emissions price forecasts from Hitachi Energy, May 2024 update.
  - Load forecast from PJM 2024 Load Forecast Report.
  - Topology based on the final 2028 Summer Peak powerflow (RTEP 2023 18-month Reliability cycle)
    - Includes all RTEP baseline projects approved by the PJM Board up to including reliability Window 1 2023.

# 2024/25 ME Cycle Assumptions Workbook

- 2024 ME Input Assumptions workbook posted on ME public page.

- Generation Expansion based on queue status as of May 14, 2024.
  - Includes NJ SAA 1.0 (See tab **NJ SAA 1.0** in **2024 ME Input Assumptions** workbook).
  - Includes additional capacity, FSA level, needed in 2032 to meet the assumed 17.8% Installed Reserve Margin (See tab **FSA Level Added Through 2032** in **2024 ME Input Assumptions** workbook).
  - Updated 2032 Generation Expansion to be consistent with the queue units identified as “Fast Lane”.

# 2024/25 ME Base Case Status

- Market Efficiency Training completed on November 19, 2024.

- 2024/25 ME Base Case Status.
  - Upgraded PROMOD IV version to 11.5.
  - Updated 2029 and 2032 modeled years posted (XML files compatible with PROMOD 11.5).
    - Updated winter bus load model to match Winter Peak RTEP cases.
    - Updated MISO generation model.

- Other files posted.
    - 2024/25 ME Window Benefits Cost Evaluation Tool.
    - Updated PROMOD procedure for executing scenarios.

# 2024/25 ME Base Case Next Steps

- 2024/25 ME Base Case Next Steps.
  - Add modeled years 2035 and 2039.
  - Update PJM generation expansion for announced deactivation and queue unit status changes.
  - When available, update the ME Base Case topology with selected 2024W1 solutions.
    - PV Analysis to determine the limits for the reactive interfaces.

- 2024/25 Long-Term Market Efficiency Window anticipated to open during Q1 2025.
  - Once the congestion drivers are finalized.
  - The final Market Efficiency Base Case to be posted before the start of the window.