PJM Update to ISAC

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Presented to Independent State Agencies Committee (ISAC)

January 31, 2022

Agenda

- 2021 RTEP Recap
- 2022 RTEP Update
- Offshore wind update

2020/21 Long-Term Window 1 (Market Efficiency)

Analysis Completed

- Cluster No. 1 (APS) - French's Mill to Junction 138 kV
  - Analysis completed: Proposal 756, terminal equipment upgrades at the French's Mill and Junction 138 kV substations, with a projected in-service date of 4/1/22, selected as the preferred solution. 1st Read presented at the 11/30/21 TEAC meeting.
- Cluster No. 2 (PECO) - Plymouth Meeting to Whitpain 230 kV
  - Analysis completed: Proposal 704, terminal equipment upgrades at the Plymouth Meeting and Whitpain 230 kV substations, with a projected in-service date of 6/1/25, selected as the preferred solution. 2nd Read presented at the 11/30/21 TEAC meeting.
- Cluster No. 3 (PPL) - Juniata to Cumberland 230 kV
  - Analysis completed: Proposal 218, reconductor the Juniata-Cumberland 230 kV line, with a projected in-service date of 12/1/23, selected as the preferred solution. 2nd Read presented at the 11/30/21 TEAC meeting.
- Cluster No. 4 (DOM) - Charlottesville to Proffit 230 kV
  - Analysis completed: Proposal 651, series reactor on the Charlottesville-Proffit 230 kV line, with a projected in-service date of 6/1/23, selected as the preferred solution. 2nd Read presented at the 11/30/21 TEAC meeting.

Cluster 1: Junction – French's Mill 230 kV (APS)

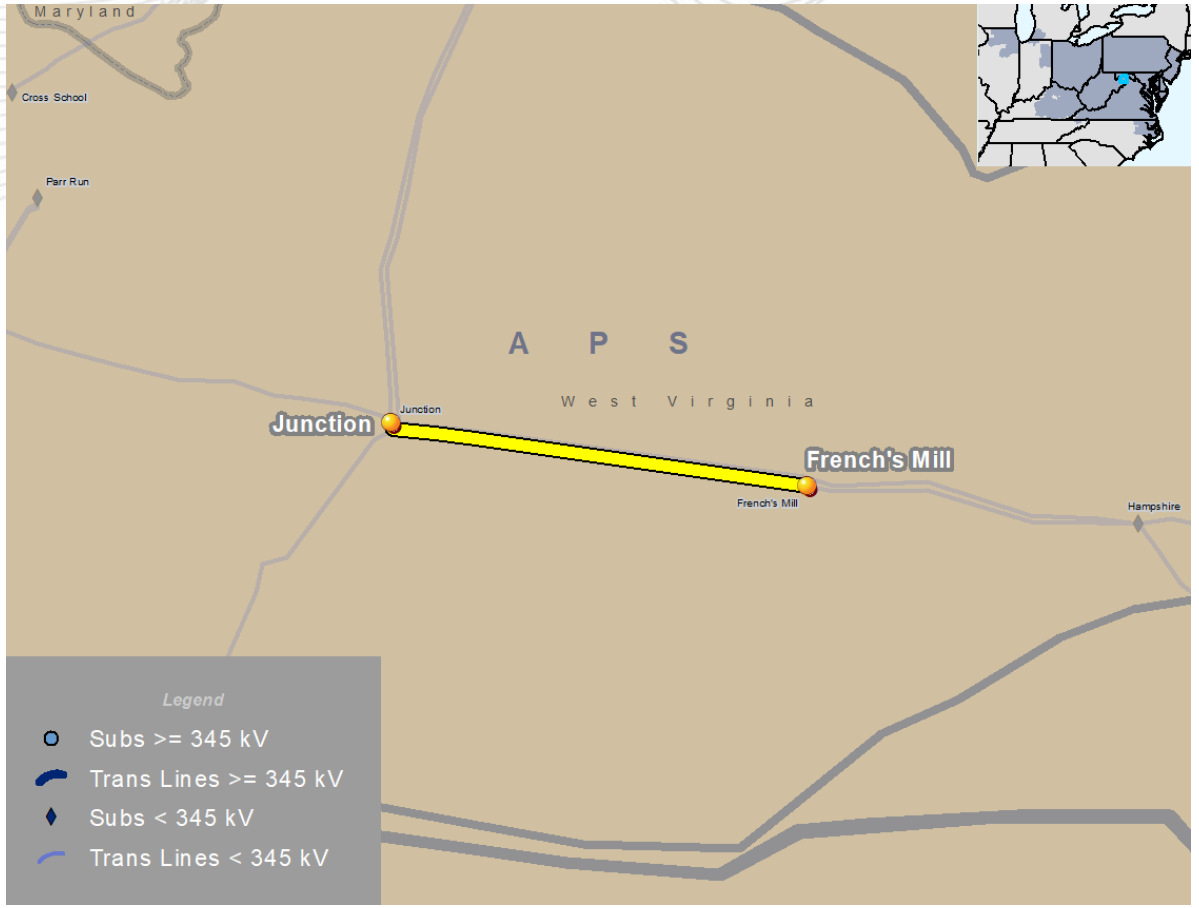
- Proposal 756, terminal equipment upgrades at the Junction and French's Mill 138 kV substations, selected as the preferred solution:
  - Addresses the target congestion and has the highest B/C Ratio, 119.03.
  - Lowest Cost: $0.77 million.
  - Projected in-service date: 4/1/2022.
  - Passes all PROMOD sensitivity scenarios.
  - Reliability analysis has been completed and no reliability violations identified associated with this solution.

- 1st Read presented at the TEAC meeting from 11/30/2021.

- PJM staff intends to submit Proposal 756 to be approved by the PJM Board for inclusion in the Regional Transmission Expansion Plan.

Proposal No. 756 (French's Mill - Junction Terminal Upgrades)

Project ID: 202021_756
Proposed Solution: Replace terminal equipment on the French's Mill-Junction 138 kV line.
Project Type: Upgrade
kV Level: 138 kV
In-Service Cost ($M): $0.77
In-Service Date: 4/1/2022
B/C Ratio = 119.03
Target Zone: APS
ME Constraints: Junction to French's Mill 138 kV
Notes: Redacted Public Proposal 756



2021 RTEP

2021 Proposal Window 1

2021 RTEP Window 1

- Window opened on 7/02/2021
- Window closed on 8/31/2021
- For this Window, PJM seeks technical solutions, also called proposals, to resolve potential reliability criteria violations on facilities identified below in accordance with all applicable planning criteria (PJM, NERC, SERC, RFC, and Local Transmission Owner criteria).
- 57 total proposals submitted from 10 different entities
  - 21 Greenfield
  - 36 Upgrades
- Cost Estimates: Approximate range from $600K to $136M
- 15 Proposals identified with Cost Containment
- 577 flowgates were addressed

Update to 2021 Proposal Window 1 Cluster 2 & 3

MetEd Transmission Zone: Baseline

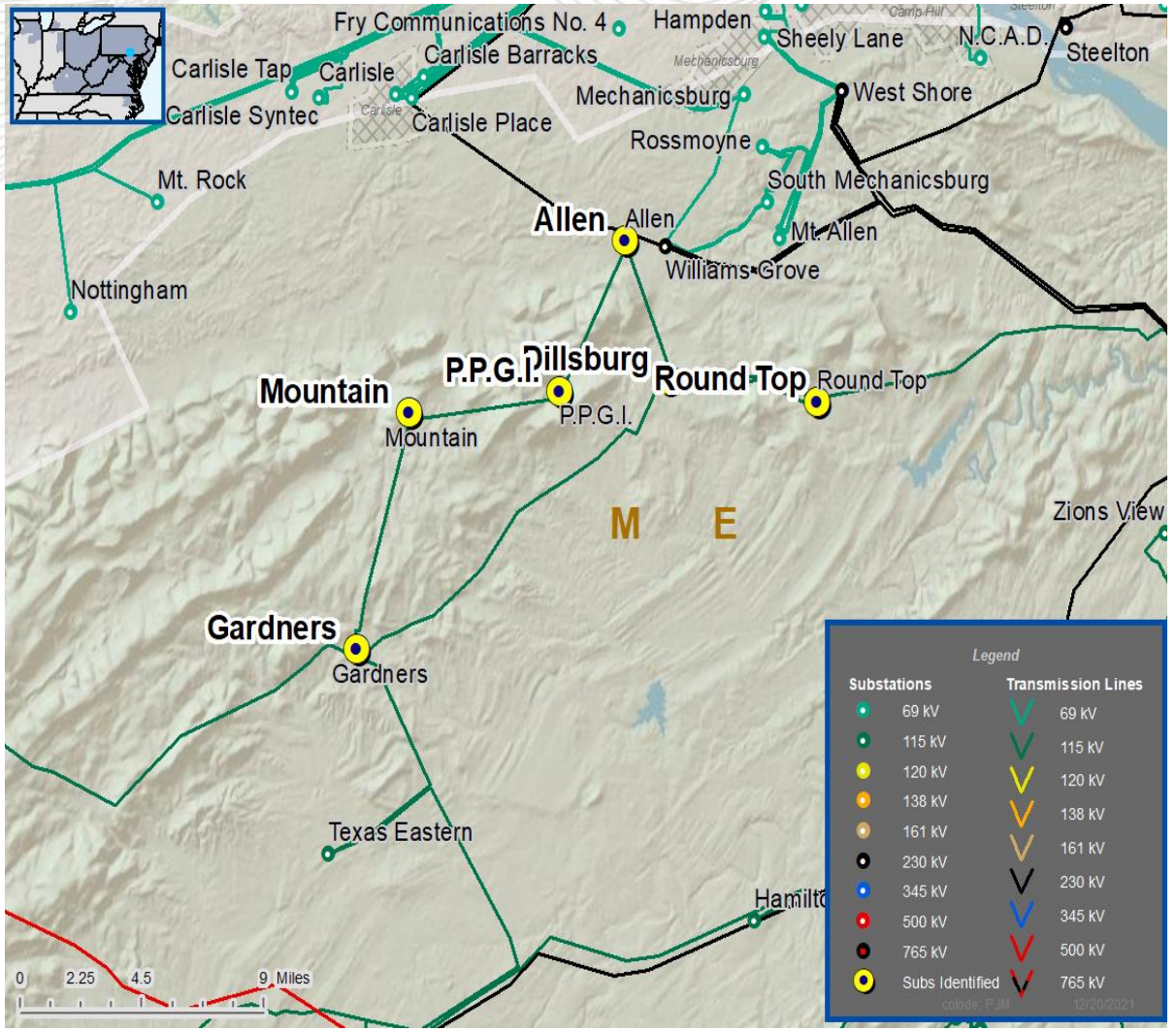
Cluster 2 - Allen area voltage Evaluation Progress

Problem Statement:

Voltage magnitude and voltage drop violation at several 115 kV stations in the Allen (MetEd) vicinity for N-1-1 contingencies.

	# of Flowgates
Violations were posted as part of the 2021 Window 1	N2-SVM8, N2-SVM9, N2-SVM10, N2-SVM11, N2-SVM12, N2-SVM13, N2-SVM16, N2-SVM17, N2-SVM18, N2-SVM19, N2-SVM26, N2-SVM27, N2-SVD1, N2-SVD2, N2-SVD3, N2-SVD4, N2-SVD5, N2-SVD6, N2-SVD7, N2-SVD8, N2-SVD9, N2-SVD10, N2-SVD11, N2-SVD12, N2-SVD15, N2-SVD16

- PJM received 10 proposals from four entities.
- Cost ranges between $12M and $32.2M
- PJM completed reliability evaluation.
- PJM is working on constructability evaluation



Penelec Transmission Zone: Baseline

Cluster 3 - Shawville transformer Evaluation Progress

Problem Statement:

The Shawville 230/115/17.2 kV transformer #2A is overloaded for multiple contingencies.

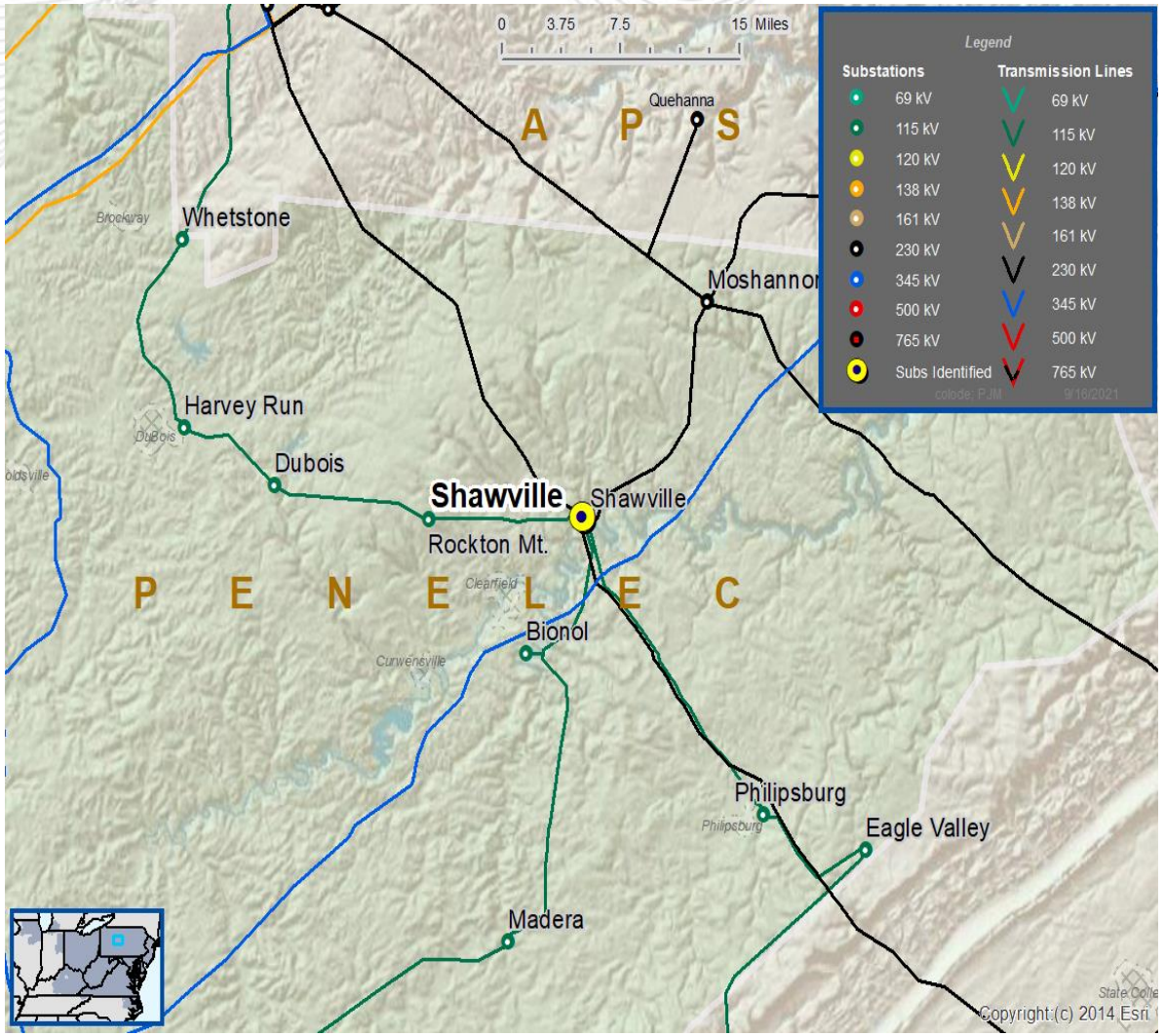
Violations were posted as part of the 2021 Window 1: FG# N1-LLT20, N1-LLT21, GD-LL45, GD-LL46

Proposed Solutions:

Proposal ID 306 - Replace the Shawville 2A 230/115-17.2 kV Transformer with a larger unit. ($5.4 M)

Proposal ID 100 - Install a new 230/115 kV transformer and associated facilities. Replace the Plant's 2B 115-17.2 kV transformer with a larger 230/17.2 kV transformer. ($8.775M)

- The preferred solution is Proposal ID 100. The project involves reconfiguring the Shawville bus and changing POI for one of the Shawville generation unit. PJM is working with GO to make sure the project doesn't have adverse impact on the generator.



2021 Proposal Window 3

2021 RTEP Window 3

- PJM closed the RTEP Window 3 on 12/8/2021 and received 3 proposals for the violations for PSEG FERC Form 715 identified below

  https://www.pjm.com/-/media/planning/planning-criteria/pseg-planning-criteria.ashx

  - Athenia 230/138 kV transformer 220-1 → Aging
  - Fairlawn 230/138 kV transformer 220-1 → Aging
  - Lawrence 230/69 kV transformer 220-4 → Aging
- Cost ranges between $4.2M and $12.95M
  - No Cost Containment
  - No Greenfield Projects

2021 RTEP Window 3

Proposal ID #	Project Type	Project Description	Total Construction Cost M$	Zone	kV Level	Analysis	Flowgate
510	Upgrade	Replace Fair Lawn 230-138kV Transformer 220-1	4.28	PSEG	230/138	FERC 715 Other	PSEG-03
524	Upgrade	Replace Lawrence Switching Station 230-69kV transformer 220-4 and its associated circuit switchers with a new larger capacity transformer with Load Tap Changer (LTC) and new dead tank circuit breaker. Install a new 230kV gas insulated breaker, associated disconnects, overhead bus, and other necessary equipment to complete the bay within the Lawrence 230kV Switchyard.	12.95	PSEG	230/69	FERC 715 Other	PSEG-01
770	Upgrade	Replace Athenia 230-138kV transformer 220-1.	12.59	PSEG	230/138	FERC 715 Other	PSEG-02

PSEG Transmission Zone: Baseline

Process Stage: First Review
Criteria: PSEG FERC Form 715
Assumption Reference: 2026 RTEP assumption
Model Used for Analysis: 2026 RTEP Summer case
Proposal Window Exclusion: None

Problem Statement:

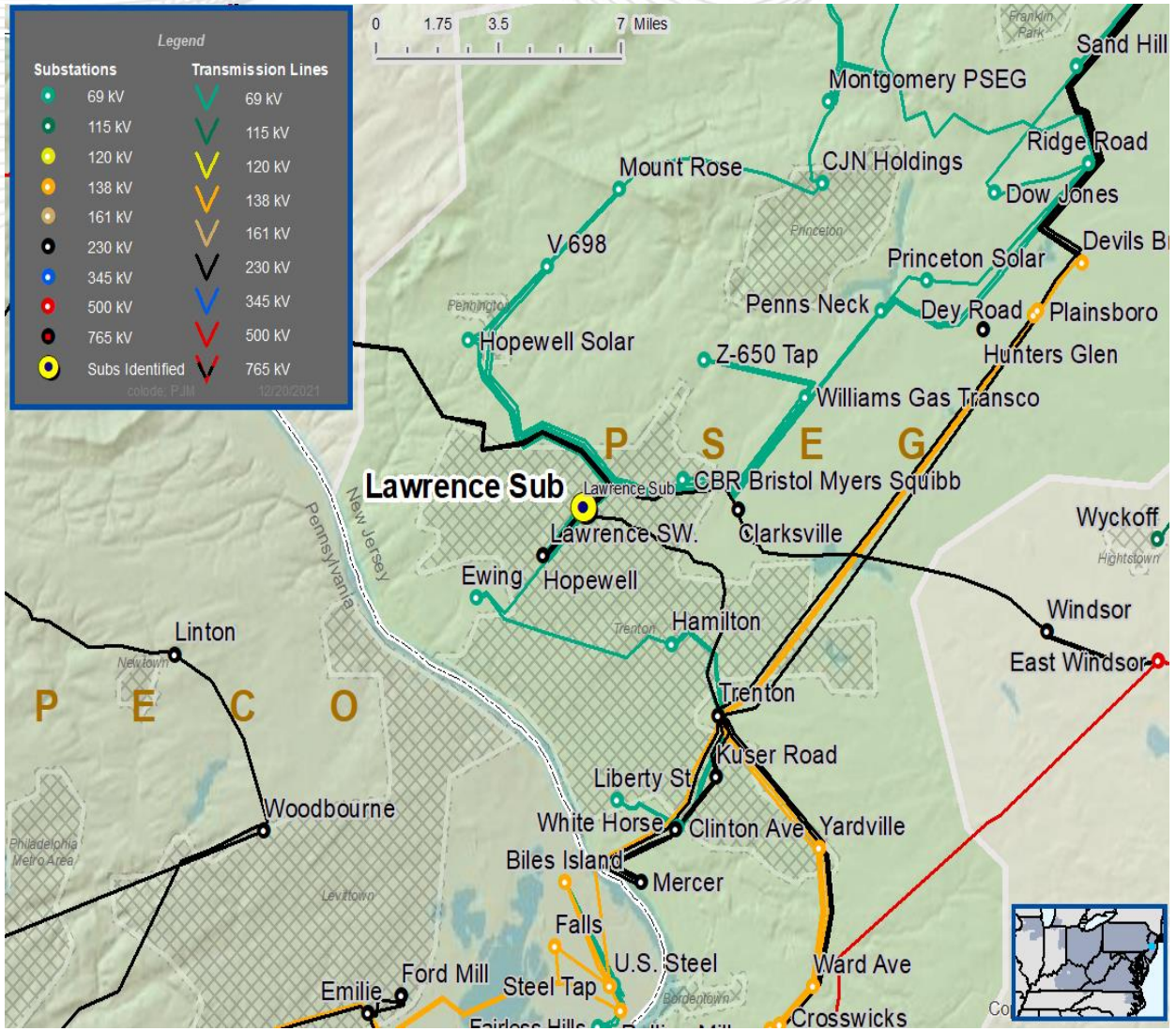
The Lawrence 230/69 kV transformer # 220-4 has been identified for replacement based on equipment performance, condition assessment and system needs.

Violations were posted as part of the 2021 Window 3: FG# PSEG-01

Existing Facility Rating: 297SN/375SE, 344WN/464WE MVA
Proposed Facility Rating: 313SN/384SE, 369WN/454WE MVA

Proposed Solution:
Replace Lawrence Switching Station 230-69kV transformer 220-4 and its associated circuit switchers with a new larger capacity transformer with Load Tap Changer (LTC) and new dead tank circuit breaker. Install a new 230kV gas insulated breaker, associated disconnects, overhead bus, and other necessary equipment to complete the bay within the Lawrence 230kV Switchyard

Estimated Cost: $13.36 M
Alternatives: N/A
Required In-Service: 6/1/2026



PSEG Transmission Zone: Baseline

Process Stage: First Review
Criteria: PSEG FERC Form 715
Assumption Reference: 2026 RTEP assumption
Model Used for Analysis: 2026 RTEP Summer case
Proposal Window Exclusion: None

Problem Statement:

The Athenia 230/138 kV transformer # 220-1 autotransformer has been identified for replacement based on equipment performance, condition assessment and system needs. . The 220-1 Auto-Transformer at Athenia has been heavily gassing for many years. The transformer has been de-gassed multiple times due to high levels of combustible gas in the main tank.

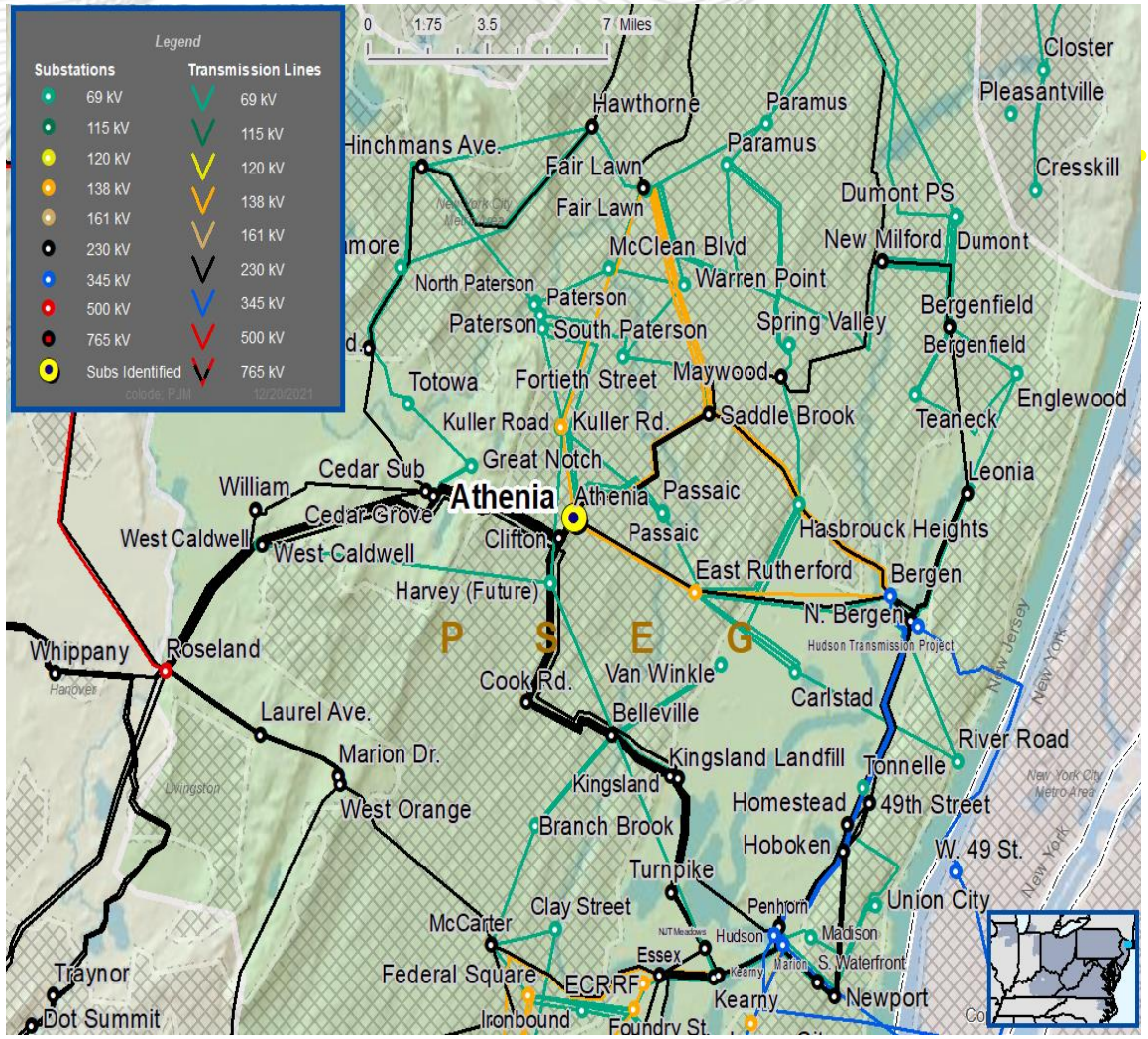
Violations were posted as part of the 2021 Window 3: FG# PSEG-02

Existing Facility Rating: 606SN/807SE, 717WN/954WE MVA
Proposed Facility Rating: 593SN/700SE, 699WN/785WE MVA

Proposed Solution:

Replace existing 230/138kV Athenia 220-1 transformer.

Estimated Cost: $13.04 M
Alternatives: N/A
Required In-Service: 6/1/2026



PSEG Transmission Zone: Baseline

Process Stage: First Review
Criteria: PSEG FERC Form 715
Assumption Reference: 2026 RTEP assumption
Model Used for Analysis: 2026 RTEP Summer case
Proposal Window Exclusion: None

Problem Statement:

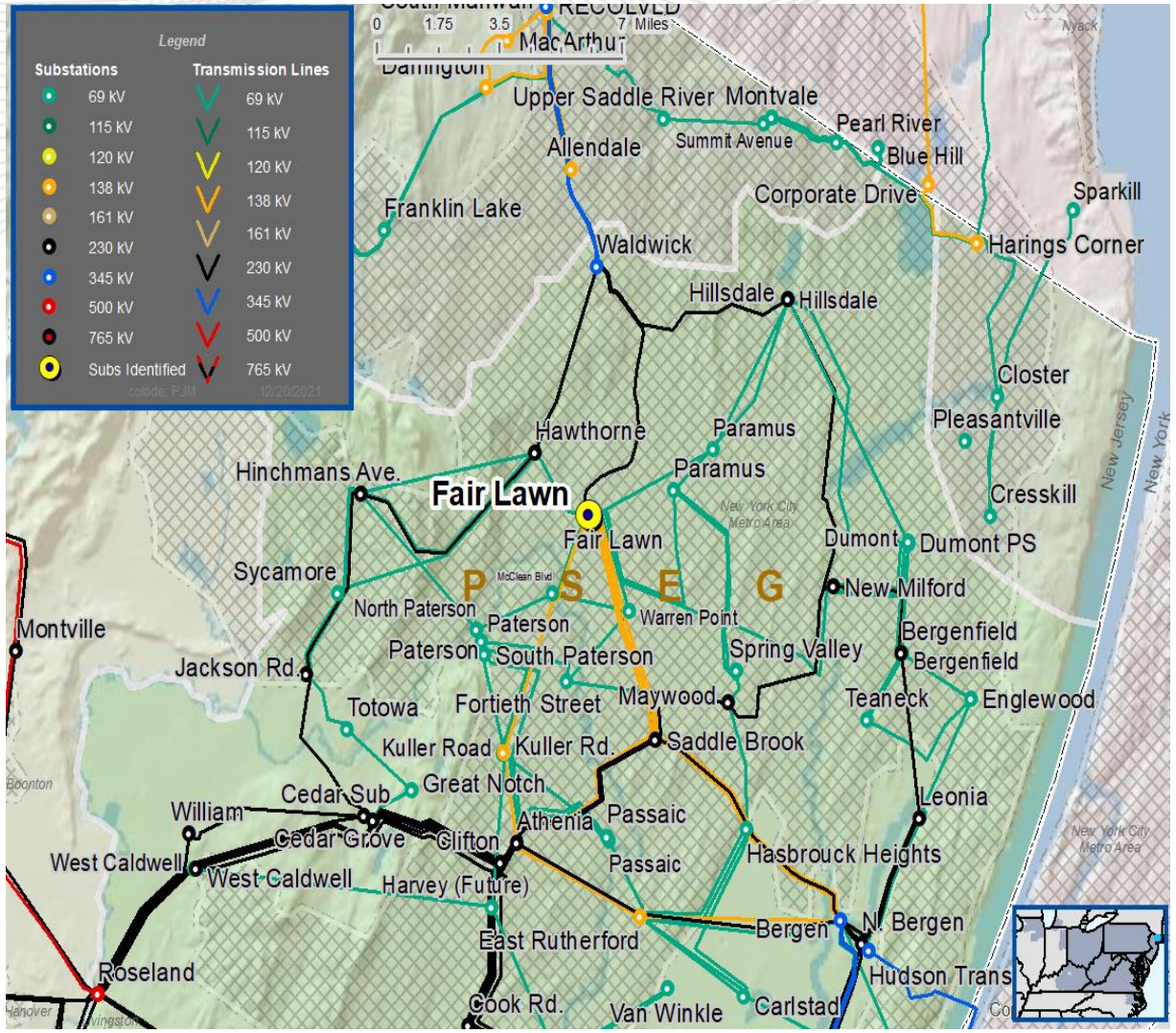
The Fair Lawn 230/138 kV #220-1 Auto-Transformer has been identified for replacement based on equipment performance, condition assessment and system needs. The transformer has been generating acetylene since 2015 along with other key combustible gasses.

Violations were posted as part of the 2021 Window 3: FG# PSEG-03

Existing Facility Rating: 596SN/808SE, 685WN/874WE MVA
Proposed Facility Rating: 470SN/674SE, 554WN/739WE MVA

Proposed Solution:
Replace Fair Lawn 230-138kV transformer 220-1 with an existing O&M system spare at Burlington.

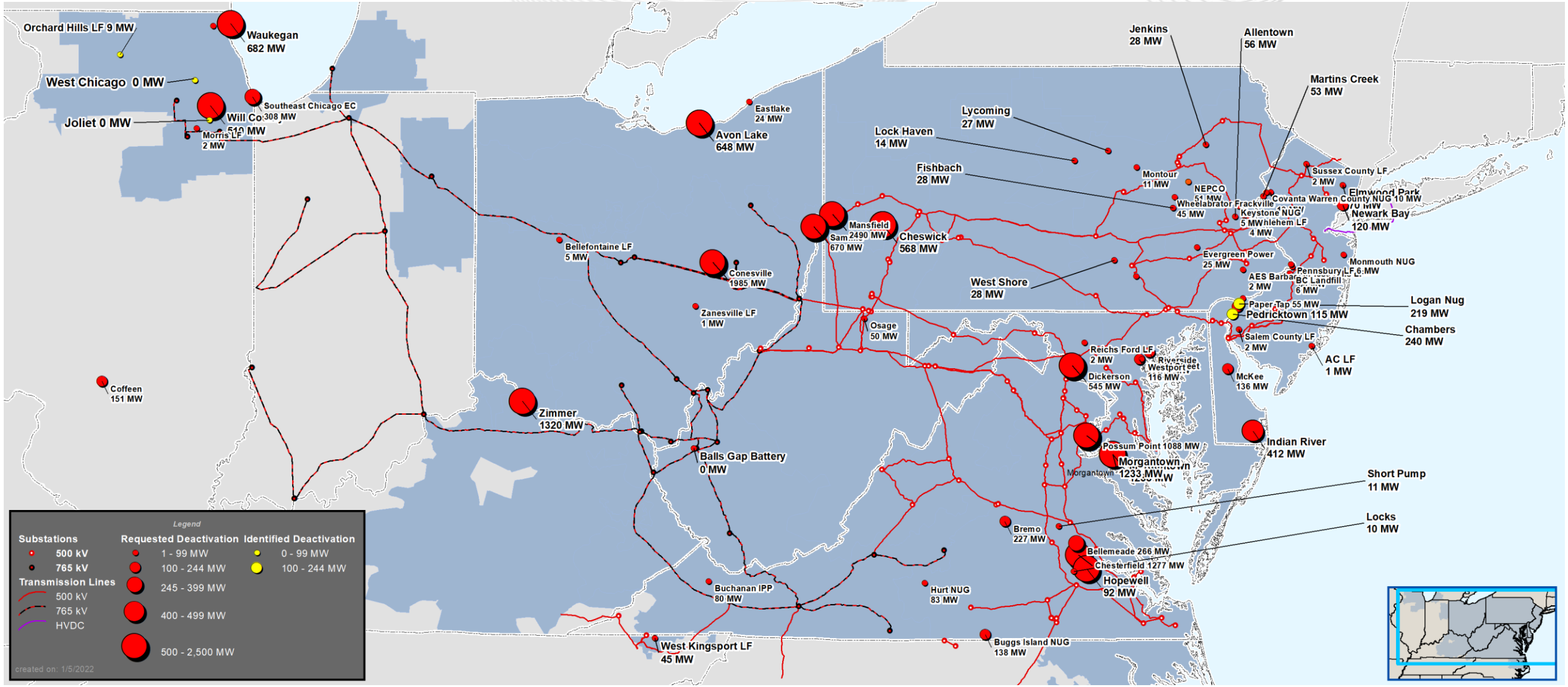
Estimated Cost: $4.454 M
Alternatives: N/A
Required In-Service: 6/1/2026



2022 RTEP

Generator Deactivations

Generation Deactivation Announcements 2018-2021



Deactivation Status

Unit(s)	Transmission Zone	Requested Deactivation Date	PJM Reliability Status
Joliet Energy Storage - Capacity: 0 MW, Energy: 20MW	ComEd	2/8/2022	Reliability analysis complete. No reliability violation identified.
West Chicago Energy Storage - Capacity: 0 MW, Energy: 20MW	ComEd	2/8/2022	Reliability analysis complete. No reliability violation identified
Logan - 219 MW	ACE	4/1/2022	Reliability analysis underway.
Chambers - 240 MW	ACE	4/1/2022	Reliability analysis underway.
Orchid Hills LF - 9.3 MW	ComEd	3/31/2022	Reliability analysis underway.

2022 RTEP Assumptions Reliability Analysis

Overview

- 2022 RTEP
  - NERC Standard TPL-001-4
- Modeling
  - MOD-032 (GOs and TOs)
    - http://pjm.com/planning/rtep-development/powerflow-cases/mod-032.aspx
    - Siemens PSS®MOD - Model On Demand (TOs)
    - PJM.com Planning Center Online Tool (Gen Model) – GOs

Expected Timeline

- November 2021: Establish 2022 RTEP base case modeling assumptions
  November 2021 to February 2022: Build base cases and perform initial case review. During this period,
  - New modeling and other basic assumption changes will not be considered unless PJM determines they may have a significant impact on the RTEP baseline studies.
  - Corrections to the analytical files will be accepted.
- February to May 2022: Perform RTEP baseline studies.
  - No new modeling or other basic assumption changes anticipated
  - Corrections to the analytical files will only be accepted if they have a widespread impact or will likely impact one or more identified violations.

Expected Timeline

- June/July 2022
  - Open competitive proposal window
  - Post modeling assumptions changes and corrections for and begin mid-year retool of 2022 RTEP baseline analysis if required
    - Accounts for major new modeling assumption changes and corrections not previously considered.
    - Basic assumptions such as planning criteria and ratings methodology that changed after February will not be considered until the 2023 RTEP.
- July/August 2022
  - Close competitive proposal window
  - Finalize mid-year retool
- August to December 2022: Evaluate proposals
- October 2022 to February 2023: Approve proposals

2022 RTEP and SRRTEP Assumptions

Details of assumptions for the 2022 RTEP and local planning needs were presented at the following TEAC and Sub-regional RTEP meetings

SRRTEP Mid-Atlantic, December 20, 2021

SRRTEP Southern, December 20, 2021

SRRTEP West, December 17, 2021

TEAC, January 11, 2022

FERC 1000 Process

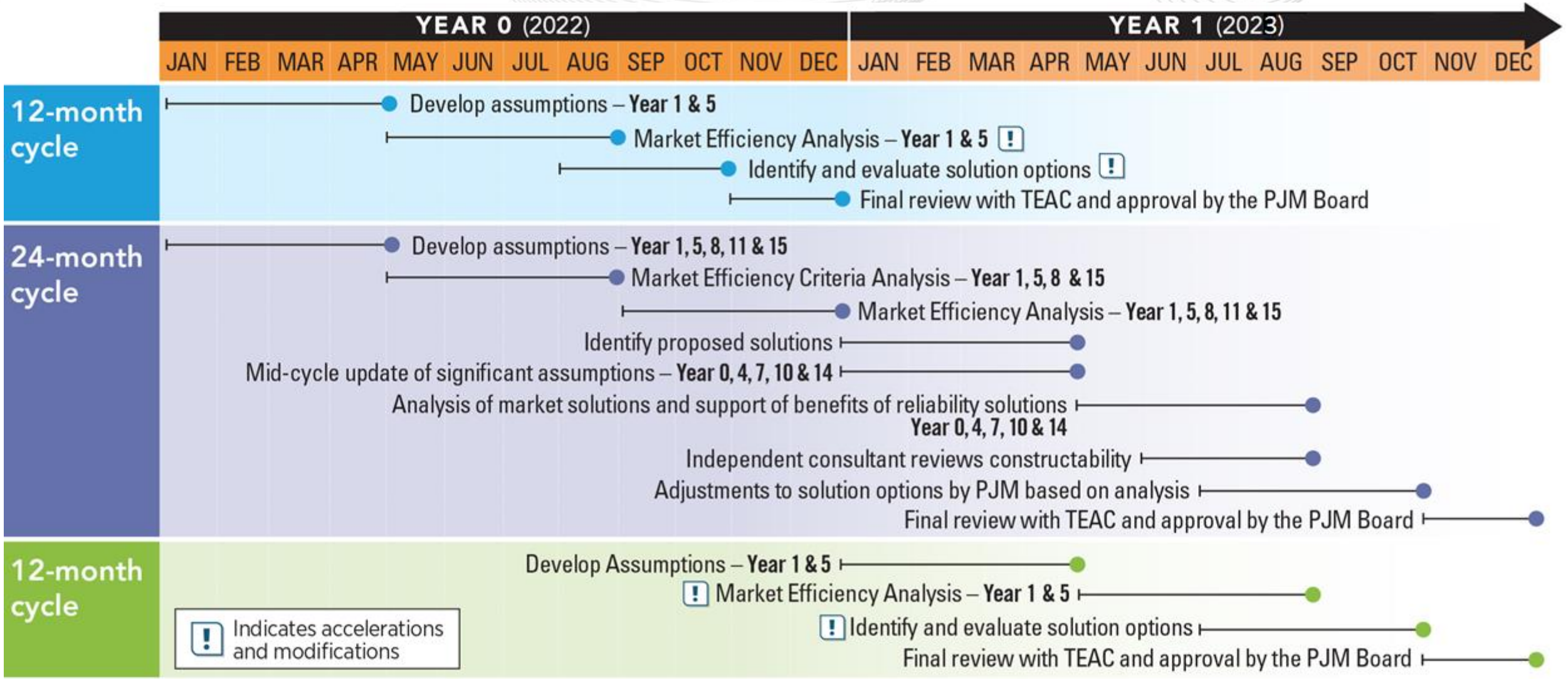
- Similar to the 2021 RTEP and per the PJM Operating Agreement, a proposal window will be conducted for all reliability needs that are not certain Immediate Need reliability upgrades or are otherwise ineligible to go through the window process.
- FERC 1000 implementation will be similar to the 2021 RTEP.
  - Advance notice and posting of potential violations
  - Advance notice of window openings
  - Window administration

2022 Scenario Analysis

- Request stakeholder suggestions for and input to 2022 alternative sensitivity studies and scenario analysis
- PJM participating in DOE Atlantic Offshore Wind Transmission study which may provide additional information for 2023 RTEP and beyond
- PJM System Planning is working to outline a scope for looking at a low carbon future to discuss in RTEP scenario discussions later in 2022 or early 2023

2022/23 Market Efficiency Cycle

2022/23 Market Efficiency Timeline



2022 Market Efficiency Assumptions

- Hitachi Energy PROMOD Database – Spring 2022.
- Powerflow consistent with the 2027 RTEP powerflow.
- Load Forecast and Demand Response based on PJM 2022 Load Forecast Report.
- Generation Expansion consistent with the machine list included in the Planning RTEP Powerflow.
- Fuel and Emissions Price forecasts provided by Hitachi Energy.
- Financial parameters Discount Rate and Carrying Charge, based on the Transmission Cost Information Center spreadsheet.

2022/23 Market Efficiency Next Steps

Step	Target Date
Develop Base Case Assumptions	May 2022
Post Preliminary Base Case	July 2022
Stakeholders Feedback	September 2022
Identify Congestion Drivers	September – November 2022
2022 Reevaluation Analysis	September – November 2022
2022 Acceleration Analysis	September – November 2022
Post Final Base Case and Target Congestion Drivers	January 2023
Long Term Proposal Window	January - May 2023
Analysis of Proposed Solutions	May – September 2023
TEAC Reviews and Board Approval	October - December 2023

- New Jersey Offshore Wind State Agreement Approach

- Offshore Wind Transmission Scenario Study Phase 2

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