Reliability Analysis Update

Aaron Berner, Senior Manager

Transmission Expansion Advisory Committee

Tuesday, January 11, 2022

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Update to 2021 Proposal Window 1 Cluster 2 & 3

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Cluster 2 - Shawville transformer Evaluation Progress

Problem Statement:

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

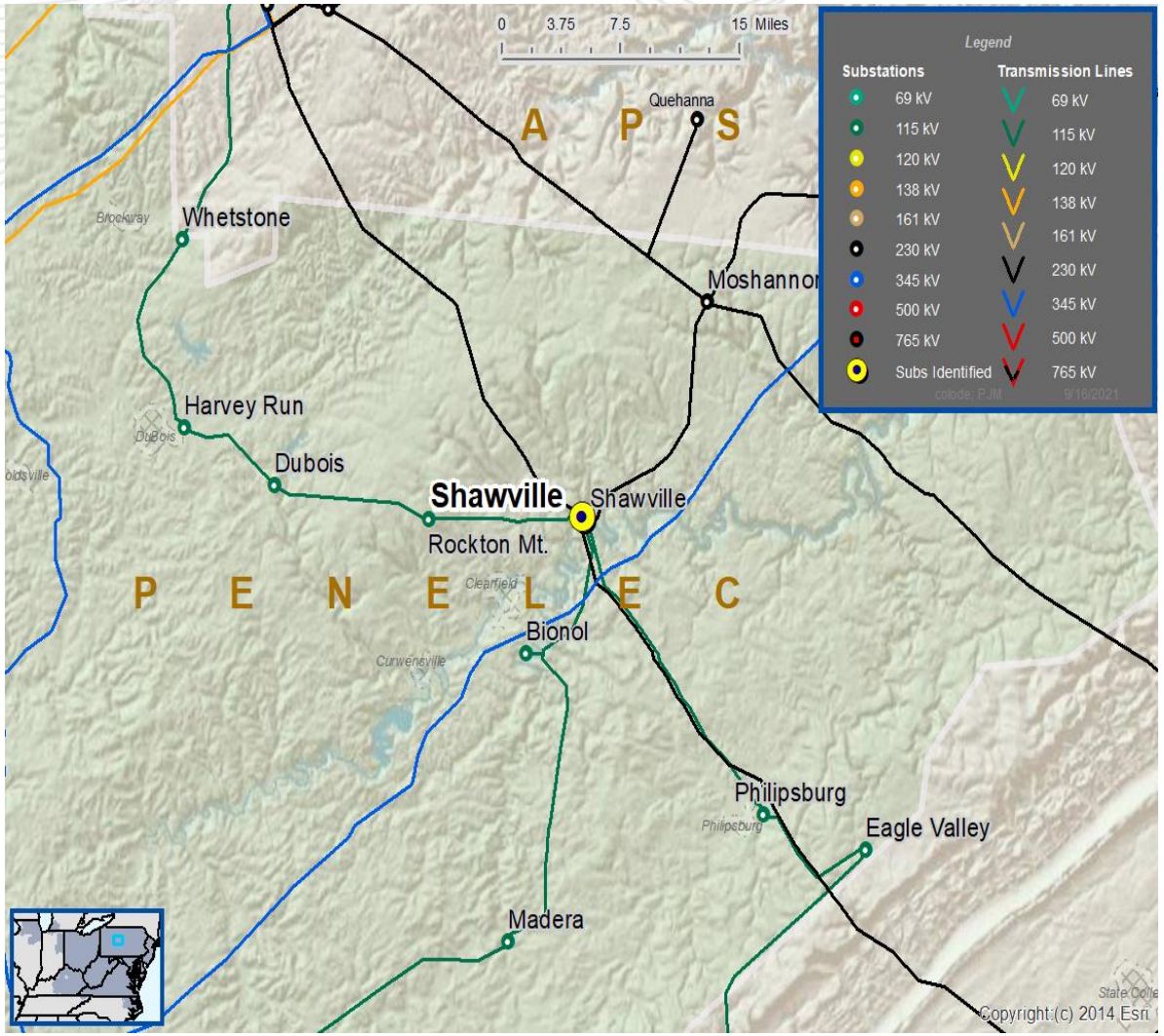
Violations were posted as part of the 2021 Window 1: FG# N1-LLT20, N1-LLT21, GD-LL45, GD-LL46

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.



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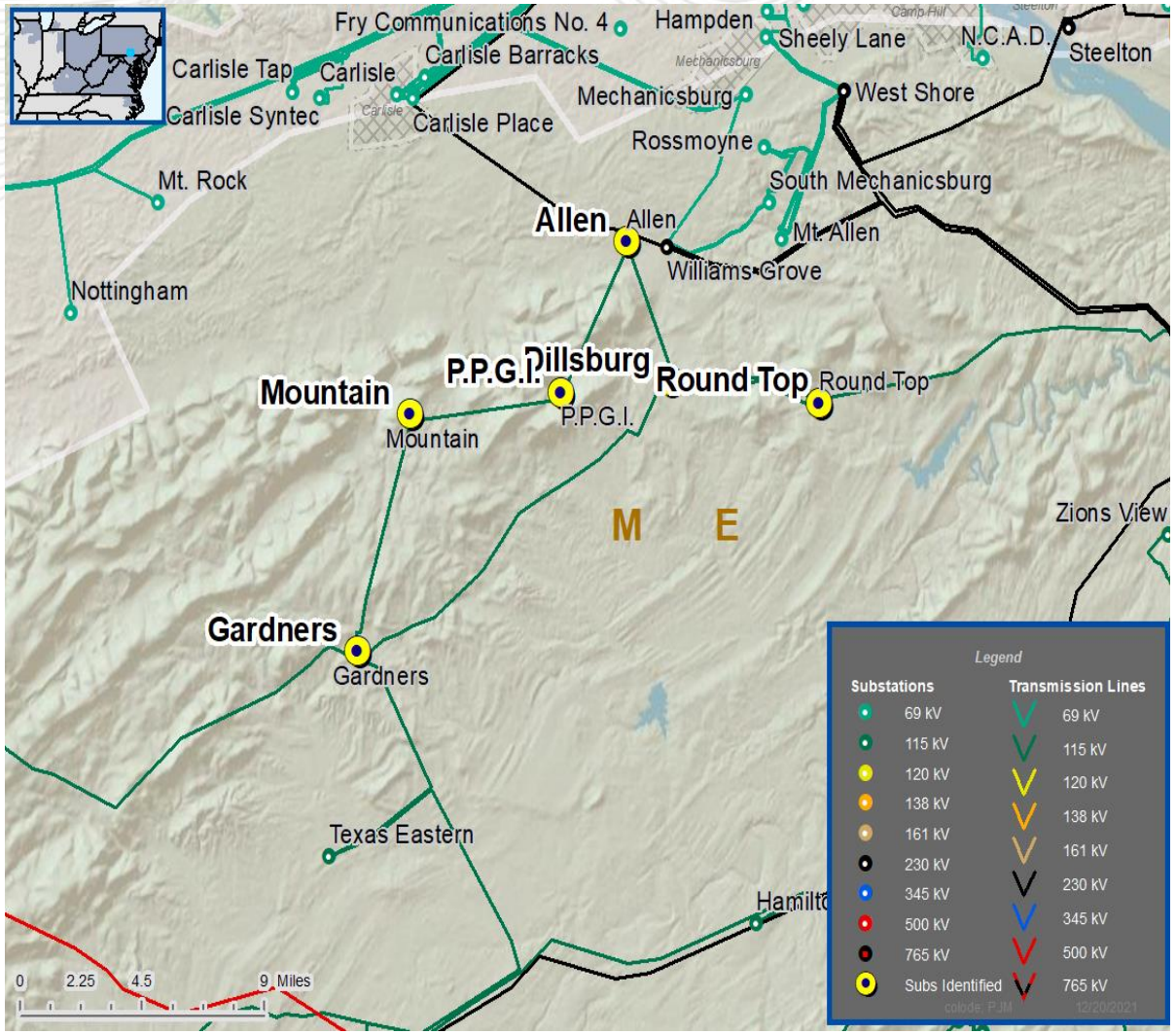
Cluster 2 - Allen area voltage Evaluation Progress

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



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Second Review

Baseline Reliability Projects

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ATSI Transmission Zone: Baseline

Hayes 345/138 kV Tr #2

Process Stage: Second Review

Criteria: Generation Deliverability

Assumption Reference: 2026 RTEP assumption

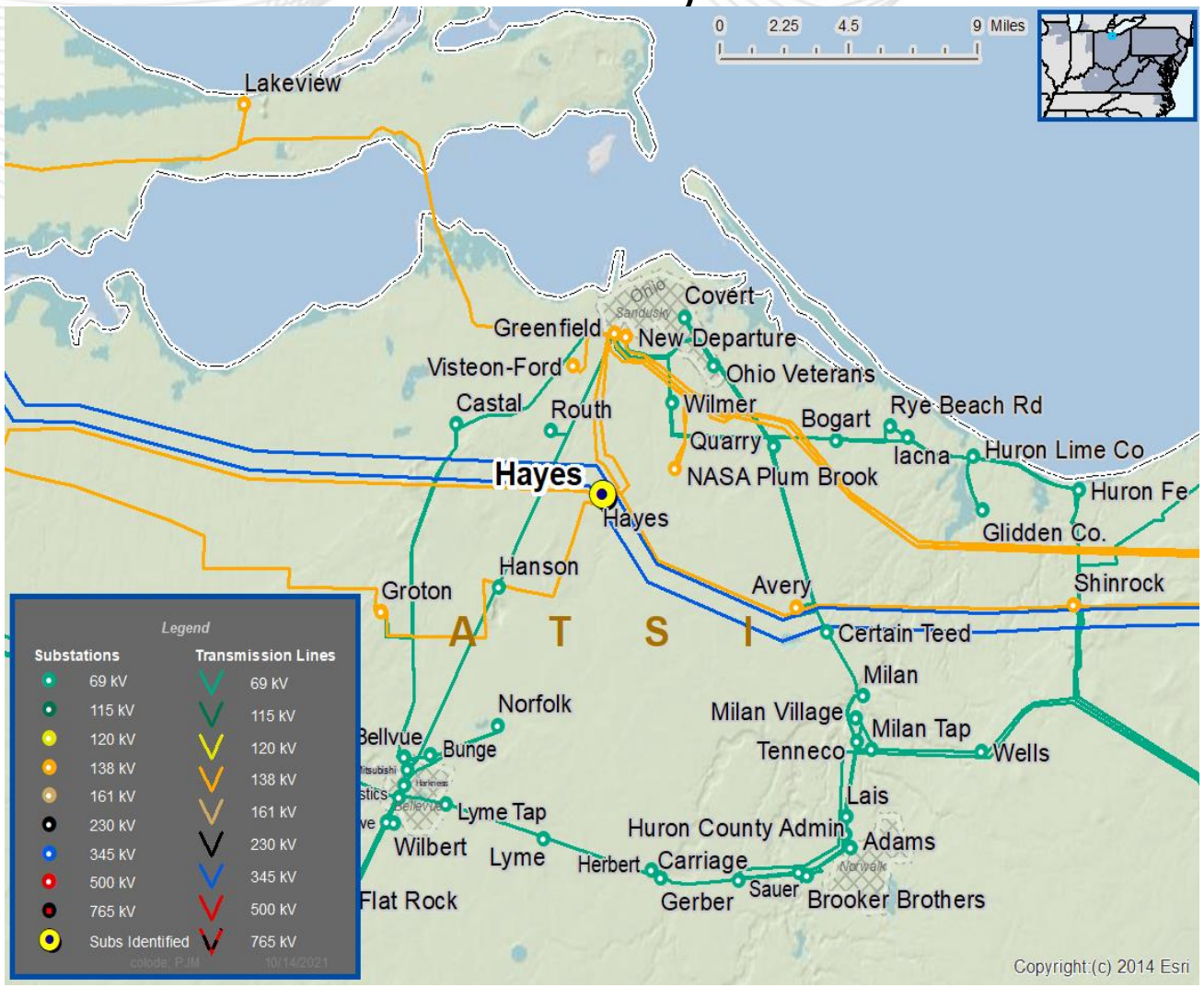
Model Used for Analysis: 2026 RTEP Summer case

Proposal Window Exclusion: None

Problem Statement:

GD-S712

In 2026 RTEP summer case, the Hayes 345/138 kV Tr # 1 is overloaded due to a tower contingency.



ATSI Transmission Zone: Baseline

Hayes 345/138 kV Tr #2

Proposed solution:

Install a second 345/138 kV transformer at Hayes, 448 MVA nameplate rating. Add one 345 kV circuit breaker (3000A) to provide transformer high side connection between breaker B-18 and the new breaker. Connect the new transformer low side to the 138 kV bus. Add one 138 kV circuit breaker (3000A) at Hayes 138 kV substation between B-42 and the new breaker. Relocate the existing 138 kV No. 1 capacitor bank between B-42 and the new breaker. Protection Per FE standard. **(b3682)**

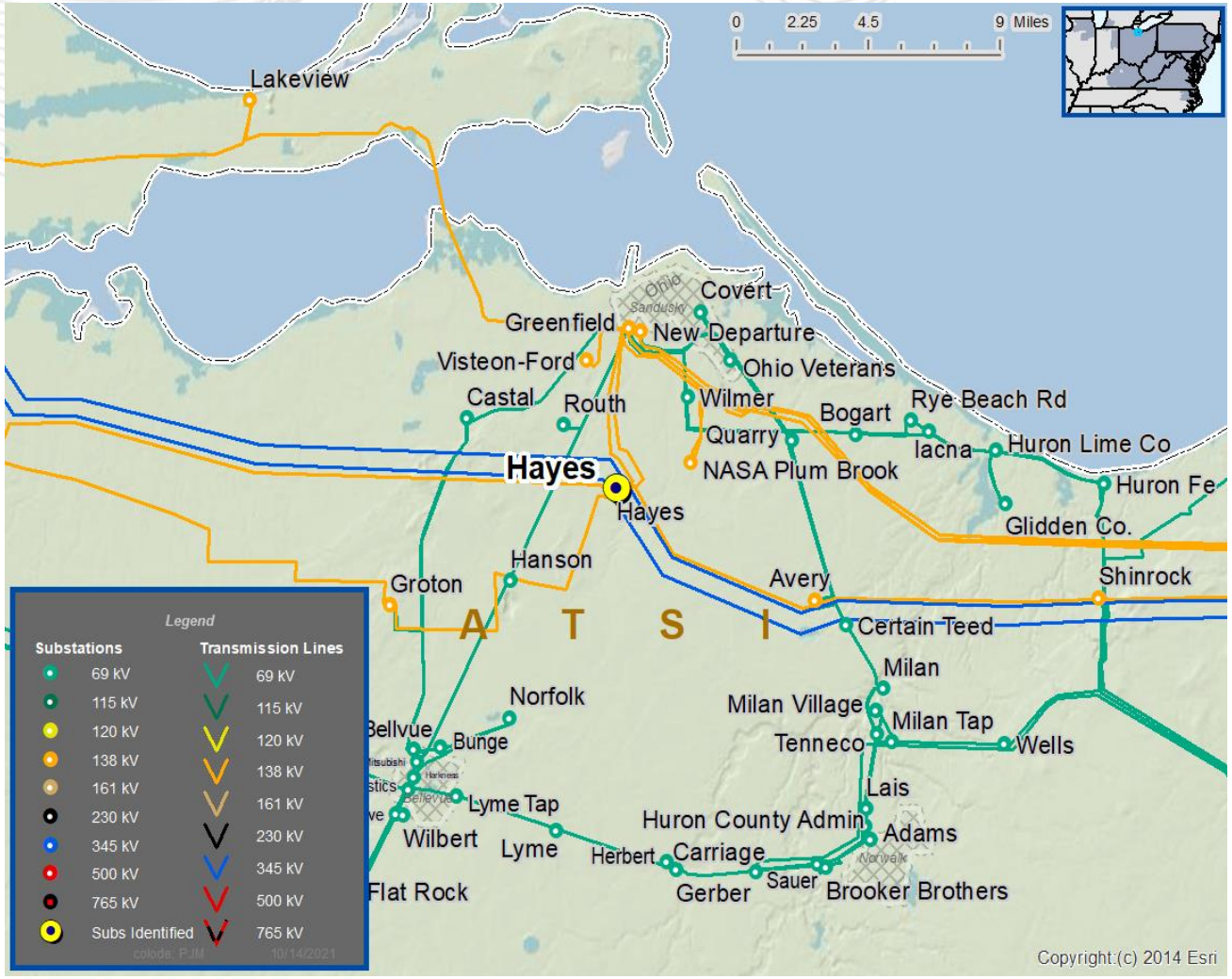
Additional Benefits: Mitigates the thermal overload on the Hayes No1 345/138 kV Transformer and provides additional capacity.

Total Estimated Cost: $7.59M

Required IS Date: 06/01/2026

Projected IS Date: 06/01/2026

Previously presented: 11/02/2021



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APS Transmission Zone: Baseline

Shingletown 230 kV

Process Stage: Second Review

Criteria: PJM N-1-1 Criteria

Assumption Reference: 2026 RTEP assumption

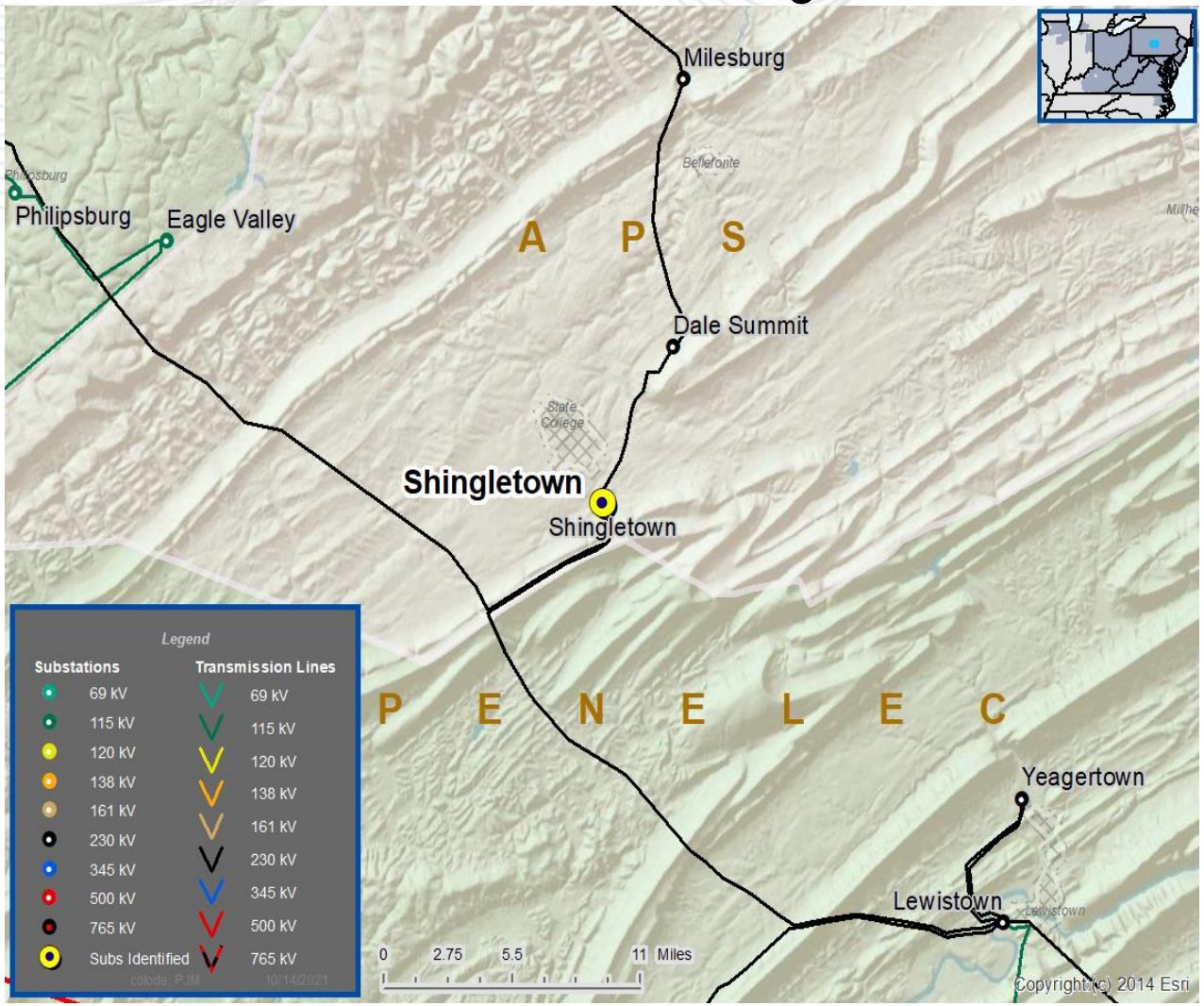
Model Used for Analysis: 2026 RTEP Summer case

Proposal Window Exclusion: None

Problem Statement:

APS-VD45 & APS-VD46

In 2026 RTEP summer case, the Shingletown 230 kV voltage drop violation occurs due to a N-1-1 contingency.



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APS Transmission Zone: Baseline

Shingletown 230 kV

As part of the 2021 RTEP Window # 1, the projects listed below are proposed to address the voltage drop APS-VD45 & APS-VD46 violations.

Proposal ID	Proposing Entity	Upgrade Description	Upgrade Cost ($M)
919	West Penn	Upgrade the Shingletown #82 230-46 kV Transformer Circuit by installing a 230 kV breaker.	1.66
779	West Penn	Convert Shingletown 230 kV Substation into a six-breaker ring bus.	11.92
608	CNTLTM	Tapping the Dale - Milesburg 230kV transmission line and creating a new substation named Persia. Connect the new Persia substation to the Yeagertown substation by creating a new 230 kV line.	77.59
560	CNTLTM	Tapping the Dale - Milesburg 230kV transmission line and creating a new substation named Persia. Connect the new Persia substation to the Elimsport substation by creating a new 230 kV line.	135.54

Upgrade the Shingletown #82 230-46 kV Transformer Circuit by installing a 230 kV breaker and disconnect switches, removing existing 230 kV switches, replacing 46 kV disconnect switches, replacing limiting substation conductor, and installing/replacing relays. **(b3681)**

Total Estimated Cost: $1.66M

Required IS Date: 06/01/2026
Projected IS Date: 06/01/2025
Previously Presented: 11/02/2021

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2021 Proposal Window 3

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- 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

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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

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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:

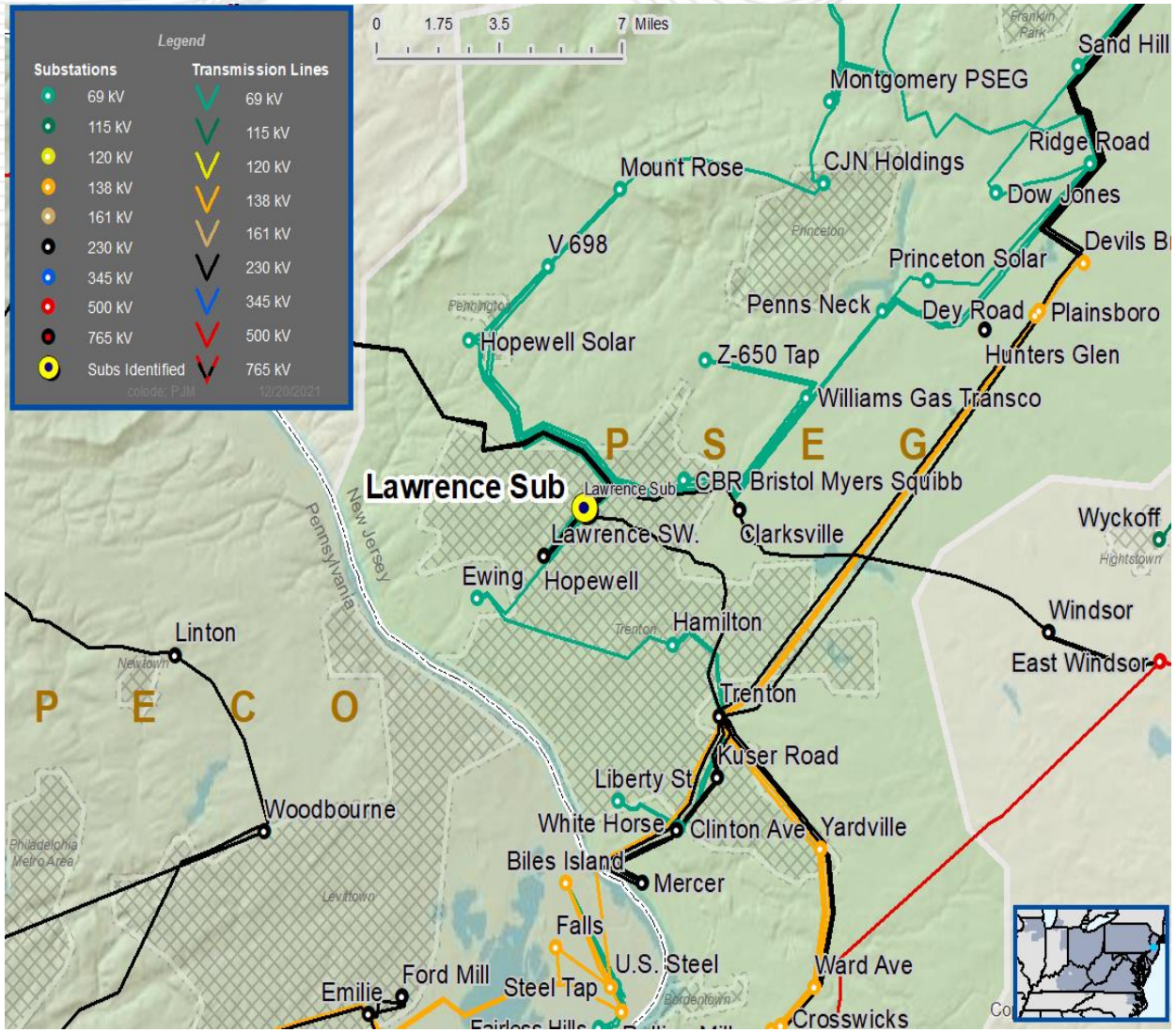
The Lawrence 230/69 kV transformer # 220-4 has been identified for replacement based on equipment performance, condition assessment and system needs.

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



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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.

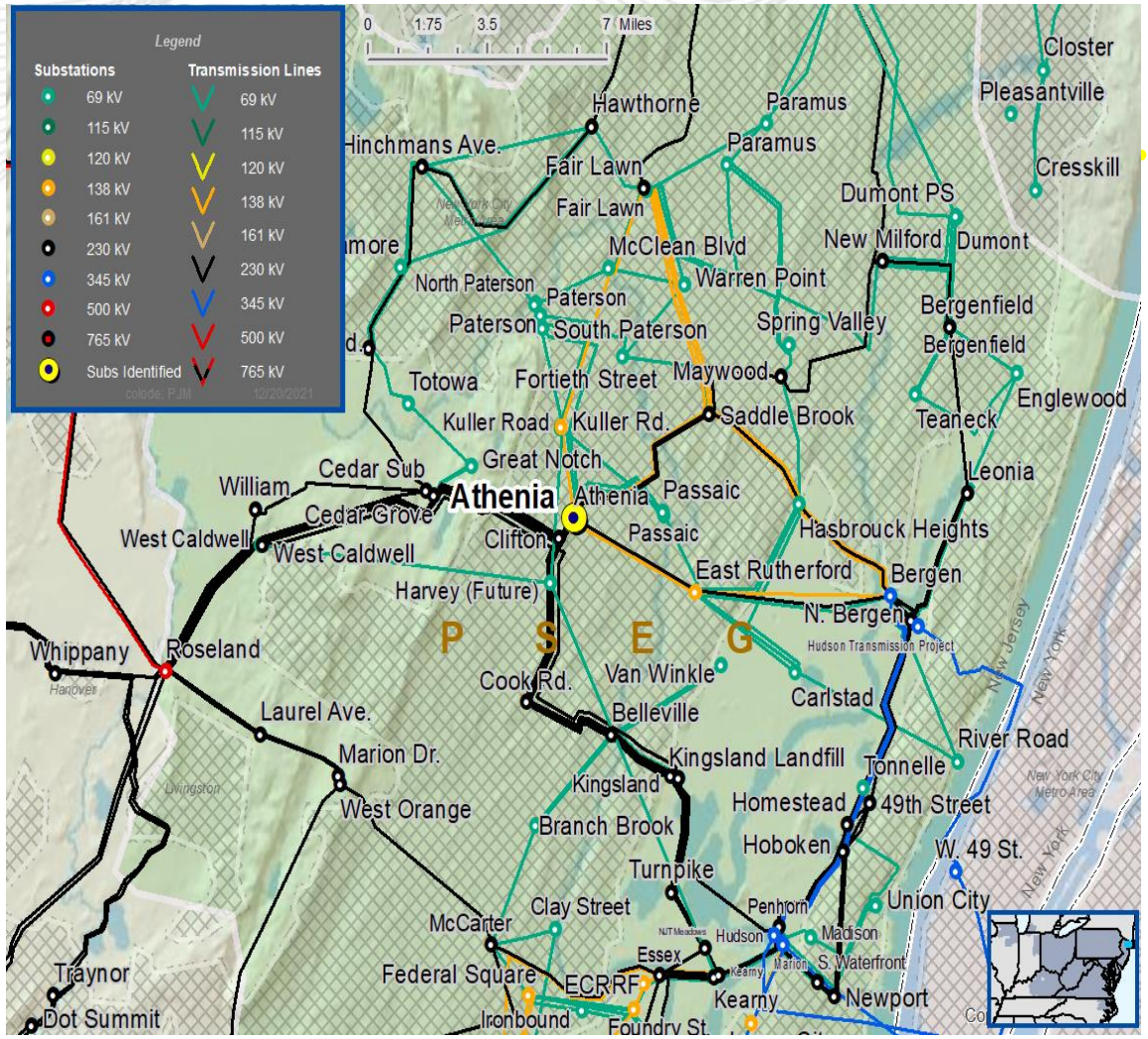
Violations were posted as part of the 2021 Window 3: FG# PSEG-02

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



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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:

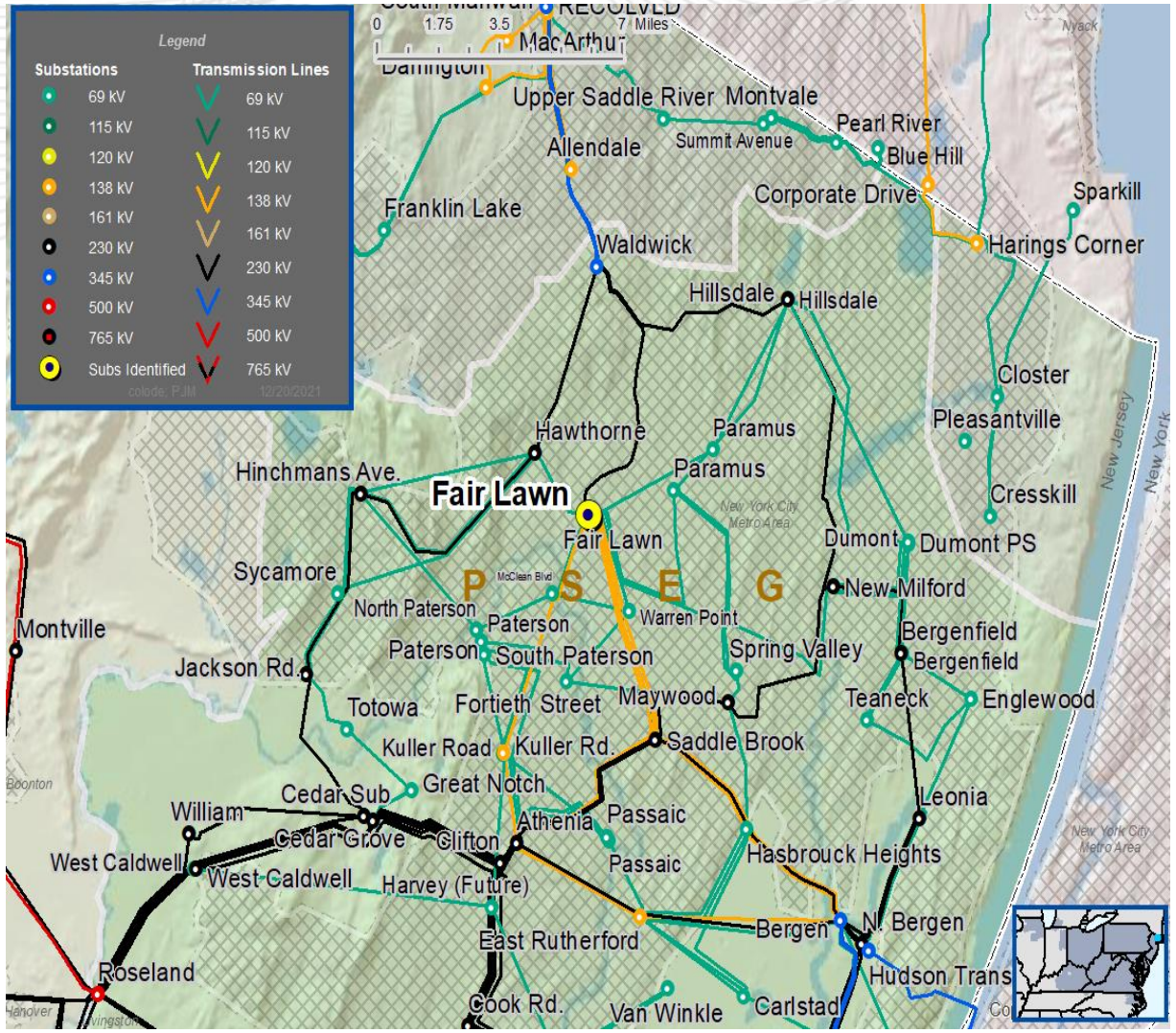
The Fair Lawn 230/138 kV #220-1 Auto-Transformer has been identified for replacement based on equipment performance, condition assessment and system needs. The transformer has been generating acetylene since 2015 along with other key combustible gasses.

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



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PJM CIL (Capacity Import Limit) Study 2021

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Background

- Compliance:
  - NERC Standard MOD-004-1, Requirement 6:
    - Requires the Transmission Planner to establish a CBM value for each Available Transfer Capability (ATC) Path or Flowgate to be used in planning during each of the full calendar years two through ten following the current year.
- Purpose:
  - The purpose of this study is to confirm that the PJM and surrounding transmission systems will be robust enough to enable PJM to import the amount of emergency assistance (CBM) assumed available in the 2021 PJM Reserve Requirement Study (RRS) and PJM RAA (R6.1).
    - The amount of CBM used in the PJM Reserve Requirement Study (RRS) is **3,500 MW**.
    - Attachment C.7 of Manual M-14B requires that CBM be preserved in generator deliverability studies
- Methodology:
  - Attachment G.11 “PJM Capacity Import Limit (CIL) Calculation Procedure”

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Supply Zone	2021 RTEP CBM Allocation (MW)	2022 RTEP CBM Allocation (MW)
North	389	131
West 1	1,063	1,693
West 2	1,348	654
South 1	18	0
South 2	682	1,022
TOTAL	**3,500**	**3,500**

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Conclusion

- The 2021 PJM CIL Study verifies that PJM meets its requirement for CBM in accordance with NERC standard MOD-004-1 Requirement 4.
- The binding flowgates for the current study are the same as the previous study.
- The primary drivers for the CBM allocation changes from the previous study are
  - North - A new load center at WarrinerPD in Penelec caused a reduction in import capability from the North Zone.
  - South 1 - Changes in LTF Transmission Service “baked into the case” caused a reduction in import capability from the South1 Zone.
  - South 2 – Changes in gen dispatch and loading on the Volunteer-Phipps Bend 500kV line caused an increase in import capability from the South 2 Zone.
  - Newly added generation to the Sedge Hill-Person 230kV line affected import capability from West1 and West2; West 1 increased and West 2 decreased.

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2021 SAA Proposal Window to Support NJ OSW

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Update on Evaluation of Proposals

- PJM is working through various analysis to validate performance of Option 1A proposals in conjunction with option 1b and 2 proposals
- PJM is working with consultants to begin evaluations of constructability and financial terms for the proposals
- PJM is seeking to enlist assistance in some analytical evaluations to be performed by a consultant
- PJM expects to present more details regarding the progress of the evaluation of the proposals at February TEAC

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Contact

Facilitator:
Sue Glatz,
Suzanne.Glatz@pjm.com

Secretary:
Mike Zhang,
Michael.Zhang@pjm.com

SME/Presenter:
Aaron Berner,
Aaron.Berner@pjm.com

Reliability Analysis Update

Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com

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Revision History

Version No.	Date	Description
1	12/30/2021	• Original slides posted
2	1/6/2022	• Add slides 20-21
3	1/14/2022	• Corrected cluster number on slide 4

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