Submission of Supplemental Projects for Inclusion in the Local Plan

APS Transmission Zone M-3 Process Misoperation Relay Projects

Need Numbers: APS-2024-057, APS-2024-058

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan – 3/7/2025

Previously Presented: Solution Meeting 08/06/2024
Need Meeting 06/04/2024

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

System Performance Projects Global Factors

- System reliability and performance
- Substation/line equipment limits

System Condition Projects

- Substation Condition Rebuild/Replacement

Upgrade Relay Schemes

- Obsolete and difficult to repair communication equipment (DTT, Blocking, etc.)
- Communication technology upgrades

Problem Statement:

- FirstEnergy has identified protection schemes using a certain vintage of relays and communication equipment that have a history of misoperation.
- Proper operation of the protection scheme requires all the separate components perform adequately during a fault.
- In many cases the protection equipment cannot be repaired due to a lack of replacement parts and available expertise in the outdated technology.
- Transmission line ratings are limited by terminal equipment.

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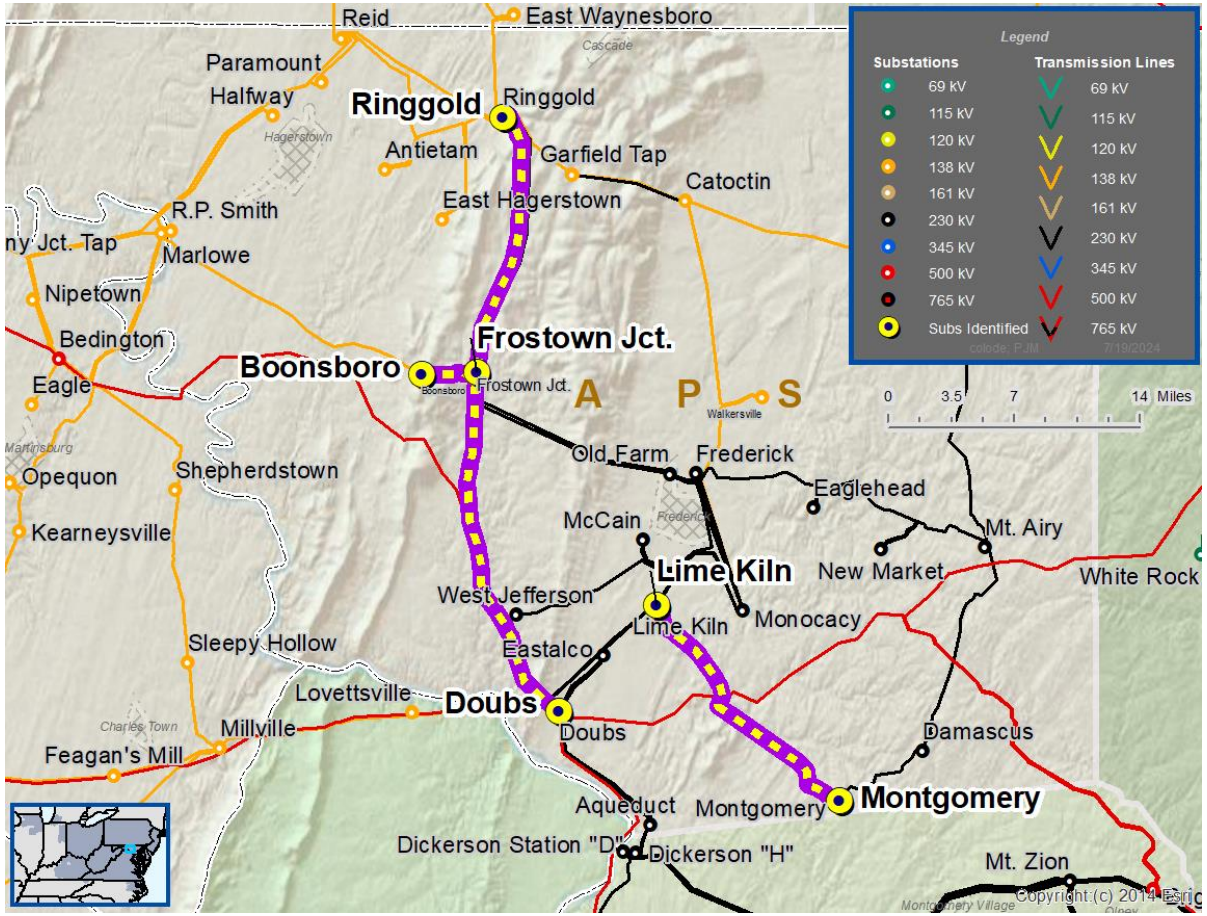

APS Transmission Zone M-3 Process
Misoperation Relay Projects

Need #	Transmission Line / Substation Locations	Existing Line Rating MVA (SN / SE / WN /WE)	Existing Conductor Rating MVA (SN / SE / WN / WE)
APS-2024-057	Doubs – Frostown Junction 230 kV Line	617 / 698 / 699 / 762	617 / 754 / 699 / 894
	Frostown Junction – Ringgold 230 kV Line	324 / 349 / 361 / 381	617 / 754 / 699 / 894
APS-2024-058	Lime Kiln – Montgomery 230 kV Line	548 / 688 / 699 / 804	617 / 754 / 699 / 894

APS Transmission Zone M-3 Process Misoperation Relay Projects

Selected Solution:

Need #	Transmission Line / Substation Locations	New MVA Line Rating (SN / SE / WN / WE)	Scope of Work	Supplemental ID	Estimated Cost ($ M)	Target ISD
APS-2024-057	Doubs – Frostown Junction 230 kV Line	617 / 754 / 699 / 894	• At Doubs, replace line trap, substation conductor and relaying	s3540.1	$6.30	12/31/2026
	Frostown Junction – Ringgold 230 kV Line	617 / 754 / 699 / 894	• At Ringgold, replace line trap, disconnect switches, substation conductor and relaying			
APS-2024-058	Lime Kiln – Montgomery 230 kV Line	617 / 754 / 699 / 894	• At Lime Kiln, replace CVT on bus, substation conductor and relaying • At Montgomery, replace CVT on bus, disconnect switches, substation conductor and relaying	s3541.1	$9.20	10/31/2026

APS Transmission Zone M-3 Process Misoperation Relay Projects

Need Number: APS-2020-003
Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan – 3/7/2025
Previously Presented: Solution Meeting – 08/16/2024
Need Meeting – 04/16/2020

Project Driver:
Equipment Material Condition, Performance and Risk
Operational Flexibility and Efficiency

Specific Assumption Reference:
System Performance Projects Global Factors
- System reliability and performance
- Substation/line equipment limits

System Condition Projects
- Substation Condition Rebuild/Replacement

Upgrade Relay Schemes
- Obsolete and difficult to repair communication equipment (DTT, Blocking, etc.)
- Communication technology upgrades

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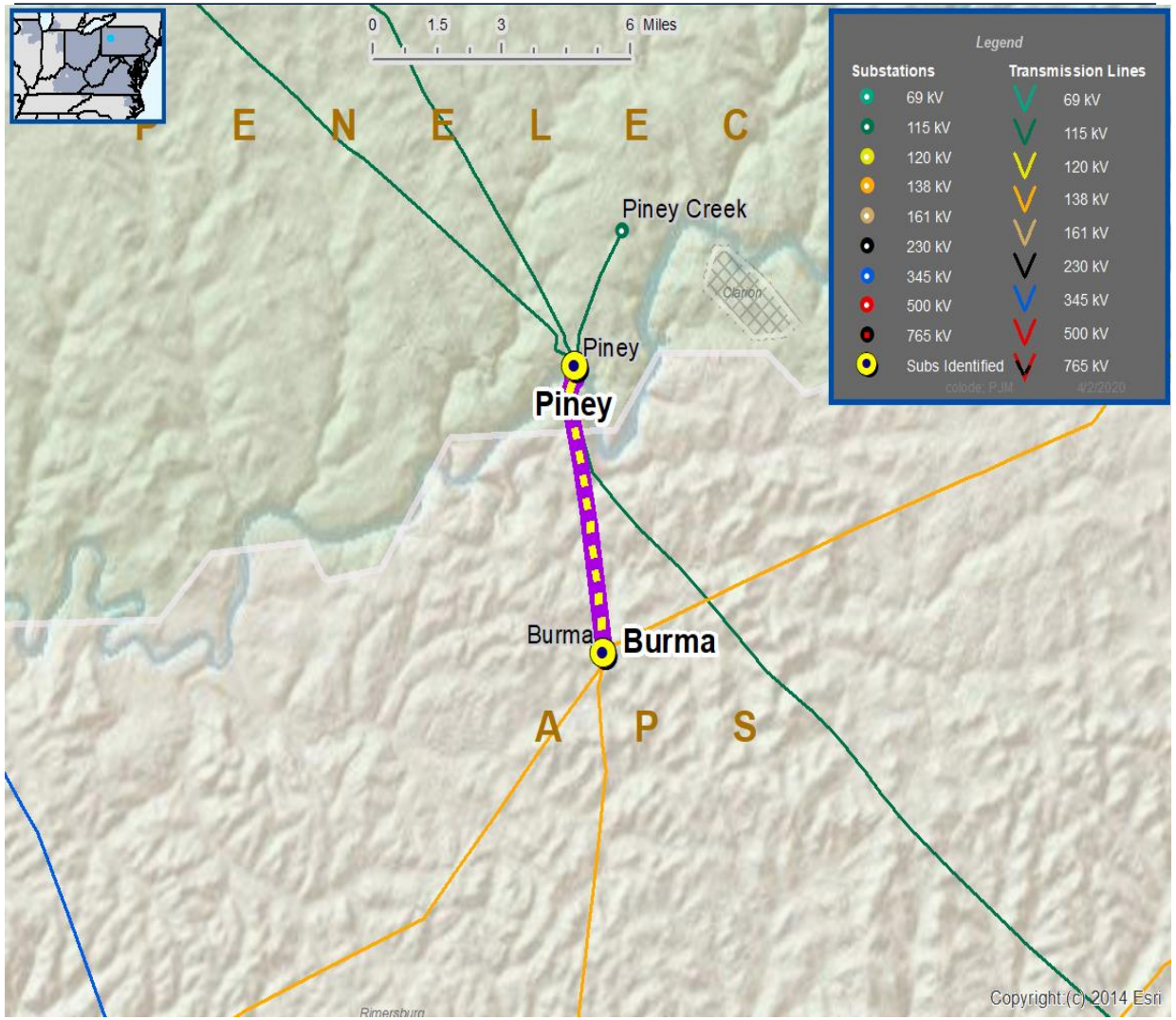


APS Transmission Zone M-3 Process Misoperation Relay Projects

Problem Statement:

- FirstEnergy has identified protection schemes using a certain vintage of relays and communication equipment that have a history of misoperation.
- Proper operation of the protection scheme requires all the separate components perform adequately during a fault.
- In many cases the protection equipment cannot be repaired due to a lack of replacement parts and available expertise in the outdated technology.
- Transmission line ratings are limited by terminal equipment.

Need #	Transmission Line / Substation Locations	Existing Line Rating MVA (SN/SE/WN/WE)	Existing Conductor Rating MVA (SN/SE/WN/WE)
APS-2020-003 PN-2020-004	Burma – Piney 115 kV Line	221 / 262 / 263 / 286	232 / 282 / 263 / 334

APS Transmission Zone M-3 Process Misoperation Relay Project

Selected Solution:

Need #	Transmission Line / Substation Locations	New MVA Line Rating (SN/SE/WN/WE)	Scope of Work	Supplemental ID	Estimated Cost ($ M)	Target ISD
APS-2020-003 PN-2020-004	Burma – Piney 115 kV Line	232 / 282 / 263 / 334	• At Burma, replace line trap, substation conductor and relays.	s3542.1	$1.9	10/31/2025

APS Transmission Zone M-3 Process
Monocacy No. 4 230/138 kV Transformer

Need Number: APS-2024-061

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan – 4/7/2025

Previously Presented: Solution Meeting – 11/06/2024

Need Meeting – 06/04/2024

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

System Performance Projects Global Factors

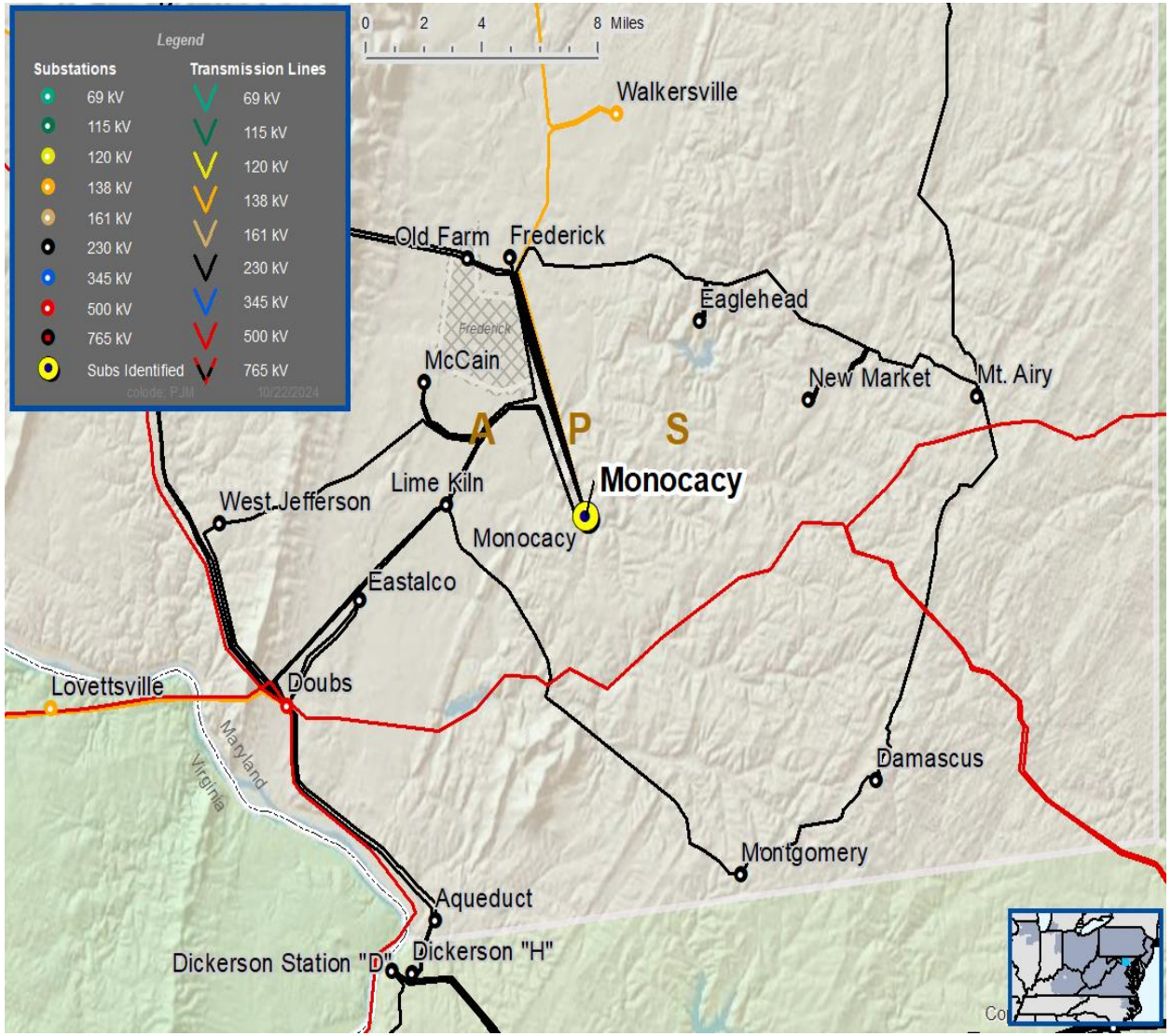
- System reliability and performance

Add/Replace Transformers

Past System Reliability/Performance

Problem Statement:

- The Monocacy No. 4 230/138 kV Transformer is approximately 51 years old and is approaching end of life.
- The transformer has experienced an increase in the level of acetylene.
- The transformer relaying is obsolete.
- Existing transformer ratings:
  - 260 / 338 MVA (SN / SSTE)
  - 313 / 368 MVA (WN / WSTE)



APS Transmission Zone M-3 Process
Monocacy No. 4 230/138 kV Transformer

Need Number: APS-2024-061
Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan 3/28/2025 – 4/7/2025

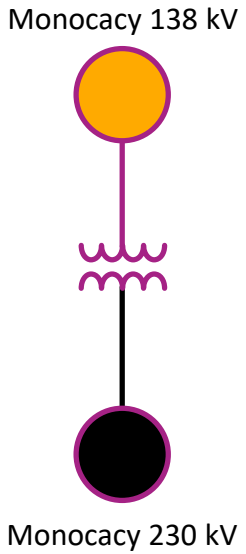
Selected Solution:

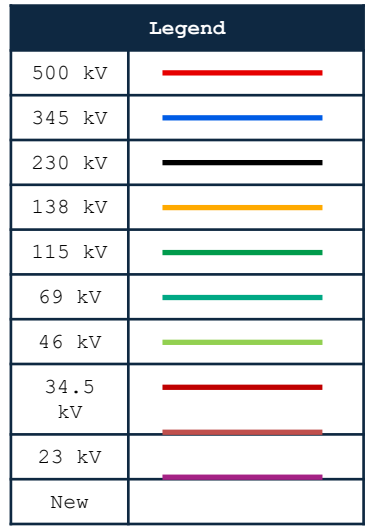
- At Monocacy Substation:
  - Replace No. 4 230/138 kV 224 MVA Transformer with a new 266 MVA unit
  - Replace transformer conductor, circuit breakers, disconnect switches and relaying

Anticipated Transformer Circuit Ratings:

- Monocacy No. 4 230/138 kV Transformer:
  - Before Proposed Solution: 260 / 338 / 313 / 368 MVA (SN/SSTE/WN/WSTE)
  - After Proposed Solution: 266 / 346 / 320 / 377 MVA (SN/SSTE/WN/WSTE)

Estimated Project Cost: $9.00 M
Projected In-Service: 12/31/2027
Supplemental Number: s3573.1





APS Transmission Zone M-3 Process
Pruntytown No. 3 500/138 kV Transformer

Need Number: APS-2024-071
Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan - 4/7/2025
Previously Presented: Solution Meeting 01/07/2025
Need Meeting 08/06/2024

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

System Performance Projects Global Factors

- System reliability and performance

Add/Replace Transformers

Past System Reliability/Performance

Problem Statement:

- The Pruntytown No. 3 500/138 kV Transformer is approximately 48 years old and is approaching end of life.
- The transformer has experienced an increase in moisture content.
- The transformer parts and relaying are obsolete.
- The transformer and relaying equipment cannot be repaired due to a lack of replacement parts and available expertise in the outdated technology.
- Existing transformer ratings:
  - 430 / 552 MVA (SN / SSTE)
  - 505 / 585 MVA (WN / WSTE)

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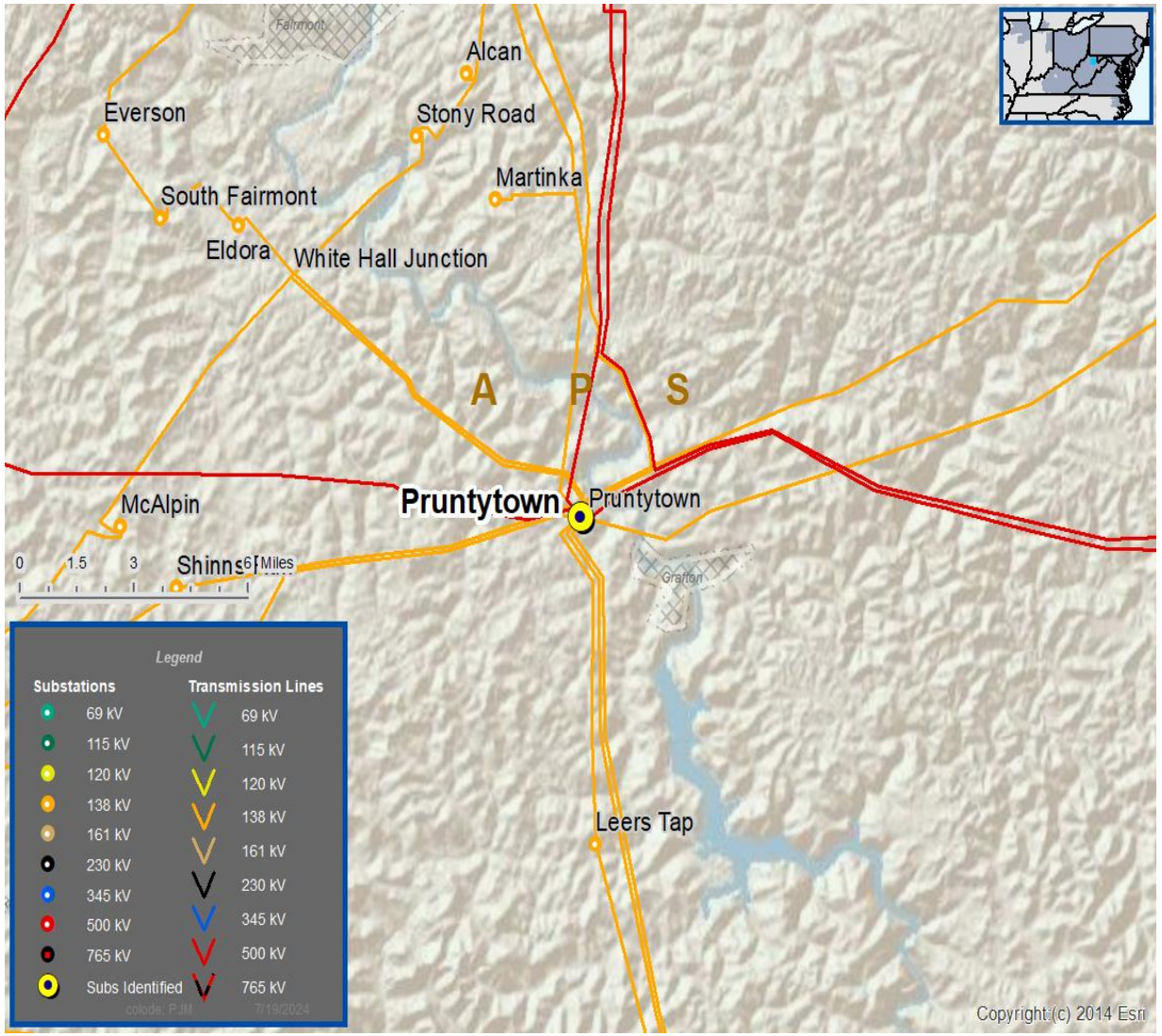


APS Transmission Zone M-3 Process
Pruntytown No. 3 500/138 kV Transformer

Need Number: APS-2024-071

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan – 4/7/2025

Selected Solution:

- At Pruntytown Substation:
  - Replace the existing 500/138 kV Transformer No. 3
  - Replace transformer conductor, circuit breakers, disconnect switches and relaying

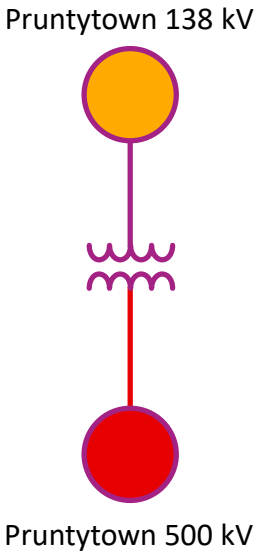
Anticipated Transformer Circuit Ratings:

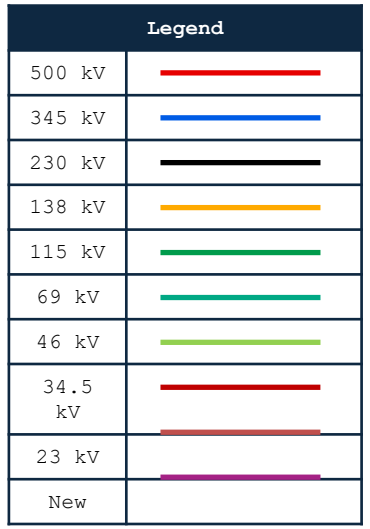
- 500/138 kV Transformer No. 3 :
  - Before Proposed Solution: 430 / 552 / 505 / 585 MVA (SN / SSTE / WN / WSTE)
  - After Proposed Solution (anticipated): 448 / 582 / 527 / 618 MVA (SN / SSTE / WN / WSTE)

Estimated Project Cost: $15.77 M

Projected In-Service: 6/30/2029

Supplemental Number: s3574.1





APS Transmission Zone M-3 Process
Stony Springs Junction Area

Need Number: APS-2023-022

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan – 4/7/2025

Previously Presented: Solution Meeting – 11/15/2024
Need Meeting – 07/21/2023

Project Driver:

Operational Flexibility and Efficiency

Specific Assumption Reference:

- System reliability and performance
- Load at risk in planning and operational scenarios
- Add/Expand Bus Configuration
- Upgrade Relay Schemes

Problem Statement:

- The Stony Springs Junction (Harrison City - Hempfield – Luxor) 138 kV Line is a three terminal line that provides direct service to over 25,000 customers and provides a transmission network path.
- The multi-terminal line creates difficulties for protective relaying.
- The tap stations on the line lack switches and SCADA.
- Terminals stations are equipped with antiquated relaying schemes and equipment that limits the use of the full capacity of the transmission line conductor.
- There is ~25 MW of load served directly from the line. Additionally, the line has 25 miles of exposure.

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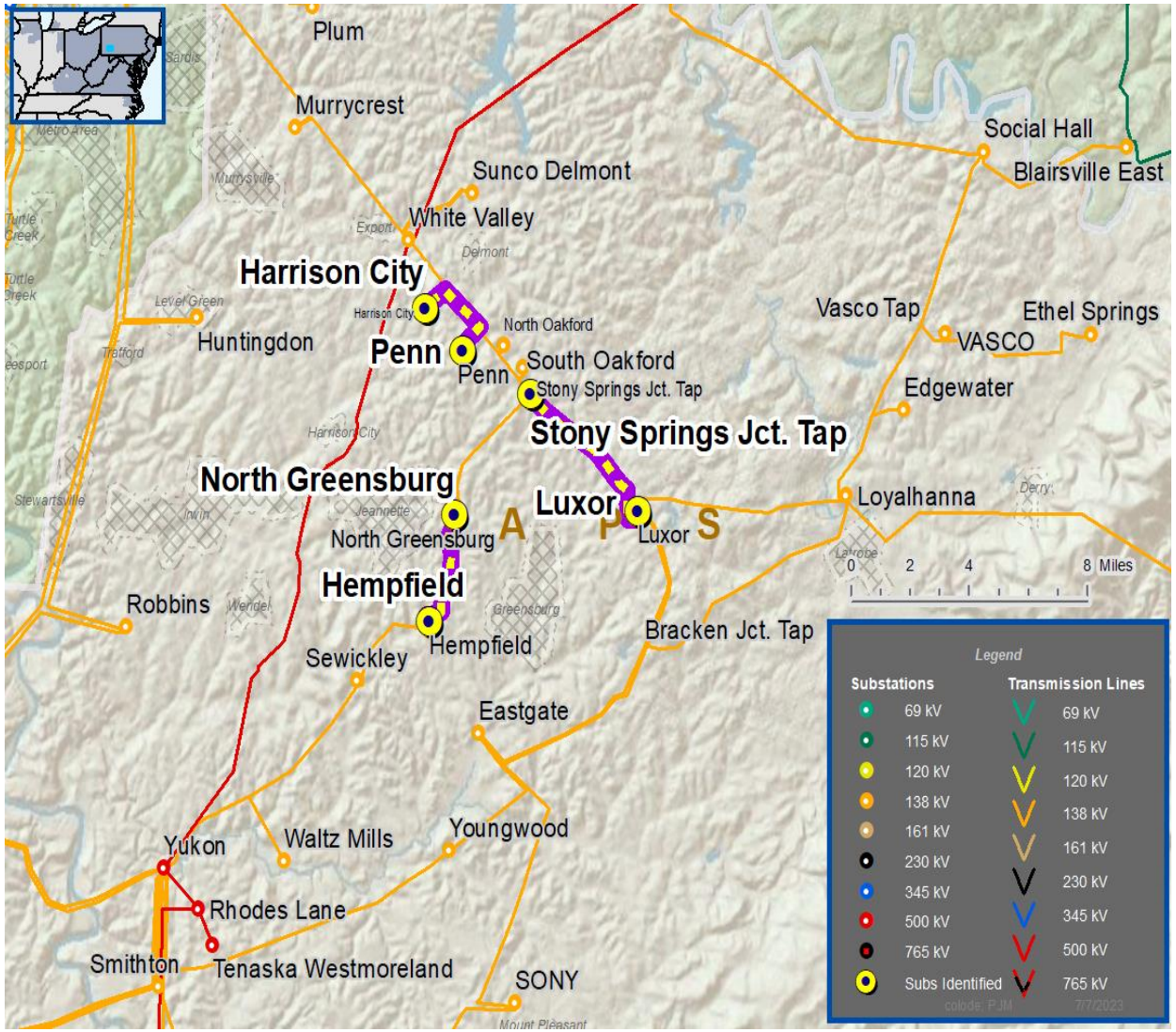


APS Transmission Zone M-3 Process
Stony Springs Junction Area

Need #	Transmission Line / Substation Locations	Existing Line Rating MVA (SN / SE / WN / WE)	Existing Conductor Rating MVA (SN / SE / WN / WE)
APS-2023-022	Harrison City – Penn 138 kV Line	242 / 297 / 310 / 351	308 / 376 / 349 / 445
	Penn – North Oakford Tap 138 kV Line	296 / 302 / 332 / 332	296 / 302 / 332 / 332
	North Oakford Tap – South Oakford Tap 138 kV Line	296 / 302 / 332 / 332	296 / 302 / 332 / 332
	North Oakford Tap – Delmont 138 kV Line	221 / 268 / 250 / 317	221 / 268 / 250 / 317
	South Oakford Tap – Stony Springs Junction 138 kV Line	296 / 302 / 332 / 322	296 / 302 / 332 / 322
	Stony Springs Junction – North Greensburg 138 kV Line	308 / 376 / 349 / 445	308 / 376 / 349 / 445
	North Greensburg – Hempfield 138 kV Line	294 / 350 / 349 / 401	308 / 376 / 349 / 445
	Stony Springs Junction – Luxor 138 kV Line	296 / 302 / 332 / 332	296 / 302 / 332 / 332

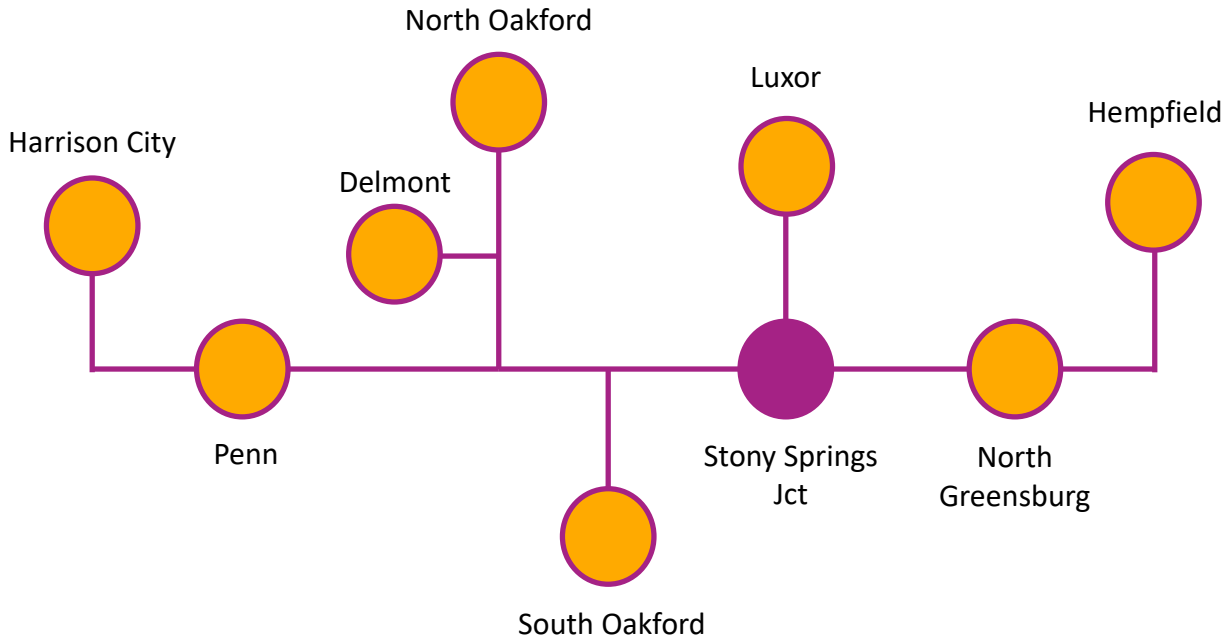
APS Transmission Zone M-3 Process
Stony Springs Junction Area

Selected Solution:

Need #	Transmission Line / Substation Locations	New MVA Line Rating (SN / SE / WN / WE)	Scope of Work	Estimated Cost ($M)	Target ISD
APS-2023-022	Harrison City – Penn 138 kV Line	308 / 376 / 349 / 445	▪ At Harrison City Substation: Replace bus and line side breaker risers. ▪ At Penn Substation: Install one line breaker and one bus tie breaker.	$13.6	6/22/2027
	Penn – North Oakford Tap 138 kV Line	296 / 302 / 332 / 332	▪ At North Oakford Tap: Install new disconnect switches equipped with auto-sectionalizing.		
	North Oakford Tap – South Oakford Tap 138 kV Line	296 / 302 / 322 / 332	▪ At South Oakford Tap: Install three switches with SCADA.		
	North Oakford – Delmont 138 kV Line	221 / 268 / 250 / 317	▪ At North Oakford Substation: Install full SCADA control on the existing switch. ▪ At Delmont Substation: Install full SCADA control on the existing switch.		
	South Oakford Tap – Stony Springs Junction 138 kV Line	296 / 302 / 332 / 322	▪ At Stony Springs Junction: Install a three-breaker ring bus and associated relaying.		
	Stony Springs Junction – North Greensburg 138 kV Line	308 / 376 / 349 / 445	▪ At North Greensburg Substation: Replace circuit breaker.		
	North Greensburg – Hempfield 138 kV Line	308 / 376 / 349 / 445	▪ At Hempfield: Replace line circuit breaker, disconnect switches and associated relaying.		
	Stony Springs Junction – Luxor 138 kV Line	296 / 302 / 332 / 367	▪ At Luxor Substation: Replace circuit breaker, substation conductor, breaker risers on both sides of breaker and relaying.		

APS Transmission Zone M-3 Process
Stony Springs Junction Area

Selected Solution:



Legend	
500 kV	
345 kV	
230 kV	
138 kV	
115 kV	
69 kV	
46 kV	
34.5 kV	
23 kV	
New	

Estimated Project Cost: $13.6M

Projected In-Service: 6/22/2027

Supplemental Number: s3575.1

APS Transmission Zone M-3 Process
New Customer

Need Number: APS-2023-029 (s3150.1, s3150.2)

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan - 4/7/2025

Previously Presented: Re-Present Solutions Meeting – 01/07/2025

Solution Meeting – 02/06/2024

Need Meeting – 7/11/2023

Project Driver(s):

Customer Service

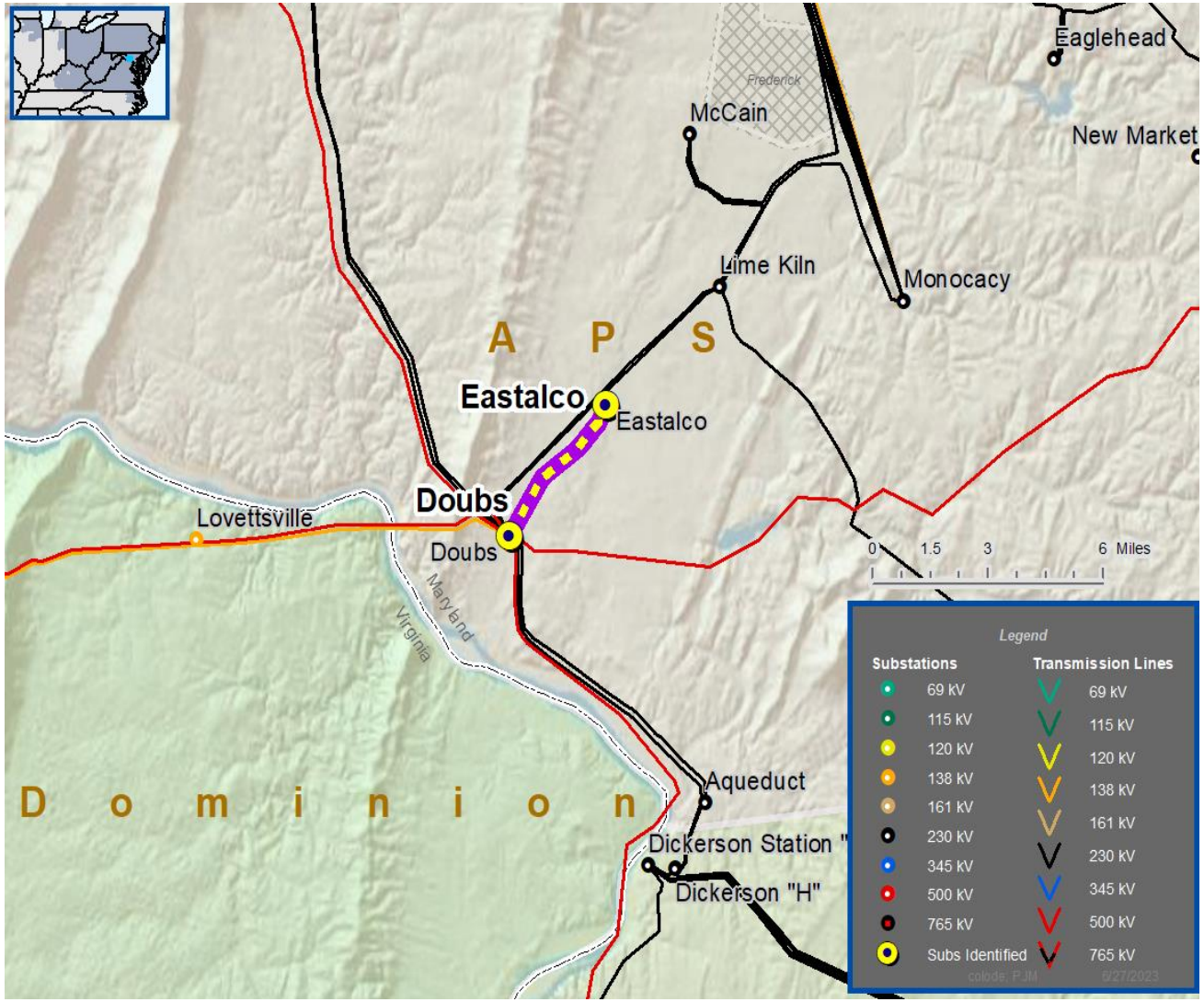
Specific Assumption Reference(s):

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 has requested 230 kV transmission service for approximately 300 MW of load near the Doubs-Sage #206 230 kV Line.

Requested In-Service Date: May 15, 2025



APS Transmission Zone M-3 Process
New Customer

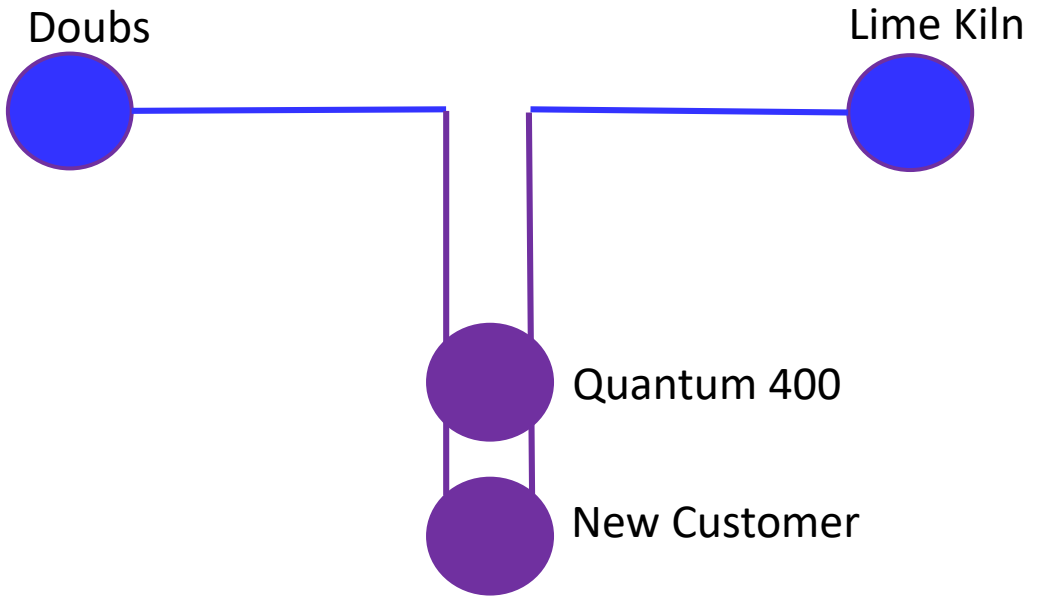
Need Number: APS-2023-029 (s3150.1, s3150.2)

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan – 4/7/2025

Selected Solution:

- Build a six breaker, three bay (expandable to four bays), breaker-and-a-half substation (Quantum 400)
- Loop the Doubs – Lime Kiln #231 230 kV Line in and out of the new substation
- Modify line relay settings at Doubs and Lime Kiln substations
- Provide two feeds to the customer facility

Estimated Project Cost: $23.2M
Projected In-Service: 12/31/2025
Supplemental Number: s3150.1, s3150.2



Legend	
500 kV	
230 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

APS Transmission Zone M-3 Process
New Customer

Need Number: APS-2023-029

Process Stage: Submission of Supplemental Projects for Inclusion in the Local Plan – 4/7/2025

Selected Solution:

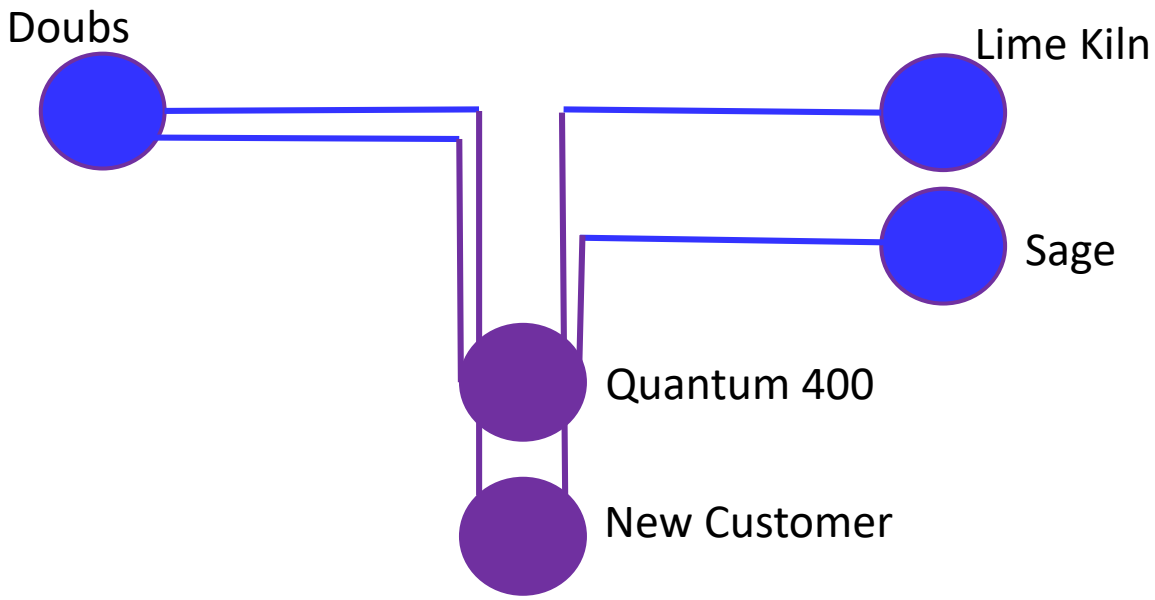
230 kV Transmission Substation (Quantum 400)

- Expand Quantum 400 station to a ten breaker, breaker-and-a-half substation
- Loop the Doubs – Sage #206 230 kV Line in and out of the new substation
- Modify line relay settings at Doubs and Sage substations

Estimated Project Cost: $8M

Projected In-Service: 12/31/2027

Supplemental Number: s3150.1, s3150.2



Legend	
500 kV	
230 kV	
138 kV	
69 kV	
34.5 kV	
23 kV	
New	

Revision History

3/7/2025 – V1 – Original Slides posted.

4/7/2025 – V2- s3573.1 ,s3574.1, s3575.1 ,s3150.1 (represent) & s3150.2 (represent)