

Transmission Expansion Advisory Committee FirstEnergy Supplemental Projects

February 6, 2024

Needs

Stakeholders must submit any comments within 10 days of this meeting in order to provide time necessary to consider these comments prior to the next phase of the M-3 process

Need Numbers: APS-2024-020 to APS-2024-022

Process Stage: Need Meeting 02/06/2024

Project Driver:

- Performance and Risk
- Operational Flexibility and Efficiency
- Infrastructure Resilience

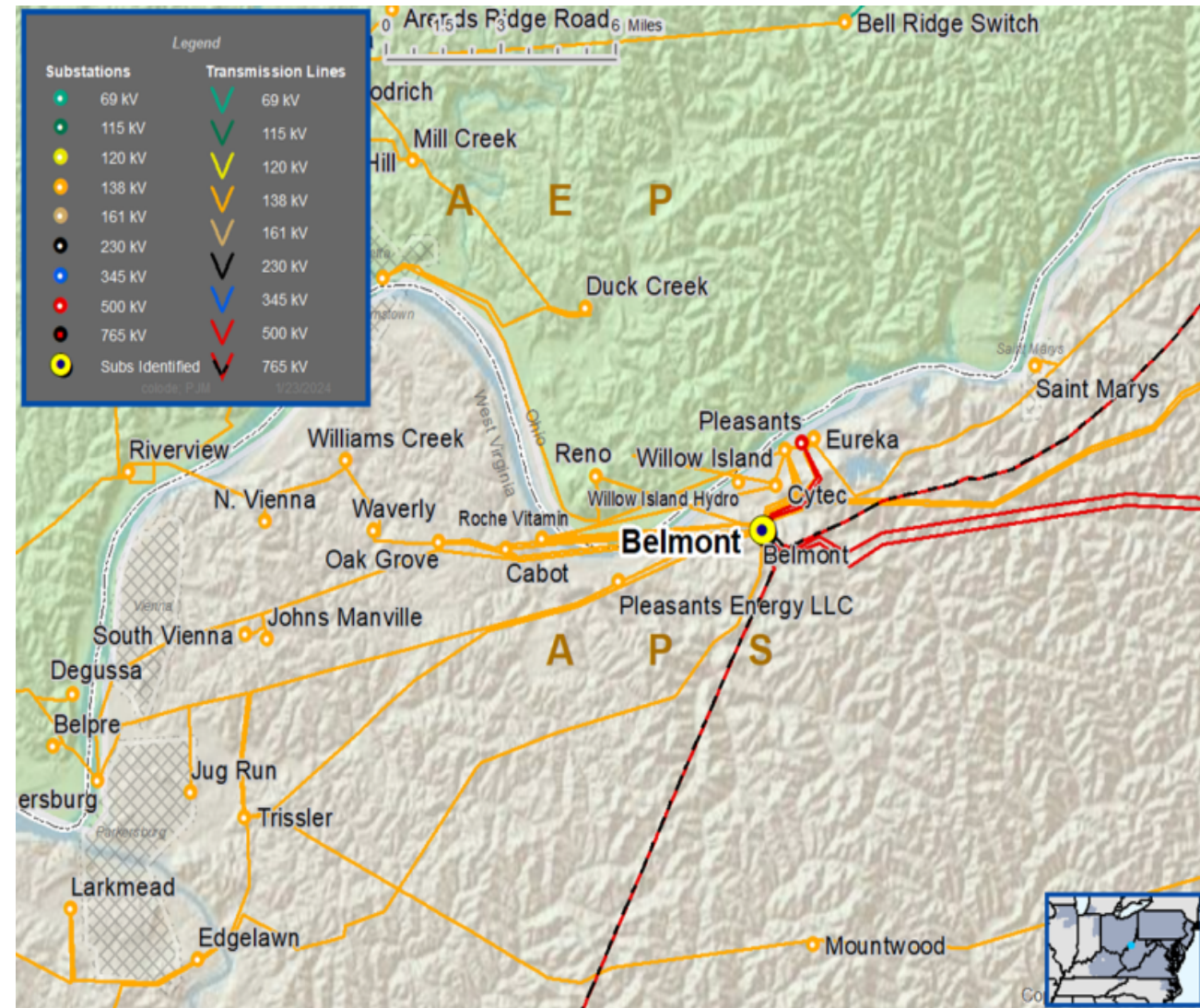
Specific Assumption Reference:

System Performance Projects Global Factors

- System Reliability and Performance
- Substation/line equipment limits
- Upgrade Relay Schemes

Problem Statement:

- The 500/138 kV Transformers #1, 2 and 3 at Belmont Substation were manufactured over 45 years ago and are approaching end of life.
- The transformers exhibit multiple maintenance issues including:
 - Elevated gas levels (such as oxygen) compared with IEEE Standards.
 - History of low breakdown voltage indicating polar contaminants.
- Equipment degradation and obsolete replacement parts.
 - The jaws of the switches are heavily worn.
- Existing TR #1 Ratings: 459 / 571 MVA (SN/SE)
- Existing TR #2 Ratings: 440 / 559 MVA (SN/SE)
- Existing TR #3 Ratings: 491 / 550 MVA (SN/SE)



Solutions

Stakeholders must submit any comments within 10 days of this meeting in order to provide time necessary to consider these comments prior to the next phase of the M-3 process

Need Numbers: APS-2024-002, APS-2024-003, APS-2024-004

Process Stage: Solution Meeting 02/06/2024

Previously Presented: Need Meeting 01/09/2024

Project Driver:

Equipment Material Condition, Performance and Risk

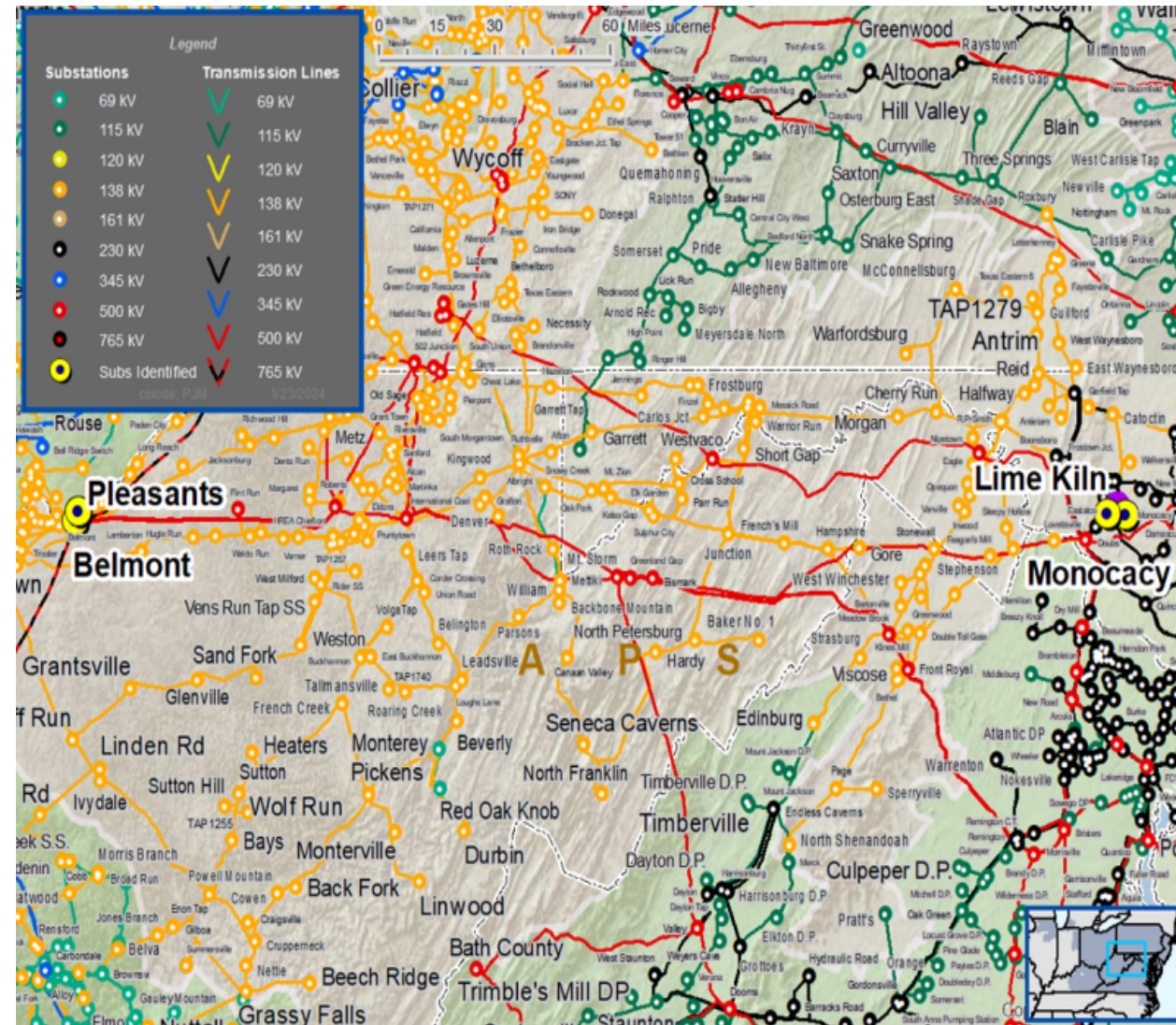
Specific Assumption Reference:

- 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.

Continued on next slide...





APS Transmission Zone M-3 Process Misoperation Relay Projects

Need #	Transmission Line / Substation Locations	Existing Line Rating (SN / SE / WN / WE)	Existing Conductor Rating (SN / SE / WN / WE)
APS-2024-002	Lime Kiln – Monocacy 230 kV	548 / 688 / 699 / 804	617 / 754 / 699 / 894
APS-2024-003	Belmont – Pleasants Unit 1 500 kV	1986 / 2492 / 2611 / 2991	3573 / 4379 / 4050 / 5194
APS-2024-004	Belmont – Pleasants Unit 2 500 kV	1986 / 2492 / 2611 / 2991	3573 / 4379 / 4050 / 5194

Proposed Solution:

Need #	Transmission Line / Substation Locations	New MVA Line Rating (SN / SE / WN / WE)	Scope of Work	Estimated Cost (\$ M)	Target ISD
APS-2024-002	Lime Kiln – Monocacy 230 kV	617 / 754 / 699 / 894	<ul style="list-style-type: none"> At Lime Kiln, replace wave trap, substation conductor and relaying At Monocacy, replace disconnect switches, wave trap, line tuner, and coax, substation conductor, CTs and relaying 	\$2.7 M	12/31/2025
APS-2024-003	Belmont – Pleasants Unit 1 500 kV	3573 / 4379 / 4050 / 5194	<ul style="list-style-type: none"> At Belmont, replace disconnect switches, substation conductor, surge arresters and relaying 	\$2.2 M	06/01/2025
APS-2024-004	Belmont – Pleasants Unit 2 500 kV	3573 / 4379 / 4050 / 5194	<ul style="list-style-type: none"> At Belmont, replace disconnect switches, substation conductor, metering and relaying 	\$1.28 M	12/01/2025

Alternatives Considered: Maintain equipment in existing condition

Project Status: Engineering

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

Re-Present Solutions

Stakeholders must submit any comments within 10 days of this meeting in order to provide time necessary to consider these comments prior to the next phase of the M-3 process

Need Number: APS-2023-017
Process Stage: Re-Present Solutions Meeting – 02/06/2024
Previously Presented: Solution Meeting – 8/8/2023
 Need Meeting – 6/6/2023

Project Driver(s):
 Customer Service

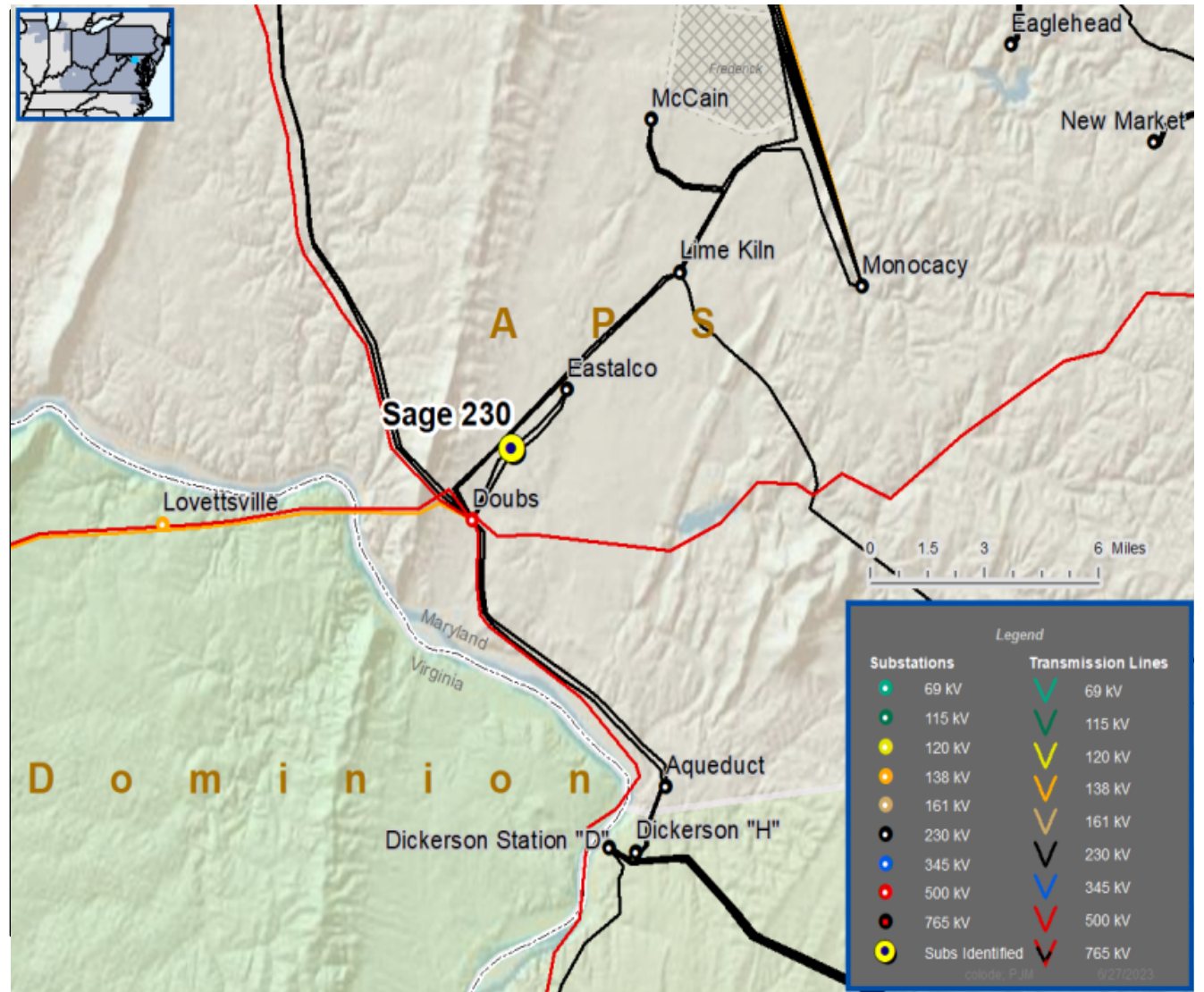
Specific Assumption Reference(s)

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

Problem Statement

Existing Customer Connection load increase - has requested a load addition to the 230 kV delivery point Sage Substation (s2881). The anticipated load increase is 336 MW with a total site load of 576 MW.

Requested in-service date is 02/13/2026.



Need Number: APS-2023-017
Process Stage: Re-Present Solutions Meeting – 02/06/2024
Previously Presented: Solution Meeting – 8/8/2023
 Need Meeting – 6/6/2023

Proposed Solution 1 of 3:

230 kV Transmission substation Expansion

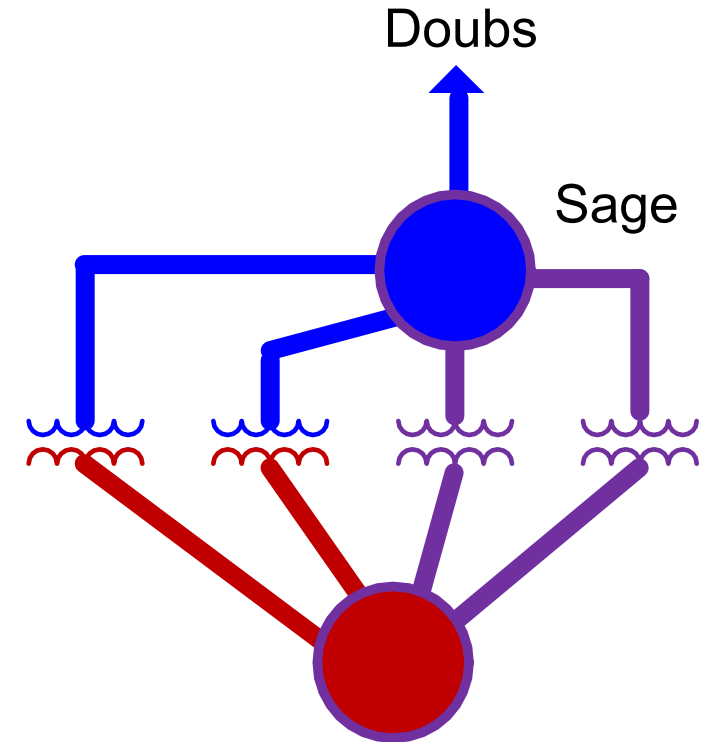
- Expand the existing 3-breaker ring bus into a 6 breaker, breaker-and-a-half substation by installing three new 230 kV circuit breakers
- Install 2 230-34.5 kV transformers
- Construct 2 34.5 kV busses on the low side of transformers

Alternatives Considered:

- No feasible alternatives to meet customer’s request

Estimated Project Cost: \$1.5M

Projected In-Service: 10/01/2025
Status: Engineering
Model: 2022 RTEP Model for 2027 Summer (50/50)



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



APS Transmission Zone M-3 Process Sage 230 kV Customer load addition- Solution Phase 3

Need Number: APS-2023-017
Process Stage: Re-Present Solutions Meeting – 02/06/2024
Previously Presented: Solution Meeting – 8/8/2023
 Need Meeting – 6/6/2023

Proposed Solution 2 of 3 :

230 kV Transmission substation Expansion

(Addresses load loss criteria violation and voltage concerns in area)

- Expand the six breaker, breaker-and-a-half substation to 15 breakers by adding nine 230 kV circuit breakers.
- Terminate the Doubs-Eastalco 206 230 kV Line into the Sage Substation
- Loop in the Doubs-Lime Kiln 207 230 kV Line into the Sage Substation

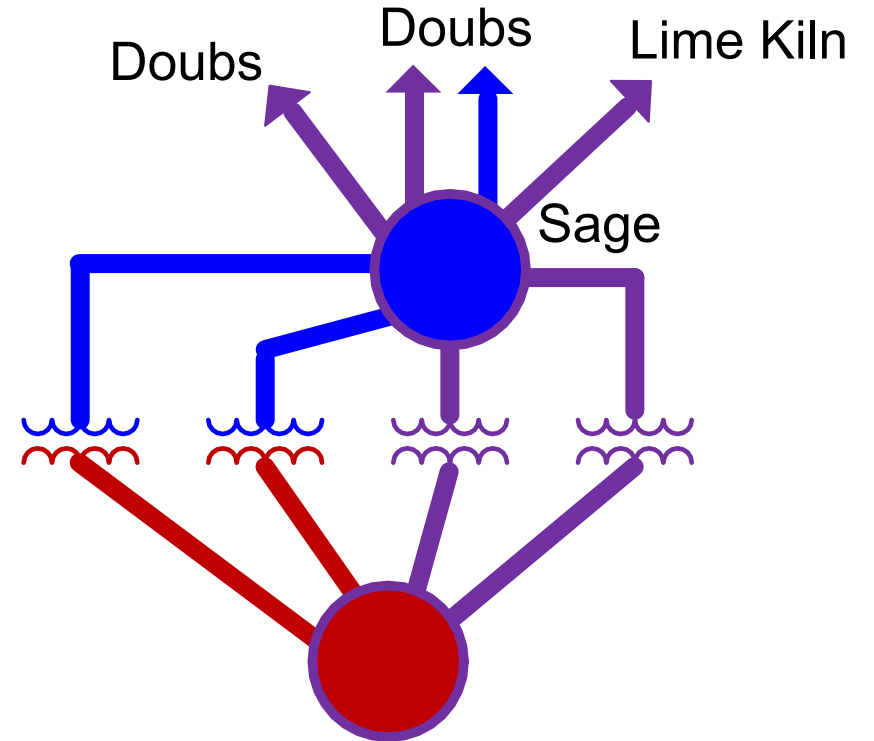
Alternatives Considered:

- No feasible alternatives to meet reliability criteria violations due to customer’s load increase. The Doubs-Eastalco 206 230 kV Line and the Doubs-Lime Kiln 207 230 kV Line are near and adjacent to the Sage Substation.

Estimated Project Cost: \$25M

Projected In-Service: 12/31/2027

Status: Project Initiation



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



APS Transmission Zone M-3 Process Sage 230 kV Customer load addition- Solution

Need Number: APS-2023-017
 Process Stage: **Re-Present Solutions Meeting – 02/06/2024**
 Previously Presented: Solution Meeting – 8/8/2023
 Need Meeting – 6/6/2023

Proposed Solution 3 of 3 :

Bartonville-Meadow Brook 138 kV Line upgrades (To be completed under n8061.6 by 12/31/2024)

(Addresses thermal violation on transmission line)

- Replace one 1200A Wave Trap at Meadow Brook Substation
- Revise relay settings

Line Ratings

- 292 MVA SN/314 MVA SE (Before Proposed Solution)
- 329 MVA SN/413 MVA SE (After Proposed Solution)

~~Alternatives Considered: —~~

~~▪ None~~

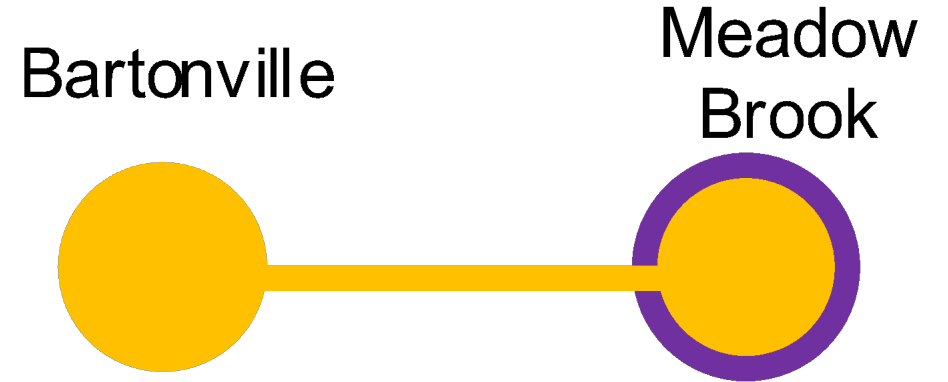
~~Estimated Project Cost: \$0.7M~~

~~Projected In Service: 03/01/2025~~

~~Status: Project Initiation~~

Solution provided assumes the following project is completed:

- RTEP # b3772: Reconductor 27.3 miles of the Messick Rd – Morgan 138 kV Line (Projected In-Service date 6/1/2027)



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

Need Number: APS-2023-029

Process Stage: Re-Present Solutions Meeting – 02/06/2024

Previously Presented: Solution Meeting – 10/31/2023
Need Meeting – 7/11/2023

Project Driver(s):
Customer Service

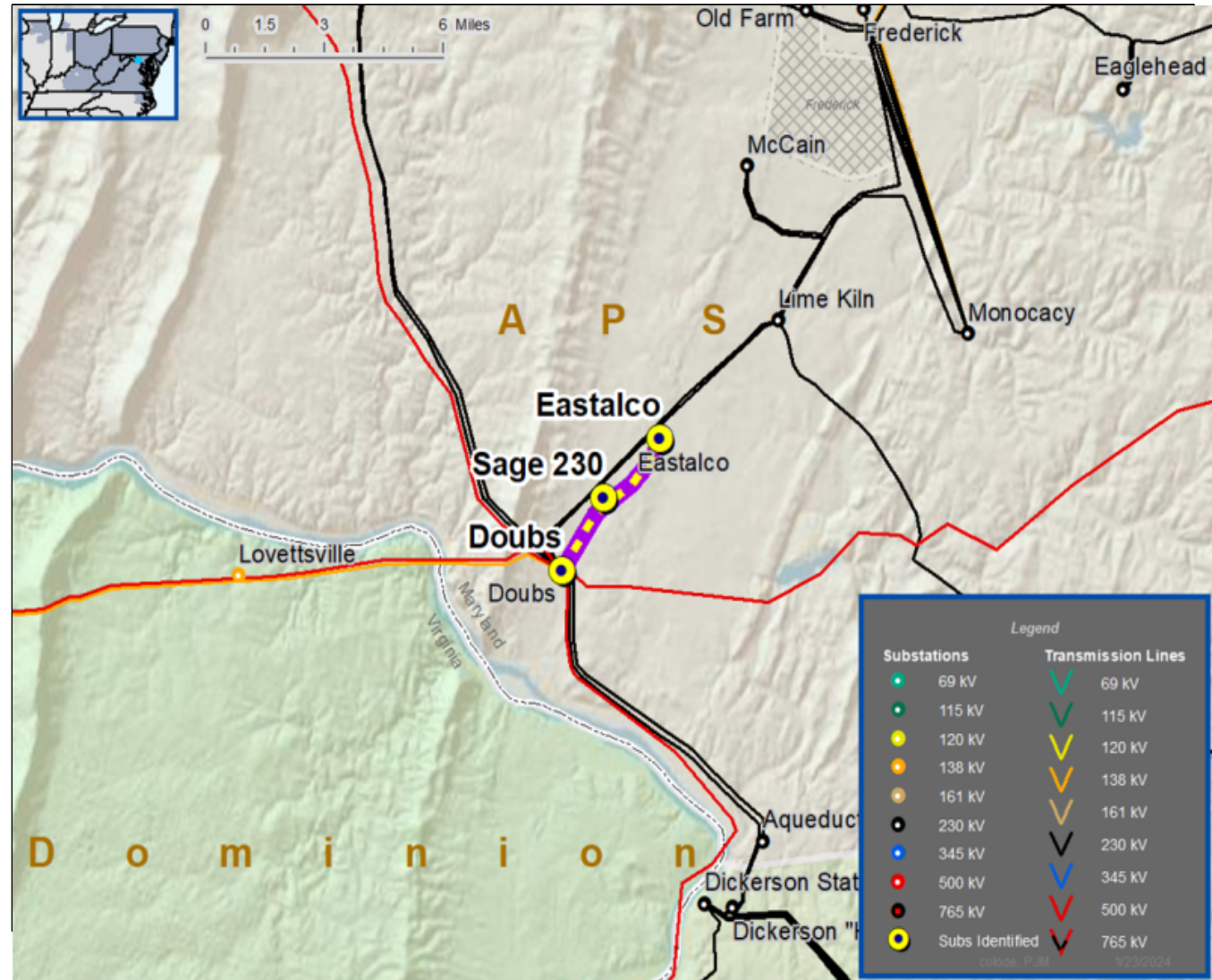
Specific Assumption Reference(s)

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 Doubs-Sage ~~#206~~ 230 kV New Customer

New additional scope to mitigate thermal violations found by PJM’s DNH analysis:

Need Number: APS-2023-029

Process Stage: Re-Present Solutions Meeting – 02/06/2024

Previously Presented: Solution Meeting – 10/31/2023

Need Meeting – 7/11/2023

Proposed Solution:

230 kV Transmission Substation (Quantum 400)

- ~~• Build a six breaker, two bay (expandable to four bays), breaker and a half substation~~
- Expand Quantum 400 station to a nine 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

~~• Provide two feeds to the customer facility~~

Violations identified during load study: (see next slides for reinforcements needed to address PJM’s DNH study)

- ~~• Thermal violation on the Doubs-Sage #206 230 kV Line~~
- ~~• Thermal violation on the #1, #2, and #4 500/230 kV transformers at Doubs Substation~~
- ~~• Thermal violation on the Doubs-Lime Kiln #207 230 kV Line~~

Alternatives Considered:

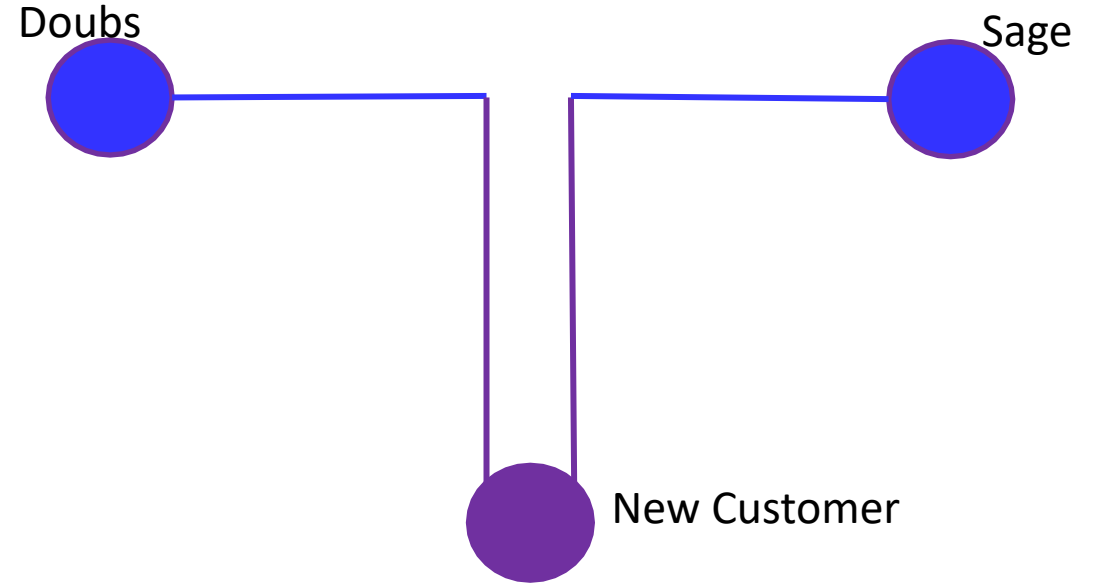
- No other feasible alternatives to serve the customer’s load

Estimated Project Cost: ~~\$20.8M~~ \$14.6M

Projected In-Service: ~~3/3/2025~~ 12/31/2027 (coordinate with APS-2023-017)

Status: ~~Pre-Engineering-Conceptual~~

Model: ~~2023 RTEP model for 2028 Summer (50/50)~~ 2028 RTEP case with 2022W3 solution



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

New additional scope to mitigate voltage and thermal violations found by PJM’s DNH analysis:

Need Number: APS-2023-029

Process Stage: Re-Present Solutions Meeting – 02/06/2024

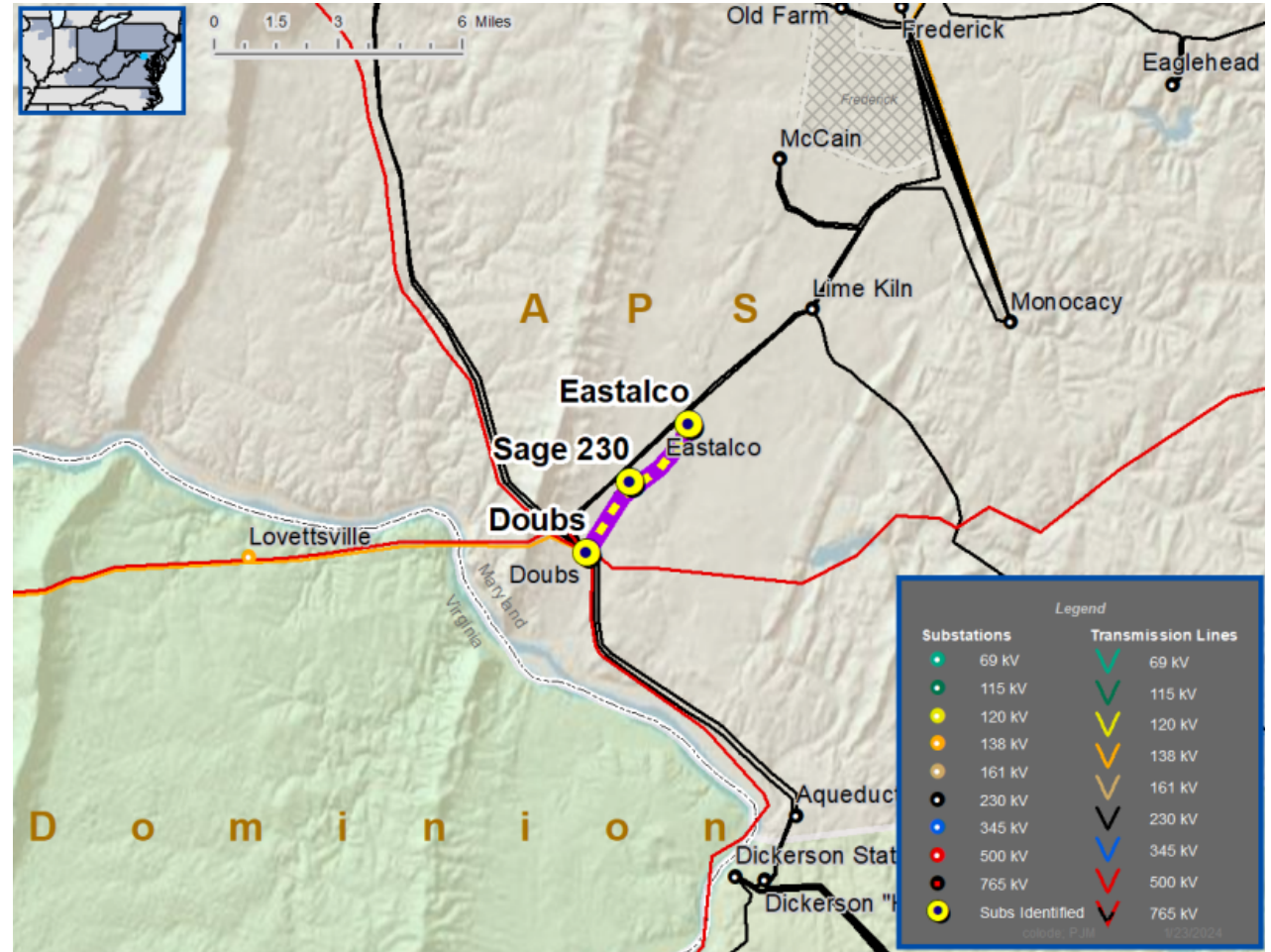
Proposed Solution:

- Build a six breaker, two 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: ~~\$14.6M~~ \$20.8M

Projected In-Service: 09/01/2025

Status: Pre-Engineering



Questions?



Appendix

High Level M-3 Meeting Schedule

Assumptions	Activity	Timing
	Posting of TO Assumptions Meeting information	20 days before Assumptions Meeting
	Stakeholder comments	10 days after Assumptions Meeting
Needs	Activity	Timing
	TOs and Stakeholders Post Needs Meeting slides	10 days before Needs Meeting
	Stakeholder comments	10 days after Needs Meeting
Solutions	Activity	Timing
	TOs and Stakeholders Post Solutions Meeting slides	10 days before Solutions Meeting
	Stakeholder comments	10 days after Solutions Meeting
Submission of Supplemental Projects & Local Plan	Activity	Timing
	Do No Harm (DNH) analysis for selected solution	Prior to posting selected solution
	Post selected solution(s)	Following completion of DNH analysis
	Stakeholder comments	10 days prior to Local Plan Submission for integration into RTEP
	Local Plan submitted to PJM for integration into RTEP	Following review and consideration of comments received after posting of selected solutions

Revision History

1/26/2024 – V1 – Original version posted to pjm.com

2/7/2024 –V2- Slide 14 text changed in the model section