Subregional RTEP Committee
FirstEnergy Supplemental Projects

October 8, 2021

Submission of Supplemental Projects for Inclusion in the Local Plan

APS Transmission Zone M-3 Process Misoperation Relay Project

Need Number: APS-2020-001

Process State: Submission of Supplemental Project for Inclusion in the Local Plan 10/8/2021

Previously Presented:

Need Meeting 4/17/2020

Solution Meeting 2/17/2021

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

Upgrade Relay Schemes

- Relay schemes that have a history of misoperation
- Obsolete and difficult to repair communication equipment (DTT, Blocking, etc.)
- Communication technology upgrades
- Bus protection schemes

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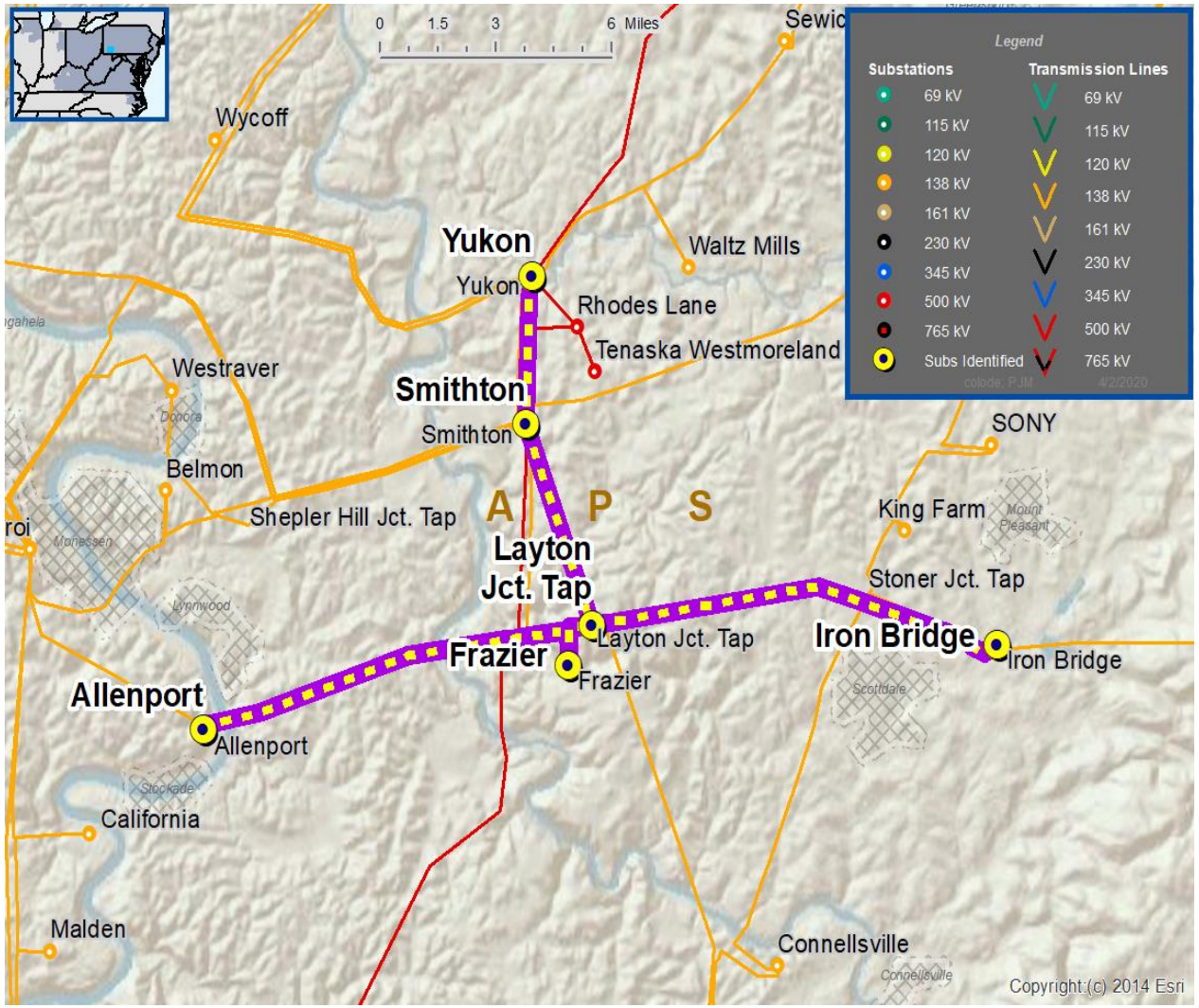


APS Transmission Zone M-3 Process Misoperation Relay Project

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cases the protection equipment cannot be repaired due to a lack of replacement parts and available expertise in the outdated technology.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 (SN / SE)	Existing Conductor Rating (SN / SE)	Limiting Terminal Equipment
APS-2020-001	Allenport – Frazier 138 kV Line	225/295	294/360	Substation Conductor, Line Trap
	Frazier – Layton Junction 138 kV Line	292/359	292/359	N/A
	Yukon – Smithton Tap 138 kV Line	285/287	285/351	Line Relaying, Line Trap
	Smithton Tap – Layton Junction 138 kV Line	236/299	236/299	N/A
	Iron Bridge – Layton Junction 138 kV Line	225/287	268/333	Line Relaying, Substation Conductor, Line Trap, CTs

Selected Solution:

Need Number	Transmission Line / Substation Locations	Supplemental Project ID	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost ($ M)	Target ISD
APS-2020-001	Allenport – Frazier 138 kV Line	s2549	294/360	• Allenport 138 kV Substation – Replace line disconnect switches, CCVT, line Trap, line tuner, coax, replace substation conductor, install AMETEK Smart-Gap in line tuner	$3.8 M	4/2/21
	Frazier – Layton Junction 138 kV Line		292/359	-		
	Yukon – Smithton Tap 138 kV Line		285/351	• Yukon 138 kV Substation – Replace line disconnect switches, CCVT, line trap, line tuner, coaxial cable, install AMETEK Smart-Gap in line tuner		
	Smithton Tap – Layton Junction 138 kV Line		236/299	-		
	Iron Bridge – Layton Junction 138 kV Line		268/333	• Iron Bridge 138 kV Substation – Replace line disconnect switch, CCVT, line trap, line tuner, coaxial cable, substation conductor, install AMETEK Smart-Gap in line tuner		

Model: 2020 RTEP model for 2025 Summer (50/50)

APS Transmission Zone M-3 Process Misoperation Relay Project

Need Number: APS-2019-015 and APS-2020-009

Process State: Submission of Supplemental Project for Inclusion in the Local Plan 10/8/2021

Previously Presented:
Needs Meeting(s) –12/18/2019 and 05/22/2020
Solutions Meeting 03/19/2021

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

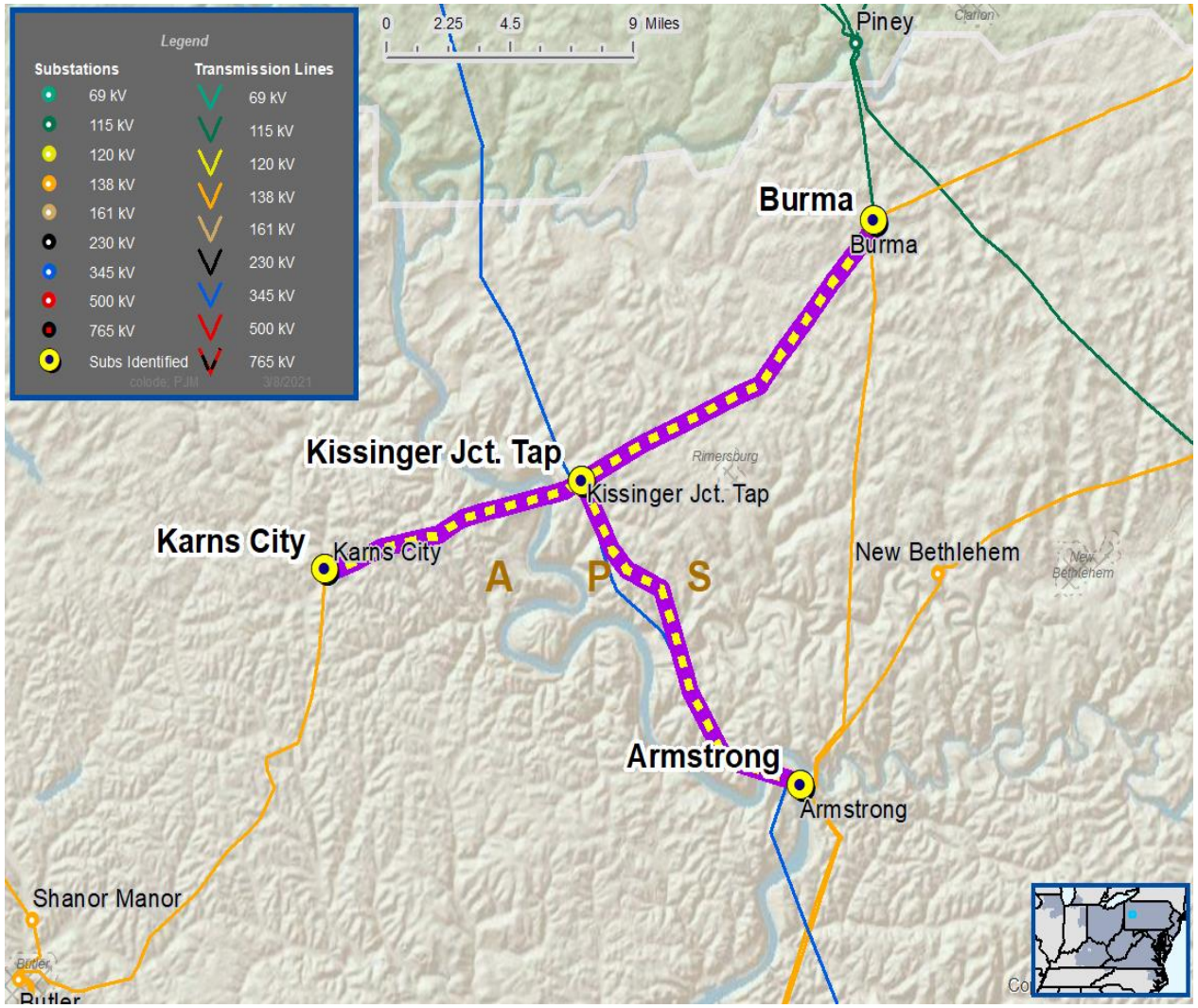
Specific Assumption Reference:

System Performance Projects Global Factors

- System reliability and performance
- Substation/line equipment limits

Upgrade Relay Schemes

- Relay schemes that have a history of misoperation
- Obsolete and difficult to repair communication equipment (DTT, Blocking, etc.)
- Bus Protection schemes



APS Transmission Zone M-3 Process Misoperation Relay Project

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 Number	Transmission Line / Substation Locations	Existing Line Rating (SN / SE)	Existing Conductor Rating (SN / SE)	Limiting Terminal Equipment
APS-2019-015	Karns City – Butler 138 kV Line	141/179	160/192	Substation Conductor
APS-2020-009	Karns City – Kissinger 138 kV Line	221/268	221/268	Line Relaying (existing rating 306 MVA (WE) conductor rating 317 MVA (WE)
	Armstrong – Kissinger 138 kV Line	221/268	221/268	N/A
	Burma – Kissinger 138 kV Line	293/332	308/376	Substation Conductor, Line Relaying, Line Trap, Circuit Breaker

APS Transmission Zone M-3 Process Misoperation Relay Project

Proposed Solution:

Need Number	Transmission Line / Substation Locations	Supplemental Project ID	New MVA Line Rating (SN / SE)	Scope of Work	Estimated Cost ($ M)	Target ISD
APS-2019-015	Karns City – Butler 138 kV Line	s2550	160/192	• At Karns City 138 kV Substation – Replace breaker, disconnect switches, line trap, line tuner, coax, CVT, and substation conductor. Install MCOV surge arrestors and AMETEK Smart-Gap in line tuner • At Butler 138 kV Substation – Replace breaker, disconnect switches, line trap, line tuner, coax, CVT, and substation conductor. Install MCOV surge arrestors and AMETEK Smart-Gap in line tuner	$1.9	10/15/2022
APS-2020-009	Karns City – Kissinger Jct 138 kV Line	s2551	221/268	• At Karns City 138 kV Substation – Replace breaker, line trap, line tuner, coax, and CVT. Install MCOV surge arrestors and AMETEK Smart-Gap in line tuner	$1.8	06/01/2023
	Armstrong – Kissinger Jct 138 kV Line		221/268	• At Armstrong 138 kV Substation – Install AMETEK Smart-Gap in line tuner		
	Burma – Kissinger Jct 138 kV Line		308/376	• At Burma 138 kV Substation – Replace breaker, disconnect switches, line trap, CVT, and substation conductor. Install MCOV surge arrestors and AMETEK Smart-Gap in line tuner		

Model: 2020 RTEP model for 2025 Summer (50/50)

APS Transmission Zone
M-3 Process

Need Number: APS-2020-007

Process State: Submission of Supplemental Project for Inclusion in the Local Plan 10/8/2021

Previously Presented:
Need Meeting – 05/22/2020
Solutions Meeting – 03/19/2021

Project Driver:

Operational Flexibility and Efficiency

Specific Assumption Reference:
System Performance Projects

- Load at risk in planning and operational scenarios

Add/Expand Bus Configuration

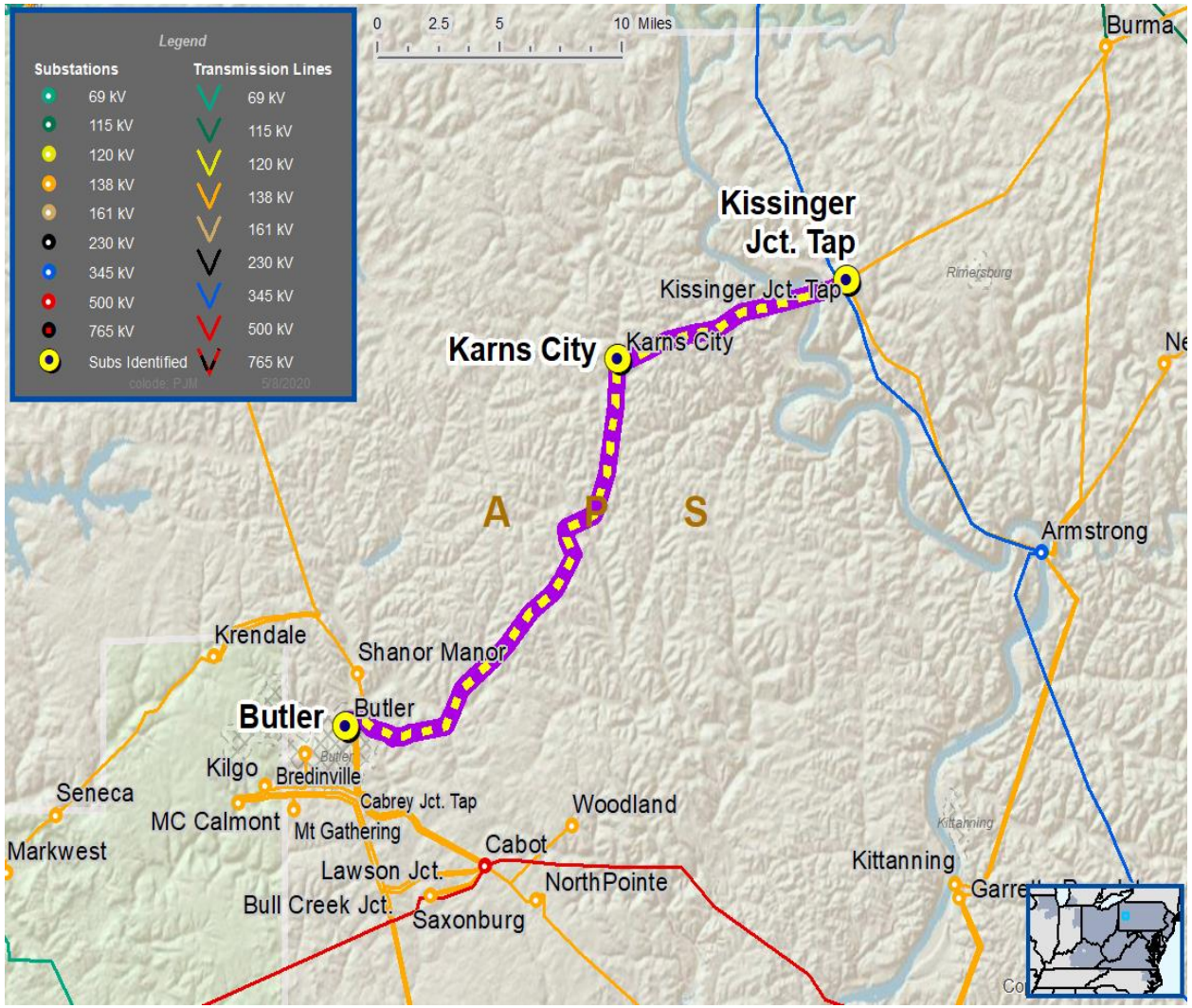
- Reduce the amount of exposed potential local load loss during contingency conditions
- Eliminate simultaneous outages to multiple networked elements

Problem Statement:
Loss of the Karns City #1 or #2 138-25 kV transformer results in significant voltage drop on the 25 kV system. Karns City substation consists of:

- Two distribution transformers connected to transmission with switches
- Two networked 138 kV transmission lines

Transmission lines are limited by terminal equipment.

- Karns City – Butler 138 kV existing line rating is 141 / 179 MVA (SN/SE). The existing transmission line conductor rating is 160 /192 MVA (SN/SE). (substation conductor) Refer to APS-2019-015.
- Karns City – Kissinger Junction 138 kV existing line rating is the existing transmission line conductor rating of 221 / 268 MVA (SN/SE). The winter emergency line rating is limited to 306 MVA from 317 MVA. (line relaying) Refer to APS-2020-009.



APS Transmission Zone
M-3 Process

Need Number: APS-2020-007

Process State: Submission of Supplemental Project for Inclusion in the Local Plan 10/8/2021

Selected Solution:

At Karns City 138 kV Substation:

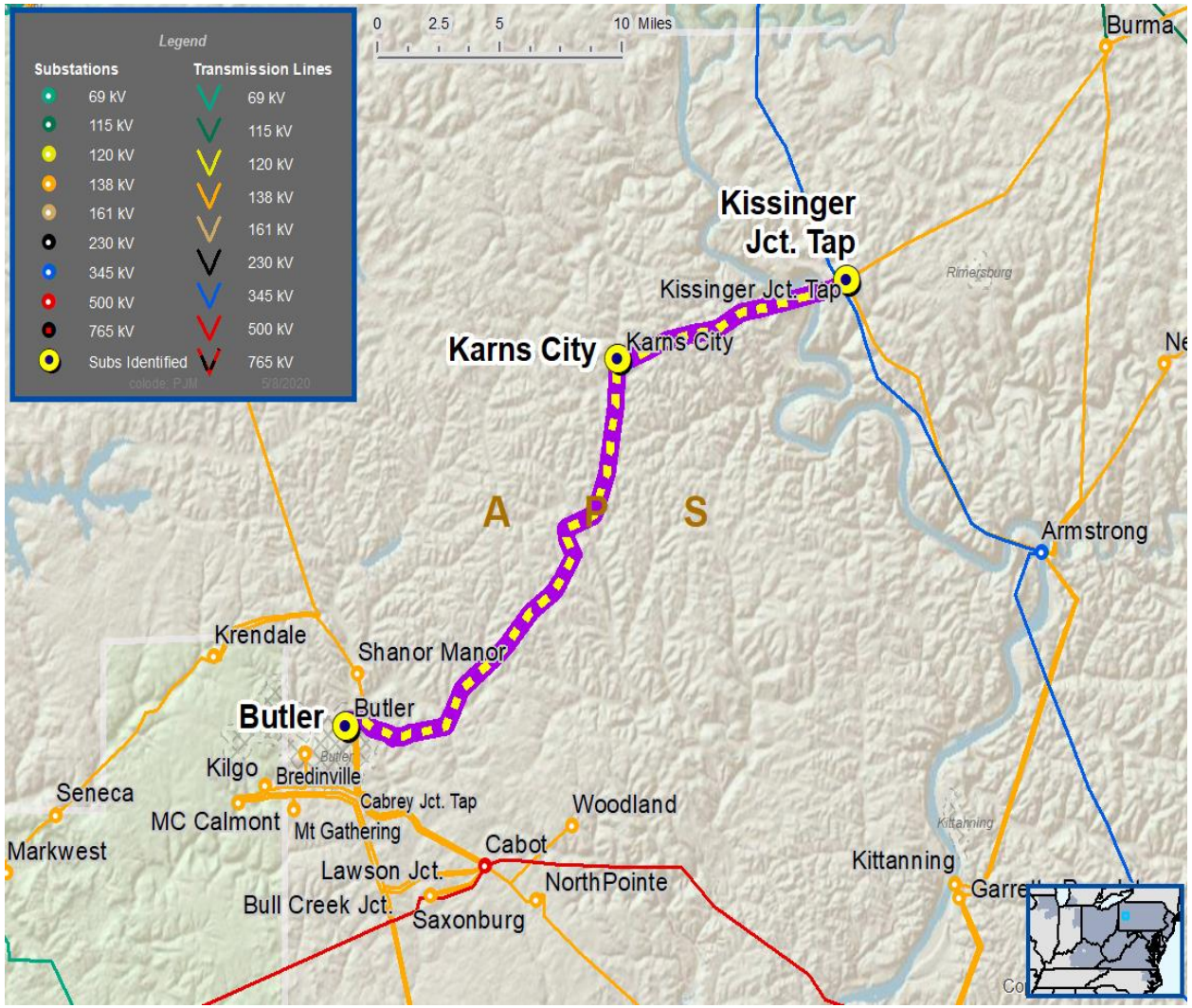
- Install a 138 kV bus tiebreaker disconnect switches.
- Install 138 kV CVT's and support structure.
- Replace/add 25 kV VT's.
- Upgrade relaying and protection.

Estimated Project Cost: $1.3M

Projected In-Service: 11/19/2022

Supplemental Project ID: s2542

Model: 2020 RTEP model for 2025 Summer (50/50)



APS Transmission Zone M-3 Process
Sand Fork, Weston, Vens Run 138 kV

Need Number: APS-2021-001

Process State: Submission of Supplemental Project for Inclusion in the Local Plan 10/8/2021

Previously Presented:

Need Meeting --2/17/2021

Solution Meeting -- Solution Meeting 4/16/2021

Project Driver:

Equipment Material Condition, Performance and Risk
Operational Flexibility and Efficiency

Specific Assumption Reference:

Global Factors

- System reliability and performance

Add/Expand Bus Configuration

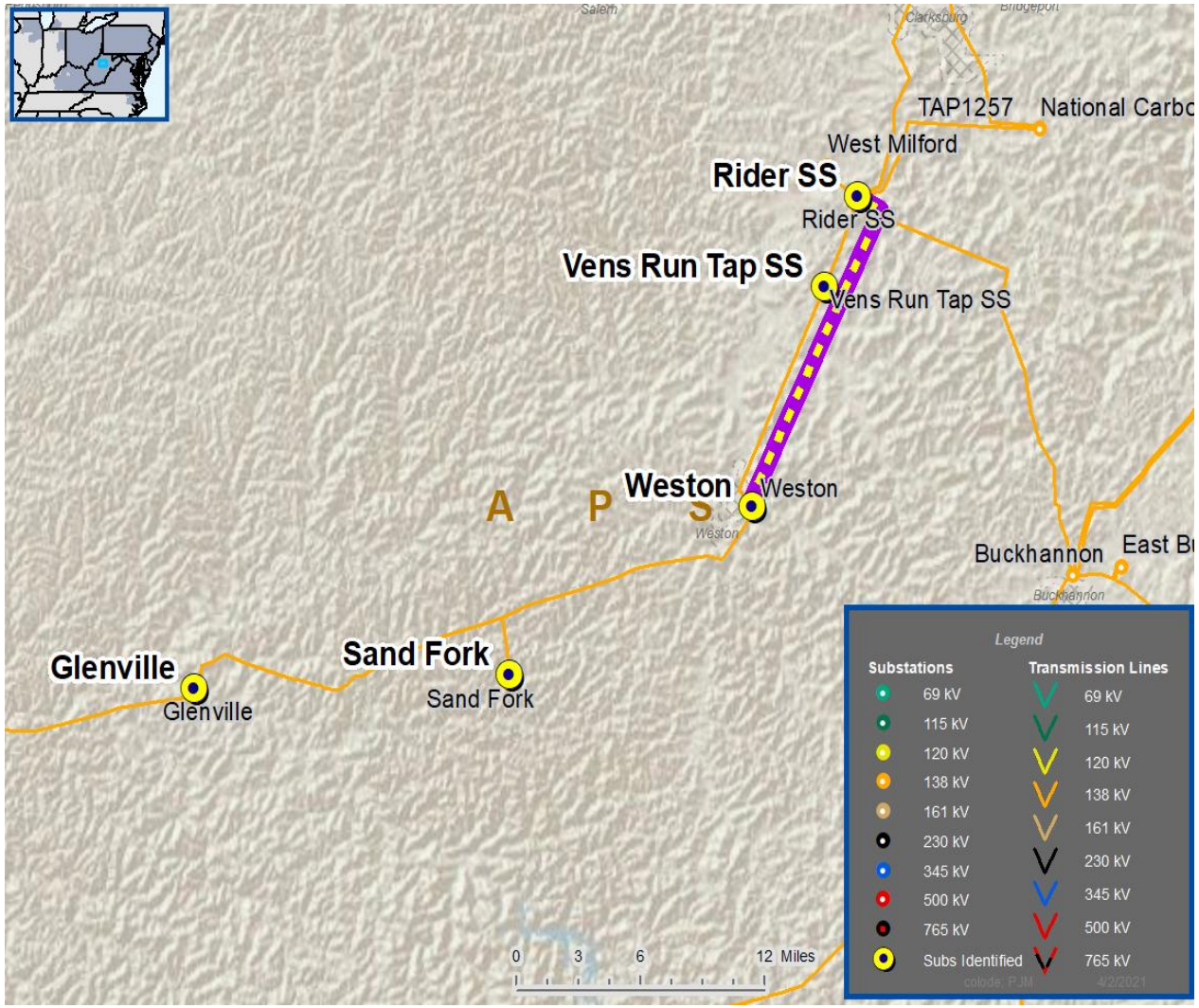
- Capability to perform substation maintenance

Permanent Reactive Device Installations

- Non-BES transmission systems facilities evaluation identifies the need for a permanent reactive device

Problem Statement:

Due to the load addition at Vens Run (s2293), a maintenance outage of the Rider to Vens Run 138 kV line followed by the loss of the Weston 138 kV capacitor results in low voltage at Weston, Vens Run, and Sand Fork 138 kV substations (0.89 p.u.).



APS Transmission Zone M-3 Process
Sand Fork, Weston, Vens Run 138 kV

Need Number: APS-2021-001

Process State: Submission of Supplemental Project for Inclusion in the Local Plan 10/8/2021

Selected Solution:

At Glenville SS:

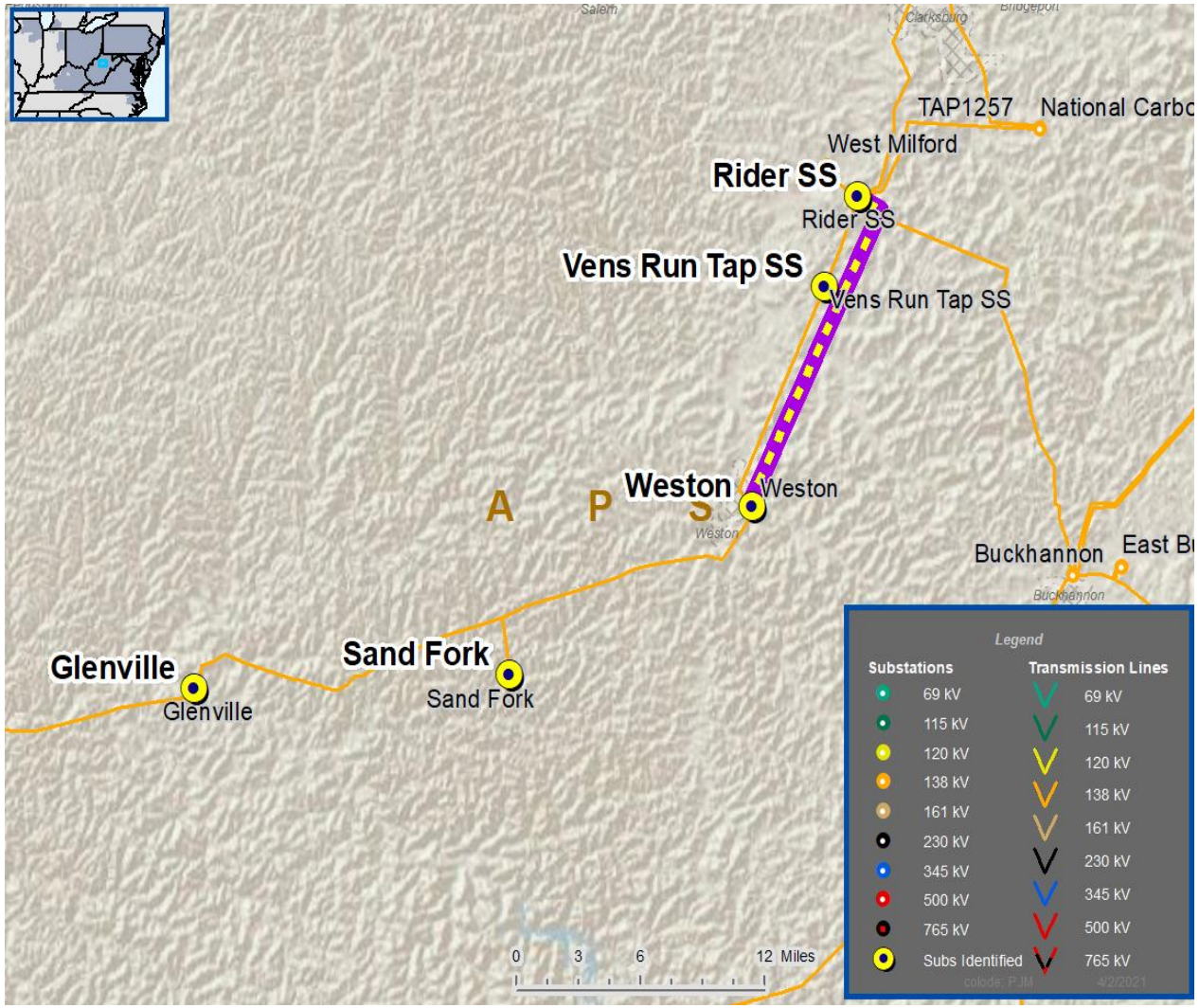
- Extend the 138 kV bus
- Install 26.4 MVAR 138 kV Capacitor
- Install 138 kV Capacitor switcher

Estimated Project Cost: $1.3M

Projected In-Service: 6/01/2021

Supplemental Project ID: s2543

Model: 2020 RTEP model for 2025 Summer (50/50)



APS Transmission Zone M-3 Process
Gore Substation

Need Number: APS-2021-002

Process State: Submission of Supplemental Project for Inclusion in the Local Plan 10/8/2021

Previously Presented:

Need Meeting – 2/17/2021

Solution Meeting – 4/16/2021

Project Driver:

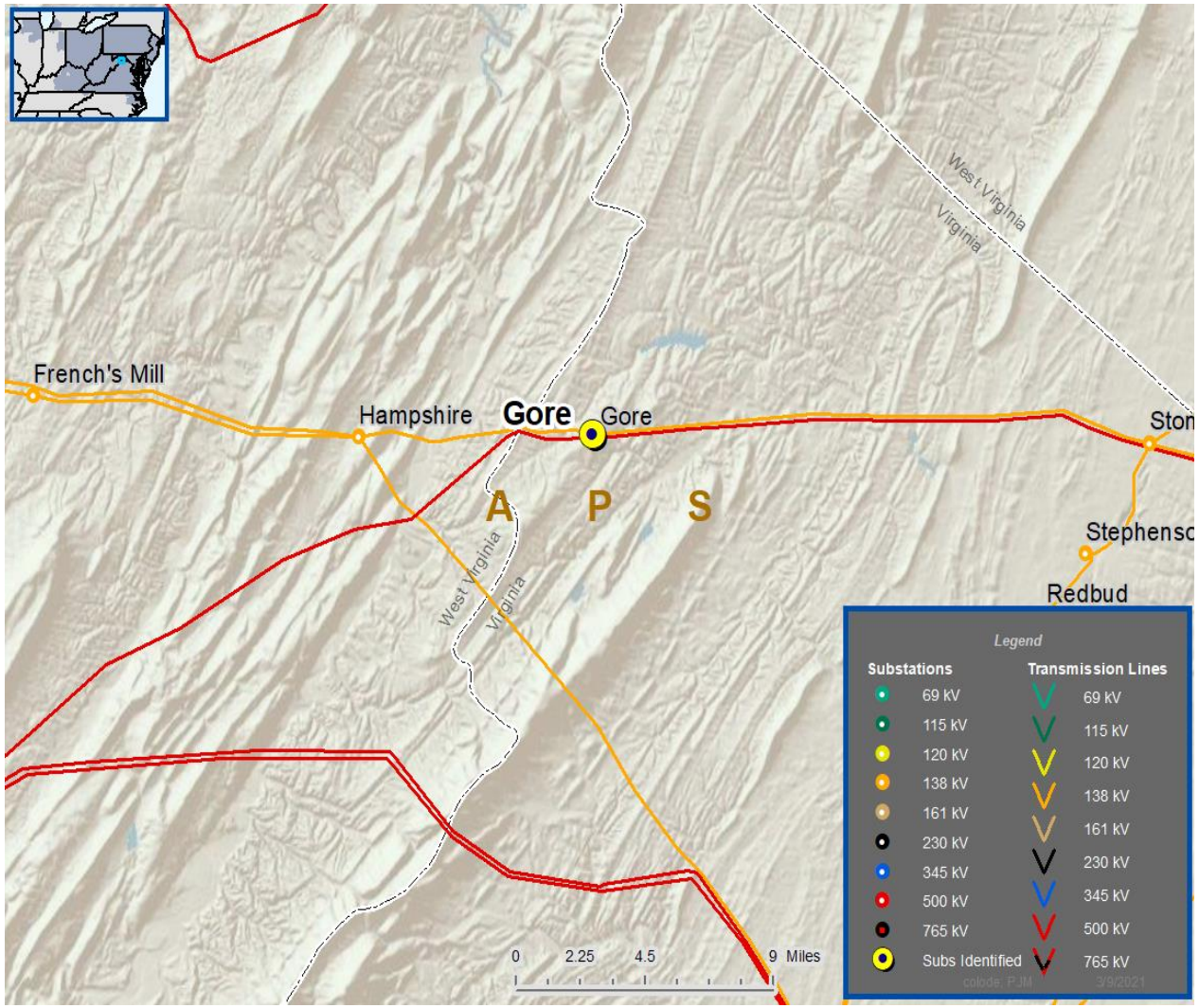
Customer Service

Specific Assumption Reference:

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

Problem Statement:

Existing Wholesale Customer Connection – Gore substation expansion to accommodate existing wholesale customer station upgrades.



APS Transmission Zone M-3 Process
Gore Substation

Need Number: APS-2021-002

Process State: Submission of Supplemental Project for Inclusion in the Local Plan 10/8/2021

Selected Solution:

At Gore:

- Install 138 kV breaker on the Stonewall terminal
- Remove existing Stonewall 138 kV line switch
- Adjust relaying

At Stonewall

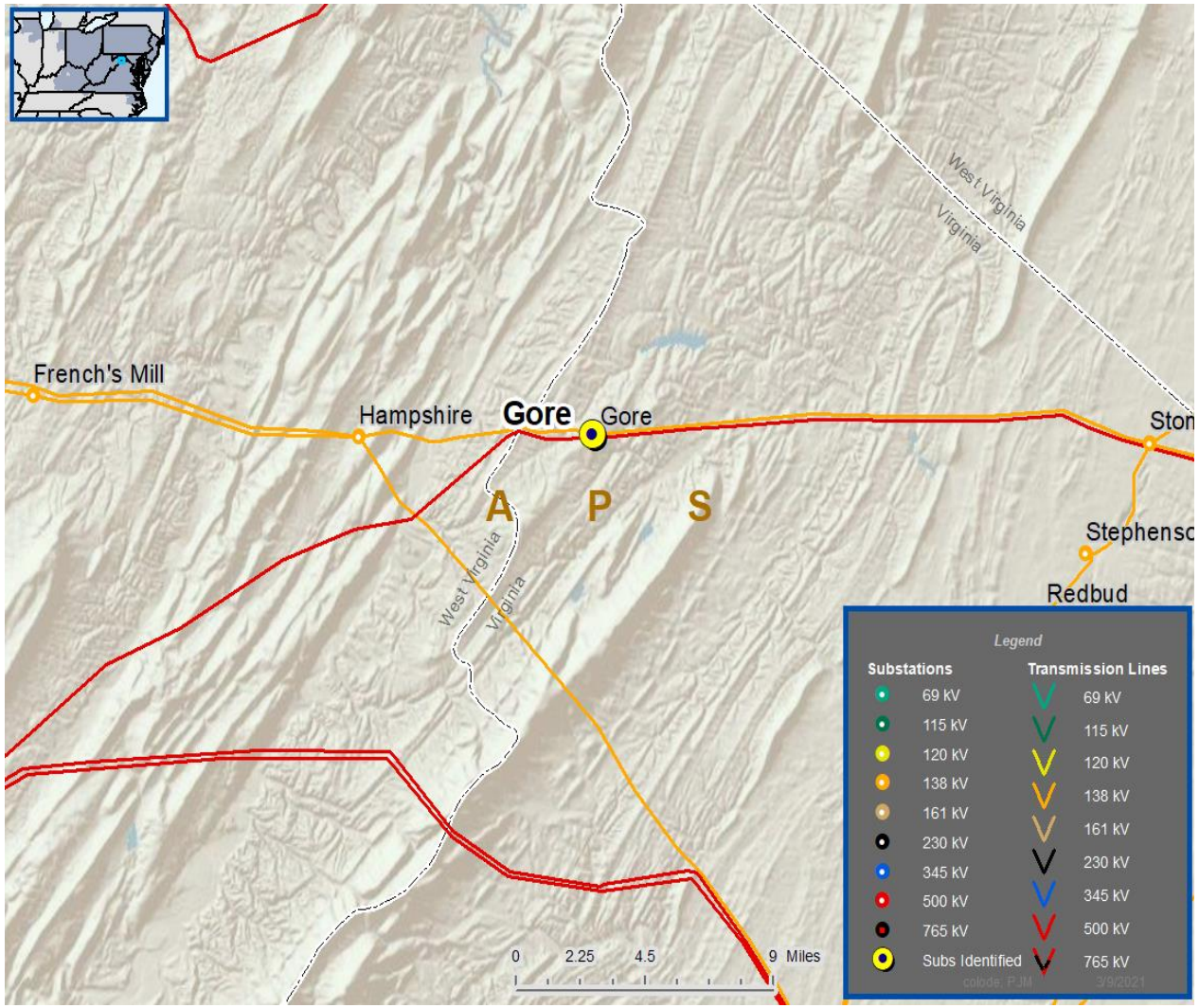
- Adjust relaying

Estimated Project Cost: $0.0M (Reimbursable)

Projected In-Service: 5/01/2021

Supplemental Project ID: s2544

Model: 2020 RTEP model for 2025 Summer (50/50)



Revision History

10/08/2021 – V1 – Local plan posted on pjm.com (S2549, S2550, S2551, s2542, s2543 & S2544)