First Energy (Penelec)
Local Plan Submission for the 2020 RTEP

Penelec Transmission Zone M-3 Process
Misoperation Relay Projects

Need Number: PN-2019-037

Process State: Submission of Supplemental Project for inclusion in the Local Plan 3/20/2020

Previously Presented:

Need Meeting 10/21/2019

Solutions Meeting 11/18/2019

Project Driver:

Equipment Material Condition, Performance and Risk

Operational Flexibility and Efficiency

Specific Assumption Reference:

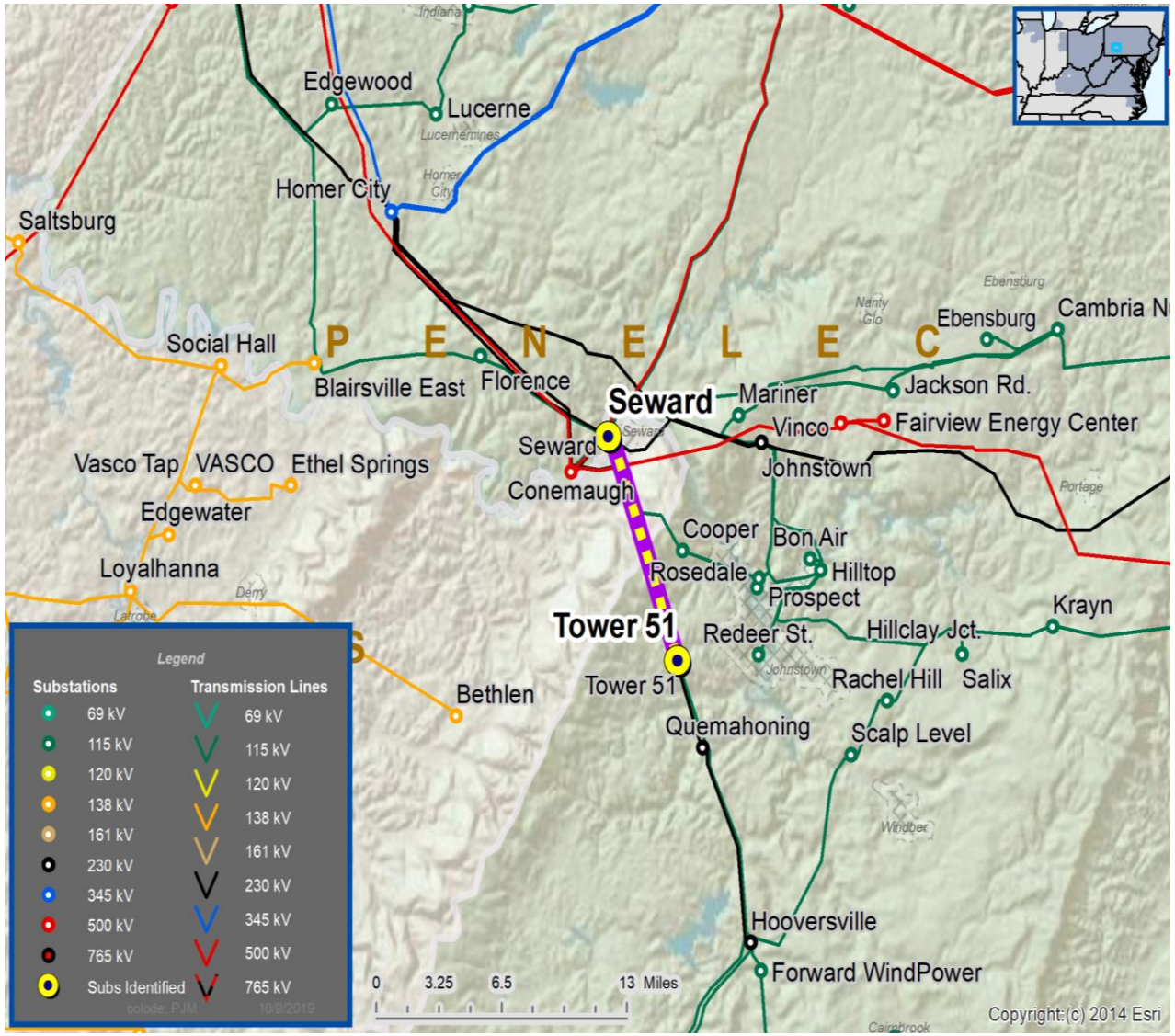
System Performance Projects Global Factors

- 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

Continued on next slide…



Penelec 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many cases the protection equipment cannot be repaired due to a lack of replacement part and available expertise in the outdated technology.
- Transmission line ratings are limited by terminal equipment.

PN-2019-	Transmission Line / Substation Locations	Existing Line Rating (SN / SE)	Existing Conductor Rating (SN / SE)	Limiting Terminal Equipment
037	Seward – Tower 51 115 kV Line	147/185	201/244	Circuit Breaker, Line Relaying, Line Trap, Substation Conductor

Selected Solution:

PN-2019-	Transmission Line / Substation Locations	Supplemental Project ID	New MVA Line Rating (SN / SE)	Scope of Work	Estimate Costs ($ M)	Target ISD
037	Seward – Tower 51 115 kV Line	s2176, s2176.1, s2176.2	201/244	• Seward 115 kV Substation – Replace circuit breaker, line relaying, line trap, and substation conductor (s2176.1) • Tower 51 115 kV Substation – Replace circuit breaker, line relaying, line trap, and substation conductor (s2176.2)	$1.4M	6/1/2020

No topology changes, no bubble diagram required.

Model: 2019 RTEP model for 2024 Summer (50/50)

Penelec Transmission Zone M-3 Process
Shelocta 230 kV Ring Bus

Need Number: PN-2020-003

Process Stage: Submission of Supplemental Project for inclusion in the Local Plan 09/22/2020

Previously Presented:

Solution Meeting 06/02/2020
Need Meeting 04/14/2020

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

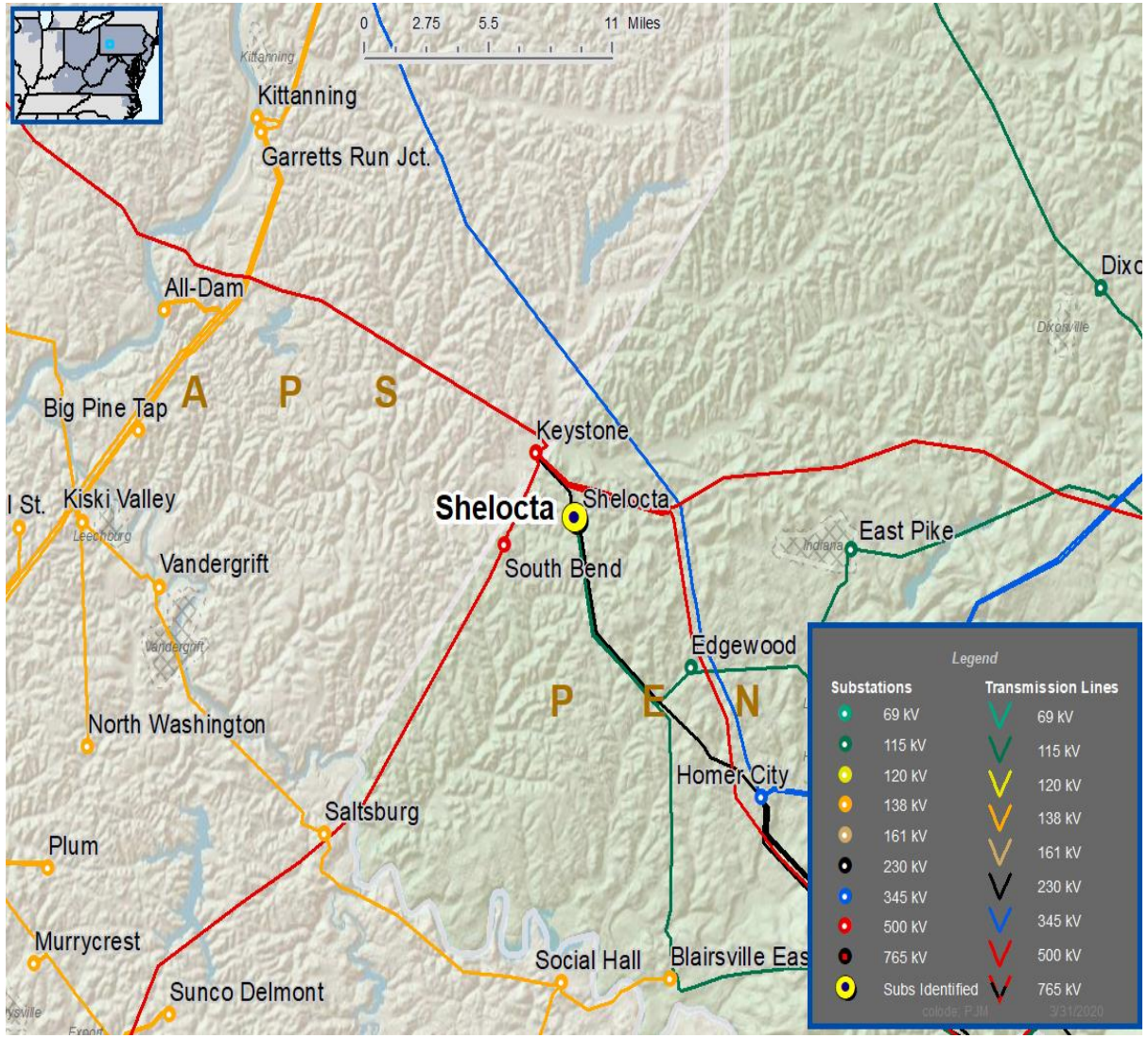
Add/Expand Bus Configuration

- Eliminate simultaneous outages to multiple networked elements

Problem Statement:

The Shelocta 230 kV bus is a three terminal line consisting of two 230 kV lines and a 230/115 kV transformer.

An N-1 outage results in the loss of all three networked elements.



Penelec Transmission Zone M-3 Process
Shelocta 230 kV Ring Bus

Need Number: PN-2020-003

Process Stage: Submission of Supplemental Project for inclusion in the Local Plan
09/22/2020

Selected Solution:

Shelocta 230 kV Substation:

- Construct three breaker ring bus (s2279.1)

Keystone 230 kV Substation:

- Replace line trap (s2279.2)

Homer City 230 kV Substation:

- Replace line trap (s2279.3)

Transmission Line Ratings:

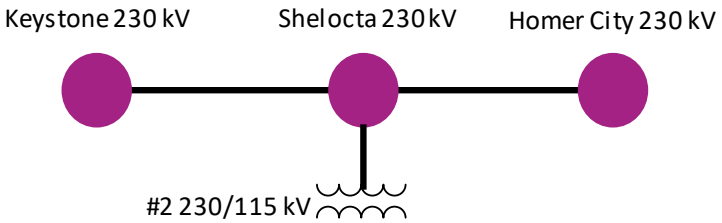
Keystone – Shelocta 230 kV Line

- Before Proposed Solution: 809 / 923 MVA (SN/SE)
- After Proposed Solution: 809 / 980 MVA (SN/SE)

Homer City – Shelocta 230 kV Line:

- Before Proposed Solution: 809 / 923 MVA (SN/SE)
- After Proposed Solution: 809 / 980 MVA (SN/SE)

Estimated Cost: $6.7M
Projected In-Service: 6/1/2022
Supplemental Project ID: s2279.1, s2279.2, s2279.3
Model: 2020 RTEP model for 2025 Summer (50/50)



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

Penelec Transmission Zone M-3 Process
Hooversville #3 230/115 kV Transformer Replacement

Need Number: PN-2020-001

Process Stage: Submission of Supplemental Project for inclusion in the Local Plan 10/16/2020

Previously Presented:
Need Meeting 05/12/2020
Solution Meeting 07/07/2020

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

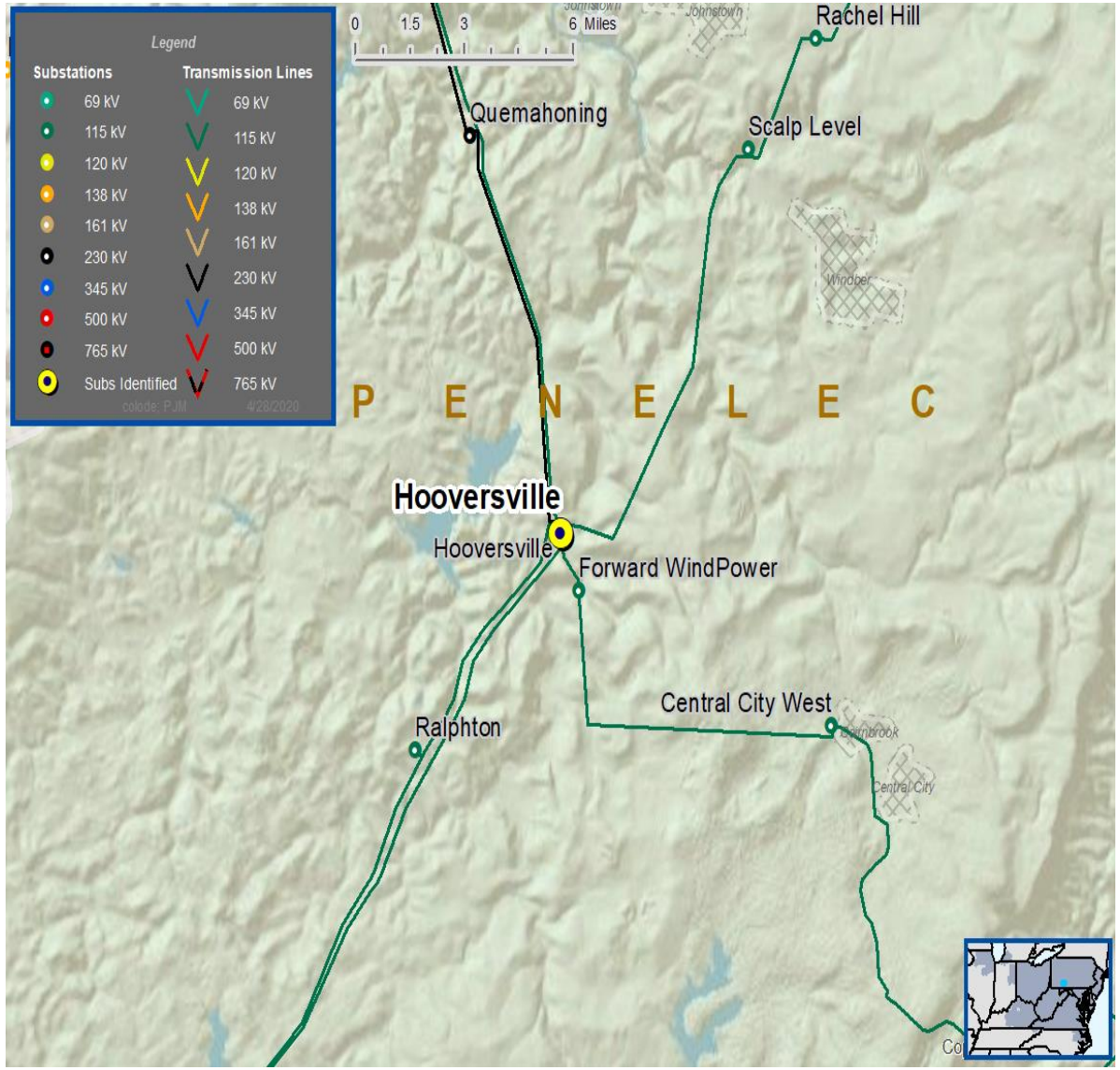
Substation Condition Rebuild/Replacement

Problem Statement:

Hooversville #3 230/115 kV Transformer

- Transformer has increased failure probability due to:
  - Transformer is 43 years old.
  - Type "U" bushings
  - High level heating gases and moisture
  - Obsolete parts
  - Nitrogen and oil leaks

Transformer circuit rating is the existing transformer rating of 245/306 MVA (SN/SE).



Need Number: PN-2020-001

Process Stage: Submission of Supplemental Project for inclusion in the Local Plan 10/16/2020

Selected Solution:

Replace Hooversville #3 230/115 kV Transformer

- Replace the #3 230/115 kV transformer and associated equipment with a 180/240/300 MVA transformer

Transformer Rating:

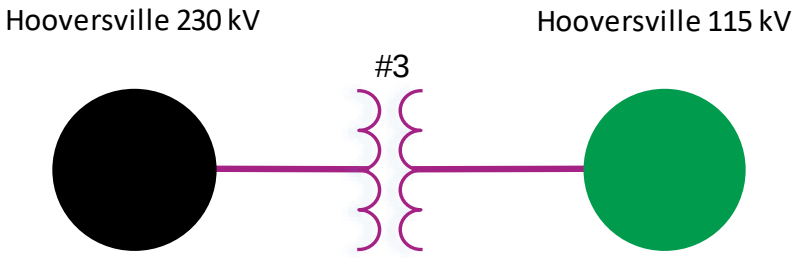
Hooversville #3 230/115 kV Transformer
- Before Proposed Solution: 245 / 306 MVA (SN/SE)
- After Proposed Solution (anticipated): 375 / 438 MVA (SN/SE)

Estimated Project Cost: $4.2M

Projected In-Service: 12/10/2021

Supplemental Project ID: s2304

Model: 2020 Series 2025 Summer RTEP 50/50



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

Need Number: PN-2020-002

Process Stage: Submission of Supplemental Project for inclusion in the Local Plan 10/16/2020

Previously Presented:
Need Meeting 5/12/2020
Solution Meeting 07/07/2020

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

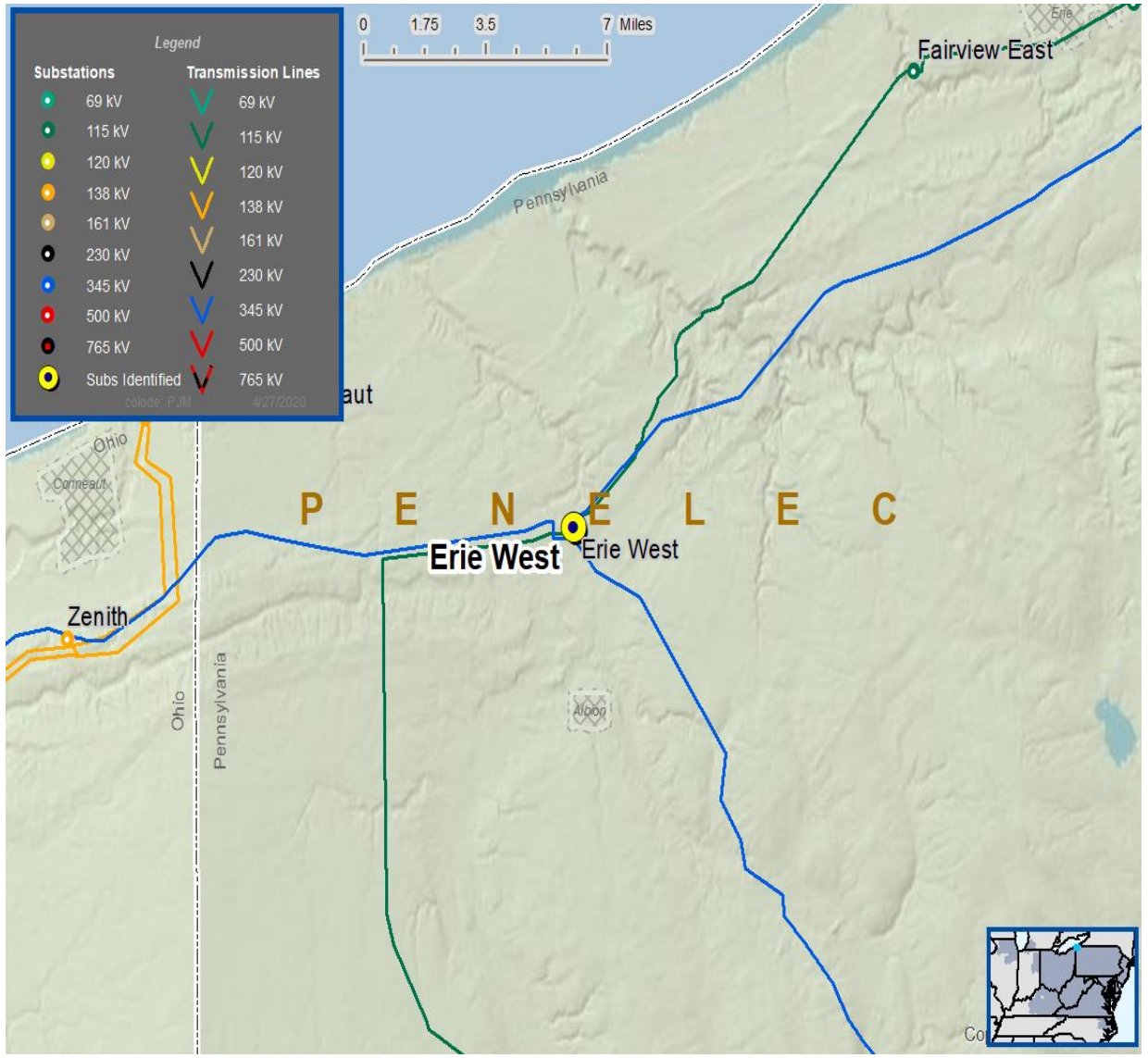
Substation Condition Rebuild/Replacement

Problem Statement:

Erie West #1 345/115 kV Transformer

- Transformer has increased failure probability due to:
  - Transformer is 47 years old.
  - High level heating gases and moisture
  - HV bushings have significant deterioration
  - Obsolete parts
  - Nitrogen and oil leaks

Transformer circuit rating is the existing transformer rating of 266/333 MVA (SN/SE).



Need Number: PN-2020-002

Process Stage: Submission of Supplemental Project for inclusion in the Local Plan 10/16/2020

Selected Solution:

Replace Erie West #1 345/115 kV Transformer

- Replace the #1 345/115 kV transformer and associated equipment with a 168/224 MVA transformer

Transformer Rating:

Erie West #1 345/115 kV Transformer

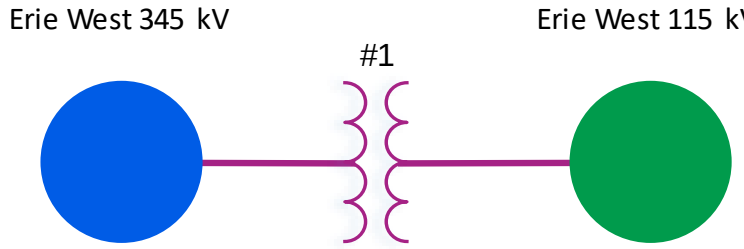
- Before Proposed Solution: 266 / 333 MVA (SN/SE)
- After Proposed Solution (anticipated): 280 / 341 MVA (SN/SE)

Estimated Project Cost: $3.3M

Projected IS Date: 12/31/2021

Supplemental Project ID: s2305

Model: 2020 Series 2025 Summer RTEP 50/50



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

Penelec Transmission Zone M-3 Process
Altoona #1 230-46 kV Transformer Replacement

Need Number: PN-2020-007

Process Stage: Submission of Supplemental Project for inclusion in the Local Plan 10/16/2020

Previously Presented:

Need Meeting 05/12/2020
Solution Meeting 07/07/2020

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

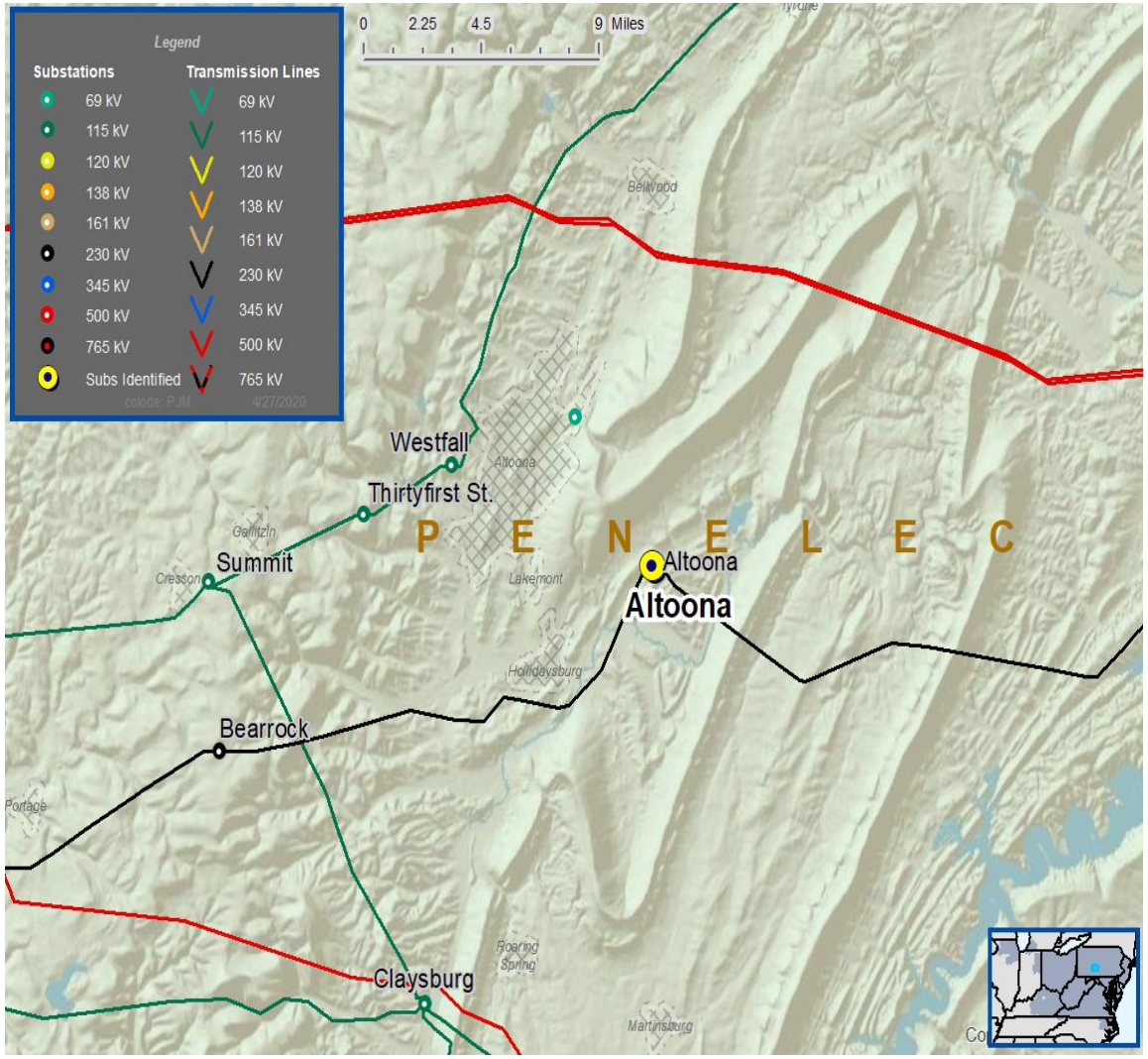
Substation Condition Rebuild/Replacement
System Performance Projects Global Factors

Problem Statement:

Altoona #1 230-46 kV Transformer

- Transformer has increased failure probability due to:
  - Transformer is 55 years old
  - Poor oil quality in LTC
  - Nitrogen leaks in tank
  - Bushing H3 oil leaks

Transformer circuit rating is 89/97 MVA (SN/SE) and the existing transformer rating is 90/97 MVA (SN/SE).
(substation conductor)



Need Number: PN-2020-007

Process Stage: Submission of Supplemental Project for inclusion in the Local Plan 10/16/2020

Selected Solution:

Replace Altoona #1 230-46 kV Transformer

- Replace the #1 230-46 kV transformer and associated equipment with a 60/80/100 MVA transformer

Transformer Rating:

Altoona #1 230-46 kV Transformer

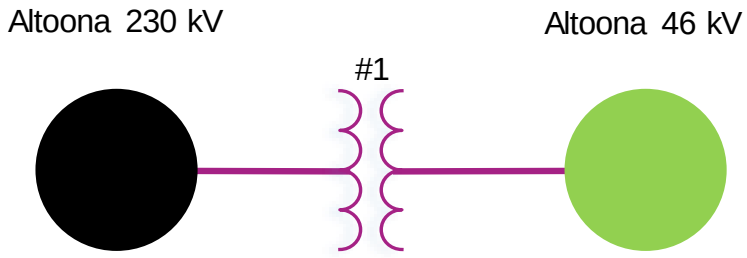
- Before Proposed Solution: 89 / 97 MVA (SN/SE)
- After Proposed Solution (anticipated): 120 / 129 MVA (SN/SE)

Estimated Project Cost: $3.5M

Projected IS Date: 06/01/2022

Supplemental Project ID: s2306

Model: 2020 Series 2025 Summer RTEP 50/50



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

Need Number: PN-2020-008

Process Stage: Submission of Supplemental Project for inclusion in the Local Plan 10/16/2020

Previously Presented:

Need Meeting 05/12/2020
Solution Meeting 07/07/2020

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

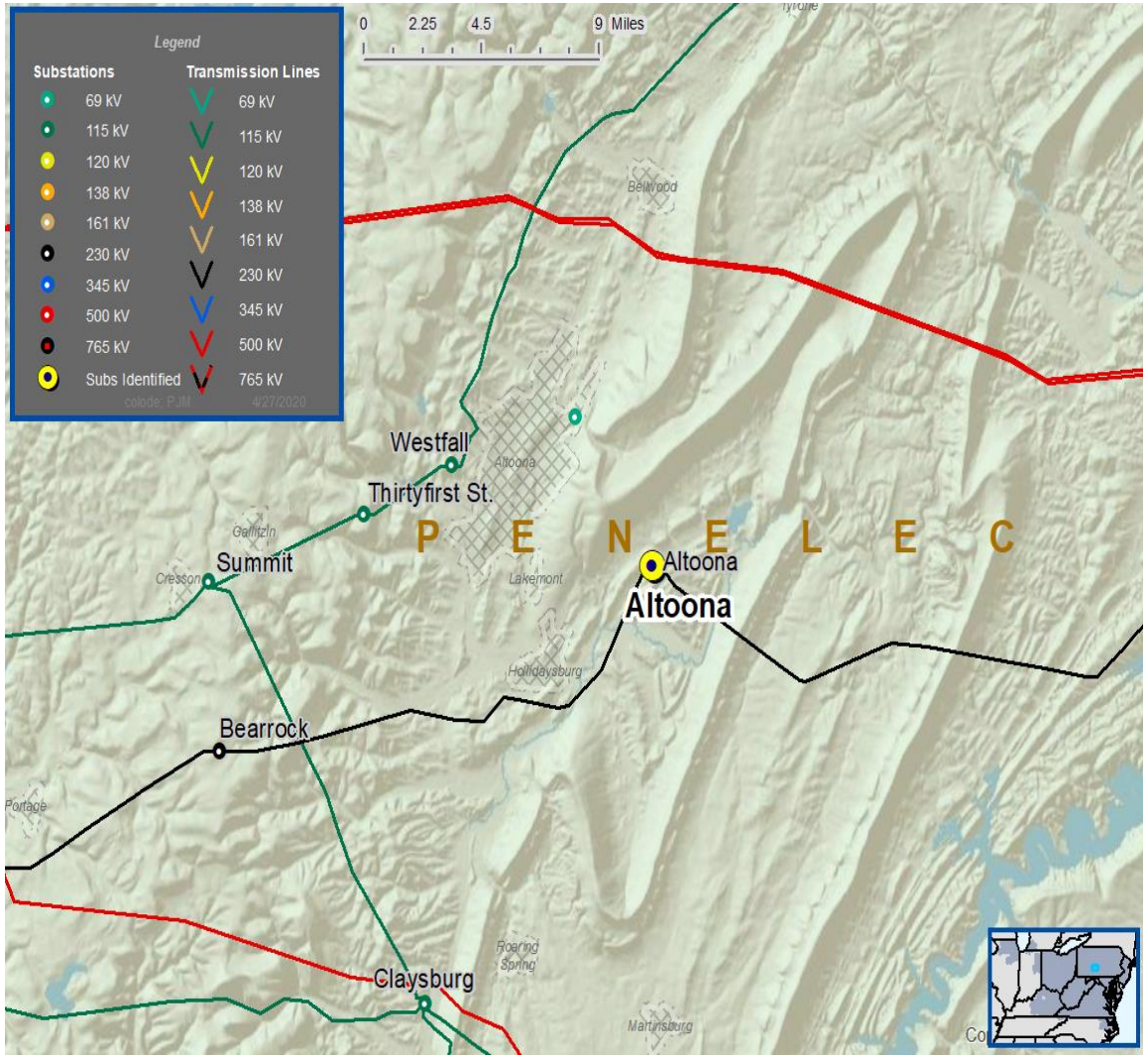
Substation Condition Rebuild/Replacement
System Performance Projects Global Factors

Problem Statement:

Altoona #2 230-46 kV Transformer

- Transformer has increased failure probability due to:
  - Transformer is 47 years old
  - Nitrogen leak in tank
  - LTC oil leak
  - Pump flanges are leaking
  - SCADA alarms are not functional

Transformer circuit rating is 89/97 MVA (SN/SE) and the existing transformer rating is 91/97 MVA (SN/SE). (substation conductor)



Need Number: PN-2020-008

Process Stage: Submission of Supplemental Project for inclusion in the Local Plan 10/16/2020

Selected Solution:

Replace Altoona #2 Transformer 230-46 kV Unit

- Replace the #2 230-46 kV transformer and associated equipment with a 60/80/100 MVA transformer

Transformer Rating:

Altoona #2 230-46 kV Transformer

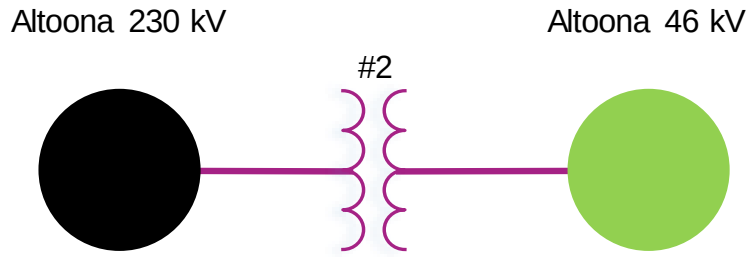
- Before Proposed Solution: 89 / 97 MVA (SN/SE)
- After Proposed Solution (anticipated): 120 / 129 MVA (SN/SE)

Estimated Project Cost: $3.6M

Projected IS Date: 12/31/2022

Supplemental Project ID: s2307

Model: 2020 Series 2025 Summer RTEP 50/50



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

Penelec Transmission Zone M-3 Process

Hooversville - Tower 51 115 kV Line

Need Number: PN-2020-010

Process Stage: Submission of Supplemental Project for inclusion in the Local Plan 10/16/2020

Previously Presented:

Need Meeting 5/21/2020
Solution Meeting 07/16/2020

Project Driver:

Equipment Material Condition, Performance and Risk

Operational Flexibility and Efficiency

Specific Assumption Reference:

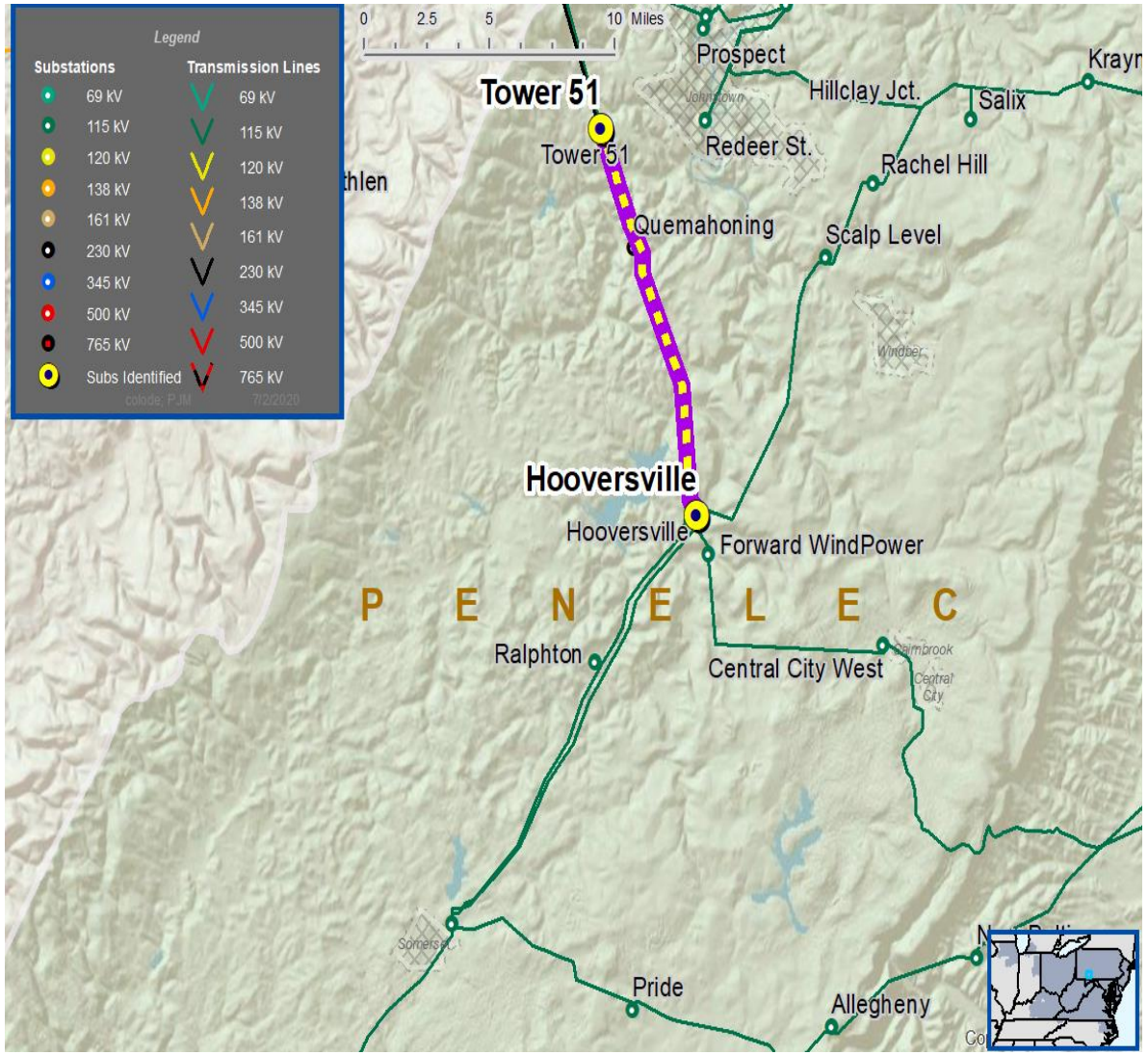
System Performance Projects Global Factors

- System reliability and performance
- Substation/line equipment limits

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

Continued on slide 10&11…



Penelec Transmission Zone M-3 Process

Morgan Street – Franklin Tap - Air Products – Geneva 115 kV

Need Number: PN-2020-012

Process Stage: Submission of Supplemental Project for inclusion in the Local Plan 10/16/2020

Previously Presented:

Need Meeting 5/21/2020
Solution Meeting 07/16/2020

Project Driver:

Equipment Material Condition, Performance and Risk

Operational Flexibility and Efficiency

Specific Assumption Reference:

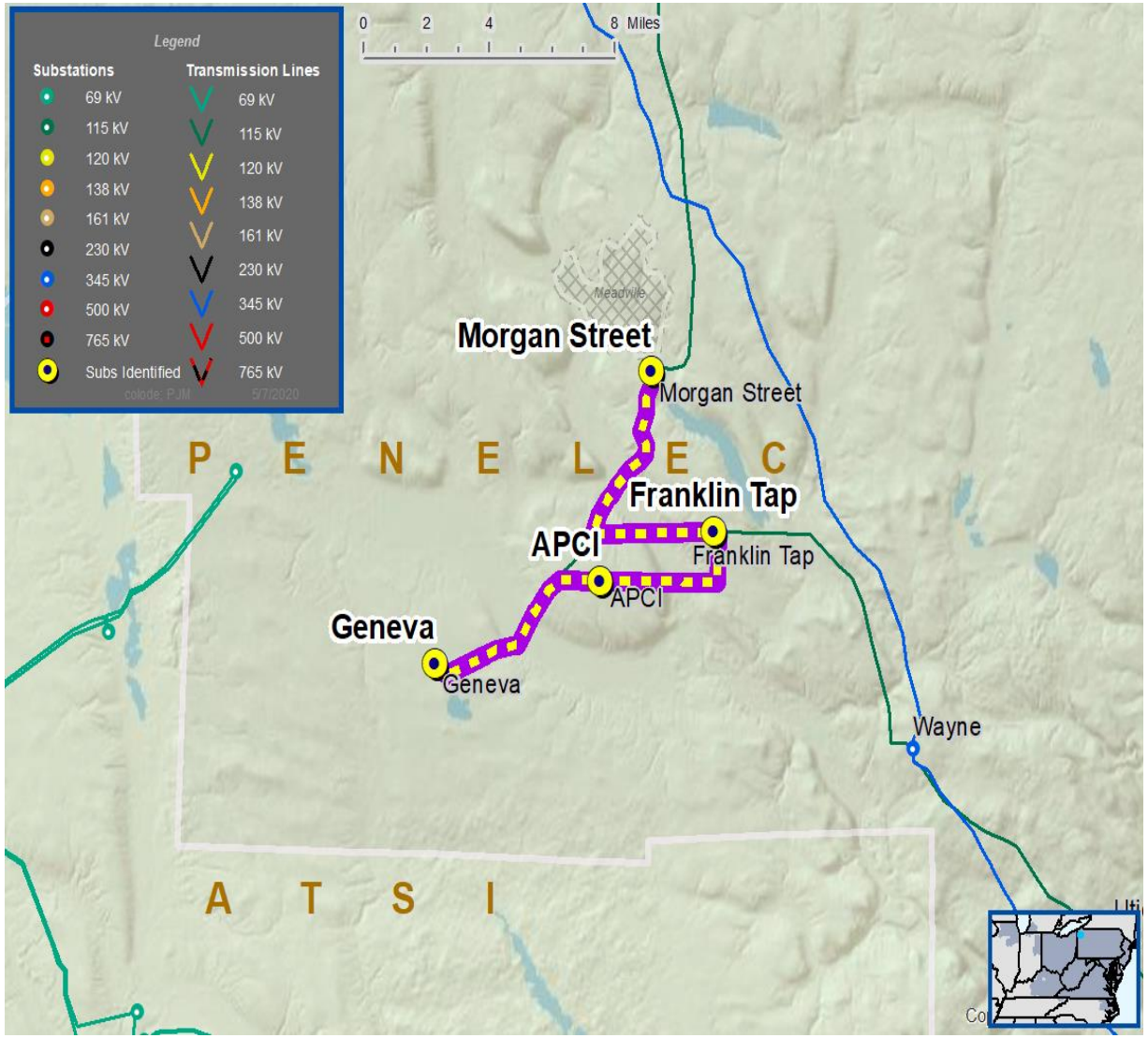
System Performance Projects Global Factors

- System reliability and performance
- Substation/line equipment limits

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

Continued on slide 10&11…



Penelec Transmission Zone M-3 Process

Blairsville East – Social Hall 138 kV

Need Number: PN-2020-015, and APS-2020-008

Process Stage: Submission of Supplemental Project for inclusion in the Local Plan 10/16/2020

Previously Presented:

Need Meeting 5/21/2020
Solution Meeting 07/16/2020

Project Driver:

Equipment Material Condition, Performance and Risk

Operational Flexibility and Efficiency

Specific Assumption Reference:

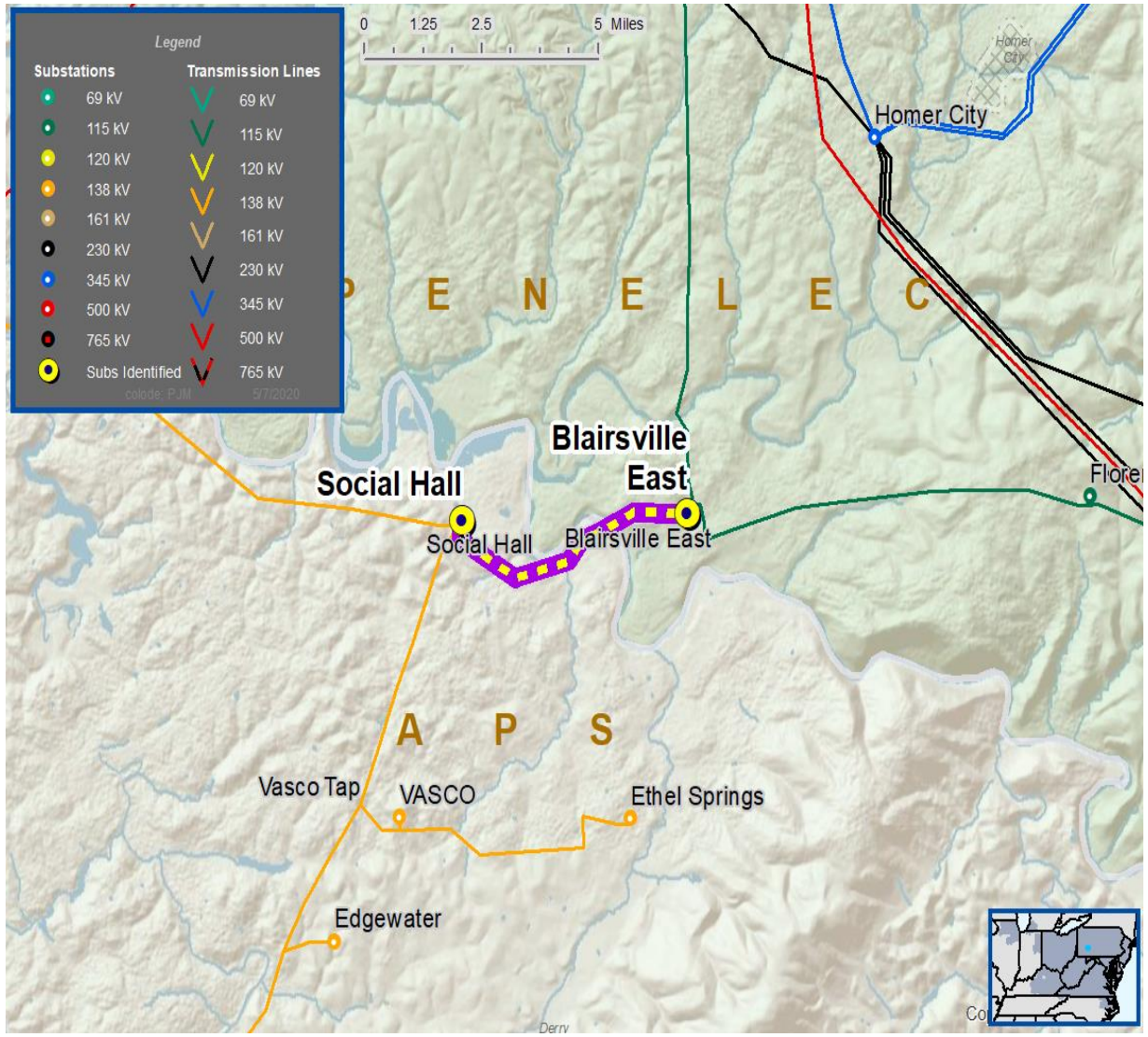
System Performance Projects Global Factors

- System reliability and performance
- Substation/line equipment limits

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

Continued on slide 10&11…



Penelec 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 part 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
PN-2020-010	Hooversville – Tower 51 115 kV Line	137 / 172	178 / 214	Disconnect Switches, CTs, Substation Conductor, Line Trap, Line Relaying
PN-2020-012	Morgan Street – Franklin Tap 115 kV Line	221 / 239	232 / 282	Substation Conductor, Line Relaying, Line Trap
	Franklin Tap – Air Products 115 kV Line	202 / 245	202 / 245	N/A
	Air Products – Geneva 115 kV Line	202 / 239	202 / 245	Line Relaying
PN-2020-015 APS-2020-008	Blairsville East – Social Hall 138 kV Line	225 / 287	243 / 294	Substation Conductor, CTs, Line Relaying, Line Trap

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
PN-2020-010	Hooversville – Tower 51 115 kV Line	s2312	178 / 214	• Hooversville 115 kV Substation – Replace line trap, line relaying, and substation conductor • Tower 51 115 kV Substation – Replace line trap line relaying, substation conductor, disconnect switches, circuit breaker, and CTs	$1.1M	03/31/2022
PN-2020-012	Morgan Street – Franklin Tap 115 kV Line	s2313	232 / 282	• Morgan Street 115 kV Substation – Replace line trap, line relaying, substation conductor, breaker and bus disconnect switches, and circuit breaker	$2.5M	05/27/2022
	Franklin Tap – Air Products 115 kV Line		202 / 245	N/A		
	Air Products – Geneva 115 kV Line		202 / 245	• Geneva 115 kV Substation – Replace line trap, line relaying, breaker and bus disconnect switches, and circuit breakers		
PN-2020-015 APS-2020-008	Blairsville East – Social Hall 138 kV Line	s2314.1	243 / 294	• Blairsville East 138 kV Substation – Replace line trap and line relaying • Social Hall 138 kV Substation – Replace line trap, line relaying, substation conductor, circuit breaker, and CTs	$0.8M	06/01/2021
		s2314.2				

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

Questions?

Revision History

3/20/2020 – V1 – Original version posted to pjm.com. Included S2176

9/22/2020 – V2 – Added local plan for S2279

10/16/2020 – V3 – Added local plan for S2304, S2305, S2306, S2307, S2312, S2313 and S2314