

Subregional RTEP Committee - Mid-Atlantic Met-Ed Supplemental Projects

July 31, 2019

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 Number: ME-2019-039

Process Stage: Need Meeting 7/31/2019

Project Driver:

Equipment Material Condition, Performance and Risk

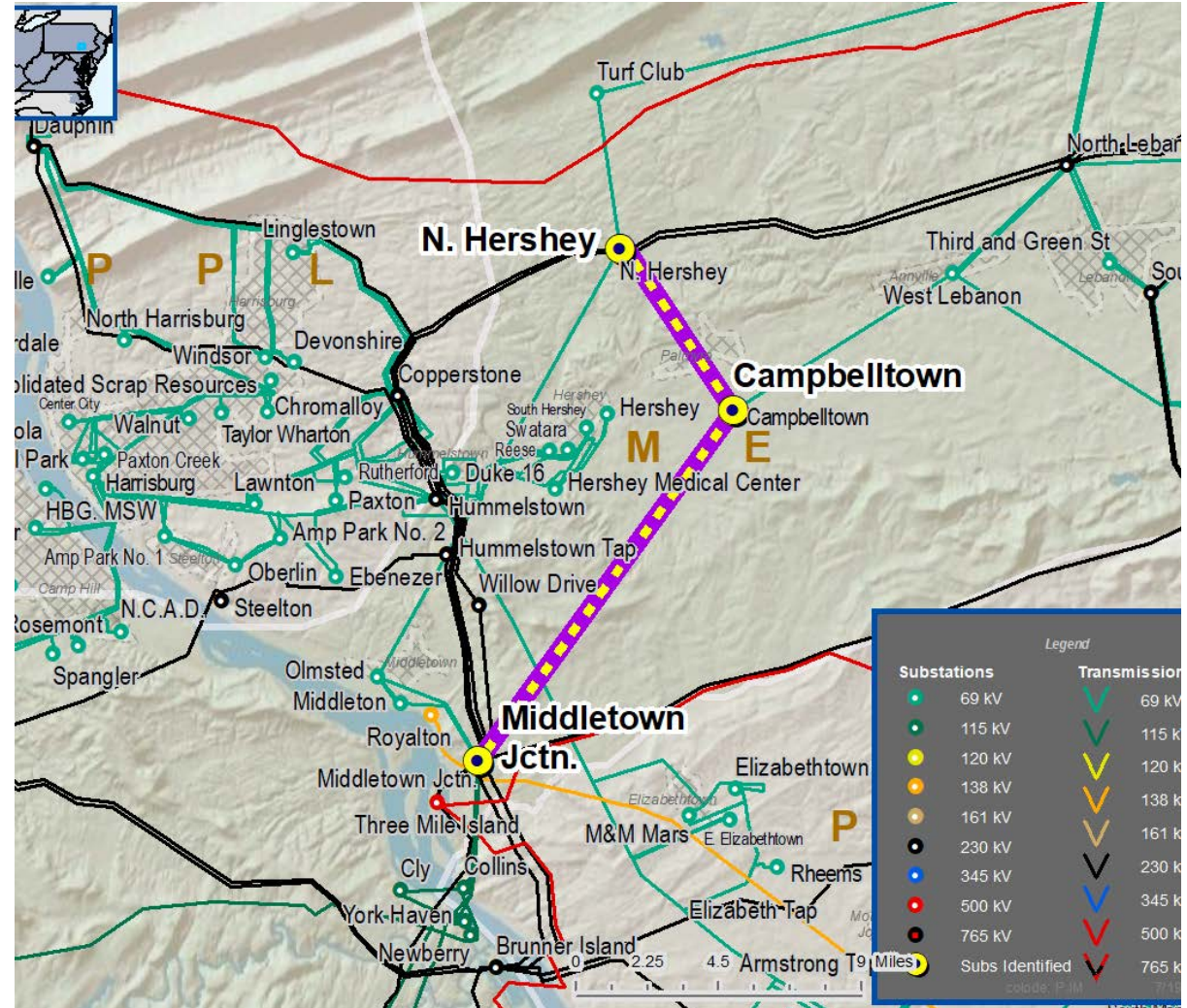
Specific Assumption Reference:

- Line Condition Rebuild/Replacement
- Age/condition of wood pole transmission line structures
- Age/condition of steel tower or steel pole transmission line structures
- Age/condition of transmission line conductors
- System Performance Projects
- Substation/line equipment limits

Problem Statement:

Campbelltown – Middletown – North Hershey 69 kV line sections are exhibiting deterioration.

- Total line distance is approximately 19.7 miles.
- 260 out of 407 structures failed inspection (64% failure rate).
- Failure reasons include age, decay, woodpecker holes.
- Transmission line ratings are limited by terminal equipment:
- Campbelltown – Campbelltown Tap 69 kV line (substation conductor, disconnect switches, relaying)
 - Existing line rating: 71/91 MVA (SN/SE)
 - Existing conductor rating: 139/169 MVA (SN/SE)
- Middletown – Wood St Tap 69 kV line (disconnect switches, line relaying, substation conductor)
 - Existing line rating: 82/103 MVA (SN/SE)
 - Existing conductor rating: 139/169 MVA (SN/SE)



Need Number: ME-2019-040

Process Stage: Need Meeting 7/31/2019

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

Line Condition Rebuild/Replacement

- Age/condition of wood pole transmission line structures
- Age/condition of steel tower or steel pole transmission line structures
- Age/condition of transmission line conductors

System Performance Projects

- Substation/line equipment limits

Problem Statement:

Carsonia – Lyons – North Boyertown 69 kV line is exhibiting deterioration.

- Total line distance is approximately 22.8 miles.
- 339 out of 447 structures failed inspection (76% failure rate).
- Failure reasons include age, woodpecker holes, bayonet pole, top rot.

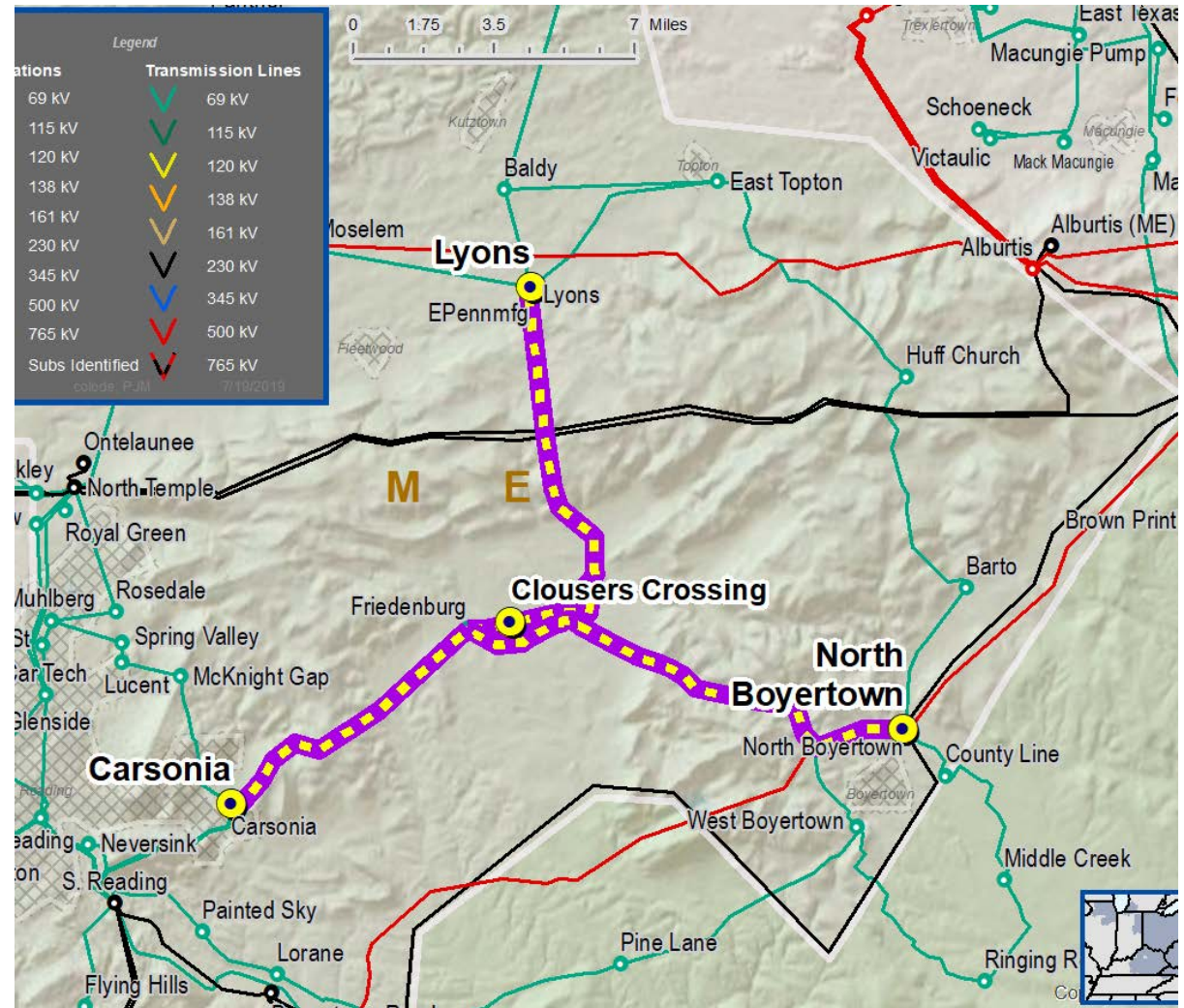
Thermal loading on the Clousers Crossing – North Boyertown 69 kV section is ~105% of the SE rating for the N-1-1 loss of the East Topton – Huffs Church 69 kV line section (bus 204829 to bus 20867) & North Boyertown 230-69 kV transformer (ME-P1-2-230-003)

(2018 RTEP Model – 2023 Summer)

Transmission line ratings are limited by terminal equipment

Lyons – Lyons tap 69 kV line (line relaying)

- Existing line rating: 167/167 MVA (SN/SE)
- Existing conductor rating: 218/251 MVA (SN/SE)



Need Number: ME-2019-041

Process Stage: Need Meeting 7/31/2019

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

System Condition Projects

- Substation Condition Rebuild/Replacement

System Performance Projects

- Substation/line equipment limits

Problem Statement:

Lucent – Muhlenberg 69 kV line – Terminal equipment has an increased risk of failure (circuit breaker, disconnect switches, line relaying) due to obsolescence of equipment. Limited spare parts are available.

- Circuit breakers are 50+ years old with Type U bushings and have a history of oil leaks
- Lucent disconnect switch has bad contacts
- Line relays have a history of overtripping

Transmission line rating is limited by terminal equipment:

Lucent – Spring Valley 69 kV line (substation conductor, disconnect switches)

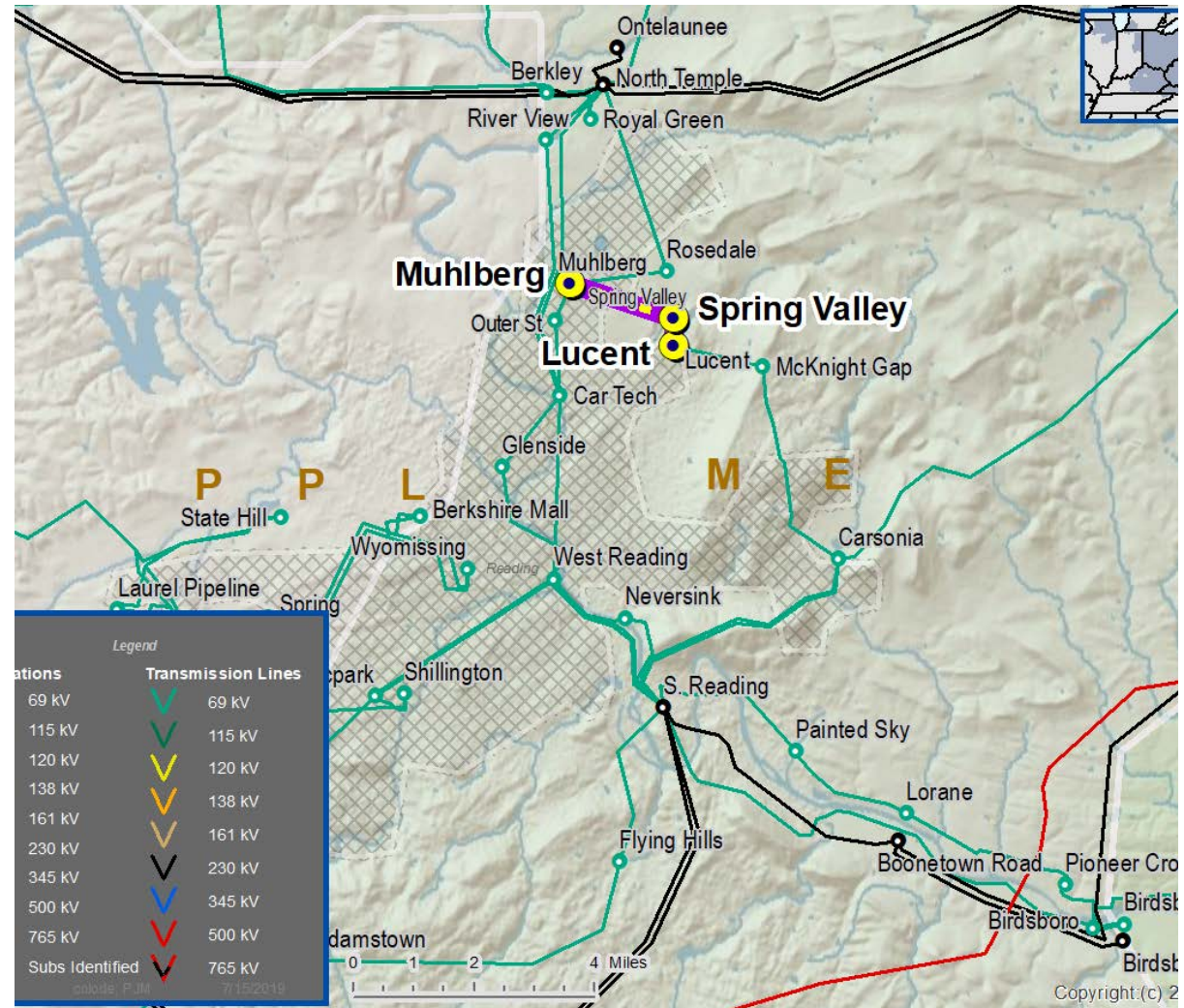
- Existing line rating: 71/91 MVA (SN/SE)
- Existing conductor rating: 111/134 MVA (SN/SE)

Spring Valley – MG Tap 69 kV line (substation conductor, disconnect switches)

- Existing line rating: 82/103 MVA (SN/SE)
- Existing conductor rating: 111/134 MVA (SN/SE)

MG Tap – Muhlenberg 69 kV line (substation conductor, disconnect switches)

- Existing line rating: 71/91 MVA (SN/SE)
- Existing conductor rating: 111/134 MVA (SN/SE)



Need Number: ME-2019-042

Process Stage: Need Meeting 7/31/2019

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

System Condition Projects

- Substation Condition Rebuild/Replacement

System Performance Projects

- Substation/line equipment limits

Problem Statement:

Middletown Junction – Olmstead - Middletown 69 kV line – Terminal equipment has an increased risk of failure (circuit breaker, disconnect switches, line relaying) due to obsolescence of equipment. Limited spare parts are available.

- Circuit breakers are 50+ years old with Type U bushings
- Circuit breakers have a history of failed compressor belt
- Circuit breaker has failing dielectric strength

Transmission line rating is limited by terminal equipment:

Middletown Junction – Olmstead 69 kV line (line relaying)

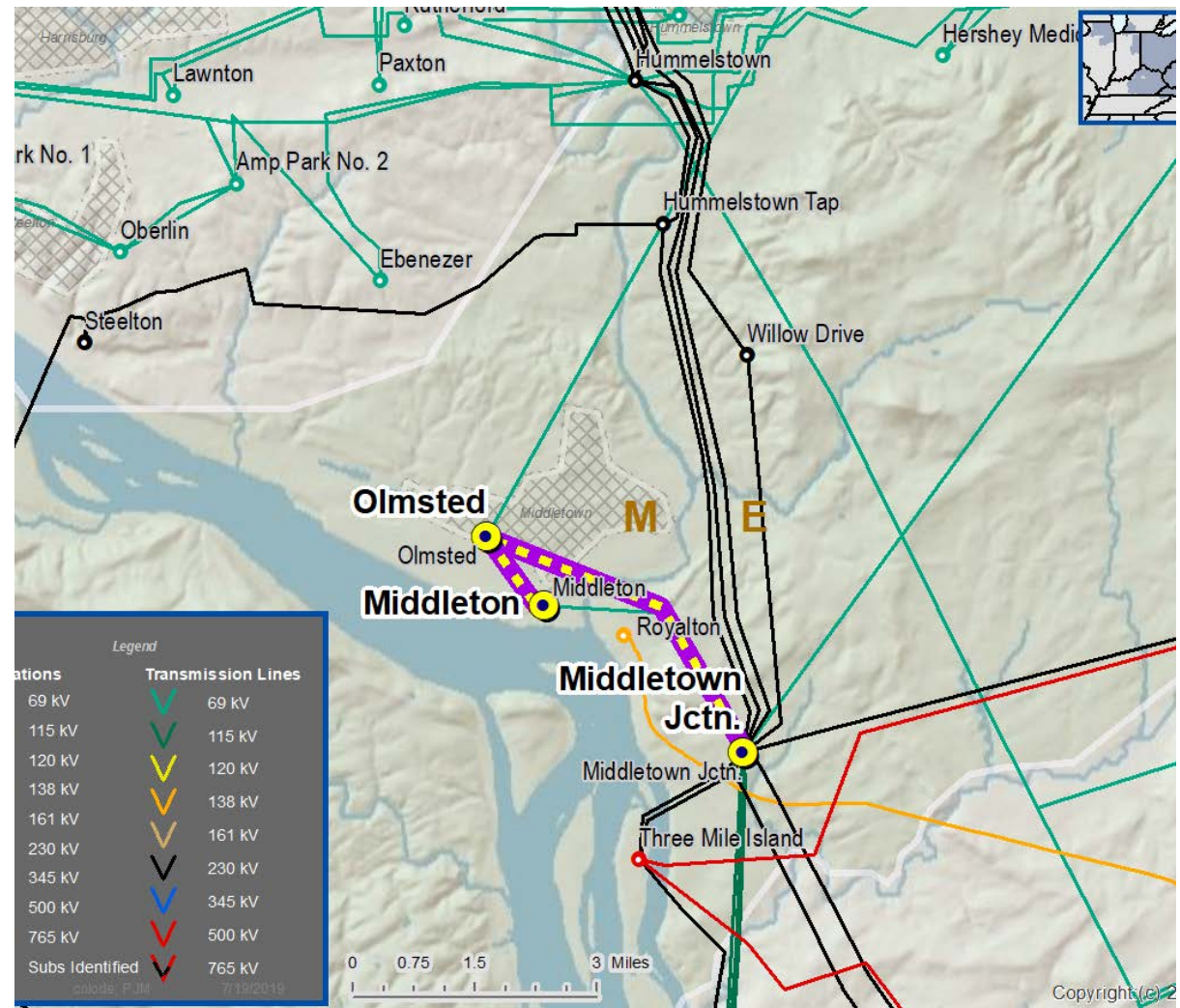
- Existing line rating: 71/91 MVA (SN/SE)
- Existing conductor rating: 111/134 MVA (SN/SE)

Wood Street Tap – Wood Street 69 kV line (substation conductor)

- Existing line rating: 38/49 MVA (SN/SE)
- Existing conductor rating: 53/64 (SN/SE)

Wood Street Tap – Middletown 69 kV line (substation conductor, disconnect switches, relaying)

- Existing line rating: 51/66 MVA (SN/SE)
- Existing conductor rating: 139/169 MVA (SN/SE)



Need Number: ME-2019-043

Process Stage: Need Meeting 7/31/2019

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

Line Condition Rebuild/Replacement

- Age/condition of wood pole transmission line structures
- Age/condition of steel tower or steel pole transmission line structures
- Age/condition of transmission line conductors

System Performance Projects

- Substation/line equipment limits

Problem Statement:

Carpenter Technology – South Reading 69 kV line is exhibiting deterioration.

- Total line distance is approximately 5.9 miles.
- 125 out of 151 structures failed inspection (83% failure rate).
- Failure reasons include age, woodpecker holes, and sound.

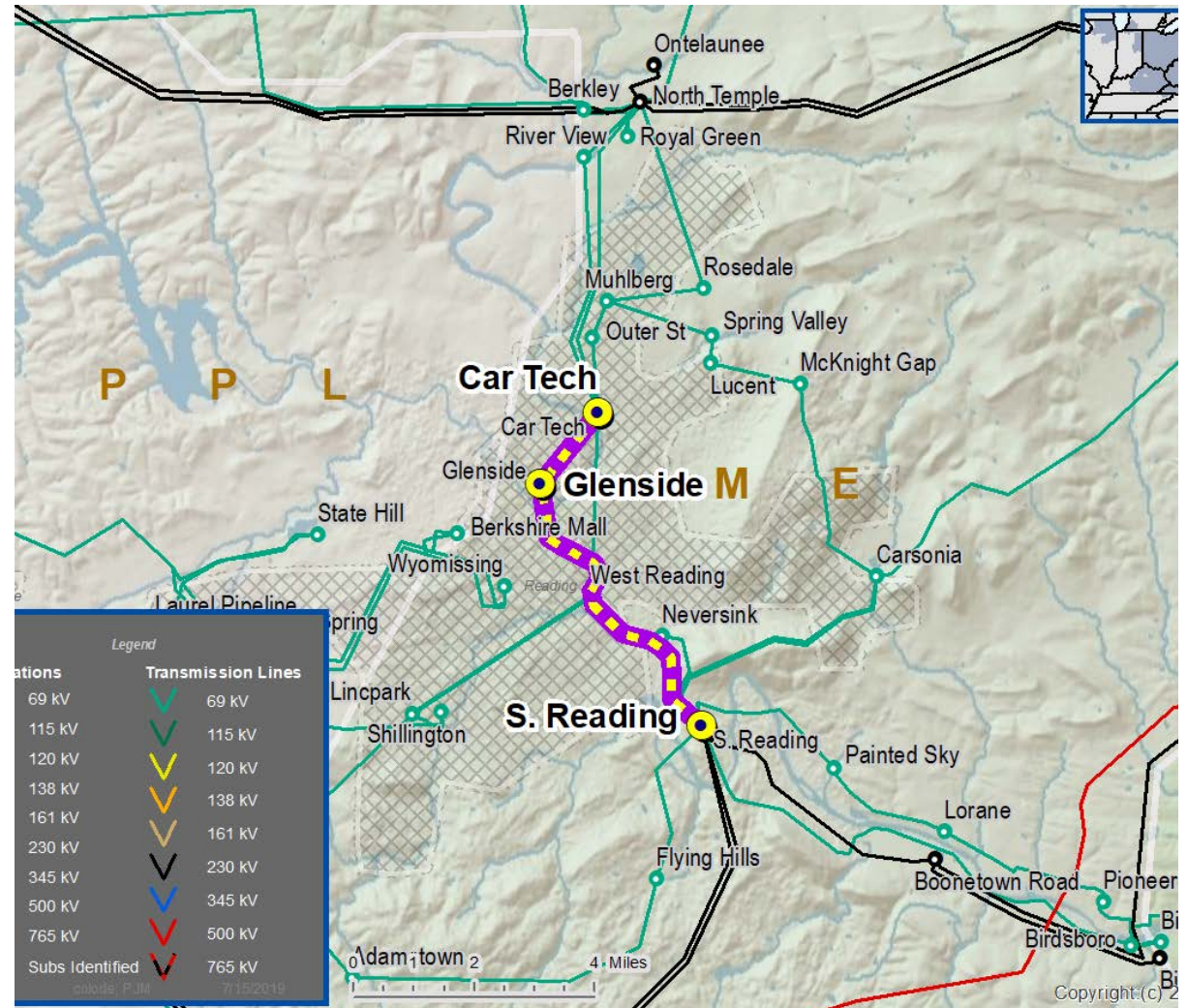
Transmission line ratings are limited by terminal equipment

Carpenter Technology – Glenside 69 kV line (disconnect switches)

- Existing line rating: 82/103 MVA (SN/SE)
- Existing conductor rating: 102/124 MVA (SN/SE)

Glenside – South Reading 69 kV line (disconnect switches, substation conductor)

- Existing line rating: 82/103 MVA (SN/SE)
- Existing conductor rating: 102/124 MVA (SN/SE)



Need Number: ME-2019-044

Process Stage: Need Meeting 7/31/2019

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

Line Condition Rebuild/Replacement

- Age/condition of wood pole transmission line structures
- Age/condition of steel tower or steel pole transmission line structures
- Age/condition of transmission line conductors

System Performance Projects

- Substation/line equipment limits

Problem Statement:

North Boyertown – West Boyertown 69 kV line is exhibiting deterioration.

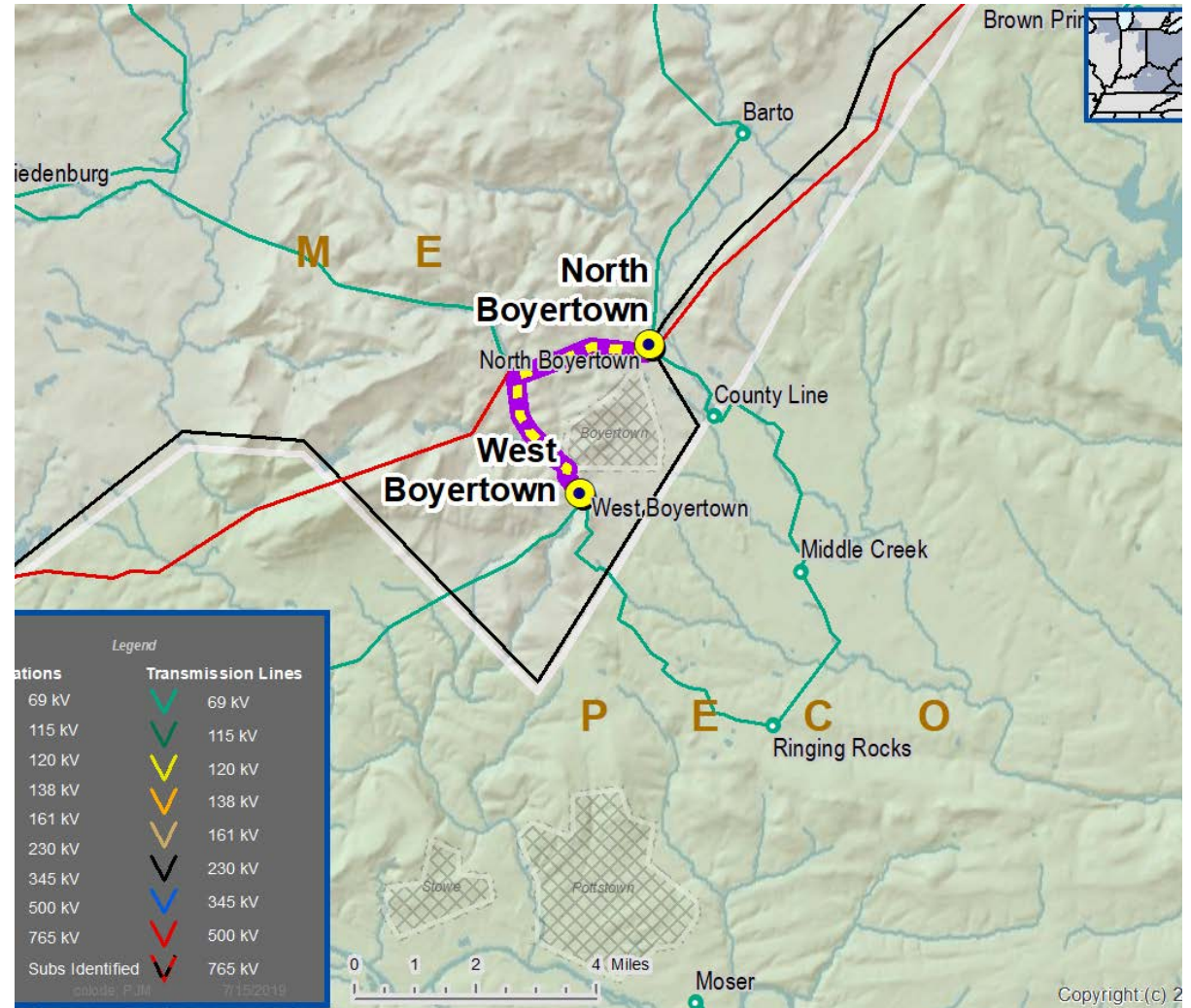
- Total line distance is approximately 3.6 miles.
- 42 out of 71 structures failed inspection (59% failure rate).
- Failure reasons include age, sound, and bayonet pole.

Thermal loading on the North Boyertown – West Boyertown 69 kV line is ~88% of the SE rating for loss of the North Boyertown – Cabot 69 kV line section (bus 204606 to bus 204834).

(2018 RTEP Model – 2023 Summer)

Transmission line ratings are limited by terminal equipment: (substation conductor, line relaying)

- Existing line rating: 71/72 MVA (SN/SE)
- Existing conductor rating: 80/96 MVA (SN/SE)



Need Number: ME-2019-045

Process Stage: Need Meeting 7/31/2019

Project Driver:

Equipment Material Condition, Performance and Risk

Specific Assumption Reference:

System Condition Projects

- Substation Condition Rebuild/Replacement

System Performance Projects

- Substation/line equipment limits

Problem Statement:

Baldy – East Topton 69 kV line – Terminal equipment has an increased risk of failure (circuit breaker and line relaying) due to obsolescence of equipment. Limited spare parts are available.

- East Topton circuit breaker is 40+ years old with Type U bushings and has a history of failed oil dielectric strength

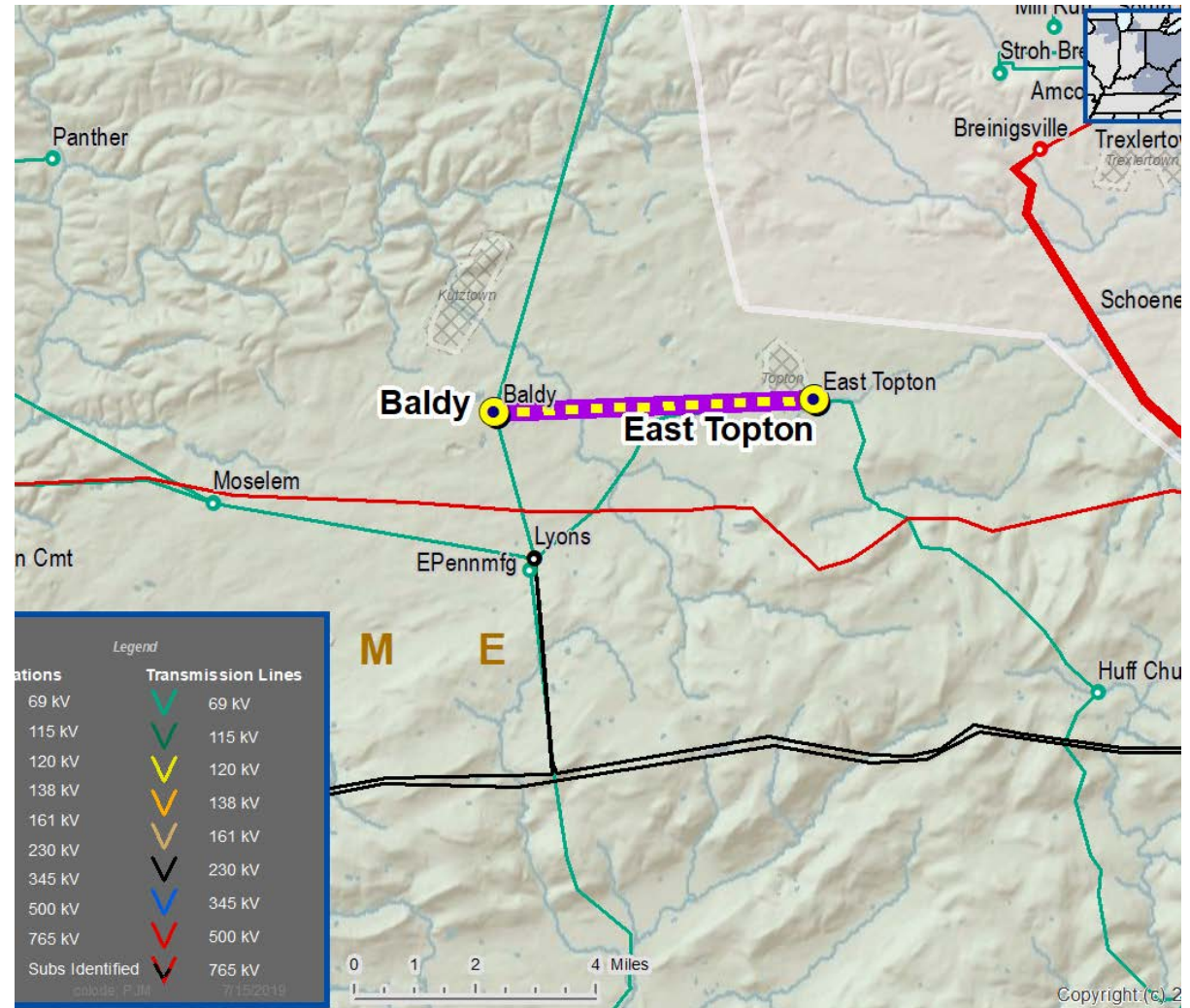
Transmission line rating is limited by terminal equipment:

Baldy – Kutztown 69 kV line (substation conductor)

- Existing line rating: 76/90 MVA (SN/SE)
- Existing conductor rating: 80/96 MVA (SN/SE)

Kutztown – East Topton 69 kV line (substation conductor, line relaying)

- Existing line rating: 62/62 MVA (SN/SE)
- Existing conductor rating: 80/96 MVA (SN/SE)



Need Number: ME-2019-046 to ME-2019-050 and ME-2019-052

Process Stage: Need Meeting 7/31/2019

Project Driver:

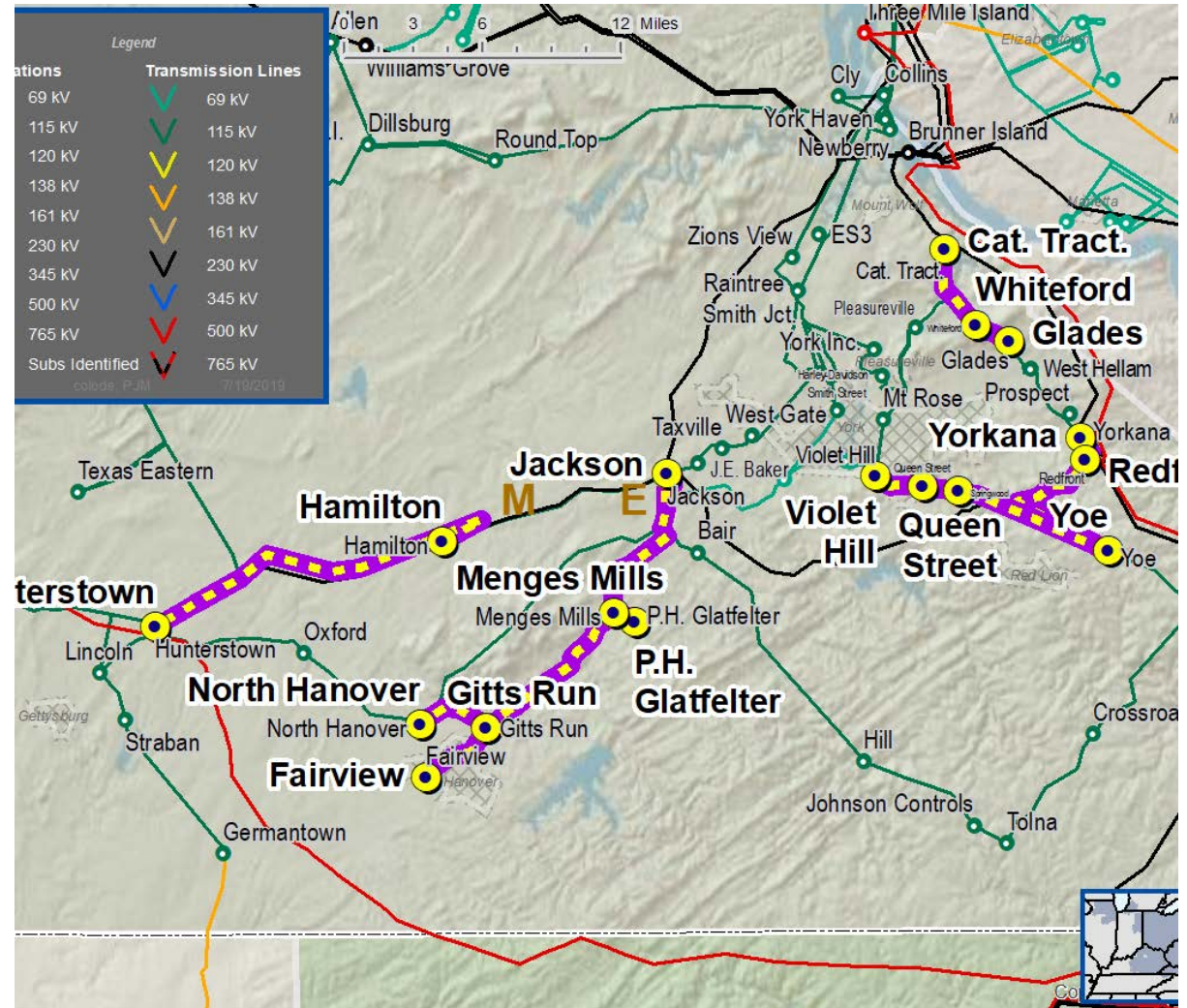
Equipment Material Condition, Performance and Risk, Operational Flexibility and Efficiency

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...



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.

ME-2019-	Transmission Line / Substation Locations	Existing Line Rating (SN / SE)	Existing Conductor Rating (SN / SE)	Limiting Terminal Equipment
046	Hamilton – Hunterstown 115 kV Line	221/263	232/282	Substation Conductor
047	North Hanover – Gitts Tap 115 kV Line Gitts Tap – Fairview 115 kV Line	221/263 232/282	232/282 232/282	Substation Conductor -
048	Jackson – Menges Mills 115 kV Line Menges Mills – PH Glatfelter 115 kV Line	163/185 221/263	184/223 232/282	Line Trap Substation Conductor
049	North Hanover – Gitts Run 115 kV Line Gitts Run – PH Glatfelter 115 kV Line	232/282 221/263	232/282 232/282	- Substation Conductor
050	Caterpillar Tractor – Whiteford 115 kV Line Whiteford – Glades 115 kV Line	232/277 184/223	232/282 184/223	Line Trap -
052	Violet Hill – Queen Street 115 kV Line Queen Street – Springwood 115 kV Line Springwood – Yoe 115 kV Line Yoe – Redfront 115 kV Line Redfront – Yorkana 115 kV Line	204/266 232/282 232/282 184/223 184/223	232/282 232/282 232/282 184/223 184/223	Substation Conductor - - - -

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: ME-2019-023

Process Stage: Solutions Meeting 7/31/2019

Previously Presented:

Needs Meeting 5/31/2019

Project Driver:

Operational Flexibility and Efficiency

Specific Assumption Reference:

System Performance Projects

- Load at risk in planning and operational scenarios

Add/Expand Bus Configuration

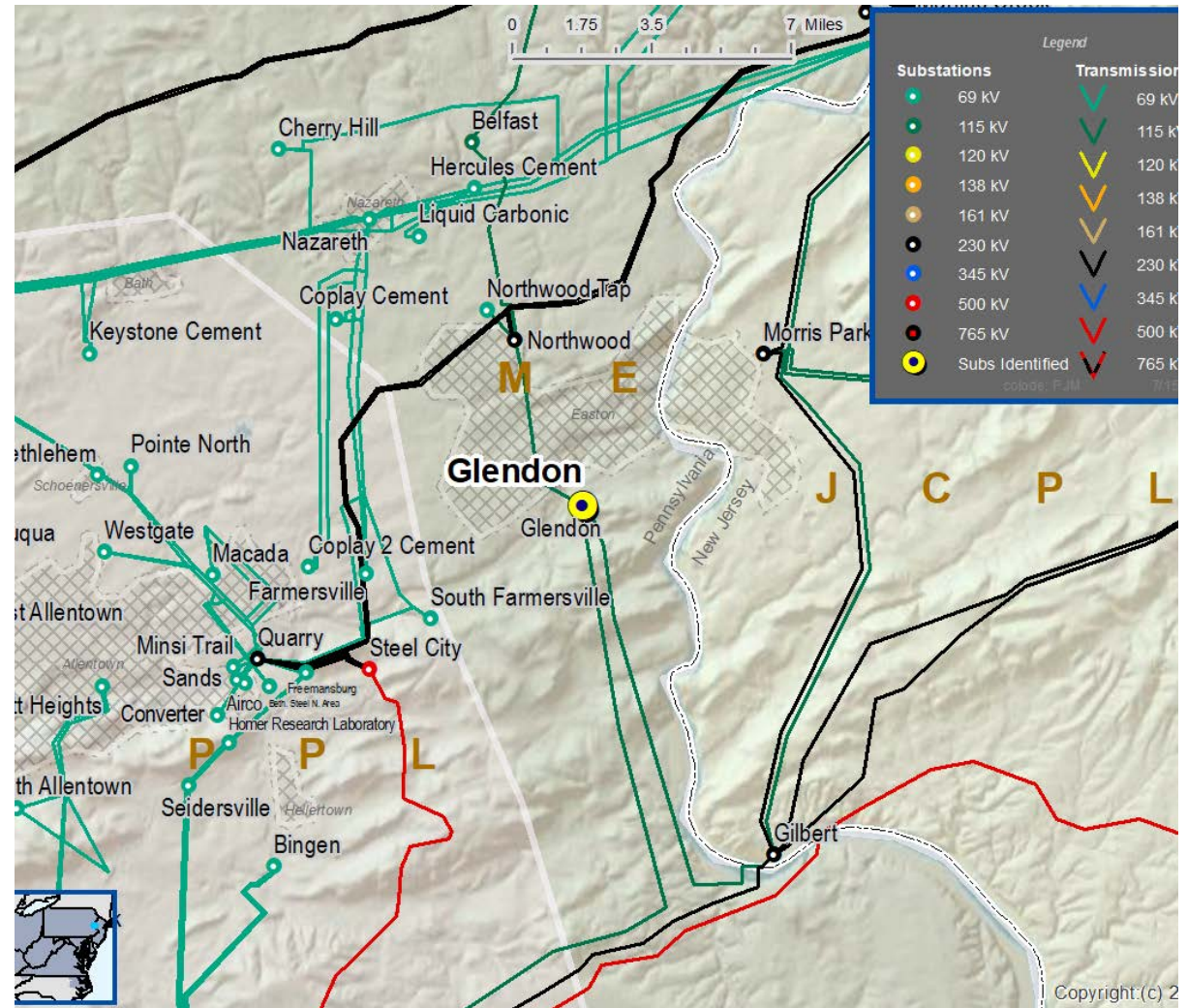
- Reduce the amount of exposed potential local load loss during contingency conditions
- Eliminate simultaneous outages to multiple networked elements

Problem Statement:

The loss of Glendon substation results in loss of approximately 39 MW of load and approximately 5,464 customers.

Substation consists of:

- Three networked 115 kV lines
- Two distribution transformers connected to transmission via switch.
- No bus tie breaker



Need Number: ME-2019-023

Process Stage: Solutions Meeting 7/31/2019

Proposed Solution:

Glendon 115 kV Ring Bus

- Construct a six breaker 115 kV ring bus.

Estimate Cost: \$9.9 M

Transmission Line Rating:

Glendon – Northwood 115 kV Line

- Before Proposed Solution: 181/218 MVA (SN/SE)
 - Substation conductor
- After Proposed Solution: 232/282 MVA (SN/SE)
 - Transmission line conductor

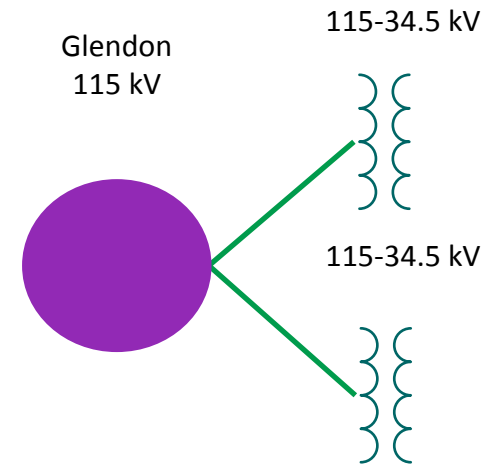
Alternatives Considered:

- Maintain existing condition

Projected In-Service: 12/31/2023

Project Status: Conceptual

Model: 2018 Series 2023 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: ME-2019-024

Process Stage: Solutions Meeting 7/31/2019

Previously Presented:

Needs Meeting 5/31/2019

Project Driver:

Operational Flexibility and Efficiency

Specific Assumption Reference:

System Performance Projects

- Load at risk in planning and operational scenarios

Add/Expand Bus Configuration

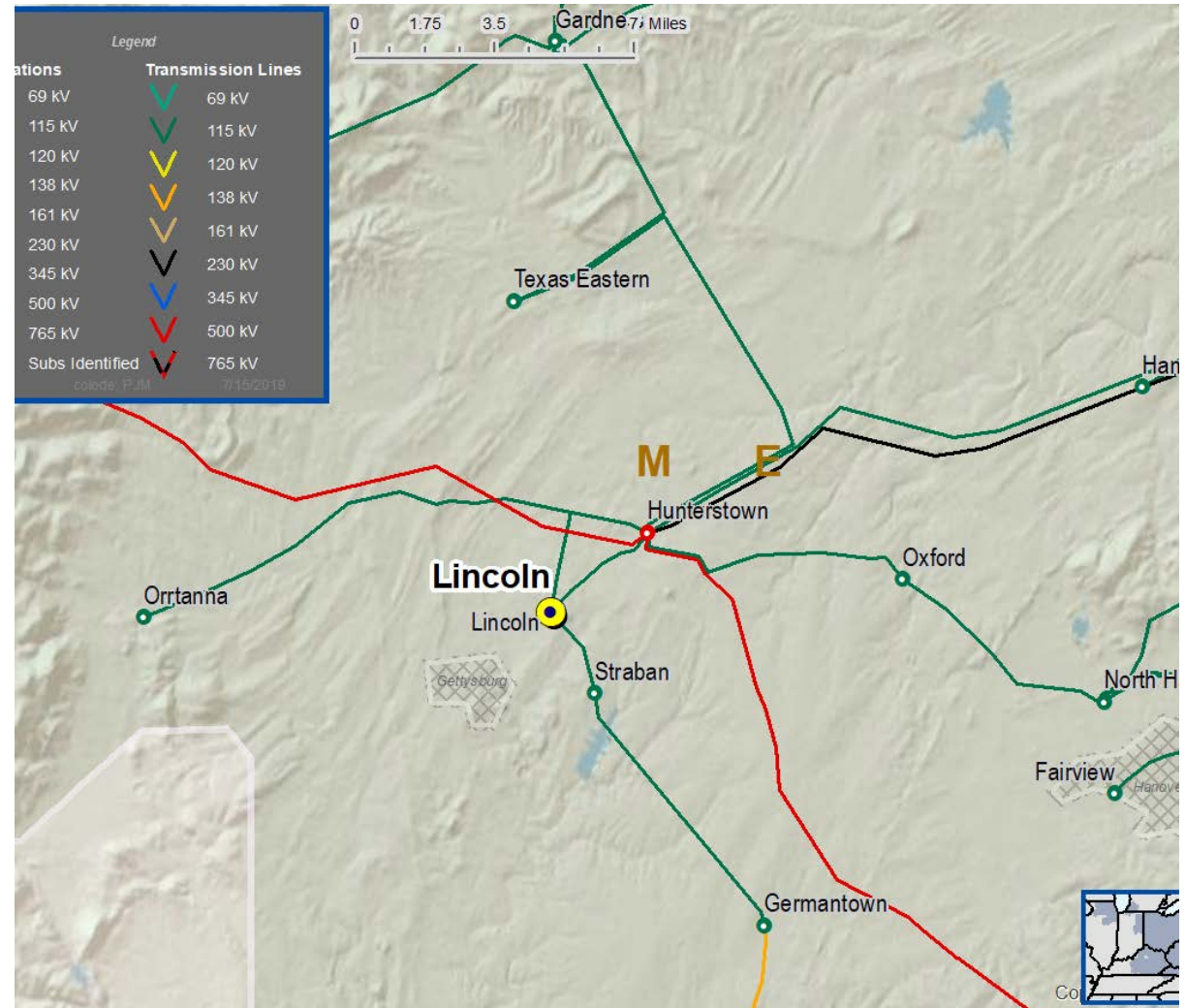
- Reduce the amount of exposed potential local load loss during contingency conditions
- Eliminate simultaneous outages to multiple networked elements

Problem Statement:

The loss of Lincoln substation results in loss of approximately 39 MW of load and approximately 5,688 customers.

Substation consists of:

- Three networked 115 kV lines
- Two distribution transformers in substation and one tapped off line. All transformer connected to transmission with switches.
- No bus tie breaker



Need Number: ME-2019-024

Process Stage: Solutions Meeting 7/31/2019

Proposed Solution:

Lincoln 115 kV Ring Bus

- Convert Lincoln 115 kV to a six breaker ring bus.

Cost: \$6.9 M

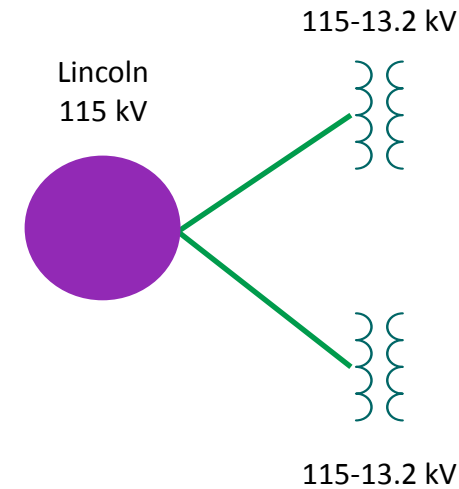
Alternatives Considered:

- Maintain existing condition

Projected In-Service: 12/31/2022

Project Status: Conceptual

Model: 2018 Series 2023 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: ME-2019-025

Process Stage: Solutions Meeting 7/31/2019

Previously Presented:

Needs Meeting 5/31/2019

Project Driver:

Operational Flexibility and Efficiency

Specific Assumption Reference:

System Performance Projects

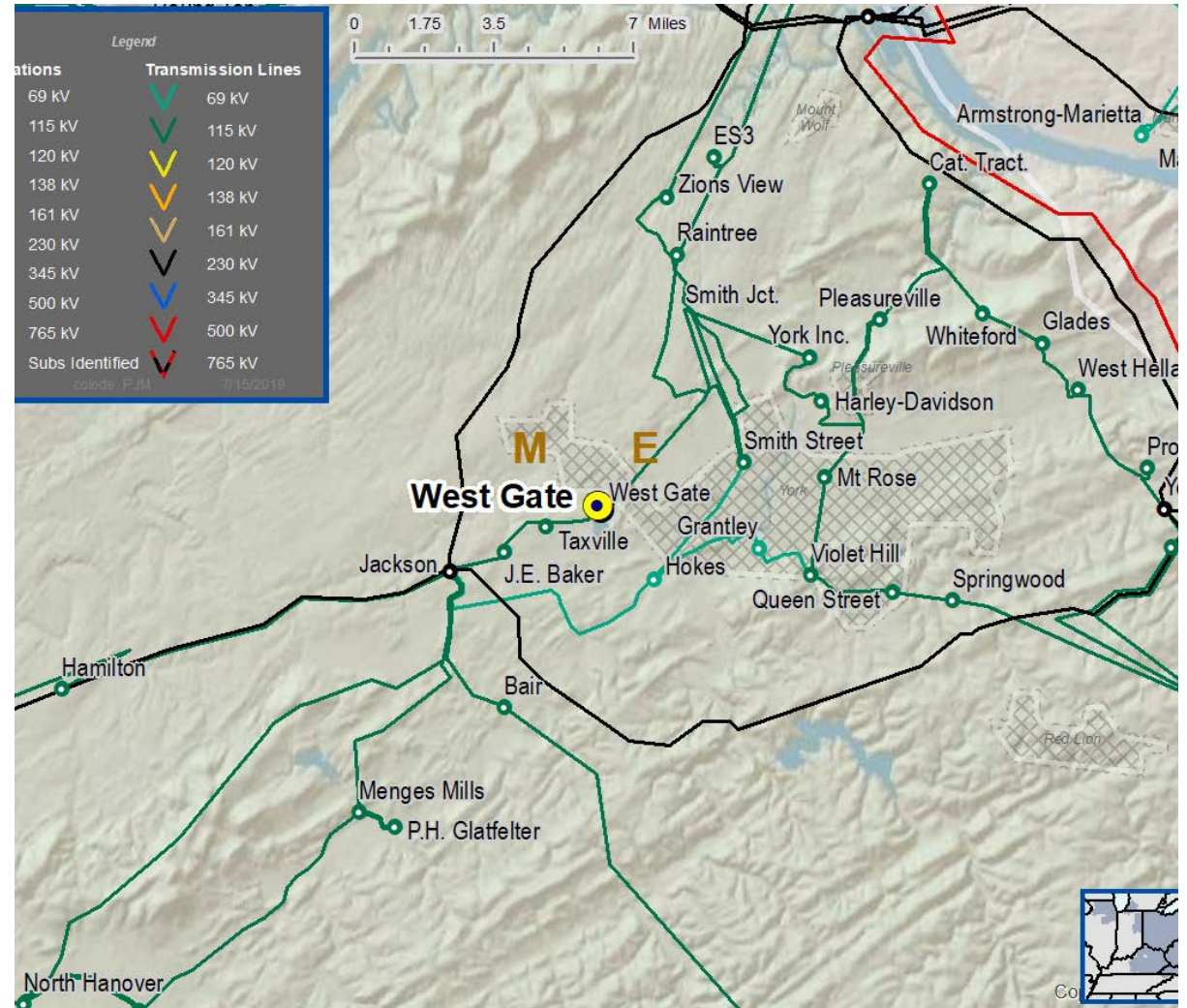
- Load at risk in planning and operational scenarios
- Add/Expand Bus Configuration
- Reduce the amount of exposed potential local load loss during contingency conditions
 - Eliminate simultaneous outages to multiple networked elements

Problem Statement:

The loss of Westgate substation results in loss of approximately 34 MW of load and approximately 5,768 customers.

Substation consists of:

- Two networked 115 kV transmission lines
- Two distribution transformers connected to transmission via switch



Need Number: ME-2019-025

Process Stage: Solutions Meeting 7/31/2019

Proposed Solution:

Westgate 115 kV Tie Breaker

- Install a tie breaker at Westgate 115 kV.

Cost: \$0.6 M

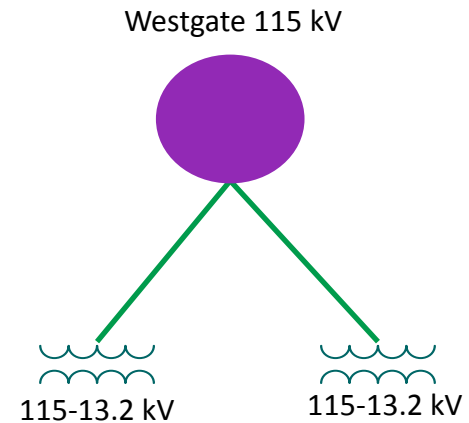
Alternatives Considered:

1. Maintain existing condition

Projected In-Service: 12/1/2020

Project Status: Conceptual

Model: 2018 Series 2023 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: ME-2019-026

Process Stage: Solutions Meeting 7/31/2019

Previously Presented:

Needs Meeting 5/31/2019

Project Driver:

Operational Flexibility and Efficiency

Specific Assumption Reference:

System Performance Projects

- Load at risk in planning and operational scenarios
- Add/Expand Bus Configuration
- Loss of substation bus adversely impacts transmission system performance
- Reduce the amount of exposed potential local load loss during contingency conditions
- Eliminate simultaneous outages to multiple networked elements

Problem Statement:

Two networked 230 kV lines

One 230/115 kV transformer connected via circuit switcher

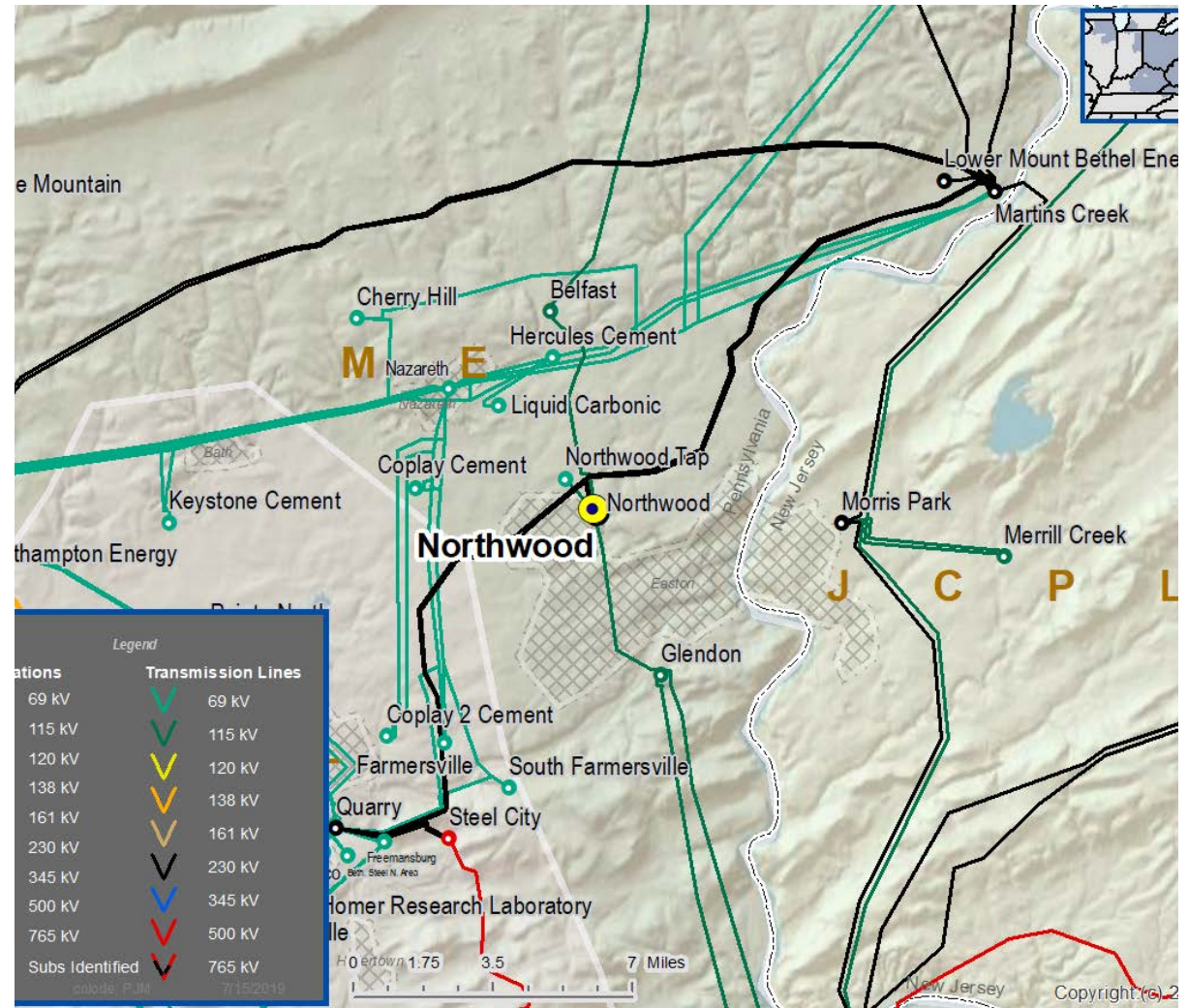
Two 230-34.5 kV distribution transformer connect with circuit switchers

One bus tie breaker

The loss of the Northwood 230 kV Substation sheds approximately 145 MW of load to 9,000 customers. Northwood has a historical peak load of 163 MW.

A fault on the line Quarry(PPL) – Northwood 230 kV line results in the loss of the #3 and #6 transformers.

A stuck breaker results in a loss of the Northwood 230 kV substation.



Need Number: ME-2019-026

Process Stage: Solutions Meeting 7/31/2019

Proposed Solution:

Northwood 230 kV Ring Bus

- Convert Northwood 230 kV into a five breaker ring bus.

Cost: \$4.5 M

Transmission Line Rating:

- Martins Creek – Northwood 230 kV Line
 - Before Proposed Solution: 520/621 MVA (SN/SE)
 - After Proposed Solution: 542/666 MVA (SN/SE)

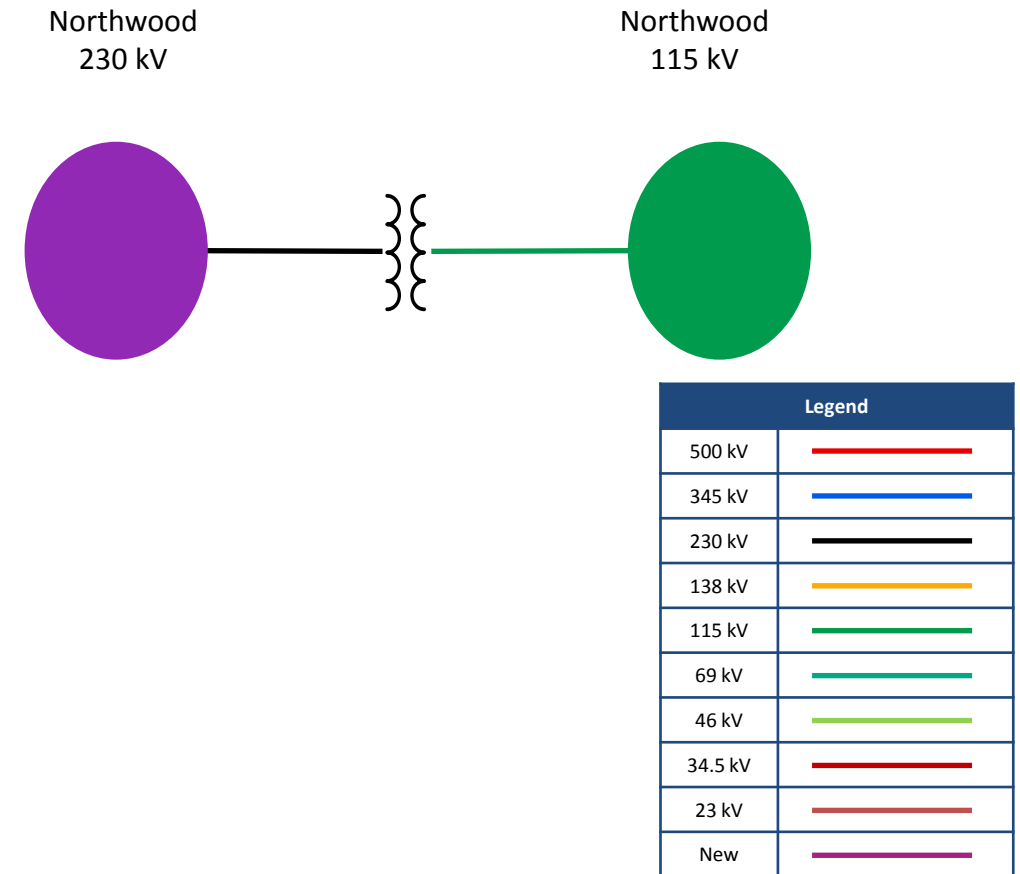
Alternatives Considered:

- Maintain existing condition

Projected In-Service: 12/31/2021

Project Status: Conceptual

Model: 2018 Series 2023 Summer RTEP 50/50



Need Number: ME-2019-027

Process Stage: Solutions Meeting 7/31/2019

Previously Presented:

Needs Meeting 5/31/2019

Project Driver:

Operational Flexibility and Efficiency

Specific Assumption Reference:

System Performance Projects

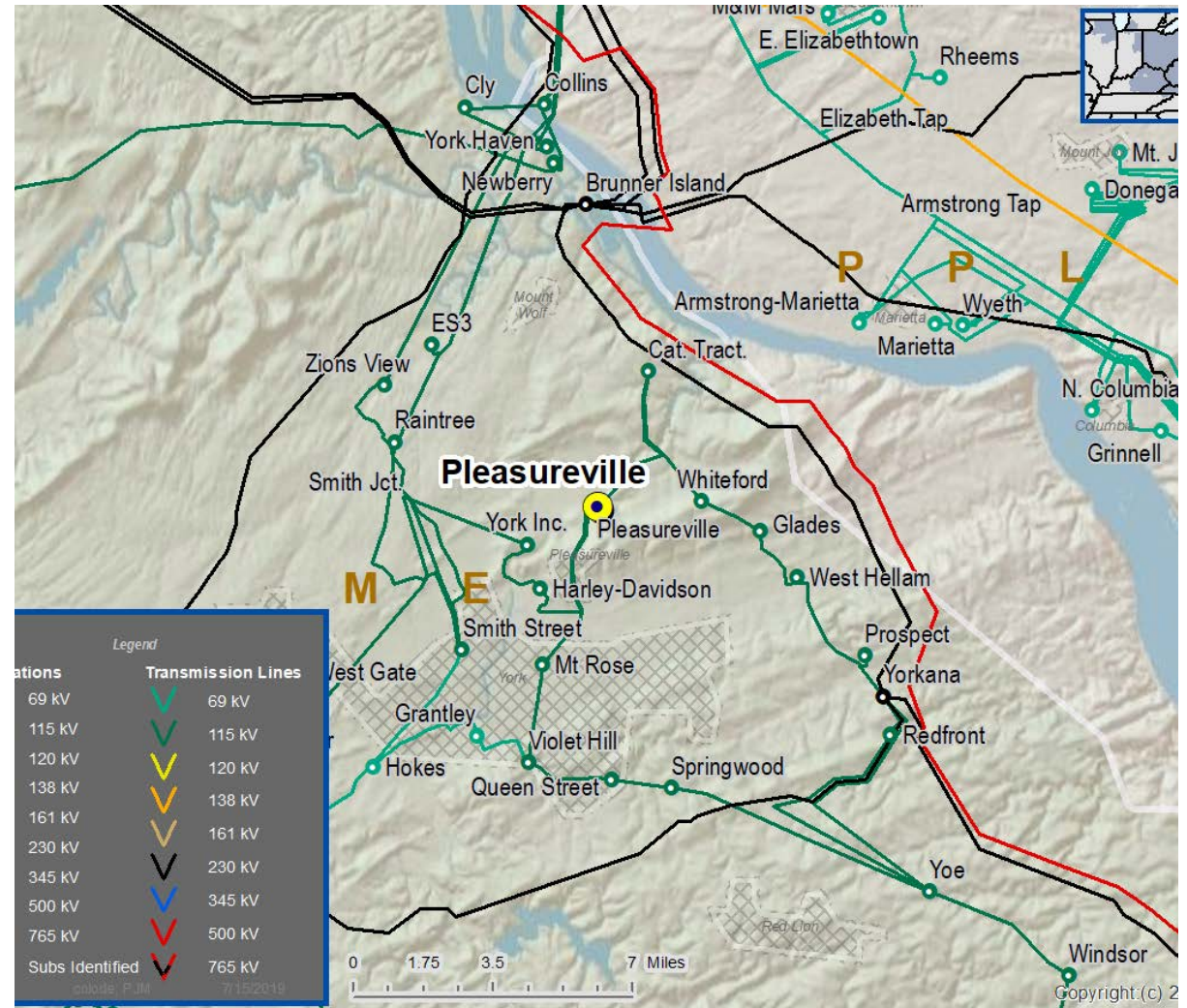
- Load at risk in planning and operational scenarios
- Add/Expand Bus Configuration
- Reduce the amount of exposed potential local load loss during contingency conditions
 - Eliminate simultaneous outages to multiple networked elements

Problem Statement:

The loss of Pleasureville substation results in loss of approximately 39 MW of load and approximately 5,817 customers.

Substation consists of:

- Three networked 115 kV lines connected to a straight bus with no tie breaker.



Need Number: ME-2019-027

Process Stage: Solutions Meeting 7/31/2019

Proposed Solution:

Pleasureville 115 kV Breaker-and-a-Half Configuration

- Expand Pleasureville 115 kV substation into a breaker-and-a-half configuration (8 breakers).

Cost: \$10 M

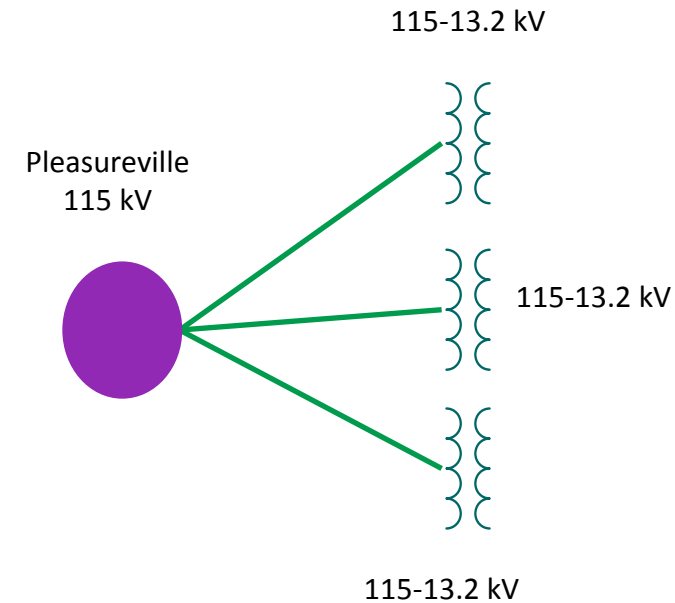
Alternatives Considered:

- Maintain existing condition

Projected In-Service: 12/31/2022

Project Status: Conceptual

Model: 2018 Series 2023 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: ME-2019-028

Process Stage: Solutions Meeting 7/31/2019

Previously Presented:

Needs Meeting 5/31/2019

Project Driver:

Operational Flexibility and Efficiency

Specific Assumption Reference:

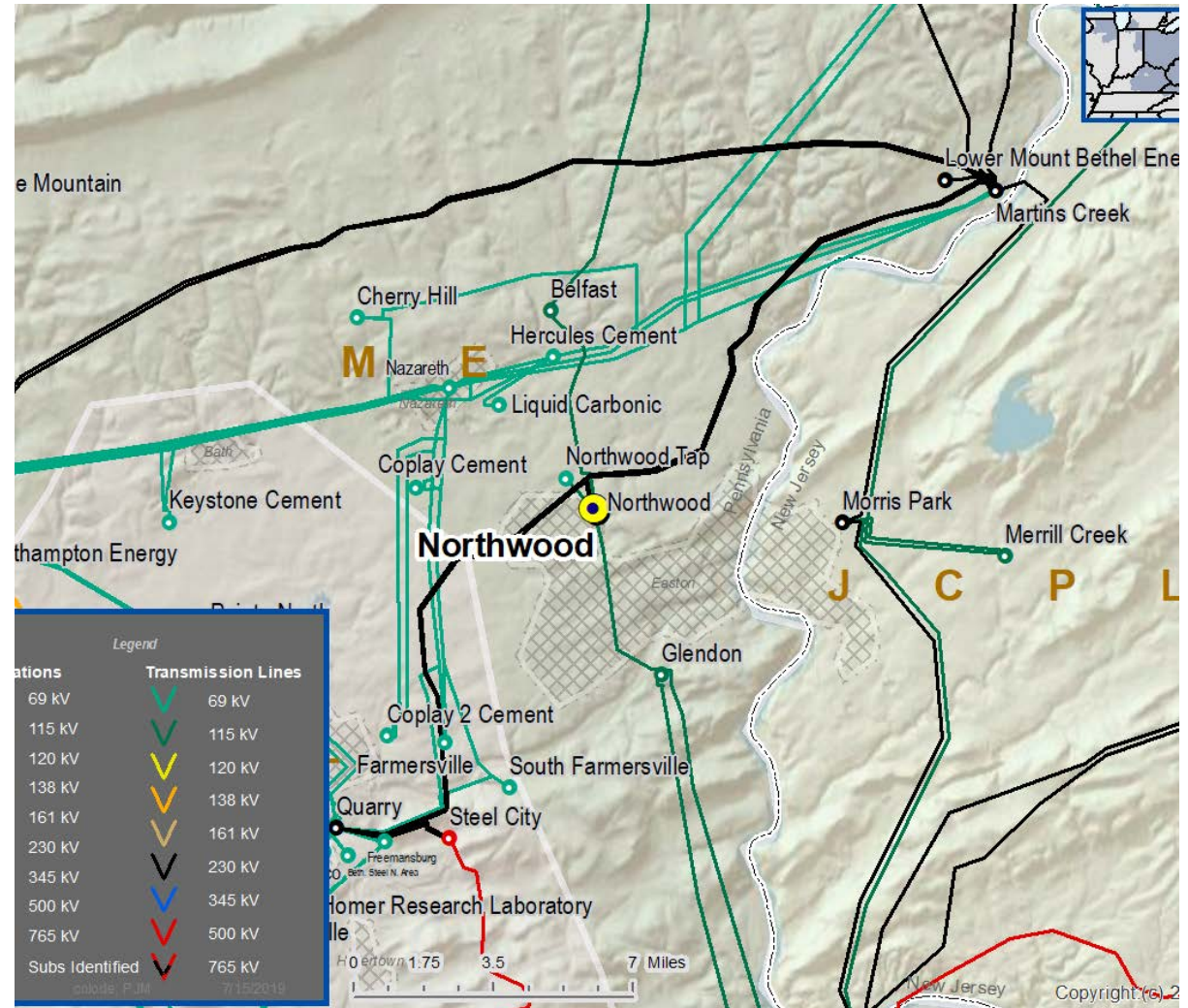
Add/Expand Bus Configuration

- Eliminate simultaneous outages to multiple networked elements

Problem Statement:

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

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



Need Number: ME-2019-028

Process Stage: Solutions Meeting 7/31/2019

Proposed Solution:

Northwood 115 kV Ring Bus

- Convert Northwood 115 kV into a three breaker ring bus.

Cost: \$4.3 M

Transmission Line Rating:

- Belfast – Northwood 115 kV Line
 - Before Proposed Solution: 232/277 MVA (SN/SE)
 - After Proposed Solution: 232/282 MVA (SN/SE)

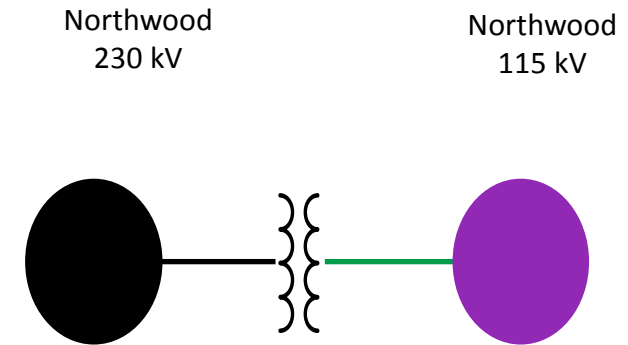
Alternatives Considered:

- Maintain existing condition

Projected In-Service: 12/31/2023

Project Status: Conceptual

Model: 2018 Series 2023 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: ME-2019-029

Process Stage: Solutions Meeting 7/31/2019

Previously Presented:

Needs Meeting 5/31/2019

Project Driver:

Operational Flexibility and Efficiency

Specific Assumption Reference:

System Performance Projects

- Load at risk in planning and operational scenarios

Network Radial Line

- Radial lines defined by normally open points

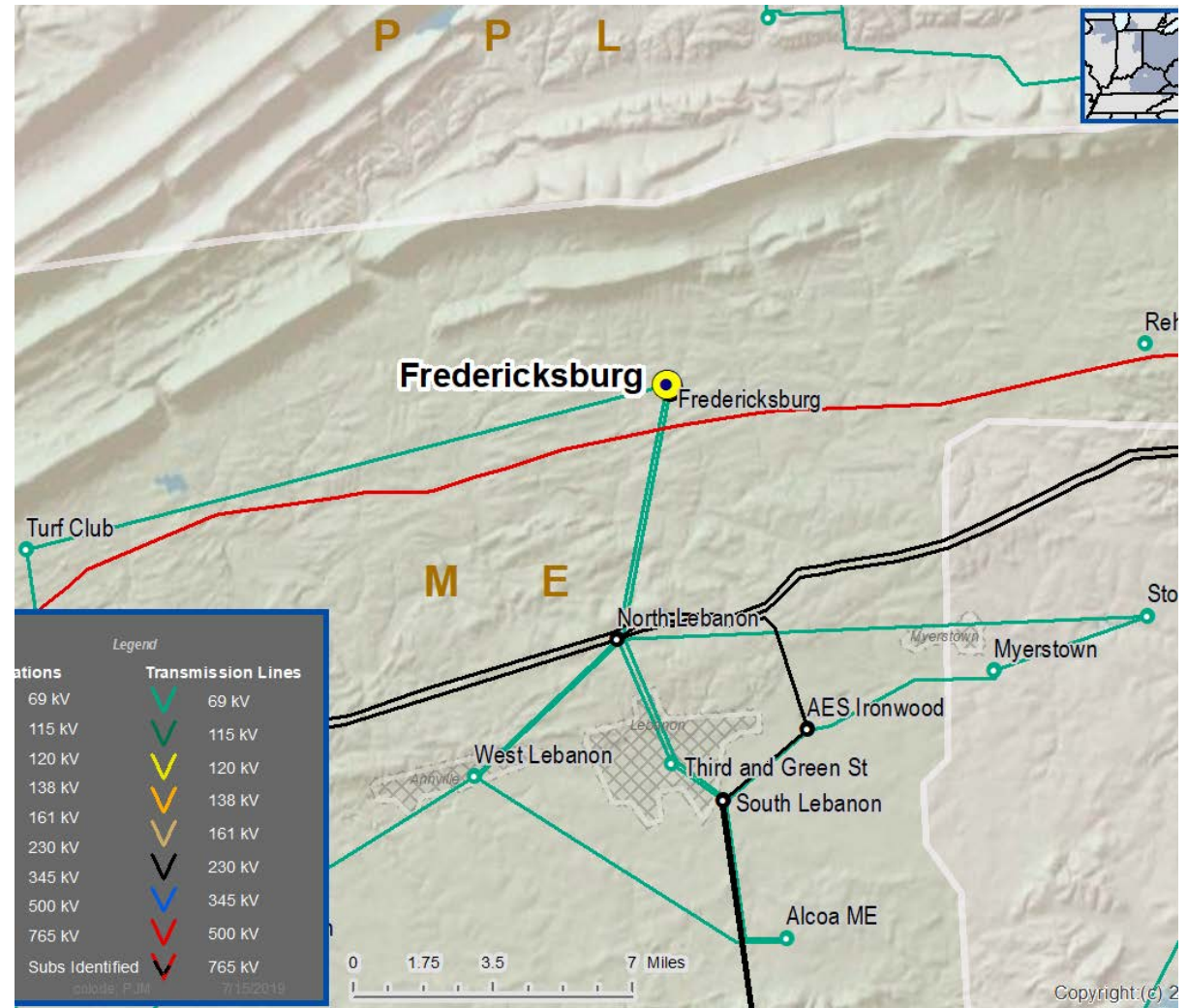
Problem Statement:

The North Lebanon – Turf Club – South Lebanon is operated normally opened at Frystown to prevent a 3-terminal line.

Substations impacted by normally open point are as follows:

- Fredericksburg – 12 MW & 1,433 Customers
- Lickdale – 24 MW & 3,302 Customers
- Indiantown Gap – 7 MW & 1 Customer (Wholesale)
- Frystown – 16 MW & 1,696 Customers
- Rehrersburg – 5 MW & 1,217 Customers

These substations total to approximately 64 MW and 7,649 customers.



Need Number: ME-2019-029

Process Stage: Solutions Meeting 7/31/2019

Proposed Solution:

Fredericksburg 69 kV Ring Bus

- Convert Fredericksburg 69 kV into a four breaker ring bus.

Cost: \$6.0 M

Alternatives Considered:

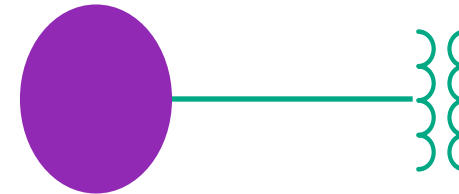
- Maintain existing condition

Projected In-Service: 12/31/2024

Project Status: Conceptual

Model: 2018 Series 2023 Summer RTEP 50/50

Fredericksburg
69 kV



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

Need Number: ME-2019-032

Process Stage: Solutions Meeting 7/31/2019

Previously Presented:

Needs Meeting 5/31/2019

Project Driver:

Operational Flexibility and Efficiency

Specific Assumption Reference:

System Performance Projects

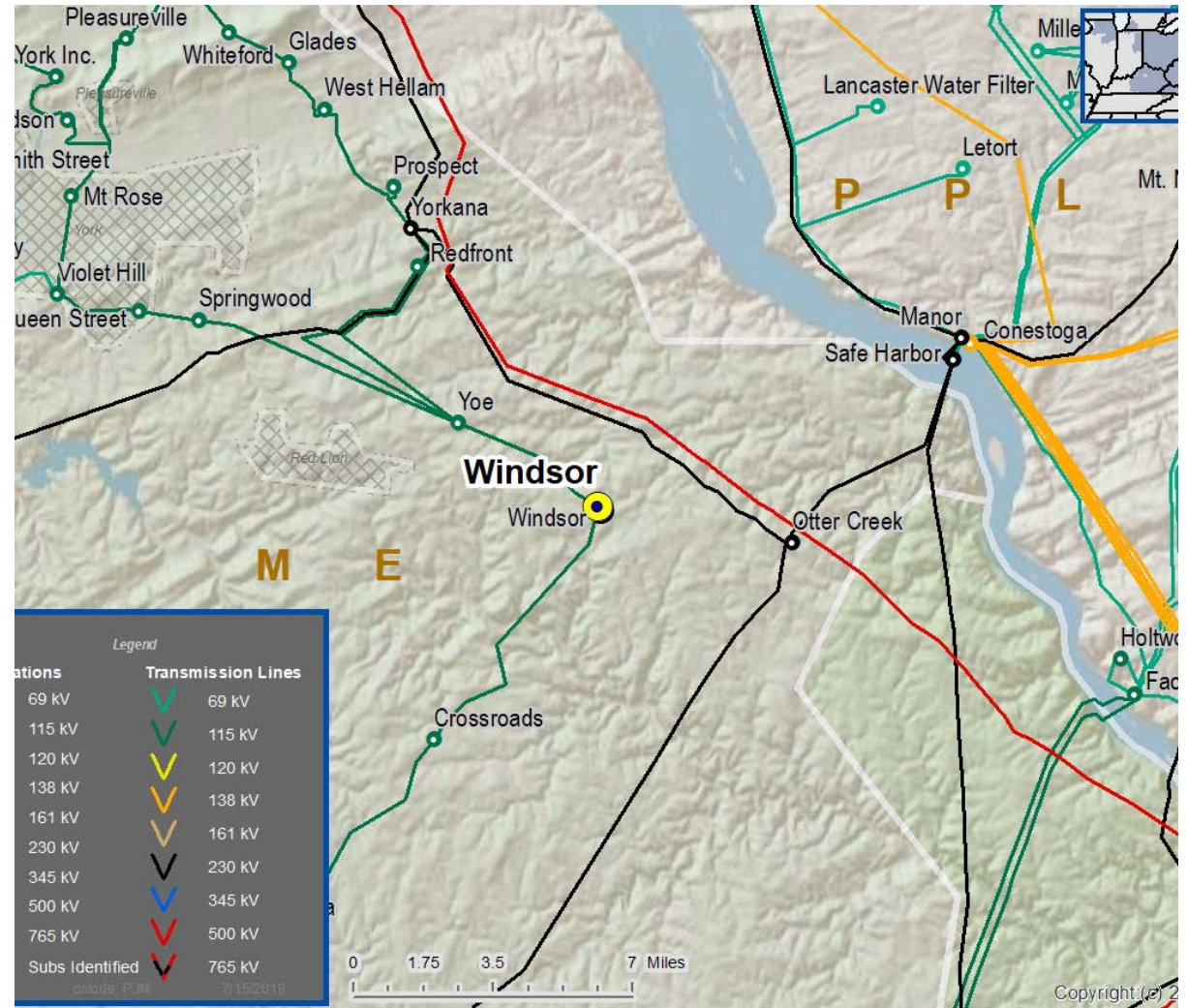
- Load at risk in planning and operational scenarios
- Add/Expand Bus Configuration
- Reduce the amount of exposed potential local load loss during contingency conditions
 - Eliminate simultaneous outages to multiple networked elements

Problem Statement:

The loss of Windsor substation results in the loss of approximately 31 MW of load and approximately 5,874 customers.

Substation consists of:

- Two networked 115 kV transmission lines
- Two distribution transformers connected to bus with switches.



Need Number: ME-2019-032

Process Stage: Solutions Meeting 7/31/2019

Proposed Solution:

Windsor 115 kV Tie Breaker

- Install a new 115 kV tie breaker at Windsor.

Cost: \$0.6 M

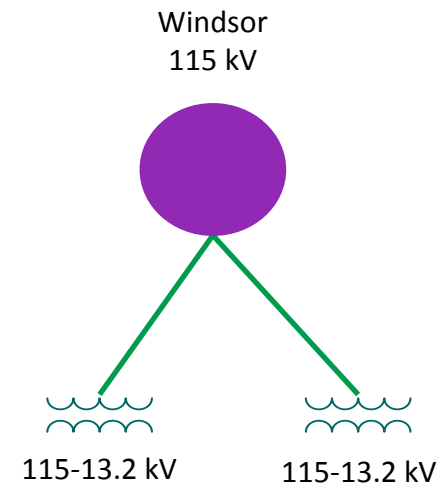
Alternatives Considered:

1. Maintain existing condition

Projected In-Service: 6/1/2021

Project Status: Conceptual

Model: 2018 Series 2023 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: ME-2019-037

Process Stage: Solutions Meeting 7/31/2019

Previously Presented:

Needs Meeting 5/31/2019

Project Driver:

Operational Flexibility and Efficiency

Specific Assumption Reference:

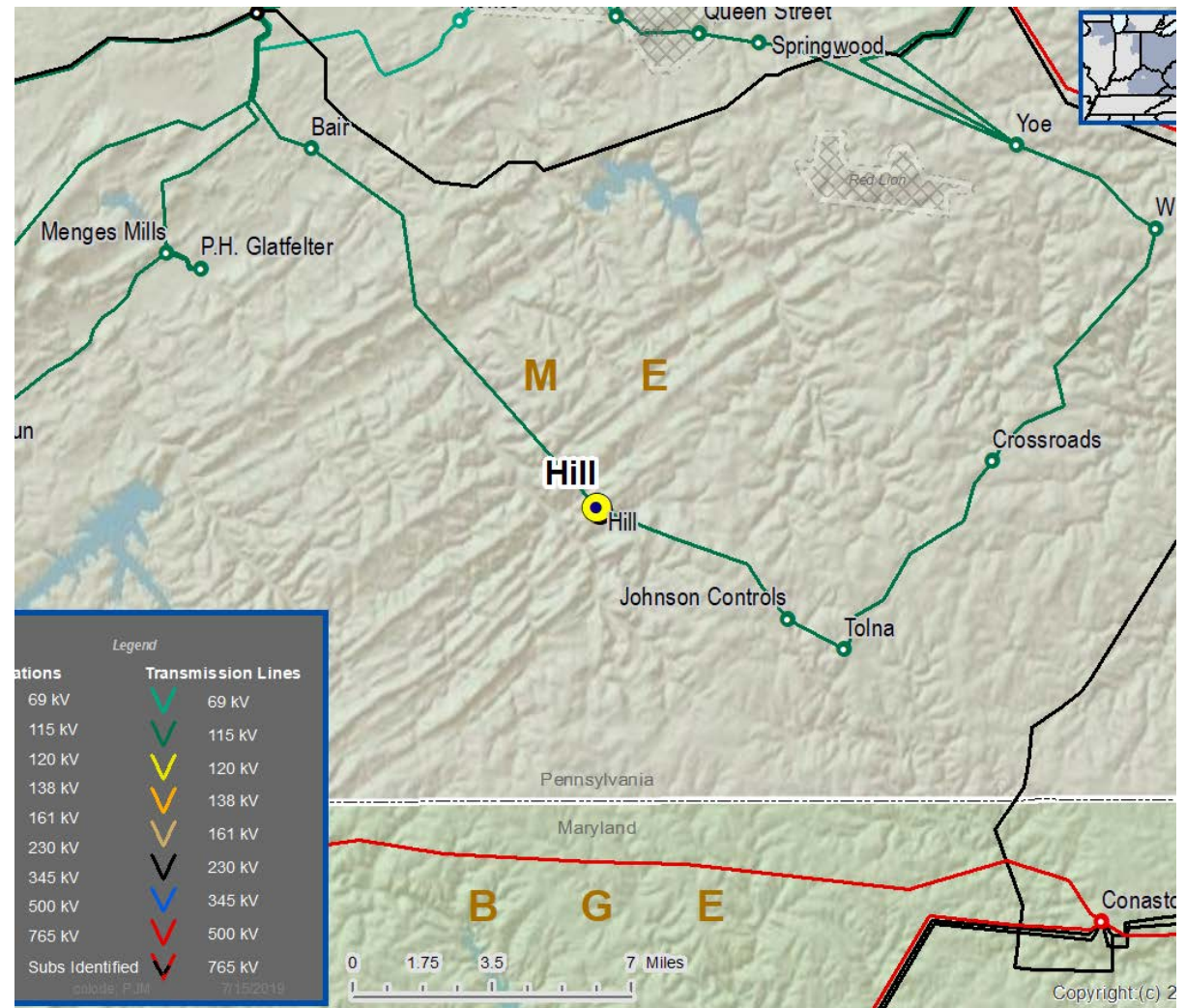
System Performance Projects

- 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:

The loss of Hill substation results in loss of approximately 34 MW of load and approximately 7,800 customers.

- Two 115 kV lines
- Two distribution transformers connected to transmission via switch



Need Number: ME-2019-037

Process Stage: Solutions Meeting 7/31/2019

Proposed Solution:

Hill 115 kV Ring Bus

- Convert Hill 115 kV into a four breaker ring bus.

Cost: \$4.4 M

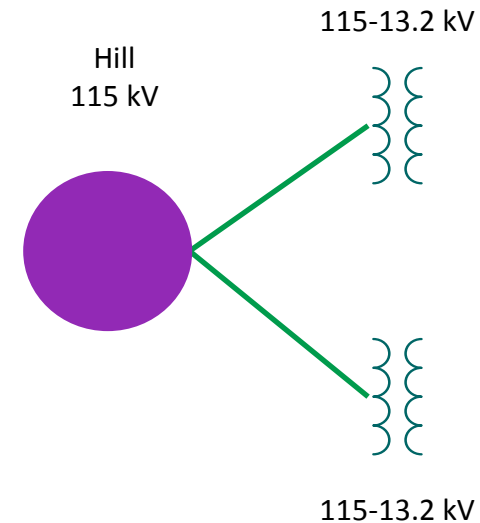
Alternatives Considered:

- Maintain existing condition

Projected In-Service: 6/1/2022

Project Status: Conceptual

Model: 2018 Series 2023 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	

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

7/19/2019 – V1 – Original version posted to pjm.com