



# Transmission Expansion Advisory Committee Market Efficiency Update

January 7, 2016



# Market Efficiency 2014/15 Long Term Proposal Window Update

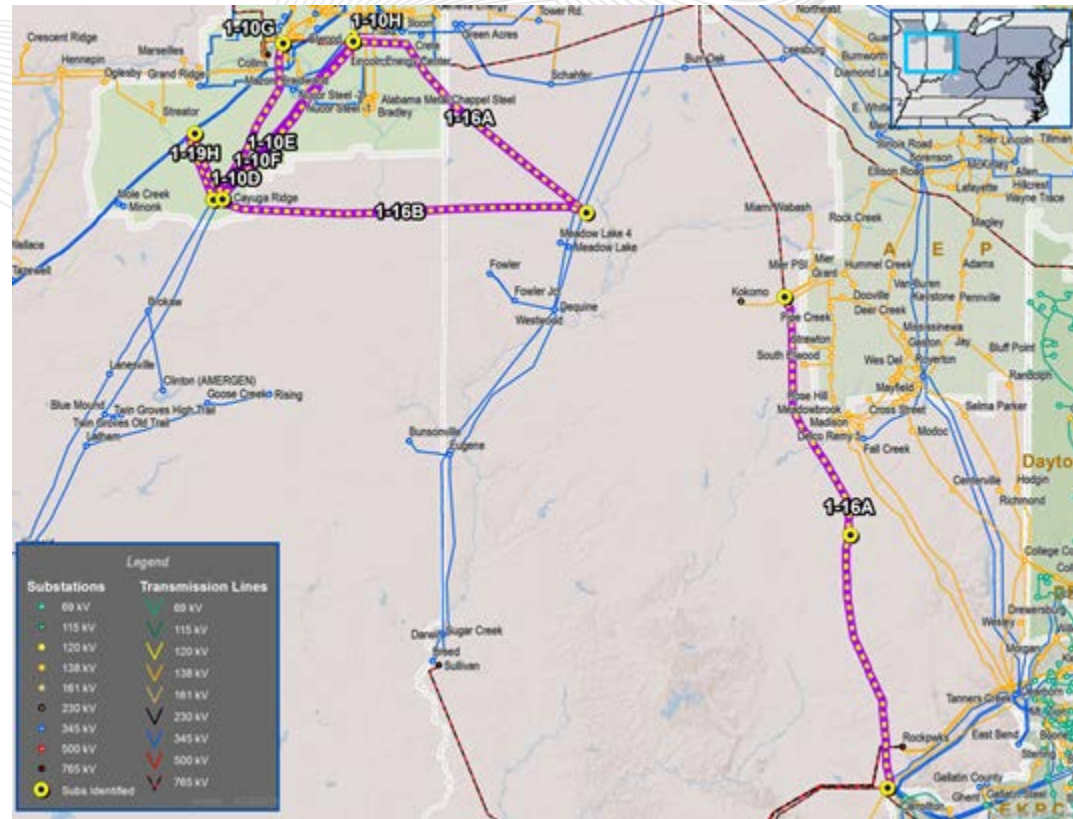
Area of Proposal	Number of Proposals	Greenfield Proposals	TO Upgrade Proposals
AEP	3	1	2
APS	5	3	2
APSOUTH and/or AEP-DOM Area	41	37	4
ATSI	4	-	4
BGE/PPL	4	-	4
ComEd	15	4	11
DEOK	8	8	-
DPL	1	-	1
DUQ	4	3	1
PECO	5	-	5
PSEG	3	2	1
<b>Grand Total</b>	<b>93</b>	<b>58</b>	<b>35</b>

Proposals were sorted based on the congestion they were addressing.

- Group 1 facilities are regional facilities associated with PJM IROL (Interconnected Reliability Operating Limit) Reactive interfaces. Evaluation of these projects will be completed in 2016.
  - Anticipated recommendation to PJM board in February 2016
  - Ongoing analytical work to determine any future recommendations
- Group 2 facilities include COMED facilities that along with the energy benefits may be providing RPM benefits.
  - Anticipated recommendation to PJM board in February 2016
- Group 2-19 facilities include facilities PJM zones other than COMED in which congestion may be alleviated with lower cost more locational type projects. Projects associated with these facilities can be more easily constructed or sometimes only require upgrades to existing equipment.
  - Projects were approved by PJM board in October 2015

# Project Evaluations Group 2 (Target zone: COMED)

- 9 Projects:
  - 1-10C,1-10D,1-10E,1-10F,1-10G,1-10H,1-16A,1-16B,1-19H
- Cost:
  - From \$11.5M to \$290M
- Constraints:
  - Loretto to Wilton CTR 345 kV
- 2018/2019 RPM BRA Results
  - COMED LDA binding with Loretto to Wilton CTR 345 kV as limiting CETL constraint



- The Reliability Pricing Model Benefit component of the Benefit/Cost Ratio evaluates the benefits of a proposed economic-based enhancement or expansion that will be realized in the capacity market and is expressed as:
  - Reliability Pricing Benefit for Regional Projects =  $[.50] * [\text{Change in Total System Capacity Cost}] + [.50] * [\text{Change in Load Capacity Payment}]$
  - Reliability Pricing Benefit for Lower Voltage Projects =  $[1.0]*[\text{Change in Load Capacity Payment}]$
- RPM Benefits Study Process:
  1. Determine if upgrades impact CETL values.
  2. Run RPM auction for multiple study years using updated CETL values.
  3. Measure Benefits for 15 year period.
- PJM completed the analysis to determine the COMED LDA CETL impact of each proposed upgrades from group 2.
  - Three different levels of CETL increases (279 MW, 769 MW, 1086 MW)
  - Upgrades with same level of CETL increase will provide the same RPM benefits
- Total Benefits = Energy Benefits + RPM Benefits

\*Only PJM transmission zones that show a decrease will be considered in determining the Change in Load Capacity Payment

Project ID	Upgrade/ Greenfield	ISD	Cost (\$M)	Target Zone	kV Level	ME Constraints Identified	Evaluation	Energy B/C Ratio	RPM B/C Ratio	Total B/C Ratio (Energy + RPM)	CETL Increase (MW)	Comment
201415_1-10D	Upgrade	2019	11.5	ComEd	345	Lorreto to Wilton CTR 345 kV	Lower Voltage	1.14	63.32	64.46	279	Recommended
201415_1-10F	Upgrade	2019	14	ComEd	345	Lorreto to Wilton CTR 345 kV	Lower Voltage	0.79	52.02	52.81	279	Not recommended at this time
201415_1-16A	Greenfield	2022	240	AEP/CE/NIPS	345	None Specified	Lower Voltage	0.07	5.15	5.22	1086	Not recommended at this time
201415_1-16B	Greenfield	2022	290	AEP/CE/NIPS	345	Lorreto to Wilton CTR 345 kV	Regional	.08	2.12	2.2	769	Not recommended at this time
201415_1-10C	Greenfield	2019	37.8	ComEd	345	Lorreto to Wilton CTR 345 kV	Lower Voltage	0.73	-	0.73	< 0	Not recommended at this time
201415_1-19H	Greenfield	2019	42.9	ComEd	345	Lorreto to Wilton CTR 345 kV	Lower Voltage	0.9	-	0.9	< 0	Not recommended at this time
201415_1-10E	Upgrade	2019	17.4	ComEd	345	Lorreto to Wilton CTR 345 kV	Lower Voltage	0.93	41.85	42.78	279	Not recommended at this time
201415_1-10G	Upgrade	2019	19.9	ComEd	345	Lorreto to Wilton CTR 345 kV	Lower Voltage	0.81	36.59	37.4	279	Not recommended at this time
201415_1-10H	Upgrade	2019	25.9	ComEd	345	Lorreto to Wilton CTR 345 kV	Lower Voltage	0.62	26.12	26.74	279	Not recommended at this time



**Project ID: 201415\_1-10D**

Proposed by: ComEd

Proposed Solution: Mitigate sag limitations on Loretto-Wilton Center Line, and replace station conductor at Wilton Center.

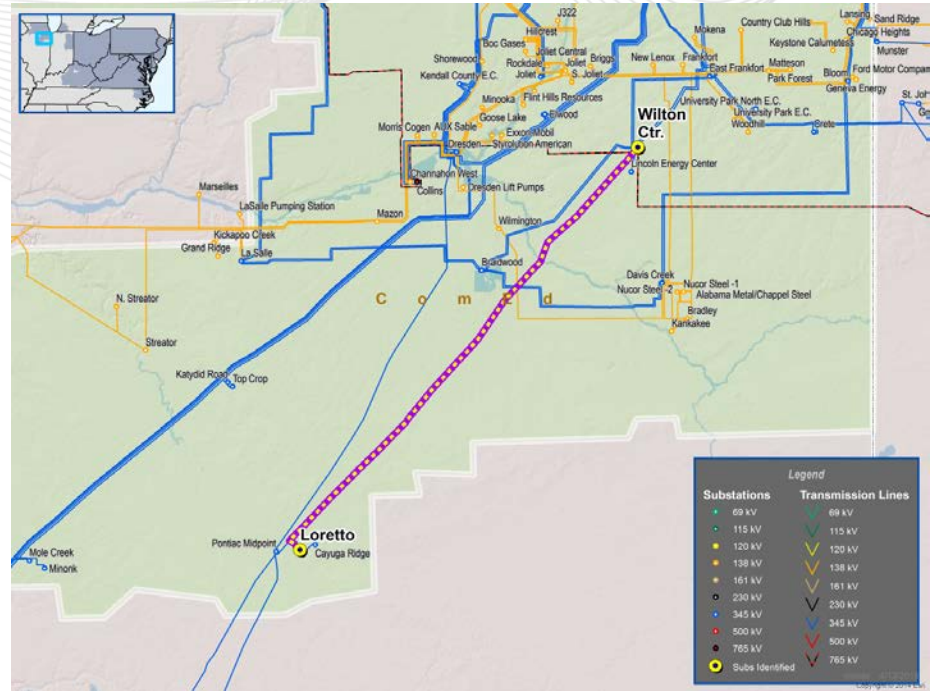
kV Level: 345

Cost (\$M): 11.5

IS Date: 2019

Target Zone: ComEd

- Anticipate recommendation for Board approval in February 2015
- Designated Entity: ComEd (the local TO)
- Additional Projects provide no incremental benefit



# Project Evaluations Group 1 (ApSouth/AEP-DOM Projects)

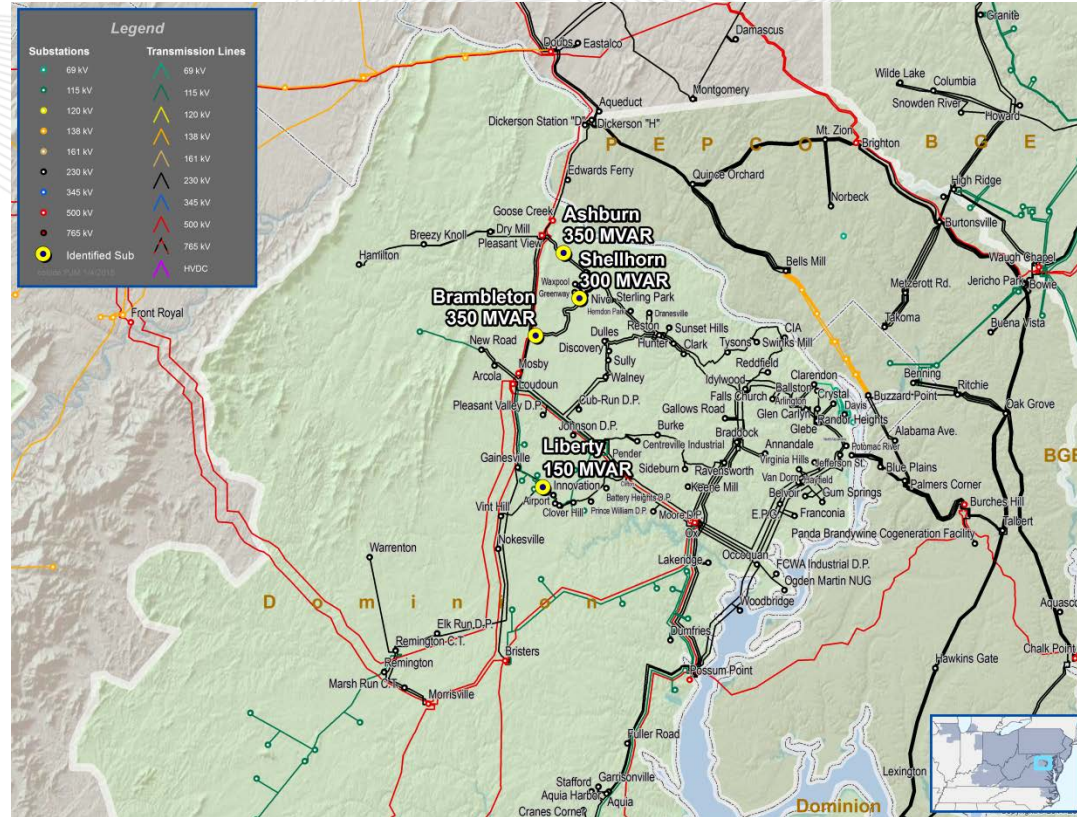
- Capacitors appear to be providing the highest Market Efficiency benefits from a theoretical view due to relatively low costs and improved reactive limits from the Planning PV analysis.
- Excess capacitors not practical to implement in PJM Operations
  - Many existing capacitors can't be turned on in PJM Operations because of high voltage problems
  - Many proposed capacitor locations already in areas where existing capacitors are located
  - Due to timing, some capacitor locations overlap recently approved RTEP reliability projects
- PJM performed additional analysis to evaluate impact of all proposed capacitors from markets, reliability, and operations perspectives to determine optimal locations and sizes/quantities.

- PJM Operations, Planning, and Markets groups collaborated to determine the optimal configuration of reactive devices to achieve the following:
  - Market benefits
  - High reliability
  - Optimal operational impact
  - Configuration that provides practical and not just theoretical benefits
- Recommendation:
  - Upgrade existing Dominion substations
    - Brambleton: New 350 MVAR capacitor
    - Ashburn: New 350 MVAR capacitor
    - Shelhorn: New 300 MVAR capacitor
    - Liberty: New 150 MVAR capacitor
  - ISD: 2019
  - Designated entity: Dominion

# Optimal Capacitors Configuration (continue)

Optimal Capacitor Configuration*	
Bus	Capacitor Size (MVAR)
Brambleton substation	350
Ashburn substation	350
Shelhorn substation	300
Liberty substation	150
<b>Total</b>	<b>1150</b>

\*Includes recently approved RTEP project +/- 450 MVAR SVC at Jacksons Ferry 765 kV substation (B2687.1)



## Hanover Pike Baseline Project (B1254)

- Build a new 500/230 kV substation (Hanover Pike) by tapping the Conastone – Brighton 500 kV and Conastone – Northwest 230 kV lines: Rebuild the Hanover Pike - North West 230 kV circuits to separate pole-lines with bundled conductor.
  - Reliability driver: Various thermal and voltage violations in the Conastone-Northwest 230 kV Areas
- Current ISD: 2021
- Designated Entity: BGE
- Project provides additional Market Efficiency benefits
  - ApSouth Congestion Reduction: \$18 million\*
- Recommendation: Pursue the ability to accelerate project ISD from 2021 to 2019
  - No cost to accelerate

\*Congestion savings represent 2019 + 2022 study years.

## Impact of optimal capacitor configuration and inclusion of B1254

- Costs: \$12.5 million (Caps only)
- B/C ratio: 15.4
- Low cost with major benefits
- Does not eliminate interface congestion

	Base Case*	Base Case ( includes B1254) + Optimal Caps	Delta**
ApSouth congestion	\$352	\$264	-\$88
AEP-DOM congestion	\$58	\$63	\$5
Total congestion	\$562	\$481	-\$81
Gross load payments	\$73,765	\$73,705	-\$59
Production costs	\$44,051	\$44,024	-\$27

\*Includes October 2015 Board approved Market Efficiency projects  
 Values in \$ millions

\*\*2019 + 2022 study years.

- The following transmission only projects were studied with the inclusion of recommended optimal capacitors configuration and acceleration of Hanover Pike (B1254).
  - Project 9A Partial: Tap the Conemaugh - Hunterstown 500 kV line and build new 230 kV double circuit line between Rice and Ringgold. Build new 230 kV double circuit line between Furnace Run and Conastone\*.
  - Project 19B: Approximately 6-mile 138 kV Line from Grand Point to a new 500/138 kV substation on the Conemaugh-Hunterstown 500 kV Line ("Green Ridge").
- PJM may review additional proposed transmission solutions.

\*Conastone - Northwest 230 kV line rebuild removed from 9A because not necessary with B1254.



	Updated Base Case*
ApSouth congestion	\$264
AEP-DOM congestion	\$63
Total Congestion	\$481
Gross Load Payments	\$73,705
Production Costs	\$44,024
Project Costs	\$12.5
B/C	15.4

Partial 9A	Delta
\$133	-\$132
\$57	-\$6
\$336	-\$145
\$73,666	-\$39
\$43,964	-\$60
\$241.5	
3.3	

19B	Delta
\$162	-\$102
\$90	\$27
\$519	\$38
\$73,682	-\$24
\$44,024	-\$0.03
\$38.9	
17.8	

\*Includes October 2015 Board approved Market Efficiency projects, B1254, and Optimal Caps  
 Values in \$ millions

\*\*Delta represents 2019 + 2022 study years.

- Anticipated Market Efficiency Project Recommendations at the February Board Meeting
  - RPM Market Efficiency project in ComEd (Loretto – Wilton Center 345 kV)
  - Optimal Capacitor configuration (Capacitor installations at existing Dominion stations)
  - Acceleration of B1254 – Hanover Pike 500/230 kV
  
- Further study of transmission solutions
  
- Finalize Reliability/Constructability Review
  
- 2016 Base Case Development

# Appendix A

## (AP-South/AEP-DOM Projects)

## Project ID: 1-9A Partial

Proposed by: DOM High Voltage / Transource

Proposed Solution: Tap the Conemaugh - Hunterstown 500 kV line and build new 230 kV double circuit line between Rice and Ringgold. Build new 230 kV double circuit line between Furnace Run and Conastone.

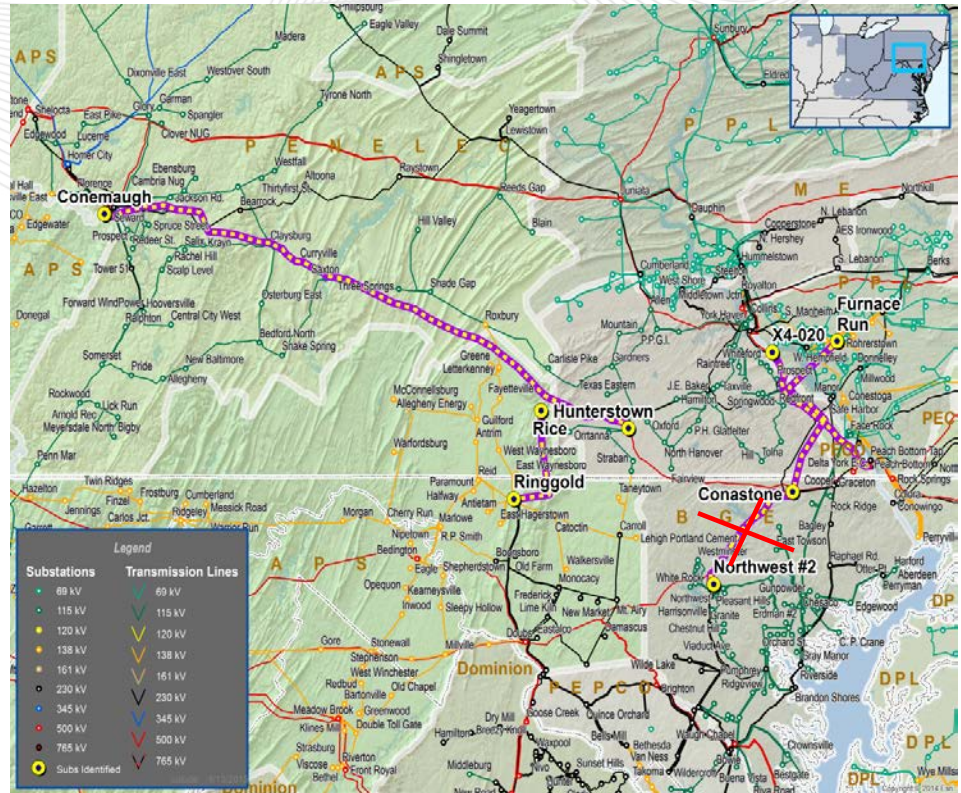
kV Level: 230

Cost (\$M): \$241.5

IS Date: 2020

BC Ratio: 3.3

Notes: Rebuild of the Conastone - Northwest 230 kV line removed because not necessary with B1254 (Hanover Pike)



**Project ID: 201415\_1-19B**

**Proposed by: Northeast Transmission Development**

**Proposed Solution: Approximately 6-mile 138 kV Line from Grand Point to a new 500/138 kV substation on the Conemaugh-Hunterstown 500 kV Line ("Green Ridge")**

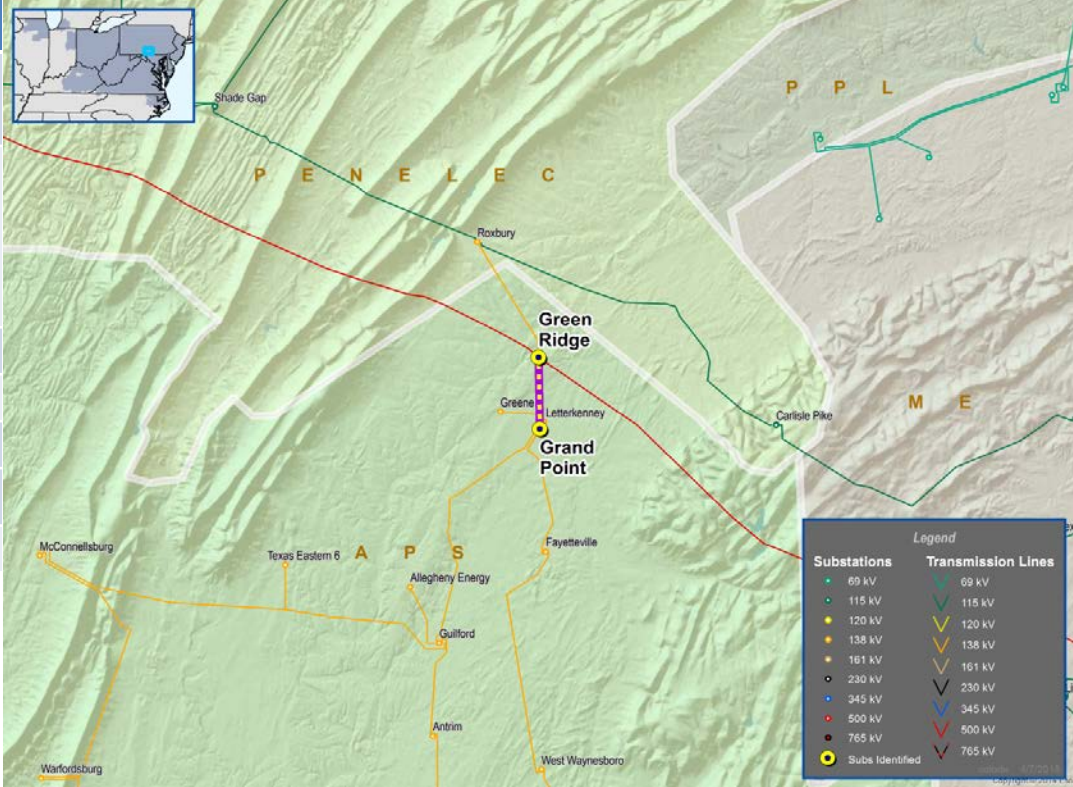
**kV Level: 138**

**Cost (\$M): 38.9**

**IS Date: 2020**

**BC Ratio: 17.8**

**Notes:**



# Hanover Pike 500/230 kV Station (b1254)

## Hanover Pike 500/230 kV Station (b1254)

Proposed by: BGE

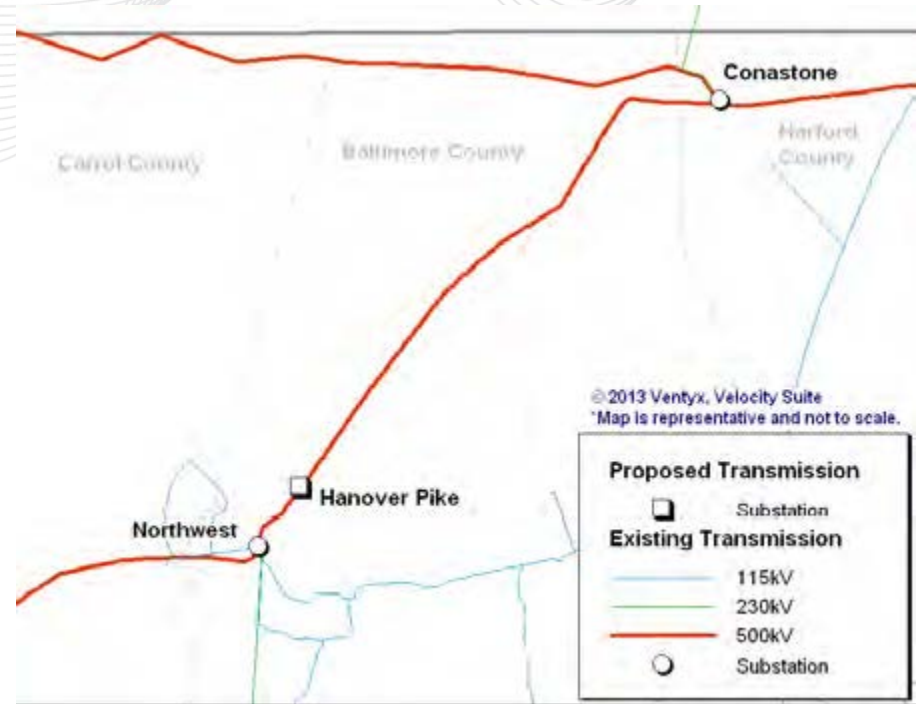
Proposed Solution: The Hanover Pike 500/230 kV Station project consists of constructing the 500/230 kV station by tapping the Conastone - Brighton 500 kV line and Conastone - Northwest 230 kV lines. The project also creates two new 230 kV bundled conductor lines from Hanover Pike Northwest Substation. The two existing 230 kV lines that connect to Northwest will be rebuilt with bundled conductor.

kV Level: 500, 230

Cost (\$M): \$113

IS Date: 2021

Notes: **Proposed Acceleration Date: 2019**



Questions?

Email: [RTEP@pjm.com](mailto:RTEP@pjm.com)