



# Transmission Expansion Advisory Committee Market Efficiency Update

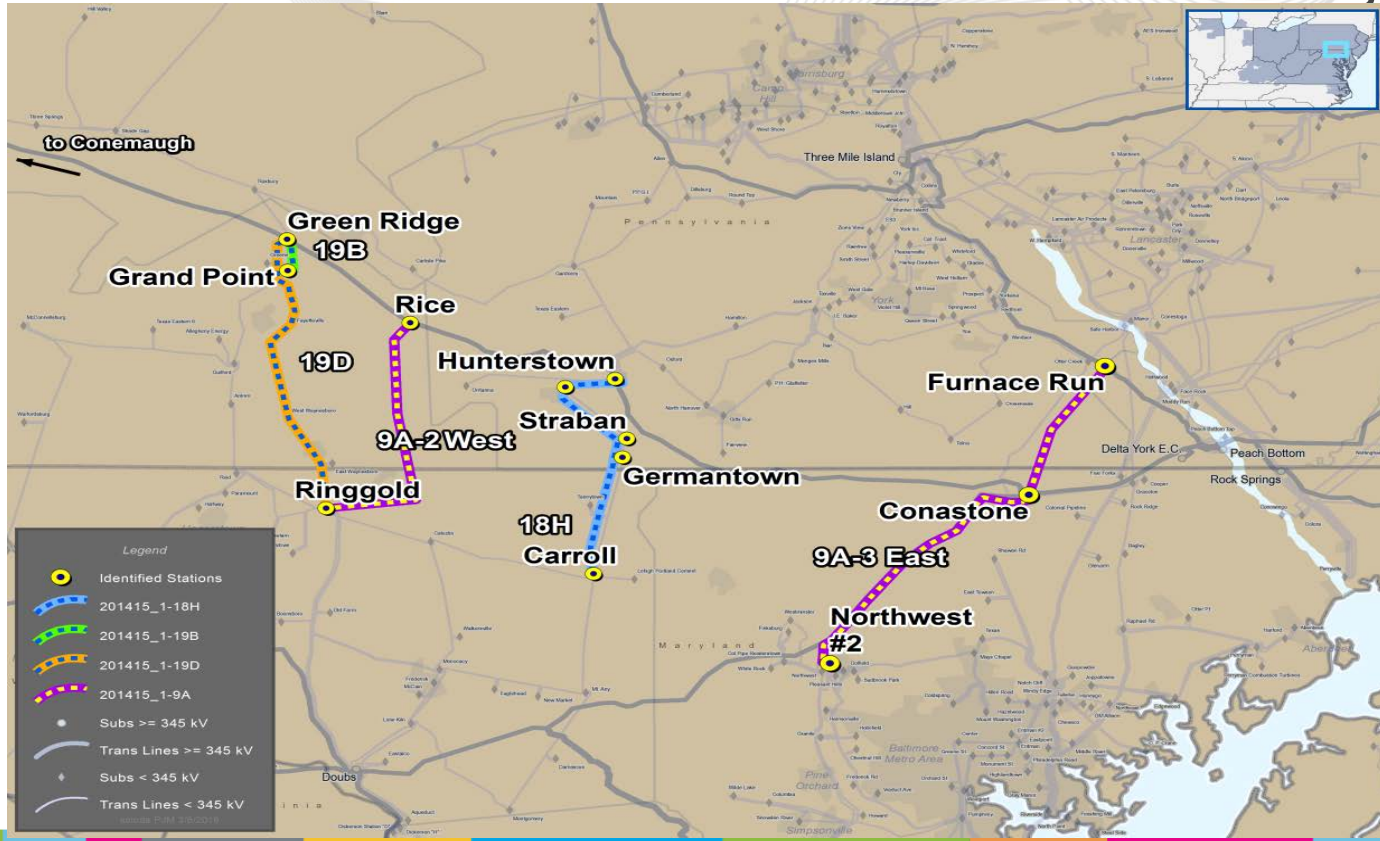
April 7, 2016



# Market Efficiency 2014/15 Long Term Proposal Window Update

- **Market Efficiency updated case\***
  - 2016 load forecast
  - 2016 February Board approved projects
  
- **PJM performed additional Sensitivity Analysis**
  - +/- 2% Load Forecast , +/- \$1 Gas Prices, Generation
  - Projects consistently pass B/C test
  - Results in Appendix A

\*Updated PROMOD cases and Reactive Interface limits posted on Market Efficiency website



# Combination Project Results

	9A	Combo 18H(Modified) +(9A-3 East)	Combo 19B+(9A-3 East)	Combo 19D+(9A-3 East)
Sponsor	Transource /DOM HV	First Energy /Transource /DOM HV	NTD/Transource/DOM HV	NTD/Transource/DOM HV
Project Cost	\$281.6	\$206.5	\$187.4	\$252.99
Additional Upgrades Description	Ringgold Transformers, Ringgold Station, Ringgold – Catoctin 138 kV	Replace Germantown Transformer, Rebuild Hunterstown-Lincoln, Convert to 230 kV (Lincoln-Carrol)	Upgrade Fayette to Grand Point to Guilford Path	Ringgold Transformers, Ringgold Station
Additional Upgrades Cost	\$30.0 - \$60.0	\$14.0	\$11.4 - \$24.8	\$30.0-\$50.0
Total Cost (w Upgrd)	\$311.6 - \$341.6	\$220.5	\$198.8 - \$212.2	\$282.99 - \$302.99
ISD	2020	2020	2020	2020
Delta in AEP-DOM L/O BED-BLA	-\$4	-\$5	-\$4	-\$7
Delta in AP SOUTH L/O BED- BLA	-\$49	-\$19	-\$26	-\$31
Delta in Total Interfaces Cong	-\$54	-\$24	-\$31	-\$38
Delta in Total PJM Cong	-\$83	-\$41	-\$44	-\$61
B/C Ratio	2.48 – 2.72	2.46	2.22 – 2.36	2.03 – 2.17
Delta in Gross Load Payment	-\$30	-\$9	-\$33	-\$13
Delta in Production Cost	-\$31	-\$16	-\$17	-\$25
Comments		Additional congestion in BGE Area	Additional congestion in BGE Area	Additional congestion in BGE Area

\*Deltas represent totals of 2019 and 2022 study years



- **Preliminary Reliability Analysis**
  - Performed Generation Deliverability and N-1-1 analysis
  
- **9A**
  - Potential reliability upgrades
    - ❖ Replacing Ringgold 230/138 kV Transformers #3 & #4
    - ❖ Ringgold 230 kV Bus station work
    - ❖ Reconductor 138 kV Ringgold – Catoclin line
  - Estimated costs TBD
  
- **Combo 19B + (9A-3 East)**
  - Evaluation in progress
  
- **Combo 19D + (9A-3 East)**
  - Potential reliability upgrades
    - ❖ Replacing Ringgold 230/138 kV Transformer #3
    - ❖ Ringgold 230 kV Bus station work
  - Estimated costs TBD

## Project ID: 1-9A

Proposed by: DOM High Voltage / Transource

### Proposed Solution:

9A Project without capacitors: 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. Rebuild of the Conastone - Northwest 230 kV line.

Additional Reliability Upgrades: Replace the Ringgold #3 and #4 transformers with 230/138 kV autotransformers; Ringgold bus reconfiguration; Reconductor of Ringgold-Catoctin 138 kV.

kV Level: 230

Cost (\$M): \$311.6 - \$341.6

IS Date: 2020

### Notes:

- Recommendation Pending Cost Analysis
- Designated Entities: TBD



- Verify Cost Estimates
- Identify Designated Entities
- Recommendation to the PJM Board





# Market Efficiency 2016/17 Long Term Proposal Window Update

# Market Efficiency Timeline





# 2016-2017 24-Month Market Efficiency Cycle Timeline

- Long Term proposal window: November 2016 - February 2017
- Analysis of proposed solutions: March 2017 - November 2017
- Determination of Final projects: December 2017

- Study Years
  - 2017 and 2021 to study approved RTEP projects for accelerations and modifications
  - 2017, 2021, 2024, 2027, and 2031 to study new system enhancements
  - Underlying input data based on March 2016 PROMOD IV Data Release
    - 2016 update to loads, generation, demand resources, emissions, and fuels
  - Simulations performed using PROMOD IV v11.1 engine

- **Powerflow Models**
  - 2016/2017 PJM and external world topology based on the 2017 summer peak case from the 2015 ERAG MMWG series
    - Any significant upgrades will be included/excluded based on simulation year
  - 2021 and later PJM topology will be based on the 2016 RTEP 2021 Summer topology case
    - External World representation will be developed in coordination with the Interregional Planning group
    - PJM topology will include all upgrades through February 2016 PJM board approvals



- Fuel Prices\*
- Emissions Prices\*
- Load and energy
- Demand resource
- Future generation
- Transmission constraints
- Carrying charge rate and discount rate

\*Fuel and emissions prices to be presented at next TEAC, May 2016

## PJM zonal peak and energy forecast from 2016 Load Forecast Report

2016 PJM Peak Load and Energy Forecast

Load	2017	2021	2024	2027	2031
Peak (MW)	154,149	157,358	159,991	162,988	167,469
Energy (GWh)	821,812	843,262	862,838	879,605	906,168

Notes: 1.) Peak and energy values from PJM Load Forecast Report Table B-1 and Table E-1, respectively.

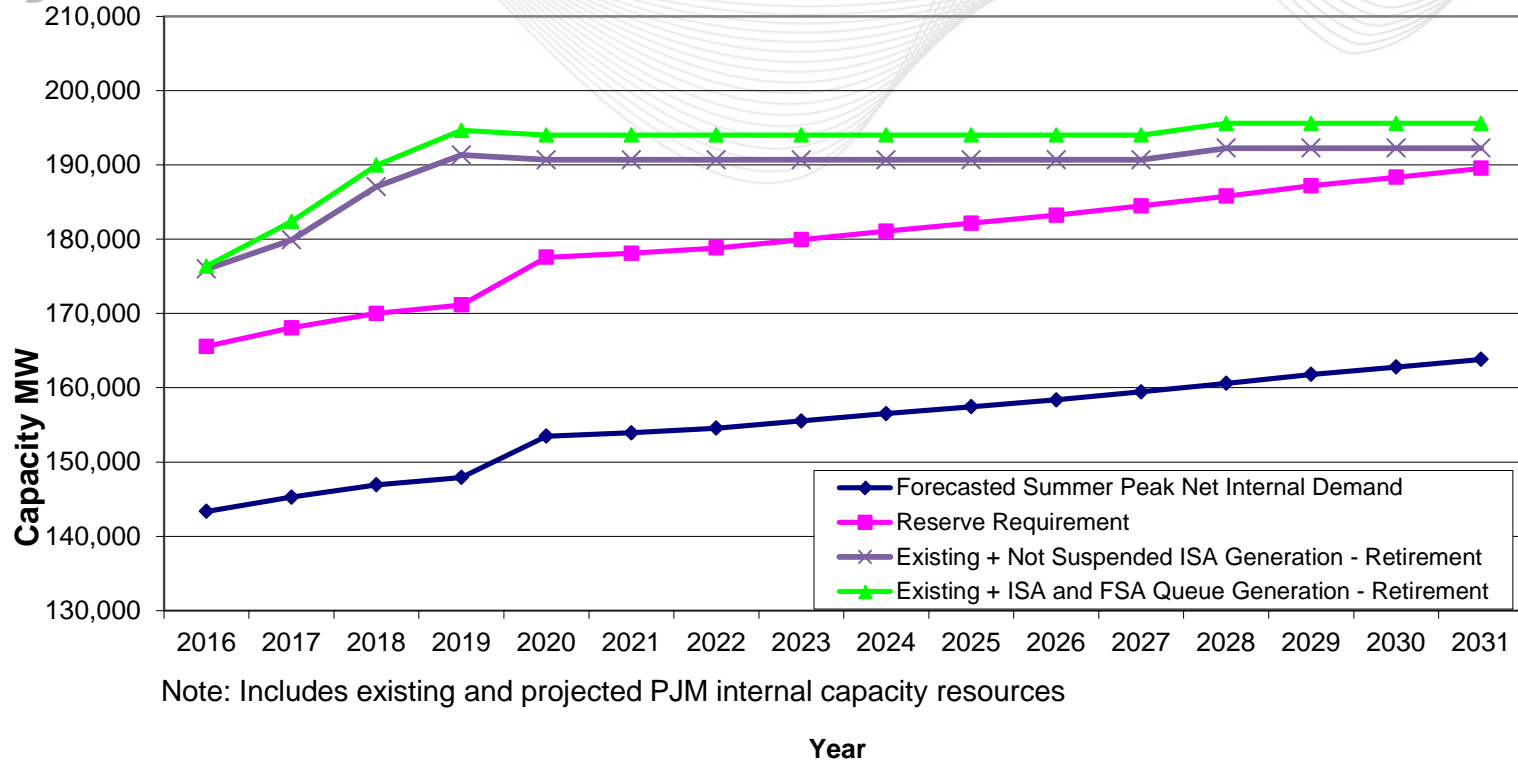
2.) Model inputs are at the zonal level, to the extent zonal load shapes create different diversity - modeled PJM peak load may vary.

Model zonal demand resources consistent with Table B-7 of the 2016 Load Forecast Report.

2016 PJM Demand Resource Forecast

	2017	2021	2024	2027	2031
Demand Resource (MW)	8,883	3,424	2,478	3,543	3,651

### PJM Market Efficiency Reserve Margin - Preliminary



Note: Includes existing and projected PJM internal capacity resources

- Generation included in Market Efficiency models include all ISAs and FSAs
- Machine list posted at February TEAC
  - <http://www.pjm.com/~media/committees-groups/committees/teac/20160211/20160211-2021-rtep-machine-list.ashx>



- Thermal Constraints
  - NERC Book of Flowgates
  - Planning study results for monitored facilities and monitored/contingency pair facilities
  - Historical PJM congestion events
  
- Voltage Constraints
  - PJM reactive interface limits
  - MW limits based on historical values and voltage stability analysis
  - RTEP upgrades impact future reactive interface limits

- Discount rate and levelized carrying charge rate developed using information contained in TO Formula Rate sheets (Attachment H) <sup>[1]</sup>
- Discount rate based on weighted average after-tax embedded cost of capital  
Discount rate = 7.4%
- Levelized annual carrying charge rate based on weighted average net plant carrying charge levelized over an assumed 45 year life of project  
Levelized Annual Carrying Charge Rate = 15.3%

[1] <http://www.pjm.com/markets-and-operations/billing-settlements-and-credit/formula-rates.aspx>

Market Efficiency Inputs:

- Fuel Prices
- Emissions Prices

May

May

Board Review of Market Efficiency Input Assumptions

May

Market Efficiency Preliminary Results:

- Stakeholder feedback on model:
- PJM review for acceleration candidates:
- Proposal window opens:

June

June-September

June-September

November

Questions?

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

# APPENDIX A: Market Efficiency Sensitivity Results



Project	AP-South Total Congestion Delta (\$million)				
	Gas Decrement	Gas Increment	Load Decrement	Load Increment	Generation Sensitivity
9A	(\$41)	(\$63)	(\$49)	(\$47)	(\$60)
Combo 9A-3 + 18H	(\$19)	(\$23)	(\$21)	(\$17)	(\$21)
Combo 9A-3 + 19B	(\$23)	(\$31)	(\$27)	(\$23)	(\$27)
Combo 9A-3 + 19D	(\$28)	(\$43)	(\$34)	(\$31)	(\$31)

\*Congestion delta is sum of 2019 + 2022 study years. Negative values represent congestion reductions (benefits).



# Sensitivity Scenarios Detailed Results – Congestion Reductions AEP-DOM

Project	AEP-DOM Total Congestion Delta (\$million)				
	Gas Decrement	Gas Increment	Load Decrement	Load Increment	Generation Sensitivity
9A	(\$4)	(\$9)	(\$5)	(\$5)	(\$4)
Combo 9A-3 + 18H	(\$4)	(\$10)	(\$4)	(\$4)	(\$3)
Combo 9A-3 + 19B	(\$2)	(\$8)	(\$4)	(\$4)	(\$4)
Combo 9A-3 + 19D	(\$5)	(\$12)	(\$6)	(\$6)	(\$5)

\*Congestion delta is sum of 2019 + 2022 study years. Negative values represent congestion reductions (benefits).

# APPENDIX B:

## Market Efficiency Project Details

## Project ID: 1-9A

Proposed by: DOM High Voltage / Transource

### Proposed Solution:

9A Project without capacitors: 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. Rebuild of the Conastone - Northwest 230 kV line.

Additional Reliability Upgrades: Replace the Ringgold #3 and #4 transformers with 230/138 kV autotransformers; Ringgold bus reconfiguration; Re-conductor of Ringgold-Catoctin 138 kV.

kV Level: 230

Cost (\$M): \$311.6 - \$341.6

IS Date: 2020

### Notes:

- Recommendation Pending Cost Analysis
- Designated Entities: TBD



## Project ID: 201415\_1-18H Modified

Proposed by: FirstEnergy

Proposed Solution: Rebuild and reconductor the Lincoln - Carroll 115/138kV path.

**Added: Path will be converted to 230kV operation; Rebuild Hunterstown-Lincoln.**

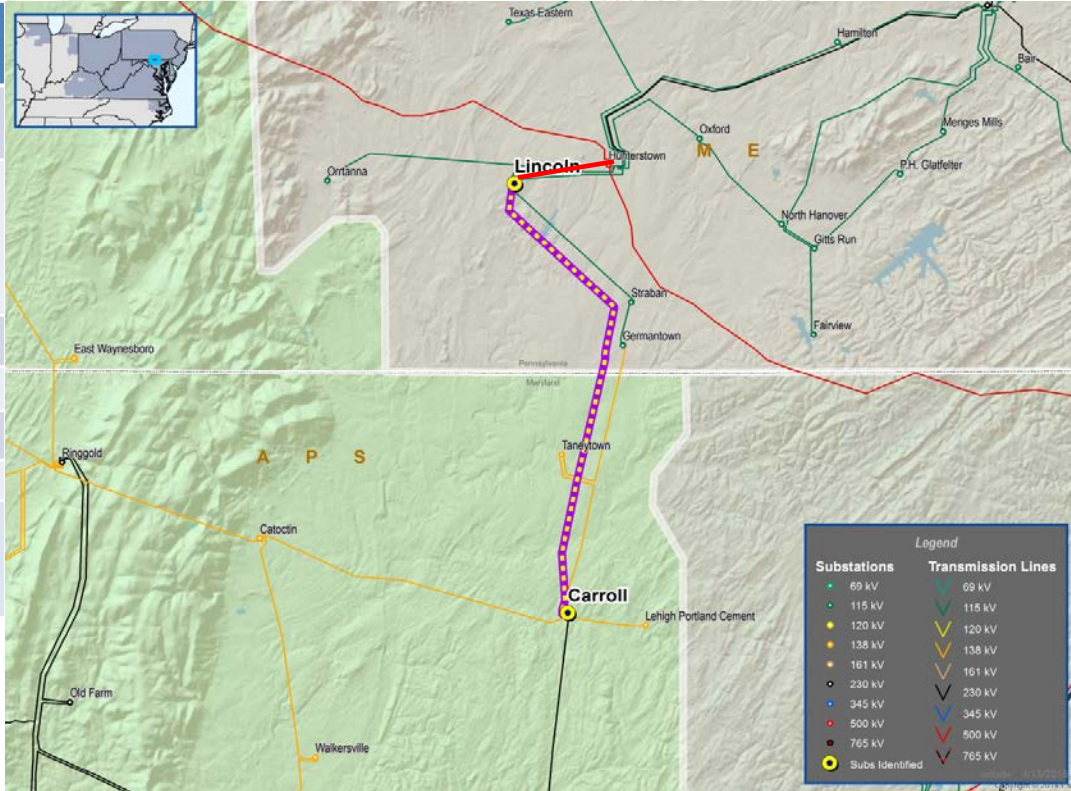
kV Level: 138

Cost (\$M): \$72

IS Date: 2019

Target Zone: APS/Meted

Notes: Moderate congestion reduction on ApSouth. Increased congestion on TMI-Jackson 230 kV line. Project has been modified from original proposal.





## 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").

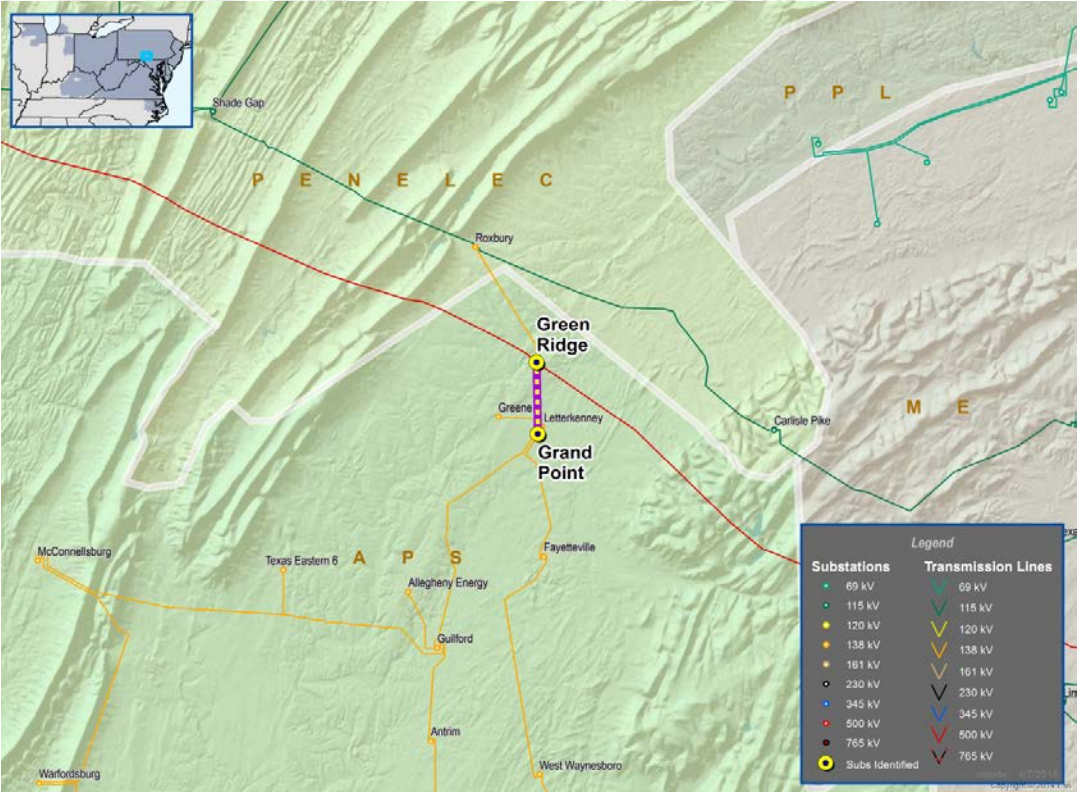
**Additional upgrades on Fayette-Grand Point-Guilford path.**

kV Level: 138

Cost (\$M): \$50.3-\$63.7

IS Date: 2020

Notes: Increases congestion on eastern area constraints near Conastone. Moderate congestion reduction on ApSouth.



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

**Proposed by: Northeast Transmission Development**

**Proposed Solution: Approximately 26-mile 230 kV Line from Ringgold to a new 500/230 kV substation on the Conemaugh-Hunterstown 500 kV Line ("Green Ridge").**

**Additional upgrades required at Ringgold.**

**kV Level: 230**

**Cost (\$M): \$134.5 - \$154.5**

**IS Date: 2020**

**Target Zone: Meted/Penelec**

**Notes: Major congestion reductions on AP-South and other PJM facilities. Increases congestion on eastern area constraints near Conastone.**

