Transmission Expansion Advisory Committee

Pittsburgh, PA

May 9, 2006

Agenda

- Planning 201 Course
- TEAC Draft Charter
- Transmission Upgrade Web Page
- RTEP Baseline Update
- Market Efficiency Analysis Update
- Interconnection Planning Impact Studies

Working to Perfect the Flow of Energy

Planning 201 Training Course

PJM's Regional Transmission Expansion Planning Process

NEXT SESSION -- June 8, 2007

Planning 201 Training Course Topics include…

- Regional Transmission Expansion Plan (RTEP) Process:
  - Scope, Definition and Objectives
  - RTO regulatory/contractual obligations
  - Brief history – evolving to meet RTO needs
  - Stakeholder process
- Baseline development concepts, reliability analyses, 15-year planning horizon
- Load Growth, CETO/CETL, Reserve Margin
- Key planning drivers and assessing their impact:
  - e.g., interconnection requests, long lead-time backbone transmission needs, aging infrastructure, generator deactivation, congestion
- Developing a package of backbone transmission solutions
- Market Efficiency
- DOE National Interest Electric Transmission Corridors (NIETC)

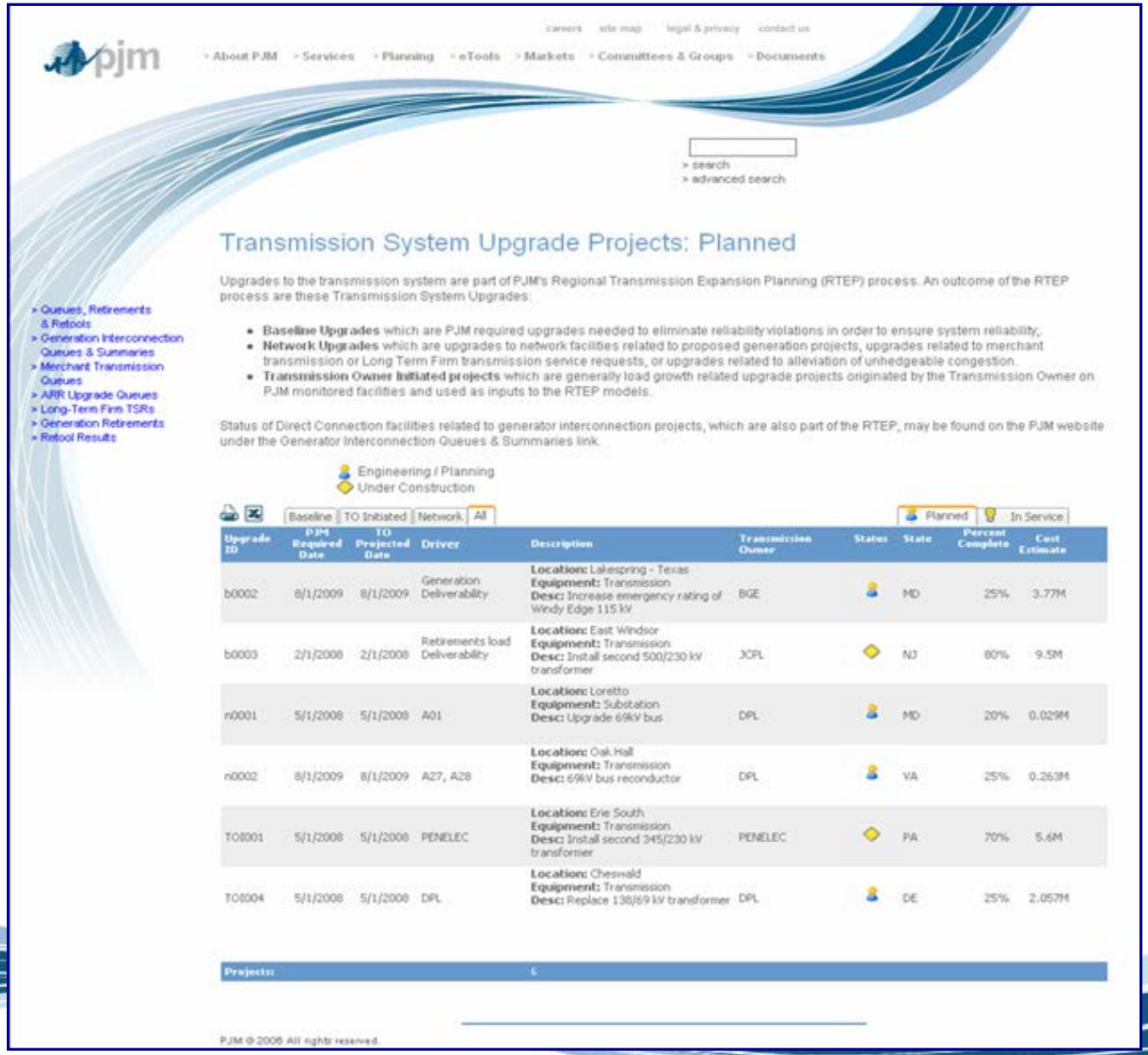
Planning 201 Training Course – Logistics

- **Date:** Friday, June 8, 2007
- **Time:** 9:00 a.m. – 3:00 p.m.
- **In-person:** PJM Visitors Center
  Norristown, PA
- **Virtual:** Yes (See Registration for details)
- **Registration:**

  http://www.pjm.com/services/courses/c-pjm-system-planning-201.html

- MRC and MC approved changes to Operating Agreement concerning the role of the TEAC
- TEAC responsibilities outlined in Schedule 6 of the OA and Manual 14B
  - Provide comments and recommendations on the scope, assumptions and analysis for the RTEP
  - Provide comments and recommendations on RTEP as requested by the PJM Board of Managers
- Draft Charter is consistent with these documents
- Seeking approval of the draft TEAC charter

Draft Data Used for Demo Purposes Only



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Transmission System Upgrade Projects: Planned

- Queues, Retirements & Retools
- Generation Interconnection Queues & Summaries
- Merchant Transmission Queues
- ARR Upgrade Queues
- Long-Term Firm TSRs
- Generation Retirements
- Retool Results

Upgrades to the transmission system are part of PJM's Regional Transmission Expansion Planning (RTEP) process. An outcome of the RTEP process are these Transmission System Upgrades:

- **Baseline Upgrades** which are PJM required upgrades needed to eliminate reliability violations in order to ensure system reliability;.
- **Network Upgrades** which are upgrades to network facilities related to proposed generation projects, upgrades related to merchant transmission or Long Term Firm transmission service requests, or upgrades related to alleviation of unhedgeable congestion.
- **Transmission Owner Initiated projects** which are generally load growth related upgrade projects originated by the Transmission Owner on PJM monitored facilities and used as inputs to the RTEP models.

Status of Direct Connection facilities related to generator interconnection projects, which are also part of the RTEP, may be found on the PJM website under the Generator Interconnection Queues & Summaries link.

Engineering / Planning
Under Construction

Baseline | TO Initiated | Network | All

Planned | In Service

Upgrade ID	PJM Required Date	TO Projected Date	Driver	Description	Transmission Owner	Status	State	Percent Complete	Cost Estimate
b0002	6/1/2009	8/1/2009	Generation Deliverability	**Location:** Lakespring - Texas **Equipment:** Transmission **Desc:** Increase emergency rating of Windy Edge 115 kV	BGE		MD	25%	3.77M
b0003	2/1/2008	2/1/2008	Retirements load Deliverability	**Location:** East Windsor **Equipment:** Transmission **Desc:** Install second 500/230 kV transformer	JCPL		NJ	80%	9.5M
n0001	5/1/2008	5/1/2008	A01	**Location:** Loretto **Equipment:** Substation **Desc:** Upgrade 69kV bus	DPL		MD	20%	0.029M
n0002	8/1/2009	8/1/2009	A27, A28	**Location:** Oak Hall **Equipment:** Transmission **Desc:** 69kV bus reconductor	DPL		VA	25%	0.263M
TO0001	5/1/2008	5/1/2008	PENELEC	**Location:** Erie South **Equipment:** Transmission **Desc:** Install second 345/230 kV transformer	PENELEC		PA	70%	5.6M
TO0004	5/1/2008	5/1/2008	DPL	**Location:** Cheswald **Equipment:** Transmission **Desc:** Replace 138/69 kV transformer	DPL		DE	25%	2.057M
Projects:				6					

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2007 RTEP Reliability Analysis Update

- On April 19th, the FERC issued orders on cost allocation.
- Cost for 500 kV and above facilities will be allocated on a region-wide basis.
- Cost for facilities that will be energized at voltages below 500 kV will be allocated to those customers who derive the benefits of the upgrade.
- PJM will submit a compliance filing for 500 kV and above facilities.
- The FERC granted a rehearing for below 500 kV facilities.
- Cost allocation for the following upgrades will be determined pending those proceedings.

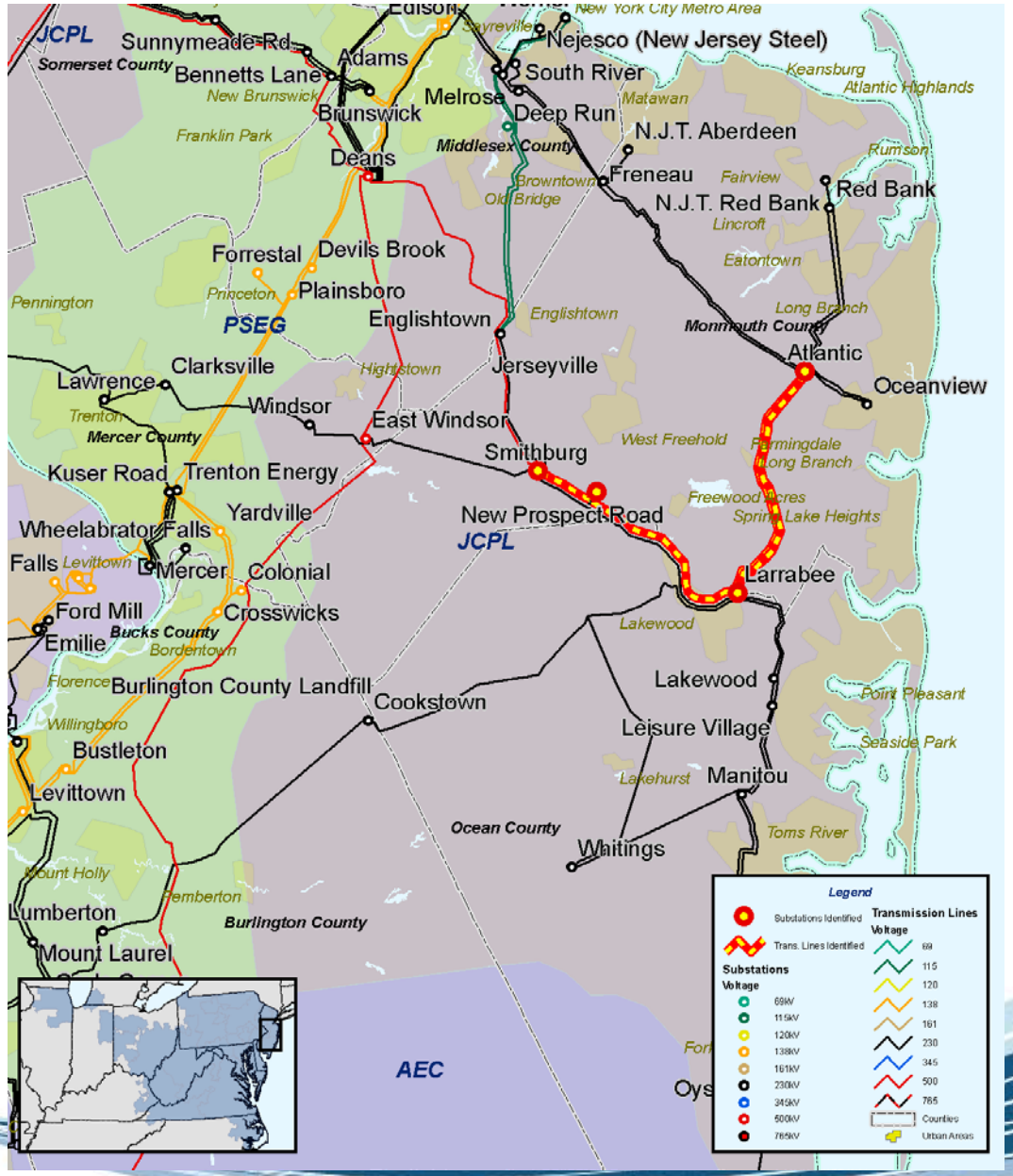
- Base case development complete
- N-2 analysis, generator and load deliverability analysis complete
- Development of solutions to identified problems is in progress
- 15 year analysis to identify longer lead time reinforcements complete
- Sensitivity analysis performed for potential generation retirements

- B.L. England Units – not in the model
- Benning Road – included in the model
- Buzzard Point – included in the model
- O66 Merchant transmission project – not in the model

5 Year Analysis Update

First Energy - JCPL Transmission Zone

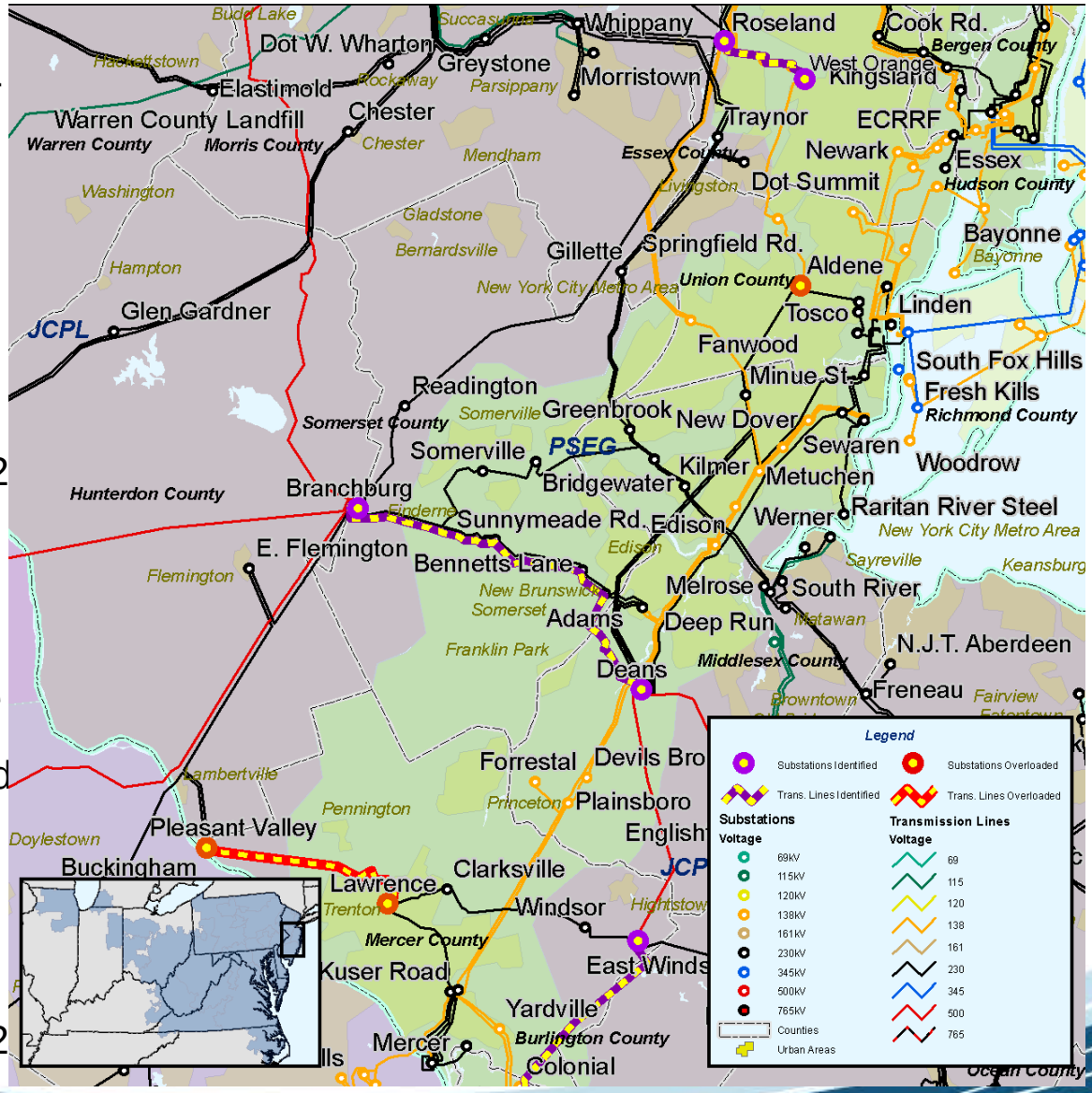
- N-2 Issues
  - Atlantic – Larrabee 230 kV line overload for the loss of Prospect Road – Smithburg – Atlantic 230 kV line + loss of Atlantic – South River 230 kV line
  - Atlantic-New Prospect Road – Smithburg 230 kV line overload for the loss of Atlantic – South River 230 kV line + Atlantic – Larrabee 230 kV line
- Solution
  - Working with FE to develop solutions



- Breaker Replacement
  - Replace the North Wales 230 kV circuit breaker #105, the capacitor bank breaker by 6/1/2010
  - The estimated cost to replace this breaker is $500,000

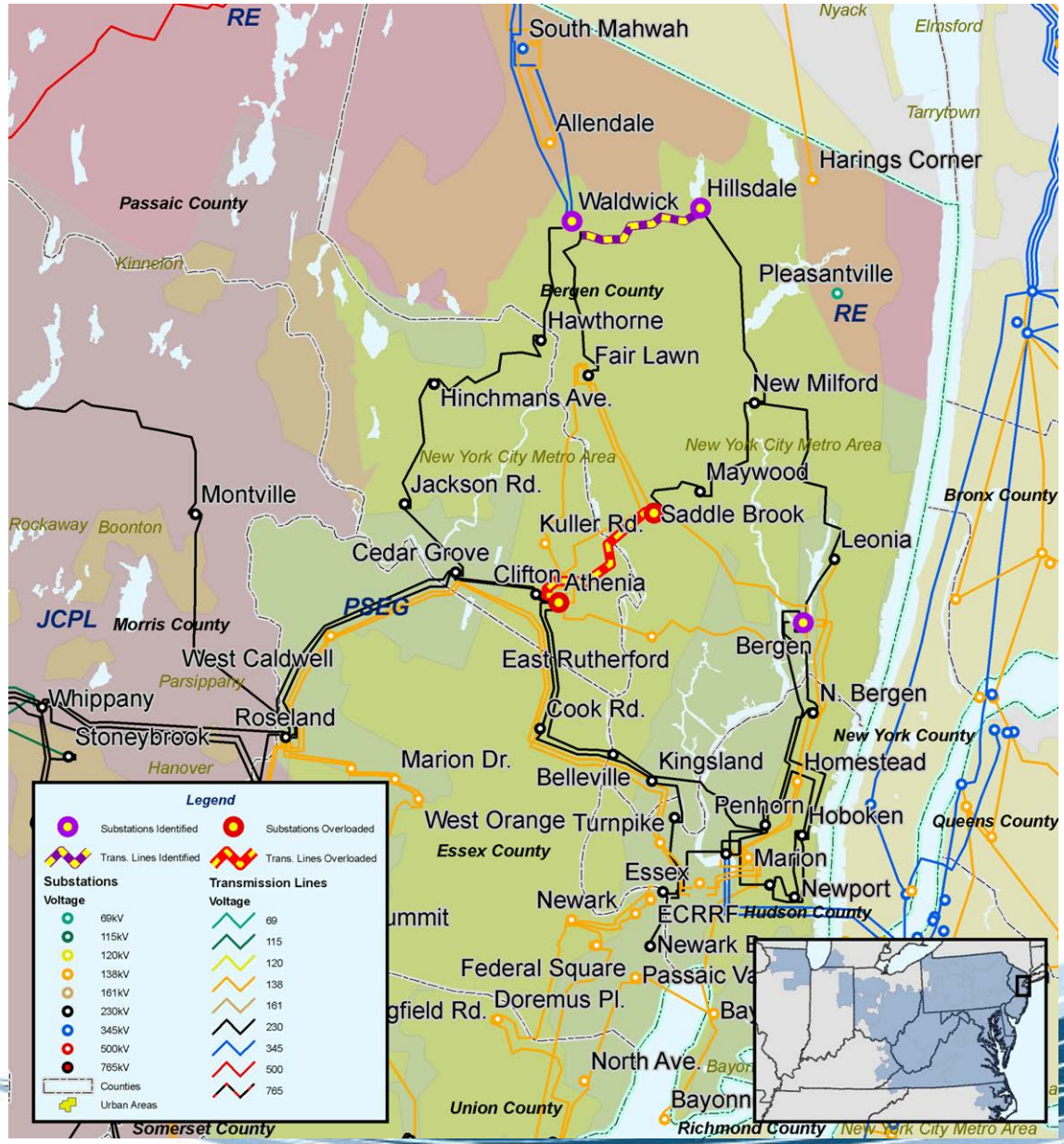
PSEG Transmission Zone

- N-2 Violation
  - –Aldene 230 / 138 kV transformer overload for the loss of the Roseland 230 / 138 kV transformer 4 + loss of West Orange – Roseland 138 kV line.
- Solution
  - –Install a 138 kV breaker at Roseland and tie the Roseland 138 kV buses.
  - –Expected in-service date: 6/1/12
  - –Estimated cost: $1.0 million
- N-2 Violation
  - –Lawrence – Pleasant Valley 230 kV line overloads for the loss of Branchburg – Deans 500 kV line and Deans 500 / 230 kV transformer + Windsor – Orchard (aka Alloway) 500 kV line
- Solution
  - –Replace the wave traps at both Lawrence and Pleasant Valley 230 kV substations.
  - –Expected in-service date: 6/1/12
  - –Estimated cost: $0.5 million



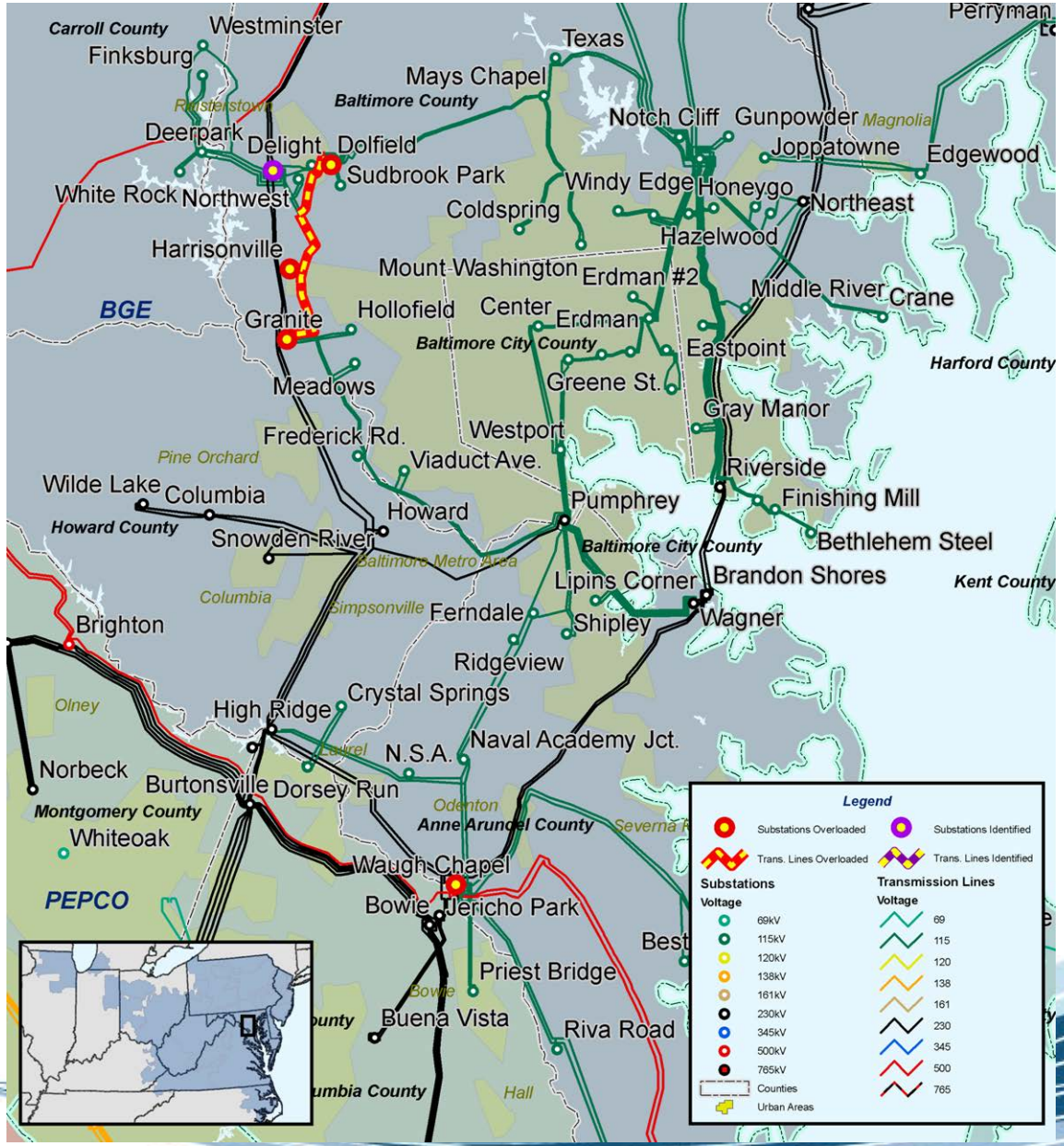
PSEG Transmission Zone

- N-2 Violation
  - Saddle Brook – Athenia 230 kV line overload for the loss of the 550 MW generator at Bergen 230 kV station + loss of Waldwick – Hillsdale 230 kV line
- Solution
  - Add forced oil cooling to increase Rate B by 25%
  - Expected in-service date: 6/1/12
  - Estimated cost: PSEG is working on an estimate.
- N-1 Load deliverability Violation
  - Voltage criteria violation in the Lawrence 230 kV vicinity for multiple single contingency.
- Solution
  - Move the 150 MVAR mobile capacitor from Aldene 230 kV to Lawrence 230 kV substation.
  - Expected in-service date: 6/1/12
  - Estimated cost: $1.5 million



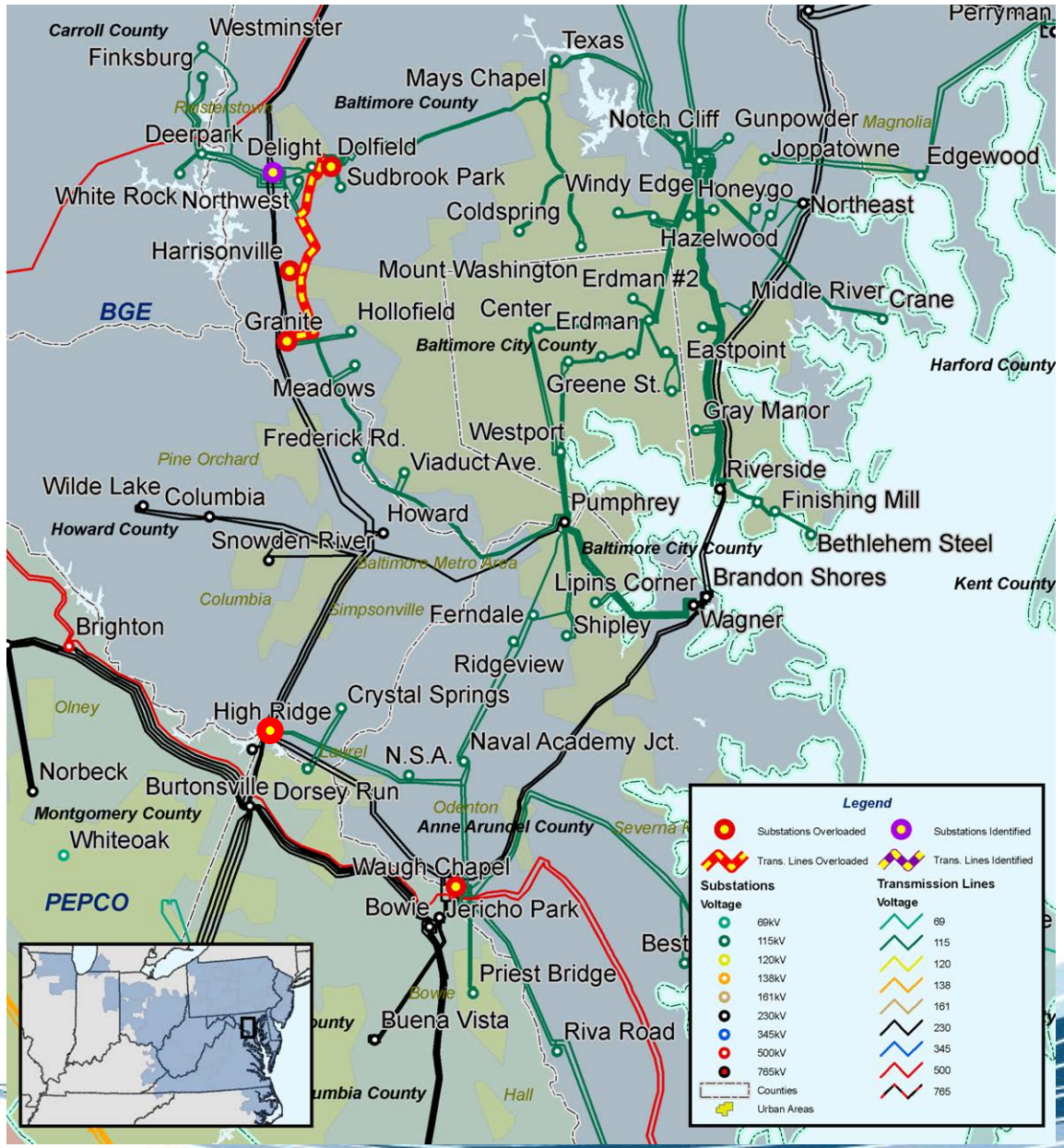
BG&E Transmission Zone

- N-2 Violation
  - Waugh Chapel 230 / 115 kV transformer overloads for the loss of the other two Waugh Chapel 230 / 115 kV transformers
- Solution
  - Add a fourth 230 / 115 kV transformer, two 230 kV circuit breakers and a 115 kV breaker at Waugh Chapel
  - Estimated cost: $17 million
  - Expected in-service date: 6/1/12
- N-2 Violation
  - Harrisonville – Granite 115 kV line and Harrisonville – Dolfield 115 kV line overloads for the loss of the two Northwest 230 / 115 kV transformers
- Solution
  - Create two 230 kV ring buses at North West
  - Add two 230 / 115 kV transformers at North West
  - Create a new 115 kV station at North West
  - Estimated cost: $20 million
  - Expected in-service date: 6/1/12



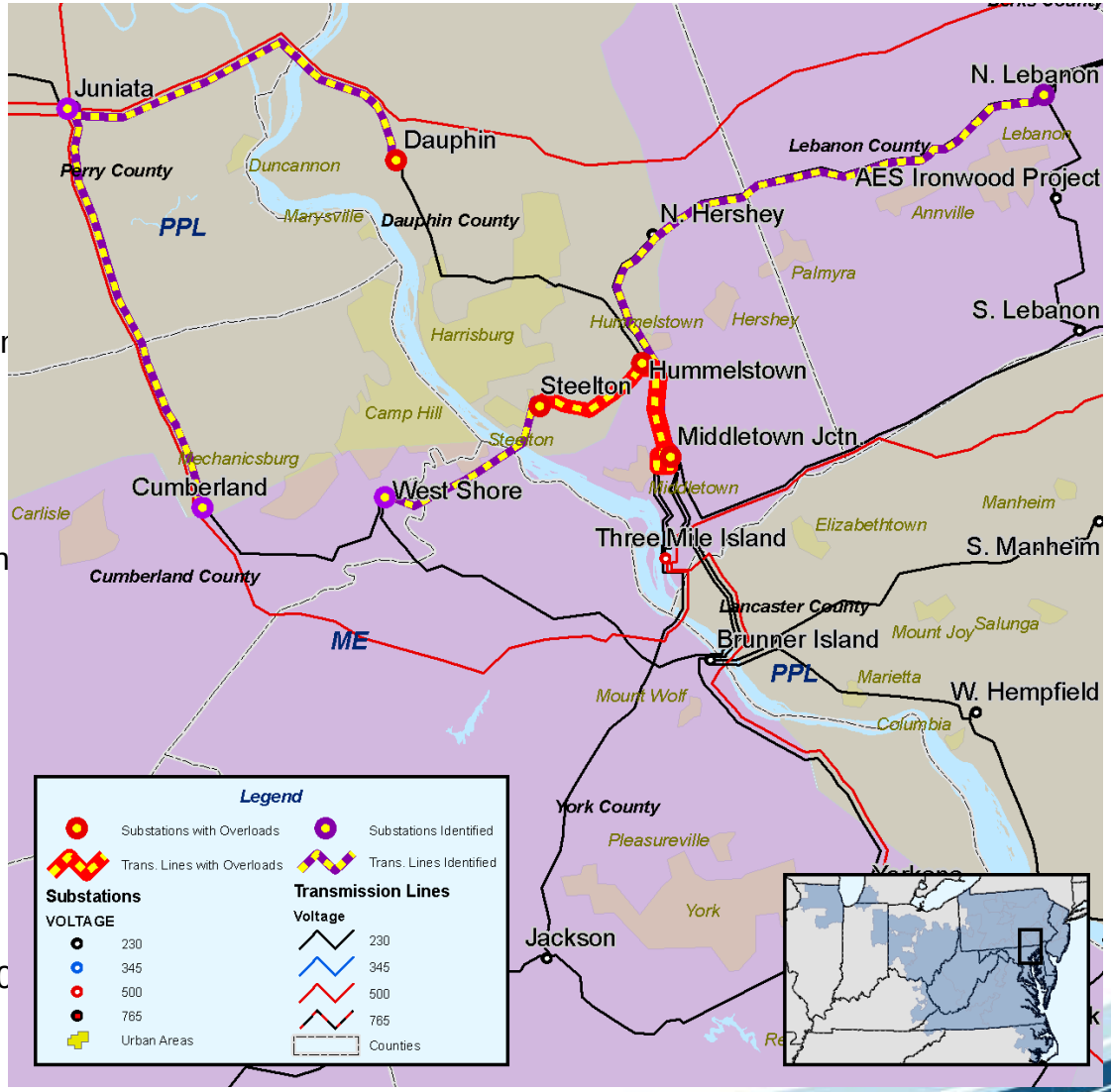
BG&E Transmission Zone

- N-2 Violation
  - –Voltage violation at High Ridge 230 kV vicinity for several N-2 contingencies.
- Solution
  - –Rebuild High Ridge 230 kV substation to Breaker and Half configuration.
  - –Expected in-service date: 6/1/12
  - –BGE is working on the cost estimate
- N-2 Violation
  - –Waugh Chapel 500/230 kV #1 transformer overloads for the loss of the other two Waugh Chapel 500/230 kV transformers
- Solution
  - –Replace Waugh Chapel 500/230 kV #1 transformer with three single phase transformers of larger capacity and install 500kV breaker
  - –Estimated cost: $26 million
  - –Expected in-service date: 6/1/12



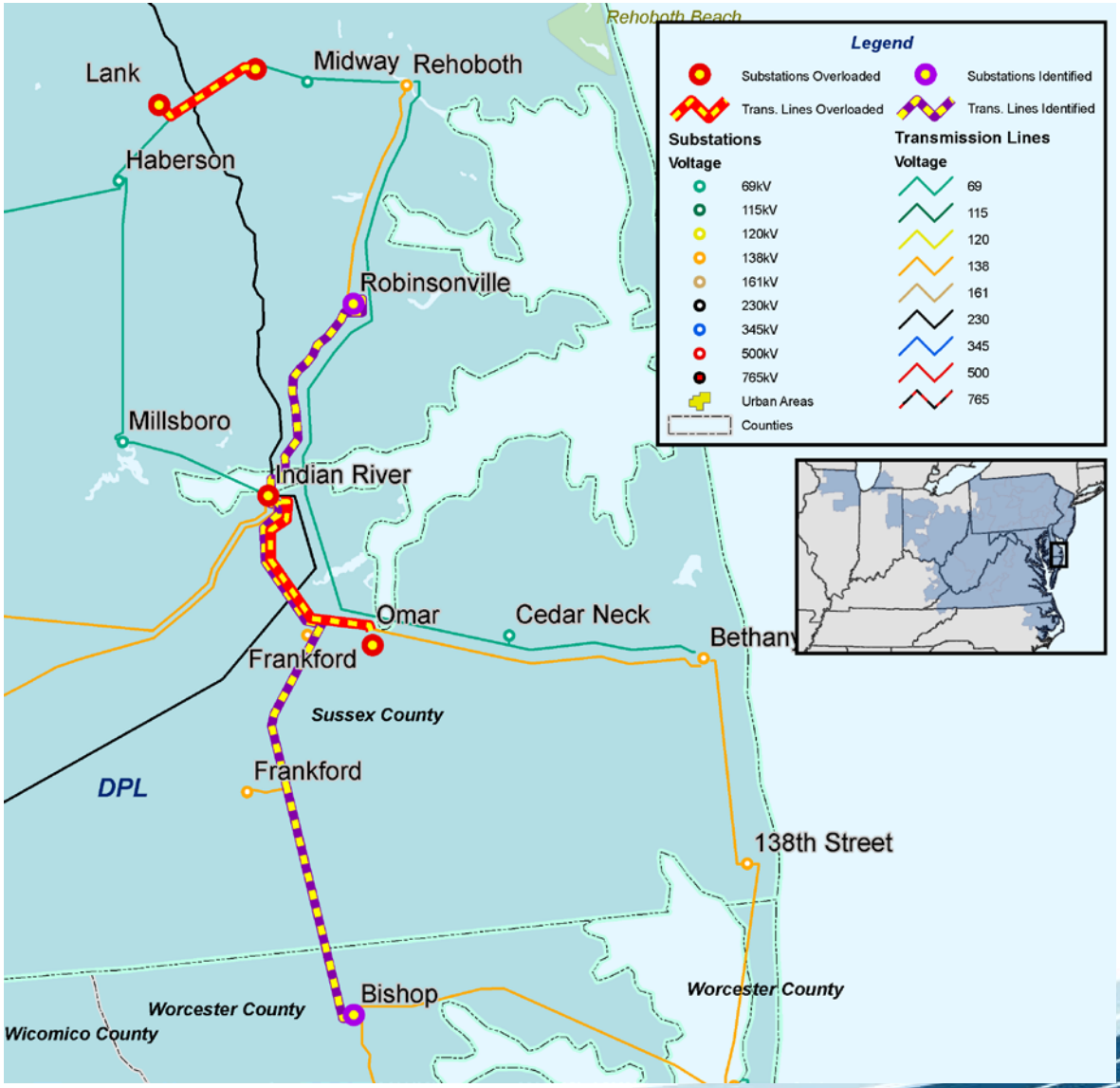
PP&L Transmission Zone

- N-2 Violations
  - Middletown Junction – Steel Tap 230 kV line overloaded for the loss of Dauphin – Juniata 230 kV line and the Dauphin 230 / 69 kV transformer 2 + loss of Middletown Junction – Hummelstown 230 kV line and Hummelstown 230 /69 kV transformer 3
  - Middletown Junction – Hummelstown 230 kV line overloaded for the loss of Dauphin – Juniata 230 kV line and the Dauphin 230 / 69 kV transformer 2 + loss of Middletown Junction – Steel Tap – Hummelstown 230 kV line
- Solution
  - Build a new substation with two 150 MVA transformers between Dauphin and Hummelstown 230 / 69 kV substations by sectionalizing the Middletown Junction – North Lebanon 230 kV line in the MetEd transmission zone.
  - Expected in-service date: 6/1/12
  - Estimated cost: $24.2 million
- N-2 Violation
  - Voltage criteria violation at Cumberland and West Shore 230 kV substation for the loss of the West Shore – Steelton and Cumberland – Juniata 230 kV circuits.
- Solution
  - Install 130 MVAR capacitor at West Shore 230 kV substation
  - Expected in-service date: 6/1/12
  - Estimated cost: $2.2 million



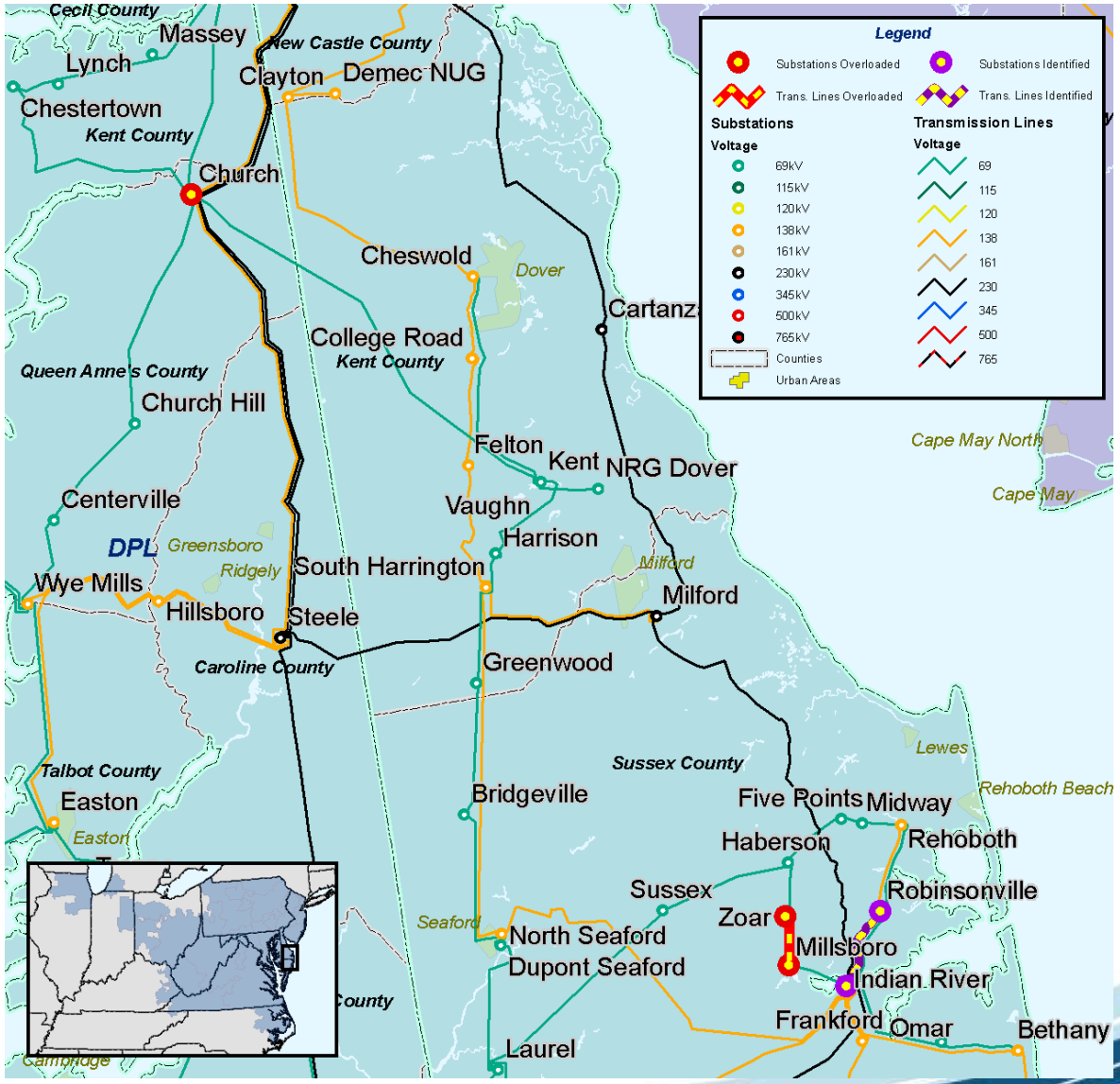
PHI – DPL Transmission Zone

- N-1 Load Deliverability Violation
  - Lank - Five Points 69 kV overloads for the loss of Indian River - Robinsonville 138 kV
- Solution
  - Rebuild Lank - Five Points 69 kV
  - Expected in-service date: 6/1/12
  - Estimated cost: $3.4 million
- N-1 Load Deliverability Violation
  - Omar - Indian River 138 kV overloads for the loss of Indian River - Bishop 138 kV
- Solution
  - Replace wave trap at Indian River 138 kV Substation
  - Expected in-service date: 6/1/12
  - Estimated cost: $0.2 million



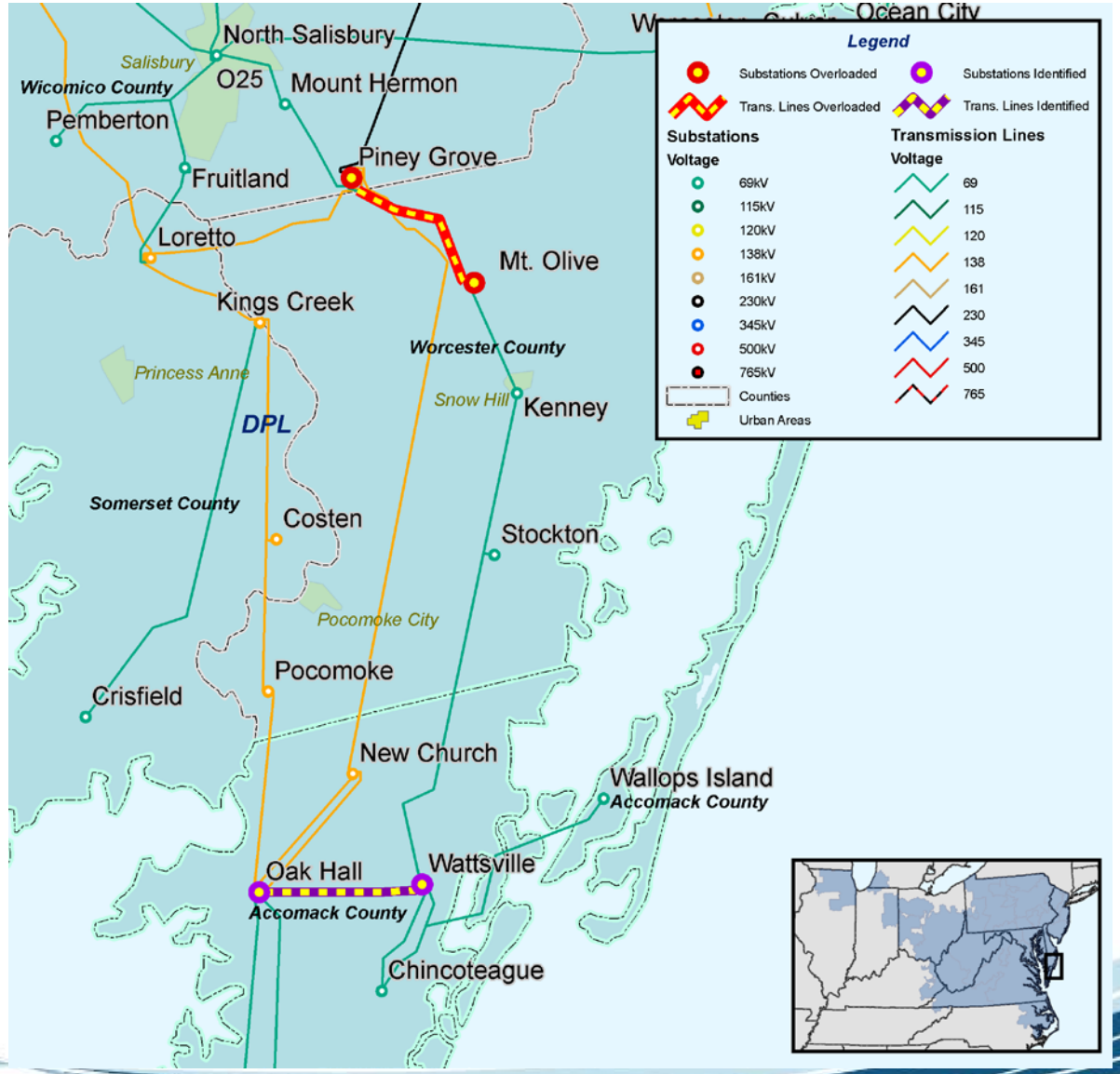
PHI – DPL Transmission Zone

- Delmarva Criteria Violation
  - Millsboro - Zoar 69 kV overloads for the loss of Indian River - Robinsonville 138 kV
- Solution
  - Rebuild Millsboro - Zoar 69 kV
  - Expected in-service date: 12/1/08
  - Estimated cost: $1.8 million
- Delmarva Criteria Violation
  - Church area Voltage violations for the loss of both Church 138/69 kV transformers
- Solution
  - Replace Church 138/69 kV transformer and add two breakers
  - Expected in-service date: 6/1/09
  - Estimated cost: $4.4 million
  - Note: This upgrade eliminates the need for B0391 project



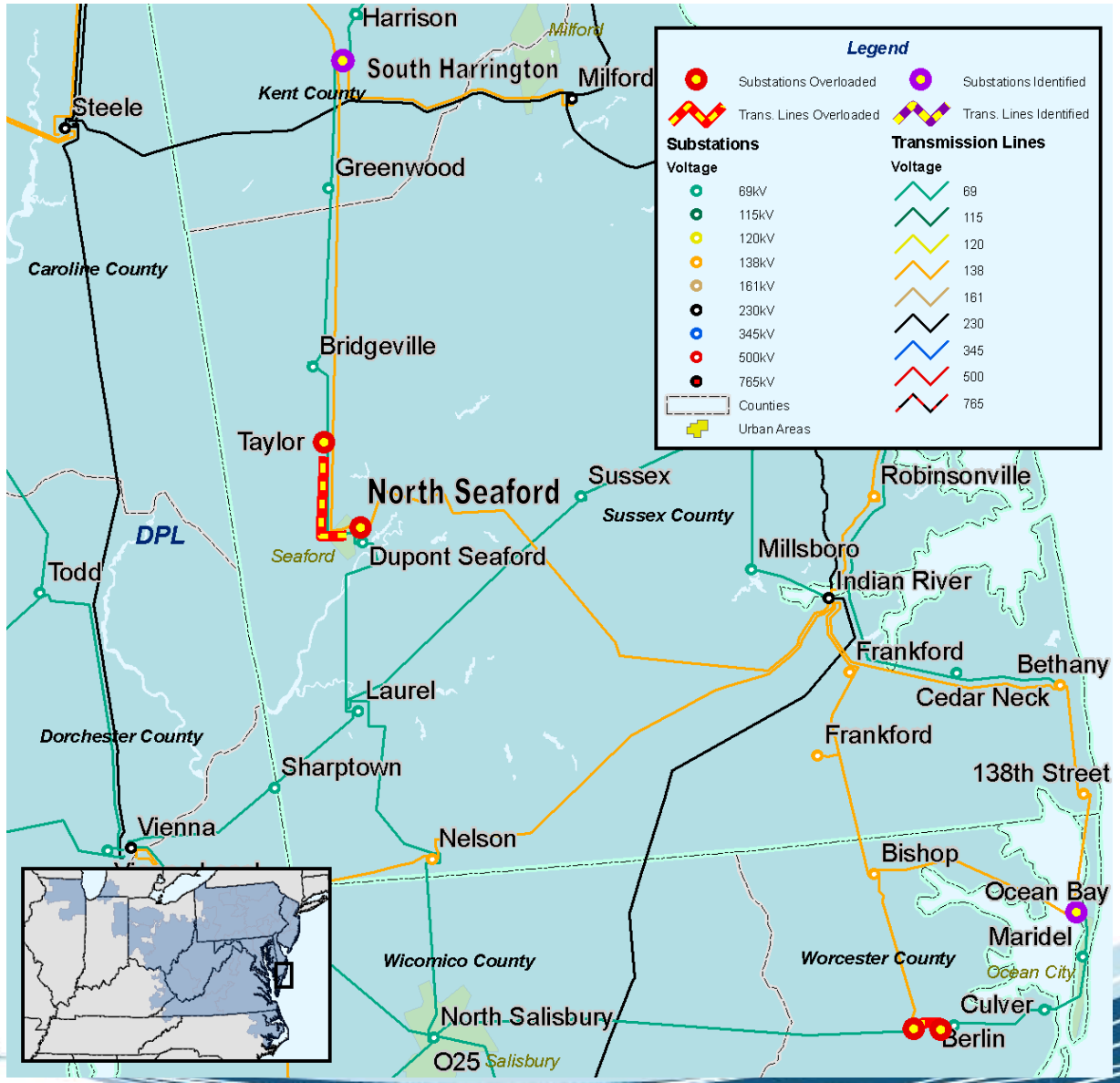
PHI – DPL Transmission Zone

- Delmarva Criteria Violation
  - –Piney Grove - Mt Olive 69 kV overloads and Mt. Olive area voltage violations for the loss of Oak Hall - Wattsville 69 kV
- Solution
  - –Build Oak Hall - Wattsville 138 kV line
  - –Estimated cost: $2.7 million
  - –Add 138/69 kV transformer at Wattsville
  - –Estimated cost: $4.1 million
  - –Establish 138 kV bus position at Oak Hall
  - –Estimated cost: $1.2 million
  - –Expected in-service date: 6/1/09



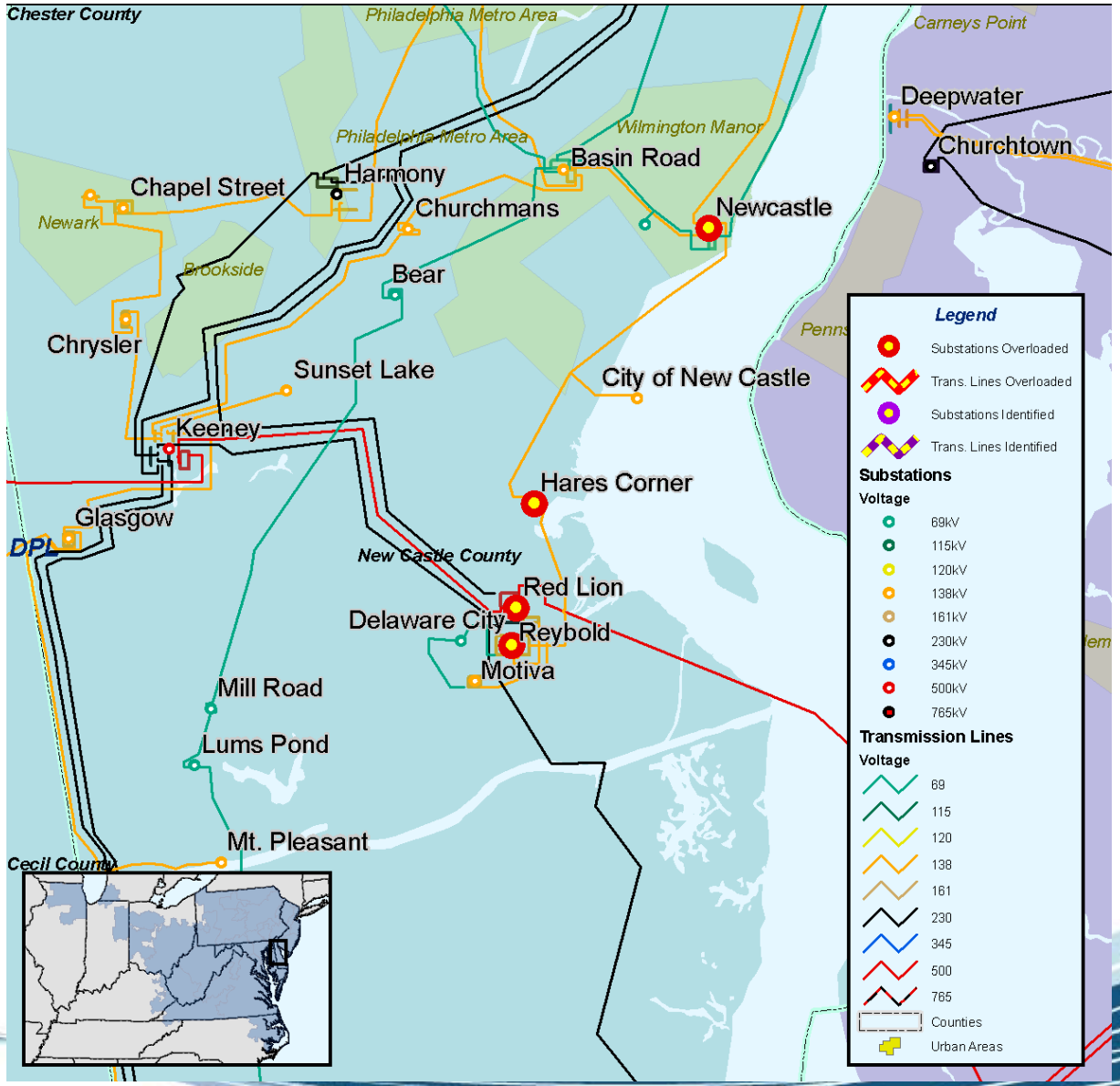
PHI – DPL Transmission Zone

- Delmarva Criteria Violation
  - Worcester - Berlin 69 kV overloads for the loss of Ocean Bay 138/69 kV transformer.
- Solution
  - Re-tension Worcester - Berlin 69 kV
  - Estimated cost $0.2 million
  - Expected in-service date: 6/1/10
- Delmarva Criteria Violation
  - Taylor – North Seaford 69 kV overloads for the loss of South Harrington 138/69 kV transformer.
- Solution
  - Re-tension Taylor – North Seaford 69 kV
  - Estimated cost $0.6 million
  - Expected in-service date: 6/1/10



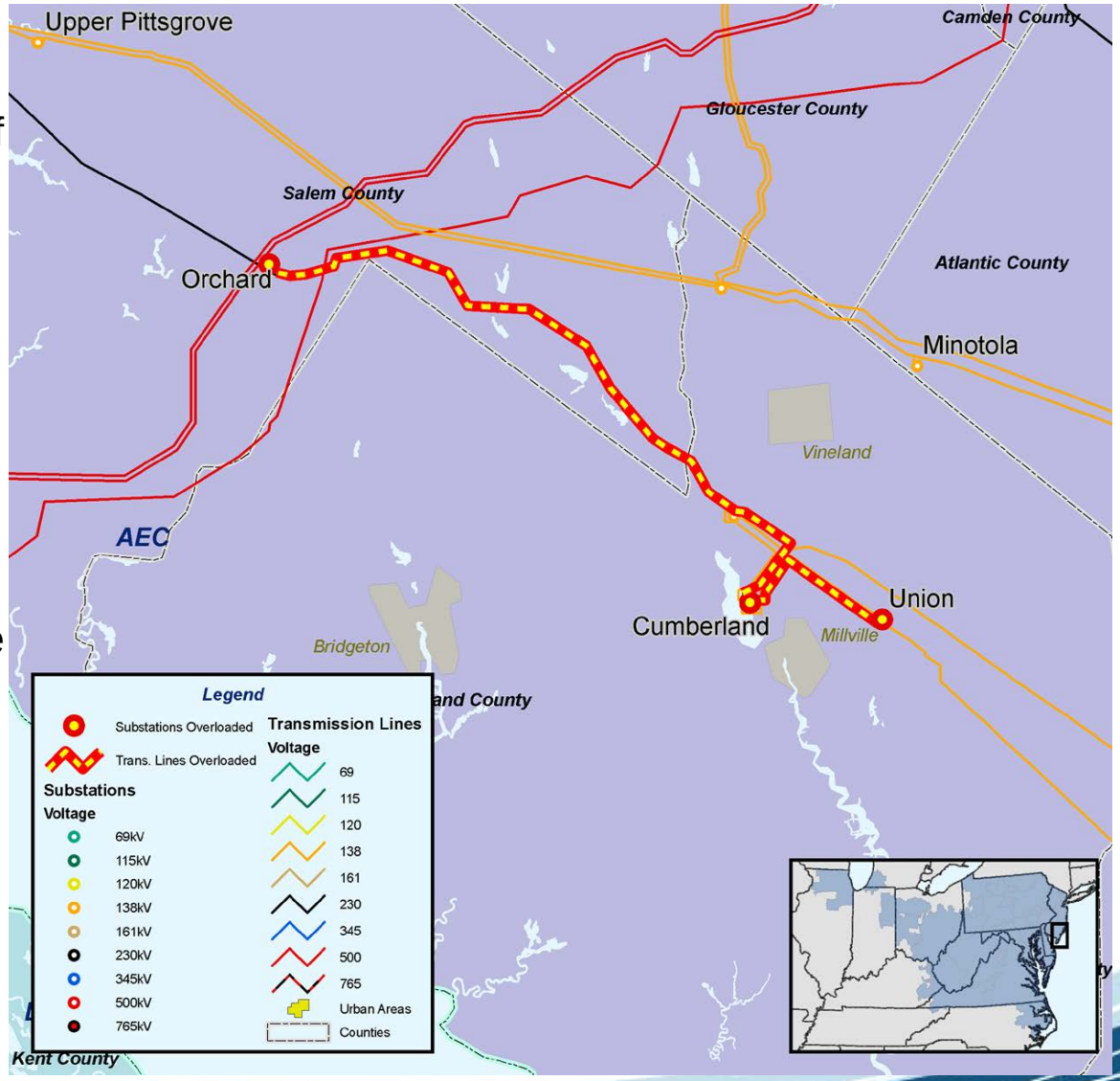
PHI – DPL Transmission Zone

- Replace baseline upgrade B0260
  - Old upgrade
    - Replace Red Lion 230/138 kV transformer for $5 million
- New upgrade
  - Install a 2nd Red Lion 230/138 kV for $2.523 million
    Hares Corner - Relay Improvement for $0.8 million
    Reybold - Relay Improvement for $0.165 million
    New Castle - Relay Improvement for $0.165 million
    Estimated total cost $3.65 million.
    Expected in-service date is 6/1/2009



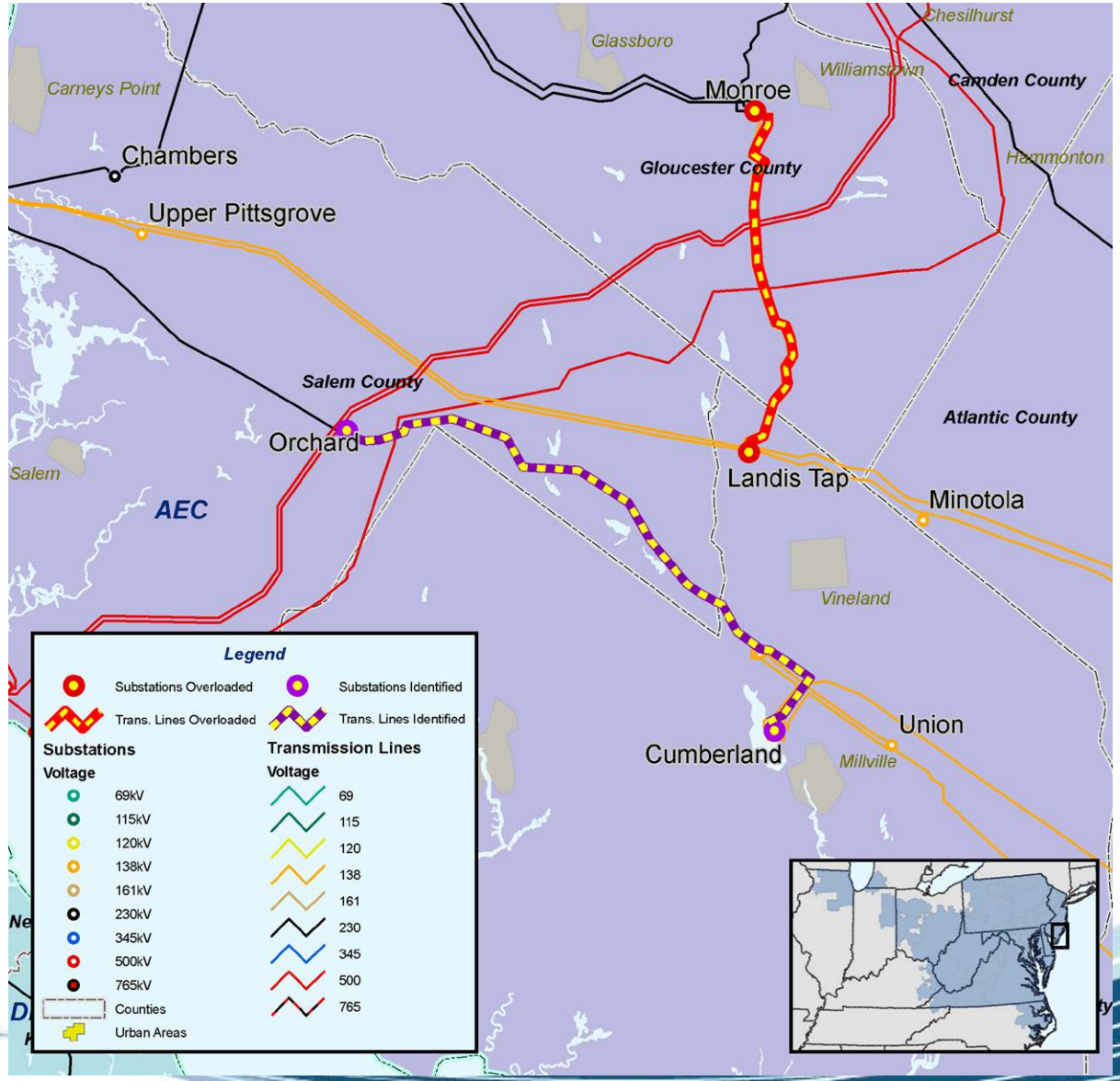
PHI – AE Transmission Zone

- N-1 Load Deliverability Violation
  - Voltage collapse for the loss of the Cumberland – Orchard (a.k.a. Alloway) 230 kV line
- Solution
  - Install a 60 MVAR 230 kV capacitor at Cumberland
  - Expected in-service: 6/1/12
  - Estimated cost: $2.0M
- N-1 Load Deliverability Violation
  - Cumberland – Union 138 kV line overload for the loss of the Dennis 230 / 138 kV transformer
- Solution
  - Complete B0433 to eliminate stranded bus limitation
  - Revise limiting relay setting to bring the line rating up to 483 MVA
  - Estimated cost: $0.0



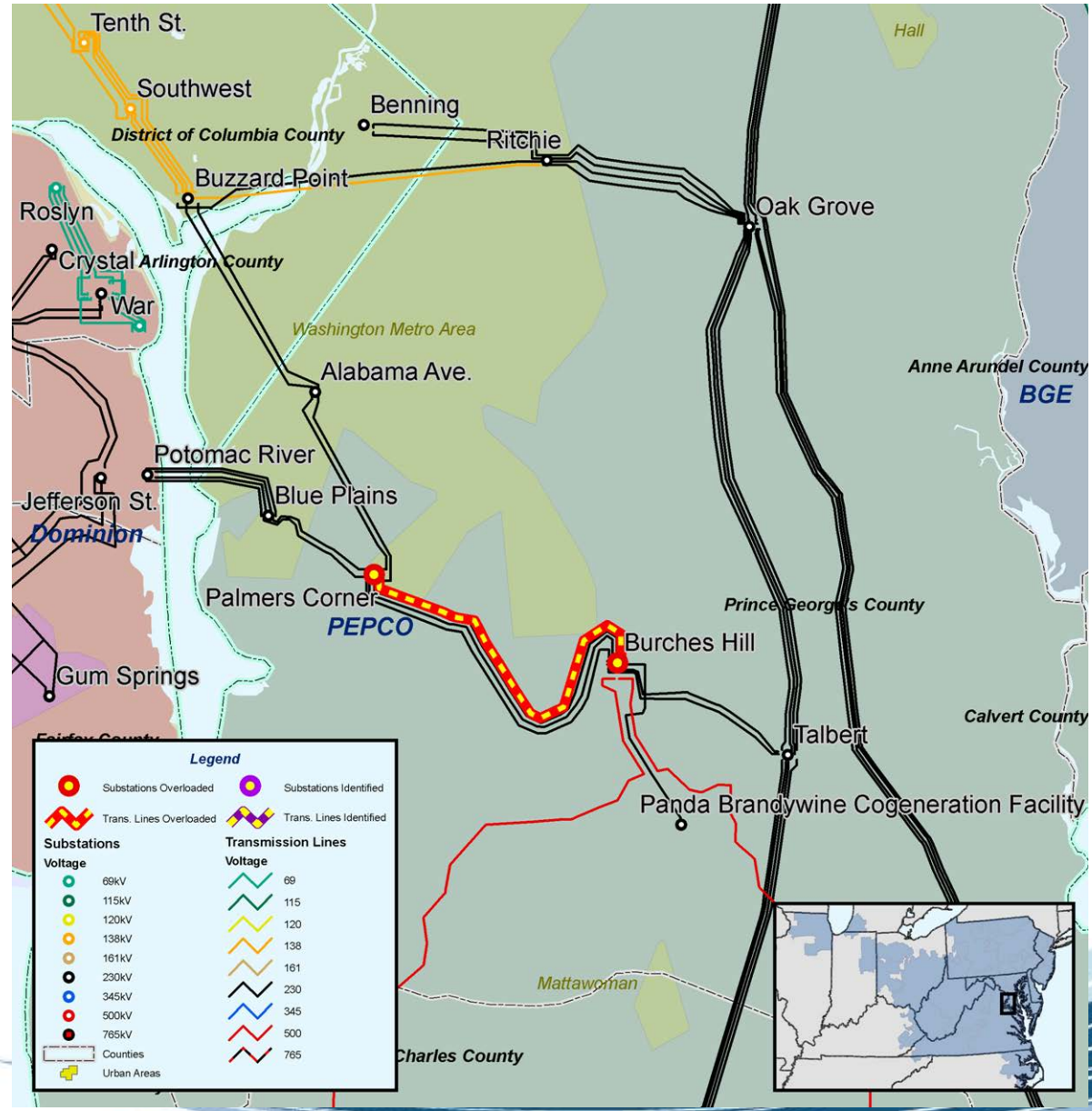
PHI – AE Transmission Zone

- N-1 Load Deliverability Violation
  - Monroe – Landis Tap – Shieldalloy – North Central 69 kV line overload for the loss of the Cumberland – Orchard (a.k.a Alloway) 230 kV line
- Solution
  - Reinforce the 138 / 69 kV facilities in the AE/Vineland area.
  - Specific plans under review
- Note: The Atlantic Electric area analysis was done with BL England out of service. Some plans may be able to be deferred if units are available.



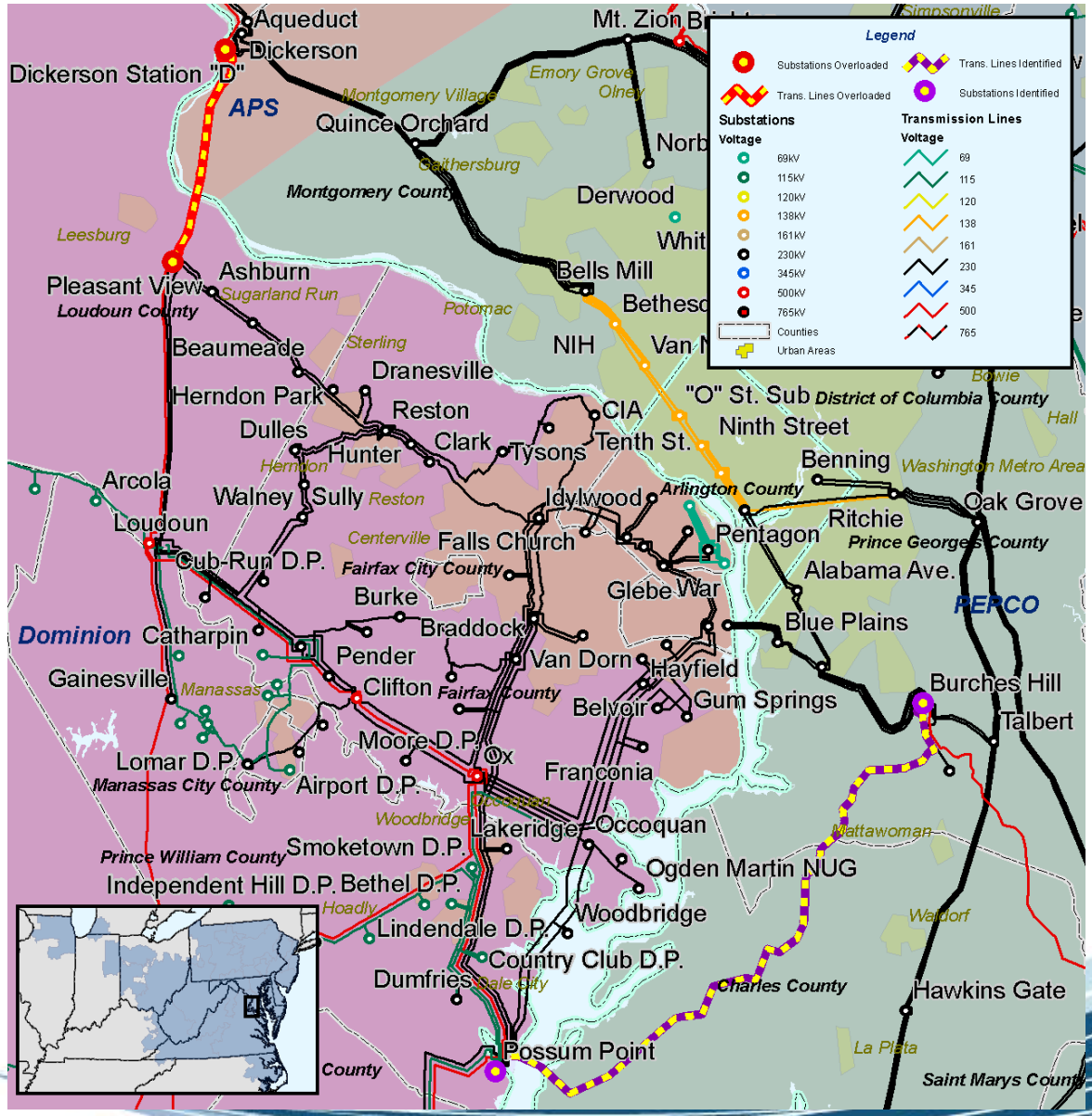
PHI – PEPCO Transmission Zone

- N-2 Violation
  - Burches Hill – Palmers Corners230 kV line overload for the loss of the other two Burches Hill – Palmers Corners 230 kV lines
- Solutions
  - Reconductor the four circuits from Burches Hill to Palmers Corner
  - Expected in service date: 6/1/12
  - Estimated cost: $10 million ($2.5 million per circuit)



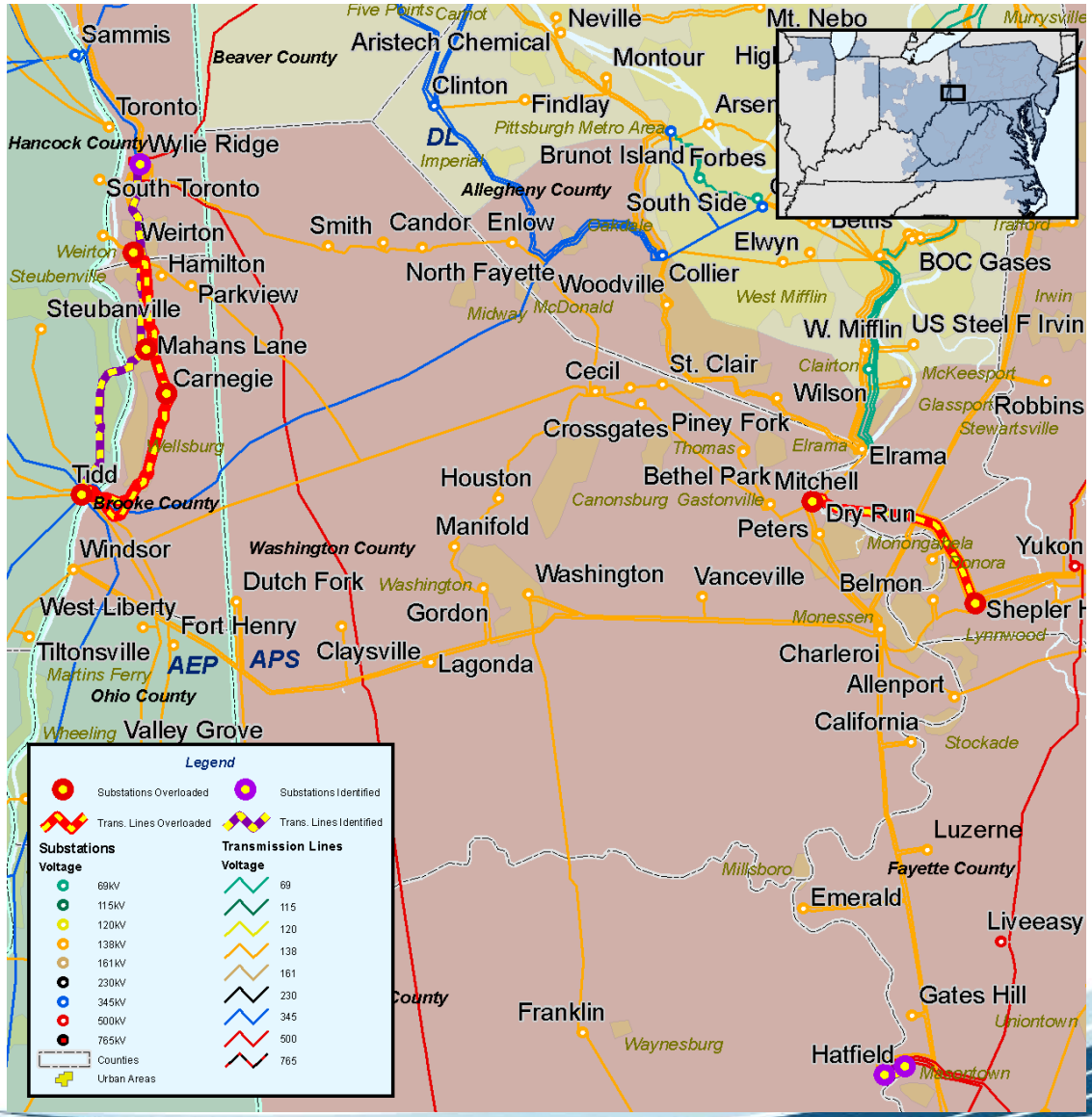
PHI – PEPCO Transmission Zone

- Mid-Atlantic Load Deliverability Issue
  - Pleasant View – Dickerson 230 kV line is overloaded for the loss of Possum Point - Burches Hill 500 kV line
- Solution
  - Reconductor the Pleasant View – Dickerson 230 kV circuit
  - Expected in service date: 6/1/2011
  - Estimated cost: $5M



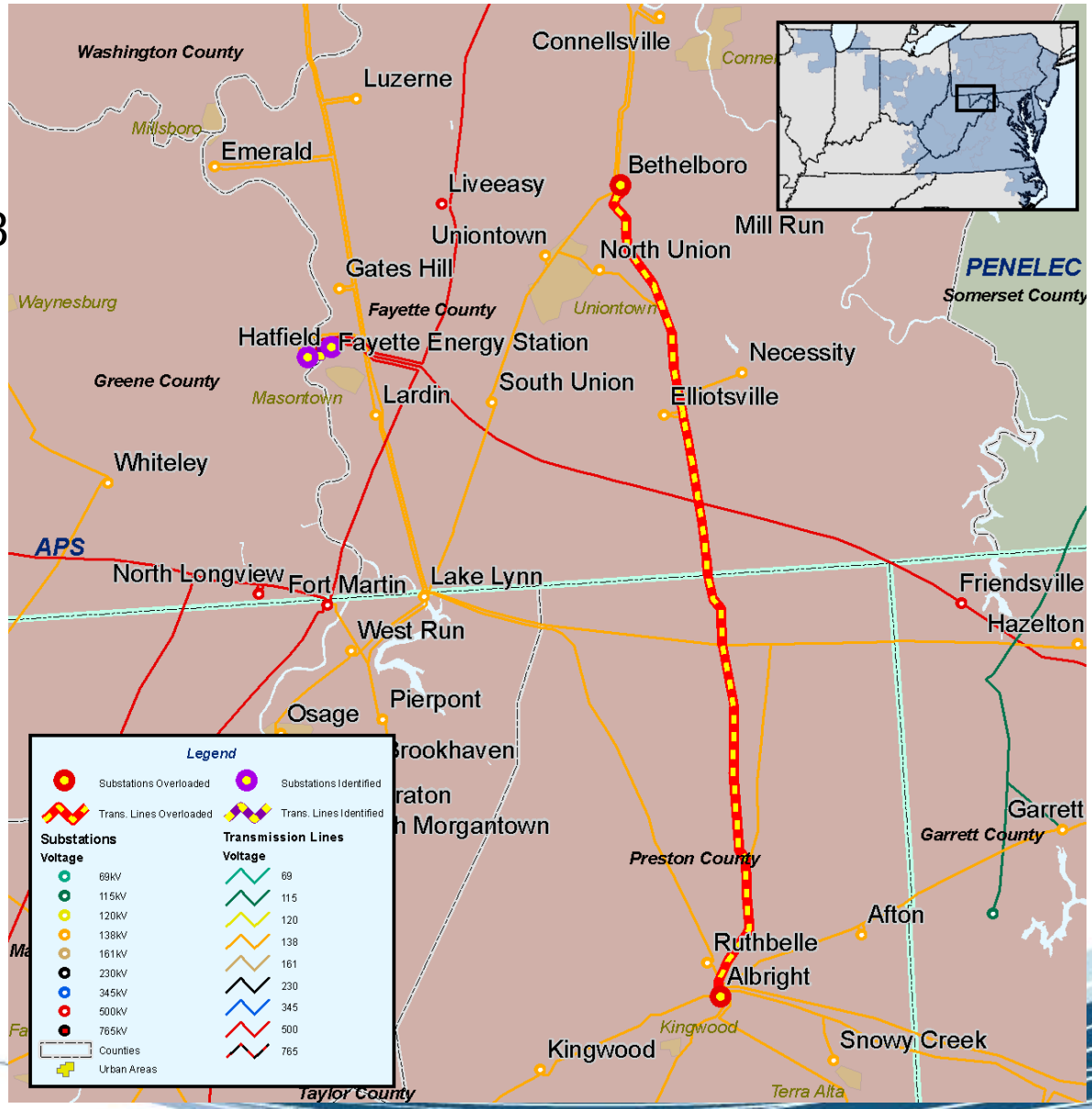
APS Transmission Zone

- Generator Deliverability Violation
  - –Tidd – Mahans Lane – Weirton 138 kV line overloaded for the loss of Wylie Ridge – Tidd 345 kV and Tidd – Collier 345 kV tower line
- Solution
  - –Upgrade substation equipment and reconductor the line with 954 ACSR
  - –Expected in service date: 6/1/12
  - –Estimated cost: $ 3 million
- N-2 Violation
  - –Mitchell – Shepler Hill Junction 138 kV line overloaded for the loss of Hatfield – Ronco 500 kV line + Hatfield Unit 1
- Solution
  - –Reconductor the Mitchell – Shepler Hill Junction 138 kV circuit with 954 ACSR
  - –Expected in service date: 6/1/10
  - –Estimated cost: $3 million



APS Transmission Zone

- Generator Deliverability Violation
  - Albright - Bethelboro 138 kV line is overloaded for the loss of Ronco - Hatfield 500kV and the Hatfield Generating Unit #3.
- Solution
  - Albright - Bethelboro 138 kV circuit will be upgraded by raising limiting structures and replacing terminal equipment in 12-2010
  - Estimated cost: $ 0.8 Million



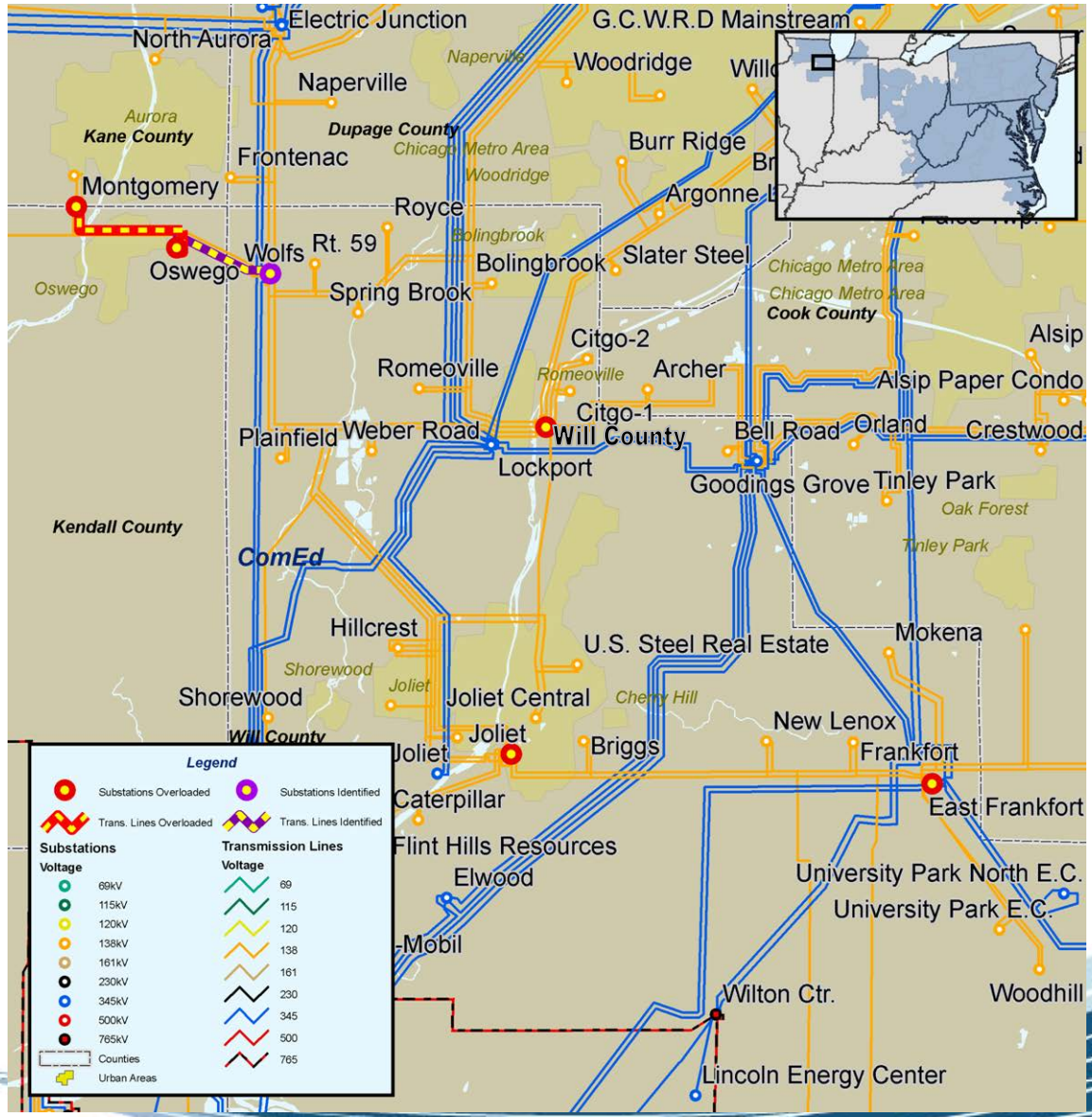
Duquesne Transmission Zone

- N-2 Thermal Violation
  - Carson – Oakland 138 kV line overload for the loss of Cheswick Unit 1 + loss of Arsenal 345 / 138 kV transformer
  - Arsenal – Brunot Island 345 kV line overloaded for the loss of the other Arsenal – Brunot Island circuit over normal rating
- Solution
  - Reviewing alternatives with DLCO
- Generator Deliverability Violation
  - Cheswick - Logan's Ferry 138 kV overloads for category C contingencies involving the loss of the parallel circuit
- Solution
  - Reconductor the circuits by June 1, 2012 for **$**2,400,000.

- Short Circuit Violation
  - Cook 345 kV breakers M2 and N2 are overstressed
- Solution
  - Replace Cook 345 kV breakers M2 and N2
  - Estimated In-Service Date: 6-1-09
  - Estimated Cost: $1.4 M

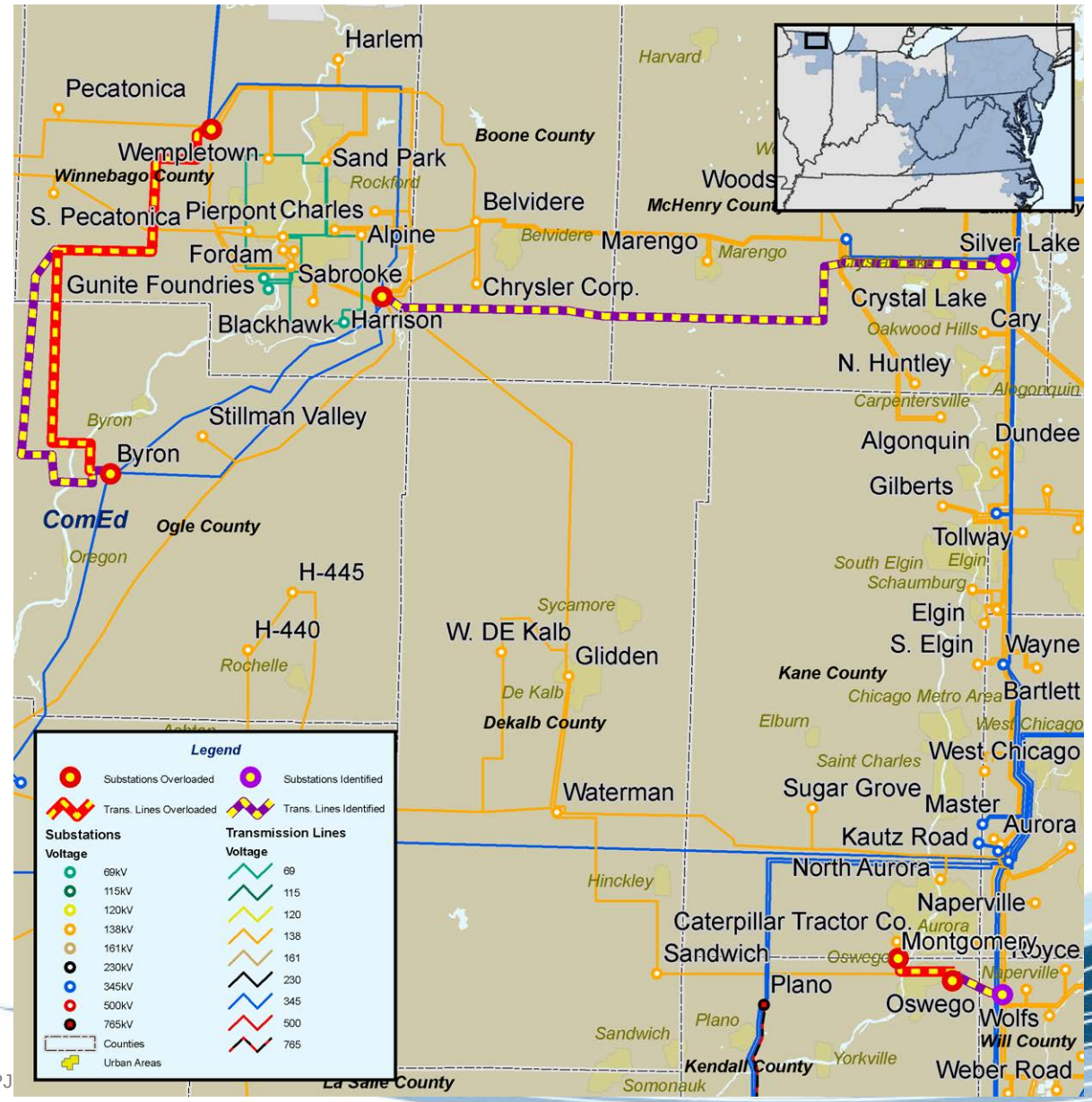
Exelon – ComEd Transmission Zone

- Generator Deliverability Violation
  - Oswego – Montgomery 138 kV line overloaded for the loss of Wolfs – Oswego 138 kV
- Solution
  - Increase rating of 138 kV line 14304 between Oswego and Montgomery
  - Estimated cost: $2.25 Million
- N-2 and Load Deliverability Voltage Violations
  - East Frankfort, Joliet, and Will County 138 kV areas
- Solution
  - Install 115.2 MVAR cap at Libertyville – Est. cost: $2.3 M
  - Install 57.6 MVAR cap at Prospect Heights – Est. cost: $1.2 M
  - Install 115.2 MVAR cap at Will County – Est. cost: $2.3 M
  - Install 115.2 MVAR cap at Joliet – Est. cost: $2.3 M
  - Install 115.2 MVAR cap at East Frankfort – Est. cost: $2.3 M
  - Expected in service date 6/1/12



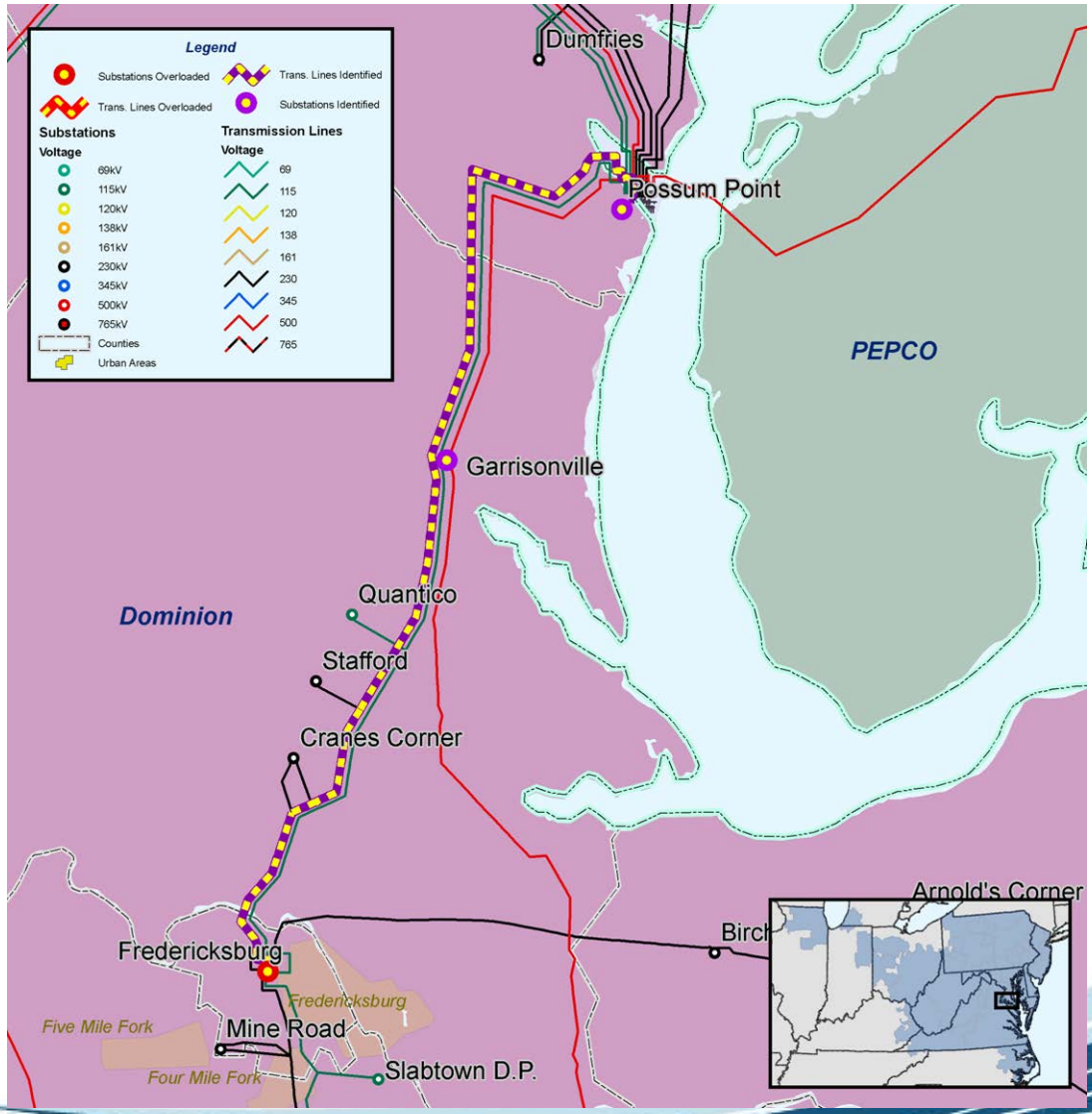
Exelon – ComEd Transmission Zone

- Generator Deliverability Violation
  - Byron – Wempletown 345 kV line overloaded for a tower contingency
- Solution
  - Advance existing baseline upgrade for second Byron – Wempletown 345 kV circuit from 2014 to 2012
  - Expected cost $14.5 Million



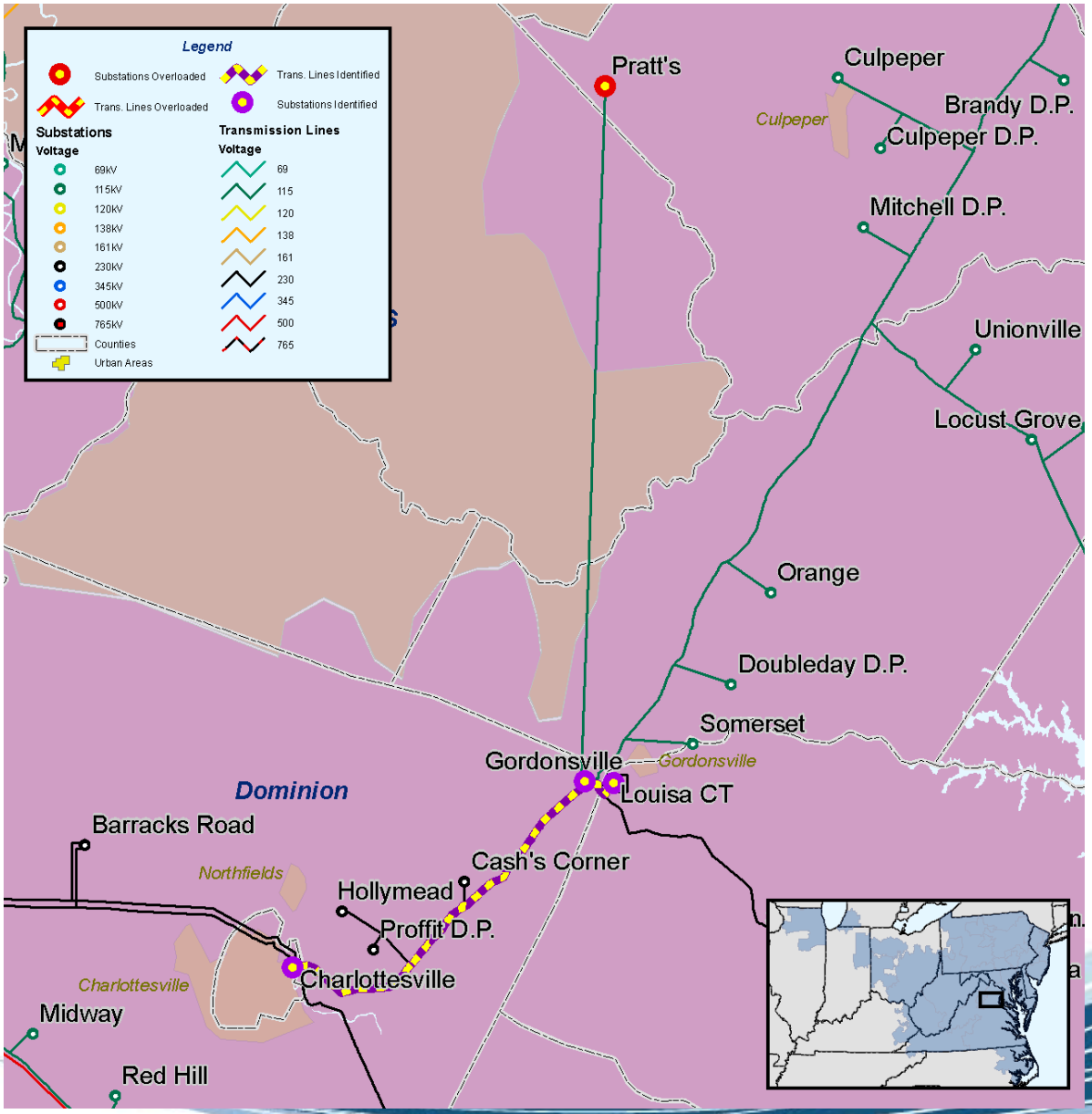
Dominion Transmission Zone

- N-2 Violation
  - –Voltage violation at Fredricksburg area 230 kV buses for the loss of Four Rivers – Fredricksburg 230 kV + Possum Point – Garrisonville 230 kV
- Solution
  - –Install a 150 MVAR 230 kV capacitor at Fredricksburg
  - –Expected in-service date: 6/1/12
  - –Estimated cost: $1.2 million



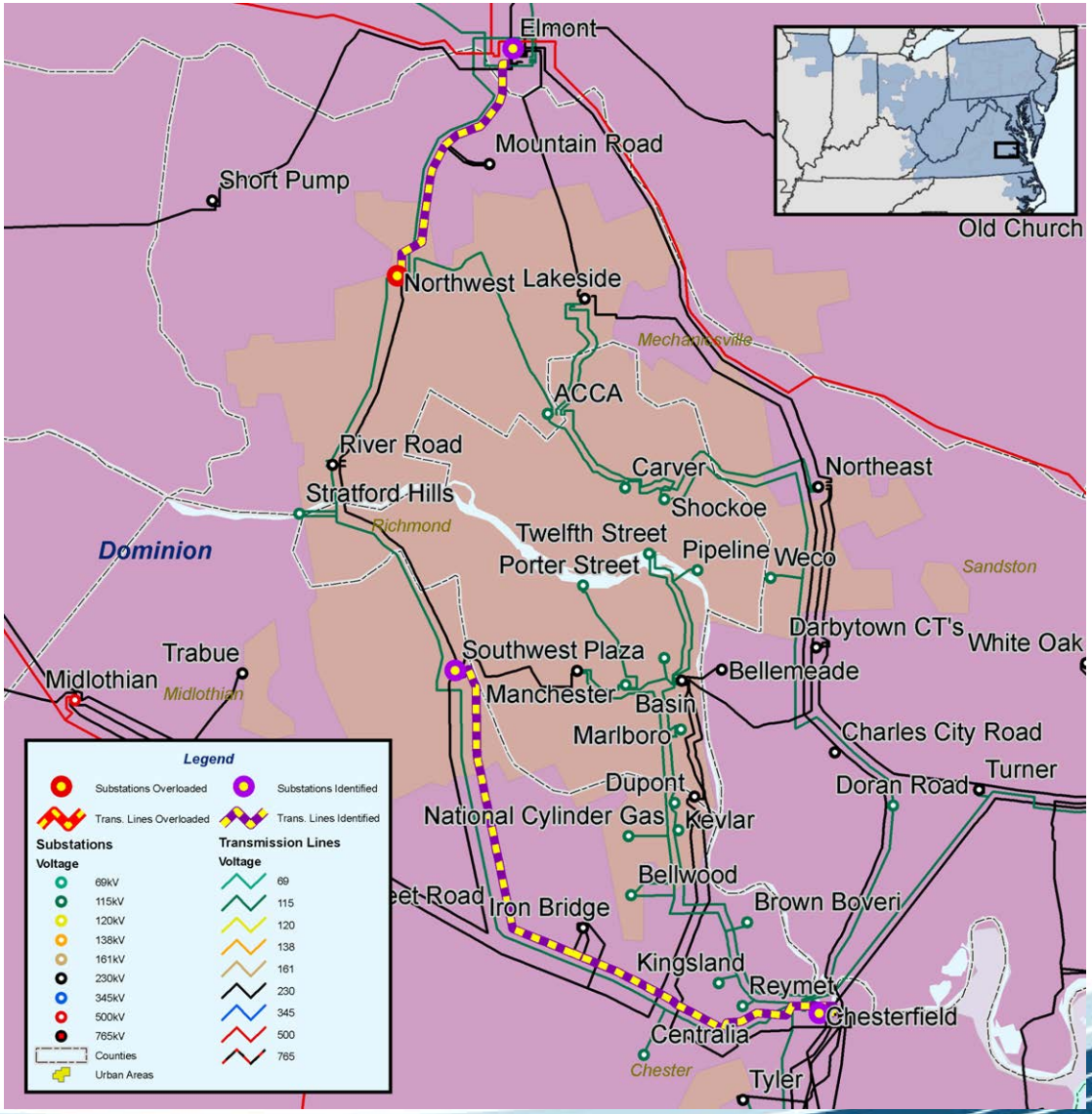
Dominion Transmission Zone

- N-2 Violation
  - Voltage violation at Pratts 115 kV for the loss of Gordonsville – Louisa Ct 230 kV + Gordonsville – Charlottesville 230 kV
- Solution
  - Install a 25 MVAR 115 kV capacitor at Somerset
  - Expected in-service date: 6/1/12
  - Estimated cost: $0.5 million



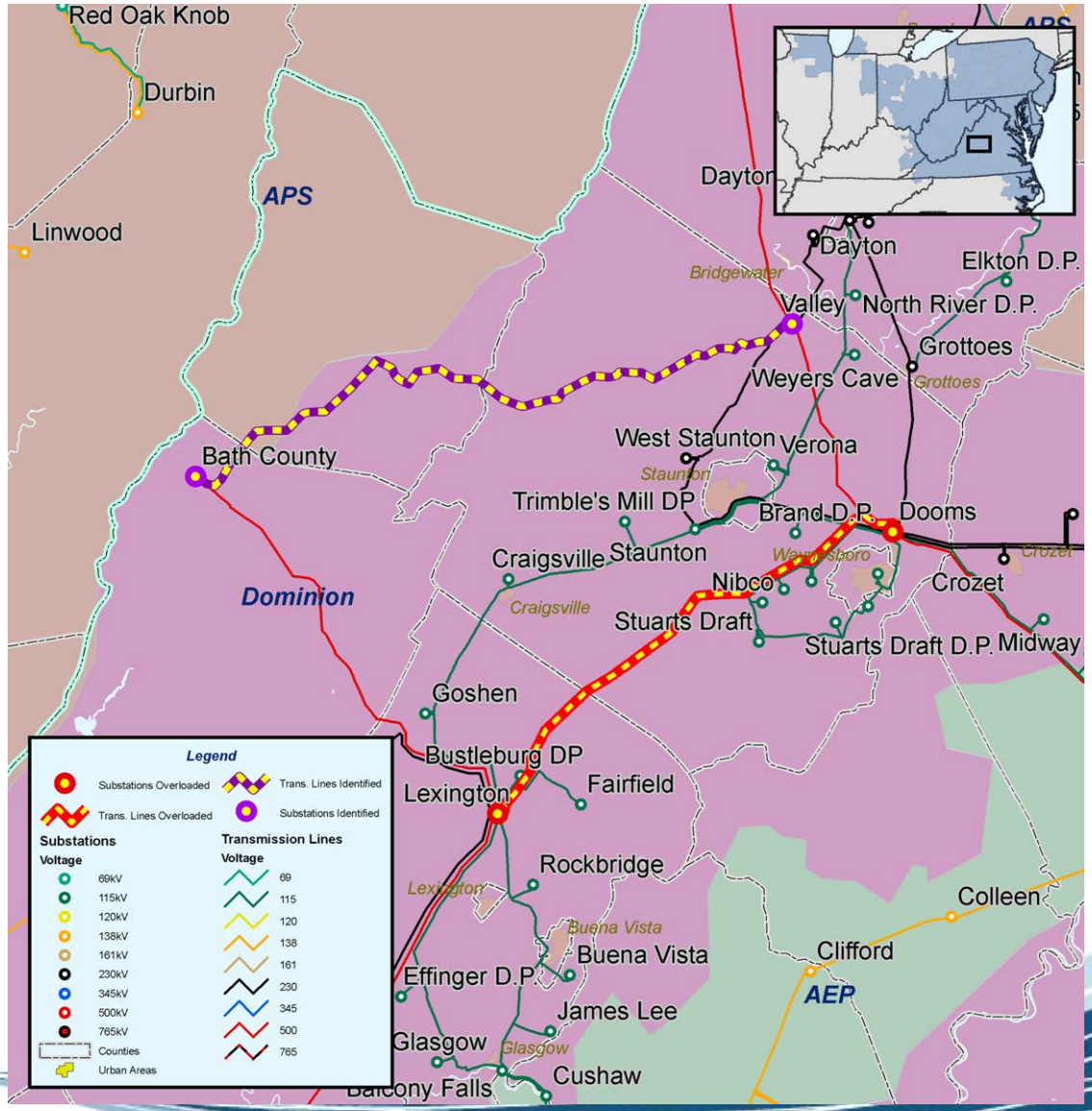
Dominion Transmission Zone

- N-2 Violation
  - Voltage violation at Northwest 230 kV for the loss of Chesterfield – Southwest 230 kV + Northwest – Elmont 230 kV
- Solution
  - Install a 150 MVAR 230 kV capacitor at Northwest
  - Expected in-service date: 6/1/12
  - Estimated cost: $1.2 million



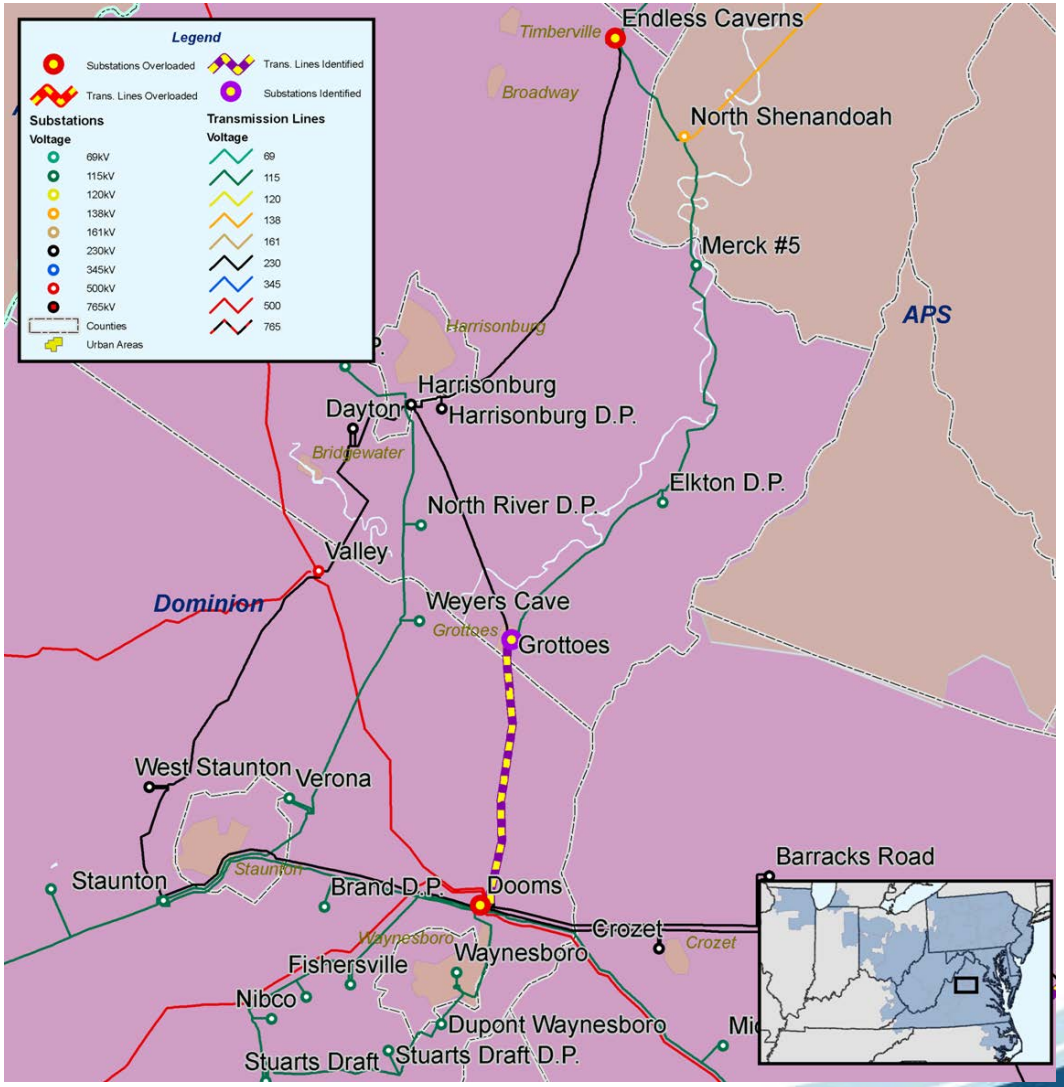
Dominion Transmission Zone

- Mid-Atlantic Load Deliverability
  - Dooms – Lexington 500 kV line overloads for the loss of Bath County – Valley 500 kV
- Solution
  - Replace the wave traps at both Lexington and Dooms
  - Expected in-service date: 6/1/12
  - Estimated cost: $0.3 million



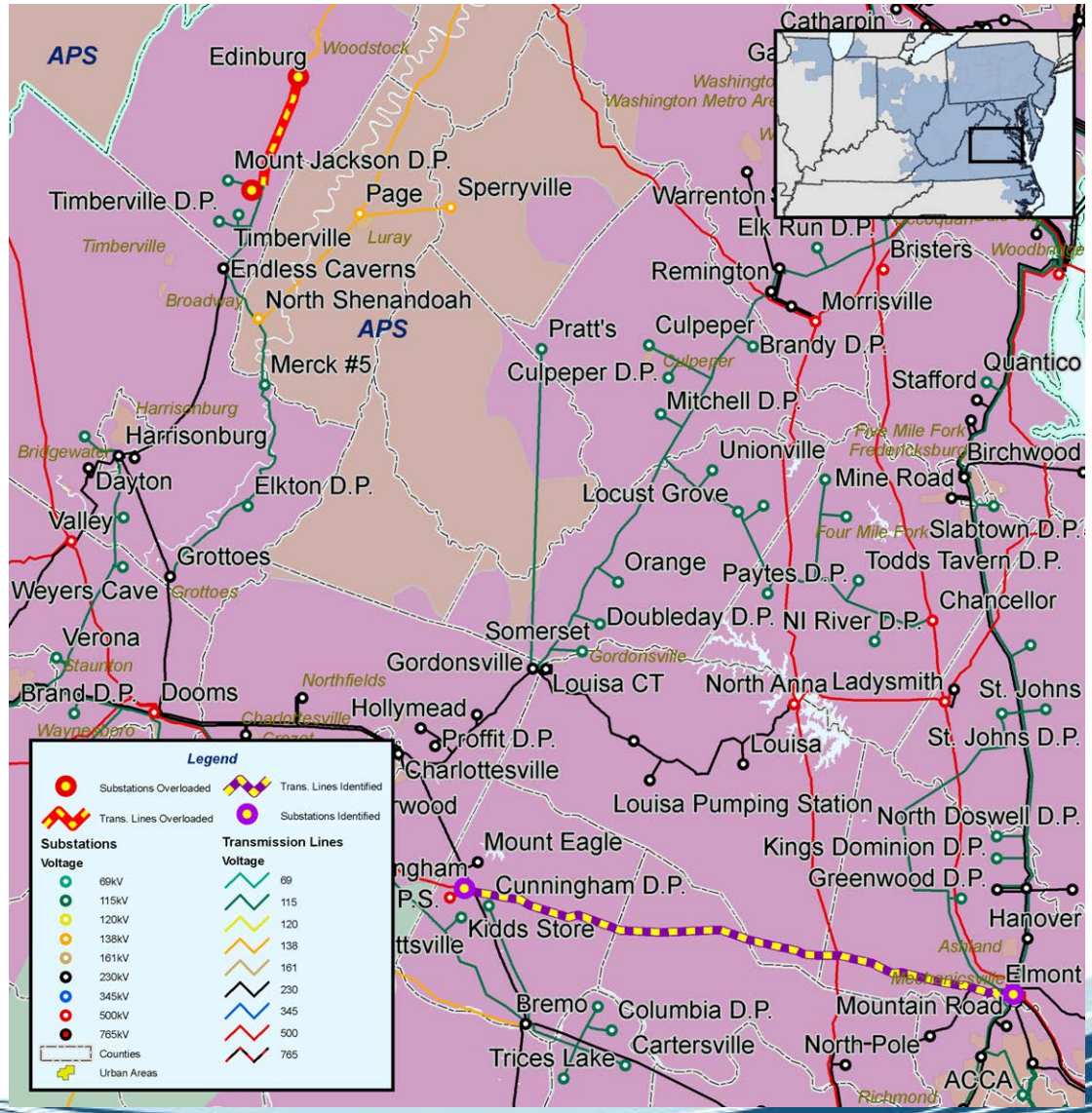
Dominion Transmission Zone

- Dominion Criteria Violation
  - Endless Caverns 230 / 115 kV transformer overloads for the loss of Dooms – Grottoes 230 kV
- Solution
  - Add a second Endless Caverns 230 / 115 kV transformer
  - Expected in-service date: 6/1/10
  - Estimated cost: $6 million



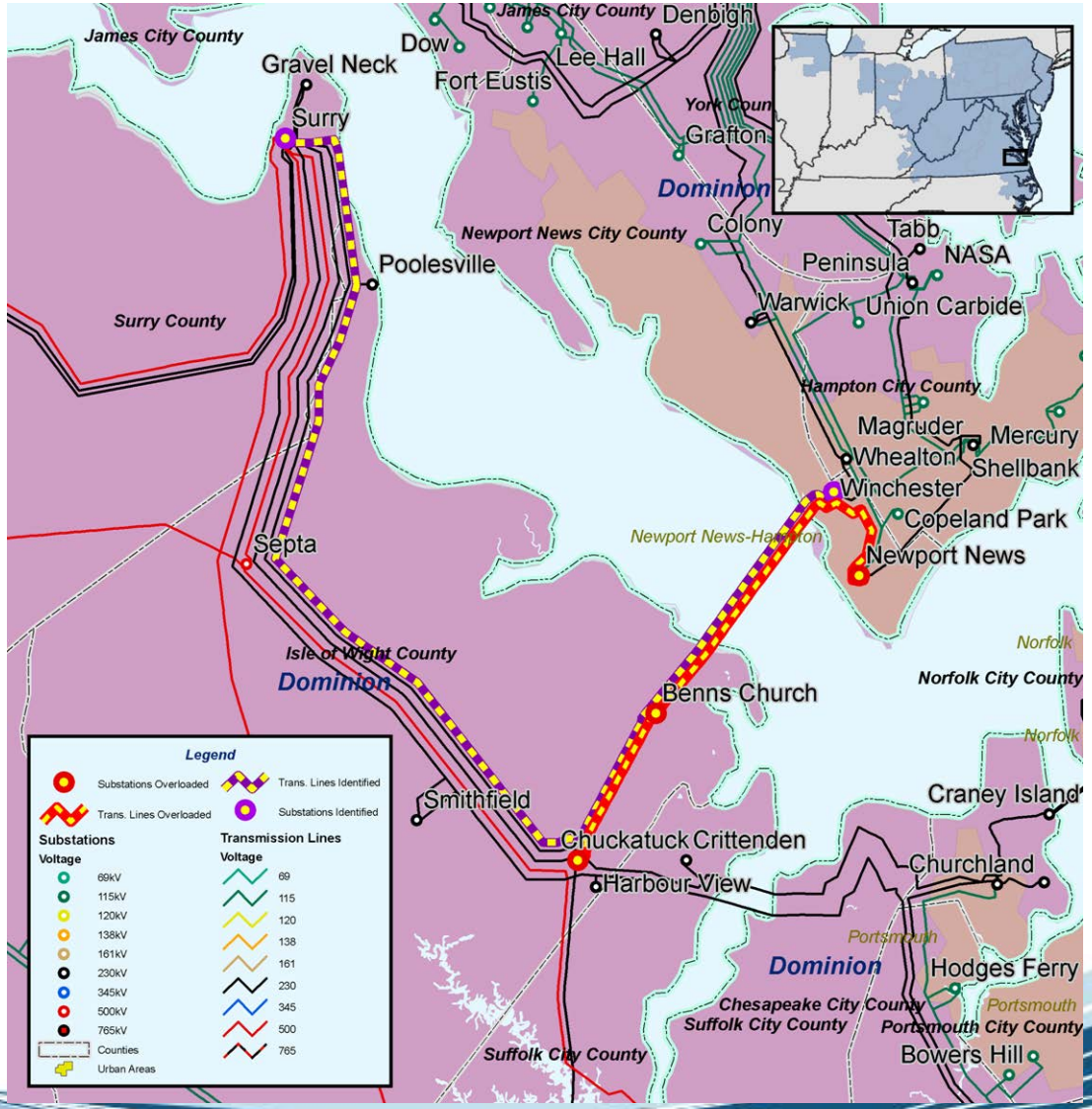
Dominion Transmission Zone

- Dominion Criteria Violation
  - Edinburg – Mt. Jackson 115 kV overloads for the loss of Cunningham – Elmont 500 kV
- Solution
  - Reconductor 9.4 miles of the Edinburg – Mt. Jackson 115 kV line
  - Expected in-service date: 6/1/10
  - Estimated cost: $5 million



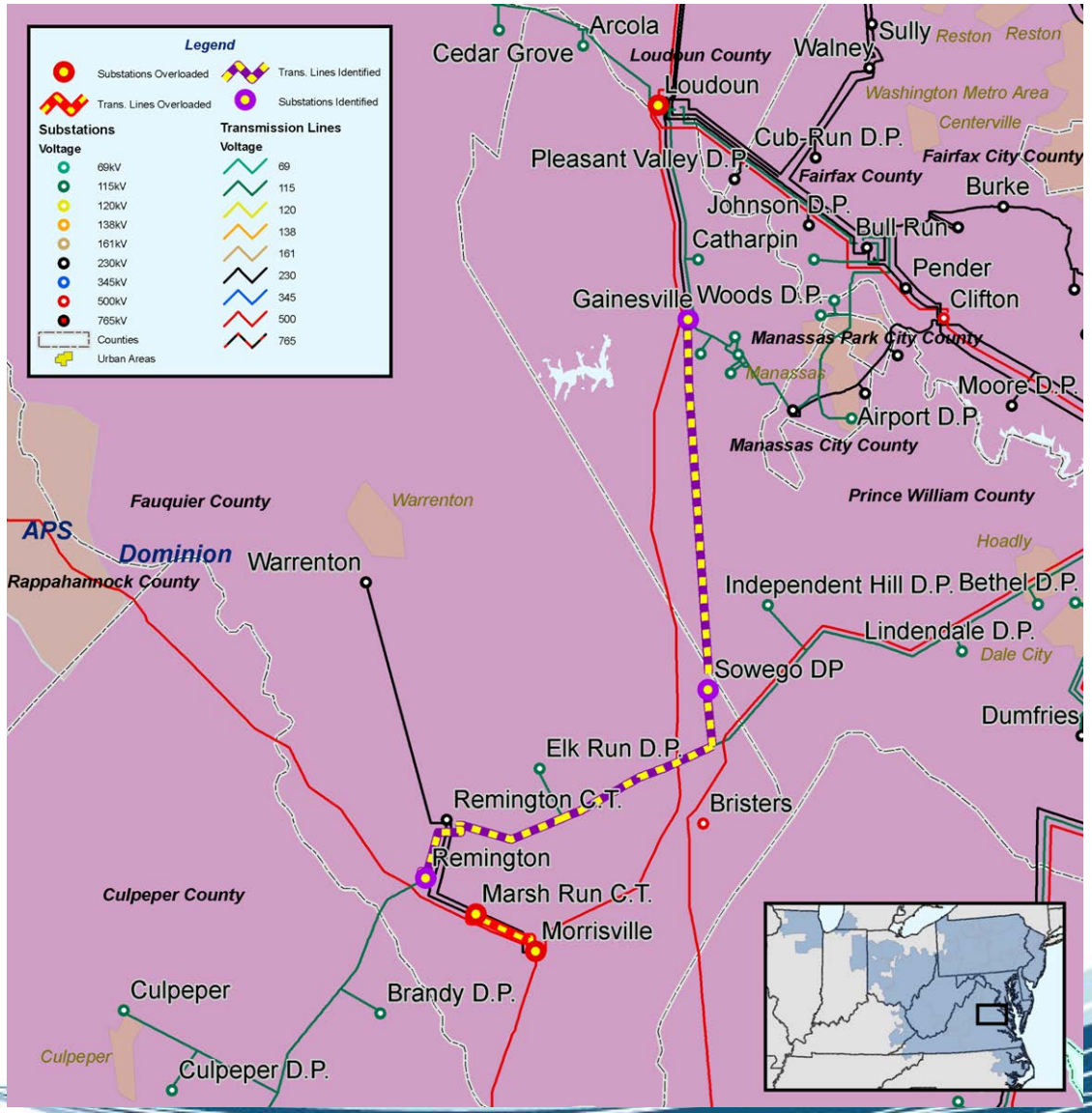
Dominion Transmission Zone

- Dominion Criteria Violation
  - Newport News – Chuckatuck 230 kV overloads for the loss of Surry – Winchester 230 kV
- Solution
  - Reconductor 2.4 miles of the Newport News – Chuckatuck 230 kV line
  - Expected in-service date: 6/1/12
  - Estimated cost: $3 million



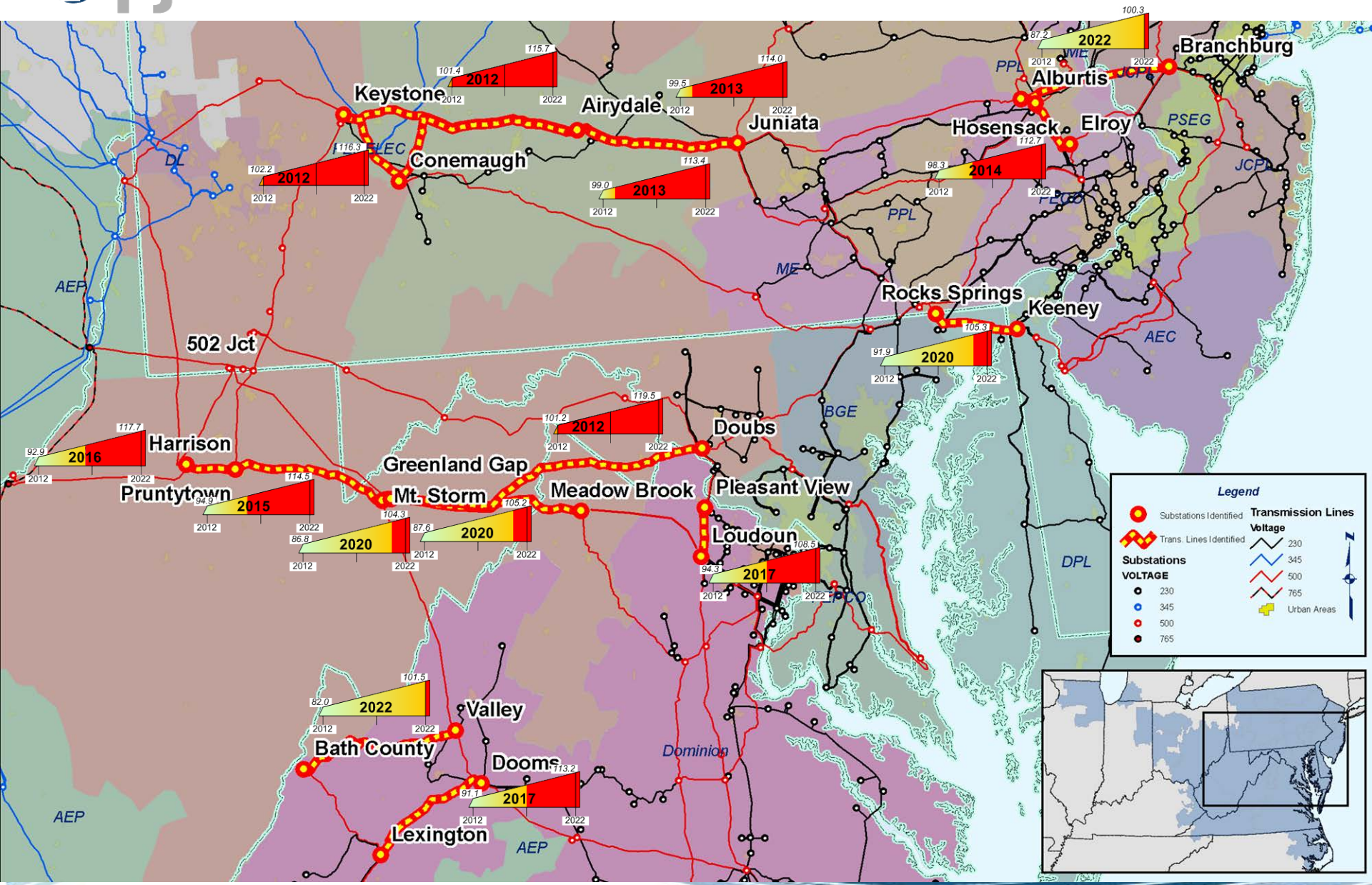
Dominion Transmission Zone

- Tower line outage & Dominion Criteria Violation
  - –Tower line outage – Morrisville to Marsh Run overloads 115 kV network in the area.
  - –Loudoun 500 / 230 kV transformer overloads for loss of the other transformer.
- Solution
  - –Convert the Remington – Sowego 115 kV line to 230 kV
  - –Add a new 230 kV line from Sowego – Gainsville
  - –Add a Sowego 230 / 115 kV transformer
  - –Estimated cost $30 million



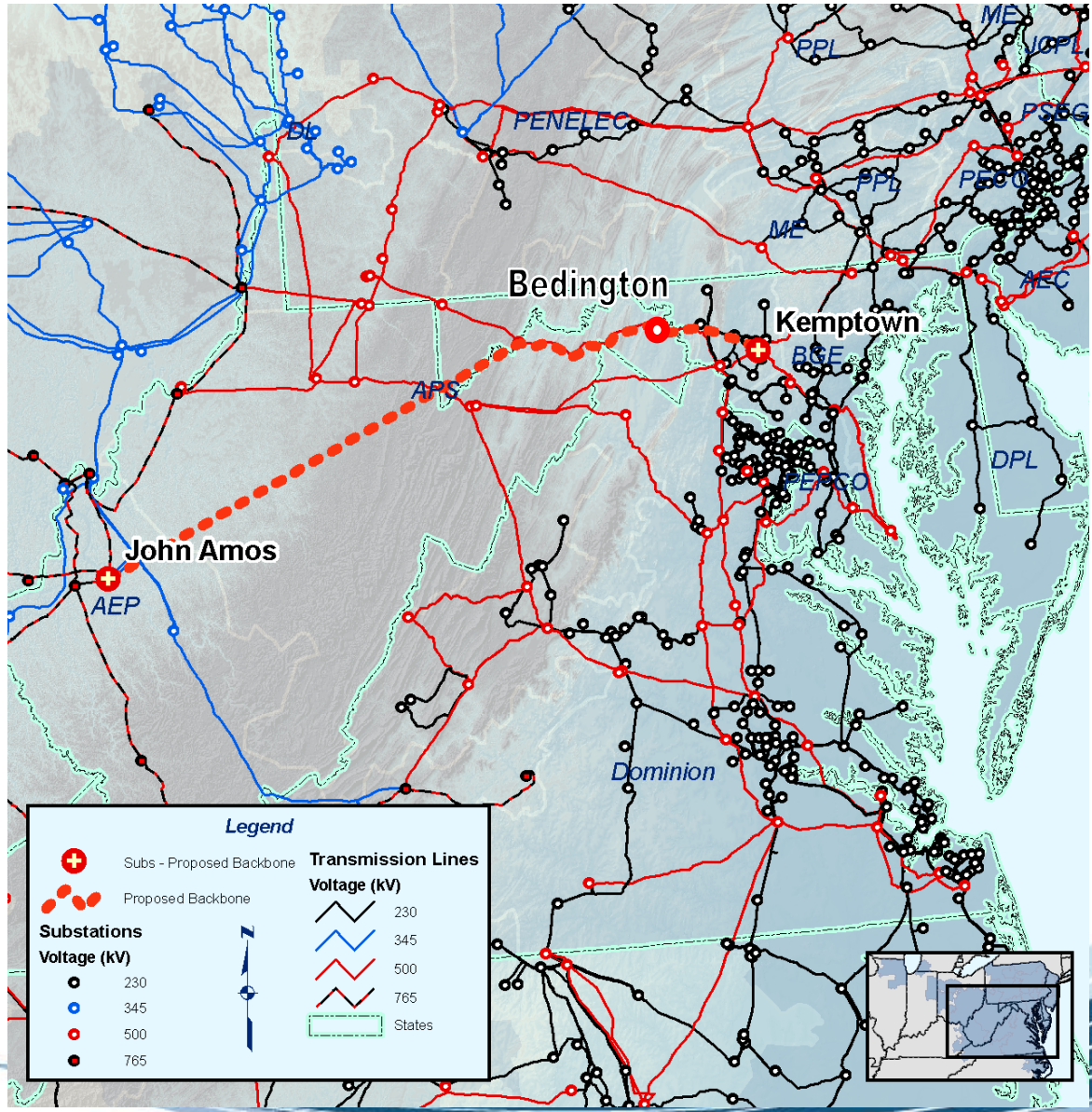
Backbone Upgrades

500 kV Overloads



Allegheny Mountain Corridor

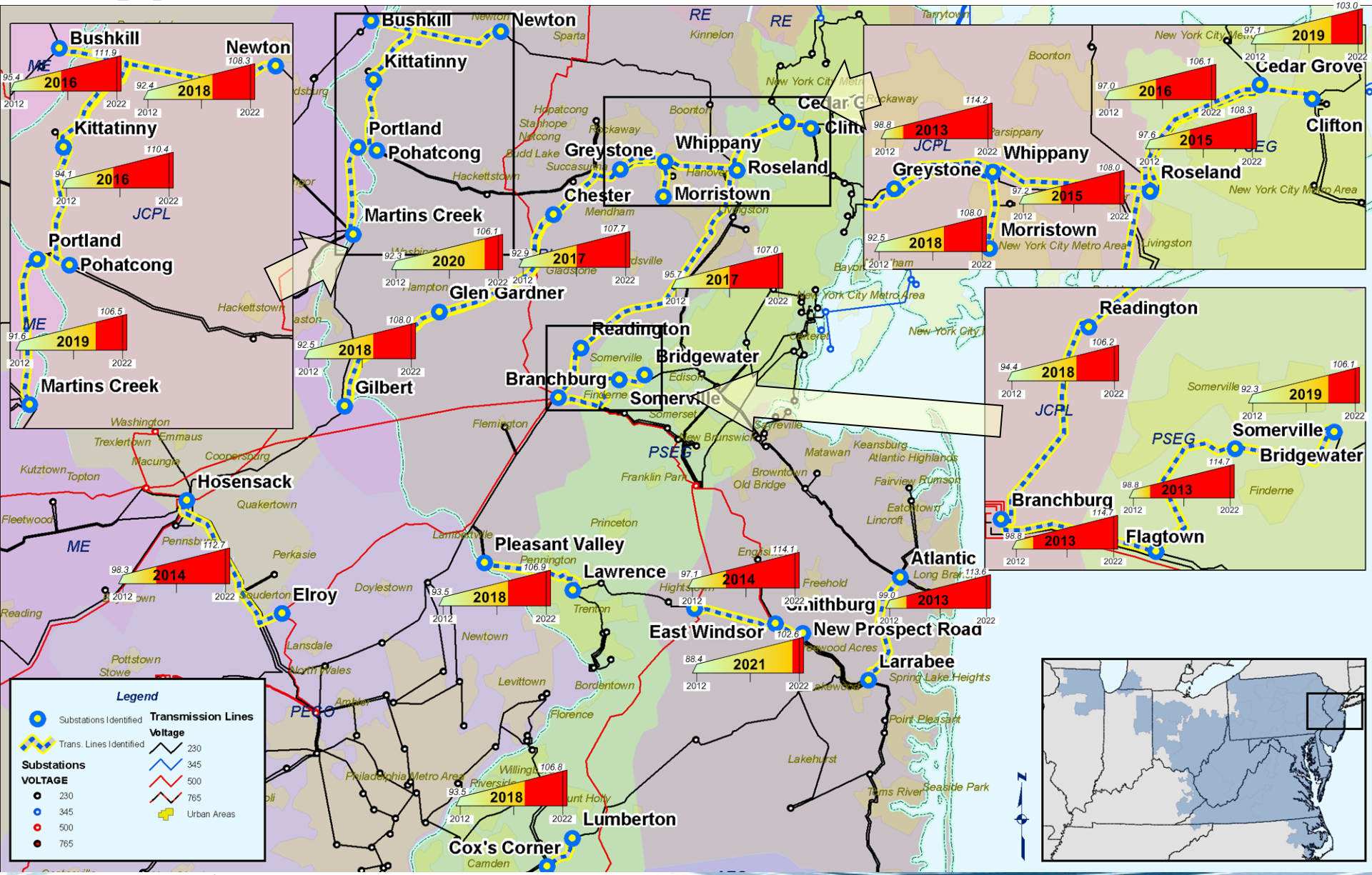
- Build a new 765 kV transmission line from the John Amos substation to Bedington substation and extend a twin circuit 500 kV line to a new substation in Kemptown near the Doubs-Brighton and Brighton-Conastone 500 kV lines.
- 15 year analysis shows that this alternative has the greatest impact on the overloads shown on the previous page.
- This line also reduces the flow on the Kammer 765 kV which was heavily overload for Mid-Atlantic load deliverability.
- Expected in service: 6/1/12
- Approximate cost: $ 1.8 Billion



500 kV Backbone Overload Reduction

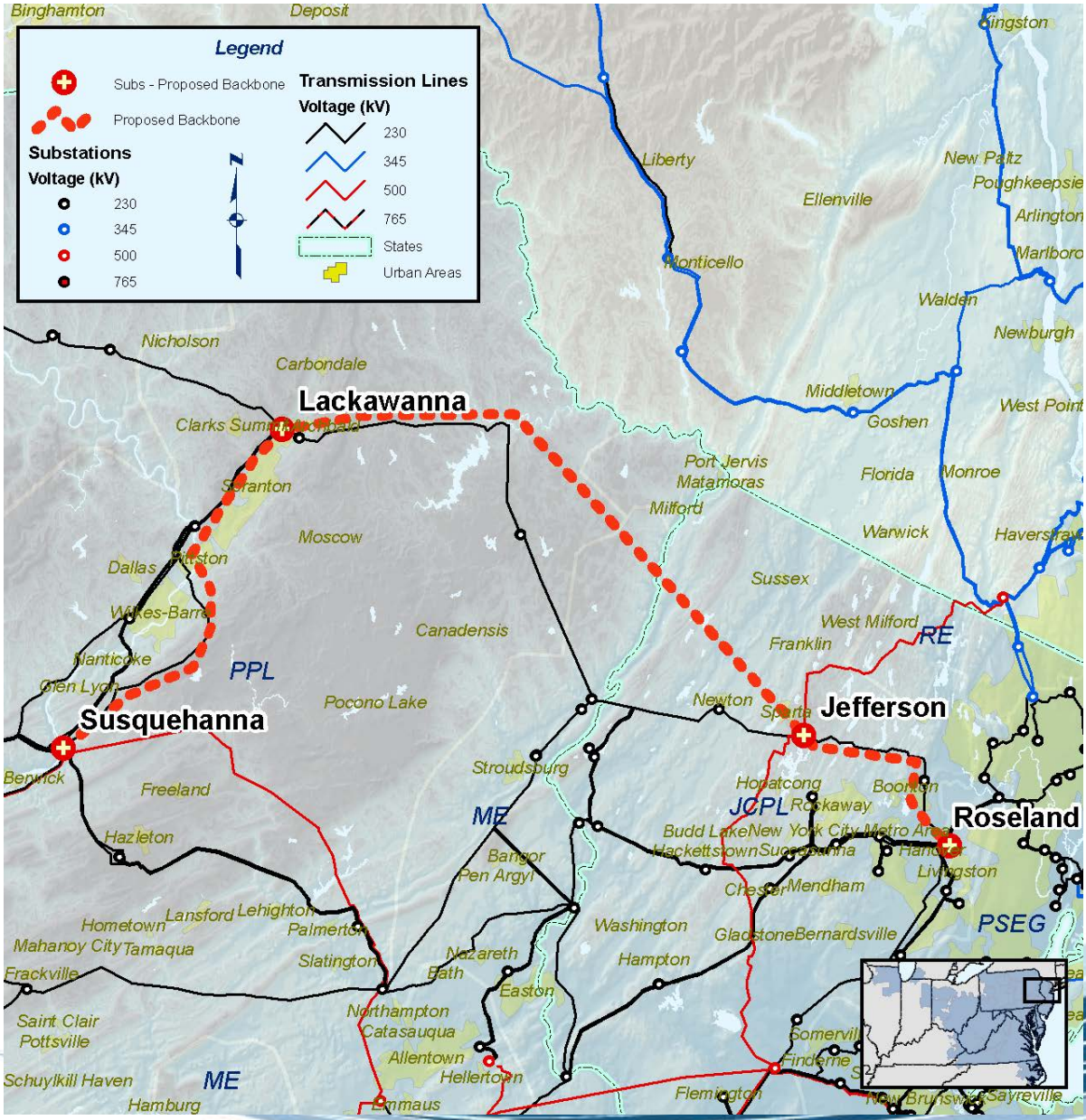
Overloaded Facility	Base Case	Amos - Bedington 765kV - Kemptown 500kV
Keystone - Airydale 500 kV	2012	> 2022
Keystone - Conemaugh 500 kV	2012	> 2022
Mt. Storm - Doubs 500 kV	2012	2022
Airydale - Juniata 500 kV	2013	2021
Airydale - Juniata 500 kV	2013	2021
Pruntytown - Mt. Storm 500 kV	2015	> 2022
Harrison - Pruntytown 500 kV	2016	> 2022
Lexington - Dooms 500 kV	2017	> 2022
Loudon - Pleasant View 500 kV	2017	> 2022
Greenland Gap - Meadowbrook 500 kV	2020	> 2022
Mt. Storm - Greenland Gap 500 kV	2020	> 2022
Hosensack - Elroy 500 kV	2021	> 2022
Bath County - Valley 500 kV	2022	> 2022

NNJ Overloads



Northern New Jersey Overloads

- Build a new 500 kV transmission line from Susquehanna – Lackawanna – Jefferson – Roseland.
- Solution resolves most of the overloads shown on the previous page.
- Terminal equipment limitations still need to be examined as conductor limits were used in the analysis.
- Expected in service: 6/1/12
- Approximate cost: $350M



Northern New Jersey Overload Reduction

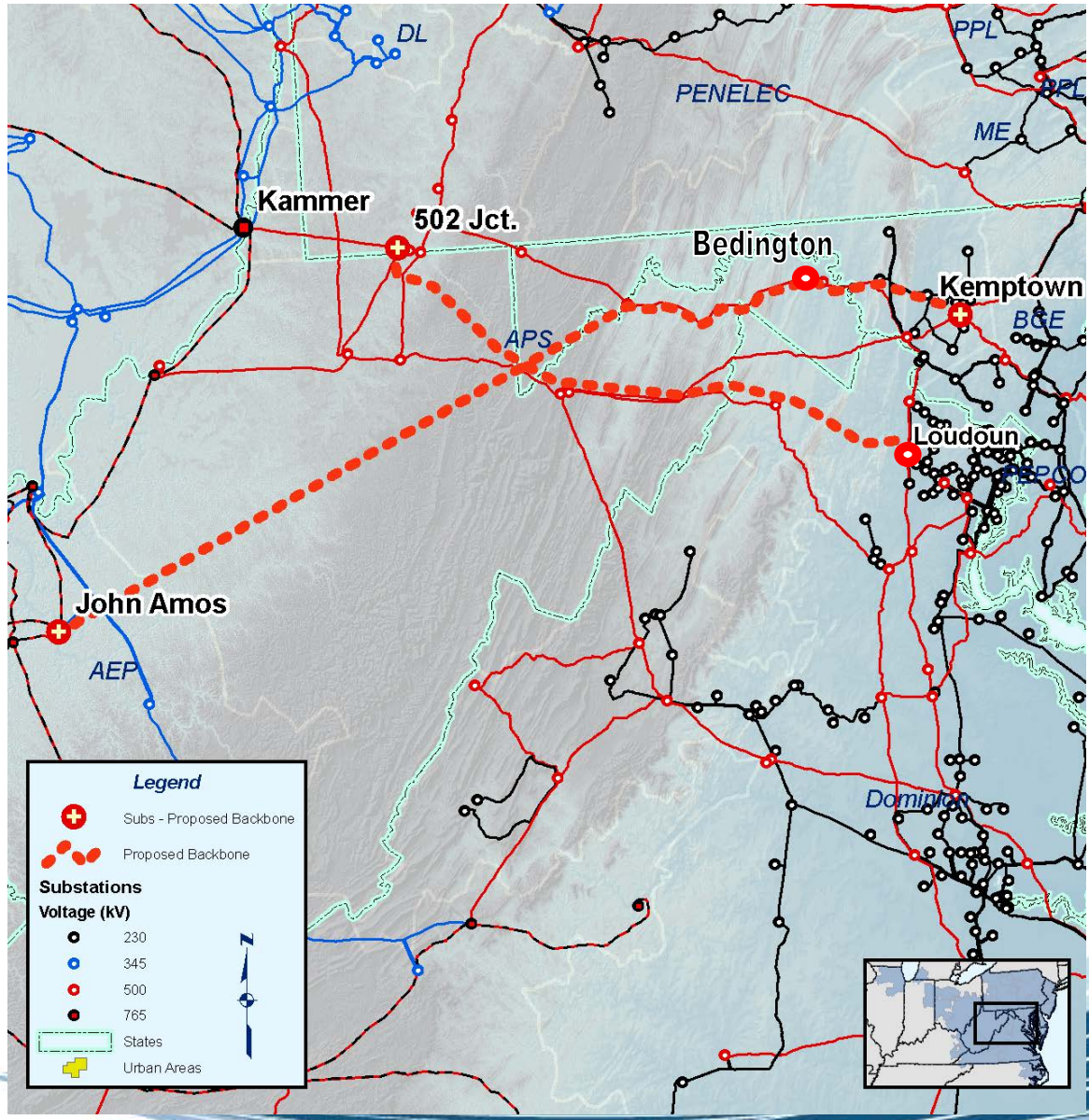
Overloaded Facility	Base Case	Susquehanna - Roseland 500kV
Greystone – Whippany 230 kV	2013	> 2022
Larrabee – Atlantic 230 kV	2013	> 2022
Branchburg – Flagtown 230 kV	2013	> 2022
Flagtown – Somerville 230 kV	2013	> 2022
East Windsor – Smithburg 230 kV	2014	2018
Hosensack – Elroy 500 kV	2014	> 2022
Cedar Grove F – Roseland 230 kV	2015	2016
Whippany – Roseland 230 kV	2015	> 2022
Kittatinny – Pohatcong 230 kV	2016	> 2022
Bushkill – Kittatinny 230 kV	2016	> 2022
Roseland – Cedar Grove B 230 kV	2016	2017

Northern New Jersey Overload Reduction

Overloaded Facility	Base Case	Susquehanna - Roseland 500kV
Gilbert – Morristown 230 kV	2017	> 2022
Readington – Roseland 230 kV	2017	> 2022
Pleasant Valley – Lawrence 230 kV	2018	2022
Cox's Corner – Lumberton 230 kV	2018	2022
Kittatinny – Newton 230 kV	2018	> 2022
Gilbert – Glenn Gardner 230 kV	2018	> 2022
Branchburg – Readington 230 kV	2018	> 2022
Portland – Martins Creek 230 kV	2019	> 2022
Somerville – Bridgewater 230 kV	2019	> 2022
Cedar Grove F – Clifton K 230 kV	2019	2018
Glen Gardner – Chester 230 kV	2020	> 2022
Smithburg – New Prospect 230 kV	2020	> 2022
Alburtis - Branchburg 500 kV	2022	> 2022
West Wharton - Greystone J 230 kV	>2022	2021

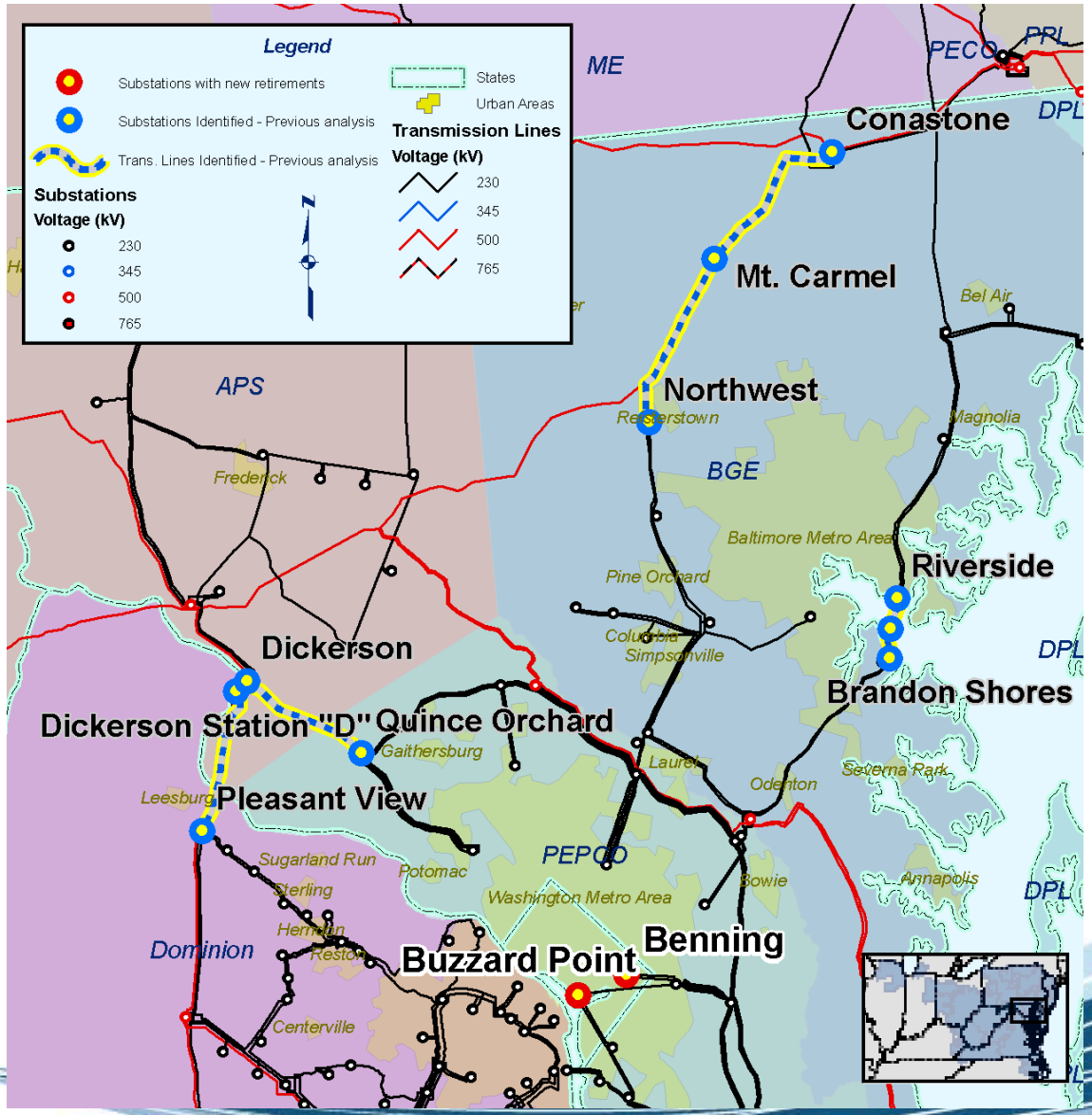
Kammer Transformer

- One phase of the Kammer 765 / 500 kV transformer failed earlier this spring and was replaced with the spare.
- There is currently no spare available.
- RTEP analysis shows this transformer is overloaded in 2012 for the Mid-Atlantic load deliverability test.
- Loading on the transformer is reduced with the addition of the Amos – Bedington – Kemptown circuit.
- Upgrading this transformer will be required if delays are experienced in construction of the new line.
- Given these issues, analysis to evaluate purchasing a new larger transformer is underway.



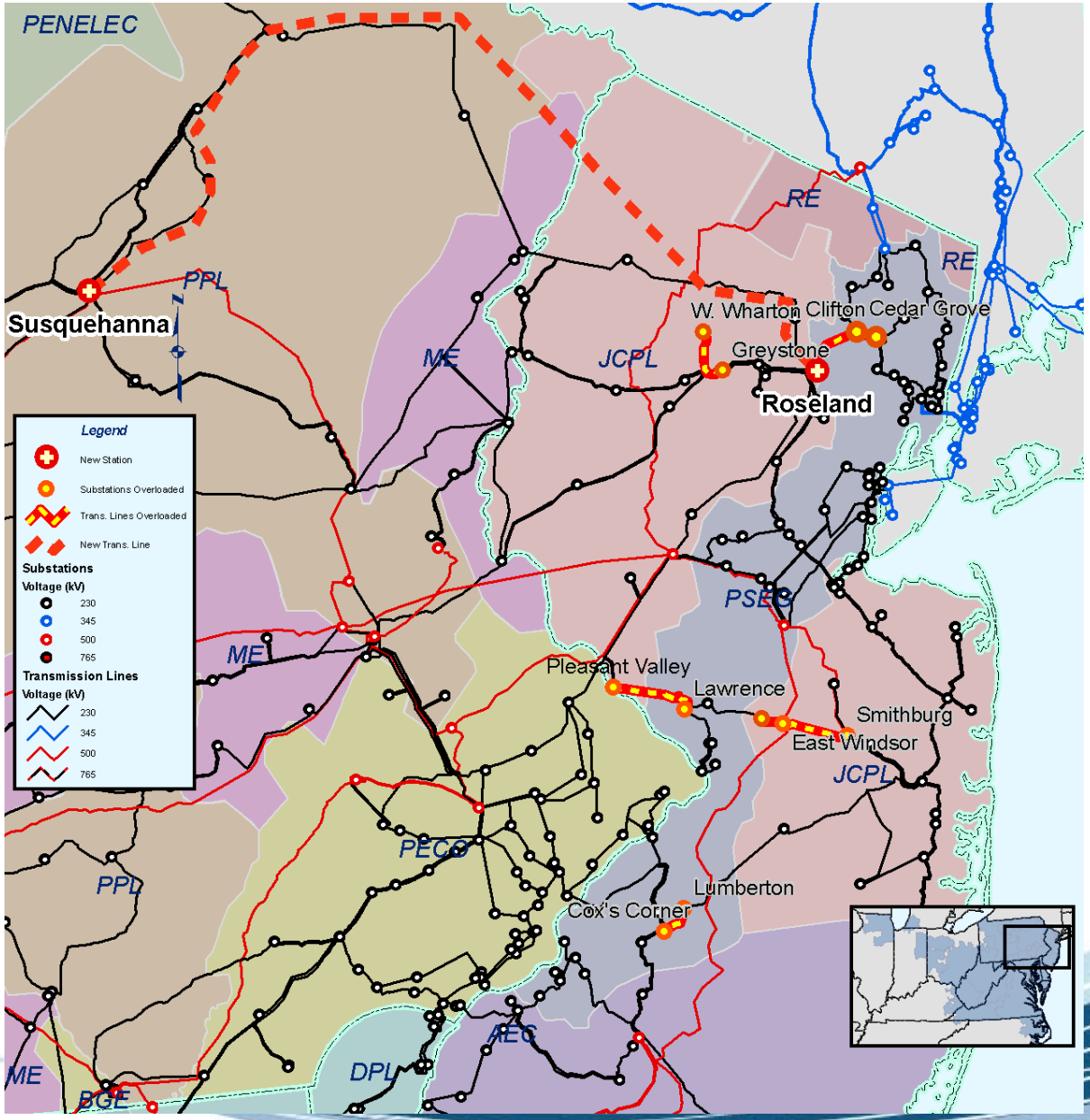
Reliability Issues – Washington D.C.

- Since the 2007 RTEP base case was developed, Benning Road and Buzzard Point generating stations have announced their intent to retire (approximately 800 MW total).
- These retirements will require transmission enhancements to address thermal and reactive issues.
- Evaluating a number of upgrades that will be required to reinforce the area.
- Evaluating backbone alternatives along with previously identified solutions.
- Analysis of the various alternatives will continue into this summer.
- These additional enhancements will be presented at a future TEAC.



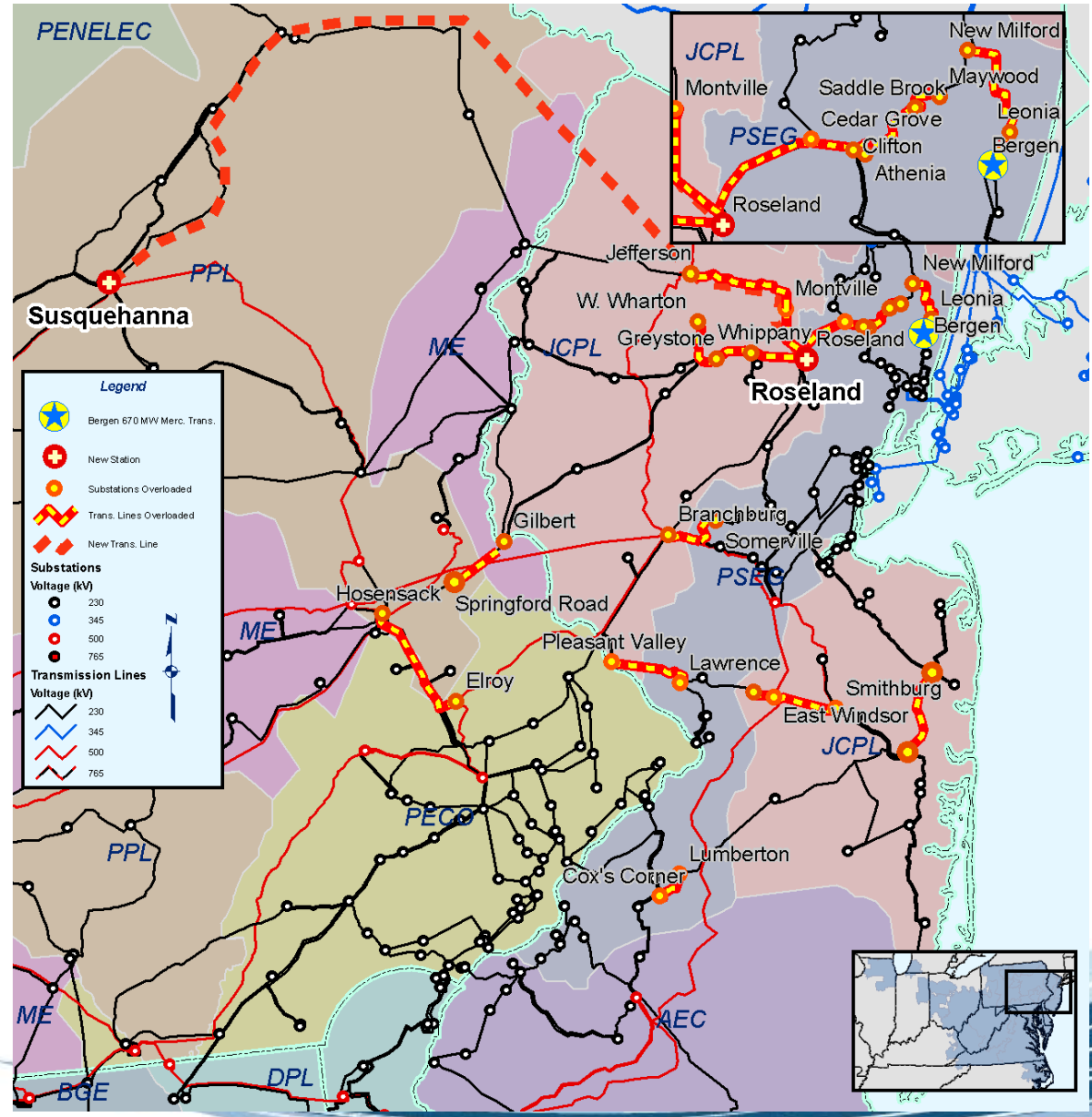
NNJ 15 Year Overloads - Sensitivies

- With Susquehanna – Lackawanna – Jefferson Roseland 500 kV circuit all NNJ overloads are resolved through 2015



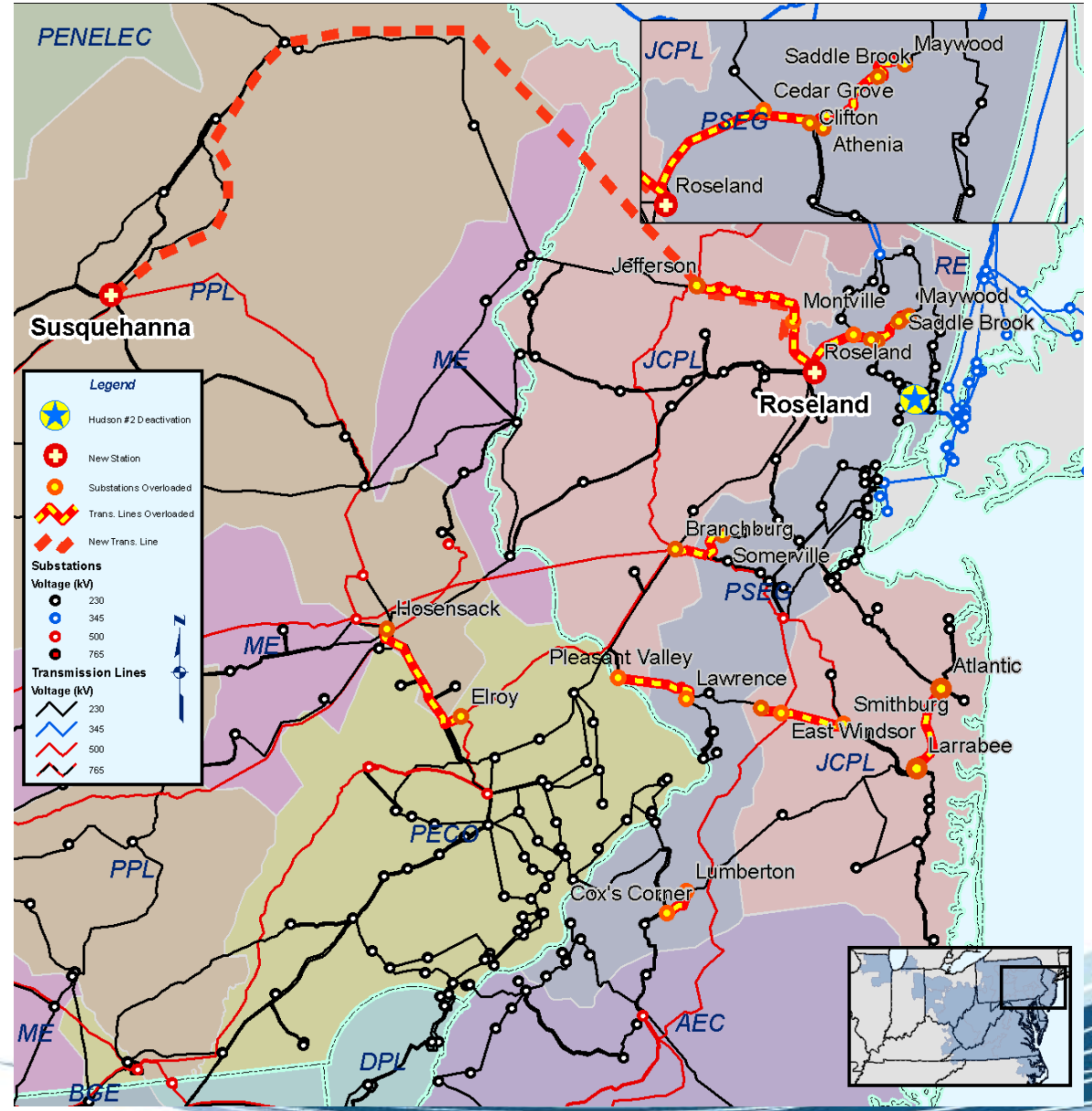
NNJ 15 Year Overloads - Sensitivies

- PJM performed sensitivity analyses to determine what additional overloads may be expected.
- The diagram shows additional overloads that result from a large withdrawal of power at Bergen 230 kV
- Over half of the 23 overloads identified occur prior to 2015



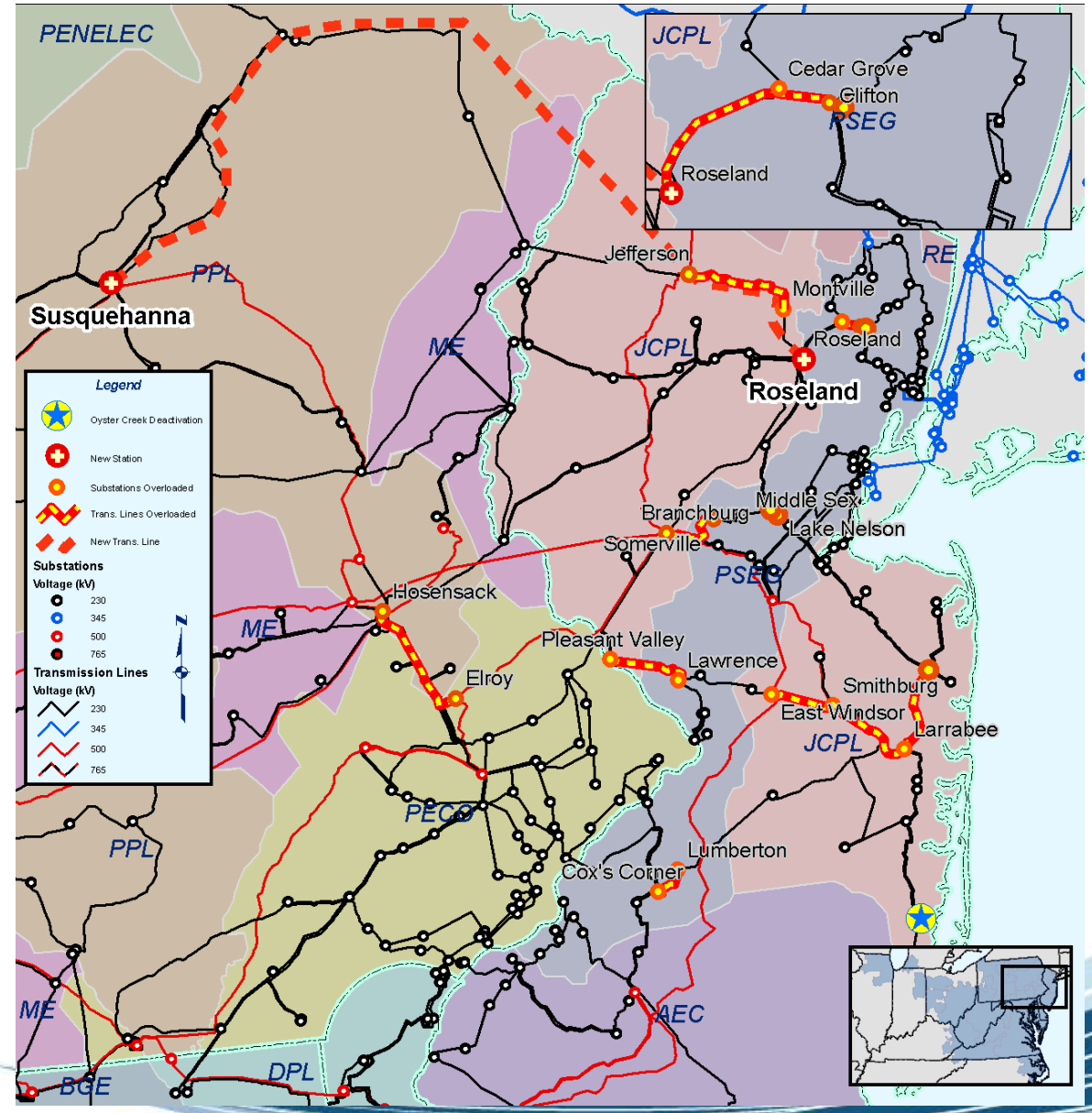
NNJ 15 Year Overloads - Sensitivies

- The diagram shows additional overloads that result from the deactivation of the Hudson #2 unit
- Over half of the 18 overloads identified occur prior to 2015

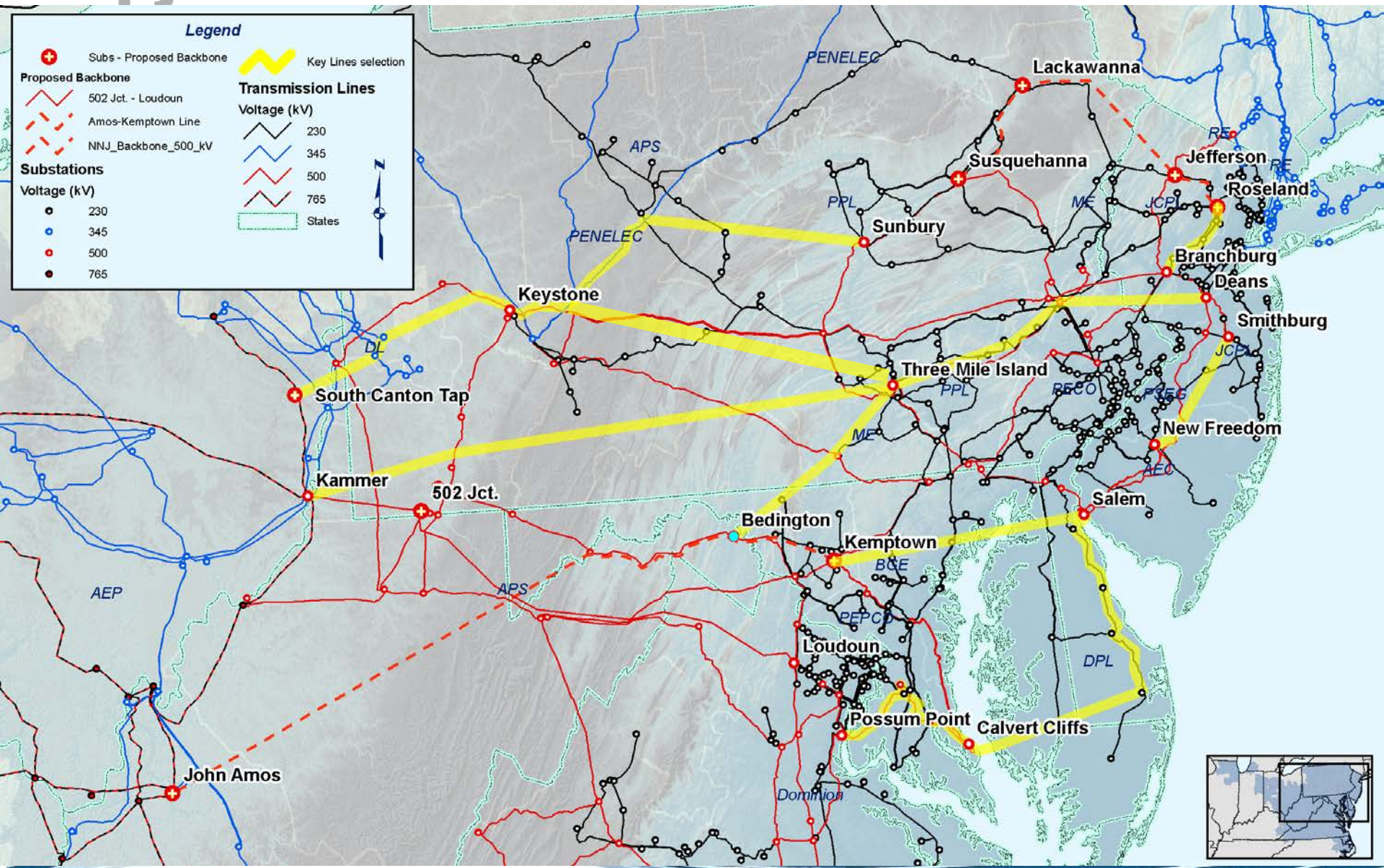


NNJ 15 Year Overloads - Sensitivies

- The diagram shows additional overloads that result from the deactivation of the Oyster Creek unit
- Over one fourth of the 16 overloads identified occur prior to 2015

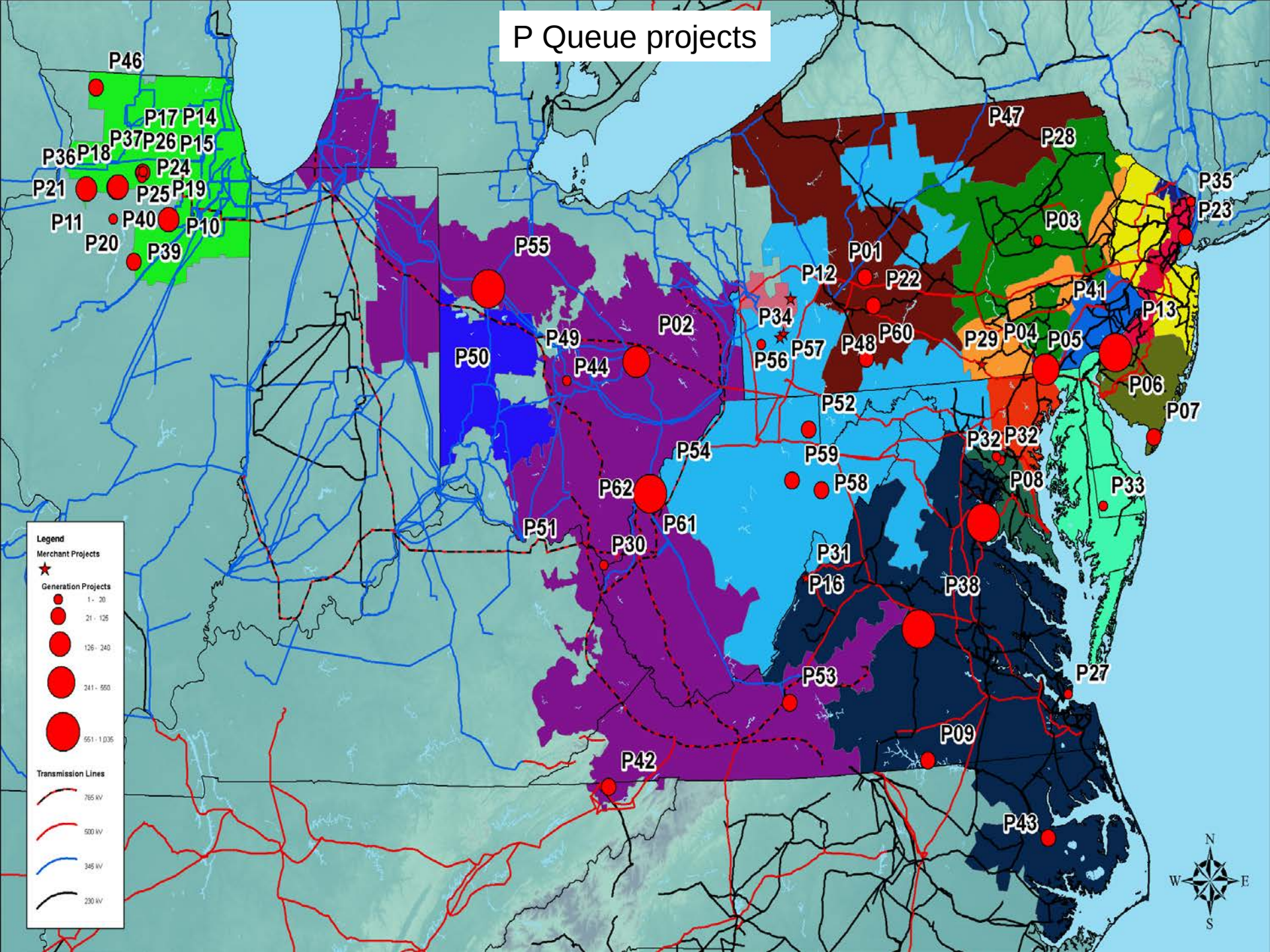


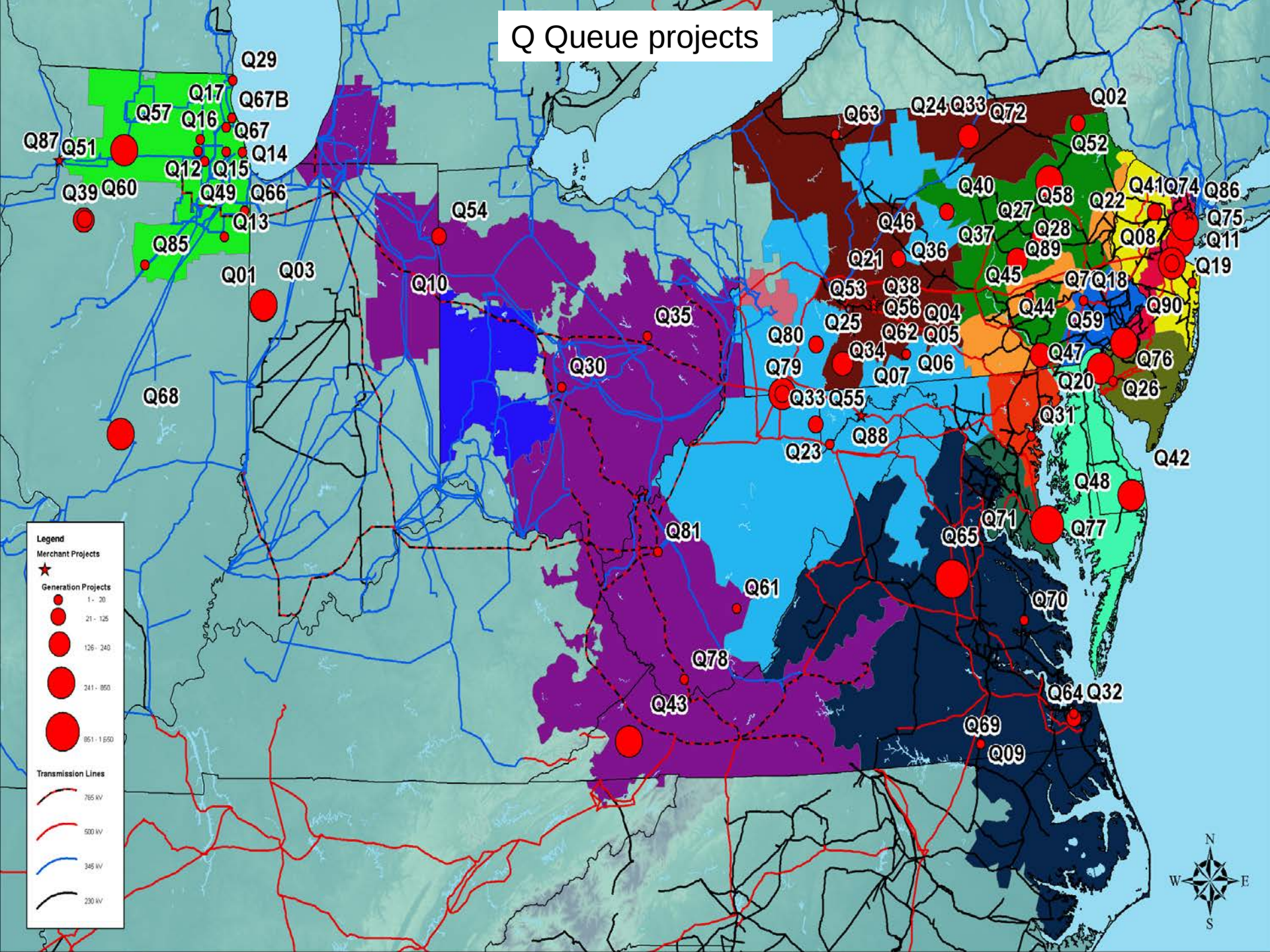
Alternative Backbone Solutions Under Consideration

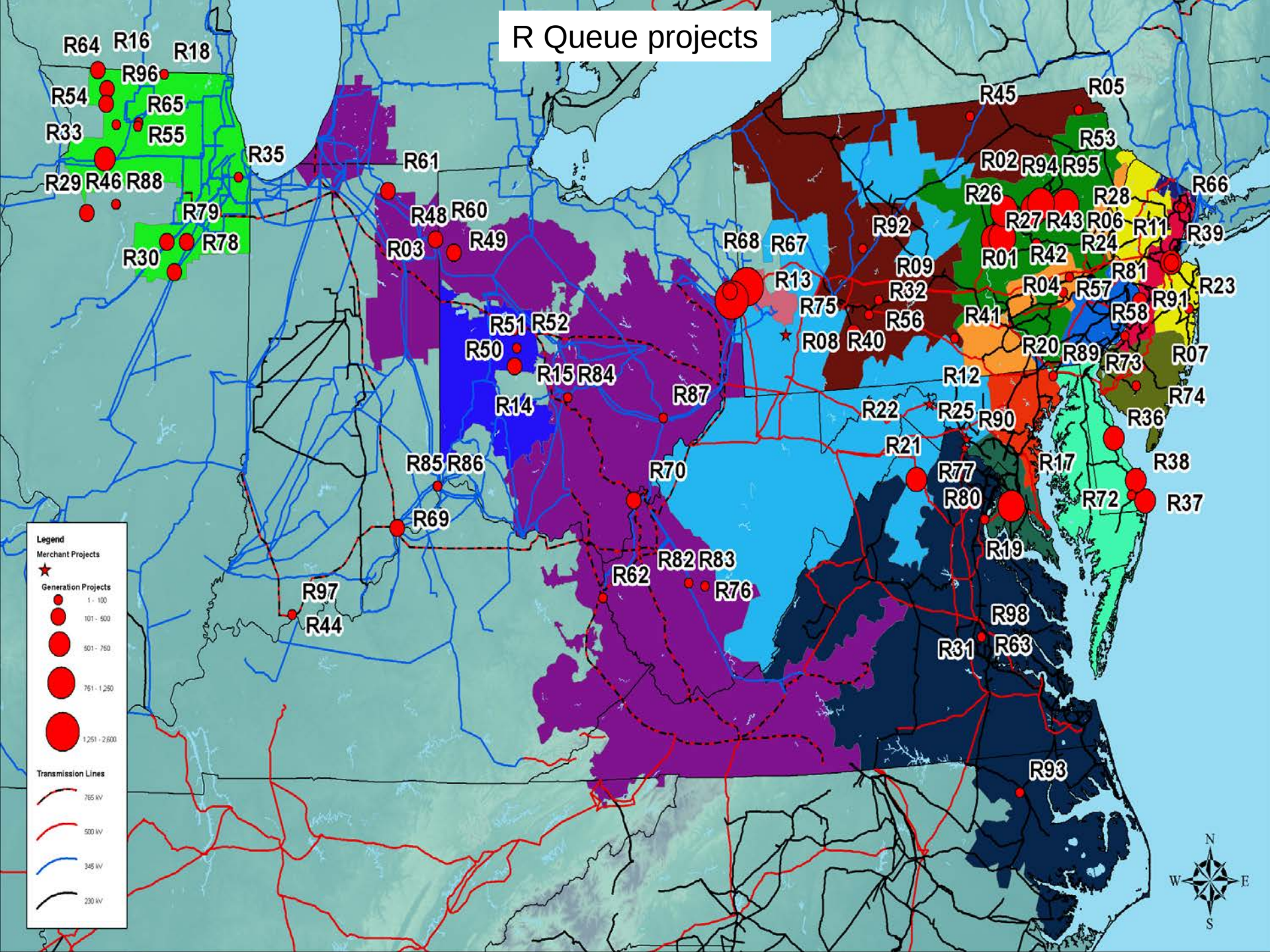


- Develop cost estimates for remaining upgrades
- Complete the reliability analysis for Southwest Mid-Atlantic area including the impact of Benning Road and Buzzard Point generation
- Develop recommendation for Kammer 765/500 kV transformer
- Continue to analyze New Jersey issues
- Reactive Analysis
- Sensitivity Analysis

Interconnection Planning Impact Studies


P Queue projects
P46
P17 P14
P37 P26 P15
P36 P18
P24
P21
P25 P19
P11
P40
P10
P20
P39
P55
P50
P49
P44
P02
P62
P54
P51
P61
P30
P42
P12
P01
P22
P34
P57
P56
P48
P60
P47
P28
P03
P35
P23
P41
P13
P29
P04
P05
P06
P07
P52
P59
P58
P32
P32
P08
P33
P31
P16
P38
P53
P27
P09
P43
Legend
Merchant Projects
Generation Projects
1 - 20
21 - 125
126 - 240
241 - 550
551 - 1,035
Transmission Lines
765 kV
500 kV
345 kV
230 kV
N
W
E
S


Q Queue projects
Q29
Q17
Q67B
Q57
Q16
Q67
Q87
Q51
Q14
Q12
Q15
Q39
Q60
Q49
Q66
Q13
Q85
Q01
Q03
Q68
Q54
Q10
Q35
Q30
Q81
Q61
Q78
Q43
Q63
Q24
Q33
Q72
Q02
Q52
Q40
Q58
Q22
Q41
Q74
Q86
Q27
Q75
Q46
Q37
Q28
Q08
Q11
Q36
Q89
Q21
Q45
Q19
Q53
Q38
Q7
Q18
Q56
Q04
Q44
Q90
Q25
Q62
Q05
Q59
Q80
Q34
Q47
Q76
Q79
Q07
Q06
Q20
Q26
Q33
Q55
Q31
Q88
Q23
Q42
Q48
Q71
Q77
Q65
Q70
Q64
Q32
Q69
Q09
Legend
Merchant Projects
Generation Projects
1 - 20
21 - 125
126 - 240
241 - 850
851 - 1,650
Transmission Lines
765 kV
500 kV
345 kV
230 kV
N
W
E
S


R Queue projects
R64
R16
R18
R96
R54
R65
R33
R55
R35
R29
R46
R88
R79
R78
R30
R61
R48
R60
R03
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R70
R82
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R92
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R75
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R02
R94
R95
R26
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R06
R11
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R01
R42
R24
R81
R04
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R91
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R73
R07
R12
R74
R22
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R90
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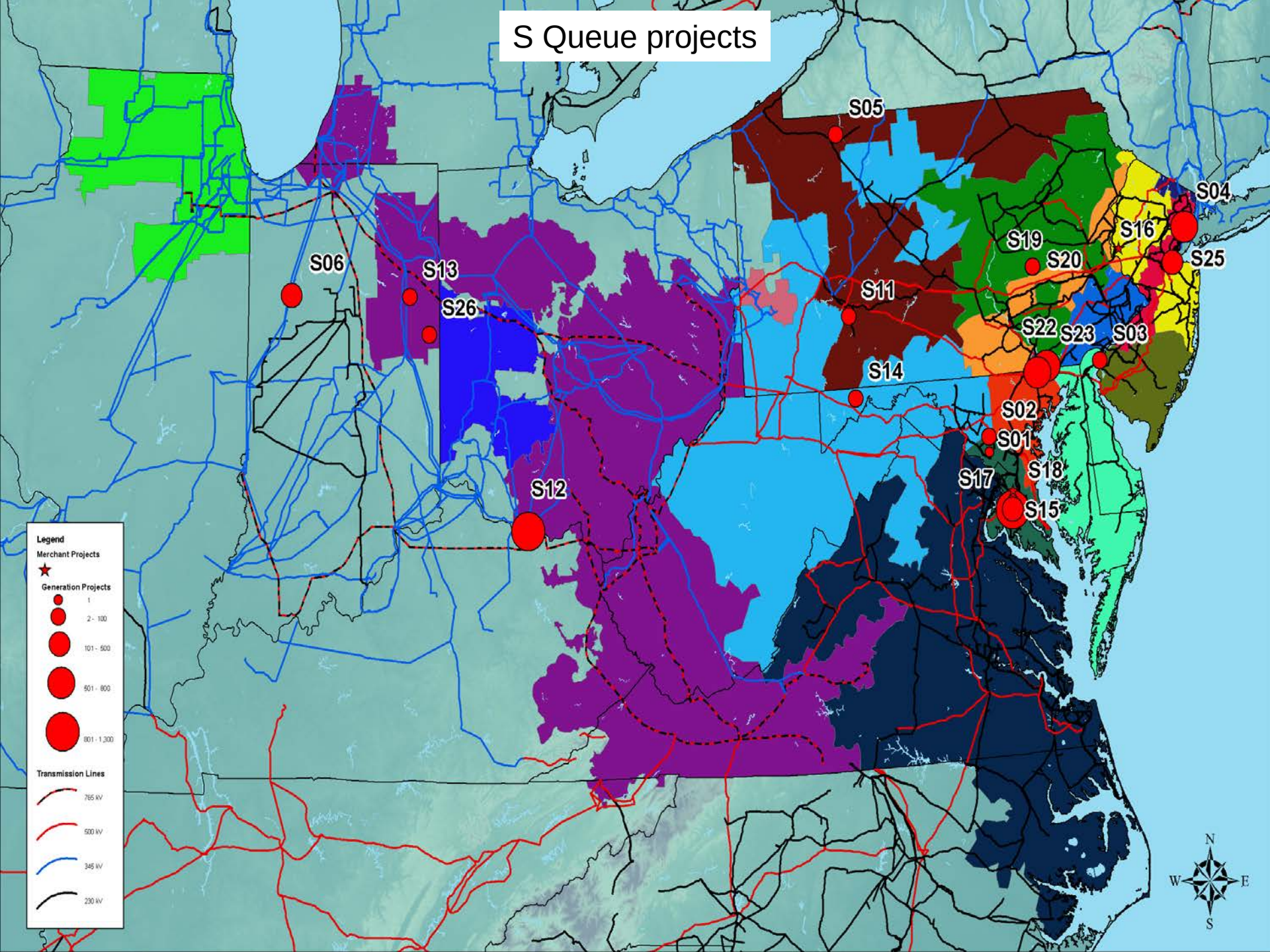
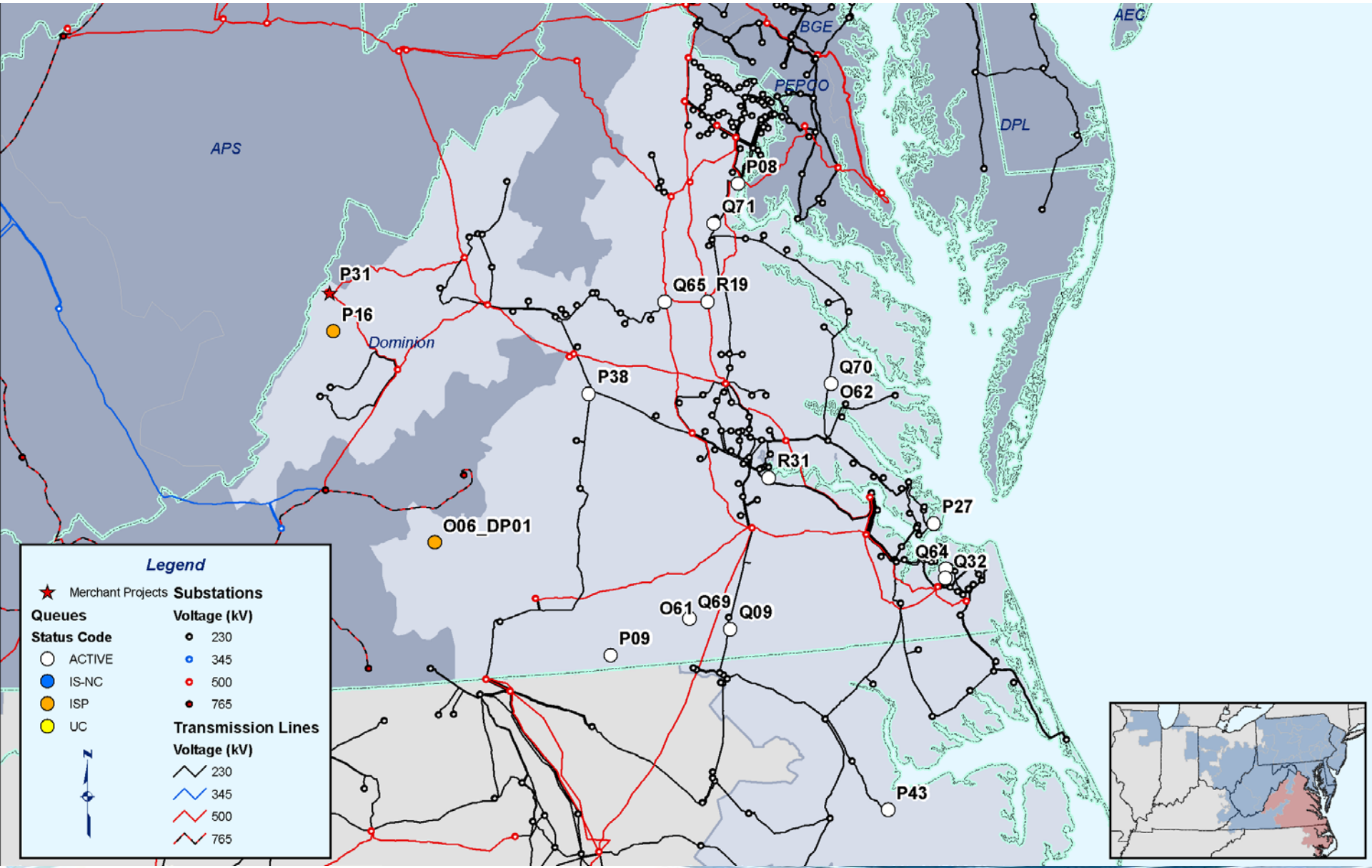
R21
R77
R17
R38
R80
R72
R37
R19
R98
R31
R63
R93
Legend
Merchant Projects
Generation Projects
1 - 100
101 - 500
501 - 750
751 - 1,250
1,251 - 2,600
Transmission Lines
765 kV
500 kV
345 kV
230 kV
N
W
E
S


S Queue projects
S05
S04
S16
S19
S20
S25
S06
S13
S26
S11
S22
S23
S03
S14
S02
S01
S18
S17
S15
S12
Legend
Merchant Projects
Generation Projects
1
2 - 100
101 - 500
501 - 800
801 - 1,200
Transmission Lines
765 kV
500 kV
345 kV
230 kV
N
W
E
S

Dominion Impact Studies Results

Dominion Interconnection Projects

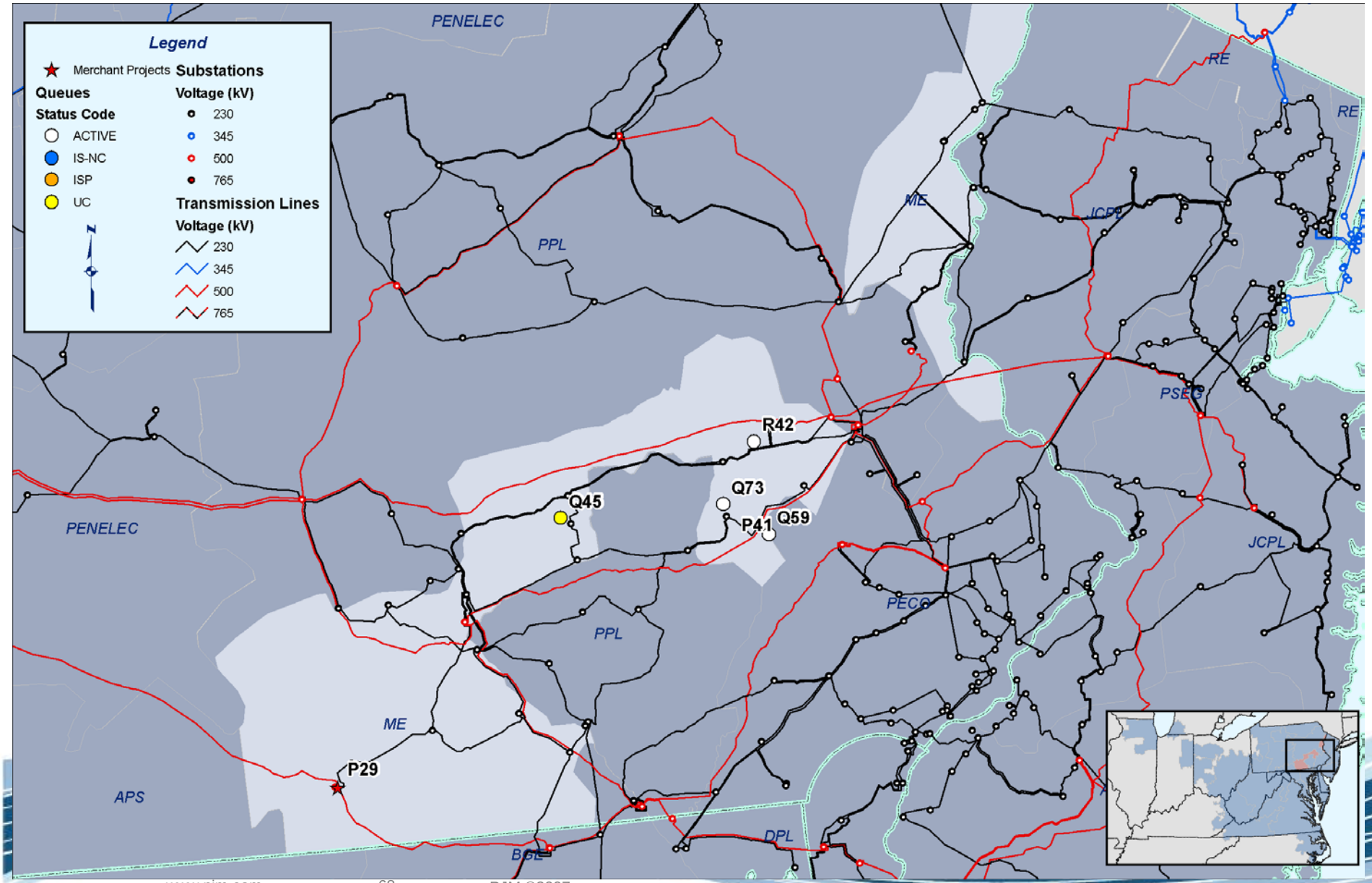


Dominion Interconnection Projects

Queue	MW	Fuel Type	Upgrade ID	Network Upgrade	Cost
P27	13	Methane	N0559	Reconductor 1.1 mi of overhead 3-ph 34.5kV distribution line from1/0 Al to 477 kcm Al. Replace 350 ft of 1/0 underground 1/0 Al with 1000 kcm Al conductor Replace line fuse device with 3-ph electronic line recloser. Install DTT and associated protective relay work at Winchester substation.	$387,720
Q09	2.5	Hydro	-	No Upgrades	$0
Q32	30	Biomass	-	No Upgrades	$0
Q69	12	Methane	N0560	Replace 3-ph hydraulic recloser with 3-ph electronic recloser with DTT capability. Install DTT and associated protective relay work at Shacklefords substation. Reconductor 0.38 mi of 3-ph circuit from #2 to 1/0 Al. Reconductor 0.9 mi of 3-ph circuit from #2 to 1/0 Al.	$550,000
Q70	11	Methane	N0561	Replace 3-ph hydraulic recloser with 3-ph electronic recloser with DTT capability. Replace 3-ph fuses with 3-ph recloser Install DTT and associated protective relay work at Lawrenceville substation. Reconductor 1.1 mi of 3-ph 34.5kV distribution line from#4 to 1/0 Al.	$490,000
Q71	2	Methane	N0562	Removal of two 1-ph step-down transformers Replace two 1-ph recloser arrangements with 3-ph reclosers with DTT capability Convert 2 mi of 2-ph four wire distribution circuit to 3-ph four wire 34.5kV. Install three step-down transformers. Replace 25 line transformers. Install DTT at Cranes Corner substation. Three phase 2000 feet of existing single phase line to POI.	$235,000

Met Ed Impact Studies Results

Met Ed Interconnection Projects



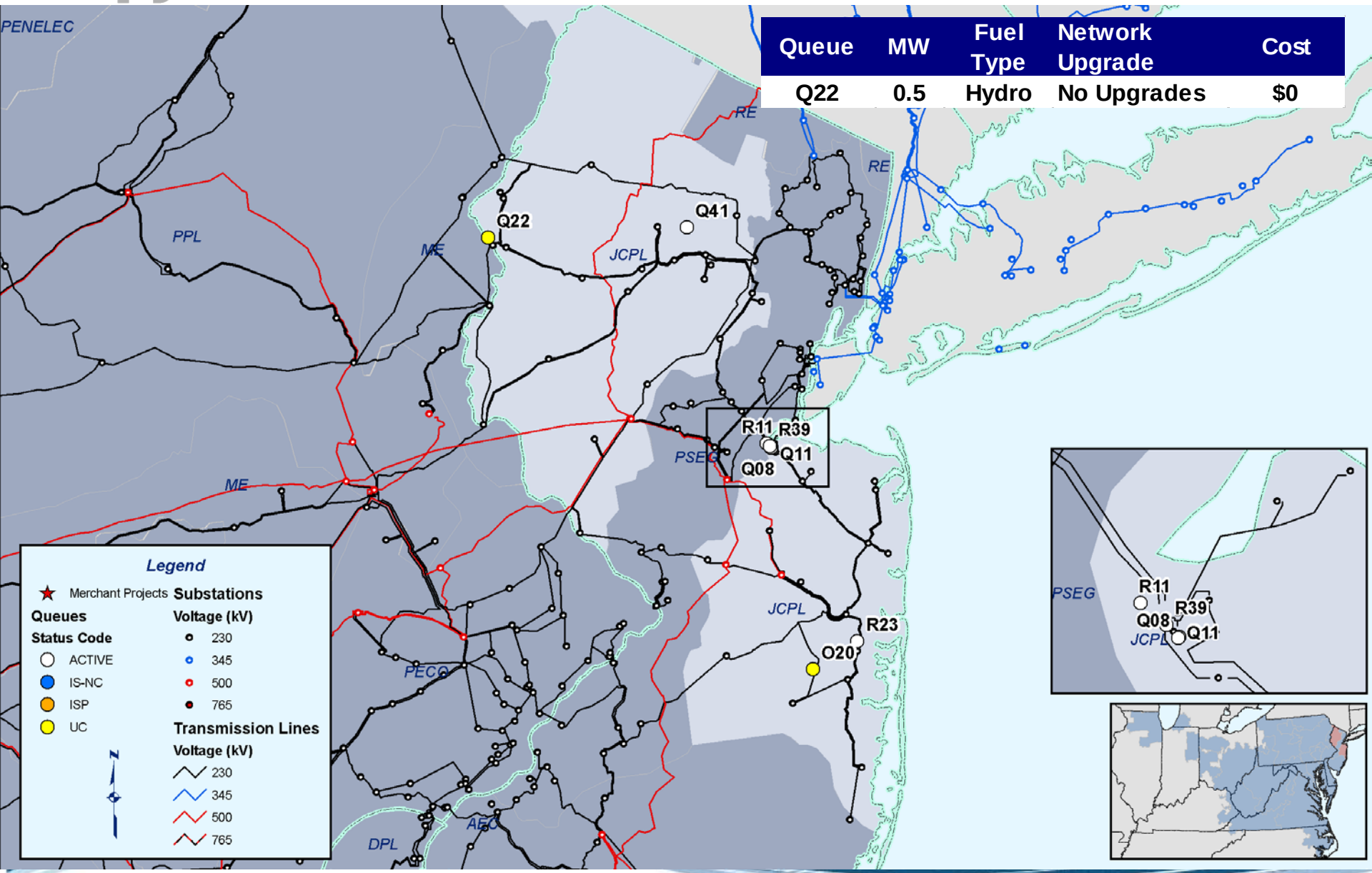
Met Ed Interconnection Projects

Queue	MW	Fuel Type	Upgrade ID	Network Upgrade	Cost
Q45	3.2	Methane	-	No Upgrades	$0
Q59	9	Biomass	n0452	South Reading Substation – Install DTT to Pioneer Crossing Substation	$65,000
			n0453	Birdsboro Substation – Install DTT to Pioneer Crossing Generation Substation	$65,000
			n0455	Replace relays on the Birdsboro terminal of the 817 69 kV line	$70,000
			n0456	69 kV Trans. Tap – Install 3-way SCADA controlled motor operated switches	$215,000

JCPL Impact Studies Results

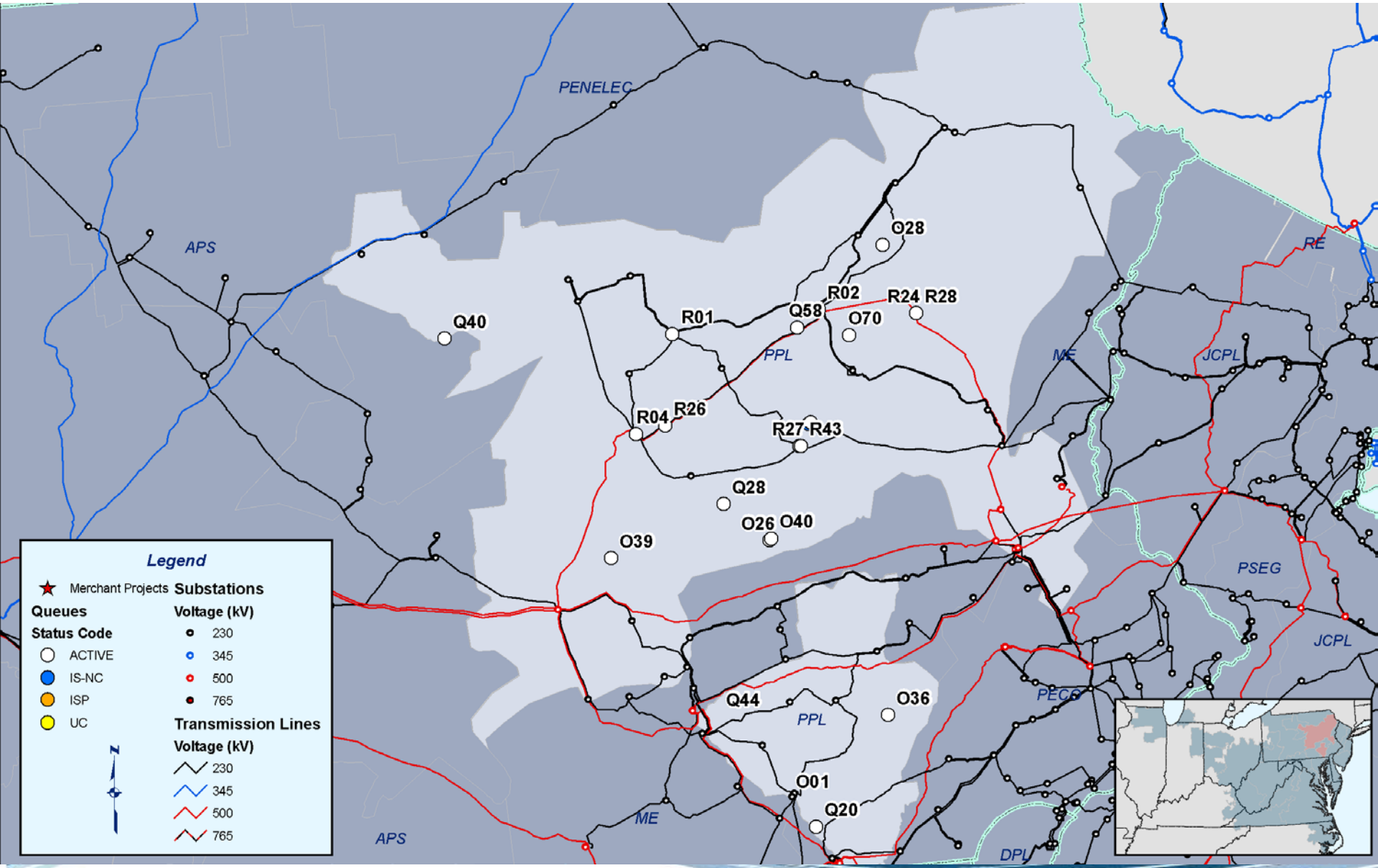
JCPL Interconnection Projects

Queue	MW	Fuel Type	Network Upgrade	Cost
Q22	0.5	Hydro	No Upgrades	$0



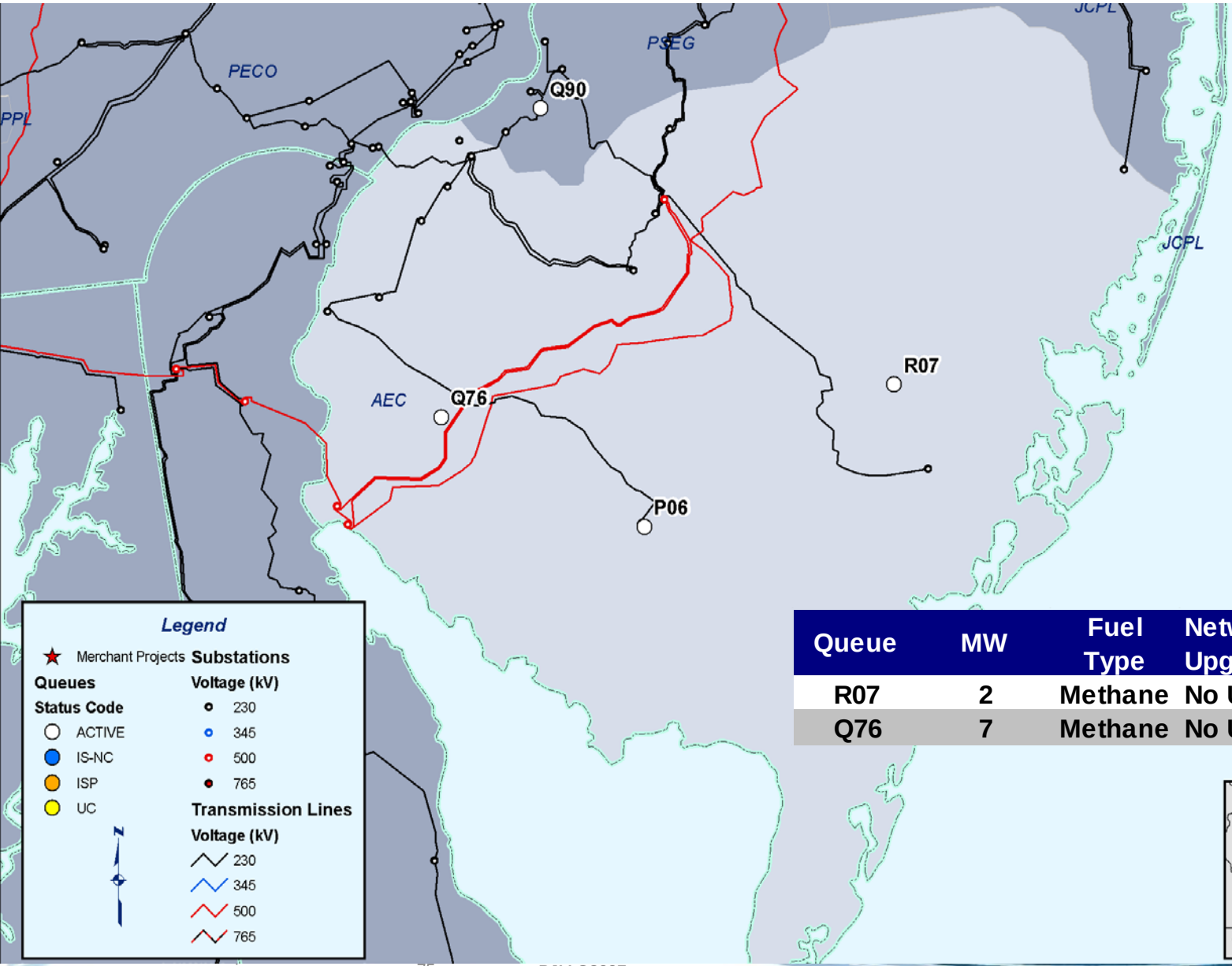
PPL Impact Studies Results

PPL Interconnection Projects

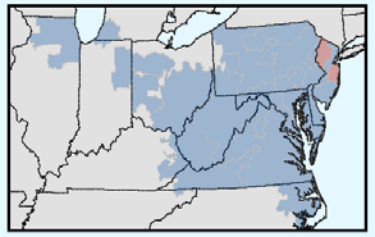


AEC Impact Studies Results

AEC Interconnection Projects

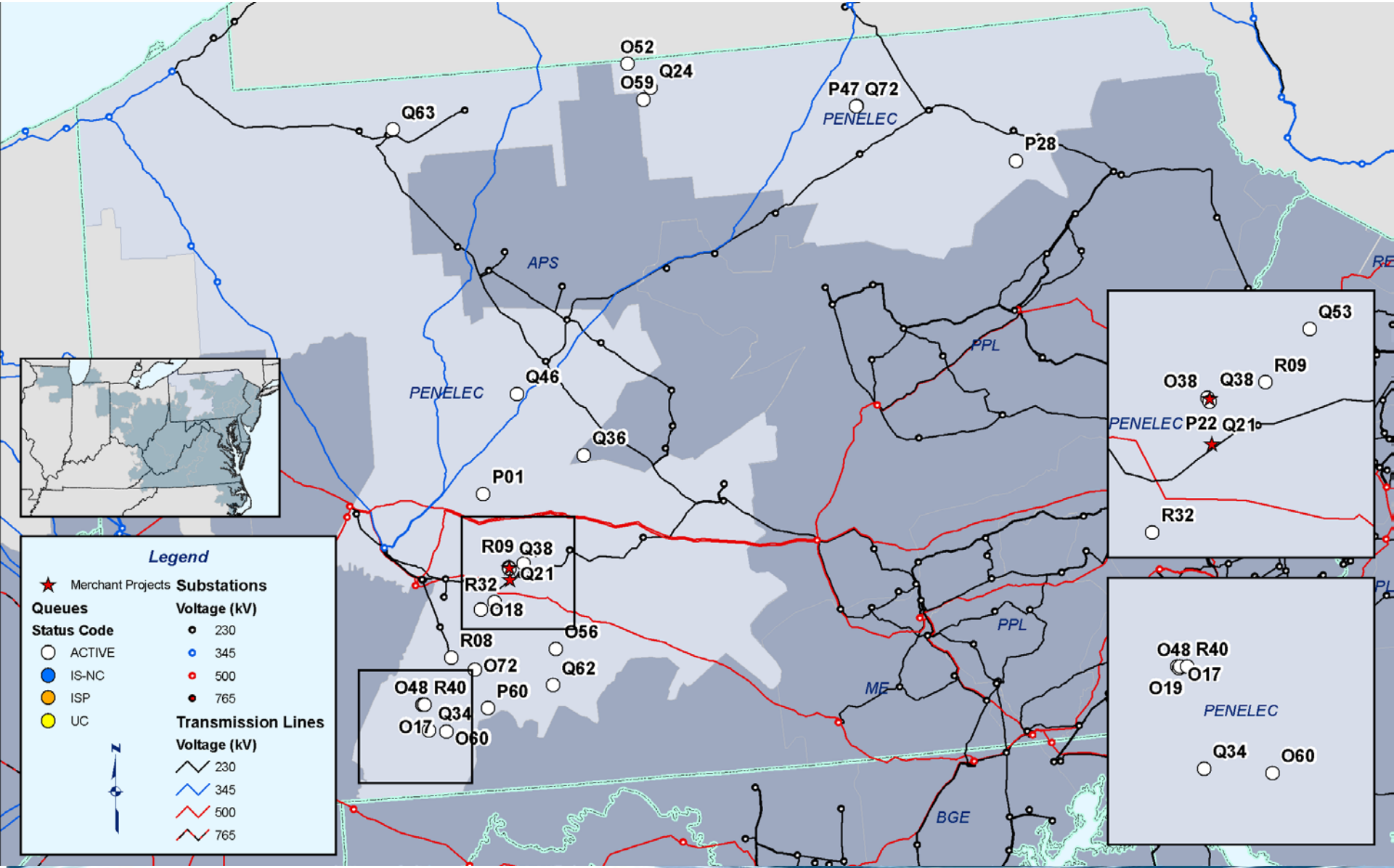


Queue	MW	Fuel Type	Network Upgrade	Cost
R07	2	Methane	No Upgrades	$0
Q76	7	Methane	No Upgrades	$0



Penelec Impact Studies Results

Penelec Interconnection Projects



Penelec Interconnection Projects

Queue	MW	Upgrade ID	Fuel Type	Network Upgrade	Cost (M)
O17	65	508	Wind	Support Queue O17 115kV interconnection switchyard	0.20
		509		Queue O17 115kV transmission tap (0.1 miles)	0.250
		510		Somerset 115kV substation upgrades for O17	0.310
		511		Allegheny 115kV substation upgrades for O17	0.310
O18	65	502	Wind	Support Queue O18 115kV interconnection switchyard	0.20
		503		Queue O18 115kV transmission tap (0.1 miles)	0.250
		504		Hilltop 115kV substation upgrades	0.20
		505		Rachel Hill 115kV substation upgrades	0.20
		506		Claysburg 115kV substation upgrades	0.310
		507		Hilltop to O18 to Rachel fiber optic installation (23 miles)	1.044
O19	33	512	Wind	Support Queue O19 115kV interconnection switchyard	0.200
		513		Queue O19 115kV transmission tap (0.1 miles)	0.250
		514		Somerset 115kV substation upgrades for O19	0.310
		515		Allegheny 115kV substation upgrades for O19	0.310
		516		Fiber optic between O19 and O17 interconnection switchyards	0.310
O38	50	517	Wind	Bear Rock substation upgrades	0.010

Penelec Interconnection Projects

Queue	MW	Upgrade ID	Fuel Type	Network Upgrade	Cost (M)
O48**	37.8	464*	Wind	Addition of fiber optic terminal equipment at Rockwood 115kV substation	0.035
		465*		Addition of fiber optic terminal equipment at Meyersdale North substation	0.035
		466*		Fiber optic line between Rockwood and Meyersdale North	0.700
R40**	37.8	518	Wind	Support Queue O48/R40 115kV interconnection switchyard and tap	0.450
		521		Arnold REC 115kV substation upgrades for O48/R40	0.005
		522		Berkley Flats WF 115kV substation upgrades for O48/R40	0.005
		523		Garrett Tap - Garret substation 115kV circuit	0.100
		525		Rockwood 115kV substation disconnect switch replacement	0.060
		526		Somerset 115kV substation disconnect switch replacement	0.060
O52	100	540	Wind	O52 115kV interconnection switchyard	0.200
		541		O52 115kV transmission tap (0.1 miles)	0.250
		542		Potter 115kV substation upgrades	0.005
		543		Niles Valley or N36 115kV substation upgrades	0.115
		545		Fiber Optic between Potter, O52, and Niles Valley	0.525
O56	125	535	Wind	O56 115kV interconnection switchyard	0.200
		536		O56 115kV transmission tap (0.1 miles)	0.250
		537		Claysburg 115kV substation upgrades	0.210
		538		Fiber Optic between Claysburg and O56 (12.54 miles)	1.200
		539		Altoona 230 kV line wave trap replacement	0.115

** note: projects O48 and R40 are combined

* note: upgrades 464, 465 and 466 are shared 50/50 by projects L13 and O48/R40

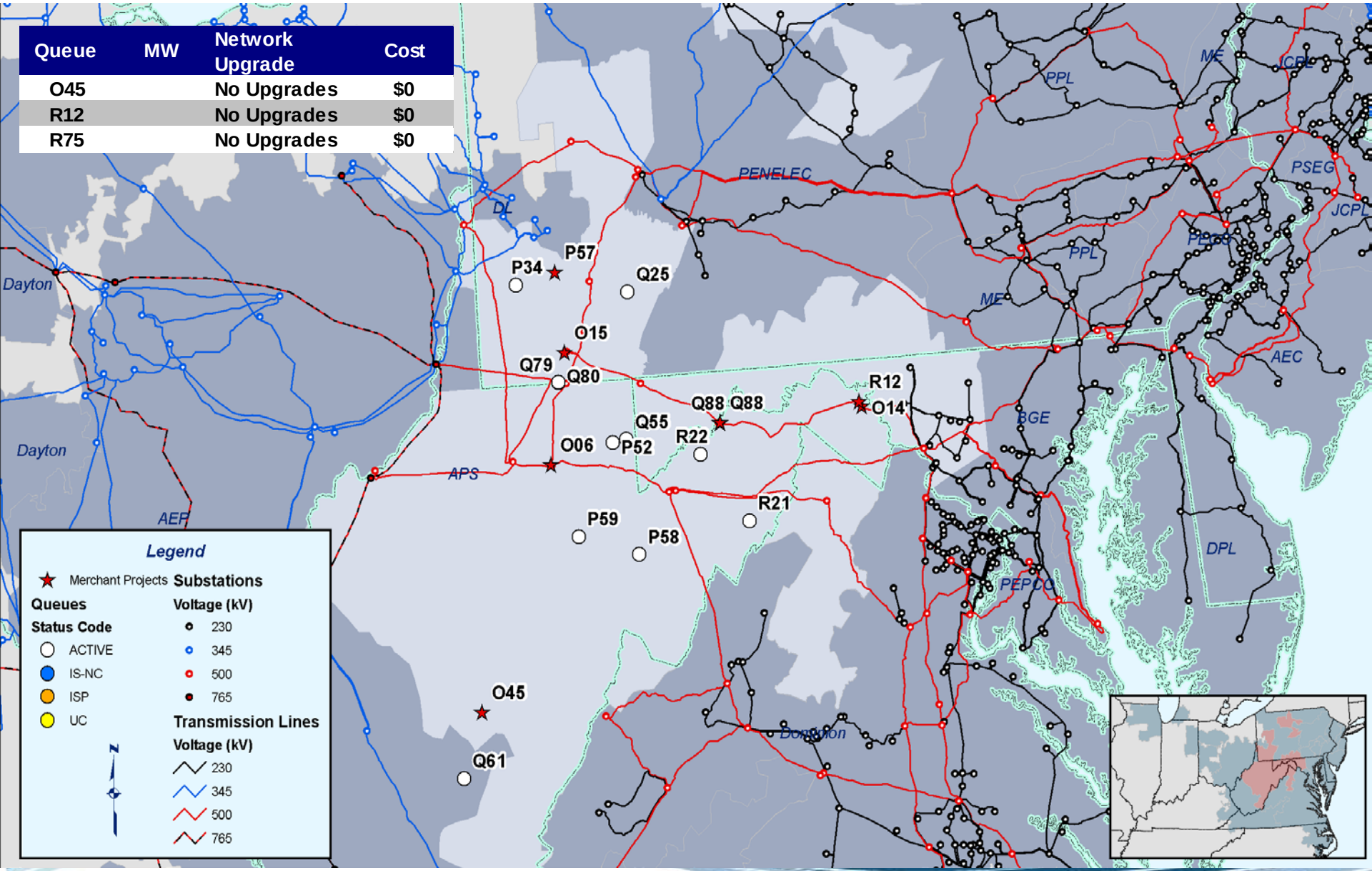
Penelec Interconnection Projects

Queue	MW	Upgrade ID	Fuel Type	Network Upgrade	Cost (M)
O59	99	546	Wind	Support N36 115kV interconnection switchyard new connection	0.005
		547		N36 115kV interconnection switchyard ring bus expansion	0.350
		548		O52 115kV substation upgrades	0.005
		549		Niles Valley 115kV substation upgrades	0.005
		550		Ansonia to Gains 34kV reconductoring (5.37 miles)	0.950
		551		Ansonia to Wellsboro 34kV reconductoring (9.47 miles)	1.660
		552		Communication equipment if O59 proceeds O52 or N36	TBA
O72	60	527	Wind	Support O72 115kV interconnection switchyard	0.200
		528		O72 115kV transmission tap (0.1 miles)	0.250
		529		I13 115kV substation upgrades	0.050
		530		Central City 115kV substation upgrades	0.030
		531		Fiber Optic O72 to I13 (3.1 miles)	0.300
		532		Altoona 230 kV line wave trap replacement	0.115
		533		Johnstown 115kV substation breaker replacement on Bon Air line	0.225
		534		Hooversville 115kV substation breaker replacement on Central City West line	0.225

APS Impact Studies Results

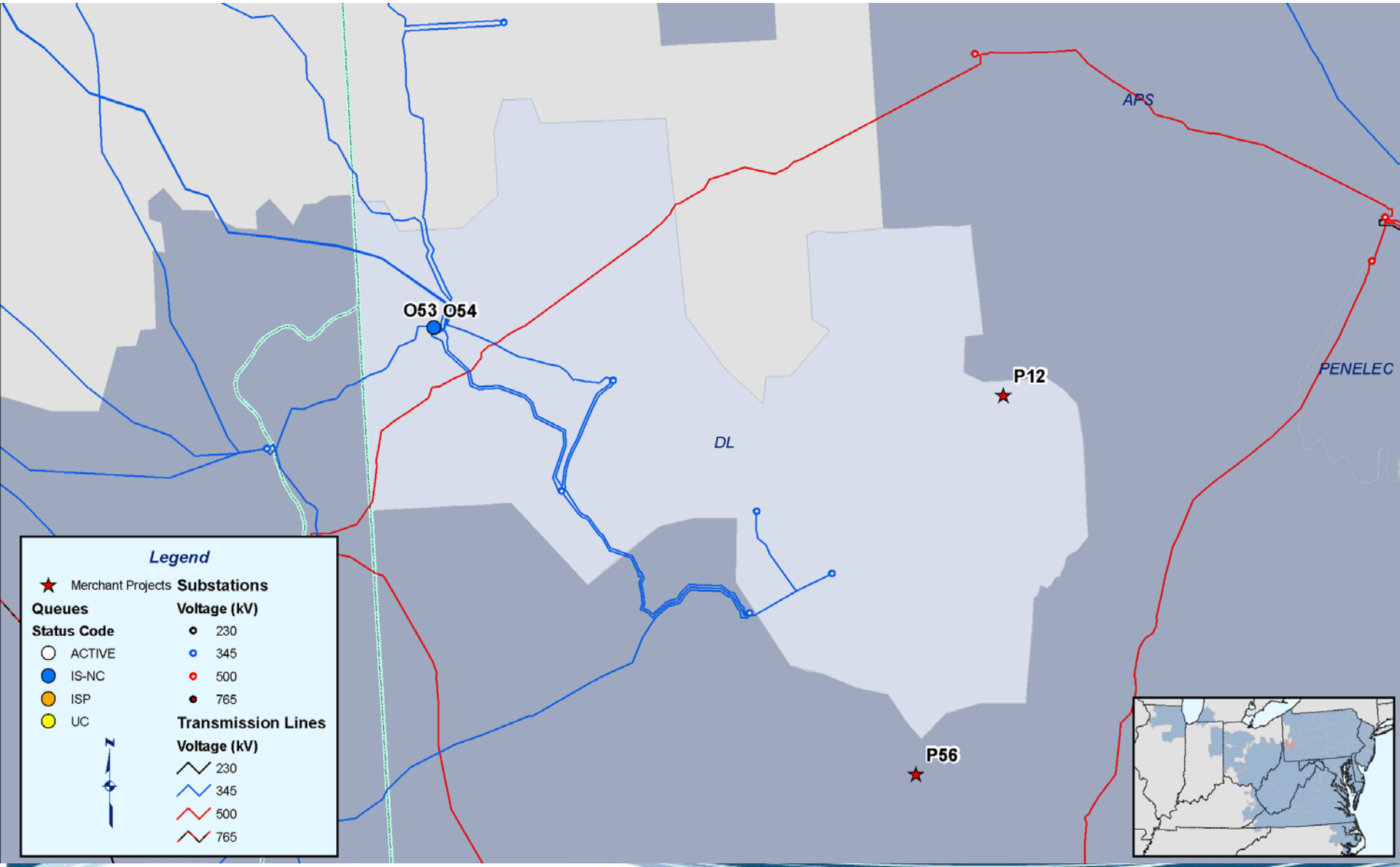
APS Interconnection Projects

Queue	MW	Network Upgrade	Cost
O45		No Upgrades	$0
R12		No Upgrades	$0
R75		No Upgrades	$0



DQE Impact Studies Results

DQE Interconnection Projects



AEP Impact Studies Results

AEP Interconnection Projects

Queue	MW	Fuel Type	Network Upgrade	Cost
P44	7	Diesel	No Upgrades	$0