



# Transmission Expansion Advisory Committee

September 2, 2014



# Interregional Planning Update

- 2014 Scenario Analysis - update
  - Scenario A - Update rollup case
  - Scenario B - Severe Heat and Drought
  - Scenario A – August 26 complete
  - Stakeholder WebEx – September 9, 10AM
  - Scenario B - September 19 case completion
    - September 30 analysis completion
  - November 17 week - Stakeholder WebEx on results

- Beyond 2014 discussions
  - Summer and Winter case builds and analysis
  - Ongoing review of potential scope
    - Production Cost Analysis
    - DOE Congestion Report Support
    - Synergies between Planning Coordinator MOD standard activities and EIPC model building
      - NERC meeting scheduled 9/22



# Interregional Planning Studies (not including JCM)

- NCTPC - update
  - Study requested by NCUC
  - Reliability analysis is in progress - status
  - Economic data checkout for NC complete
  - 2014 target completion
- PJM/MISO IPSAC
  - Joint Planning Study is complete
  - Next steps:
    - JOA metric discussions from JCM referred to IPSAC
    - Initial stakeholder process meetings set
      - September 11 WebEx 9:30-11:30
      - October 2 In-person at PJM 9:00-3:00
      - October 24 in-person at MISO 9:00-4:00
- Northeast Protocol Activities – reviewing possibilities for end of year IPSAC WebEx

# New Service Queue Update

# System Impact Studies Completed 10/2/2013 – 7/1/2014

(Study reports located at: <http://www.pjm.com/planning.aspx>)



# Merchant Transmission (MTX) Projects

| <b>Queue Number</b> | <b>Project Name</b>            | <b>TO</b> |
|---------------------|--------------------------------|-----------|
| X2-029              | Danville-East Danville 138kV   | AEP       |
| Y3-030              | Sandy Springs-High Ridge 230kV | BGE       |
| Z1-017              | Limerick-Peach Bottom          | PECO      |
| Z1-031              | Lake Nelson-Middlesex 230kV    | JCPL      |
| Z1-031              | Lake Nelson-Middlesex 230kV    | JCPL      |
| Z1-031              | Lake Nelson-Middlesex 230kV    | JCPL      |
| Z1-031              | Lake Nelson-Middlesex 230kV    | JCPL      |
| Z1-037              | Krendale-Shanor Manor 138kV    | APS       |
| Z1-054              | Byron-Cherry Valley            | ComEd     |





# Long Term Firm Transmission Service (LTF) Projects

| Queue Number | Path Name         | MW   |
|--------------|-------------------|------|
| Y2-006       | IPL-PJM           | 237  |
| Y2-030       | LGEE-PJM          | 167  |
| Y2-031       | LGEE-PJM          | 167  |
| Y2-032       | LGEE-PJM          | 167  |
| Y2-032       | LGEE-PJM          | 167  |
| Y2-034       | DUK-PJM           | 299  |
| Y2-044       | NYIS-PJM          | 170  |
| Y2-049       | MECS-PJM          | 542  |
| Y2-056       | ALTE-PJM          | 468  |
| Y2-068       | AMIL-PJM          | 3081 |
| Y2-073       | NYISJK-PJM-NYISBC | 250  |
| Y2-082       | MECS-PJM          | 100  |
| Y3-022       | PJM-LGEE          | 300  |
| Y3-028       | CIN-PJM           | 200  |
| Y3-032       | MECS-PJM          | 250  |



# Long Term Firm Transmission Service (LTF) Projects

| Queue Number | Path Name | MW  |
|--------------|-----------|-----|
| Y3-059       | PJM-MECS  | 500 |
| Y3-059       | PJM-MECS  | 500 |
| Y3-067       | ALTE-PJM  | 312 |
| Y3-069       | NIPS-PJM  | 233 |
| Y3-072       | NIPS-PJM  | 233 |
| Y3-083       | MECS-PJM  | 250 |
| Y3-094       | CIN-PJM   | 223 |
| Y3-115       | PJM-WEC   | 250 |
| Z1-007       | CIN-PJM   | 87  |
| Z1-007       | CIN-PJM   | 87  |
| Z1-019       | NYIS-PJM  | 600 |
| Z1-023       | TVA-PJM   | 300 |
| Z1-023       | TVA-PJM   | 300 |



# Long Term Firm Transmission Service (LTF) Projects

| Queue Number | Path Name | MW  |
|--------------|-----------|-----|
| Z1-025       | CIN-PJM   | 206 |
| Z1-025       | CIN-PJM   | 206 |
| Z1-027       | NIPS-PJM  | 124 |
| Z1-029       | CIN-PJM   | 59  |
| Z1-029       | CIN-PJM   | 59  |
| Z1-043       | AMIL-PJM  | 260 |
| Z1-045       | PJM-MECS  | 894 |
| Z1-046       | TVA-PJM   | 240 |
| Z1-067       | DUK-PJM   | 50  |
| Z1-067       | DUK-PJM   | 50  |
| Z1-071       | TVA-PJM   | 82  |
| Z1-112       | MEC-PJM   | 108 |
| Z1-112       | MEC-PJM   | 108 |
| Z1-112       | MEC-PJM   | 108 |



# Additional System Upgrades for New Service Requests

10/1/2013 – 7/1/2014

(Construction Status located at: <http://www.pjm.com/planning/rtep-upgrades-status/construct-status.aspx>)

| Upgrade ID | Description   | Cost Estimate | Driver |
|------------|---|---------------|--------|
| n4225      | Engineering and design related activities required to construct a new substation adjacent to the Quinton-Roadstown 69 kV circuit. Cut and loop the circuit into the new substation.                           | 4.80          | W2-101 |
| n4226      | Create a transmission loop by cutting into the Quinton to Roadstown 69 kV line and constructing a double circuit 69 kV pole line with 795 ACSR conductor and OPGW for a distance of approximately 1,500 feet. | 0.88          | W2-101 |
| n4227      | Install 48SM ADSS fiber cable on the Quinton to Roadstown to Laurel 69kV line, a distance of approximately 15.0 miles.  | 0.67          | W2-101 |
| n4144      | Install two 95 foot self-supporting steel poles on concrete foundations with two spans of 1590 ACSR Lapwing conductor from the Cedar substation to the Interconnection Customer's circuit breaker.            | 0.23          | W3-028 |
| n4210      | Construct a new 69 kV line position at the Quinton Substation including one 75' self-supporting steel pole with a gang-motor operated disconnect switch   | 0.47          | X2-027 |
| n4213      | Construct a new 69 kV 3 breaker ring bus substation adjacent to the Lewis-FAATC 69 kV circuit   | 4.30          | W3-033 |
| n4214      | Create a transmission loop by cutting the Lewis-FAATC 69 kV circuit into and out of the newly constructed substation.   | 2.00          | W3-033 |
| n4229      | Construct a new 230 kV terminal at the Mickleton substation.  | 4.60          | W4-016 |
| n4230      | Install a self-supporting 230 kV steel pole with a concrete foundation, motor operated disconnects, and a short span to Mickleton substation.   | 0.38          | W4-016 |
| n4231      | Rebuild the MICKLETON-MONROE 230 kV line #ckt #2 to achieve a new emergency rating of 1200A.  | 14.30         | W4-016 |
| n4232      | Rebuild the MICKLETON-MONROE 230 kV line #ckt #1 to achieve a new emergency rating of 1200A.  | 14.30         | W4-016 |

| Upgrade ID | Description   | Cost Estimate | Driver |
|------------|---|---------------|--------|
| n4041      | Install 3 138kV circuit breakers, revenue metering and associated equipment at Fostoria Central 138kV station   | 3.03          | V4-015 |
| n4042      | Modify relays on the Fostoria Central line at North Findlay 138kV station.  | 0.37          | V4-015 |
| n4056      | Replace the Dumont wave trap on the Dumont - Sorenson 765 kV line.  | 0.50          | Y2-068 |
| n4054      | AEP shall install a new 69 kV circuit breaker at Buckskin station, relaying, SCADA, and associated equipment.   | 0.71          | W3-170 |
| n4055      | AEP shall install 69 kV revenue metering for this IPP project.  | 0.18          | W3-170 |
| n4104      | Sag study req -\$48k, If normal rating needs fixed, rebuild required for \$12M.   | 12.05         | X4-036 |
| n4105      | Reconductor from Collinsville through Huston to Trenton appr 12.2 miles along with the structures for \$12M.  | 12.05         | X4-036 |
| n4106      | The 345 kV line between Jefferson and Cliffy Creek can be sag studied to increase the emergency rating from 2354 to 3211. The cost of a sag study to identify any mitigation requirements should cost around \$4,000. If remediation can only be reached through a rebuild, we'd expect that to cost around \$2,000,000. Note that the transformer will still be limited to 2919 MVA emergency. | 2.00          | X4-036 |
| n4107      | Install a 3rd transformer in parallel to the existing ones at \$6M  | 6.00          | X4-036 |
| n4108      | Reconductor 4.54 miles at \$2.5M  | 2.50          | X4-036 |
| n4109      | Sag study req - \$4000, if normal rating needs fixed, rebuild required for \$1M   | 1.00          | X4-036 |
| n4110      | Terminal equipment needs to be replaced. Cost estimate \$2M.  | 2.00          | X4-036 |
| n4111      | Sag study req - \$34,400, if normal rating needs fixed, rebuild required for \$9M   | 9.03          | X4-036 |

| Upgrade ID | Description  | Cost Estimate | Driver |
|------------|--|---------------|--------|
| n4135      | Replace Benton 345/138 kV transformer  | 3.50          | Y3-032 |
| n4002      | To resolve the 556BKRSTA-8CARSON 500 kV line overload: Upgrade 556BKRSTA-8CARSON 500 kV line (Existing line #556 (Future line#511) to at least 2811MVA (3246Amps). Replace 3000Amp wave trap at Carson w   | 0.08          | Z1-046 |
| n4010      | Modify relaying at Jacksons Ferry 765 kV Station.  | 0.55          | Z1-046 |
| n4058      | Perform a sag study on the Stillwell - Dumont 345 kV line  | 0.03          | Z1-046 |
| n4082      | ABINGDON-HILLMAN 69 kV line: Rebuild 4.9 mile section of 69 kV line with an estimated cost: \$5,880,000.   | 5.00          | Z1-046 |
| n4083      | 05CLNCHR-05LEBANO 138 kV line: Replace the Clinch River riser with estimated cost: \$50,000. Replace the Lebanon Switch (1200A) with estimated cost: \$100,000. Rebuild 0.16 mile of the Clinch River - Lebanon 138 kV line section with estimated cost: \$240,000. Rebuild 0.06 mile of the Clinch River - Lebanon 138 kV line section with estimated cost: \$90,000.   | 0.48          | Z1-046 |
| n4084      | 05KEYWSS-05BROADF 138 kV line: A sag study will be required for the ACSR ~ 397.5 ~ 30/7 ~ LARK conductor section 1 to determine if the line section can be operated above its emergency rating of 167 MVA. The results could prove that no additional upgrades are necessary, that some upgrades on the circuit are necessary, or that the entire 33.25 mile section of line would need to be rebuilt. The estimated cost for the sag study: \$133,000. If deemed necessary to rebuild section of line, estimated cost: \$49,875,000. Replace Keywood S.S. riser with estimated cost: \$150,000. | 49.88         | Z1-046 |

| Upgrade ID | Description   | Cost Estimate | Driver |
|------------|---|---------------|--------|
| n4138      | Upgrade terminal equipment and bus at Mitchell on the Elrama/Wilson terminal. | 0.95          | Y2-080 |





# ATSI Transmission Zone

| <b>Upgrade ID</b> | <b>Description</b>  | <b>Cost Estimate</b> | <b>Driver</b> |
|-------------------|---|----------------------|---------------|
| n4047             | Connect Fiber from the tap point at Cedar Point Road and Otter Creek Road to Ironville substation | 0.25                 | U2-028A_AT1   |
| n4137             | Reconductoring the Woodville Tap – Lemoyne 138 kV line is required.                               | 2.96                 | Y3-059        |



# ComEd Transmission Zone

| Upgrade ID | Description   | Cost Estimate | Driver      |
|------------|---|---------------|-------------|
| n4190      | Upgrade 345kV BT 7-8 & 8-9 CB's at TSS 155 Nelson   | 7.00          | J278 - MISO |
| n4228      | New line section for generator lead and upgrade bus relaying  | 3.88          | Q39         |
| n4102      | Replace Bus Ties 3-4 ckt breakers at Braidwood. The rating on the BraidwoodB-E.FrankfurtB 345kV line will be 1134/1528 after the upgrade.   | 2.40          | X4-036      |
| n4103      | Replace Bus Ties 14-15 ckt breakers at Braidwood. The rating on the BraidwoodR-E.FrankfurtR 345kV line will be 1134/1528 after the upgrade.   | 2.40          | X4-036      |
| n4112      | Replace station conductor on 345 kV line 11601 to achieve new ratings of 1660/1917/2488 for \$0.2M.   | 0.20          | X4-036      |
| n4113      | Reconductor 10.2 miles of 138 kV line 0108 from Mazon to LaSalle to achieve new ratings of 208/264/275 for \$17.75M.  | 17.75         | X4-036      |
| n4114      | Reconductor 5.7 miles of 138 kV line 1205 from Mazon to Dresden to achieve new ratings of 292/321/433 for \$9.75M.  | 9.75          | X4-036      |
| n4115      | Install 4th autotransformer at Davis Creek, \$14.6M (IDEV attached).  | 14.60         | X4-036      |
| n4116      | Upgrade station conductor at East Frankfort and Goodings Grove  | 0.15          | X4-036      |
| n4117      | To upgrade Beckjord-Pierce 138kV line, its going to cost \$350,000. The line would be upgraded by replacing a circuit breaker and disconnect switch (or switches) that currently limit the circuit. The transmission line conductor will become the limiting element. | 0.35          | X4-036      |
| n4118      | Replace ComEd CB at State Line raises rating to 561   | 1.20          | X4-036      |
| n4133      | Replace 3 circuit breakers, reconductor the line, and replace station conductor   | 40.00         | Y3-094      |
| n4147      | Install new 345 kV breakers   | 5.00          | Z1-043      |
| n4074      | Reconductor ~0.5 miles of 2338 overhead ACAR conductor  | 1.00          | Z1-112      |



# DL Transmission Zone

| Upgrade ID | Description  | Cost Estimate | Driver |
|------------|--|---------------|--------|
| n4139      | Reconductor a 3.34 mile portion of the Mitchell-Wilson 138 kV tie line | 2.80          | Y2-080 |



# Dominion Transmission Zone

| <b>Upgrade ID</b> | <b>Description</b>   | <b>Cost Estimate</b> | <b>Driver</b> |
|-------------------|--|----------------------|---------------|
| n3935.1           | Upgrade Clifton breakers 26582, 265T266 & 26682 from 50kA to 63kA                          | 0.94                 | X4-039        |
| n3935.2           | Upgrade Clifton breakers 26582, 265T266 & 26682 from 50kA to 63kA                          | 0.94                 | X4-039        |
| n3935.3           | Upgrade Clifton breakers 26582, 265T266 & 26682 from 50kA to 63kA                          | 0.94                 | X4-039        |
| n4059             | Coupling capacitor voltage transformers, Conductor, Transceiver, Transfer Trip Transmitter | 0.10                 | Z2-027        |
| n4060             | Reconductor 3400' of line 434  | 0.20                 | Z2-027        |
| n4061             | Transfer Trip Transmitter  | 0.05                 | Z2-027        |
| n4062             | Transfer Trip Transmitter  | 0.05                 | Z2-027        |

| Upgrade ID | Description   | Cost Estimate | Driver |
|------------|---|---------------|--------|
| n4081      | Upgrade the Easton & Todd Substation Relay Protection and Control Equipment to handle at Least 174 MVA Emergency Rating | 0.56          | Y3-082 |

| Upgrade ID | Description  | Cost Estimate | Driver |
|------------|--|---------------|--------|
| n4043      | Reconductor the 0.8 mile I1023 line between Lake Nelson and Middlesex with a single 1590 kcmil ACSS conductor, replacing the existing 1590 kcmil ACSR. Replace drop looks on the 230kV Lake Nelson bus with bundled 1590 ACSR. | 2.24          | Z1-031 |



# ODEC (within the Dominion Transmission Zone)

| Upgrade ID | Description   | Cost Estimate | Driver |
|------------|---|---------------|--------|
| n4209      | Construct a 69 kV line tap structure on the Tasley - Kellam 69kV line | 0.42          | W1-008 |



# PECO Transmission Zone

| Upgrade ID | Description   | Cost Estimate | Driver |
|------------|---|---------------|--------|
| n4015      | Replace line traps, station cables, meters, disconnect switches, circuit breakers, reactor and relays | 2.60          | W4-016 |





# PENELEC Transmission Zone

| <b>Upgrade ID</b> | <b>Description</b>   | <b>Cost Estimate</b> | <b>Driver</b> |
|-------------------|--|----------------------|---------------|
| n4028             | Provide revenue metering equipment.  | 0.05                 | Y1-047        |
| n4073             | Expand existing Krayn substation from 4 breaker ring bus to 5 breaker ring bus. Existing substation yard will be expanded to the west.   | 1.64                 | X2-031        |
| n4078             | Replace Towanda and Canyon 230 kV line with 1033 ACSS conductor. Upgrade terminals at E. Towanda and Canyon.   | 14.27                | Z1-019        |
| n4079             | Rebuild N. Meshoppen and Oxbow 230 kV line using 1622 ACSS conductor. Upgrade terminals at N. Meshoppen and Oxbow.   | 27.31                | Z1-019        |
| n4080             | Rebuild line using 1622 ACSS conductor. Upgrade terminals at Oxbow and Lackawanna.   | 44.13                | Z1-019        |
| n4222             | Install new wave trap, tuner, and TT receiver on the 115kV Warren/Warren South Line exit. Add PT between No. 1 TR and 34.5kV breaker. Replace existing ABB32 and 62T relays with an SEL-351 on reverse power panel. Add sync check and reverse power relaying for 34.5kV Parker St line breaker. Remove 34.5kV bus diff relaying and install SEL-311L line/bus differential relay. | 0.57                 | Y2-055        |
| n4223             | Install CVT, wavetrapped, tuner, and transfer trip transmitter on the 115kV Elm Street/Warren South Tap Line exit. Add auto reclosing and sync check relaying for the two 115kV breakers adjacent to the Elm Street/Warren South Tap Line exit.  | 0.40                 | Y2-055        |
| n4224             | Install new wave trap on the 115kV Warren/Elm Street Line exit.  | 0.09                 | Y2-055        |



# PEPCO Transmission Zone

| <b>Upgrade ID</b> | <b>Description</b>  | <b>Cost Estimate</b> | <b>Driver</b> |
|-------------------|---|----------------------|---------------|
| n4217             | Modify or construct a 230kV terminal at the Burches Hill substation to accept the new direct connect circuit from the Customer Facility | 0.00                 | X3-087        |
| n4218             | Construct an approximate 6 mile direct connect 230kV circuit from the customer facility to the Burches Hill sub                         | 0.00                 | X3-087        |
| n4219             | Upgrade the Burches Hill ABB GCB 230kV breaker to 80kV  | 0.73                 | X3-087        |
| n4220             | Upgrade the Burches Hill ITE OCB 230kV breaker to 80kV  | 0.73                 | X3-087        |
| n4221             | Upgrade the Burches Hill West OCB 230kV breaker to 80kV   | 0.73                 | X3-087        |

The following slides related to interconnection requests were previously presented at the August 2014 TEAC meeting.

# System Impact Studies Completed 10/2/2013 – 7/1/2014

(Study reports located at: <http://www.pjm.com/planning.aspx>)

| <b>Queue Number</b> | <b>Fuel Type</b> | <b>MWC (FTIR/FTWR)</b> | <b>MWE (NFTIR/NFTWR)</b> |
|---------------------|------------------|------------------------|--------------------------|
| W3-175              | natural gas      | 371                    | 371                      |
| W4-015              | natural gas      | 136                    | 210                      |
| Y3-012              | natural gas      | 0                      | 7.5                      |

| Queue Number | Fuel Type   | MWC (FTIR/FTWR) | MWE (NFTIR/NFTWR) |
|--------------|-------------|-----------------|-------------------|
| V4-011       | methane     | 3.2             | 3.2               |
| X3-023       | wind        | 7.8             | 60                |
| Y2-050       | natural gas | 672             | 742               |
| Y2-067       | coal        | 12              | 12                |
| Y3-023       | methane     | 4.8             | 4.8               |
| Y3-024       | methane     | 3.2             | 3.2               |
| Y3-025       | methane     | 3.18            | 3.18              |
| Y3-036       | coal        | 36              | 36                |
| Y3-037       | coal        | 36              | 36                |
| Y3-068       | natural gas | 525             | 525               |
| Y3-097       | storage     | 0               | 4                 |

| <b>Queue Number</b> | <b>Fuel Type</b> | <b>MWC (FTIR/FTWR)</b> | <b>MWE (NFTIR/NFTWR)</b> |
|---------------------|------------------|------------------------|--------------------------|
| T16                 | wind             | 6                      | 30                       |
| T174                | natural gas      | 900                    | 930                      |
| Y2-088              | natural gas      | 19.9                   | 19.9                     |
| Y2-096              | biomass          | 49.2                   | 49.2                     |

| <b>Queue Number</b> | <b>Fuel Type</b> | <b>MWC (FTIR/FTWR)</b> | <b>MWE (NFTIR/NFTWR)</b> |
|---------------------|------------------|------------------------|--------------------------|
| W3-059A_AT6         | wind             | 12.9                   | 99                       |
| X1-027A_AT12        | wind             | 65                     | 500                      |
| Y1-015              | natural gas      | 870                    | 1000                     |
| Y1-069              | natural gas      | 799                    | 799                      |
| Z2-019              | methane          | 0                      | 0.85                     |



| Queue Number | Fuel Type   | MWC (FTIR/FTWR) | MWE (NFTIR/NFTWR) |
|--------------|-------------|-----------------|-------------------|
| R16          | wind        | 25.2            | 126               |
| S36          | wind        | 35              | 175               |
| T143         | wind        | 50              | 250               |
| T148         | wind        | 20              | 100               |
| T99          | wind        | 20              | 100               |
| U3-021       | natural gas | 100             | 100               |
| U4-027       | natural gas | 100             | 100               |
| U4-033       | natural gas | 36              | 36                |
| W2-048       | wind        | 0               | 62.5              |
| W3-046       | wind        | 0               | 207.5             |
| W4-005       | wind        | 45.6            | 351               |
| X1-087       | methane     | 15.3            | 15.3              |
| X2-022       | wind        | 0               | 189               |

| Queue Number | Fuel Type   | MWC (FTIR/FTWR) | MWE (NFTIR/NFTWR) |
|--------------|-------------|-----------------|-------------------|
| Y2-113       | natural gas | 12.6            | 12.6              |
| Y3-088       | natural gas | 20              | 20                |
| Y3-089       | natural gas | 20              | 20                |
| Y3-090       | natural gas | 20              | 20                |
| Y3-091       | natural gas | 20              | 20                |
| Z1-072       | wind        | 10              | 0                 |
| Z1-073       | wind        | 6               | 0                 |
| Z1-106       | storage     | 0               | 20                |
| Z1-107       | storage     | 0               | 20                |
| Z1-108       | storage     | 0               | 20                |

| <b>Queue Number</b> | <b>Fuel Type</b> | <b>MWC (FTIR/FTWR)</b> | <b>MWE (NFTIR/NFTWR)</b> |
|---------------------|------------------|------------------------|--------------------------|
| Y3-103              | natural gas      | 97                     | 205                      |

| Queue Number | Fuel Type   | MWC (FTIR/FTWR) | MWE (NFTIR/NFTWR) |
|--------------|-------------|-----------------|-------------------|
| Y3-033       | wind        | 16.77           | 129               |
| Y3-054       | solar       | 4.56            | 12                |
| Y3-058       | solar       | 5.7             | 15                |
| Z1-057       | natural gas | 15.9            | 0                 |
| Z1-099       | natural gas | 7               | 7                 |
| Z1-100       | solar       | 4.162           | 0                 |
| Z1-101       | solar       | 4.162           | 0                 |
| Z1-102       | solar       | 4.162           | 0                 |

| <b>Queue Number</b> | <b>Fuel Type</b> | <b>MWC (FTIR/FTWR)</b> | <b>MWE (NFTIR/NFTWR)</b> |
|---------------------|------------------|------------------------|--------------------------|
| Y3-099              | storage          | 0                      | 2                        |
| Y3-100              | storage          | 0                      | 2                        |
| Z1-065              | storage          | 0                      | 6                        |
| Z1-080              | storage          | 0                      | 6                        |

| <b>Queue Number</b> | <b>Fuel Type</b> | <b>MWC (FTIR/FTWR)</b> | <b>MWE (NFTIR/NFTWR)</b> |
|---------------------|------------------|------------------------|--------------------------|
| Y2-078              | natural gas      | 20                     | 20                       |
| Y2-079              | natural gas      | 200                    | 200                      |
| Z1-050              | hydro            | 20                     | 20                       |

| <b>Queue Number</b> | <b>Fuel Type</b> | <b>MWC (FTIR/FTWR)</b> | <b>MWE (NFTIR/NFTWR)</b> |
|---------------------|------------------|------------------------|--------------------------|
| Y3-102              | natural gas      | 135                    | 135                      |
| Z1-041              | natural gas      | 2                      | 2                        |

| <b>Queue Number</b> | <b>Fuel Type</b> | <b>MWC (FTIR/FTWR)</b> | <b>MWE (NFTIR/NFTWR)</b> |
|---------------------|------------------|------------------------|--------------------------|
| W2-014              | oil              | 2                      | 2                        |
| X4-027              | natural gas      | 35                     | 12                       |
| Y3-043              | natural gas      | 760                    | 760                      |



| <b>Queue Number</b> | <b>Fuel Type</b> | <b>MWC (FTIR/FTWR)</b> | <b>MWE (NFTIR/NFTWR)</b> |
|---------------------|------------------|------------------------|--------------------------|
| W3-099              | wind             | 13                     | 100                      |
| Y2-042              | natural gas      | 18.3                   | 18.3                     |
| Y2-055              | natural gas      | 29                     | 29                       |

| <b>Queue Number</b> | <b>Fuel Type</b> | <b>MWC (FTIR/FTWR)</b> | <b>MWE (NFTIR/NFTWR)</b> |
|---------------------|------------------|------------------------|--------------------------|
| Y2-015              | natural gas      | 337                    | 344                      |
| Y2-063              | natural gas      | 337                    | 344                      |
| Y2-089              | natural gas      | 370                    | 370                      |
| Y3-041              | wind             | 8                      | 62                       |
| Y3-104              | storage          | 0                      | 20                       |
| Z1-098              | storage          | 0                      | 20                       |

| Queue Number | Fuel Type   | MWC (FTIR/FTWR) | MWE (NFTIR/NFTWR) |
|--------------|-------------|-----------------|-------------------|
| X4-044       | natural gas | 9.9             | 17.9              |
| Y1-026       | natural gas | 160             | 160               |
| Y2-081       | solar       | 1.9             | 5                 |
| Y2-105       | natural gas | 50              | 50                |
| Y3-026       | solar       | 3.8             | 10                |
| Y3-027       | solar       | 2.28            | 6                 |
| Y3-044       | natural gas | 5               | 5                 |
| Y3-045       | natural gas | 5               | 5                 |
| Y3-046       | natural gas | 6               | 6                 |
| Y3-048       | natural gas | 3               | 2                 |
| Y3-050       | natural gas | 21              | 24                |
| Y3-051       | natural gas | 4               | 47                |
| Y3-052       | natural gas | 10              | 50                |

| <b>Queue Number</b> | <b>Fuel Type</b> | <b>MWC (FTIR/FTWR)</b> | <b>MWE (NFTIR/NFTWR)</b> |
|---------------------|------------------|------------------------|--------------------------|
| Y3-053              | natural gas      | 13                     | 40                       |
| Y3-087              | solar            | 1.44                   | 3.8                      |
| Y3-107              | natural gas      | 45                     | 35                       |
| Z1-082              | storage          | 0                      | 1                        |
| Z1-096              | solar            | 2.98                   | 7.84                     |

# System Upgrades for New Service Requests 10/1/2013 – 7/1/2014

(Construction Status located at: <http://www.pjm.com/planning/rtep-upgrades-status/construct-status.aspx>)

| Upgrade ID | Description   | Cost Estimate (M) | Driver |
|------------|---|-------------------|--------|
| n3960      | Construct new 345kV (Stemple) station switchyard  | 13.15             | Y2-050 |
| n4035      | Willard Station Fiber Optic Option: Protection and Relaying Cost  | 0.27              | X3-023 |
| n4036      | SCADA will also be required in the following facilities: Greenwich 69 kV station, General Electric Tiffin 69 kV station, and Tiffin Tap 69 kV station. Estimated Cost (2013 Dollars): \$750,000   | 0.75              | X3-023 |
| n4076      | Upgrade relaying at Fostoria Central 345kV substation including replacing one existing relay on the Bay Shore circuit and adding a second transfer trip carrier relay for interfacing with carrier equipment and remote FirstEnergy terminal. Also replace existing Fostoria Central - Bay Shore 345kV metering on 345kV Bayshore circuit to FirstEnergy. | 0.18              | Y1-069 |
| n4193      | Replace the George Washington 138/69 kV Transformer #2  | 1.94              | Y3-068 |
| n4194      | Rebuild 5.83 miles of the Glendale - Brues 69 kV line.  | 3.68              | Y3-068 |
| n4195      | Rebuild 5.02 miles of the DILLES-SHADYSID 69 kV line  | 5.80              | Y3-068 |
| n4196      | Rebuild 4.14 miles of the Tilton – Windsor 138 kV line  | 3.10              | Y3-068 |

| Upgrade ID | Description  | Cost Estimate (M) | Driver |
|------------|--|-------------------|--------|
| n4200      | Install two (2) new 138 kV circuit breakers to connect the proposed generation. SCADA, 138 kV revenue metering, and associated equipment will also need to be installed. | 1.57              | Y3-068 |
| n4201      | Line protections and controls at the existing George Washington 138 kV station will need to be upgraded.   | 0.12              | Y3-068 |
| n4204      | Replace "I" and "K" CBs at Geo Washington Substation   | 1.60              | Y3-068 |
| n4205      | Replace the George Washington 138/69 kV TR #2  | 1.94              | Y3-068 |
| n4206      | Rebuild the entire 5.83 mile section of DILLES - SHADYSID 69 kV line   | 5.80              | Y3-068 |
| n4207      | Rebuild the entire 5.02 mile section of Glendale- Brues 69 kV  | 3.68              | Y3-068 |
| n4208      | Rebuild entire 4.14 miles of the Tilton – Windsor 138 kV line - (ACSR 556.5 26/7 Dove conductor section 1)   | 3.10              | Y3-068 |
| n4211      | Construct and cut in 0.75 miles of new 345kV transmission line   | 2.66              | Y2-050 |

| Upgrade ID | Description  | Cost Estimate (M) | Driver |
|------------|--|-------------------|--------|
| n4176      | Construct a 34.5kV 3 breaker ring bus switching station.   | 2.98              | Y2-096 |
| n4177      | Line Loop: Loop 34.5kV Line into proposed Metropolitan Court Switching Station.  | 0.10              | Y2-096 |
| n4178      | Install anti-islanding (transfer trip) facilities at Fredrick A substation   | 0.17              | Y2-096 |
| n4179      | Install anti-islanding (transfer trip) facilities at Lime Kiln substation  | 0.17              | Y2-096 |
| n4180      | Install anti-islanding (transfer trip) facilities at Ballenger Creek substation  | 0.32              | Y2-096 |
| n4181      | A fiber optic digital channel between Ballenger Creek & Lime Kiln and the new Metropolitan Court interconnect substation is required. (Est 2.2 miles ADSS) | 0.28              | y2-096 |
| n4182      | Ballenger Creek - Detention Center 34.5kV Line: Reconductor 0.01 miles of 34.5kV line and parallel 0.03 miles of underground cable.                        | 0.10              | Y2-096 |
| n4216      | Provide revenue metering equipment in Developer's Generation Substation.   | 0.11              | Y2-096 |



| Upgrade ID | Description  | Cost Estimate (M) | Driver |
|------------|--|-------------------|--------|
| n4046      | Cedar Street-New Castle (Z-100) 138kV - Reconductor New Castle to Ellwood Steel Tap Section (3.11 Miles) with 795 kcmil ACSS. Reconductor the Cedar Street-New Castle (Z-100) 138kV line - New Castle to Ellwood Steel Tap Section - replacing the existing 795 kcmil ACSR conductor with new 795 kcmil ACSS conductor. The line section length is approximately 3.11 miles. Includes associated modifications at New Castle substation. | 2.09              | Y1-015 |
| n4087      | Replace overdutied 138kV circuit breaker 50 at Bruce Mansfield substation  | 0.94              | Y3-103 |
| n4088      | Replace overdutied 138kV circuit breaker 54 at Bruce Mansfield substation  | 0.94              | Y3-103 |
| n4089      | Replace overdutied 138kV circuit breaker 34 at Bruce Mansfield substation  | 0.94              | Y3-103 |
| n4090      | Replace overdutied 138kV circuit breaker 38 at Bruce Mansfield substation  | 0.94              | Y3-103 |
| n4091      | Replace overdutied 138kV circuit breaker 27 at Bruce Mansfield substation  | 0.94              | Y3-103 |

| Upgrade ID | Description   | Cost Estimate (M) | Driver |
|------------|---|-------------------|--------|
| n4092      | Replace overdutied 138kV circuit breaker 65 at Bruce Mansfield substation | 0.94              | Y3-103 |
| n4093      | Replace overdutied 138kV circuit breaker 30 at Bruce Mansfield substation | 0.94              | Y3-103 |
| n4094      | Replace overdutied 138kV circuit breaker 19 at Bruce Mansfield substation | 0.94              | Y3-103 |
| n4095      | Replace overdutied 138kV circuit breaker 8 at Bruce Mansfield substation  | 0.94              | Y3-103 |
| n4096      | Replace overdutied 138kV circuit breaker 23 at Bruce Mansfield substation | 0.94              | Y3-103 |
| n4097      | Replace overdutied 138kV circuit breaker 12 at Bruce Mansfield substation | 0.94              | Y3-103 |
| n4098      | Replace overdutied 138kV circuit breaker 61 at Bruce Mansfield substation | 0.94              | Y3-103 |
| n4099      | Replace overdutied 138kV circuit breaker 57 at Bruce Mansfield substation | 0.94              | Y3-103 |

| Upgrade ID | Description  | Cost Estimate (M) | Driver |
|------------|--|-------------------|--------|
| n4100      | Replace overdutied 138kV circuit breaker 46 at Bruce Mansfield substation                              | 0.94              | Y3-103 |
| n4145      | Replace overdutied circuit breaker B-26 with a circuit breaker rated for 63kA interrupting capability. | 0.21              | Y1-015 |
| n4146      | Replace 138kV breaker B-30 with 63kA breaker.  | 0.20              | Y1-015 |



# BGE Transmission Zone

| <b>Upgrade ID</b> | <b>Description</b>  | <b>Cost Estimate</b> | <b>Driver</b> |
|-------------------|---|----------------------|---------------|
| n4121.2           | Replace 2 disconnect switches, 2 circuit breakers, and 1 line trap at Conastone | 1.80                 | Y3-043        |

| Upgrade ID | Description   | Cost Estimate | Driver |
|------------|---|---------------|--------|
| n1832.1    | Relay and SCADA modifications   | 0.36          | S36    |
| n1832.2    | Relay and SCADA modifications   | 0.60          | S36    |
| n1832.3    | Relay and SCADA modifications   | 0.14          | S36    |
| n2130      | Install new 345kV bus tie circuit breaker at TSS 900 Elwood Energy Center | 5.00          | W4-005 |
| n3995      | 345kV transmission line tie-in  | 2.00          | W3-046 |
| n3996      | Install 345kV three breaker ring bus                                      | 15.00         | W3-046 |
| n3997      | Remote-end relay upgrade  | 1.00          | W3-046 |
| n3998      | 345kV transmission line tie-in  | 2.00          | W4-005 |
| n3999      | Install 345kV three breaker ring bus                                      | 15.00         | W4-005 |
| n4000      | Remote-end relay upgrade  | 1.00          | W4-005 |
| n4001      | Install an extra three 345kV breakers at TSS 92 Mt. Pulaski substation    | 9.00          | X2-022 |
| n4199      | The upgrade is to install a new transformer.                              | 30.00         | W4-005 |

| Upgrade ID | Description   | Cost Estimate | Driver |
|------------|---|---------------|--------|
| n4018      | Installation of interconnection metering, communications, protection and control upgrades to Beckjord circuit breaker 906 necessary to accommodate connection of the new facilities | 0.23          | Y3-099 |

| Upgrade ID | Description  | Cost Estimate | Driver |
|------------|--|---------------|--------|
| n4085      | Install three-breaker loop 138kV substation, relaying, metering, RTU, SCADA and other miscellaneous supporting equipment | 2.44          | Y3-103 |
| n4086      | Replace overdutied 138kV circuit breaker Z-37 at Raccoon substation  | 0.44          | Y3-103 |

| Upgrade ID | Description   | Cost Estimate | Driver |
|------------|---|---------------|--------|
| n4140      | Construct a 69 kV three-breaker ring bus substation, inclusive of a terminal position for the queue project on the Chestertown - Millington 69 kV line.   | 2.00          | Y3-033 |
| n4141      | Cut circuit 6773 and loop into and out of the new substation. Install two (2) self-supporting steel poles with anchor bolt foundations, post construction tangent structures, and short span to DPL substation. | 1.00          | Y3-033 |



| Upgrade ID | Description                                  | Cost Estimate | Driver |
|------------|--|---------------|--------|
| n4122      | Rebuild the 9.5 mile line with 3x 1590 ACSR. | 61.75         | Y3-043 |



# PECO Transmission Zone

| Upgrade ID | Description   | Cost Estimate | Driver |
|------------|---|---------------|--------|
| n4121.1    | Replace 5 disconnect switches, 2 circuit breakers, and 1 line trap at Peach Bottom. | 3.50          | Y3-043 |

| Upgrade ID | Description   | Cost Estimate | Driver |
|------------|---|---------------|--------|
| n3904      | Protection system modifications.  | 0.25          | Y2-015 |
| n3906      | Replace wave trap and protective relays.  | 0.25          | Y2-015 |
| n3908      | Rebuild the Eldred-Frackville 230kV line using double 1590 ACSR conductor (12 miles)  | 34.62         | Y2-015 |
| n3909      | Replace the substation conductors with 1590 ACSR. Replace two breakers, 4 switches and associated equipment with 3000amp rated equipment. | 4.00          | Y2-015 |
| n3910      | Replace the substation conductors with 1590 ACSR. Replace two breakers, 4 switches and associated equipment with 3000amp rated equipment. | 3.00          | Y2-015 |
| n3968      | Upgrade the line described in N3562 to be triple bundled 1590 ACSR.   | 1.81          | Y2-089 |
| n3969      | Upgrade the equipment described in N3563 to be rated for 4000A  | 0.43          | Y2-089 |
| n4119      | Build 0.15 mile 69kV line between the Stanton-Sullivan Trail 69kV line and Y3-104   | 1.44          | Y3-104 |
| n4120      | Install DTT equipment   | 0.26          | Y3-104 |



# PPL Transmission Zone

| <b>Upgrade ID</b> | <b>Description</b>  | <b>Cost Estimate</b> | <b>Driver</b> |
|-------------------|---|----------------------|---------------|
| n4123             | Construct a line, approximately 1000 feet long, connecting Y3-041 to the Peckville-Jackson 69kV line and two MOLBAB switches. | 1.26                 | Y3-041        |
| n4124             | Install transfer trip equipment   | 0.27                 | Y3-041        |
| n4125             | Install transfer trip equipment   | 0.23                 | Y3-041        |
| n4126             | Install transfer trip equipment   | 0.24                 | Y3-041        |
| n4127             | Install transfer trip equipment   | 0.28                 | Y3-041        |

# Interconnection Questions?



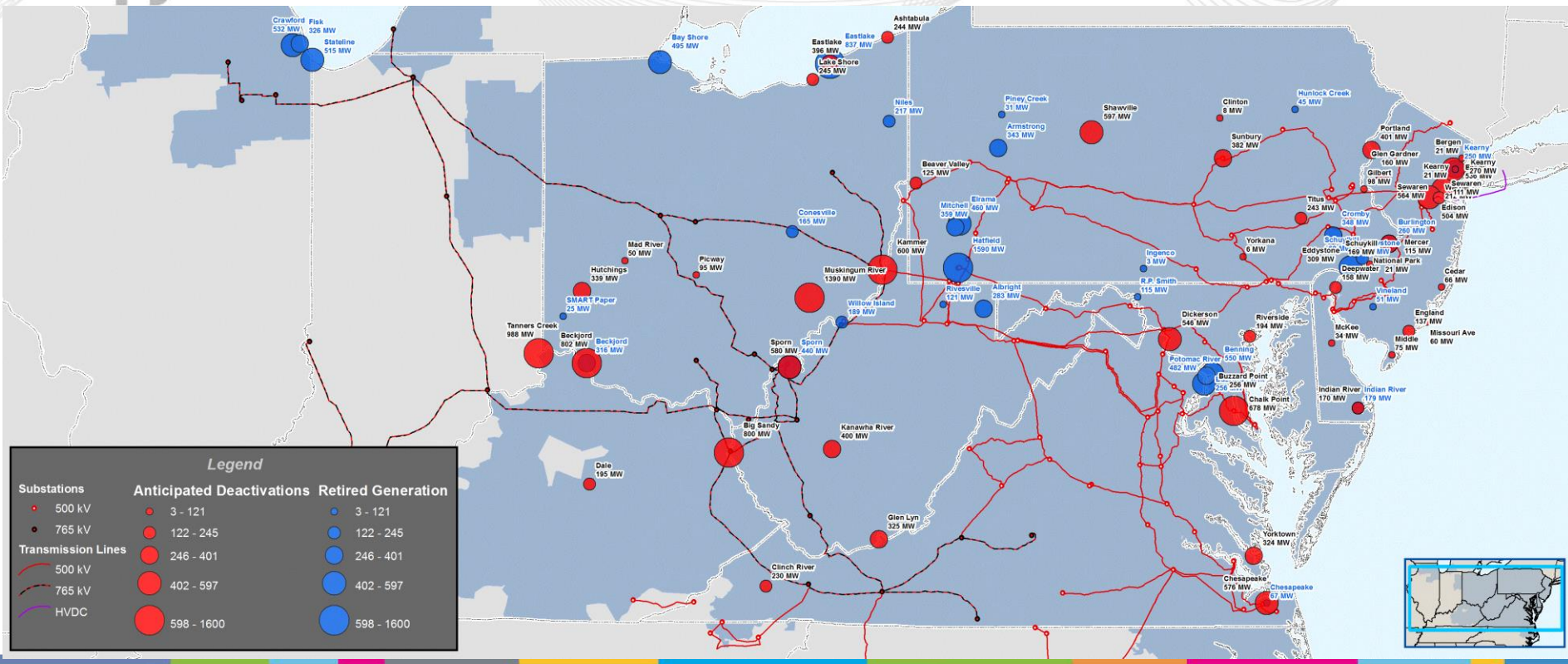
Aaron Berner  
[aaron.berner@pjm.com](mailto:aaron.berner@pjm.com)

# Generation Deactivation Notification (Retirements) Update



# Generation Deactivation Status Update

| Unit(s)  | Transmission Zone | Requested Deactivation Date                             | PJM Reliability Status        |
|--|-------------------|---|-------------------------------|
| Will County Unit 3<br>(251MWs)                         | ComEd             | 4/15/2015   | Reliability analysis underway |
| East Lake 1, 2 & 3 and Lake Shore 18<br>(641MWs total) | ATSI              | Requested change in deactivation date to April 15, 2015 | Reliability analysis underway |





# 2014 Baseline RTEP Status & Timeline

- RTEP Proposal Window #1
  - Closed, scope included baseline N-1, generator deliverability, load deliverability, N-1-1 thermal
- RTEP Proposal Window #2
  - Anticipated scope to include voltage analysis, light load analysis and TO criteria violations
- 2022 (Year 8) Case and Analysis
- Long-Term Window (November 2014 through February 2015)
- PJM Board Approval of 2014 RTEP

- Anticipated scope to include N-1 voltage, N-1-1 voltage analysis, Light Load Reliability Criteria analysis and TO criteria violations
- TO criteria violations are due back to PJM on 9/2/2014

# Reliability Analysis Update

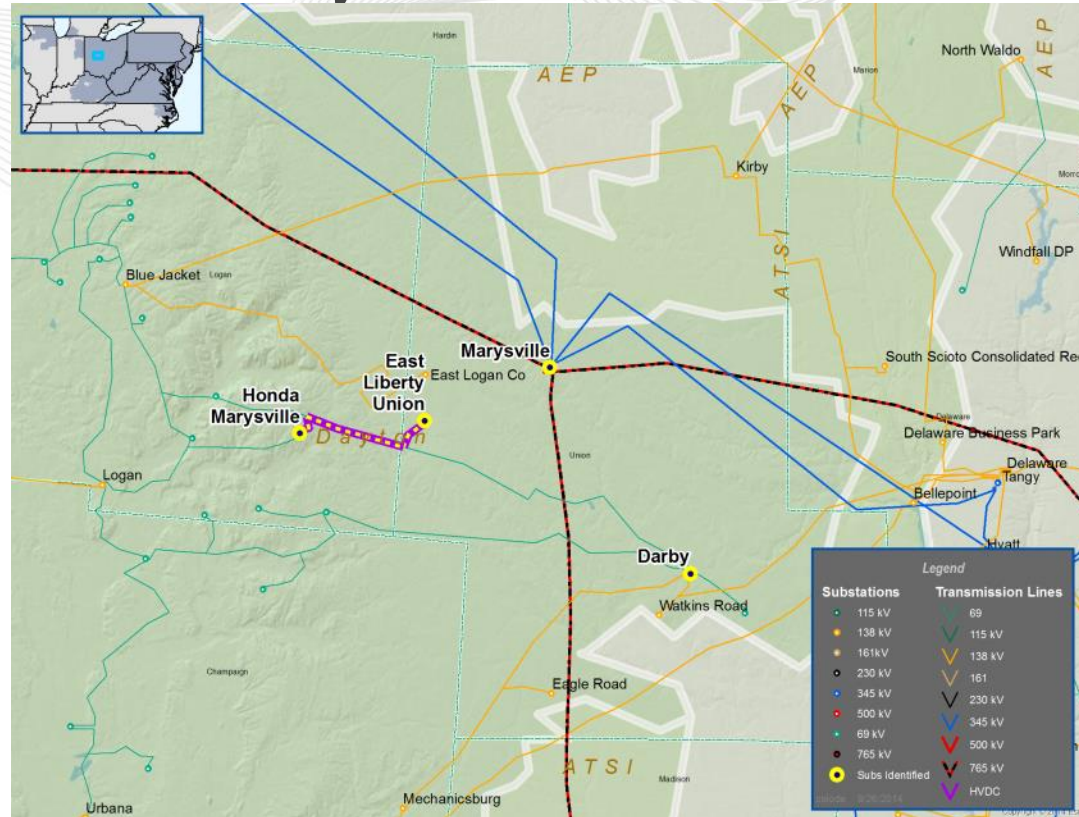
## Plan to mitigate the Construction Delay of B1570, B1570.1, B1570.2, B1570.3

### Existing Approved Plan:

- B1570: Add a 345/69 kV transformer at AEP Marysville 345 kV bus
- B1570.1: Add Marysville - Darby 69 kV line
- B1570.2: Add Marysville - Union REA 69 kV line
- B1570.3: Reconductor Union REA - Honda MT 69 kV line
- Required IS date: 6/1/2014
- Projected IS date: 6/1/2018

### Additional recommended scope to maintain reliability in the near term:

- Increase the rating of the Shelby-E. Sidney-Quincy-Logan 138 kV line to 224 MVA by Replace/raise a three pole swing out structure; Push/pull/retension conductors on two spans; Lower eight spans of single phase underbuild (B2540)
- Estimated Project Cost: \$0.042M
- Required IS Date: 6/1/2015



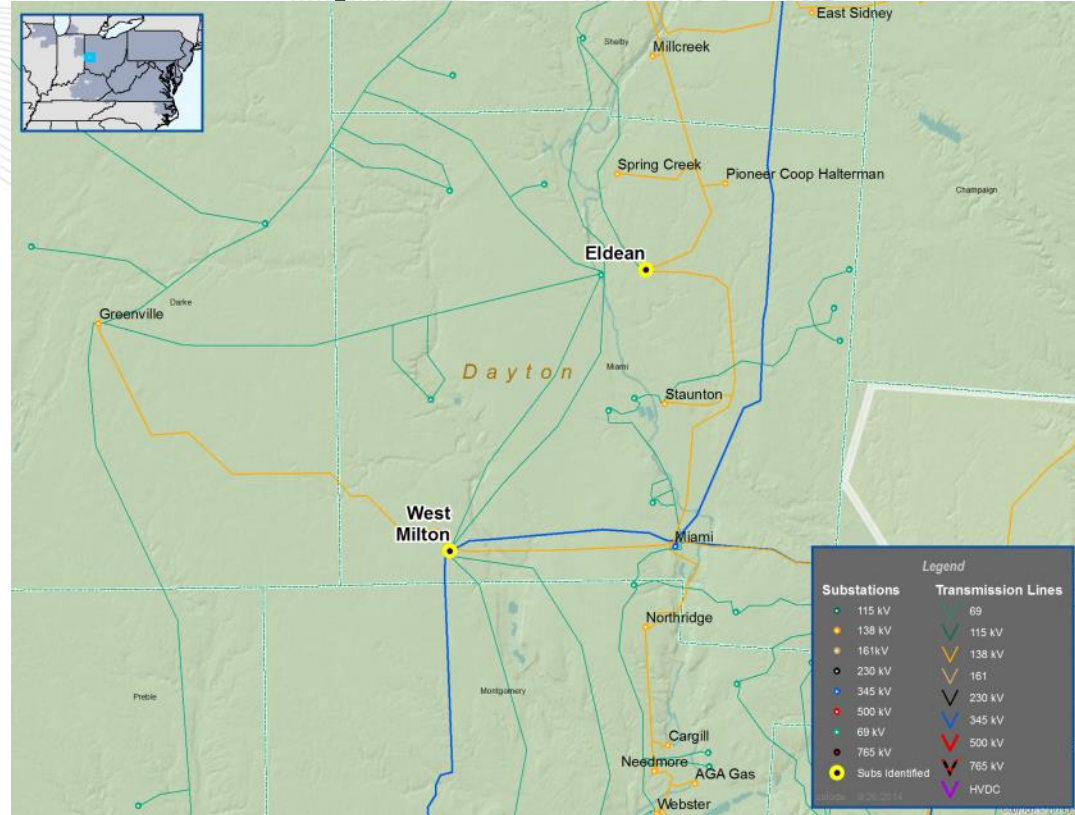
## Plan to mitigate the Construction Delay of B1572

### Existing Approved Plan:

- B1572: Construct a new 138 kV line from West Milton to Eldean
- Required IS date: 6/1/2014
- Projected IS date: 6/1/2018

### Additional recommended scope to maintain reliability in the near term:

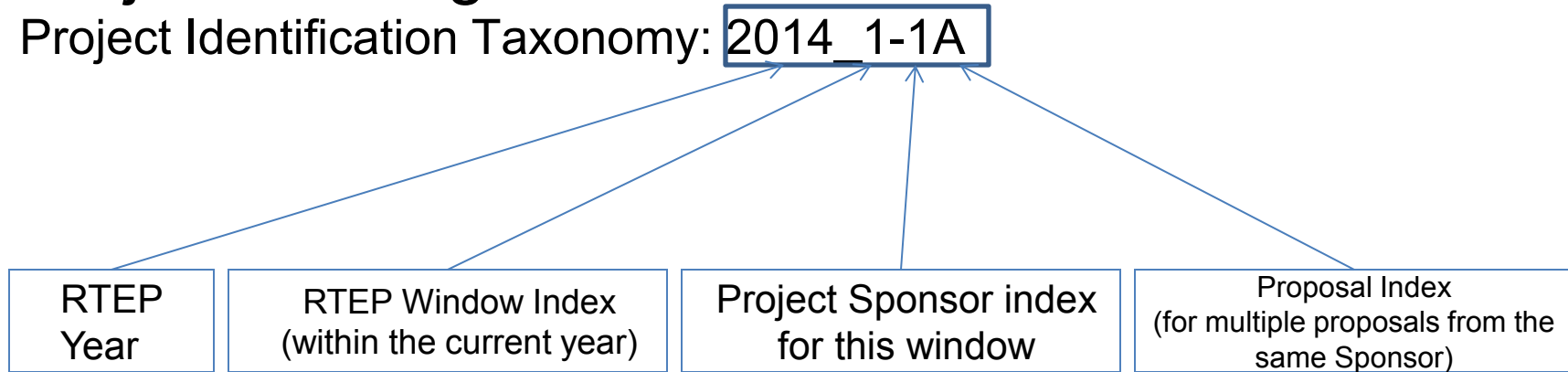
- As needed in PJM Operations, connect two 30MVAR mobile shunts to Eldean 69kV and Sidney 69kV buses, Block the LTCs for Eldean 138/69kV and Sidney 138/69kV transformers after either the loss of the Shelby – Sidney 138kV line or the loss of Miami – Eldean - Staunt 138kV line (B2541)
- Estimated Project Cost: \$0M
- Required IS Date: Immediate Need



# 2014 RTEP Proposal Window #1 Update



- Window opened on 6/27/2014
- Closed on 7/28/2014
  
- Project Naming Convention
- Project Identification Taxonomy: 2014\_1-1A

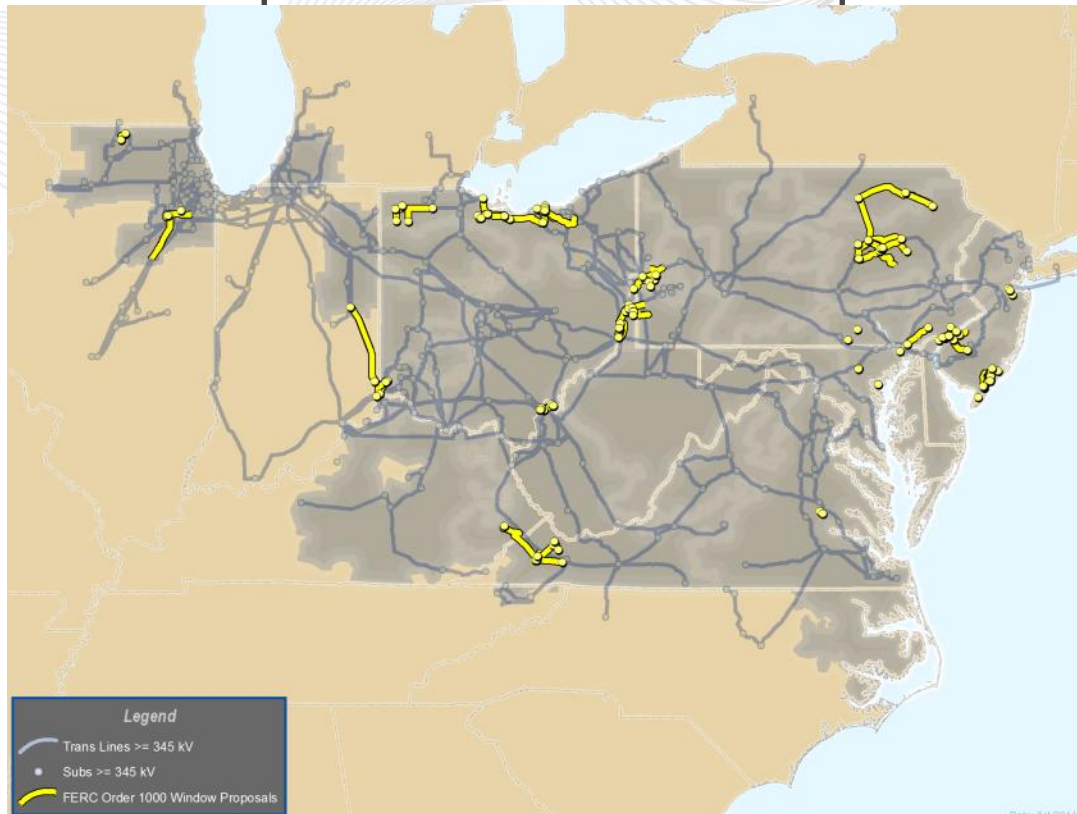




- Transmission Owner Upgrade is a Defined Term
- *“Transmission Owner Upgrade” shall mean an upgrade to a Transmission Owner’s own transmission facilities, which is an improvement to, addition to, or replacement of a part of, an existing facility and is not an entirely new transmission facility.*

# 2014 RTEP Proposal Window #1 Proposals

- Approximately 50 individual facilities with reliability criteria violations
  - Approximately 112 flow gates are identified
- 15 proposing entities
- 106 proposals
  - 46 Transmission Owner Upgrades
    - Cost range of \$0.02M to \$139.2M
  - 60 Greenfield Projects
    - Cost range of \$10.2M to \$1,367M
- 18 target TO zones
- Proposals span 10 States
  - DE, IL, IN, KY, MD, NJ, OH, PA, VA, WV

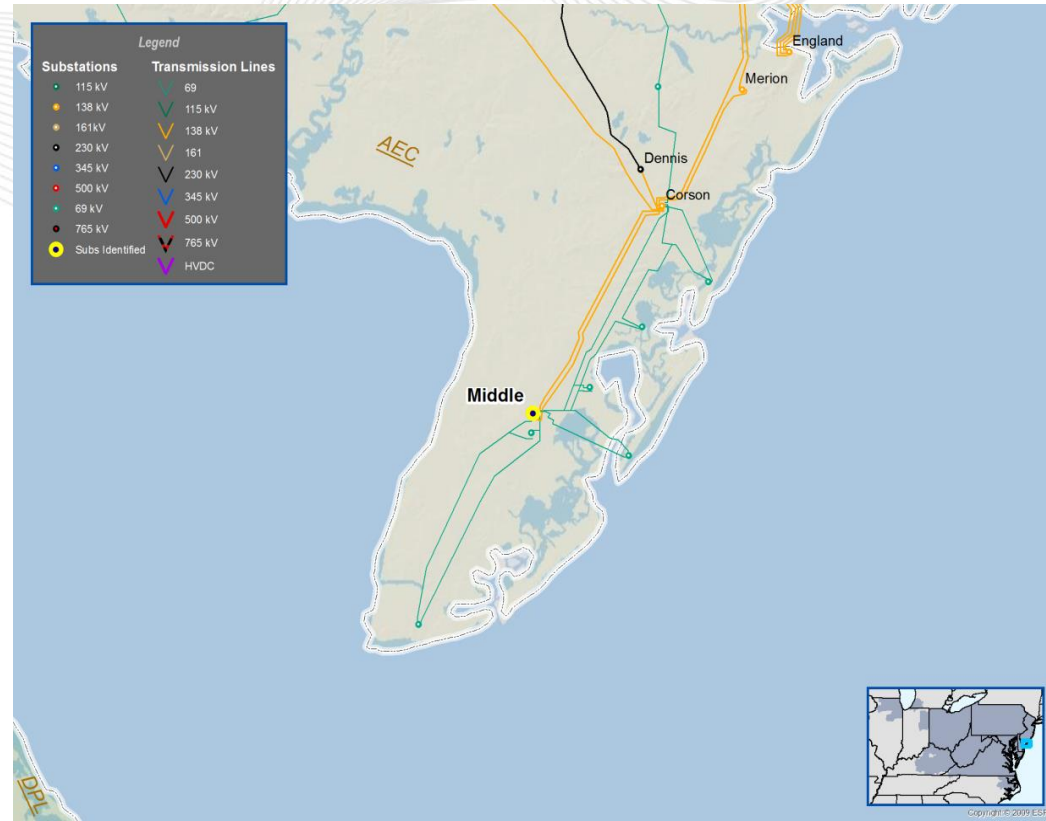


- PJM continues to evaluate the proposed projects
- Based on the work done to date proposals fall into the following high level categories
  1. Preliminary recommended solutions
  2. Retirement/At Risk related (reliability violations will be re-evaluated pending the status of the retirement/at risk generation)
  3. FSA generation related (reliability violations will be re-evaluated pending the status of the planned generation)
  4. Technical evaluation is on-going as necessary to develop a preliminary recommended solution

- As part of the evaluation, PJM considered the 15-year analysis results when making preliminary recommendations to check if a more robust solution would be needed due to that test
- The 15-year analysis results did not indicate a need for more robust preliminary recommendation solutions

- In the AE zone, only 1 transmission facility violation is unrelated to generation retirements or planned FSA generation
  - Middle 138/69 kV transformer #1 overload
- One project solution was submitted to address this violation
- 7 additional facilities in the AE zone are identified as being potentially overloaded and are related to generation retirements
  - PJM does not intend to recommend upgrades to these facilities at this time
  - The need to upgrade these facilities will be re-visited if the status of the generation changes

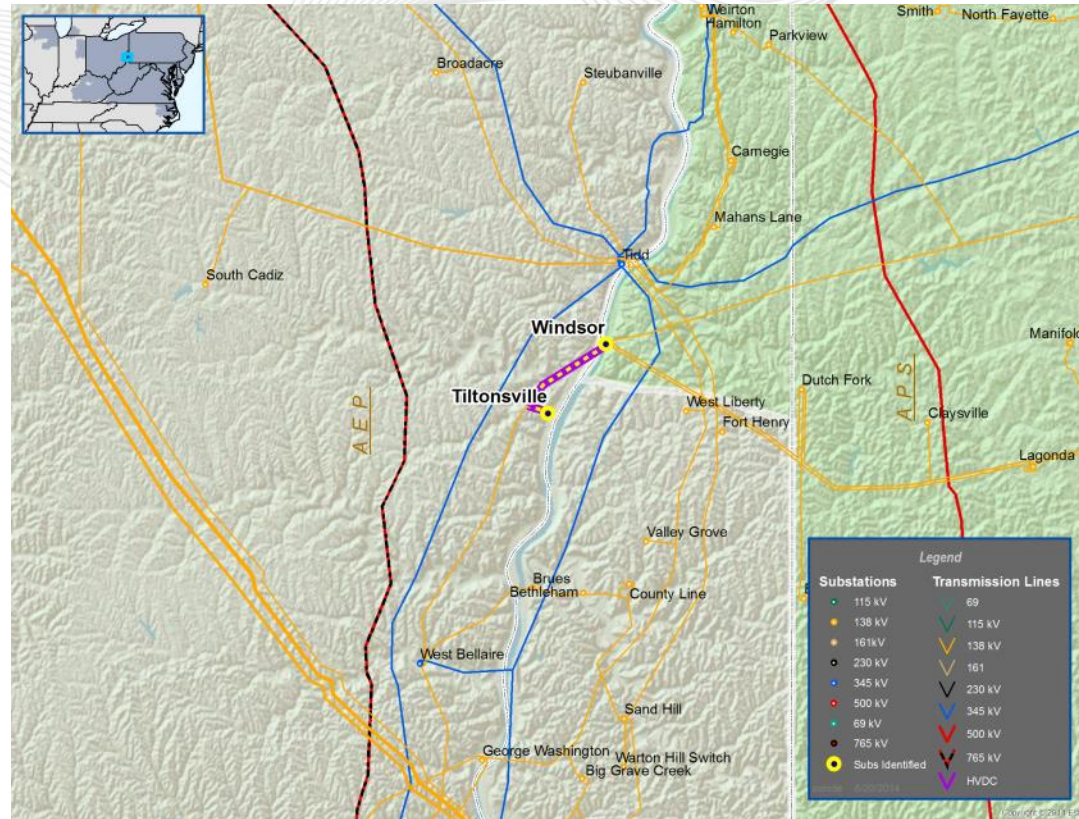
- **Common Mode Outage Violation (FG # New 1)**
- The Middle 138/69 kV transformer #1 is overloaded for line stuck breaker contingency loss of the BL England – Middle Tap – Corson and Corson – Dennis 138 kV circuits, plus Corson 138/69 kV transformer #2.
- Alternatives considered:
  - Only one project solution was submitted: P2014\_1-12J (\$7.98M)
- Preliminary Recommended Solution:
  - Replace Middle 138/69 kV transformer #1. (P2014\_1-12J)
- Estimated Project Cost:  
\$ 7.98 M
- Expected IS Date:  
6/1/2019



- In the AEP/APS zone, two transmission facility violations are unrelated to pending generation retirements or planned FSA generation
  - Tilton – Windsor 138kV
  - Clinch River – Clinch Field 138kV
- Two project solutions were submitted to address this violation
- PJM verified that the violations are resolved by two Transmission Owner Upgrade Projects
- 8 additional facilities in the AEP/APS zone are identified as being potentially overloaded and are related to pending generation retirements
  - PJM does not intend to recommend upgrades to these facilities at this time
  - The need to upgrade these facilities will be re-visited if the status of the generation changes

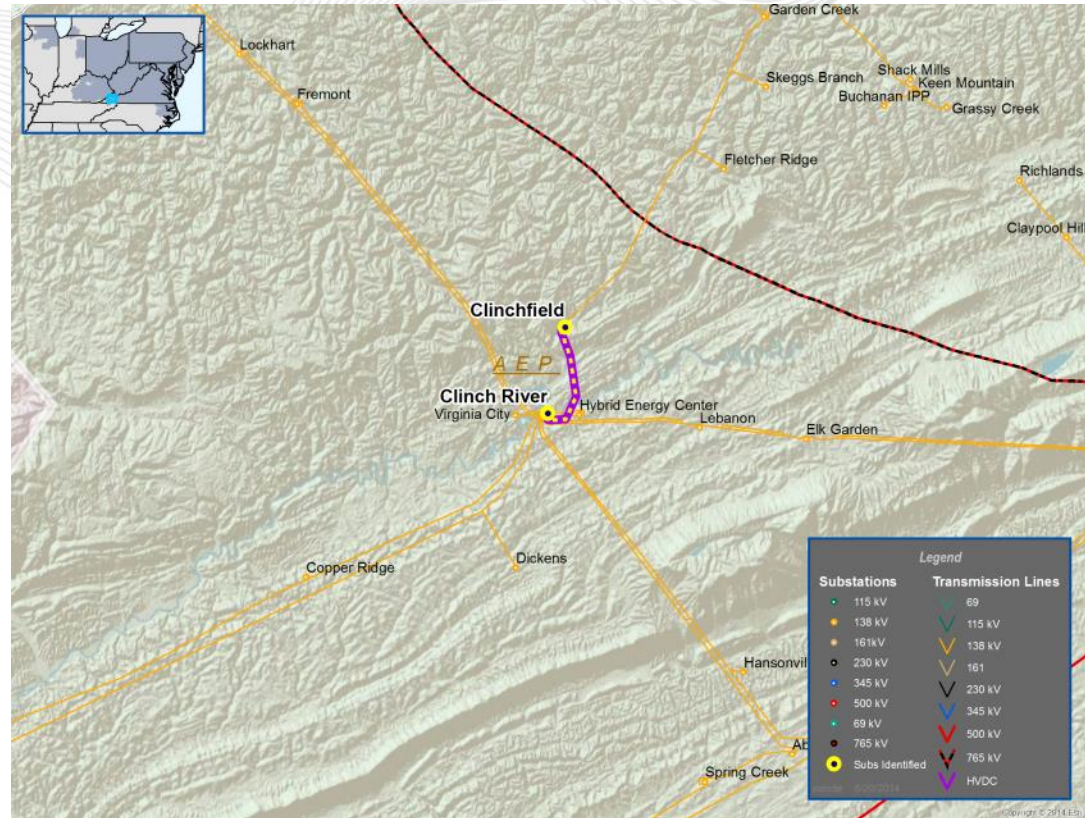


- **Baseline (FG# 133, 204, 205) and Generator Deliverability /Common Mode Outage (FG# 232, 234, 799, 1042) Violation**
- The Tilton – Windsor 138kV is overloaded for system normal and multiple contingencies.
- Alternatives considered:
  - Only one project solution was submitted: P2014\_1-2A (\$2M)
- Preliminary Recommended Solution: Reconductor 0.5 miles of Tiltonsville-Windsor 138 kV and string the vacant side of the 4.5 mile section using 556 ACSR in a six wire configuration. (P2014\_1-2A)
- Estimated Project Cost: \$2.0M
- Required IS Date: 6/1/2019





- **Common Mode Outage (FG# 794) Violation**
- The Clinch River – Clinch Field 138kV line is overloaded for the tower outage of the Clinch River – Fremont 138kV line and Clinch River – Dorton 138kV line.
- Alternatives considered:
  - Only one project solution was submitted: P2014\_1-2D (\$1.1M)
- Preliminary Recommended Solution: Install two 138 kV prop structures to increase the Maximum Operating Temperature of the Clinch River – Clinch Field 138 kV line. (P2014\_1-2D)
- Estimated Project Cost: \$1.1M
- Required IS date: 6/1/2019



- In the ATSI zone, four transmission facility violations are identified
  - Avon 345/138 kV transformer #92
  - Richland to Naomi 138 kV
  - Black River to Lorain 138 kV
  - Ottawa -Lakeview – Greenfield 138 kV
- Several project solutions were submitted to address these violations

- **Common Mode Outage (FG# 1057) Violation**

- The Avon 345/138 kV transformer #92 is overloaded for line fault stuck breaker contingency loss of Avon – Juniper 345 kV circuit and Avon 345/138 kV transformer #91.

- Alternatives Considered:

- P2014\_1-3B \$38.3M
- P2014\_1-3C \$52.4M
- P2014\_1-7G \$279.5M
- P2014\_1-9E \$5.4M
- P2014\_1-14K \$32.5M

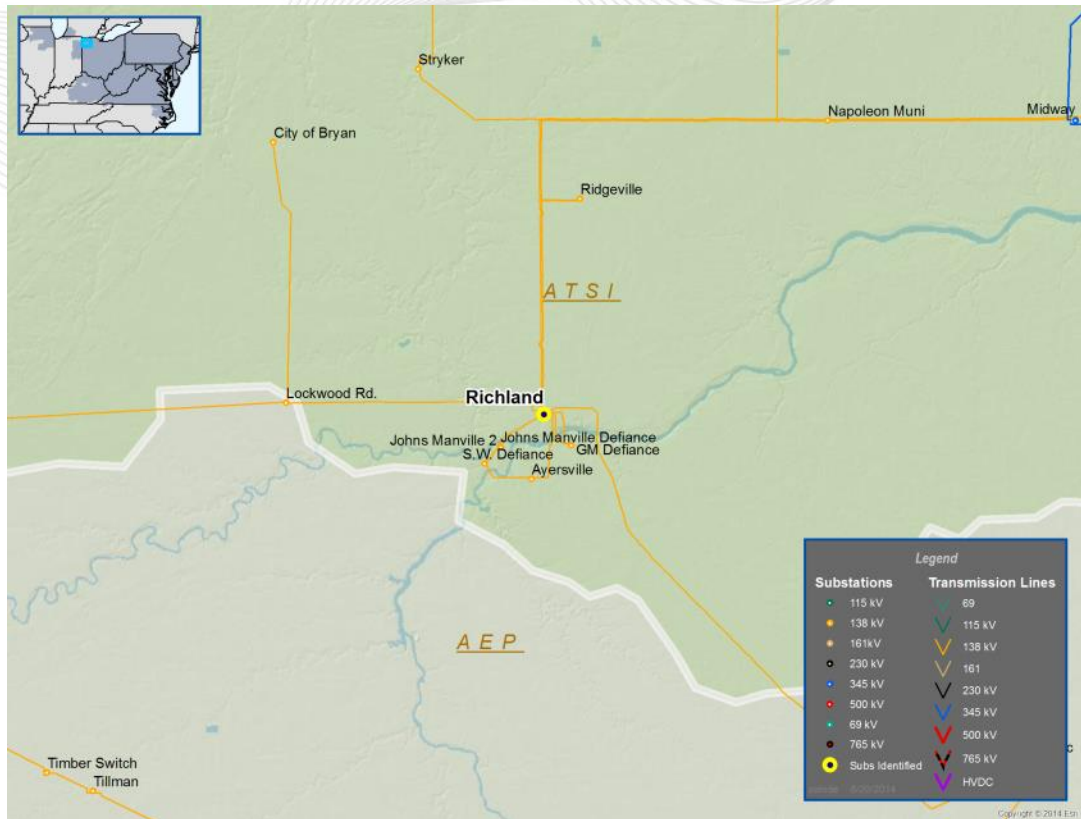
- Preliminary Recommended Solution: At Avon substation, replace the existing 345/138kV 448MVA #92 transformer with a 560MVA unit. (P2014\_1-9E)

- Estimated Project Cost: \$5.4M

- Required IS date: 6/1/2019



- **Common Mode Outage (FG# 720) Violation**
- The Richland to Naomi 138 kV circuit is overloaded for bus contingency loss of the Richland 138 kV bus section.
- **Alternatives Considered:**
  - P2014\_1-3D \$19M
  - P2014\_1-3E \$10.2M
  - P2014\_1-7H \$66.1M
  - P2014\_1-9H \$0.02M
- **Preliminary Recommended Solution:** Close normally open switch A13404 to create a Richland J Bus - Richland K Bus 138kV line. (P2014\_1-9H)
- **Estimated Project Cost:** \$0.02M
- **Required IS date:** 6/1/2019





- **Baseline (FG# 99, 100, 101) and Common Mode Outage (FG# 754, 918, 919, 920, 921) Violation**
- The Black River to Lorain 138 kV circuit is overloaded for multiple category C contingencies.
- Alternatives Considered:
  - P2014\_1-3B \$38.30M
  - P2014\_1-3C \$52.4M
  - P2014\_1-7G \$279.5M
  - P2014\_1-9F \$9.6M
  - P2014\_1-14K \$32.50M
- Preliminary Recommended Solution: Reconductor the Black River-Lorain 138kV line and upgrade Black River and Lorain substation terminal end equipment.(P2014\_1-9F)
- Estimated Project Cost: \$9.6M
- Required IS date: 6/1/2019

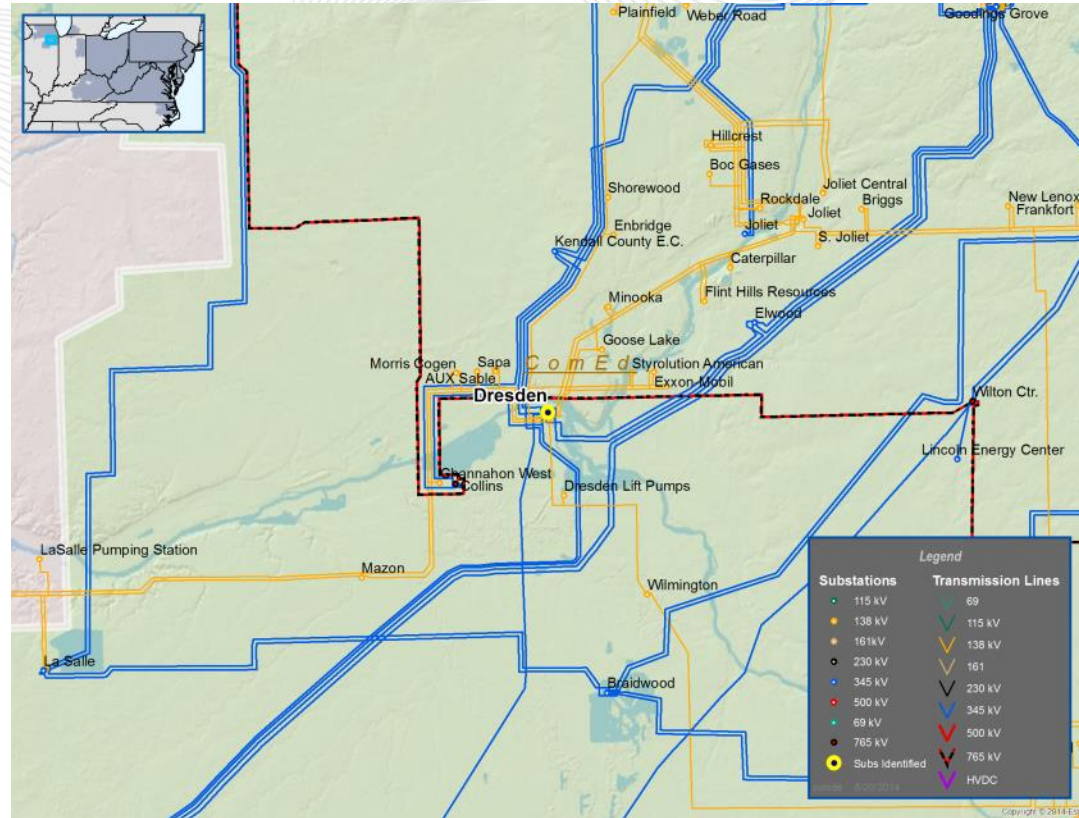


- **Common Mode Outage (FG# 790, 802) Violation**
- The Ottawa -Lakeview – Greenfield 138 kV circuit is overloaded for tower contingency loss of the Dave Besse – Lemoyne and Dave Besse – Beaver 345 kV circuits.
- Alternatives considered:
  - P2014\_1-3F \$64.9M
  - P2014\_1-3G \$67.3M
  - P2014\_1-7G \$279.5M
  - P2014\_1-9G \$7.4M
  - P2014\_1-11B \$107M
  - P2014\_1-11C \$97.4M
- Preliminary Recommended Solution: Construct second 138kV line between West Fremont and Hayes substation on open tower position of the West Fremont - Groton - Hayes 138kV line. (P2014\_1-9G)
- Estimated Project Cost: \$7.4M
- Required IS date: 6/1/2019



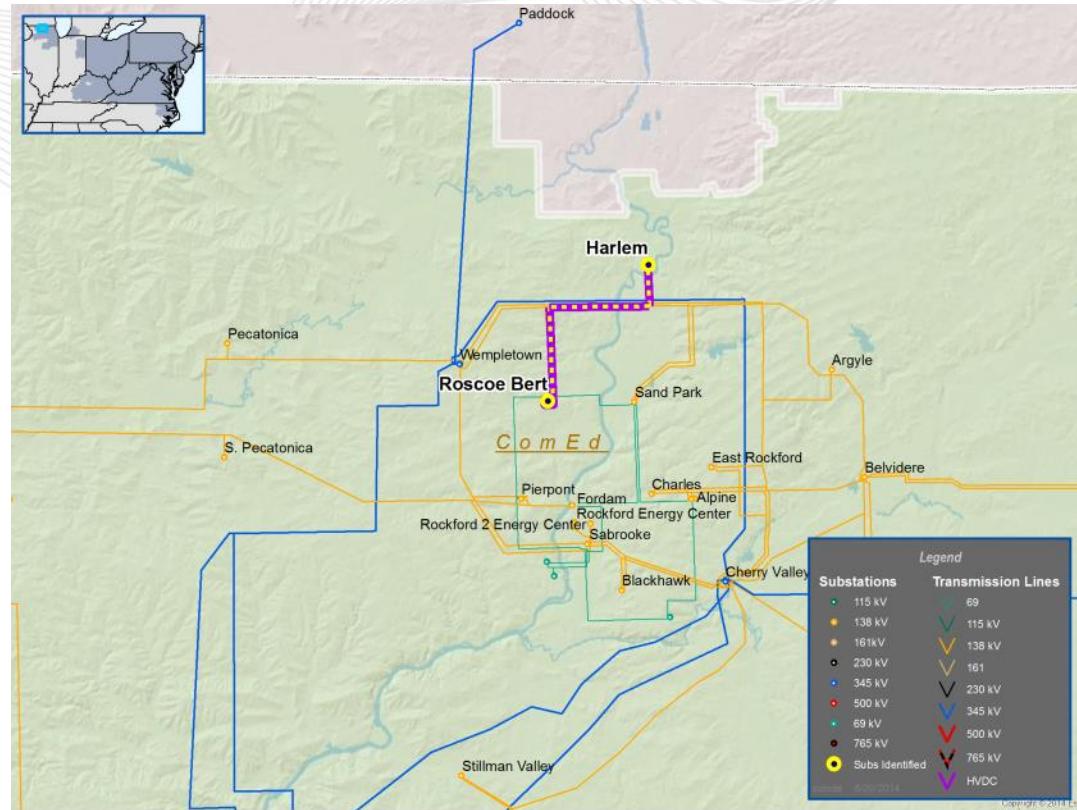
- In the ComEd zone, two transmission facility violations are identified
  - Dresden 345/138 kV transformer 83
  - Harlem to Roscoe Bert 138kV Blue line
- Several project solutions were submitted to address these violations

- **Common Mode Outage (FG# 993) Violation**
- The Dresden 345/138 kV transformer 83 is overloaded for line fault stuck breaker contingency loss of Dresden – Elwood 345 kV circuit and Elwood bus tie.
- Alternatives Considered:
  - P2014\_1-3K \$71M
  - P2014\_1-6C \$2.6M
- Preliminary Recommended Solution: Install new 345 kV circuit breaker 5-7 at Elwood substation (P2014\_1-6C)
- Estimated Project Cost: \$2.6M
- Required IS date: 6/1/2019



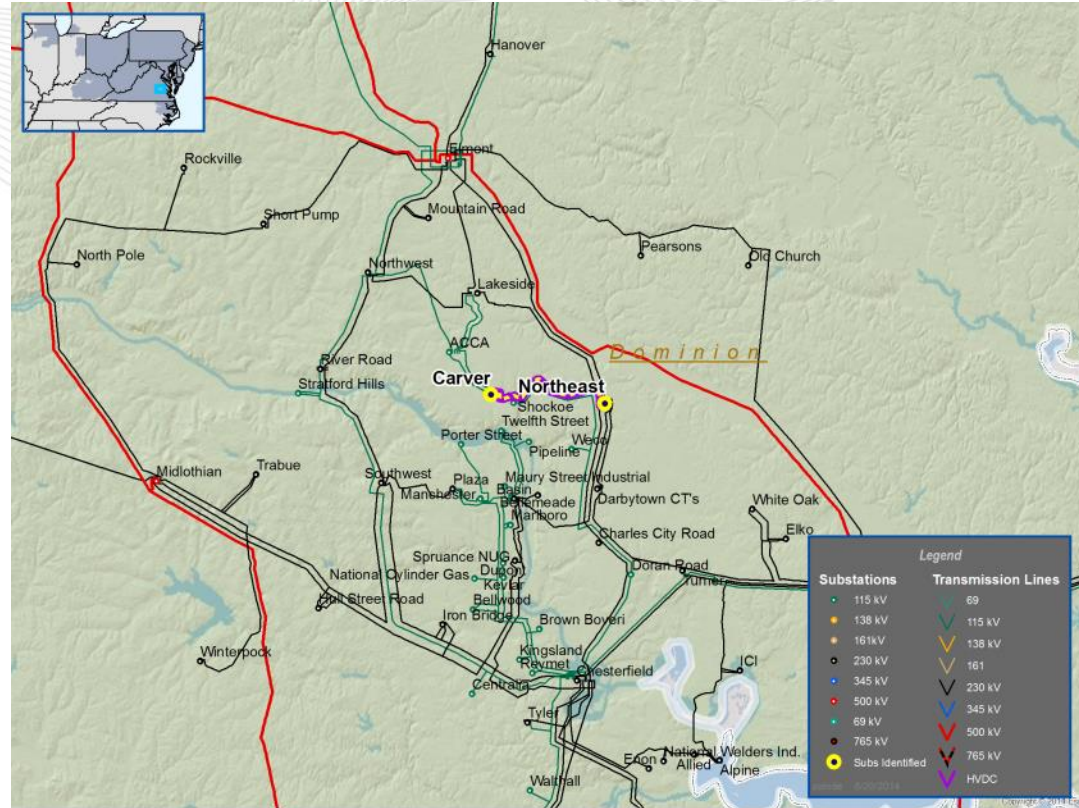


- **Baseline (FG# 175), Generation Deliverability (FG# 190) and N-1-1 (FG# 1.1, 1.5, 1.7, 2.6) Violation**
- The Harlem to Roscoe Bert 138kV Blue line is overloaded for single contingency loss of the Cherry Valley – Belvidere 138 kV circuit and for multiple contingency pairs.
- Alternatives Considered:
  - P2014\_1-6A \$4.6M
  - P2014\_1-6B \$4.7M
- Preliminary Recommended Solution :  
Remove 2.0 miles of wood poles on 138 kV line 17105, erect new steel structures, and install new 1113 kcmil ACSR conductor from Roscoe Bert to Harlem (P2014\_1-6A)
- Estimated Project Cost: \$4.6M
- Required IS date: 6/1/2019



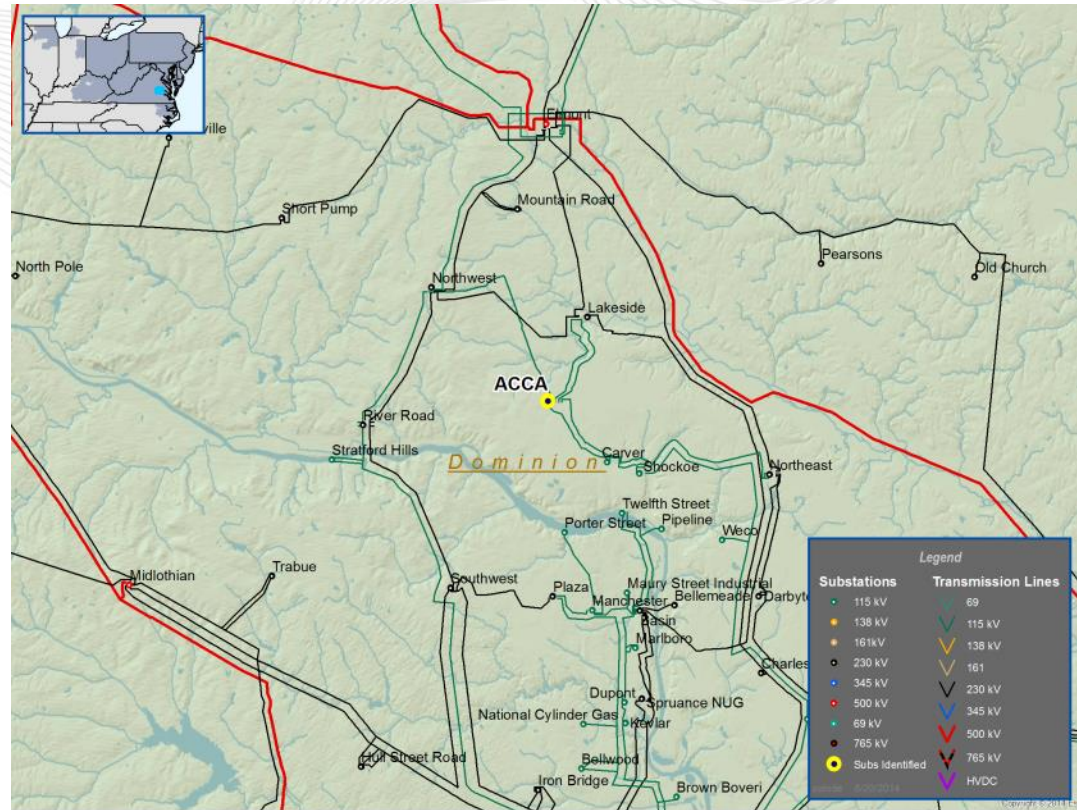
- In the Dominion zone, two transmission facility violations are identified
  - Northeast to Carver 115 kV
  - ACCA to Herm 115 kV
- Two project solutions were submitted to address these violations

- **Baseline (FG# 429) and Generation Deliverability (FG# 320) Violation**
- The Northeast to Carver 115 kV circuit is overloaded for single contingency loss of Northeast – Shockoe 115 kV circuit.
- Alternatives Considered:
  - Only one project was submitted
  - P2014\_1-4B \$0.04M
- Preliminary Recommended Solution: Replace Wave Trap at Carver Substation with a 2000A Wave Trap. (P2014\_1-4B)
- Estimated Project Cost: \$0.04M
- Required IS date: 6/1/2019



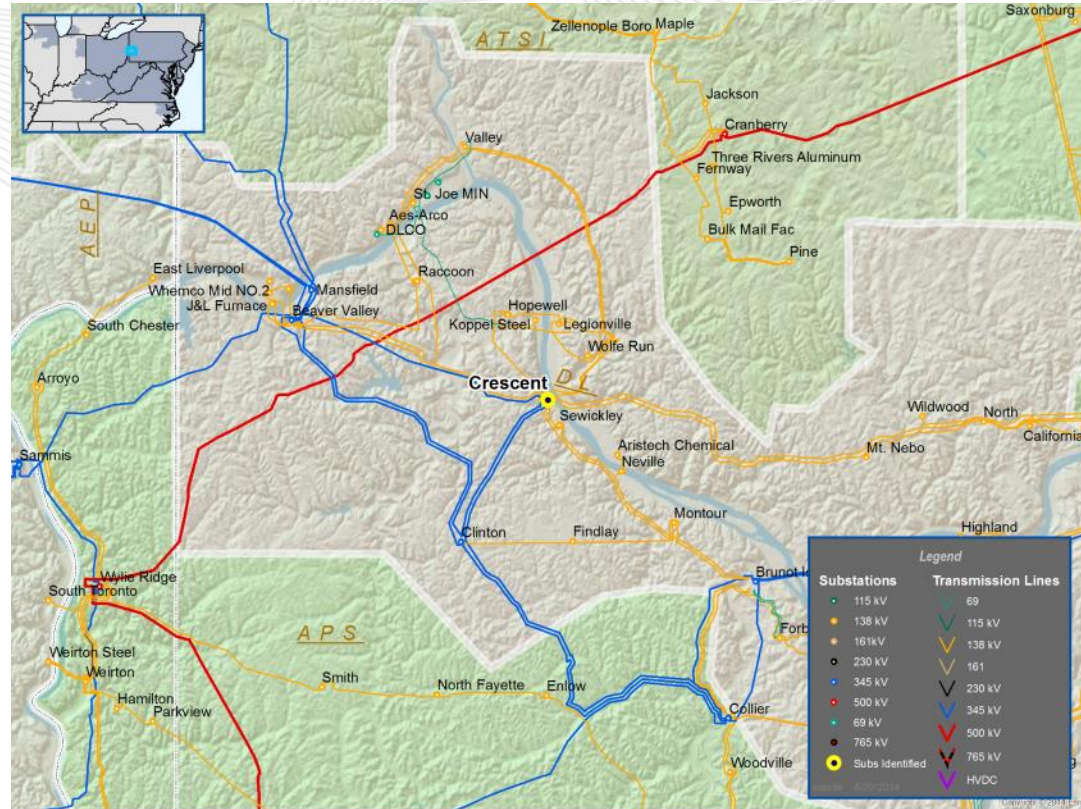


- **Baseline (FG# 366) and Generation Deliverability (FG# 289) Violation**
- The ACCA to Herm 115 kV circuit is overloaded for single contingency loss of Northeast – Shockoe 115 kV circuit.
- Alternatives Considered:
  - Only one project was submitted
  - P2014\_1-4A \$1.82M
- Preliminary Recommended Solution: Reconductor 1.41 miles of existing line between Acca and Hermitage and upgrade associated terminal equipment. (P2014\_1-4A)
- Estimated Project Cost: \$1.82M
- Required IS date: 6/1/2019



- In the Duquesne zone, two transmission facility violations are identified
  - Crescent 345/138 kV transformers #1 and #2
- Several project solutions were submitted to address these violations

- **Baseline (FG# 195, 196, 197) and Generation Deliverability (FG# 719, 1108, 1109) Violation**
- The Crescent 345/138 kV transformers #1 and #2 are overloaded for multiple category C contingencies.
- Alternatives Considered:
  - P2014\_1-3J \$30.8M
  - P2014\_1-10A \$7.285M
  - P2014\_1-11E \$45.4M
  - P2014\_1-14A \$50.1M
- Preliminary Recommended Solution: Operate with the Crescent # 3 - 345/138kV autotransformer in-service by replacing eight (8) overdutied 138kV breakers at Crescent and three (3) 138kV breakers at Beaver Valley and install a # 1 section 345kV breaker for the 331 circuit at Crescent. (P2014\_1-10A)
- Estimated Project Cost: \$7.285M
- Required IS date: 6/1/2019



- In the DEOK zone, one transmission facility violation is identified
  - Miami Fort - Willey 138 kV
- Several project solutions were submitted to address these violations



- **Baseline (FG# 124) and Common Mode Outage (FG# 1037) Violation**

- The Miami Fort - Willey 138 kV circuit is overloaded for line fault stuck breaker contingency loss of the Miami Fort – Clifty Creek, Miami Fort – Hebron Tap, Miami Fort – Midway, Miami Fort – Morgan 138 kV circuits and one of the Miami Fort 345/138 kV transformer.

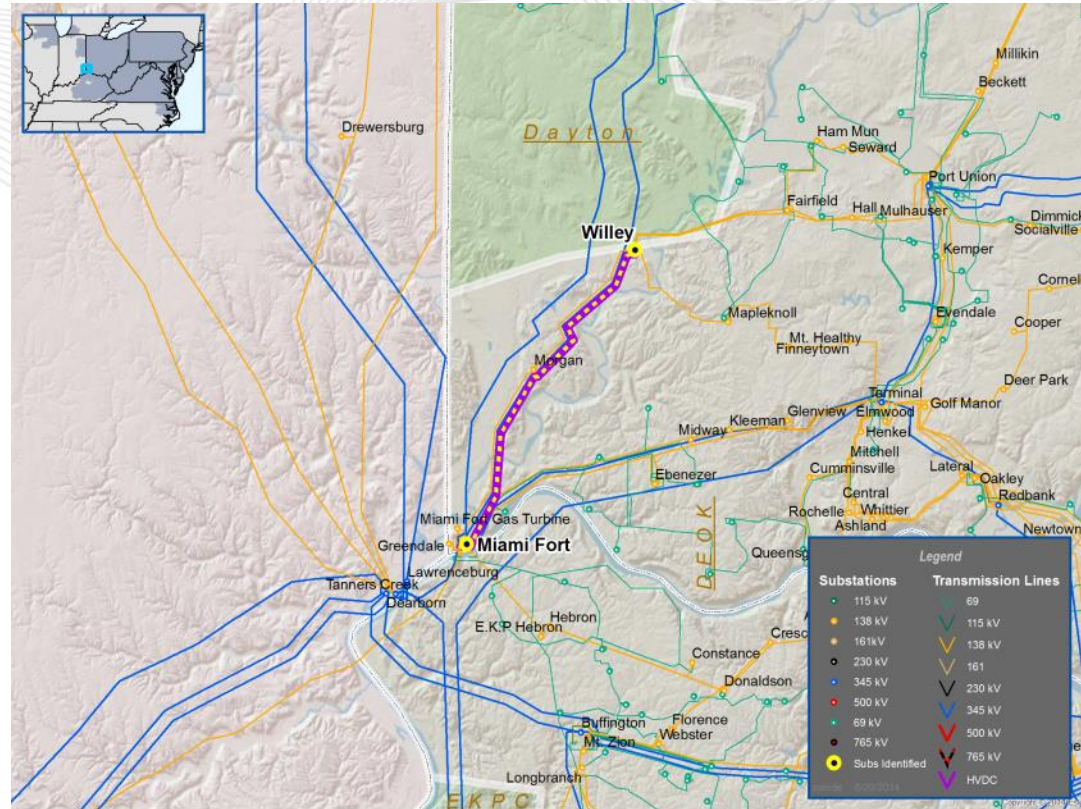
- Alternatives Considered:

- P2014\_1-1A \$2M
- P2014\_1-1B \$20M
- P2014\_1-14F \$32M
- P2014\_1-3H \$34.1M

- Preliminary Recommended Solution: Add two breakers at Miami Fort 138 kV. (P2014\_1-1A)

- Estimated Project Cost: \$2M

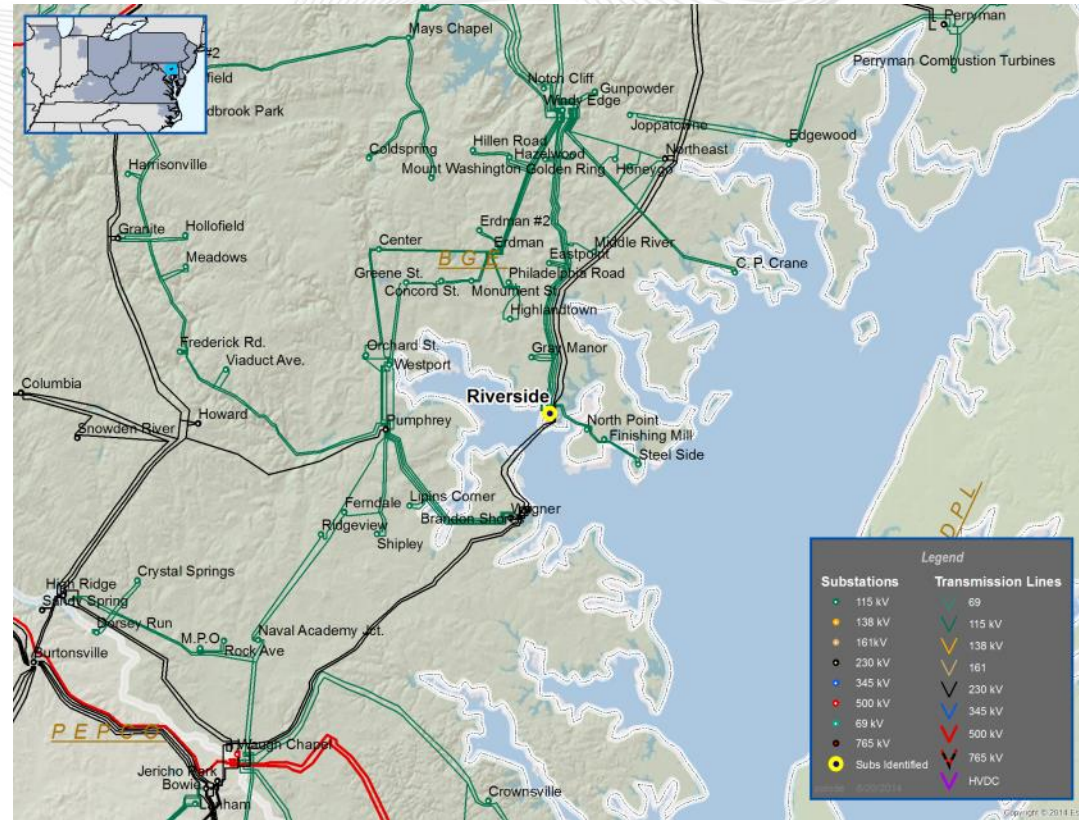
- Required IS date: 6/1/2019



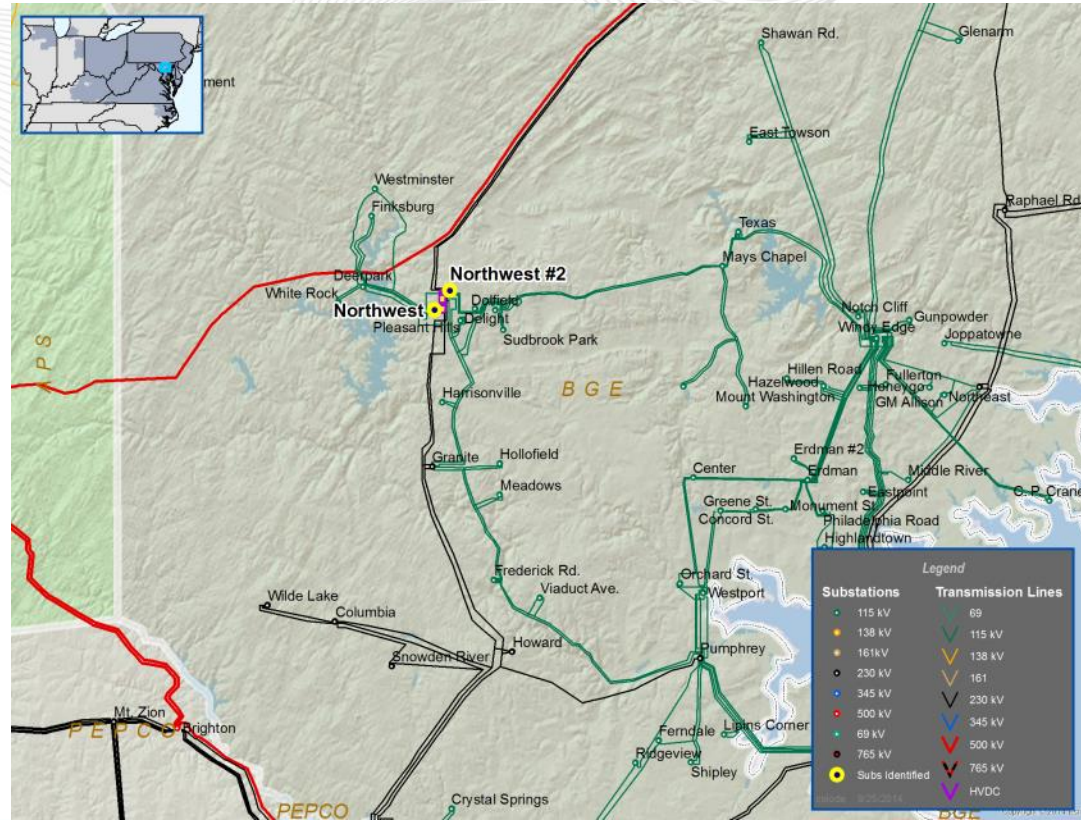


- In the BGE zone, two transmission facility violations are identified
  - Riverside 115 kV bus section
  - Northwest – Northwest #2 115kV tie circuit
- Several project solutions were submitted to address these violations

- **Baseline (FG# 222) and Common Mode Outage (FG# 1099) Violation**
- The Riverside 115 kV bus section is overloaded for line fault stuck breaker contingency loss of the Brandon Shores to Riverside 230 kV circuit '2344', Riverside 230/115 kV transformer #1 and Brandon Shores 230/115 kV transformer #2.
- Alternatives Considered:
  - P2014\_1-8A \$1.14M
  - P2014\_1-8B \$2.6M
  - P2014\_1-8C \$3.74M
- Preliminary Recommended Solution: Upgrade the Riverside 115kV substation strain bus conductors on circuits 115012 and 115011 with double bundled 1272 ACSR to achieve ratings of 491/577 MVA SN/SE on both transformer leads. (P2014\_1-8A)
- Estimated Project Cost: \$1.14M
- Required IS date: 6/1/2019



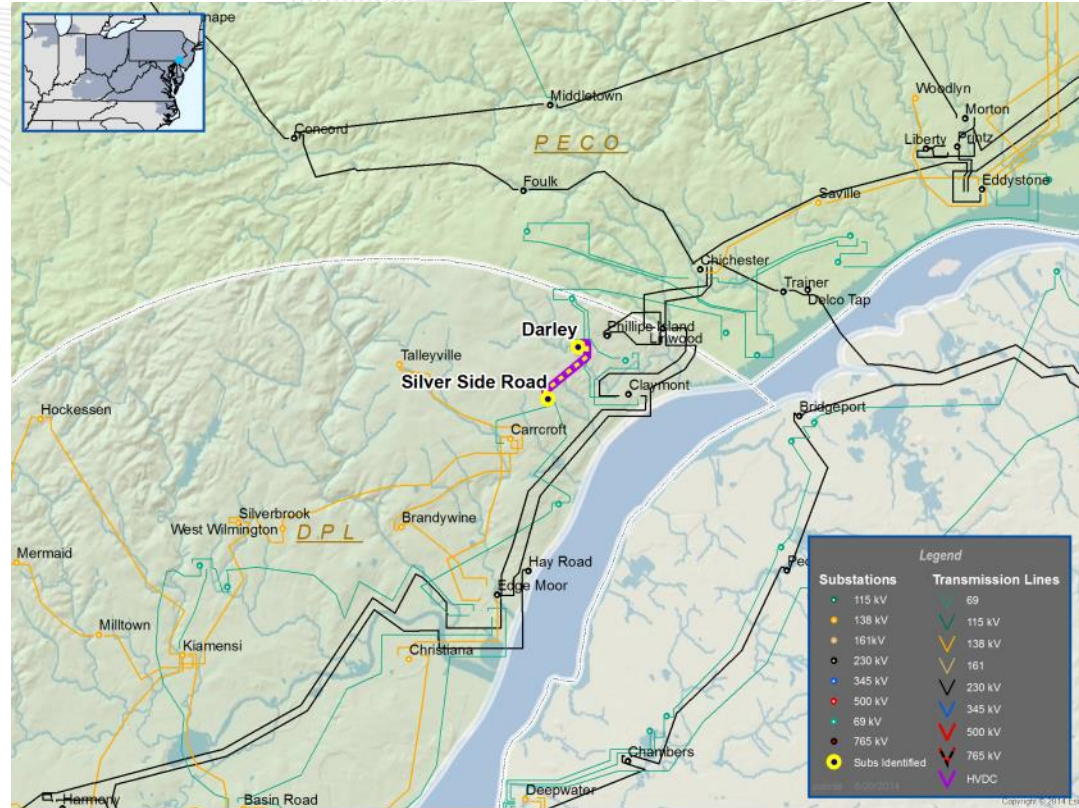
- **N-1-1 Thermal (FG# 1.8) Violation**
- Northwest – Northwest #2 115kV tie circuit is overloaded for the loss of the Northwest 230-2 transformer and the loss of the Northwest 230-3 transformer
- Alternatives Considered:
  - P2014\_1-8D \$1.2M
  - P2014\_1-8E \$2.5M
- Preliminary Recommended Solution:  
Reconductor Northwest – Northwest #2 115kV 110574 substation tie circuit with 2167 ACSR to achieve ratings of 400/462 MVA SN/SE. (P2014\_1-8D)
- Estimated Project Cost: \$1.2M
- Required IS date: 6/1/2019



- In the DPL zone, one transmission facility violation is identified
  - Silver Side Road to Darley 69 kV circuit
- One project solution was submitted to address this violation

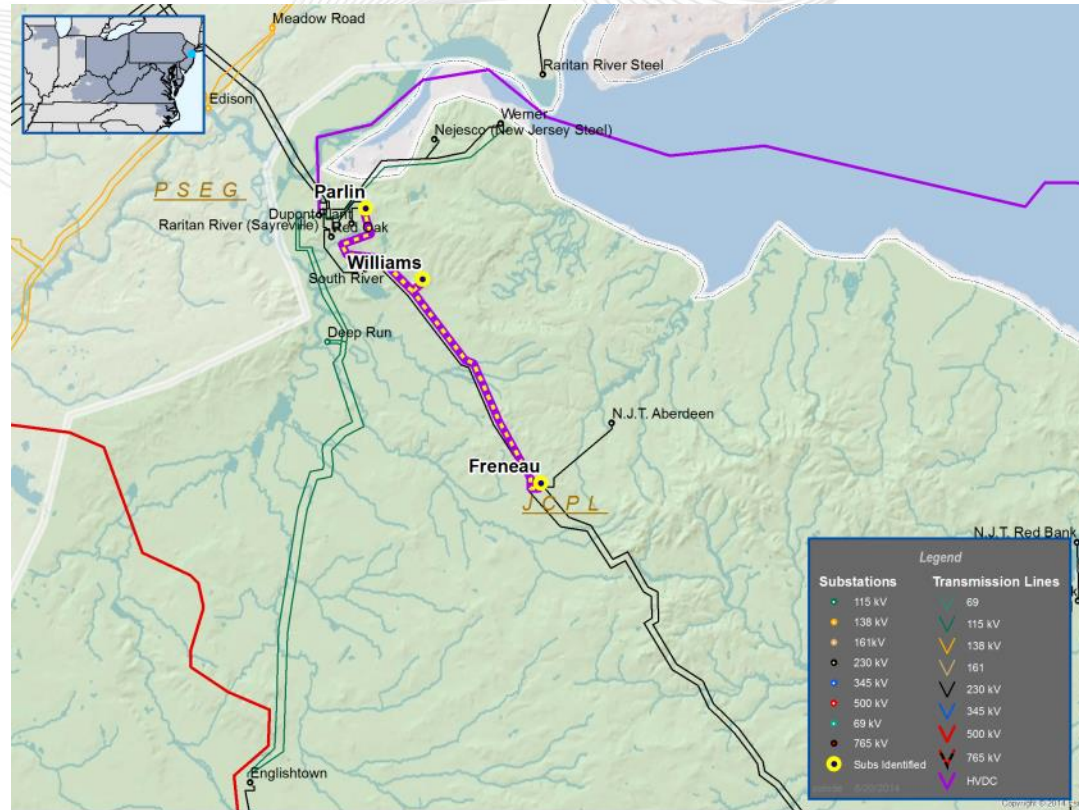


- **Common Mode Outage (FG# 804) Violation**
- The Silver Side Road to Darley 69 kV circuit is overloaded for tower contingency loss of the Edgemore – Clay and Edgemore – Linwood 230 kV circuits
- Alternatives Considered:
  - Only one project was submitted
  - 2014\_1-12K \$0.04M
- Preliminary Recommended Solution: Replace Terminal equipment at Silverside 69 kV substation. (2014\_1-12K)
- Estimated Project Cost: \$0.04M
- Required IS date: 6/1/2019



- In the JCPL zone, one transmission facility violation is identified
  - Parlin – Williams – Freneau 230 kV
- One project solution was submitted to address this violation

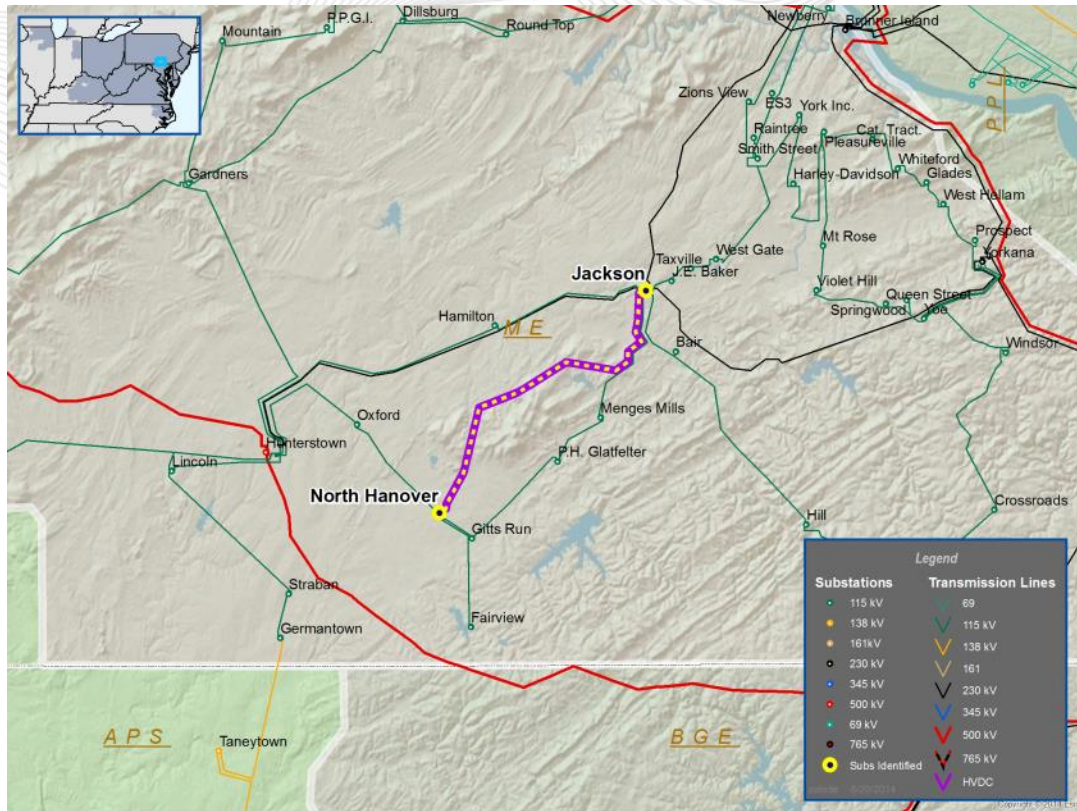
- **Common Mode Outage (FG# 843, 844, 846, 847, 1128) Violation**
- The Parlin – Williams – Freneau 230 kV circuit is overloaded for multiple tower and breaker contingencies.
- Alternatives Considered:
  - Only one project was submitted
  - 2014\_1-9D \$0.6M
- Preliminary Recommended Solution: Upgrade limiting terminal facilities at Freneau, Parlin, and Williams substations. (2014\_1-9D)
- Estimated Project Cost: \$0.6M
- Required IS date: 6/1/2019



- In the Meted zone, one transmission facility violation is identified
  - Jackson to North Hanover 115 kV
- One project solution was submitted to address this violation

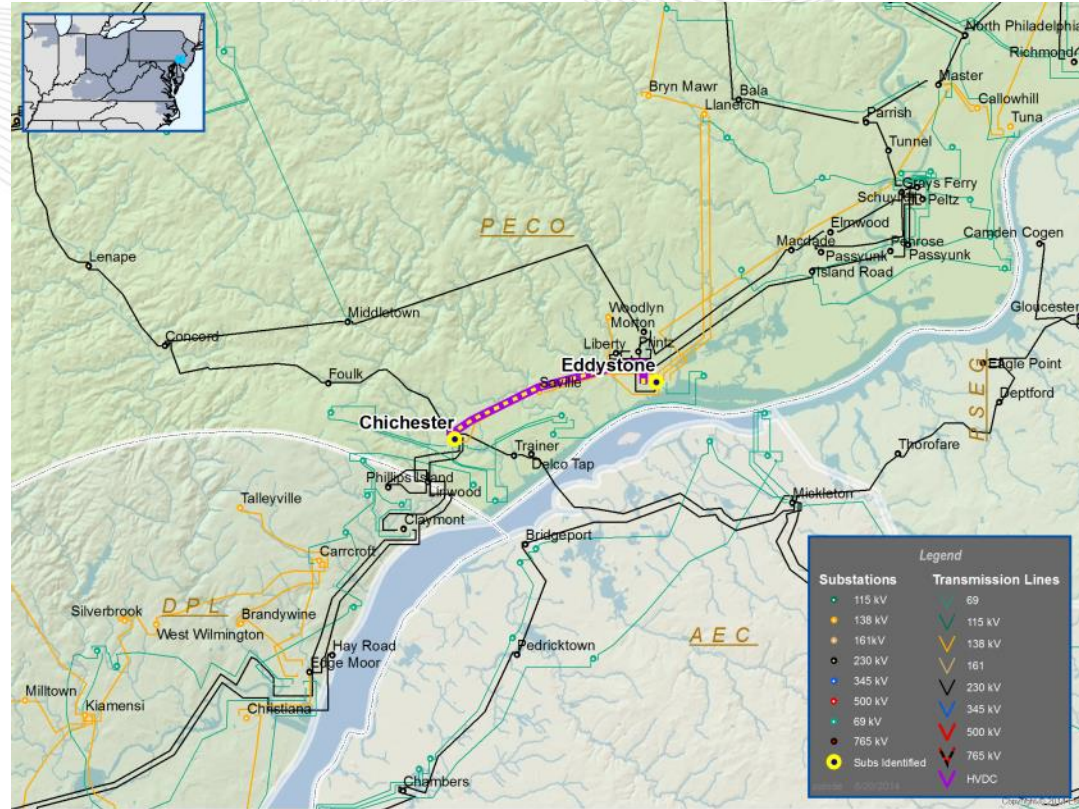


- **N-1-1 Thermal (FG# 1.1, 1.2) Violation**
- The Jackson to North Hanover 115 kV circuit is overloaded for multiple N-1-1 contingencies.
- Alternatives Considered:
  - Only one project was submitted
  - P2014\_1-9C
- Preliminary Recommended Solution: Upgrade the limiting terminal facilities at both Jackson and North Hanover. (P2014\_1-9C)
- Estimated Project Cost: \$0.1M
- Required IS date: 6/1/2019



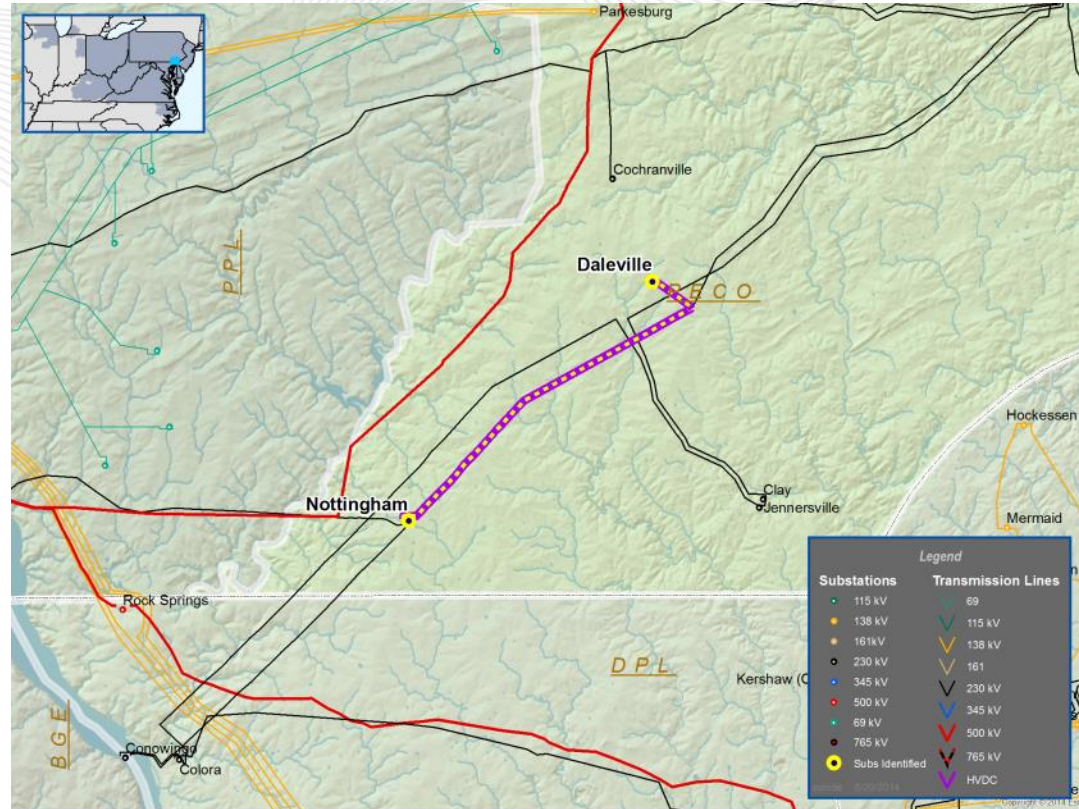
- In the PECO zone, three transmission facility violations are identified
  - Chichester to Eddystone 230 kV
  - Nottingham to Daleville 230 kV
  - Eddystone to Llanerch 138 kV
- Several project solutions were submitted to address these violations

- **Generation Deliverability (FG# 170, 171) Violation**
- The Chichester – Eddystone 230 kV circuit is overloaded for multiple single contingencies.
- Alternatives Considered:
  - P2014\_1-5A \$0.4M
  - P2014\_1-5B \$2.2M
  - P2014\_1-14B \$22.7M
- Preliminary Recommended Solution: Replace terminal equipment inside Chichester substation on the 220-36 (Chichester – Eddystone) 230 kV line. (P2014\_1-5A)
- Estimated Project Cost:\$ 0.4 M
- Required IS Date:6/1/2019

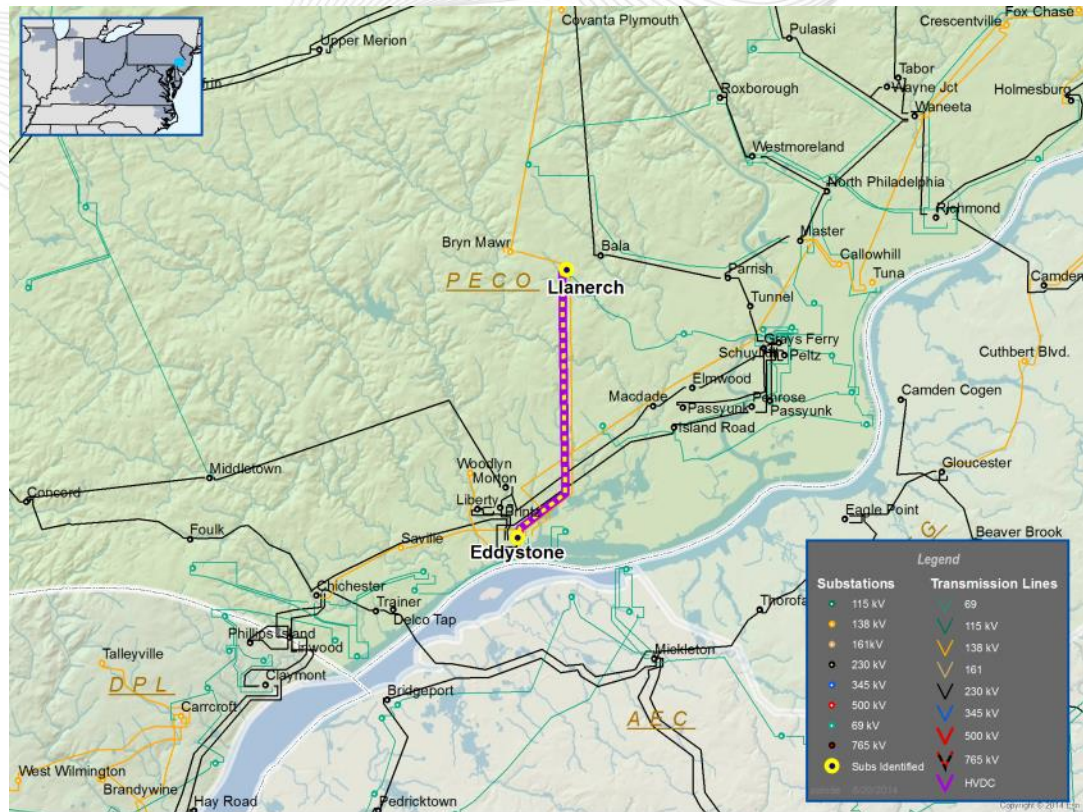




- **Generation Deliverability (FG# 315) Violation**
- The Nottingham – Daleville 230 kV circuit is overloaded for single contingency loss of Colora – Conowingo 230 kV circuit.
- Alternatives Considered:
  - P2014\_1-5C \$0.1M
  - P2014\_1-5D \$26.5M
  - P2014\_1-11D \$27.1M
- Preliminary Recommended Solution: Replace terminal equipment inside Nottingham substation on the 220-05 (Nottingham – Daleville – Bradford) 230 kV line. (P2014\_1-5C)
- Estimated Project Cost:\$ 0.1 M
- Required IS Date:6/1/2019



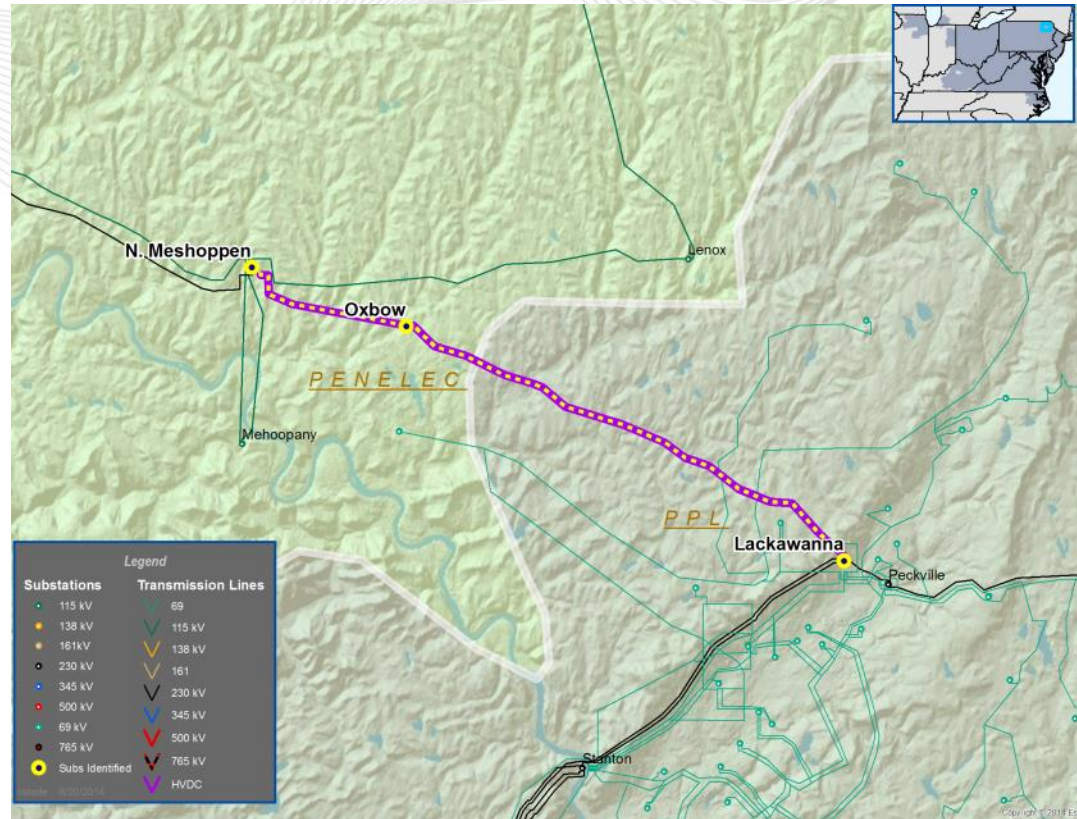
- N-1-1 (FG# 2.3) Violation
- The Eddystone to Llanerch 138 kV circuit '130-45' is overloaded for N-1-1 contingency loss of Plymouth – Brynmawr 230 kV and Eddystone to Llanerch 138 kV '130-42' circuits.
- Alternatives Considered:
  - P2014\_1-5E \$0.1M
  - P2014\_1-5F \$38.4M
  - P2014\_1-14B \$22.7M
- Preliminary Recommended Solution: Replace terminal equipment inside Llanerch substation on the 130-45 (Eddystone to Llanerch) 138 kV line. (P2014\_1-5E)
- Estimated Project Cost: \$ 0.1 M
- Required IS Date: 6/1/2019



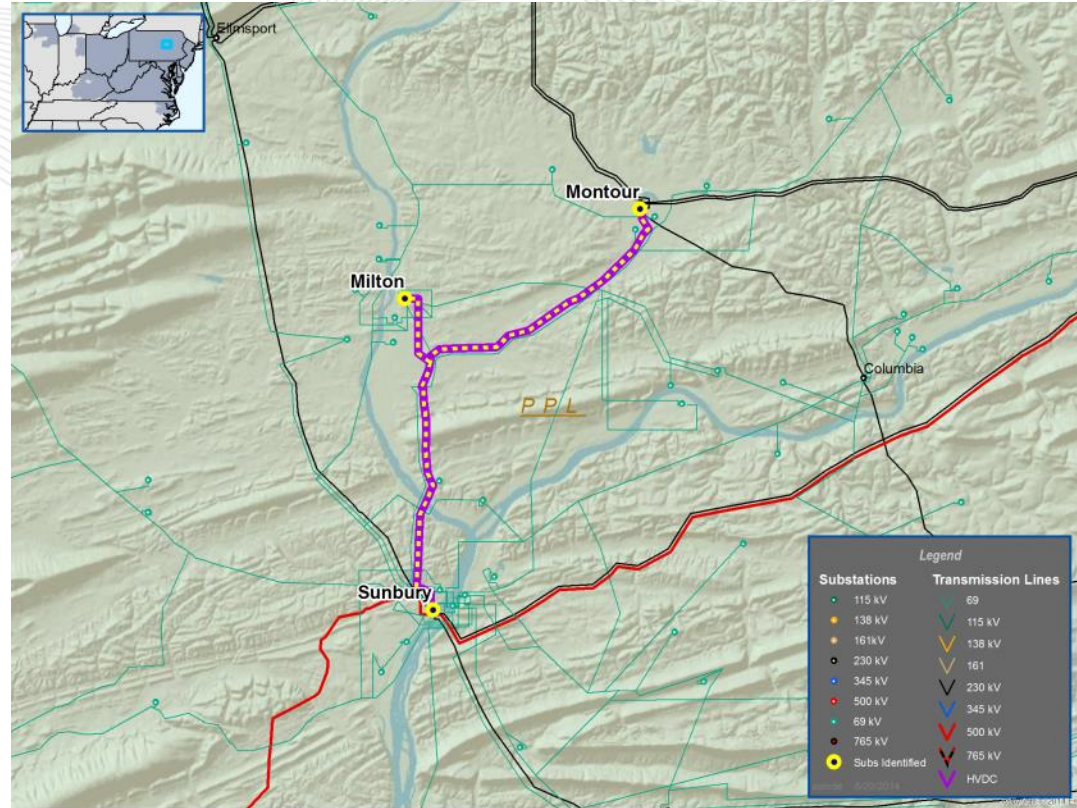
- In the PPL/Penelec zone, two transmission facility violations are identified
  - North Meshoppen to Oxbow 230 kV
  - Oxbow-Lackawanna 230 kV
- Several Project solutions were submitted to address these violations
- Solution alternatives for one additional facility are still being evaluated
  - Montour – Milton – Sunbury 230 kV circuit



- **Common Mode Outage (FG# 965, 971) Violation**
- The North Meshoppen – Oxbow - Lackawanna 230 kV circuit is overloaded for line fault stuck breaker contingency loss of Susquehanna generator # 1 and Susquehanna – Mountain 230 kV circuit.
- Alternatives Considered
  - P2014\_1-7P \$1,367M
  - P2014\_1-9A \$26.5M
  - P2014\_1-9B \$73.4M
  - P2014\_1-13A \$68.81M
- Preliminary Recommended Solution: Reconductor the North Meshoppen – Oxbow - Lackawanna 230 kV circuit and upgrade terminal equipment. (P2014\_1-9A)
- Estimated Project Cost: \$ 26.5 M
- Required IS Date: 6/1/2019



- **Common Mode Outage (FG # 797, 801) Violation**
- The Montour – Milton – Sunbury 230 kV circuit is overloaded for lower contingency loss of Montour – Susquehanna 230 kV circuits.
- **Solution Alternatives Submitted:**
  - P2014\_1-3I            \$146.4M
  - P2014\_1-4C            \$31.8M
  - P2014\_1-7I            \$139.2M
  - P2014\_1-7J            \$29.2M
  - P2014\_1-7K            \$114.1M
  - P2014\_1-7L            \$87.1M
  - P2014\_1-7M            \$102.9M
  - P2014\_1-7N            \$112.5M
  - P2014\_1-7O            \$164.2M
  - P2014\_1-7P            \$1,367M
  - P2014\_1-13B           \$55.36
  - P2014\_1-14E           \$29.8M
  - P2014\_1-14E1        \$80.9M
- PJM is in the process of evaluating these potential solution alternatives





# Future Retired Generators Related Overloads

- As noted previously, PJM identified several potential issues on facilities where the loading on the facility includes a contribution from a generator that is expected to retire prior to 2019 (i.e. the year being studied)
- Assuming the generation retires as anticipated, the loading on these facilities will be within applicable ratings.
- PJM does not intend to recommend upgrades to solve these issues at this time
- See the list of overloads in the following slides
- Retired/At Risk Generators
  - BL England (453 MW) at risk
  - Clinch River (230 MW) retiring on 6/1/2015
  - Tanner Creek (988 MW) retiring on 6/1/2015
  - Kammer (600 MW) retiring on 6/1/2015

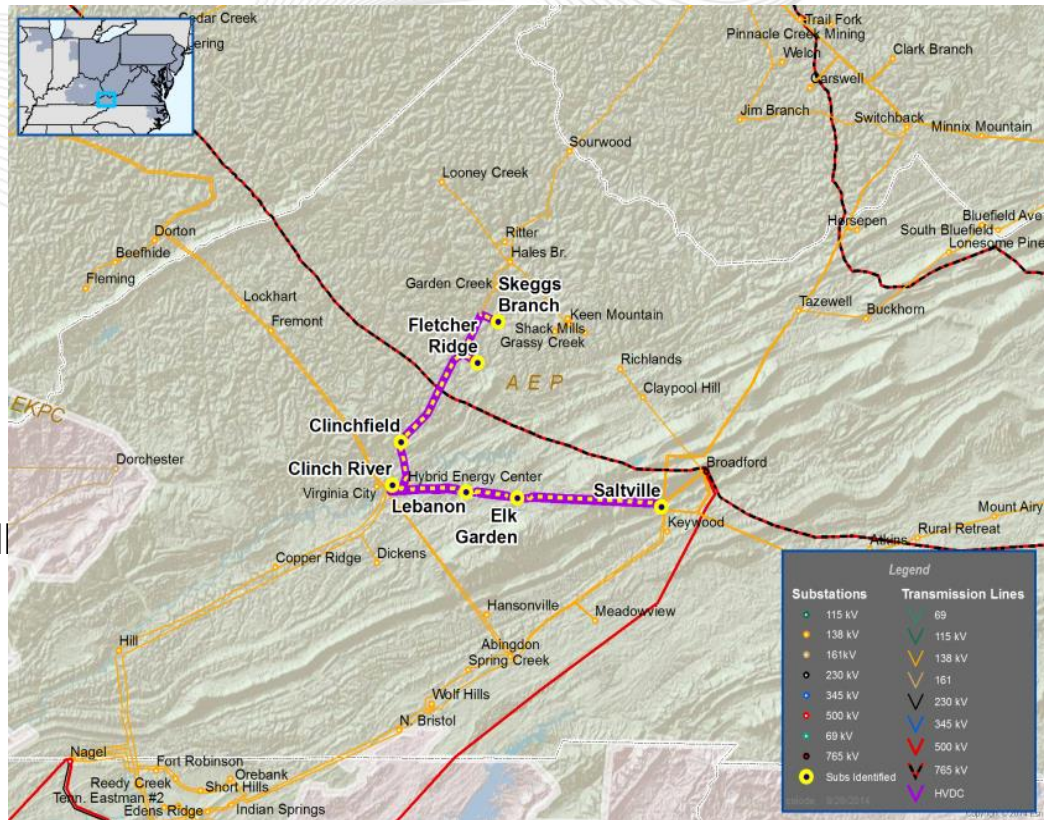
# BL England Retirement Related Overloads

- Transmission Facility Violations for various test methods
- Violations include:
  - Scull#1 to Mill#1 138kV
  - BLE to Scull#2 138kV
  - Scull#2 to Mill#2 138 kV
  - BLE to Scull#1 138 kV
  - BLE to Middle TP 138 kV
  - Mill#1 to Lewis#1 138 kV
  - Gloucstr 2 to Cuthbert 4 230 kV
- The need to upgrade these facilities will be re-evaluated if the generation does not deactivate as expected



# Clinch River Retirement Related Overloads

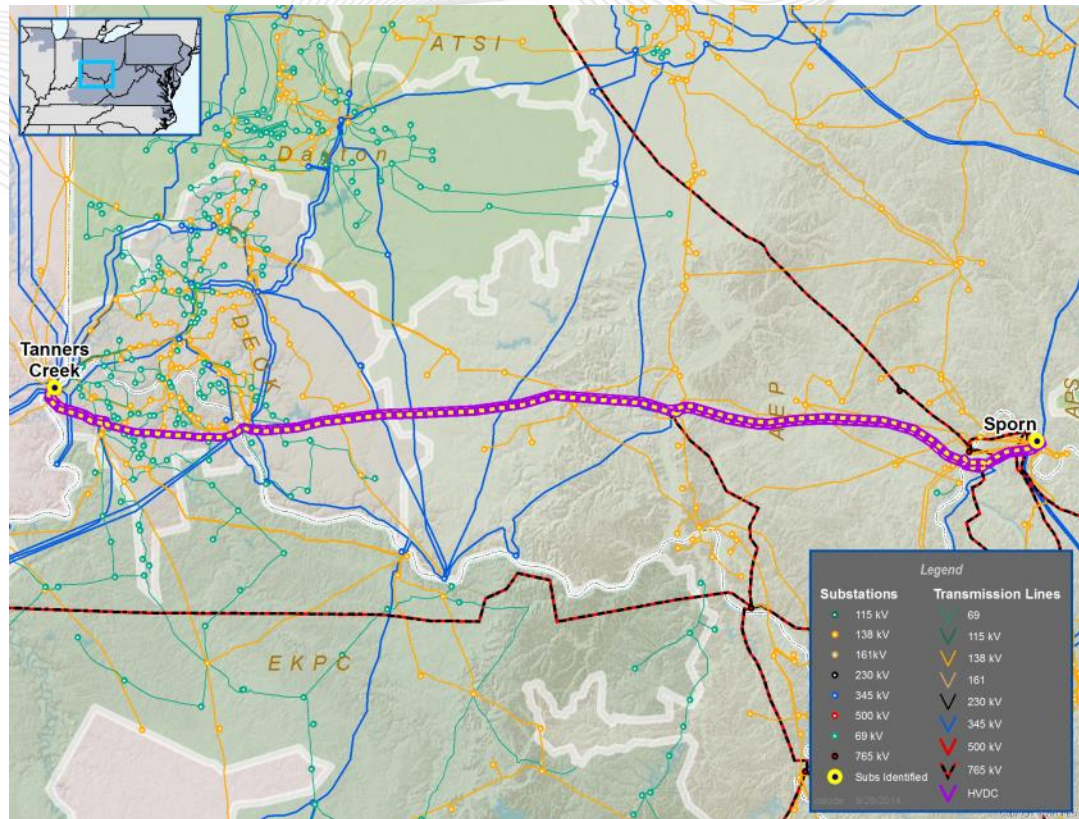
- Transmission Facility Violations for various test methods
- Violations include:
  - Elkgas to Saltv1 138 kV
  - Clinchr to Clnlfd 138 kV
  - Clnchr to Lebano 138 kV
  - Clnchr to Fletch 138 kV
  - Fletch to Skeggb 138 kV
  - Lebano to Elkgas 138 kV
- The need to upgrade these facilities will be re-evaluated if the generation does not deactivate as expected





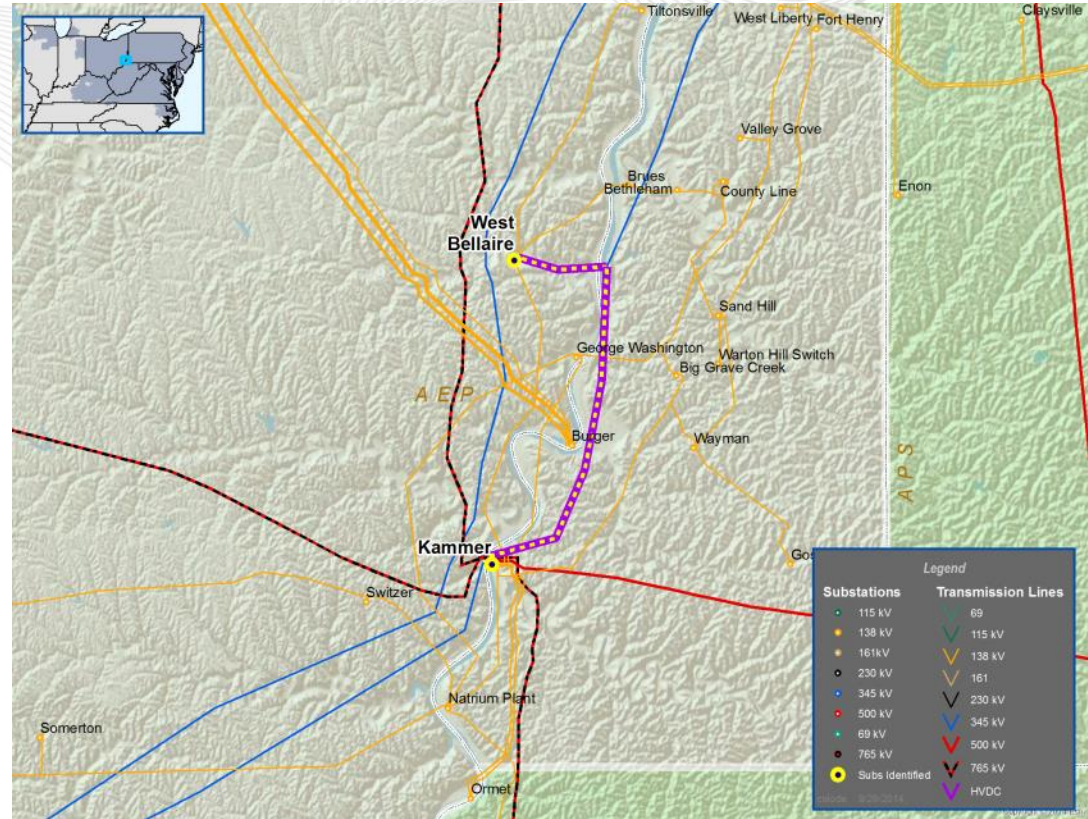
# Tanner Creek Retirement Related Overloads

- Transmission Facility Violations for various test methods
- Violations include:
  - Kyger to Sporn Ckt 2 345 kV
- The need to upgrade these facilities will be re-evaluated if the generation does not deactivate as expected



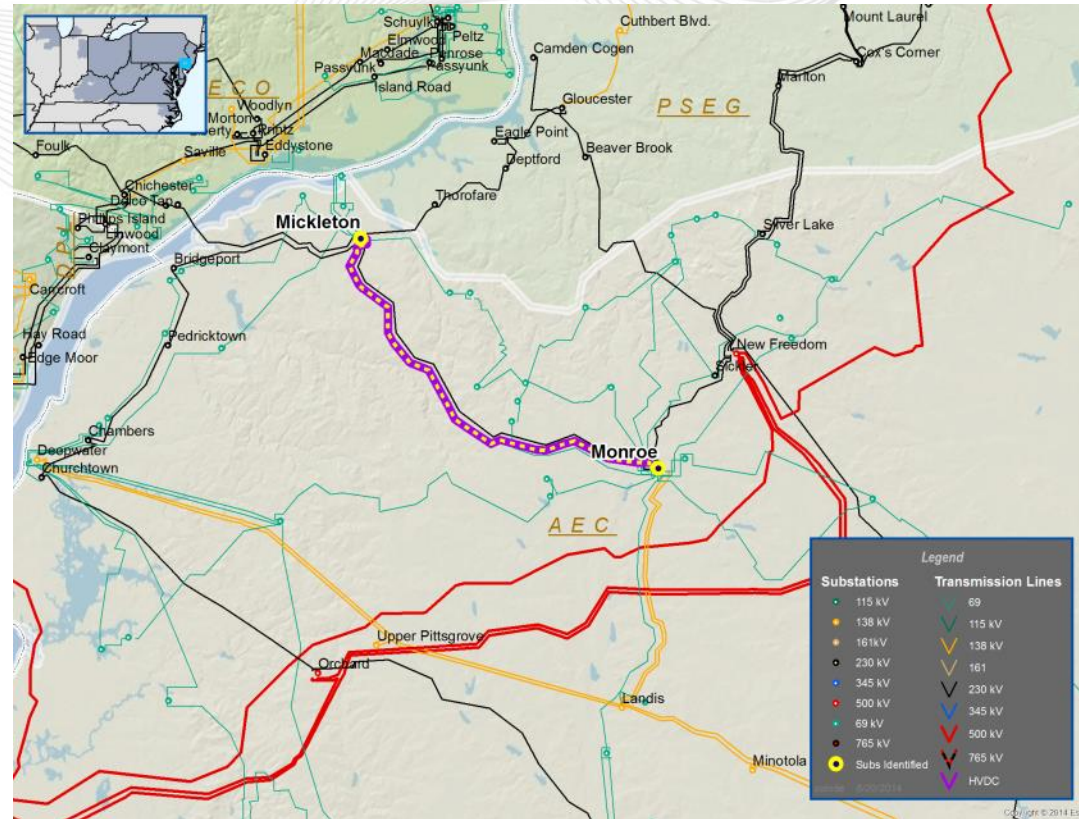
# Kammer Retirement Related Overloads

- Transmission Facility Violations for various test methods
- Violations include:
  - Kammer to Wbella 138 kV
- The need to upgrade these facilities will be re-evaluated if the generation does not deactivate as expected





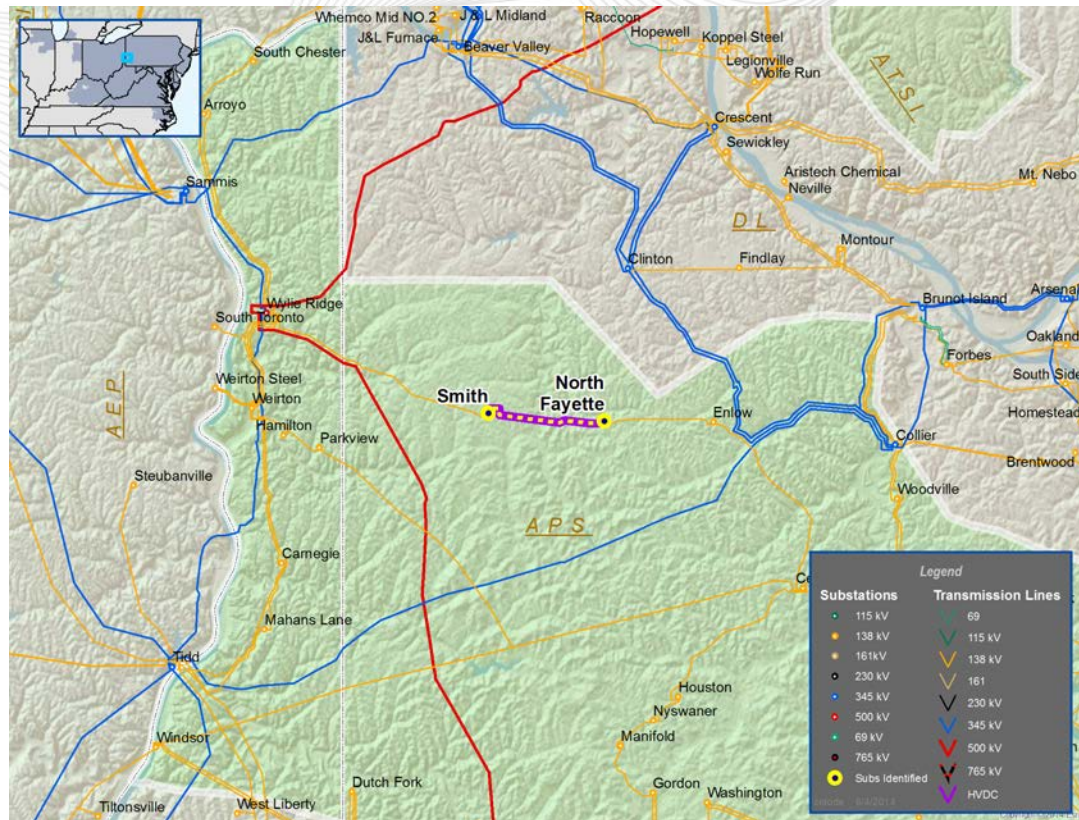
- Common Mode Outage Violation
- The Mickleton – Monroe 230 kV circuit #1 & #2 are overloaded for tower contingency loss of the Gloucester – Eagle Point and Gloucester – Deptford 230 kV circuits.
- This overload will no longer be a criteria violation if a specific PJM FSA generator withdraws from the queue
- If the queued FSA generator signs an ISA agreement, PJM will re-visit the analysis and recommend a solution if necessary



# Supplemental Projects



- Supplemental Project
- Load connection to Tap into the Smith – North Fayette 138kV line; Construct approximately 1.3 miles of 138kV line to customer dead-end and install 3 SCADA controlled 138kV switches and two 138kV meters; Install a 138kV breaker on the North Fayette terminal at Smith 138KV substation (S0736)
- Estimated Project Cost: \$3.8M
- Projected IS Date: 8/1/2015



# Light Load Analysis

- PJM has conducted preliminary Light Load Reliability analysis for the 2018 planning year
- The TOs will be sent the results in early September to do a Quality Control Check
- The preliminary results will be posted to PJM.com following the Quality Control Check
- 2018 Light Load Analysis will be included in the 2014 Proposal Window #2

- Complete Artificial Island Recommendation
- Finalize the 2019 Winter Study
- Recommend RTEP Proposal Window #1 solutions
- Conduct RTEP Proposal Window #2
- Recommend solutions to the PJM Board

Questions?

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

- **Revision History**

- Version 1: Original version posted to the PJM TEAC on 8/29/2014
- Version 2: Incorporated comments received at the 9/2/2014 TEAC meeting