# Transmission Expansion Advisory Committee

March 10, 2010

# RTEP Sensitivity Studies

- Load Sensitivity Study Ideas
  - Load forecast
    - Use different econometric projections to establish varying load forecast
    - DR and EE
      - Use state orders and projections for DR/EE
      - Vary existing DR forecasts – 33%, 66% of forecast values
- Generation Sensitivity Study Ideas
  - “At Risk” Generation
    - Generation that has not cleared in recent RPM auctions
    - Generation in a carbon constrained world
    - Revenue adequacy at risk generation
    - Generation that has been in-service for 40 years or more

- Generation Sensitivity Study Ideas
  - Renewable resource integration
    - Use data from the interconnection queue to displace “at risk” generation noted on the previous page
- Other Sensitivity Study Suggestions
  - Loop flows
  - CETO input assumption sensitivities

- Next Steps
  - Develop / refine analytic methods to test various sensitivity scenarios

- Stakeholders have suggested various alternatives to both the MAPP and PATH projects
- Alternatives will be reviewed at subsequent TEAC meetings
- Initial analytic focus will be on determining the magnitude and timing of violations

# Exelon Generation Retirements

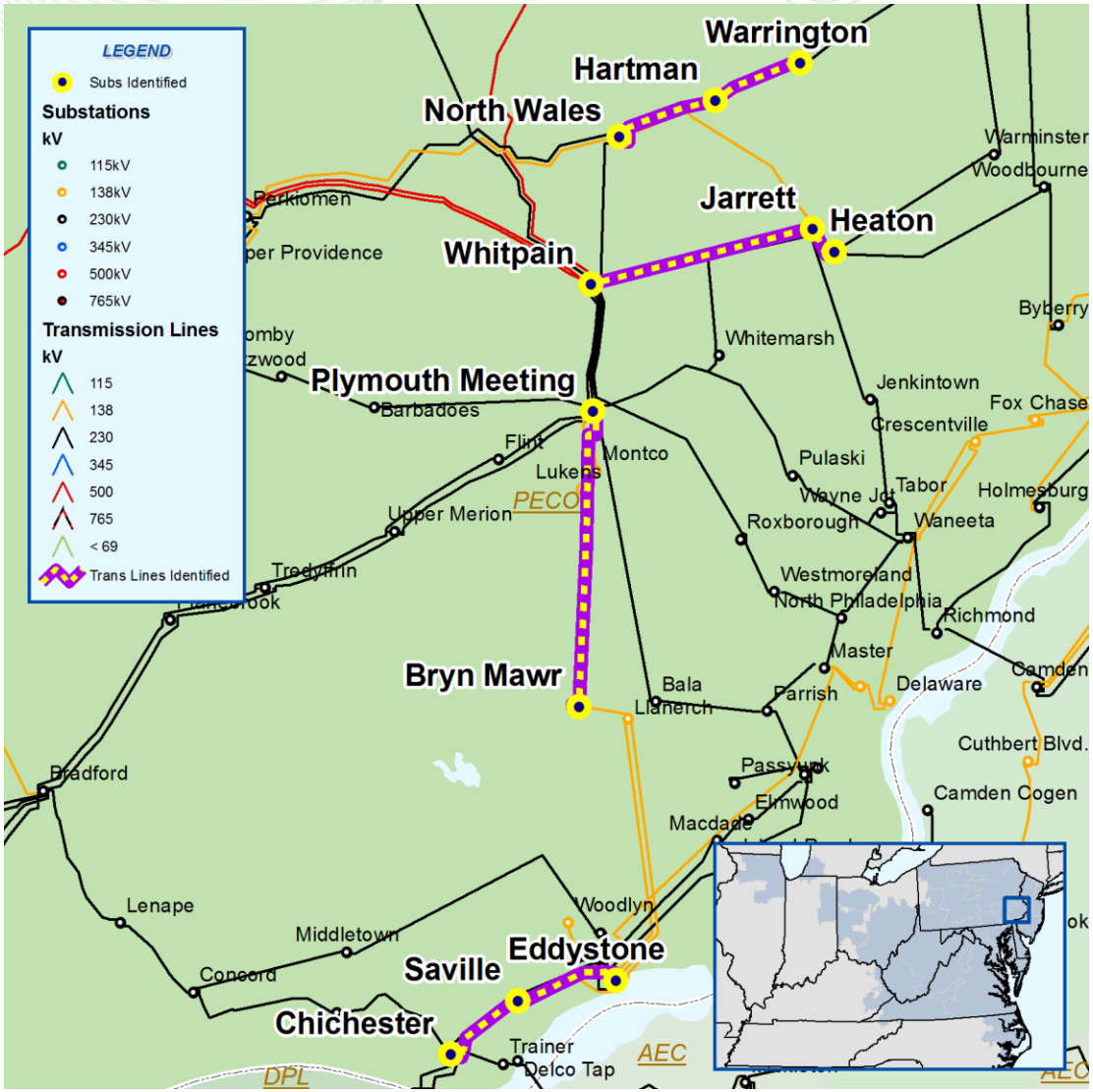
# Proposed Generation Retirement

- In December 2009 Exelon notified PJM of their intent to retire the Eddystone 1&2 units and the Cromby 1&2 units in the PECO Energy Transmission zone
- Proposed deactivation date is May 31, 2011
- PJM staff has been evaluating the impact of the proposed deactivation
- The following slides include the recommended upgrades and the expected in-service date

# PECO Transmission Zone

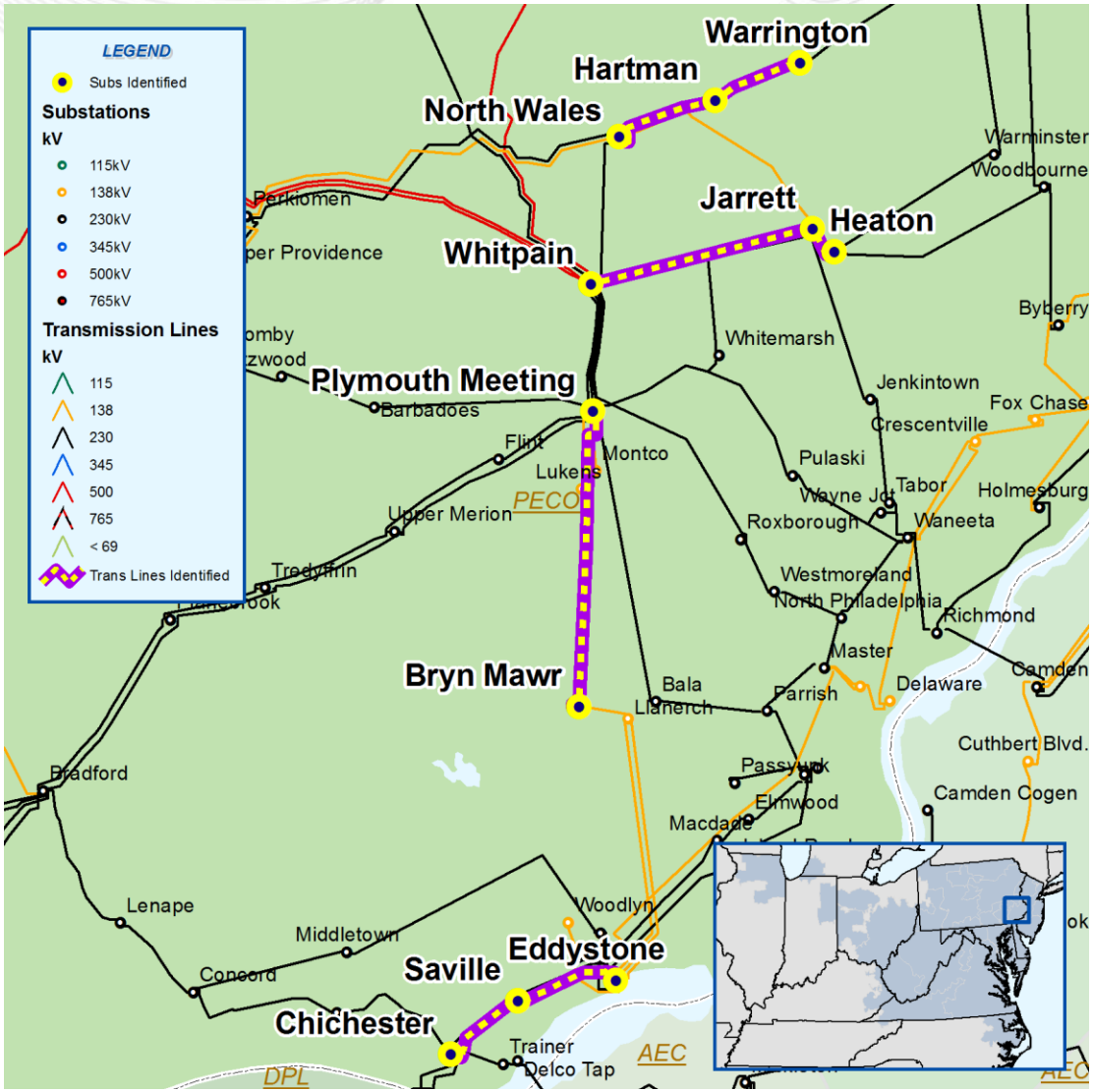
- Chichester 230/138 kV transformer / loss of Macdade – Ridley – Morton 230 kV line (220-46) + loss of Island Road – Eddystone 230 kV line (220-23)

- Recommended Solution: Add a second 230 / 138 kV transformer at Chichester. Add an inductor in series with the parallel transformers
- Estimated cost: $5.908 M
- Expected In-service: December 16, 2011



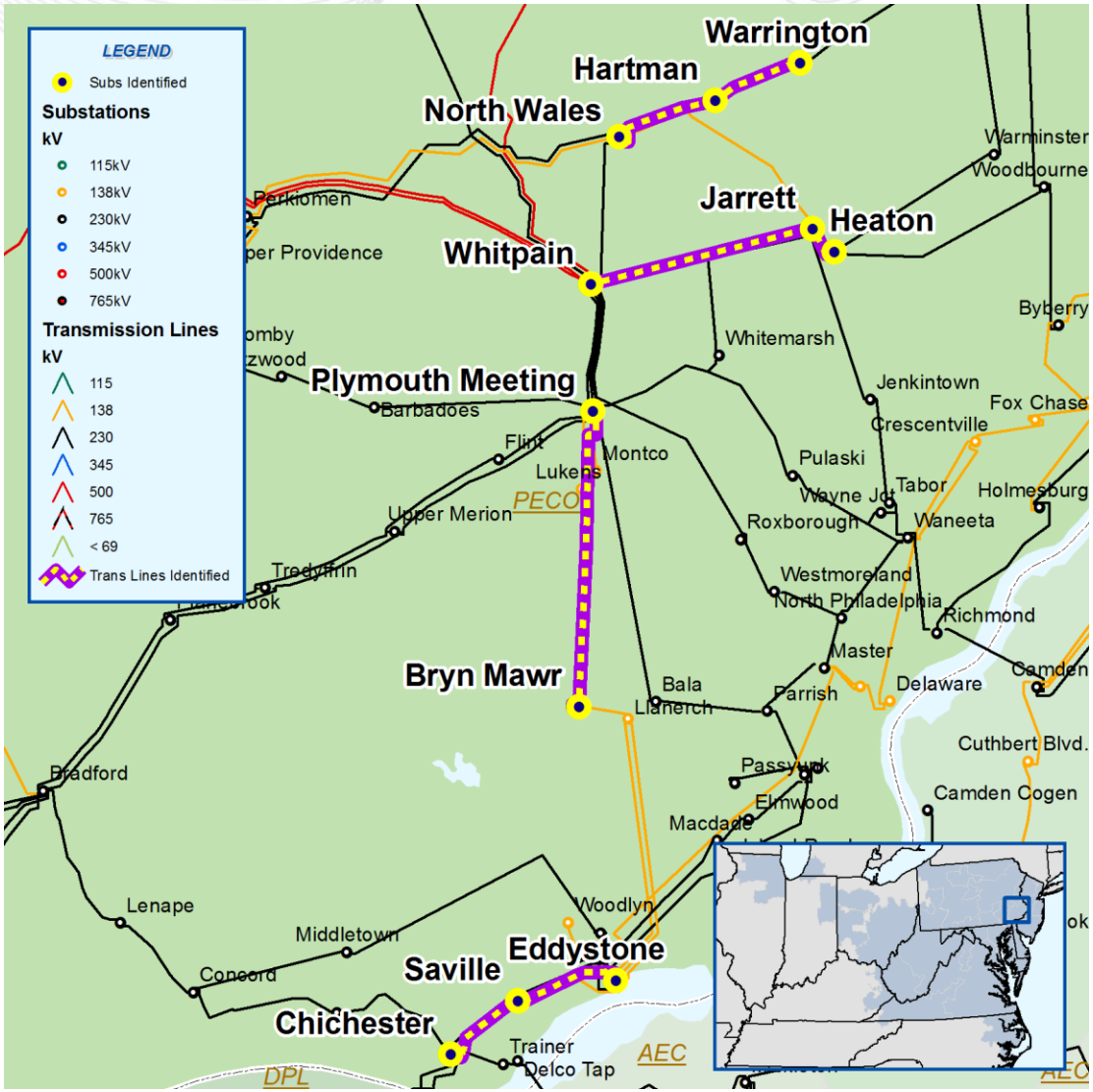
# PECO Transmission Zone

- Eddystone – Saville 138 kV line / loss of Macdade – Ridley – Morton 230 kV line (220-46) + loss of Island Road – Eddystone 230 kV line (220-23)
- Recommended Solution: Replace terminal equipment at Eddystone and Saville and replace underground section of the line
- Estimated Cost: $3.94 M
- Projected In-Service: May 27, 2011



# PECO Transmission Zone

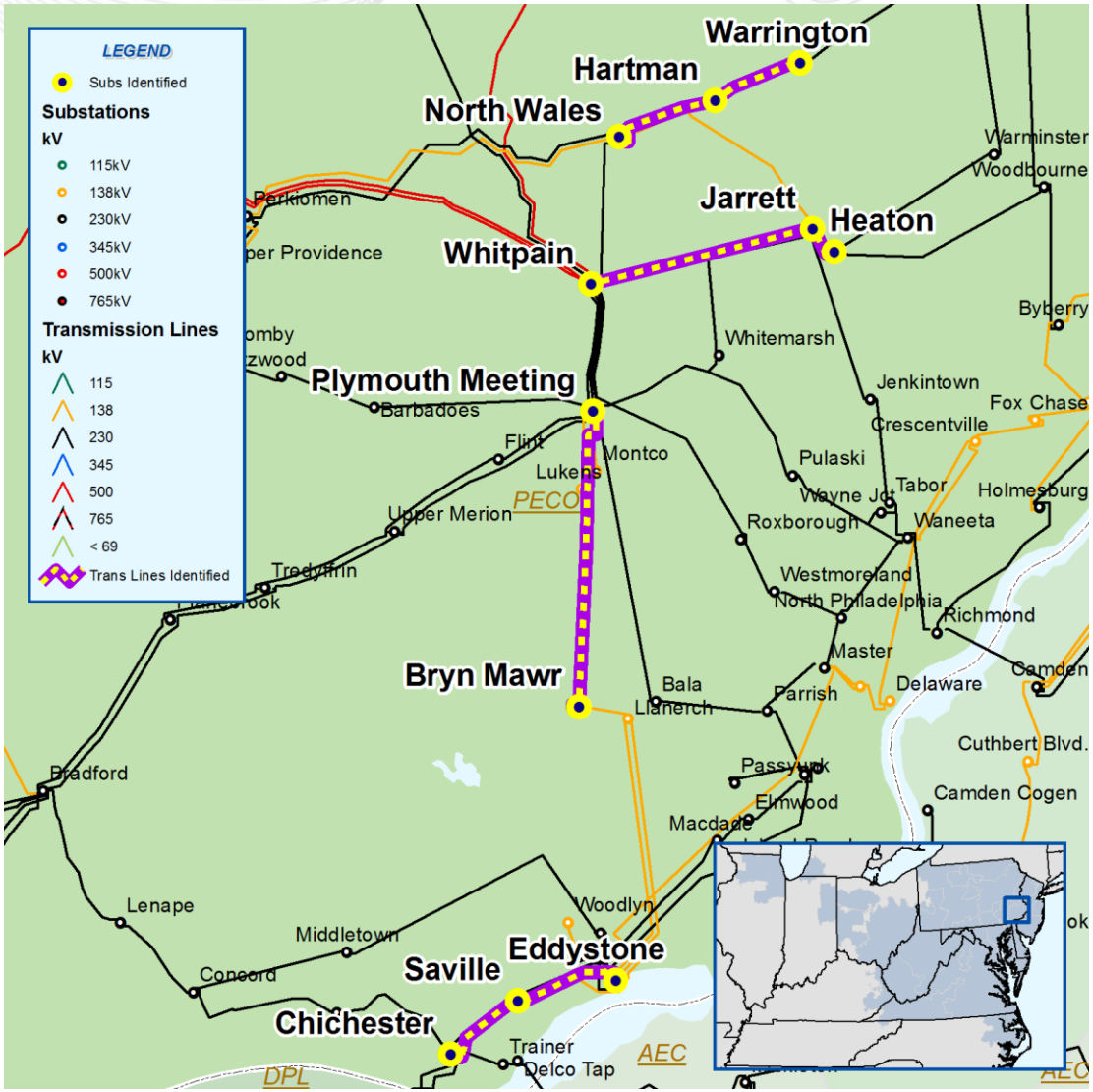
- Jarrett – Whitpain 230 kV line / loss of North Wales – Hartman 230 kV line (220-71) + Basecase
- Recommended Solution: Replace terminal equipment at Whitpain and Jarrett
- Estimated Cost: $ 0.175 M
- Projected In-Service: May 27, 2011



# PECO Transmission Zone

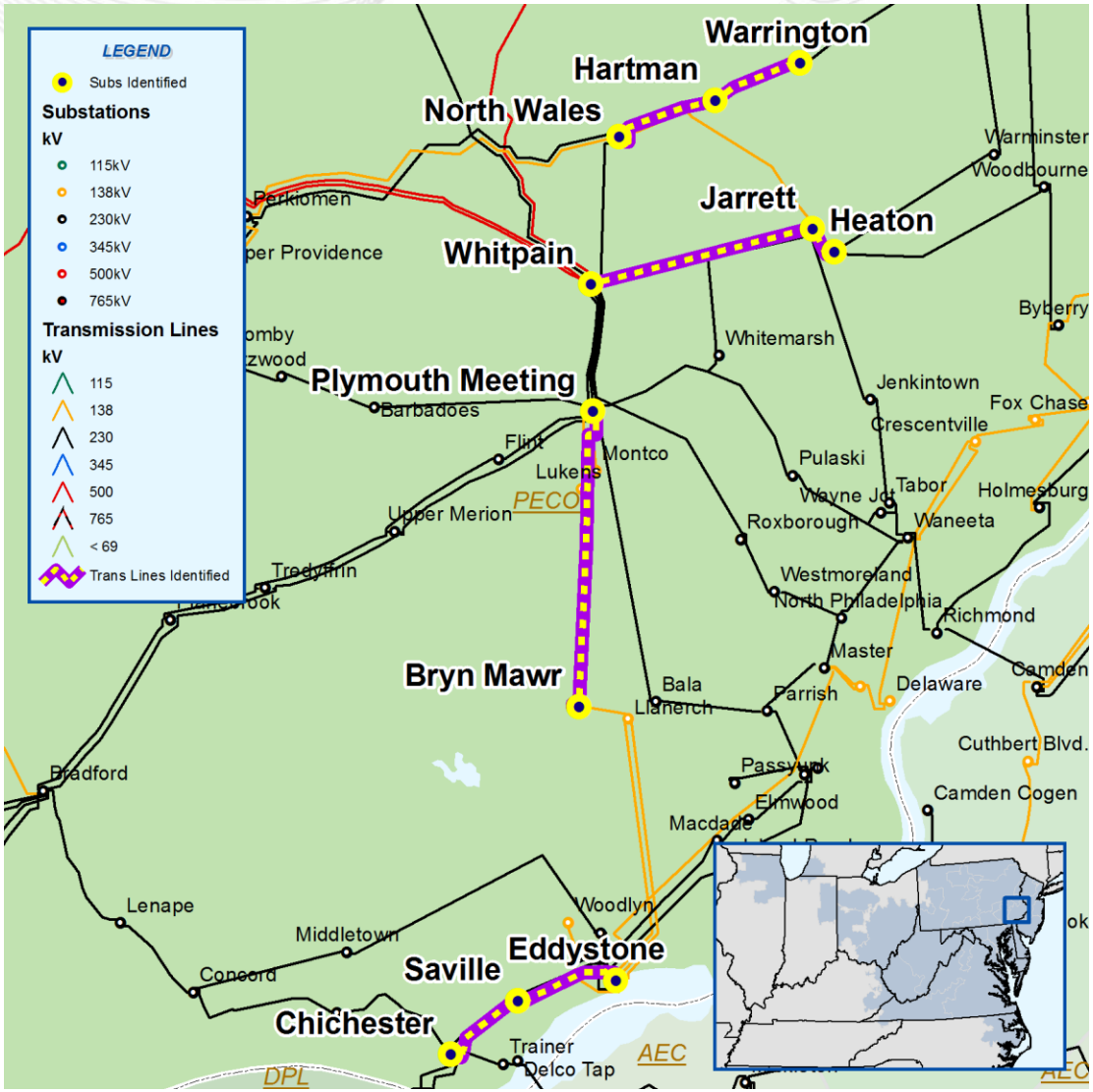
- Jarrett – Heaton 230 kV line / loss of North Wales – Hartman 230 kV line (220-71) + Basecase

- Recommended Solution: Replace terminal equipment at Heaton and Jarrett substations
- Estimated cost: $ 0.525 M
- Expected In-Service: June 1, 2012



# PECO Transmission Zone

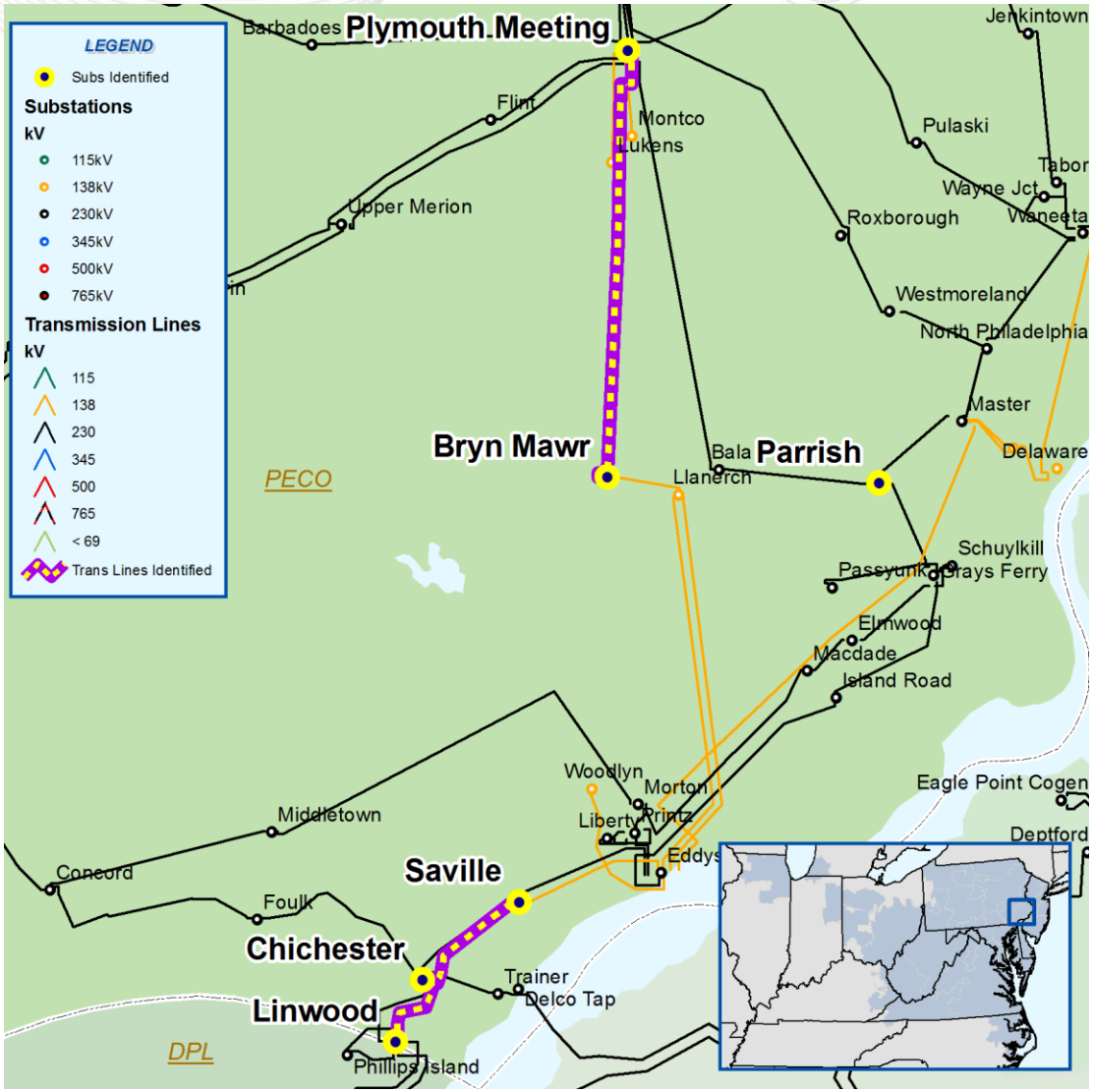
- Hartman – Warrington 230 kV line overload for the following contingencies
  - loss of Emilie – Neshaminy 138 kV line (130-25) + loss of Jarrett – Whitpain 230 kV line (220-52)
  - loss of Jarrett – Whitpain 230 kV line (220-52) + Basecase
- Recommended Solution: Replace terminal equipment at Warrington and Hartman
- Estimated Cost: $ 0.375 M
- Projected In-Service: May 27, 2011



# PECO Transmission Zone

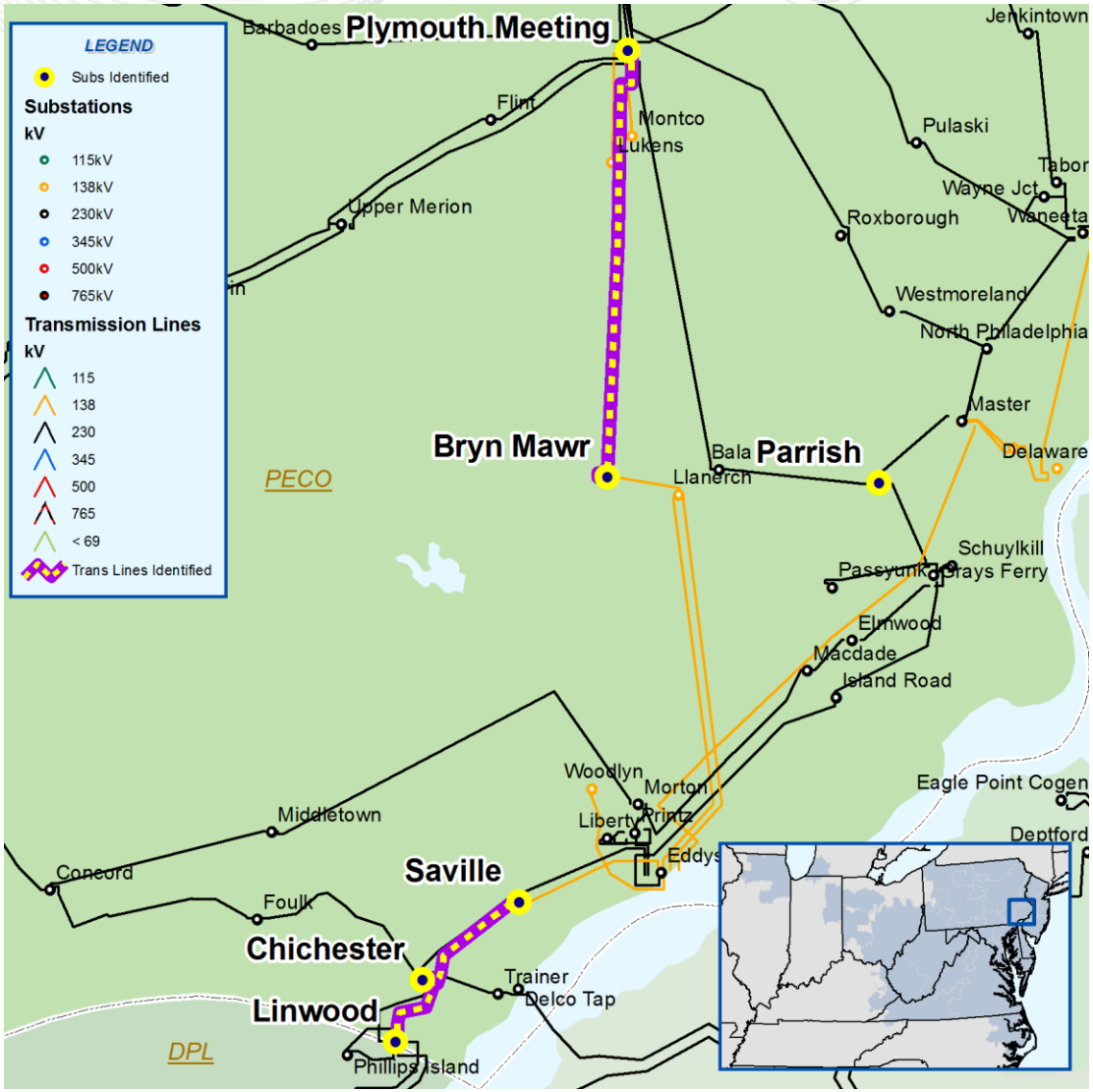
- Linwood – Chichester ‘220-43’ 230 kV line / single contingency (‘220-39’) loss of Linwood – Chichester ‘220-39’ 230 kV line and Philips island generating units CT2, CT3, and ST

- Recommended Solution: Replace terminal equipment at Chichester
- Estimated Cost: $0.475 M
- Expected In-Service: May 27, 2011



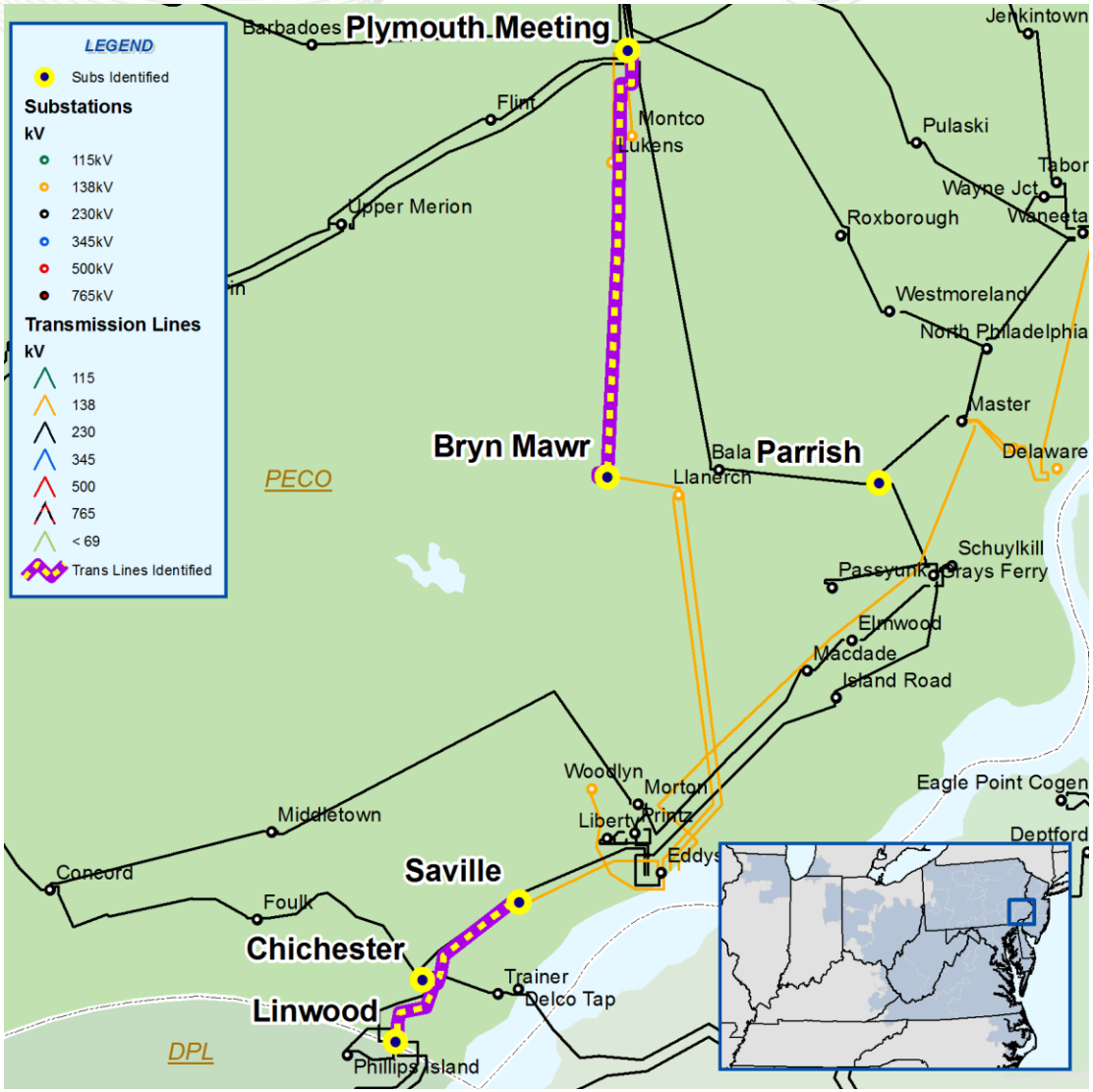
# PECO Transmission Zone

- Linwood – Chichester ‘220-39’ 230 kV line / single contingency (‘220-43’) loss of Linwood – Chichester ‘220-43’ 230 kV line and Philips island generating units CT2, CT3, and ST
- Recommended Solution: Replace terminal equipment at Chichester
- Estimated Cost: $0.475 M
- Expected In-Service: May 27, 2011



# PECO Transmission Zone

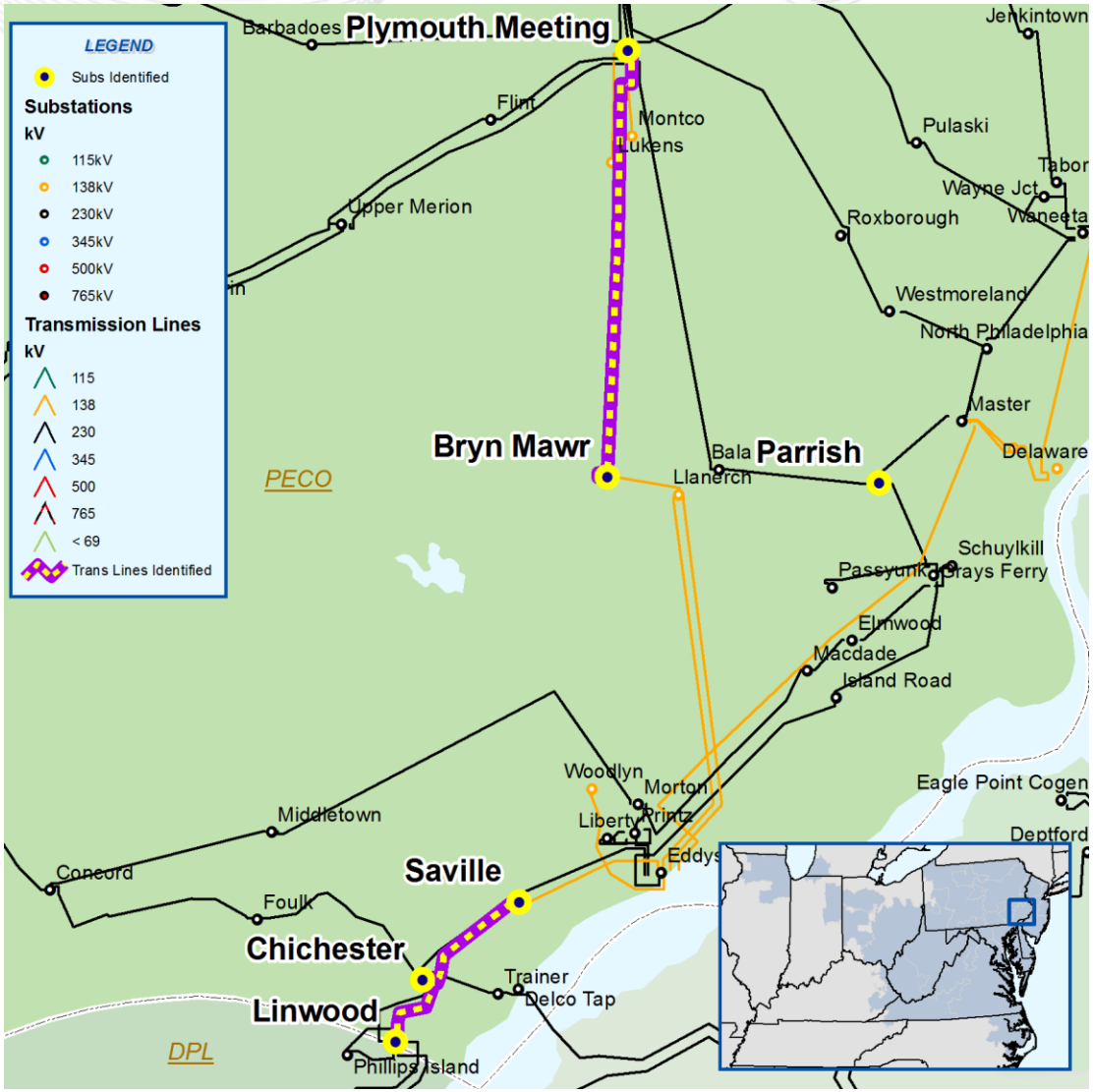
- Chichester – Saville 138 kV line overloaded for the following contingencies:
  - line fault with stuck breaker contingency ('GRAYS275') loss of Grays Ferry – Tunnel 230 kV line due to Grays Ferry stuck breaker '275'
  - bus contingency ('PLYM138B') loss of Plymouth Meeting 138 kV bus
  - single contingency ('220-27B') loss of Gays Ferry – Tunnel 230 kV line
  - Basecase for gen deliv test
  - loss of Macdade – Ridley – Morton 230 kV line (220-46) + loss of Island Road – Eddystone 230 kV line (220-23)
- Recommended Solution: Reconductor the line and upgrade terminal equipment
- Estimated cost: $ 8.5 M
- Expected in-service: December 31, 2013



# PECO Transmission Zone

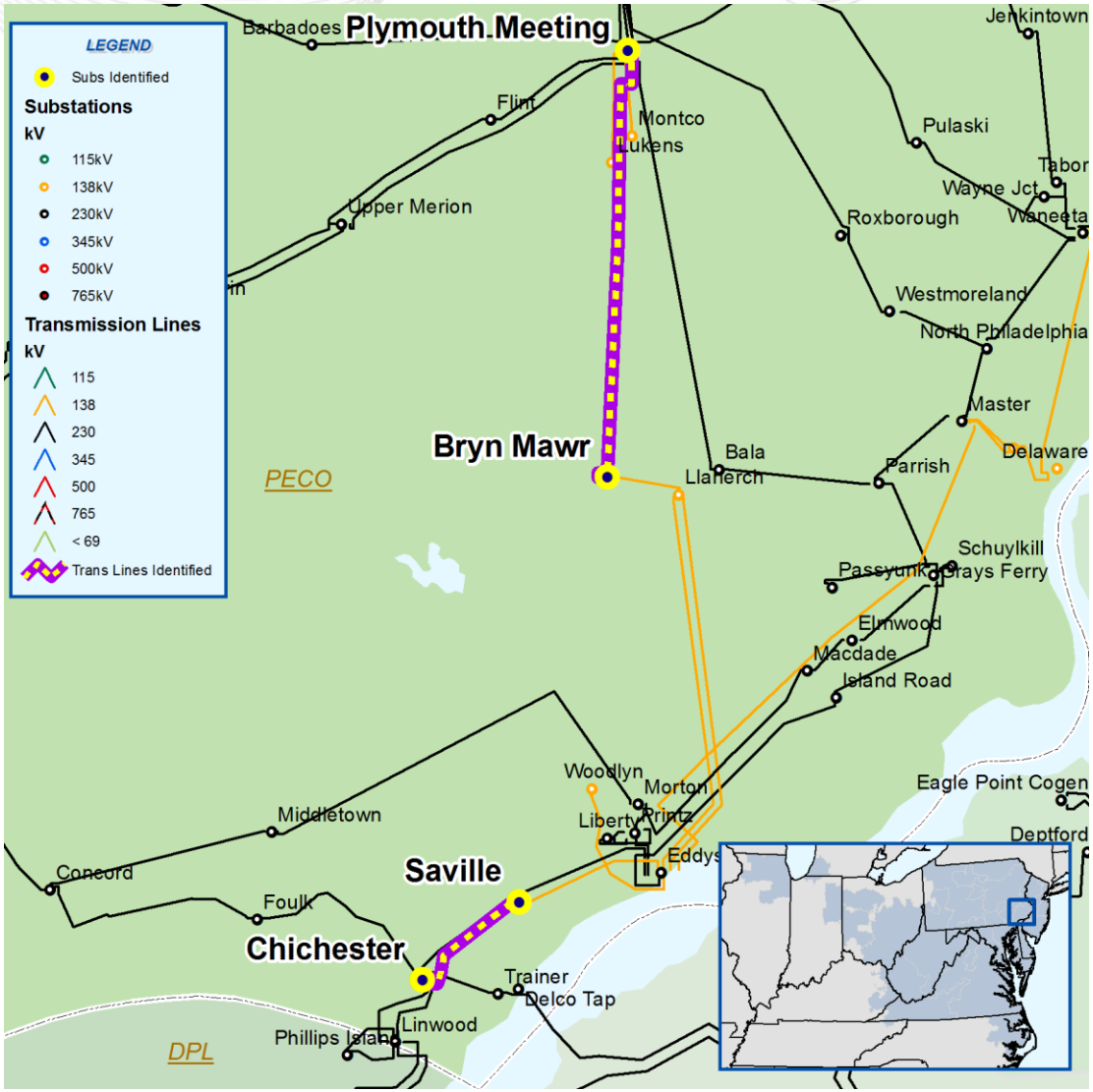
- Tunnel – Parrish 230 kV line overloaded for the following contingencies
  - single contingency (‘PJM89_A’) loss of New Freedom – East Windsor 500 kV for gen deliv test
  - Basecase for gen deliv test

- Recommended Solution: Replace terminal equipment at Parrish
- Estimated Cost: $0.15 M
- Expected In-Service: May 27, 2011



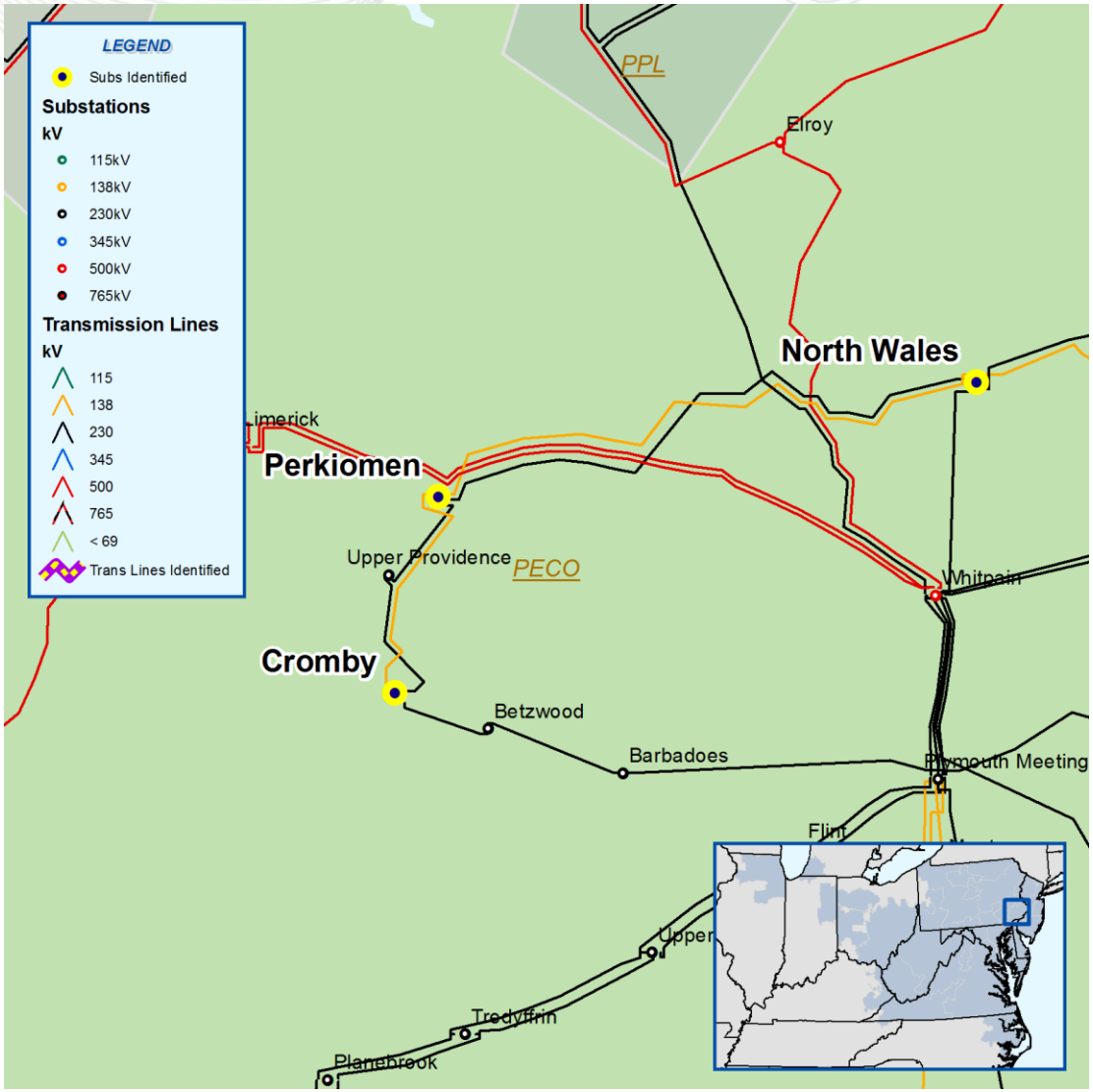
# PECO Transmission Zone

- Plymouth Meeting – Bryn Mawr 138 kV line overload for the following contingencies:
  - bus contingency ('CHI230B1') loss of Chichester bus section 1
  - line fault with stuck breaker contingency ('CHICH045') loss of Chichester – Foulk 230 kV line and Foulk 230/13.8 kV transformer #2 as well as Chichester bus section 1 due to the Chichester stuck breaker '045'
  - loss of Chichester 230/138 kV transformer (CHICH-T9) + Basecase
  - loss of Chichester 230/138 kV transformer (CHICH-T9) + Eddystone – Master 138 kV line (130-43)
  - line fault with stuck breaker contingency ('CHICH785') loss of the Chichester 230/138 kV transformer and Chichester 138/69 kV transformer s #7 & 8
- Recommended solution: Install 230/138 kV transformer at Eddystone
- Estimated cost: $3.6 M
- Expected in-service: June 1, 2011



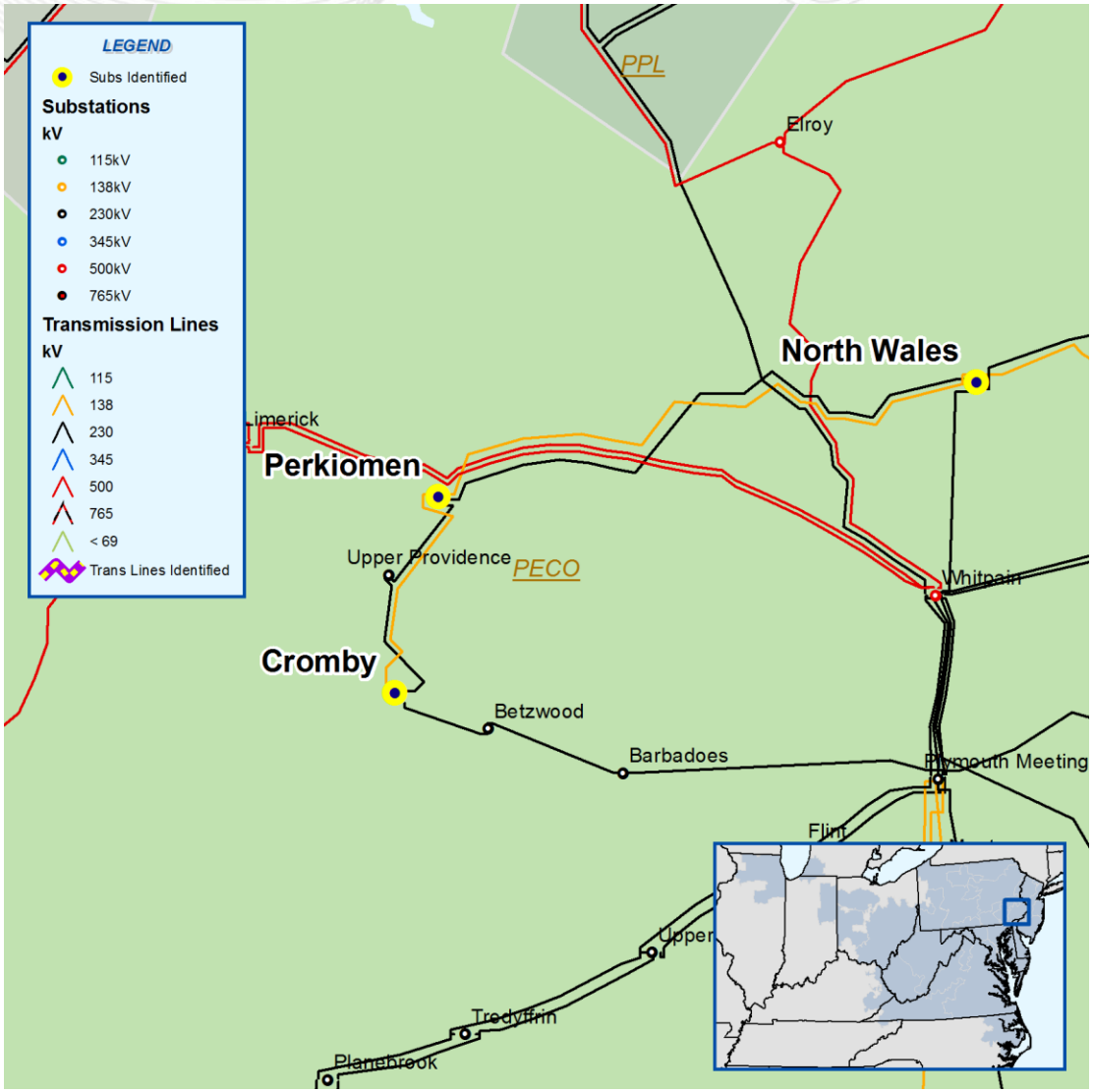
# PECO Transmission Zone

- North Wales and Heaton 138 kV area low voltage violations for the following contingencies
  - bus contingency ('HEAT138B') loss of Heaton 138 kV station bus section 2
  - line fault with stuck breaker contingency ('HEAT0805') loss of Heaton – Woodbourne 230 kV line with stuck breaker 805
  - line fault with stuck breaker contingency ('HEAT0995') loss of Heaton – Woodbourne 230 kV line with stuck breaker 995
- Recommended Solution: Add a second 230/138 kV transformer at Heaton. Add a circuit breaker on the Heaton – North Wales 138 kV line. Add a 35 MVAR capacitor at Heaton
- Estimated cost: $7.754 M
- Expected in-service: December 16, 2011



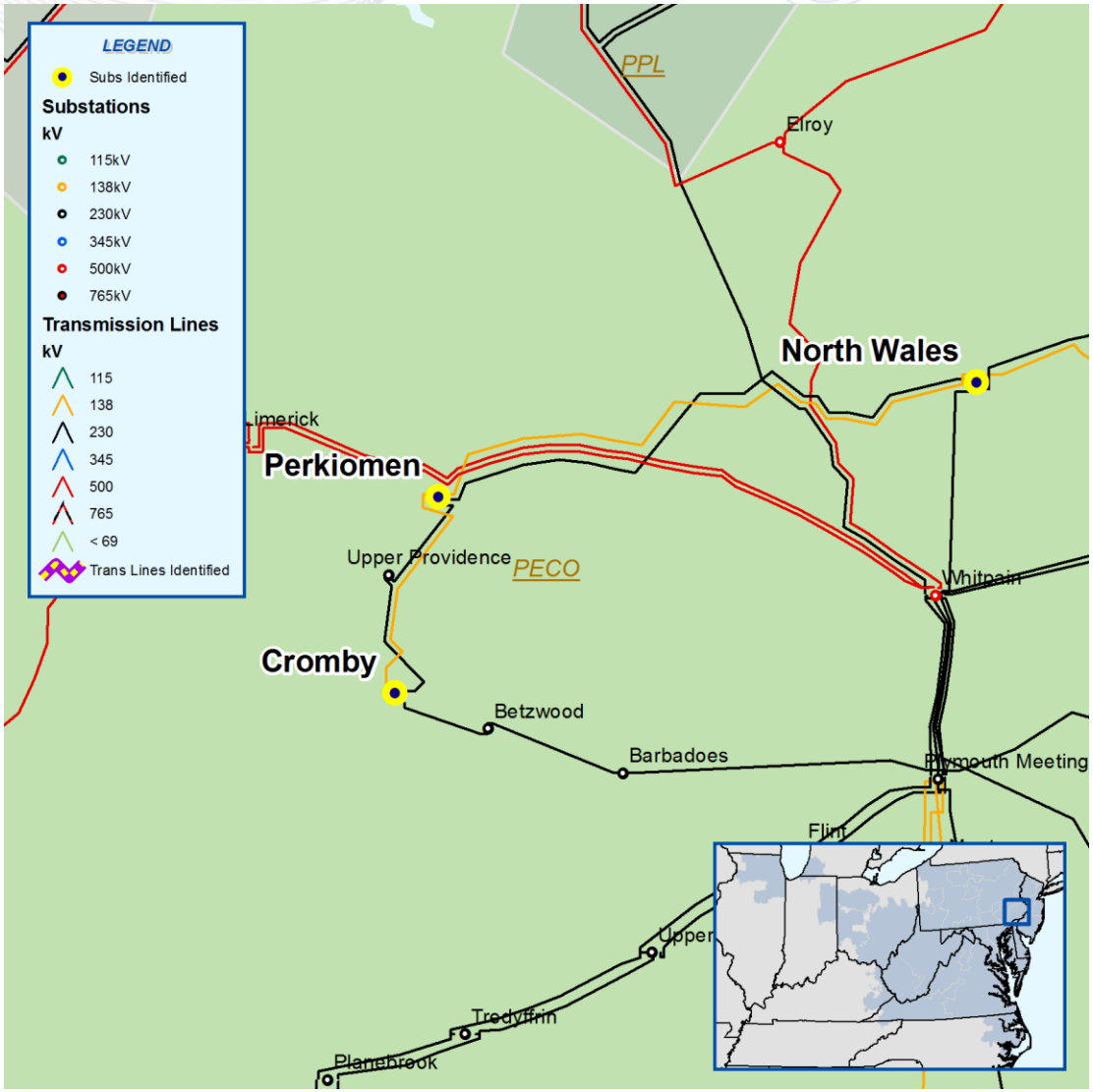
# PECO Transmission Zone

- Cromby 138 kV station low voltage violations for the following contingencies:
  - bus contingency ('HEAT138B') loss of Heaton 138 kV station bus section 2
  - line fault with stuck breaker contingency ('HEAT0805') loss of Heaton – Woodbourne 230 kV line with stuck breaker 805
  - line fault with stuck breaker contingency ('HEAT0995') loss of Heaton – Woodbourne 230 kV line with stuck breaker 995
- Recommended Solution: Replace 230/69 kV transformer #6 at Cromby. Add two 50 MVAR 230 kV capacitor banks at Cromby
- Estimated Cost: $ 6.142 M
- Projected in-service: May 1, 2012



# PECO Transmission Zone

- Perkiomen 138 kV station voltage violations for the following contingencies:
  - bus contingency ('HEAT138B') loss of Heaton 138 kV station bus section 2
  - line fault with stuck breaker contingency ('HEAT0805') loss of Heaton – Woodbourne 230 kV line with stuck breaker 805
  - line fault with stuck breaker contingency ('HEAT0995') loss of Heaton – Woodbourne 230 kV line with stuck breaker 995
- Recommended Solution: Add 138 kV circuit breakers at Cromby, Perkiomen, and North Wales. Add a 35 MVAR 138 kV capacitor at Perkiomen
- Estimated Cost: $ 3.9 M
- Expected In-Service: August 1, 2011



- Eddystone 230 kV CB #365
  - Recommended solution: Upgrade the circuit breaker
  - Estimated Cost: $0.125 M
  - Expected In-Service: May 31, 2011

- Eddystone 230 kV CB #785
  - Recommended solution: Upgrade the circuit breaker
  - Estimated Cost: $0.125 M
  - Expected In-Service: May 31, 2011

- Eddystone 230 kV CB #35
  - Recommended solution: Upgrade / replace the circuit breaker
  - Estimated Cost: TBD
  - Expected In-Service: May 27, 2011
- Eddystone 230 kV CB #45
  - Recommended solution: Upgrade the circuit breaker
  - Estimated Cost: TBD
  - Expected In-Service: May 27, 2011
- Note: Both of these circuit breakers are Exelon Power circuit breakers

- As noted on the previous slides a number of upgrades are not expected to be placed in-service until after the requested deactivation date

- PJM notified Exelon Power that Cromby 2 is needed for reliability until June 1, 2012 and Eddystone 2 is need for reliability until December 31, 2013

- 2015 Analysis
  - Initial efforts will focus on identifying criteria violations
    - Load deliverability
    - Generation Deliverability
    - Common Mode Violations
    - N-1-1
  - Alternative Evaluations
- 2013 Retool
- Develop / refine analytic methods for sensitivity studies
- Other retool work

# Comments or Questions?