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
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.
• 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
• 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
- 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
- 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
• Hartman – Warrington 230 kV line overload for the following contingencies
  – 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
• 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
- 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
• 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
• 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
Short Circuit Violations

• 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
Next Steps

• 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?