Transmission Expansion Advisory Committee

July 7, 2011
Issues Tracking
• Open Issues
  – None

• New Issues
EIPC Update
Phase I Major Deliverables

- **Official project start 7/19/2010**
  - Before this date, Stakeholder organization began

- **Roll-up and integration of regional plans for 2020**

- **8 Macroeconomic “futures”**
  - Input assumptions determined by states/stakeholders
  - Up to 9 sensitivities of input variables on each “future”

- **Phase I Report – December 2011 /January 2012**
Phase I Major Deliverables

• Official project start 7/19/2010
  - Before this date, Stakeholder organization began

• Roll-up and integration of regional plans for 2020

• 8 Macroeconomic “futures”
  - Input assumptions determined by states/stakeholders
  - Up to 9 sensitivities of input variables on each “future”

• Phase I Report – December 2011 /January 2012
Phase II Major Deliverables

- 3 Future resource scenarios with fully developed transmission build-out options that meet reliability requirements

- Production cost analysis and resource cost estimates

- Phase II Report – December 2012
Project Task Status

Task 1
- **Initiate Project:** complete
  - SSC and work groups formed
  - Coordination with EISPC (Topic B) established

Task 2
- **Integrate Regional Plans:** nearing completion
  - 2020 Integrated Regional Plan & Draft Report delivered
  - Complete Final Draft Report issued on 3/7/11

Task 3
- **Production Cost Analysis:** not required

Task 4
- **Macroeconomic Futures Development:** complete
  - BAU and first set of sensitivities defined 2/11/11
  - Remaining 7 futures & sensitivities: high-level def. 3/29/11
  - SSC final decision on all 8 futures & sensitivities on 5/18/11

Task 5
- **Macroeconomic Analysis:** underway
  - Final results for BAU & all sensitivities: posted 5/11/11
  - Final results for Future 2 & sensitivities: posted 6/13/11
  - Initial results for Future 3: posted 6/13/11
  - Target completion by 9/9/11
1. Business as Usual


3. Federal Carbon Constraint: State and Regional Implementation

4. Aggressive Energy Efficiency, Demand Response, Distributed Generation and Smart Grid
5. National RPS – Top-Down Implementation

6. National RPS – State/Regional Implementation

7. Nuclear Resurgence

   Clean Energy Standard 2035
Examples of Sensitivities

Examples:
- Revised Transfer Capability
- Hi & Low Load Growth
- Hi & Low Natural Gas Prices
- Hi & Low Cost of Renewables
- Higher penetration levels for EE/RPS/DR/PHEVs
- Future-specific sensitivities
Highlights of Upcoming Activities

• EIPC presented its high level transmission cost estimation methodology for Task 5

• EIPC presented an outline of its proposed process for transmission build outs in Phase II
  – EIPC is updating its proposal to clarify the schedule—to include opportunities that will be provided for stakeholder input

• Stakeholder Task Force formed to develop criteria for the selection of 3 Scenarios for detailed analysis in Phase II
Upcoming Activity Summary

• Scenario review by SSC through August

• SSC selection of final 3 scenarios November

• Final Phase report end of year

• www.eipconline.com

• Comments / Input for PJM
  – lieboc@pjm.com
2011 RTEP Voltage Analysis
• 2016 baseline load deliverability testing initial results

• (CETL – CETO) margins noted in the table below
  – Margins for years beyond 2016 estimated based on load growth

• Sensitivity analysis considering “at-risk” generation is in-progress

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Other Reactive Considerations

• Previous analyses assumed various backbone lines to be in-service

• “At-Risk” generation could further deplete dynamic reactive capability

• High voltage during light load periods has identified the need for devices to absorb vars
Baseline Reliability Update
15 Year Analysis Update
2011 RTEP 15 Year Planning Result

Single Contingency Result

- Highest loading from applicable contingencies in all of the deliverability tests
- Conductor ratings applied
- Reinforcements may already be in development for some of these facilities

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Since the last meeting, PJM staff has been working on baseline, generation deliverability and load deliverability testing.

- Baseline analysis complete
- Generation deliverability analysis complete
  - Verifying potential solutions
- Load deliverability testing in-progress
  - Verifying potential solutions

- Validating potential issues and testing reinforcements
• Common Mode Outage Procedure
• Overload on Mill T2 138/69 kV transformer for a few contingencies
• Proposed Solution: Upgrade the Mill T2 138/69 kV transformer (B1600).
• Estimated Project Cost: $5.0 M
• Expected IS Date: 6/1/2016
• Common Mode Outage Procedure
• Overload on Sherman Ave. – Carl’s Corner 69 kV circuit for several contingencies
• Proposed Solution: Recondutor the Sherman Ave. – Carl’s Corner 69 kV circuit (B1598).
• Estimated Project Cost: $ 5.6 M
• Expected IS Date: 6/1/2016
• Common Mode Outage Procedure
• Overload on Central North – Shieldalloy 69 kV circuit for tower-line contingency loss of the BL England – Lewis 138 kV circuits
• Proposed Solution: Replace terminal equipments at Central North 69 kV substation (B1599).
• Estimated Project Cost: $ 0.476 M
• Expected IS Date: 6/1/2016
• Baseline analysis / Generation Deliverability:
• Overload on Center – Erdman 115 kV circuits for several contingencies
• Proposed Solution:
  - Move the station supply connections of the Hazelwood 115/13kV station.
  - Install 115kV tie breakers at Melvale.
  - Erdman Rebuild from an open air ring-bus to a GIS ring-bus to allow lines to be reconfigured correctly.
• Estimated Project Cost: $ TBD
• Expected IS Date: 6/1/2016
DPL Transmission Zone

- Common Mode Outage Procedure
- Proposed Solution:
  Upgrade 19 miles conductor (B1603).
- Estimated Project Cost:
  $15 M
- Expected IS Date:
  6/1/2016
ATSI Transmission Zone

- Common Mode Violation
- Galion –GM Mansfield 138KV line is overloaded for various category C contingencies.
  
  - Recommended Solution:
    - Replace GM Mansfield 477 ACSR SCCIR with 954 ACSR SCCIR (B1585)
  
  - Estimated Project Cost: $0.05M
  
  - Expected IS date: 06/01/2016
ATSI Transmission Zone

- Common Mode Violation
- Barberton – Star #2 138KV line is overloaded for the tower outage of Barberton – Star 138kV line #1 and Cloverdale – Start 138kV line
- Recommended Solution:
  - Change the relay setting Limit (B1586)
- Estimated Project Cost: $0M
- Expected IS date: 06/01/2016
• Common Mode Violation

• GM Mansfield – Ontario 138kV line is overloaded for various category C contingencies.

• Recommended Solution:
  • Build New Mansfield 69kV Switching Station networking Leaside, Longview, and Galion Subs @ existing Alta 69kV Sub Site (B1587)

• Estimated Project Cost: $6.8M

• Expected IS date: 06/01/2016
The previously presented Marysville project to add a 345/69kV transformer at AEP Marysville 345kV bus, add a Marysville – Darby 69kV line, Marysville – Union REA 69kV line, and reconductor Union REA 69kV – Honda MT 69kV replaces the need for other baseline projects.

Recommended Solution:
- Cancel B1065.1, B1065.2, B1065.3, B1067, and B1077
  - Cancelled projects below:
    - Install a new Shelby 138/69 kV transformer at Shelby station
    - Install a 69 kV line between Shelby 69kV station and Blue Jacket 69 kV station
    - Install a new 30 MVAR capacitor bank at Blue Jacket 69 kV station
    - Install a new 30 MVAR shunt at Logan 69 kV station
    - Reconductor East Sidney-Shelby 138 kV
Baseline analysis / Generation Deliverability:

Overload on Reybold – Motiva 138 kV circuit for pre-contingency and for the loss of Reybold 138/69 transformer single contingency.

Proposed Solution:
Replace terminal equipments.

Estimated Project Cost:
$ TBD

Expected IS Date:
6/1/2016
Duke Energy Ohio Kentucky Transmission Zone

- Common Mode Violation

- Todhunter 345/138KV transformers 15 & 17 are overloaded for breaker failure operation of the Todhunter 345kV Breaker 1385 or Breaker 1387.

- Recommended Solution:
  - Reconfigure the Todhunter 345KV ring bus (B1573)

- Estimated Project Cost: $1.325M

- Expected IS date: 06/01/2014
Duke Energy Ohio Kentucky Transmission Zone

- Common Mode Violation
- The Port Union - Dimmick 138kV circuit (#5483) and Dimmick – Cornell Tap 138KV circuit are overloaded for several multiple facility contingencies at Foster 138kV bus.

- Recommended Solution:
  - Re-conductor the circuits for 6 miles with 556 ACSS conductor and replace a wavetrap. (B1574)
  
- Estimated Project Cost: $1.85M
- Expected IS date: 06/01/2014
• Common Mode Violation

• The Todhunter - Trenton 138kV circuit (#3284) is overloaded for several multiple facility contingencies.

• Recommended Solution:
• Re-conductor the 5 miles circuit with the 556ACSS conductor (B1576)

• Estimated Project Cost: $1.05M

• Expected IS date: 06/01/2013
Duke Energy Ohio Kentucky Transmission Zone

- Common Mode Violation

- The Circuit 4515 Miami Fort - Terminal 345kV circuit is overloaded for the tower contingency of losing both circuit #4561 and circuit #4562

- Recommended Solution:
  - Replace wavetrap and line switch (B1585)

- Estimated Cost: $0.104M

- Expected IS date: 06/01/2013
Duke Energy Ohio Kentucky Transmission Zone

- Generator Deliverability Violation

- The circuit 4561 Woodsdale - Todhunter 345kV circuit is overloaded for the loss of circuit #4562

- Recommended Solution:
  - Replace wavetraps and line switches (B1586)

- Estimated Project Cost: $0.21M

- Expected IS date: 06/01/2013
Duke Energy Ohio Kentucky Transmission Zone

- Generator Deliverability Violation
- The circuit 4562 Woodsdale - Todhunter 345kV circuit is overloaded for the loss of circuit #4561
- Recommended Solution:
  - Replace wavetraps and line switches (B1587)
- Estimated Project Cost: $0.21M
- Expected IS date: 06/01/2013
Duke Energy Ohio Kentucky Transmission Zone

- Common Mode Violation

- The Berjord - Tobasco 138kV circuit (#1885) is overloaded for several multiple facility contingencies;
- The Red Bank - Oakley 138kV circuit (#885) is overloaded for several multiple facility contingencies.

- Recommended Solution:
  - Add a 138/69kV transformer at Newtown substation (B1588.1)
  - Add a new 69kV line Newtown – Mt. Washington B1588.2
  - Add a new 69kV line Newtown – Berkshire (B1588.3)
  - Reconfigure the 69kV loop (B1588.4)

- Estimated Project Cost: $8M

- Expected IS date: 06/01/2014
• Common Mode Outage Procedure:
• Overload on the Richmond – Waneeta 230 kV circuit for the a bus and line fault stuck breaker contingencies loss of Chichester buses.
• Proposed Solution: Reconductor the underground portion of the Richmond – Waneeta 230 kV circuit and replace terminal equipments (B1591).
• Estimated Project Cost: $ 12 M
• Expected IS Date: 6/1/2016
PenElec Transmission Zone

- Common Mode Outage Procedure
- Overload on New Baltimore – Bedford North 115 kV circuit for several contingencies.
- Proposed Solution: Reconductor the New Baltimore – Bedford North 115 kV circuit.
- Estimated Project Cost: $ TBD
- Expected IS Date: 6/1/2016
• Basecase/Common Mode Outage Procedure
• Thermal and voltage violations in the northern PenElec 115 kV system for several contingencies.
• Proposed Solution: Construct a new 345/115 kV substation and loop the Mansfield – Everts Drive 115 kV line.
• Estimated Project Cost: $ TBD
• Expected IS Date: 6/1/2016
• Basecase Category C
  Overload on Erie West 345/115 kV transformer #3 and Voltage magnitude and Voltage drop violations on the 115 kV path from Erie West to Buffalo Road for several line fault stuck breaker contingencies

• Proposed Solution:
  Construct Four Mile Junction 230/115 kV substation. Loop the Erie South-Erie East 230 kV line, Buffalo Road-Corry East & Buffalo Road-Erie South 115 kV lines.

• Estimated Project Cost: $ TBD

• Expected IS Date: 6/1/2016
PenElec Transmission Zone

- Basecase/Common Mode Outage Procedure
- Overload on the Lewistown 230/46 kV transformer and voltage drop violation at Lewistown and Yeagertown 230 kV substations for a couple of contingencies.

- Proposed Solution:
  Construct a new 345/115 kV substation and loop the Mansfield – Everts Drive 115 kV line.

- Estimated Project Cost: $ TBD

- Expected IS Date: 6/1/2016
• Common Mode Outage Procedure
• Overload on Oak Grove - Bowie 230 kV ‘23045’ circuit for the tower-line outage of the Chalk Point – Bowie ‘23054’ and Oak Grove – Burtonsville ‘23042’ 230 kV circuits.
• Proposed Solution: Reconductor the Oak Grove – Bowie 230 kV ‘23045’ circuit and upgrade terminal equipments at Oak Grove and Bowie 230 kV substations (B1592).
• Estimated Project Cost: $17 M
• Expected IS Date: 6/1/2016
PEPCO Transmission Zone

- Common Mode Outage Procedure
- Overload on Oak Grove - Bowie 230 kV ‘23042’ circuit for the tower-line outage of the Chalk Point – Bowie ‘23065’ and Oak Grove – Burtonsville ‘23045’ 230 kV circuits.
- Proposed Solution: Reconductor the Oak Grove – Bowie 230 kV ‘23042’ circuit and upgrade terminal equipments at Oak Grove and Bowie 230 kV substations (B1594).
- Estimated Project Cost: $ 17 M
- Expected IS Date: 6/1/2016
• Common Mode Outage Procedure

• Overload on Bowie – Burtonsville 230 kV ‘23045’ circuit for the tower-line outage of the Chalk Point – Bowie ‘23054’ and Oak Grove – Burtonsville ‘23042’ 230 kV circuits.

• Proposed Solution: Recondutor the Bowie - Burtonsville 230 kV ‘23045’ circuit and upgrade terminal equipments at Bowie and Burtonsville 230 kV substations (B1593).

• Estimated Project Cost: $ 8.0 M

• Expected IS Date: 6/1/2016
PEPCO Transmission Zone

- **Common Mode Outage Procedure**
- **Overload on Bowie – Burtonsville 230 kV ‘23042’ circuit** for the tower-line outage of the Chalk Point – Bowie ‘23065’ and Oak Grove – Burtonsville ‘23045’ 230 kV circuits.
- **Proposed Solution:**
  Reconductor the Bowie – Burtonsville 230 kV ‘23042’ circuit and upgrade terminal equipments at Oak Grove and Burtonsville 230 kV substations (B1595).
- **Estimated Project Cost:** $ 8.0 M
- **Expected IS Date:** 6/1/2016
• Common Mode Outage Procedure

• Overload on Dickerson station “H” – Quince Orchard 230 kV ‘23032’ circuit for the tower-line outage of the Dickerson station “D” – Quince Orchard 230 kV circuits ‘23033’ & ’23035’.

• Proposed Solution:
Reconductor the Dickerson station “H” – Quince Orchard 230 kV ‘23032’ circuit and upgrade terminal equipments at Dickerson station “H” and Quince Orchard 230 kV substations (B1596).

• Estimated Project Cost: $9.2 M

• Expected IS Date: 6/1/2016
• Common Mode Outage Procedure
• Overload on Oak Grove - Aquasco 230 kV ‘23062’ circuit for the tower-line outage of the Chalk Point – Bowie ‘23063’ ‘23065’ 230 kV circuits.
• Proposed Solution: Reconductor the Oak Grove - Aquasco 230 kV ‘23062’ circuit and upgrade terminal equipments at Oak Grove and Aquasco 230 kV substations (B1597).
• Estimated Project Cost: $ 27 M
• Expected IS Date: 6/1/2016
Baseline analysis:
Voltage drop violation on Elimsport, Clinton and Lycoming 230 kV substations for towerline outage of the Montour – Elimsport and Montour – Clinton 230 kV circuits

Proposed Solution:
Re-configure the Elimsport 230 kV substation to breaker and half scheme and install 80 MVAR capacitor (B1602).

Estimated Project Cost:
$ 3.7 M

Expected IS Date:
6/1/2016
PSE&G Transmission Zone

- Common Mode Outage Procedure:
  Overload on the Camden – Richmond 230 kV circuit for the loss of several bus and line fault stuck breaker contingencies.

- Proposed Solution:
  Replace the B1398.6 upgrade scope with upgrade the PECO portion of the Camden – Richmond 230 kV to a six wire conductor and replace terminal equipment at Richmond. In 2016, replace terminal equipment at Richmond (B1590.1).

- Estimated Project Cost:
  $ 2.7 M (B1398.6)
  $ 0.8 M (B1590.1)

- Expected IS Date:
  6/1/2015 (B1398.6)
  6/1/2016 (B1590.1)
• Generation Deliverability:
• Overload on the Eagle Point – Gloucester 230 kV circuit #1 and #2. Loss of one circuit overloads the other circuit.
• Proposed Solution: Reconductor the Eagle Point – Gloucester 230 kV circuit #1 and #2 with higher conductor rating (B1588).
• Estimated Project Cost: $25 M
• Expected IS Date: 6/1/2016
• Common Mode Outage Procedure
• Proposed Solution: Re-configure the Kearny 230 kV substation and loop the P-2216-1 (Essex – NJT Meadows) 230 kV circuit (B1589).
• Estimated Project Cost: $ 48 M
• Expected IS Date: 6/1/2016
PSE&G Transmission Zone

- Common Mode Outage Procedure:
  - Overload on the Camden – Richmond 230 kV circuit for the loss of several bus and line fault stuck breaker contingencies.

- Proposed Solution:
  - Upgrade the PSEG portion of the Camden – Richmond 230 kV to a six wire conductor and replace terminal equipments at Camden (B1590).

- Estimated Project Cost:
  - $40 M

- Expected IS Date:
  - 6/1/2011
Short Circuit Upgrades
The Hazelwood 115 kV breakers ‘110602’ and ‘110604’ are overstressed.

Proposed Solution: Replace Hazelwood 115 kV breakers ‘110602’ and ‘110604’ (b1583, b1584)

Estimated Project Cost: $130 K per breaker

Expected IS Date: 12/1/2012
The State Line 138 kV breakers ‘7 L0707’ and ‘7 L0761’ are overstressed

Proposed Solution: Revise reclosing and upgrade relays at State Line 138 kV breakers ‘7 L0707’ and ‘7 L0761’ (b1579, b1580)

Estimated Project Cost: $100 K per breaker

Expected IS Date: 6/1/2012
The Cherry Valley 138 kV breaker ‘156 15622’ is overstressed

Proposed Solution: Revise reclosing and upgrade relays at Cherry Valley 138 kV breaker ‘156 15622’ (b1581)

Estimated Project Cost: $100 K

Expected IS Date: 6/1/2012
• The Lombard 138 kV breaker ‘120 12008’ is overstressed
• Proposed Solution: Replace Lombard 138 kV breaker ‘120 12008 (b1582)
• Estimated Project Cost: $900 K
• Expected IS Date: 6/1/2012
• The following breakers are overstressed:
  – Terminal 138 kV breaker ‘906’
  – Terminal 138 kV breaker ‘913’
  – Terminal 138 kV breaker ‘914’
  – Terminal 138 kV breaker ‘919’
  – Terminal 138 kV breaker ‘903’
  – Terminal 138 kV breaker ‘910’

• Proposed Solution:
  – Replace the Terminal 138 kV breaker ‘906’ with 63 kA (b1550)
  – Replace the Terminal 138 kV breaker ‘913’ with 63 kA (b1551)
  – Replace the Terminal 138 kV breaker ‘914’ with 63 kA (b1552)
  – Replace the Terminal 138 kV breaker ‘919’ with 63 kA (b1553)
• Proposed Solution (cont’d):
  – Revise the reclosing on the Terminal 138 kV breaker ‘903’ to 15 seconds (b1554)
  – Revise the reclosing on the Terminal 138 kV breaker ‘910’ to 15 seconds (b1555)

• Estimated Project Cost:
  – $250 K for each new breaker
  – $0 to revise the reclosing

• Expected IS Date:
  – 12/31/2011 – for breakers 903 and 910
  – 12/31/2012 – for breakers 914 and 919
  – 12/31/2014 – for breakers 913 and 906
DUKE Transmission Zone

- The following breakers are overstressed:
  - Miami Fort 138 kV breaker ‘804’
  - Miami Fort 138 kV breaker ‘806’
  - Miami Fort 138 kV breaker ‘904’
  - Miami Fort 138 kV breaker ‘928’
  - Miami Fort 138 kV breaker ‘927’

- Proposed Solution:
  - Replace the Miami Fort 138 kV breaker ‘804’ with 63 kA (b1557)
  - Replace the Miami Fort 138 kV breaker ‘806’ with 63 kA (b1558)
  - Replace the Miami Fort 138 kV breaker ‘904’ with 63 kA (b1559)
  - Replace the Miami Fort 138 kV breaker ‘928’ with 63 kA (b1560)
  - Revise the reclosing on the Miami Fort 138 kV breaker ‘927’ to 15 seconds (b1561)

- Estimated Project Cost:
  - $250 K for each new breaker
  - $0 to revise the reclosing
Expected IS Date:
- 12/31/2011 – for breaker 927
- 12/31/2012 – for breakers 806 and 928
- 12/31/2014 – for breakers 804 and 904
The following breakers are overstressed:
- Todhunter 138 kV breaker ‘917’
- Todhunter 138 kV breaker ‘919’
- Todhunter 138 kV breaker ‘923’
- Todhunter 138 kV breaker ‘927’
- Todhunter 138 kV breaker ‘929’
- Todhunter 138 kV breaker ‘931’
- Todhunter 138 kV breaker ‘937’
- Todhunter 138 kV breaker ‘911’

Proposed Solution:
- Replace the Todhunter 138 kV breaker '917' with 63 kA (b1562)
- Replace the Todhunter 138 kV breaker '919' with 63 kA (b1563)
- Replace the Todhunter 138 kV breaker '923' with 63 kA (b1564)
- Replace the Todhunter 138 kV breaker '927' with 63 kA (b1565)
- Replace the Todhunter 138 kV breaker '929' with 63 kA (b1566)
- Replace the Todhunter 138 kV breaker '931' with 63 kA (b1567)
- Replace the Todhunter 138 kV breaker '937' with 63 kA (b1568)
• **Proposed Solution (cont’d):**
  – Revise the reclosing on the Todhunter 138 kV breaker ‘911’ to 15 seconds (b1569)
• **Estimated Project Cost:**
  – $250 K for each new breaker
  – $0 to revise the reclosing
• **Expected IS Date:**
  – 12/31/2011 – for breaker 911
  – 12/31/2012 – for breakers 927, 929, and 937
  – 12/31/2013 – for breakers 931, 919, 917, and 923
DUKE Transmission Zone

- The following breakers are overstressed:
  - Oakley 138 kV breaker ‘805’

- Proposed Solution:
  - Replace the Oakley 138 kV breaker ‘805’ with 63 kA (b1556)

- Estimated Project Cost:
  - $250 K

- Expected IS Date:
  12/31/2014
• 2016 N-1-1 Thermal and Voltage Testing

• Develop solutions to the identified problems

• Retool Work
Email RTEP@pjm.com with any comments or questions
Review Issues Tracking