

Transmission Expansion Advisory Committee

December 16, 2009





- Objectives
 - To ensure that the PJM system meets stability criteria under the Capacity Emergency Transfer Objective (CETO), a critical stressed power transfer scenario.
- Study Case
 - 2013 load deliverability case (a 90/10 Summer Peak load condition).
 - Both thermal and voltage sample cases were studied.
- Tested Stability Criteria
 - Transient stability (angular stability).
 - Damping (positive damping).



• Procedure

Select Target Load Deliv. Case	Build a dynamic stability case	Build Contingency List	Perform Transient and Small Signal Stability Analysis
 2013 load deliverability case Thermal and voltage cases 90/10 summer peak load condition. 	 Modifying power flow generator models based on physical unit models. Preparing dynamic models. 	 Select critical contingencies. Convert them into dynamic contingency format for dynamic simulation. 	 Run 20 sec. time domain simulation. Perform Eigenvalue analysis to screen out possible insufficient damping modes. Assess transient and small signal stability.

Analysis Tools
 – PSSE, SSAT.



- Studied Contingencies
 - Critical single contingencies (PJM 500kV lines) involving a 3-ph fault with normal clearing and several machine outage contingencies.
- Analysis Results
 - No transient stability issues have been identified.
 - All transient oscillations damp out within 10~20 seconds.



 Example: PJM17: 3ph fault @ Peach Bottom 500kV on Peach Bottom -Conastone 500kV





MAAC Stability Analysis

• PJM21: 3ph fault @ Conemaugh 500kV on Conemaugh - Keystone 500kV.





Baseline Reliability Update



- N-1-1 thermal overloads of Edgewater – Vasco Tap 138 kV line; Edgewater – Loyalhanna 138 kV line for Loss of STNYSP 138 kV, SOAKFD kV bus, and NOAKFD 138 kV busses; and Loss of Youngwood – Yukon 138 kV line
- Proposed Solution:
- Reconductor the Edgewater –
 Vasco Tap; Edgewater –
 Loyalhanna 138 kV lines with 954
 ACSR (b1128)
- Estimated Cost: TBD
- Expected IS Date: 6/01/2014





• N-1-1 thermal overload of East Waynesboro – Ringgold 138

kV line for Loss of Antrim – Ried 138 kV; and Loss of Harmony 138 kV Bus

• Proposed Solution:

- Reconductor the East Waynesboro – Ringgold 138 kV line with 954 ACSR (b1129).
- Estimated Cost: \$3 M
- Expected IS Date: 6/01/2014





 N-1-1 thermal overloads of Double Tollgate – Meadowbrook CKT 1 138 kV line for Loss of DTG – Meadowbrook CKT 2 138 kV; and Loss of Meadowbrook – W Winchester 138 kV line

• Proposed Solution:

- Upgrade Double Tollgate-Meadowbrook MDT Terminal Equipment (b1131)
- Estimated Cost: TBD
- Expected IS Date: 6/01/2014



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LEGEND



 N-1-1 thermal overloads of Double Tollgate – Meadowbrook CKT 2 138 kV line fir Loss of DTG – Meadowbrook CKT 1 138 kV; and Loss of Meadowbrook – W Winchester 138 kV line

• Proposed Solution:

- Upgrade Double Tollgate-Meadowbrook MBG terminal equipment (b1132)
- Estimated Cost: TBD
- Expected IS Date: 6/01/2014





• N-1-1 thermal overloads of Grand Point – South Chamber 138 kV line for Loss of E Waynesboro - Ringgold 138 kV line; and Loss of Lewistown 230/115 kV Transformer # 3, Lewistown – Raystown 230 kV line, Lewistown - Shingletown 230 kV line, Lewistown – Yeagerstown 230 kV CKT 2, Lewistown Transformer #2

Proposed Solution:

- B0684 can be revised to reconductor Grand Point – South Chambersburg – Guliford. (B1152)
- Estimated Cost: \$2.9 M
- Expected IS Date: 6/01/2014



West Waynesboro

East Waynesboro

Ringgold

Guilford

Reid

APS Antrim

Halfwa

Ørrtanna

kV

0 345kV

kV

A 115 A 138

A 230

∧ 345

∧ 500 A 765 ∧ < 69

115kV

138kV 230kV

500kV • 765kV



 N-1-1 thermal overloads of Allegheny Ludlum 4 Junction – Springdale 138 kV line for Loss of Murrycrest 138 kV – Wallace 138 kV; and Loss of Shaffers Corner – Springdale 138 kV line

• Proposed Solution:

- Upgrade terminal equipment at Springdale. (B1133)
- Estimated Cost: TBD
- Expected IS Date: 6/01/2014





 N-1-1 thermal overloads of Bartonville – Meadowbrook 138 kV line for loss of Bedington – Black Oak 500 kV line; and Loss of Bedington – Doubs 500 kV line

• Proposed Solution:

- Reconductor the Bartonville Meadowbrook 138 kV line with high temperature conductor. (B1135)
- Estimated Cost: TBD
- Expected IS Date: 6/01/2014





 N-1-1 thermal overloads of Eastgate 2 – Luxor 138 kV line; Eastgate – Sony 138 kV line for loss of Youngwood – Yukon 138 kV line; and Loss of Waltz T 138 kV and Waltz Mills 138 kV busses

• Proposed Solution:

- Reconductor the Eastgate Luxor 138 kV; Eastgate – Sony 138 kV line with 954 ACSR. (B1137)
- Estimated Cost: TBD
- Expected IS Date: 6/01/2014





- N-1-1 thermal overloads of King Farm – Sony 138 kV line for loss of Youngwood – Yukon 138 kV line; and Loss of Waltz T 138 kV and Waltz Mills 138 kV busses
- Proposed Solution:
- Reconductor the King Farm –
 Sony 138 kV line with 954 ACSR.
 (B1138)
- Estimated Cost: TBD
- Expected IS Date: 6/01/2014





 N-1-1 thermal overloads of Yukon – Waltz T 138 kV line for loss of Youngwood – Yukon 138 kV line; and Loss of Springdale – Wallace 138 kV line

Proposed Solution:

- Reconductor the Yukon Waltz Mills 138 kV line with high temperature conductor. (B1139)
- Estimated Cost: TBD
- Expected IS Date: 6/01/2014

APS Transmission Zone



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 N-1-1 thermal overloads of Bracken Junction – Luxor 138 kV line for loss of Youngwood – Yukon 138 kV line; and Loss of Loyalhanna – Luxor 138 kV line

Proposed Solution:

- Reconductor the Bracken Junction
 Luxor 138 kV line with 954
 ACSR. (B1140)
- Estimated Cost: \$0.8 M
- Expected IS Date: 6/01/2014





N-1-1 thermal overloads of Sewickley – Waltz T 138 kV line for loss of Bedington – Doubs 500 kV line; and Loss of Springdale – Wallace 138 kV line

• Proposed Solution:

- Reconductor the Sewickley –
 Waltz Mills Tap 138 kV line with high temperature conductor. (B1141)
- Estimated Cost: TBD
- Expected IS Date: 6/01/2014





 N-1-1 thermal overloads of Bartonville – Stephenson138 kV line; Stonewall – Stephenson 138 kV line for loss of Bedington – Doubs 500 kV line; and Loss of Black Oak – Hatfield 500 kV

• Proposed Solution:

- Reconductor the Bartonville Stephenson 138 kV; Stonewall – Stephenson 138 kV line with 954 ACSR. (B1142)
- Estimated Cost: TBD
- Expected IS Date: 6/01/2014





 N-1-1 thermal overloads of Youngwood – Yukon 138 kV line for loss of Hempfield – Sewickley 138 kV line; and Loss of Springdale – Wallace 138 kV line

• Proposed Solution:

- Reconductor the Youngwood Yukon 138 kV line with high temperature conductor. (B1143)
- Estimated Cost: TBD
- Expected IS Date: 6/01/2014

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 N-1-1 thermal overloads of Bull Creek Junction – Cabot 138 kV line for loss of Cabrey 138 kV bus; and loss of Lawson 138 kV bus

• Proposed Solution:

- Reconductor the Bull Creek Junction – Cabot 138 kV line with high temperature conductor. (B1144)
- Estimated Cost: TBD
- Expected IS Date: 6/01/2014





 N-1-1 thermal overloads of Cabot – Lawson 138 kV line for loss of Bull Creek Junction 138 kV bus; and Loss of Cabrey 138 kV bus

• Proposed Solution:

- Reconductor the Lawson Junction
 Cabot 138 kV line with high temperature conductor. (B1145)
- Estimated Cost: TBD
- Expected IS Date: 6/01/2014





- N-1-1 thermal overloads of Layton – Smith 61 138 kV line for Loss of Waltz T 138 kV Bus and Waltz Mills 138 kV bus; and Loss of Youngwood – Yukon 138 kV line
- Proposed Solution:
- Replace structures along Layton Smith 61 138 kV to increase line rating. (B1146)
- Estimated Cost: TBD
- Expected IS Date: 6/01/2014





- N-1-1 thermal overloads of Smith – Yukon 138 kV line for Loss of Waltz T 138 kV Bus and Waltz Mills 138 kV bus; and Loss of Youngwood – Yukon 138 kV line
- Proposed Solution:
- Replace structures along Smith Yukon 138 kV to increase line rating. (B1147)
- Estimated Cost: TBD
- Expected IS Date: 6/01/2014

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 N-1-1 thermal overloads of Loyalhanna - Luxor 138 kV line for Loss of Bracken Junction -Eastgate 138 kV line, Eastgate -Youngwood 138 kV, Bracken Junction - Luxor 138 kV line, Bracken Junction - Unity 138 kV + Vasco - Vasco Tap 138 kV line, Vasco - Ethel Springs 138 kV line, Vasco Tap - Edgewater -Loyalhanna 138 kV line, Vasco Tap - Social Hall 138 kV line

• Proposed Solution:

- Reconductor the Loyalhanna Luxor 138 kV line with 954 ACSR. (B1148)
- Estimated Cost: TBD
- Expected IS Date: 6/01/2014





 N-1-1 thermal overloads of Luxor - Stony Springs Junction 138 kV line for Loss of Yukon -Waltz Mills - Sewickley 138 kV line
 + Springdale - Wallace 138 kV line

Proposed Solution:

- Reconductor the Luxor Stony Springs Junction 138 kV line with 954 ACSR. (B1149)
- Estimated Cost: TBD
- Expected IS Date: 6/01/2014





• N-1-1 thermal overloads of Social Hall - Vasco Tap 138 kV line for loss of Youngwood - Yukon 138 kV line + Yukon - Waltz Mills -Sewickley 138 kV line

• Proposed Solution:

- Upgrade terminal equipment at Social Hall. (B1150)
- Estimated Cost: TBD
- Expected IS Date: 6/01/2014





 N-1-1 thermal overloads of Greenwood - Redbud 138 kV line for Loss of Meadow Brook - West Winchester 138 kV line + Base Case

• Proposed Solution:

- Reconductor the Greenwood Redbud 138 kV line with 954 ACSR. (B1151)
- Estimated Cost: \$2.7 M
- Expected IS Date: 6/01/2014





BGE Transmission Zone

- N-1-1 thermal overload of Mays Chapel – Texas
 115kV line for the loss of Mays Chapel – Mt.
 Washington CKT 110702 + loss of Northwest – Delight -Gwynnbrook - Mays Chapel
 CKT 110579 115kV line
- Proposed Solution:
 - Transfer 6 MW of load s from Mt. Washington to East Towson.
- Estimated Cost: \$ 0.0 M
- Expected IS Date: 6/01/2014





- N-1-1 voltage drop violations in Texas, Delight, Notch Cliff, Shawn Rd. vicinity for the following contingencies :
- Loss of Northwest Sudbrook CKT 110578 + loss of Mays Chapel – MT. Washington CKT 110701.
- Loss of Northwest Westminster CKT 110579 + loss of Mays Chapel – MT. Washington CKT 110702.
- Loss of Windy Edge Mays Chapel CKT 110509 + loss of Mays Chapel – MT. Washington CKT 110702.
- Proposed Temporary Solution in 2014 (permanent solution to be determined):

Apply a special protection scheme (load drop and H/S switching removal at Mt. Washington)

- Estimated Cost: \$ 0.1 M
- Expected IS Date: 6/01/2014

BGE Transmission Zone





- South Mahwah Elmsford Allendale Harings Corner Hillsdale magnitude violation in the West Waldwick RE ADG Foel Cel inchmans Ave Fair Lawn New Milford lackson Rd. Saddle Brook Montville Kuller Rd Leonia Bronx Zoo W. Wharton Cedar Grove Sherman Creel Berger East Rutherfor Hell Gate N. Bergen Whippany ook Rd Astoria Charles Polett Marion Dr. West Orange, Kingsland LEGEND Laurel Ave. Subs Identified Morristown Turn Substations raynor PSEG New: Dot/Summit 115kV Foundry St 138k\ Federal So Springfield Rd Doremus P 230k\ 345kV North Ave. 500kV 765kV NyC Aldene Bayway Bayonne Transmission Lines kV Fanwood Goethals A 115 aden Virginia Aver 138 Minu seaSouth A 230 New Dove adingtor ▲ 345 Greenbrook Λ 500 on Ave Woodrow A 765 Somer Metuchen ∧ < 69 Meadow Road
- **Proposed Solution:**

N-1-1 Voltage Violation

Voltage drop and voltage

Orange 138 kV vicinity for

several contingencies.

- Convert the following facilities from 138 kV to 230 kV. (B1154) >West Orange 138 kV substation
- >The Roseland West Orange two 138 kV circuits (S-1319 & T-1320).
- >The Roseland Sewaren 138 kV circuit (O-1315).
- Estimated Cost: \$200 M
- Expected IS Date: 06/01/2014



- N-1-1 Voltage Violation
- Voltage drop and voltage magnitude violation in the Bridgewater, Greenbrook and Lake Nelson 230 kV vicinity for several contingencies.
- Proposed Solution:

Build a new 230 kV circuit from Branchburg to Middlesex Sw. Rack. Build a new 230 kV substation at Middlesex by connecting the new and the existing circuits from Branchburg, plus the two 230 kV parallel circuits from Raritan River to Gillette (I-1023 and W-1037).

(B1155)

- Estimated Cost: \$125 M
- Expected IS Date: 06/01/2014

PSEG Transmission Zone Horristown West Orange N. West Orang



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- N-1-1 Voltage Violation Voltage drop and voltage magnitude violation in the Burlington 138 kV vicinity for several contingencies.
- Proposed Solution:

Convert the following facilities from138 kV to 230 kV (B1156).

>The Burlington 138 kV substation.

>The Camden 138 kV substation.

- >The 138 kV circuits from Burlington to Camden (I-1309 and J-1310).
- >The 138 kV circuit from Camden to Cuthbert Blvd. and the Cuthbert Blvd 138 kV substation
- Estimated Cost: \$150 M
- Expected IS Date: 06/01/2014

