

The background of the slide is a photograph of a large, white, lattice-structured transmission tower against a clear blue sky. Power lines are visible extending from the tower across the frame.

Transmission Expansion Advisory Committee Meeting

2010 Market Efficiency Analysis Results Update

October 6, 2010

- Summary of Results for 2010, 2013, 2016, and 2019 Study Years
- Long Range Congestion Projection for 2024
- Summary of various Benefit/Cost analysis
- Next Steps

- Market Efficiency Runs – Study Year and Topology

Study Year	2010	2013	2016	2019	2024
System Topology	2010 As-Is Model	2014 topology without MAPP, PATH, Branchburg-Roseland-Hudson, Susquehanna-Roseland	2014 topology Without Branchburg-Roseland-Hudson	2014 topology Without Branchburg-Roseland-Hudson	2014 topology Without Branchburg-Roseland-Hudson



2010, 2013, 2016, and 2019 Load and Generation Scenarios

Market Simulation Results

Constraint	AREA	2010 Study Year		2013 Study Year		2016 Study Year		2019 Study Year	
		Frequency (Hours)	Market Congestion (\$millions)	Frequency (Hours)	Market Congestion (\$millions)	Frequency (Hours)	Market Congestion (\$millions)	Frequency (Hours)	Market Congestion (\$millions)
		2010 As-Is System Topology		2014 System Topology (without PATH, MAPP, Susquehanna-Roseland, Branchburg-Roseland-Hudson)		2014 System Topology (without Branchburg-Roseland-Hudson)		2014 System Topology (without Branchburg-Roseland-Hudson)	
AP - South Interface	APS/DOM	4605	\$401.9	5888	\$909.3	4327	\$803.6	4300	\$801.7
01BLACKO - 01BEDNGT	APS/DOM	3745	\$359.9	52	\$6.3	26	\$4.9	17	\$1.5
01DOUBS - 01DOUBS	APS/DOM	470	\$198.7	0	\$0.0	6	\$0.0	22	\$6.5
8LEXNGTN - 8DOOMS	APS/DOM	595	\$129.5	317	\$68.4	7	\$0.5	29	\$8.7
01PRNTY - 8MT STM	APS/DOM	1511	\$61.8	0	\$0.0	0	\$0.0	0	\$0.0
05CLOVRD - 8LEXNGTN	APS/DOM	1181	\$44.0	1902	\$102.8	135	\$4.9	395	\$22.0
8MT STM (T157 TAP) - 01DOUBS	APS/DOM	131	\$18.0	88	\$21.1	0	\$0.0	0	\$0.0
6CLOVER - 8CLOVER	APS/DOM	198	\$7.1	1210	\$34.2	241	\$10.3	621	\$26.2
01BEDNGT - 01HARMNY	APS/DOM	49	\$5.0	0	\$0.0	0	\$0.0	0	\$0.0
3HALIFAX - 3MT LREL	APS/DOM	2	\$0.1	162	\$17.9	234	\$57.9	408	\$96.0
8PL VIEW - 6PL VIEW	APS/DOM	0	\$0.0	0	\$0.0	0	\$0.0	46	\$23.0
8NO ANNA - 8MORRSVL	APS/DOM	0	\$0.0	0	\$0.0	0	\$0.0	124	\$38.5
8LOUDOUN - 6LOUDOUN	APS/DOM	0	\$0.0	0	\$0.0	0	\$0.0	5	\$11.6
Eastern Interface		278	\$11.7	1988	\$236.6	88	\$20.6	115	\$5.3
CDR GV F - CLIFTN K	EMAAC	3557	\$1.5	6913	\$49.0	5816	\$161.9	5943	\$30.0
BRADFRD2 - PLANBRK1	EMAAC	2	\$0.1	14	\$2.3	26	\$6.8	29	\$10.9
ATHENIA - BERGEN	EMAAC	0	\$0.0	1884	\$30.9	1561	\$97.7	1558	\$47.8
PRINTZ - RIDLEY	EMAAC	0	\$0.0	4	\$0.2	14	\$1.1	60	\$22.4
BRANCHBG - READ-GTN	EMAAC	0	\$0.0	37	\$10.9	0	\$0.0	0	\$0.0
TODD - VIENN 69	EMAAC	0	\$0.0	0	\$0.0	68	\$8.5	112	\$18.8
RL 138N - HARES CR	EMAAC	0	\$0.0	0	\$0.0	24	\$2.7	51	\$6.8
LINWOOD - CHICHST2	EMAAC	0	\$0.0	0	\$0.0	230	\$15.6	219	\$15.1
50045005 Interface		3634	\$287.6	707	\$45.7	955	\$75.9	1171	\$154.3
ALTOONA - BEAR RCK	Rest of MAAC +ATSI,DUQ	2212	\$54.5	2699	\$86.8	1807	\$74.4	2415	\$138.6
15ELRM 5 - 01MITCHL	Rest of MAAC +ATSI,DUQ	1752	\$13.1	920	\$7.3	761	\$7.6	175	\$2.3
02SAMMIS - 01WYLLIE	Rest of MAAC +ATSI,DUQ	774	\$6.8	56	\$0.2	25	\$0.2	0	\$0.0
Central Interface		164	\$4.3	1316	\$71.0	1216	\$43.5	1895	\$95.0
Western Interface		30	\$0.8	1611	\$92.1	0	\$0.0	0	\$0.0
01MITCHL - 01UNIONJ	Rest of MAAC +ATSI,DUQ	0	\$0.0	114	\$2.3	246	\$3.6	211	\$5.3
E FRA; B - CRETE;BP	WEST	1615	\$29.2	1226	\$16.2	121	\$1.1	445	\$14.9
WATER;3B - W DEK;3T	WEST	51	\$8.0	40	\$7.2	129	\$16.9	208	\$33.0
MAREN;RT - P VAL; R	WEST	64	\$0.2	656	\$49.2	2567	\$243.2	4083	\$1,031.7
CHERR; B - CHERR;2M	WEST	0	\$0.0	87	\$4.5	172	\$12.8	261	\$53.1
LORET;B - PONTI; B	WEST	0	\$0.0	23	\$2.3	12	\$0.7	89	\$12.2
SOLPT 44 - RIV2339	SWMAAC	99	\$1.0	60	\$4.1	111	\$6.9	205	\$9.0
SANDY34T - H.RDGE16	SWMAAC	0	\$0.0	2	\$0.0	22	\$0.5	84	\$17.0
			\$1,664.2		\$1,894.6		\$1,688.6		\$2,780.4

- Congestion by Area for Constraints

- includes constraints with congestion greater than \$5 million in any study year

	Study Year			
	2010	2013	2016	2019
	Market Congestion (\$millions)	Market Congestion (\$millions)	Market Congestion (\$millions)	Market Congestion (\$millions)
APS/DOM	\$1,226	\$1,160	\$882	\$1,036
EMAAC	\$13	\$330	\$315	\$157
Rest of MAAC + ATSI, DUQ	\$367	\$305	\$205	\$395
SWMAAC	\$1	\$4	\$7	\$26
WEST	\$37	\$79	\$275	\$1,145

Note: APS/DOM includes APS and Dominion zones.

EMAAC includes AE, DPL, JCPL, PECO, PS, and RECO zones.

SWMAAC includes BGE and PEPCO zones.

WEST includes COMED, Dayton, and AEP zones

Rest of MAAC + ATSI, DUQ includes PENELEC, METED, PPL, ATSI, and DUQ zones.

- APS/DOM Congestion reduction between 2010 and 2016 mainly due to Trail and PATH backbone upgrades
 - Congestion levels still higher over time due to continued west-to-east transfer levels
- EMACC Congestion higher in future years without Branchburg-Roseland-Hudson
 - Alternative upgrades should help alleviate congestion
- West Area Congestion constantly increases with new wind development
 - Future Merchant, RTEP, and Merchant Efficiency projects being considered
 - Interregional and separate Wind studies in progress

- No candidates for Acceleration
 - Impractical for upgrades to be accelerated for constraints that show a significant reduction in congestion between 2010 and 2013
- Projects are currently being evaluated that could relieve congestion-causing constraints for future study years.



Long Range Congestion Projection for Study Year 2024

Congestion over \$20 million

		2024 Study Year	
		2014 System Topology (without Branchburg-Roseland-Hudson)	
Constraint	Region	Frequency (Hours)	Market Congestion (\$millions)
MAREN;RT - P VAL; R 1	WEST	5839	\$2,341
APSOUTH Interface	APS/DOM	4624	\$1,029
3HALIFAX - 3MT LREL 1	APS/DOM	905	\$259
CHERR; B - CHERR;2M 1	WEST	635	\$227
WATER;3B - W DEK;3T 1	WEST	685	\$142
8LOUDOUN - 6LOUDOUN 2	APS/DOM	76	\$137
8PL VIEW - 6PL VIEW 1	APS/DOM	125	\$131
E FRA; B - CRETE;BP 1	WEST	1278	\$131
ALTOONA - BEAR RCK 1	Rest of MAAC +ATSI,DUQ	1217	\$94
50045005 Interface	Rest of MAAC +ATSI,DUQ	457	\$49
ATHENIA - BERGEN 1	EMAAC	2868	\$44
LASCO; R - PLANO; R 1	WEST	74	\$42
MARIDEL - OCEANCTY 1	EMAAC	125	\$41
01BLACKO - 01BEDNGT 1	APS/DOM	115	\$39
TODD - VIENN 69 1	EMAAC	220	\$32
6CLOVER - 8CLOVER 1	APS/DOM	575	\$29
LINWOOD - CHICHST2 2	EMAAC	443	\$25
NELSO; B - P20 1	WEST	37	\$22
OCEANCTY - CULVER 1	EMAAC	90	\$22
CHERR; R - E ROC;RT 1	WEST	26	\$20
SOLPT 44 - RIV2339 1	SWMAAC	260	\$18
Eastern Interface	EMAAC	118	\$17
			\$5,119

Note: APS/DOM includes APS and Dominion zones.
 EMAAC includes AE, DPL, JCPL, PECO, PS, and PS zones.
 SWMAAC includes BGE and PEPCO zones.
 WEST includes COMED, Dayton, and AEP zones
 Rest of MAAC + ATSI, DUQ includes PENELEC, METED, PPL, ATSI, and DUQ zones.

Benefit/Cost Analysis

- Present value of annual project benefit for first 15 years of project life compared to present value of annual project cost for first 15 years of project life
 - Annual project benefit equals sum of Energy Market Benefit and Reliability Pricing Model Benefit
- Project is considered economic and included in RTEP if B/C ratio exceeds 1.25:1

Energy Market Benefit Metric

Annual Energy Market Benefit = $(.7)(\Delta \text{ System Production Cost}) + (.3)(\Delta \text{ Load Energy Payment})$

- Δ System Production Cost is change in system generation variable cost (fuel costs, variable O&M costs and emissions costs) associated with total PJM energy production
- Δ Load Energy Payment is change in net load energy payment (change in gross load payment minus change in transmission right credit)
 - For projects that have costs allocated regionally (500 kV and up), the load energy payment for all PJM zones is considered
 - For projects that have costs allocated using a flow-based methodology (below 500 kV), the load energy payment for only those PJM zones that show a decrease in load energy payment is considered.

Overview of Market Efficiency Benefit/Cost Test Procedure (cont)

Reliability Pricing Model Benefit Metric

Annual Reliability Pricing Model Benefit = $(.7)(\Delta \text{ Total System Capacity Cost}) + (.3)(\Delta \text{ Load Capacity Payment})$

- Δ Total System Capacity Cost is change in yearly costs (MW * prices) estimated to be cleared in RPM auction with and without enhancement
- Δ Load Capacity Payment is change in net load capacity payment (zonal load MW * zonal Capacity prices) estimated to be cleared in RPM auction with and without enhancement.
 - For projects that have costs allocated regionally (500 kV and up), the load capacity payment for all PJM zones is considered
 - For projects that have costs allocated using a flow-based methodology (below 500 kV) , the load energy payment for only those PJM zones that show a decrease in load capacity payment is considered.
- The Reliability Pricing Model Benefit will equal zero if location of enhancement is in LDA that does not have a RPM limiting facility or if the enhancement does not change the limiting facility for the constrained RPM LDA areas.

Overview of Market Efficiency Benefit/Cost Test Procedure (cont.)

Simulation/Model Details

- ▶ Annual market simulations made with and without upgrade for future years 1, 4, 7 and 10 (current year (cy), cy+3, cy+6 and cy+9)
- ▶ Annual benefits within the 10-year time frame for years which were not simulated interpolated using these simulation results
- ▶ Annual benefits for years beyond the 10-year simulation time frame based on an extrapolation of the market simulation results for years 1, 4, 7 and 10
- ▶ A higher-level annual market simulation made for future year 15 (cy+14) to validate the extrapolation results and extrapolation of annual benefits for years beyond the 10-year simulation time frame may be adjusted accordingly

- Market Efficiency Project (b1153) for Conemaugh-Seward 230 KV and Conemaugh 500/230 KV transformer.
 - Reviewed Benefit and Costs using current Market Efficiency data
 - Project continues to exceed the Benefit/Cost ratio of 1.25 and therefore is still recommended.

- Duquesne Light additional 345/138 kV transformer at Crescent (S0168).
 - Expected in-service date is 6/1/2014
 - Expected Costs= \$11 million
 - Benefit/Cost ratio equals .37 and therefore does not qualify as a Market Efficiency project since does not exceed required Benefit/Cost ratio of 1.25.

- Conduct Benefit/Cost Analysis for requested projects.
 1. LaSalle Transmission Project submitted by Central Transmission, LCC for new single or double 345 kV line from Pontiac Midpoint to Reynolds to Dumont (V4-026) with ISD of 6/1/2014.
 2. La Fayette Transmission Project submitted by Central Transmission, LCC for new single or double 345 kV line from Quad Cities to Kewanee to Pontiac Midpoint to Reynolds to Dumont along with 345/138 KV transformers at Kewanee station with ISD of 6/1/2015.
 3. Various configurations of 1 and 2
 4. BCP Transmission Project submitted by Central Transmission, LCC for new single 345 kV line from Byron to Cherry Valley to Pleasant Valley with ISD of 6/1/2015.
- Evaluate appropriate projects as part of Interregional studies