



# **Transmission Expansion Advisory Committee Meeting**

## **2009 Market Efficiency Analysis Results**

September 16, 2009



## Identifying Potential Acceleration Candidates

- For the 2009 and 2012 study years, simulations have been made using 2 different power flow models:
  - 2009 power flow case representing today's "as-is" system
  - 2013 RTEP power flow case to represent future 2013 system
- 2013 RTEP upgrades with congestion-reducing impacts are identified by comparing these simulation results
- A list of these upgrades is reviewed for potential acceleration candidates



# Market Simulation Results 2009 Generation and Load Scenario

Constraint	2009 As-Is System Topology		2013 System Topology (see Note 1)	
	Frequency (Hours)	Market Congestion (\$Millions)	Frequency (Hours)	Market Congestion (\$Millions)
AP-South Interface	4565	319.2	3396	161.3
BLA-BED Interface	3345	207.4	42	2.5
01DOUBS - 01DOUBS	62	68.8	0	0
05KAMMER - 01KAMMER	3292	62.8	0	0
05CLOVRD - 8LEXNGTN	1079	58	982	38.1
8LEXNGTN - 8DOOMS	321	36.3	78	4.9
Western Interface	815	33.9	2998	114.9
8MT STM - 01DOUBS	98	16.8	0	0
15ELRM 5 - 01MITCHL	2032	14.9	3936	25.6
Eastern Interface	412	12.6	0	0
01PRNTY - 8MT STM	241	4.3	186	2.4
50045005 Interface	161	4.3	0	0
Central Interface	325	3.9	1770	27.1
8CLOVER - 6CLOVER	299	2.7	1216	11.9
01MITCHL - 01SHEPLR	584	2.3	0	0
GRACETON - RAPHAEL	18	0.8	0	0
CROYDON - BRLGTN11	1734	0.5	3099	0.2
ALTOONA - RAYSTOWN	55	0.5	0	0
ALTOONA - BEAR RCK	16	0.4	174	3.5
HOMER CT - SHELOCTA	225	0.4	104	0.7
CRETE;BP - 17STJOHN	78	0.4	0	0
SHAWVL 1 - YBUS820	158	0.3	0	0
SHAWVL 2 - YBUS821	209	0.3	0	0
NRGDOVER - KENT	62	0.2	39	0.1
01BEDNGT - 01HARMNY	8	0.2	0	0
KEYSTONE - CONEM-GH	33	0.2	0	0
LEWISTWN - JUNIATA	21	0.1	2	0
CONOWG01 - COLOR PE	0	0	273	3.4
05KAMMER - 05WBELLA	0	0	244	1.1
HOMER CY - WATRC345	0	0	362	1
01CHARLR - 01MITCHL	0	0	128	0.9
WANEETA3 - RICHMOND	69	0	3123	0.3
SHAWVL 1 - SHAW1MID	0	0	89	0.3
JUNIATA - DAUPH-H2	2	0	48	0.2
01MITCHL - 01UNIONJ	6	0	7	0.1
SHAWVL 2 - SHAW2MID	0	0	112	0.1
WLOOP; B - STARWLOO	0	0	1085	0.1
ERIE SE - ERIE E	0	0	157	0.1
		852.5		400.8

Indicates Congestion reduced by at least \$5 million in simulation made with 2013 System Topology

Note 1: Includes TRAIL and Susquehanna-Roseland 500 KV. Does not includes PATH, MAPP, Branchburg-Roseland 500 KV, and Roseland-Hudson 500 KV upgrades



# Market Simulation Results 2012 Generation and Load Scenario

Constraint	2009 As-Is System Topology		2013 System Topology (see Note 1)	
	Frequency (Hours)	Market Congestion (\$Millions)	Frequency (Hours)	Market Congestion (\$Millions)
AP-South Interface	4379	496	2616	223.1
BLA-BED Interface	2793	340.2	91	14.3
01DOUBS - 01DOUBS	155	157.5	0	0
Eastern Interface	968	114.2	6	0.1
ATHENIA - SADDLBRK	5189	76.2	0	0
05CLOVRD - 8LEXNGTN	881	41.8	837	25.2
PORTLAND - GRYSTN Q	87	35.5	0	0
Western Interface	615	31.7	1313	121.4
Central Interface	811	24.8	1432	43.6
8LEXNGTN - 8DOOMS	126	21.5	23	1.9
6BREMO - 6POWHATN	530	18.6	8	0.5
8CLOVER - 6CLOVER	501	13.8	1548	40.1
05KAMMER - 01KAMMER	677	13.8	0	0
8MT STM - 01DOUBS	73	11.8	0	0
15ELRM 5 - 01MITCHL	966	7.6	2084	15.3
EDDYSTN3 - ISLANDR6	25	5.5	0	0
GRACETON - RAPHAEL	66	4	0	0
01MITCHL - 01SHEPLR	563	3.6	0	0
ALTOONA - BEAR RCK	125	3.3	622	23.3
01PRNTY - 8MT STM	149	2.7	84	2.5
CDR NKTP - CEDAR NK	21	2.3	0	0
01BEDNGT - 01HARMNY	15	2.2	0	0
N WALES7 - HARTMAN	9	2.2	0	0
NRGDOVER - KENT	209	1.3	161	0.5
CROYDON - BRLGTN11	2603	1.1	3487	0.4
50045005 Interface	52	1.1	0	0
KEYSTONE - CONEM-GH	69	1.1	0	0
N PHILA - WANEETA2	279	0.7	0	0
01MAHNSL - 05TIDD	260	0.5	0	0
CRETE;BP - 17STJOHN	62	0.3	0	0
SHAWVL 1 - YBUS820	89	0.3	0	0
LINWOOD - CHICHST2	5	0.2	2	0
SHAWVL 2 - YBUS821	115	0.2	0	0
01MITCHL - 01UNIONJ	14	0.1	20	0.6
HOMER CT - SHELOCTA	8	0.1	108	0.4
WANEETA3 - RICHMOND	206	0.1	1810	0.3
BRUNNER - YORKANA	1	0.1	6	0.1
BURT2314 - SANDY14T	2	0.1	0	0
CORDO; B - NELSO; B	18	0.1	0	0
CONOWG01 - COLOR PE	0	0	114	2.3
01CHARLR - 01MITCHL	0	0	190	2.1
HOMER CY - WATRC345	0	0	280	1.2
SHAWVL 1 - SHAW1MID	0	0	144	0.8
GRACETON - BAGLEY13	0	0	3	0.6
GRACETON - PCHBTMTP	0	0	53	0.4
05KAMMER - 05WBELLA	0	0	31	0.3
SHAWVL 2 - SHAW2MID	0	0	109	0.2
ATHENIA - BERGEN	0	0	400	0.2
ERIE SE - ERIE E	0	0	200	0.2
WLOOP; B - STARWLOO	0	0	862	0.1
		1438.2		522

Indicates Congestion reduced by at least \$5 million in simulation made with 2013 System Topology

Note 1: Includes TRAIL and Susquehanna-Roseland 500 KV. Does not includes PATH, MAPP, Branchburg-Roseland 500 KV, and Roseland-Hudson 500 KV upgrades



# RTEP Upgrades Responsible for Congestion Reduction 2009 and 2012 Simulations

Constraints with at least \$5 million Congestion Reduction and RTEP Upgrade(s) responsible for reduction	
Constraint	RTEP Upgrade most responsible for Reduction
AP-South Interface	TrAIL (6/2011); Meadow Brook Capacitor (12/2009)
BLA-BED Interface	TrAIL (6/2011)
01DOUBS - 01DOUBS	Replace Doubs #2 (6/2011), #3 (12/2010), and #4 (6/2010) Transformers
Eastern Interface	600 MVAR Capacitor at Elroy (in-service/spring 2009); Susquehanna-Roseland 500 KV (6/2012)
ATHENIA - SADDLBRK	Susquehanna-Roseland 500 KV (6/2012)
05CLOVRD - 8LEXNGTN	TrAIL (6/2011)
PORTLAND - GRYSTN Q	Susquehanna-Roseland 500 KV (6/2012)
8LEXNGTN - 8DOOMS	TrAIL (6/2011)
6BREMO - 6POWHATN	TrAIL (6/2011)
05KAMMER - 01KAMMER	Replace Kammer Transformer (11/2009)
8MT STM - 01DOUBS	TrAIL (6/2011)
EDDYSTN3 - ISLANDR6	Eddystone - Island Rd line terminal equipment (6/2011)



## Identifying Future Congestion Bottlenecks

- Simulations made of study years 2012, 2015 and 2018 using 2013 RTEP power flow case
- Review results to identify future constraints causing significant congestion

# Congestion by Constraints for Study Years 2012, 2015, and 2018,

		2012 Study Year		2015 Study Year		2018 Study Year	
		2013 System Topology (see Note 1)		2013 System Topology (see Note 2)		2013 System Topology (see Note 2)	
Constraint	From/Area	Frequency (Hours)	Market Congestion (\$Millions)	Frequency (Hours)	Market Congestion (\$Millions)	Frequency (Hours)	Market Congestion (\$Millions)
AP-South Interface	-	2616	223.1	1564	77.5	3228	384.8
Western Interface	-	1313	121.4	0	0	0	0
Central Interface	-	1432	43.6	1531	25.6	2468	89.3
8CLOVER - 6CLOVER	VIEP - VIEP	1548	40.1	721	17.6	1668	66
05CLOVRD - 8LEXNGTN	AEP - VIEP	837	25.2	117	1.3	966	29.6
ALTOONA - BEAR RCK	PENNELEC - PENNELEC	622	23.3	796	33.5	2175	111.4
15ELRM 5 - 01MITCHL	APS - DQE	2084	15.3	513	3.8	903	9.4
BLA-BED Interface	-	91	14.3	14	2.7	22	8.3
01PRNTY - 8MT STM	APS - VIEP	84	2.5	0	0	0	0
CONOWG01 - COLOR PE	PECO - DPLC	114	2.3	8	0	3	0
01CHARLR - 01MITCHL	APS - APS	190	2.1	26	0.1	92	0.6
8LEXNGTN - 8DOOMS	VIEP - VIEP	23	1.9	3	0.2	16	1.7
HOMER CY - WATRC345	PENNELEC - NYISO	280	1.2	142	0.5	433	2.7
SHAWVL 1 - SHAW1MID	PENNELEC - PENNELEC	144	0.8	171	1.1	359	2.1
01MITCHL - 01UNIONJ	APS - APS	20	0.6	0	0	26	1.3
GRACETON - BAGLEY13	BG&E - BG&E	3	0.6	8	0	19	0.6
NRGDOVER - KENT	DPLC - DPLC	161	0.5	41	0.1	30	0.1
6BREMO - 6POWHATN	VIEP - VIEP	8	0.5	0	0	59	1.1
GRACETON - PCHBTMTP	PECO - BG&E	53	0.4	113	0.3	347	2
CROYDON - BRLGNT11	PECO - PSEG	3487	0.4	2514	0.1	3153	0.5
HOMER CT - SHELOCTA	PENNELEC - PENNELEC	108	0.4	30	0	232	0.3
WANEETA3 - RICHMOND	PECO - PECO	1810	0.3	1004	0.2	2011	0.8
05KAMMER - 05WBELLA	AEP - AEP	31	0.3	0	0	5	0
SHAWVL 2 - SHAW2MID	PENNELEC - PENNELEC	109	0.2	181	0.7	296	0.6
ERIE SE - ERIE E	PENNELEC - PENNELEC	200	0.2	22	0	29	0
ATHENIA - BERGEN	PSEG - PSEG	400	0.2	0	0	0	0
Eastern Interface	-	6	0.1	30	2.4	42	0.9
WLOOP; B - STARWLOO	COED - COED	862	0.1	995	0.1	830	0.1
BRUNNER - YORKANA	METED - PPL	6	0.1	1	0	5	0
BURT2334 - SANDY34T	BG&E - PEPSCO	1	0	121	12.1	117	16.4
LINWOOD - CHICHST2	PECO - PECO	2	0	117	3.9	89	1
PRINTZ - RIDLEY	PECO - PECO	0	0	18	3.1	8	0.4
IRONWOOD - S LEBTAP	METED - METED	0	0	672	2.3	1085	13.2
LUMBRN - COOKSTOW	JCPL - PSEG	7	0	100	1	160	0
COXSCRNR - LUMBRN	PSEG - PSEG	774	0	512	0.4	1021	0.4
WESTFALL - TYRONE N	PENNELEC - PENNELEC	2	0	38	0.3	67	1
BRIGH014 - BURT2314	PEPCO - PEPCO	0	0	3	0.2	0	0
PONTI; B - WILTO; B	COED - COED	1	0	10	0.1	236	16.6
50045005 Interface	-	0	0	2	0.1	5	0.7
FORDML90 - EMILIE7	PECO - PECO	0	0	0	0	724	1.7
KENDA;BU - LOCKP; B	COED - COED	0	0	0	0	56	1.4
BYRON; R - CHERR; R	COED - COED	0	0	1	0	45	1
O24 - DRES; R	COED - COED	0	0	0	0	15	1
CONASTON - MT CAR22	BG&E - BG&E	0	0	2	0	22	0.3
GOODI;2R - LOCKP; R	COED - COED	0	0	0	0	4	0.3
QUAD3-11 - H471 ;	COED - COED	13	0	10	0	14	0.3
GESG TAP - GORE JCT	PENNELEC - PENNELEC	0	0	28	0	72	0.2
CHERR; R - SILVE; R	COED - COED	0	0	0	0	5	0.1
GOODI;4B - LOCKP; B	COED - COED	0	0	0	0	3	0.1
JUNIATA - DAUPH-H2	PPL - PPL	0	0	0	0	4	0.1
			522		191.3		770.4

Indicates Congestion Costs of at least \$5 million in study year 2012, 2015, or 2018.

Note 1: Includes TRAIL and Susquehanna-Roseland 500 KV. Does not includes PATH, MAPP, Branchburg-Roseland 500 KV, and Roseland-Hudson 500 KV upgrades

Note 2: Includes TRAIL, PATH, Susquehanna-Roseland 500 KV, MAPP, Branchburg-Roseland 500 KV, and Roseland-Hudson 500 KV upgrades.



## Constraints showing Significant Congestion Levels in 2012 , 2015, and 2018 Simulations

Constraints with at least \$5 million of Simulated Future Congestion	
Constraint	Observations
AP-South Interface	PATH (6/2014) significantly reduces but does not eliminate congestion
BLA-BED Interface	PATH (6/2014) significantly reduces but does not eliminate congestion
Western Interface	PATH (6/2014) eliminates congestion
Central Interface	MAPP (6/2014) significantly reduces but does not eliminate congestion
8CLOVER - 6CLOVER	PATH (6/2014) significantly reduces but does not eliminate congestion
05CLOVRD - 8LEXNGTN	PATH (6/2014) significantly reduces but does not eliminate congestion
ALTOONA - BEAR RCK	Significant levels of congestion observed on Penelec's underlying system - consistent throughout study period
15ELRM 5 - 01MITCHL	502-Prexy replacement upgrades (6/2010) were not modeled in RTEP case - these upgrades will be included in future simulations
BURT2334 - SANDY34T	B0870 (6/2013 - rebuild using double bundle 1033 ACSR. Double circuit 2314/2334) not modeled in RTEP case. To be included in future simulations
IRONWOOD - S.LEBTAP	Significant congestion appears in 2018 simulation. Will closely monitor in future Market Efficiency Analysis.
PONTI; B - WILTO:B	Significant congestion appears in 2018 simulation. Will closely monitor in future Market Efficiency Analysis.

- Identify potential upgrade acceleration candidates from list on Slide 5
- Consider upgrades to relieve congestion-causing constraints of slide 8
- Conduct cost-benefit analysis of any acceleration candidates or any economic upgrades