

A large, white, lattice-structured transmission tower stands prominently in the center of the slide, set against a clear blue sky. Several power lines extend from the tower towards the top corners of the frame.

# **Transmission Expansion Advisory Committee Meeting**

## **2008 Market Efficiency Analysis Preliminary Results**

August 20, 2008

- Review 2007 Historical Market Congestion
- Review Preliminary Simulation Results
- Next Steps

- Total market congestion for 2007 about \$1,840 million
- Top 20 congestion-causing constraints account for 87.4% of total 2007 congestion
- Future RTEP upgrades needed for reliability expected to relieve or eliminate most congestion associated with 2007 historical constraints

# 2007 Historical Market Congestion Top 20 Congestion-Causing Constraints

Rank	Constraint	Type	Voltage	Location	# of Real-Time Hours	Market Congestion (\$Millions)	% of Total Congestion	Upgrades expected to provide Congestion Relief
1	Bedington - Black Oak	Interface	500	500	1826	\$ 711.3	38.7%	- Black Oak 500 kV SVC (12/2007) - 502 Junction-Mt. Storm-Meadowbrook-Loudoun 500 kV (6/2011) - Amos-Bedington 765 kV - Bedington-Kempton 500 kV (6/2012)
2	Cloverdale - Lexington	Line	500	500	1872	\$ 226.8	12.3%	- Bath County SPS (winter 2008/09) - 502 Junction-Mt. Storm-Meadowbrook-Loudoun 500 kV (6/2011) - Amos-Bedington 765 kV - Bedington-Kempton 500 kV (6/2012)
3	5004/5005 Interface	Interface	500	500	385	\$ 116.6	6.3%	- Build Airydale 500 kV and install 400 MVAR capacitor (6/2010) - Airydale 500 kV SVC (5/2010 and 5/2011) - 502 Junction-Mt. Storm-Meadowbrook-Loudoun 500 kV (6/2011) - Amos-Bedington 765 kV - Bedington-Kempton 500 kV (6/2012) - MAPP (6/2013)
4	AP South	Interface	500	500	130	\$ 101.2	5.5%	- install 200 MVAR capacitor at Meadow Brook 500 kV (6/2012) - 502 Junction-Mt. Storm-Meadowbrook-Loudoun 500 kV (6/2011) - Amos-Bedington 765 kV - Bedington-Kempton 500 kV (6/2012)
5	Kammer	Transformer	765	500	942	\$ 64.4	3.5%	- Replace Kammer 765/500 kV transformer (11/2009) - Amos-Bedington 765 kV - Bedington-Kempton 500 kV (6/2012)
6	Branchburg - Readington	Line	230	PSEG	719	\$ 63.1	3.4%	- Replace wave trap on Branchburg-Readington (6/2008) - Reconductor Branchburg-Readington (6/2010) - Susquehanna-Roseland 500 kV (6/2012)
7	Bedington	Transformer	500	APS	427	\$ 59.7	3.2%	- 4th Bedington 500/138 kV Trf (5/2009)
8	Meadowbrook	Transformer	500	APS	235	\$ 44.9	2.4%	- 4th Meadowbrook 500/138 kV Trf (5/2008)
9	Central	Interface	500	500	25	\$ 32.6	1.8%	- Build Airydale 500 kV and install 400 MVAR capacitor (6/2010) - Airydale 500 kV SVC (5/2010 and 5/2011) - MAPP (6/2013)
10	Atlantic - Larrabee	Line	230	JCPL	134	\$ 22.9	1.2%	- replace line traps and reconductor circuit (6/2010)

# 2007 Historical Market Congestion Top 20 Congestion-Causing Constraints (cont.)

Constraint	Type	Voltage	Location	# of Real-Time Hours	Market Congestion (\$Millions)	% of Total Congestion	Upgrades expected to provide Congestion Relief
Branchburg - Flagtown	Line	230	PSEG	104	\$ 19.6	1.1%	- New Branchburg-Flagtown 230 kV section (6/2011)
Wylie Ridge	Transformer	345	APS	681	\$ 18.9	1.0%	- 4th Wylie Ridge 500/345 kV Trf (12/2007)
Brunner Island - Yorkana	Line	230	METED	194	\$ 18.6	1.0%	
East	Interface	500	500	5	\$ 17.6	1.0%	- Whippany 500 kV SVC (6/2009) - Whippany 130 MVAR capacitor (6/2010) - Whippany 500 kV SVC (6/2011) - Branchburg 500 kV Capacitor (6/2010) - Susquehanna-Roseland 500 kV (6/2012) - MAPP (6/2013)
Amos 345/138	Transformer	345	AEP	136	\$ 17.0	0.9%	- Install a 765/138 kV transformer at Amos (6/2008)
Conastone	Transformer	500	BGE	56	\$ 14.8	0.8%	- Replace Conastone Trfs (6/2009)
Kanawha - Matt Funk	Interface	345	AEP	93	\$ 14.7	0.8%	- 502 Junction-Mt. Storm-Meadowbrook-Loudoun 500 kV (6/2011) - Amos-Bedington 765 kV - Bedington-Kempton 500 kV (6/2012)
Doubs	Transformer	500	APS	101	\$ 14.6	0.8%	- Replace Doubs #2, #3 & #4 Trfs (6/2011)
Beckett - Paulsboro	Line	69	AECO	417	\$ 14.2	0.8%	- Reconductor Beckett-Paulsboro 69 kV (12/2007)
Bedington - Nipetown	Line	138	APS	175	\$ 13.9	0.8%	- Reconductor Bedington-Nipetown (6/2008)

Top 20 \$ 1,607.3 87.4%

- 2008 generation and load scenario has been simulated against 2 different transmission system topologies
  - (1) as-is 2008 system topology
  - (2) 2012 RTEP system topology
- Annual simulations using as-is 2008 system topology will be benchmarked to 2007 historical constraints
- Annual simulations using 2012 RTEP system topology will estimate economic impact of future upgrades
  - Identify acceleration candidates
  - Identify future bottlenecks

### Impact of 2012 RTEP Upgrades on Congestion by Constraint

Constraint	2008 As-Is System Topology		2012 RTEP System Topology	
	# of Hours	Market Congestion (\$Millions)	# of Hours	Market Congestion (\$Millions)
AP-South Interface	3241	1,128.1	47	35.9
05CLOVRD-8LEXNGTN	3854	318.6	862	53.8
01DOUBS-01DOUBS	143	160.9	0	0.0
50045005	506	74.4	9	4.7
Western Interface	628	72.5	5	1.2
01BLACKO-01BEDNGT	544	72.3	0	0.0
Central Interface	399	37.8	1057	131.0
05KAMMER-01KAMMER	1011	32.3	0	0.0
01BEDNGT-01BEDNGT	27	31.1	0	0.0
01PRNTY-8MT STM	244	30.7	0	0.0
Eastern Interface	149	28.2	0	0.0
01AQUEDT-01DOUBS	116	24.8	0	0.0
02SAMMIS-01WR SAM	680	19.1	121	3.0
8CLOVER-6CLOVER	190	12.9	32	1.8
6DOOMS-8DOOMS	81	12.2	0	0.0
KEENEY-KEEN_230	116	8.0	226	16.5
01MITCHL-01SHEPLR	522	6.4	305	6.3
GRACETON-RAPHAEL	55	3.4	0	0.0
ATHENIA-SADDLBRK	1180	2.4	0	0.0
HOMER CT-SHELOCTA	149	1.6	23	0.1
PONTI; B-WILTO; B	4	1.6	0	0.0
15ELRM 5-01MITCHL	210	1.4	342	5.1
01CHARLR-01MITCHL	70	0.7	310	3.9
E FRA; B-GOODI;3B	7	0.7	2	0.0
ELWOO; R-GOODI;1R	5	0.3	0	0.0
01CABOT-01CABOT	3	0.3	1	0.0
BURT2334-SANDY34T	2	0.2	13	0.9
01MAHNSL-05TIDD	15	0.2	0	0.0
EDISON 3-MDW RD R	2	0.1	0	0.0
01MITCHL-01UNIONJ	4	0.1	0	0.0
		2,083.3		264.3

Top 20 Constraint for 2007



# Market Simulation Results

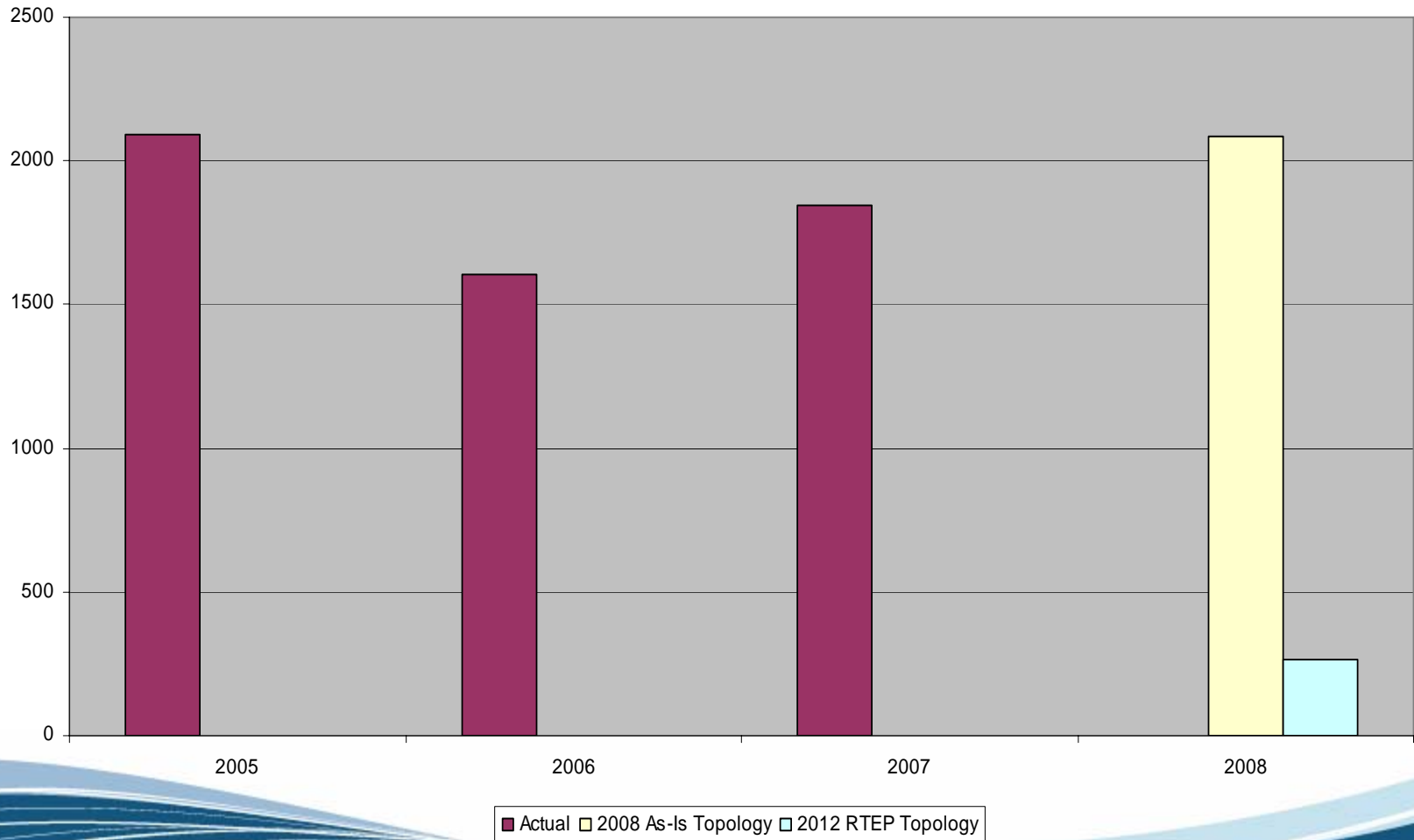
## 2008 Generation and Load Scenario (cont.)

### Economic Impact of 2012 RTEP Upgrades

Zone	Δ Gross Load Payment (\$)	Δ Average Load-Weighted LMP (\$/MWh)	Δ FTR Credits (\$)	Δ Marginal Loss Surplus Credits (\$)	Δ Net Load Payment (\$)	Δ Generation (MWh)	Δ Gross Generation Revenue (\$)	Δ Average Gen-Weighted LMP (\$/MWh)	Δ Generation Production Costs (\$)	Δ Net Generation Revenue (\$)
ACEC	-79.7	-6.76	-6.6	1.1	-74.2	-649,633	-66.5	-5.01	-25.4	-41.1
AEP	1,001.2	7.33	-31.3	12.4	1,020.1	12,249,919	1,584.5	6.69	344.0	1,240.5
APS	-39.0	-0.78	-543.1	4.5	499.5	2,405,836	483.9	7.26	82.0	401.9
BG&E	-503.5	-14.45	-95.1	3.2	-411.6	-2,510,051	-446.6	-12.35	-96.8	-349.8
COED	749.6	7.06	-6.7	9.6	746.7	2,364,665	943.9	6.40	129.1	814.8
DP&L	144.5	7.87	-1.4	1.7	144.2	1,874,619	192.0	6.75	50.9	141.1
DPLC	-132.8	-6.75	-10.1	1.8	-124.5	-1,040,727	-123.0	-6.30	-53.7	-69.3
DQE	100.1	6.76	2.2	1.3	96.6	766,840	162.3	6.71	25.8	136.5
JCPL	-158.8	-6.41	-30.2	2.2	-130.8	-615,299	-108.1	-6.35	-43.6	-64.4
METED	-98.1	-6.12	-26.9	1.5	-72.7	-1,170,277	-138.6	-5.04	-55.4	-83.2
PECO	-262.6	-6.30	-46.4	3.8	-220.0	-1,548,425	-386.5	-6.12	-91.3	-295.3
PENNELEC	46.0	2.62	-17.6	1.6	62.0	-609,471	105.5	2.82	-20.0	125.5
PEPCO	-554.9	-16.81	-46.6	3.0	-511.4	-2,476,317	-449.6	-15.91	-138.4	-311.2
PPL	-179.3	-4.25	-58.8	3.8	-124.3	-1,380,409	-224.0	-3.38	-48.2	-175.7
PSEG	-307.8	-6.42	-37.1	4.4	-275.0	-2,136,275	-395.8	-6.41	-134.1	-261.7
RECO	-9.7	-6.23	0.0	0.1	-9.9	0	0.0	0.00	0.0	0.0
VIÉP	-962.4	-10.19	-489.1	8.6	-481.8	-5,454,596	-658.4	-5.10	-315.7	-342.8
Neptune	-31.5	-5.24	0.0	0.5	-32.1	0	0.0	0.00	0.0	0.0
<b>TOTAL</b>	<b>-1,278.8</b>	<b>-1.78</b>	<b>-1,444.7</b>	<b>65.2</b>	<b>100.7</b>	<b>70,399</b>	<b>475.1</b>	<b>0.64</b>	<b>-390.8</b>	<b>865.9</b>

## Impact of 2012 RTEP Upgrades on Total PJM Congestion

Annual Congestion Costs (\$Millions)



- Conduct additional contingency analysis to ensure that monitor/contingency files are complete
- Conduct cost-benefit analysis of any acceleration candidate or any economic upgrade
- Conduct annual simulations of 2011, 2014, 2017 and 2022 generation and load scenarios
  - Identify potential acceleration candidates
  - Identify future transmission bottlenecks and enhance existing upgrades or develop new upgrades to relieve