

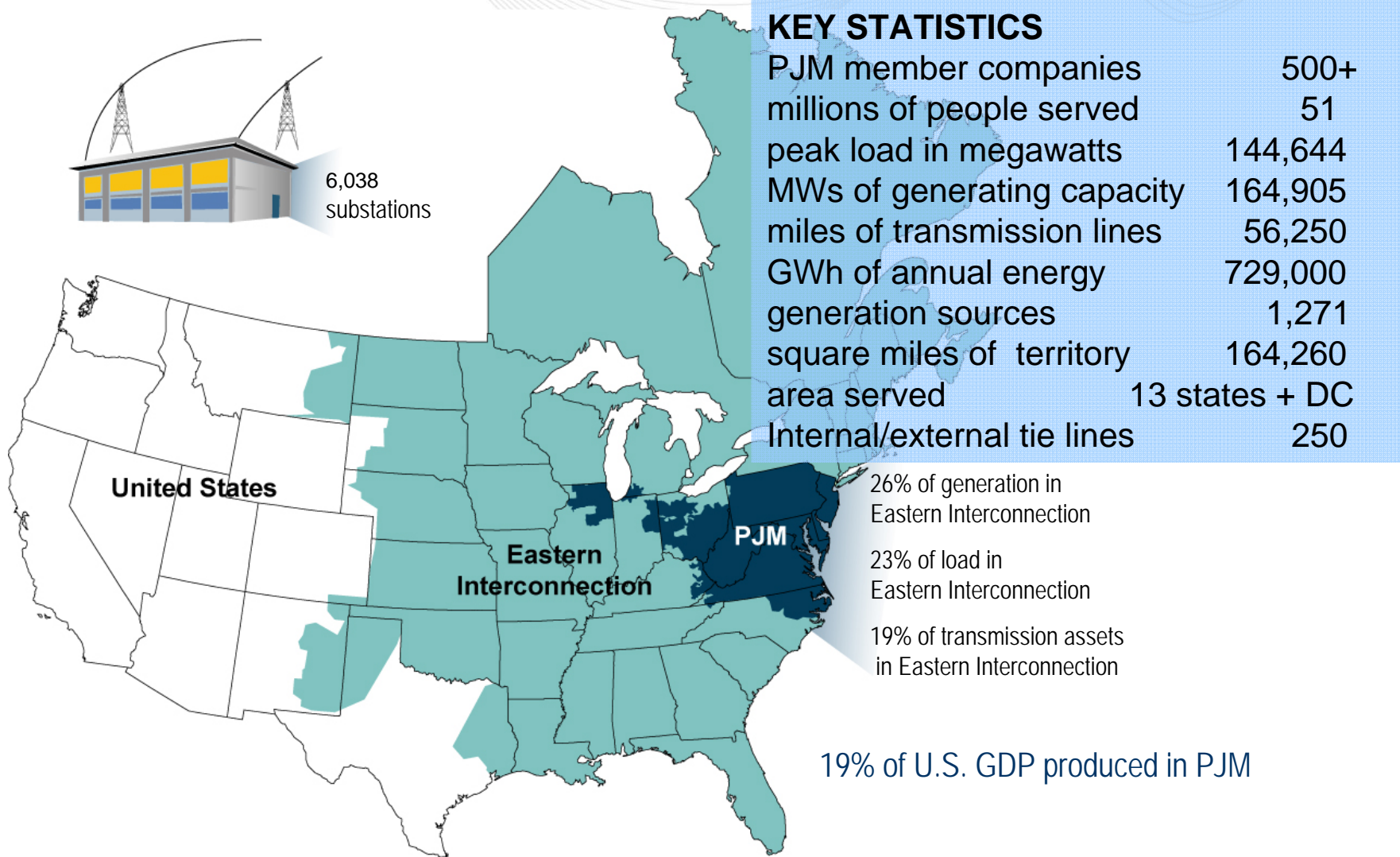
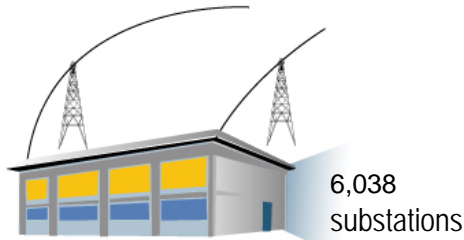


Congestion and the PJM Regional Transmission Plan

Steven R. Herling
Vice President, Planning
PJM Interconnection
March 25, 2009



PJM as Part of the Eastern Interconnection





Top 25 constraints with frequent occurrence: Calendar years 2007 to 2008

No.	Constraint	Type	Event Hours						Percent of Annual Hours					
			Day Ahead			Real Time			Day Ahead			Real Time		
			2007	2008	Change	2007	2008	Change	2007	2008	Change	2007	2008	Change
1	Bedington - Black Oak	Interface	5,493	1,384	(4,109)	1,836	279	(1,557)	63%	16%	(47%)	21%	3%	(18%)
2	AP South	Interface	706	3,572	2,866	133	997	864	8%	41%	33%	2%	11%	10%
3	Mount Storm - Pruntytown	Line	33	2,559	2,526	151	722	571	0%	29%	29%	2%	8%	6%
4	Sammis - Wylie Ridge	Line	90	1,915	1,825	109	1,239	1,130	1%	22%	21%	1%	14%	13%
5	Trainer - Delco Tap	Line	0	2,218	2,218	0	0	0	0%	25%	25%	0%	0%	0%
6	Kammer	Transformer	2,005	3,069	1,064	947	1,567	620	23%	35%	12%	11%	18%	7%
7	Branchburg - Readington	Line	2,324	1,121	(1,203)	721	271	(450)	27%	13%	(14%)	8%	3%	(5%)
8	West	Interface	359	1,690	1,331	338	385	47	4%	19%	15%	4%	4%	1%
9	Krendale - Seneca	Line	89	1,389	1,300	16	24	8	1%	16%	15%	0%	0%	0%
10	Mount Storm	Transformer	0	935	935	0	373	373	0%	11%	11%	0%	4%	4%
11	Atlantic - Larrabee	Line	680	1,556	876	134	380	246	8%	18%	10%	2%	4%	3%
12	Pumphrey - Westport	Line	9	1,092	1,083	0	0	0	0%	12%	12%	0%	0%	0%
13	Monroe	Transformer	6	815	809	3	247	244	0%	9%	9%	0%	3%	3%
14	Leonia - New Milford	Line	0	919	919	0	84	84	0%	10%	10%	0%	1%	1%
15	East Frankfort - Crete	Line	38	1,002	964	0	0	0	0%	11%	11%	0%	0%	0%
16	Dickerson - Pleasant View	Line	34	844	810	68	218	150	0%	10%	9%	1%	2%	2%
17	Cedar Grove - Clifton	Line	145	793	648	69	372	303	2%	9%	7%	1%	4%	3%
18	Dunes Acres - Michigan City	Flowgate	150	687	537	96	435	339	2%	8%	6%	1%	5%	4%
19	5004/5005 Interface	Interface	1,512	736	(776)	386	411	25	17%	8%	(9%)	4%	5%	0%
20	East Towanda	Transformer	1,055	803	(252)	410	306	(104)	12%	9%	(3%)	5%	3%	(1%)
21	Cloverdale - Lexington	Line	3,704	3,529	(175)	1,885	1,739	(146)	42%	40%	(2%)	22%	20%	(2%)
22	Pinehill - Stratford	Line	3,274	3,088	(186)	0	0	0	37%	35%	(2%)	0%	0%	0%
23	State Line - Wolf Lake	Flowgate	1,241	1,342	101	590	341	(249)	14%	15%	1%	7%	4%	(3%)
24	Bedington	Transformer	928	1,192	264	429	299	(130)	11%	14%	3%	5%	3%	(1%)
25	Mahans Lane - Tidd	Line	727	847	120	210	211	1	8%	10%	1%	2%	2%	0%

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Top 25 constraints affecting annual PJM congestion costs (By facility): Calendar year 2008

No.	Constraint	Type	Location	Congestion Costs (Millions)								Percent of Total PJM Congestion Costs 2008	
				Day Ahead				Balancing					Grand Total
				Load Payments	Generation Credits	Explicit	Total	Load Payments	Generation Credits	Explicit	Total		
1	AP South	Interface	500	\$196.2	(\$367.1)	\$23.8	\$587.1	(\$11.9)	\$5.5	(\$11.7)	(\$29.1)	\$558.0	26%
2	Cloverdale - Lexington	Line	AEP	\$153.8	(\$77.5)	\$9.0	\$240.3	(\$20.6)	(\$18.6)	(\$9.1)	(\$11.0)	\$229.3	11%
3	Mount Storm - Pruntytown	Line	AP	\$60.1	(\$157.0)	\$15.8	\$232.8	(\$21.6)	(\$15.8)	(\$2.9)	(\$8.7)	\$224.1	11%
4	Bedington - Black Oak	Interface	500	\$52.2	(\$106.2)	\$7.0	\$165.5	(\$1.3)	(\$0.6)	(\$0.2)	(\$0.9)	\$164.6	8%
5	West	Interface	500	\$67.8	(\$42.5)	\$8.0	\$118.3	(\$2.0)	\$8.2	(\$2.2)	(\$12.4)	\$105.9	5%
6	Kammer	Transformer	500	\$100.9	\$23.3	\$10.4	\$88.0	(\$17.0)	(\$3.7)	\$1.4	(\$11.9)	\$76.1	4%
7	Sammis - Wylie Ridge	Line	AP	\$18.4	(\$5.9)	\$23.1	\$47.4	(\$29.7)	\$5.2	(\$71.9)	(\$106.9)	(\$59.5)	(3%)
8	Bedington	Transformer	AP	\$21.5	(\$33.2)	\$2.2	\$56.9	(\$1.8)	(\$1.4)	(\$1.1)	(\$1.4)	\$55.4	3%
9	5004/5005 Interface	Interface	500	\$16.5	(\$34.9)	\$3.0	\$54.4	(\$2.8)	\$6.9	(\$2.0)	(\$11.7)	\$42.7	2%
10	Mount Storm	Transformer	AP	\$22.3	(\$61.3)	\$10.0	\$93.6	(\$20.9)	\$14.1	(\$15.9)	(\$50.9)	\$42.7	2%
11	East	Interface	500	\$21.7	(\$17.5)	\$1.2	\$40.4	(\$0.1)	(\$0.0)	\$0.0	(\$0.0)	\$40.4	2%
12	Atlantic - Larrabee	Line	JCPL	\$41.1	(\$15.4)	\$5.4	\$61.9	(\$9.7)	\$8.2	(\$4.8)	(\$22.7)	\$39.2	2%
13	Meadow Brook	Transformer	AP	\$21.8	(\$17.5)	\$0.8	\$40.1	(\$4.4)	(\$1.2)	(\$0.4)	(\$3.6)	\$36.5	2%
14	Branchburg - Readington	Line	PSEG	\$31.0	(\$12.2)	\$4.8	\$48.1	(\$6.4)	\$8.8	(\$2.0)	(\$17.2)	\$30.9	1%
15	East Frankfort - Crete	Line	ComEd	\$7.7	(\$13.8)	\$6.7	\$28.2	\$0.0	\$0.0	\$0.0	\$0.0	\$28.2	1%
16	Aqueduct - Doubs	Line	AP	\$23.7	(\$3.9)	\$0.5	\$28.0	\$0.0	(\$0.1)	(\$0.0)	\$0.1	\$28.1	1%
17	Central	Interface	500	\$13.9	(\$11.1)	\$1.6	\$26.6	(\$0.1)	\$0.0	\$0.1	(\$0.0)	\$26.6	1%
18	Axton	Transformer	AEP	\$9.1	(\$15.4)	\$1.6	\$26.2	\$0.0	\$0.0	\$0.0	\$0.0	\$26.2	1%
19	Unclassified	Unclassified	Unclassified	\$10.9	(\$10.6)	\$2.0	\$23.4	\$0.0	\$0.0	(\$0.0)	(\$0.0)	\$23.4	1%
20	Harwood - Susquehanna	Line	PPL	\$9.0	(\$19.9)	\$0.5	\$29.4	(\$2.6)	\$3.0	(\$0.7)	(\$6.3)	\$23.2	1%
21	Krendale - Seneca	Line	AP	\$18.6	\$3.4	\$7.4	\$22.5	(\$0.1)	\$0.0	(\$0.1)	(\$0.3)	\$22.3	1%
22	Dickerson - Plesant View	Line	Pepco	\$41.5	\$24.9	\$2.2	\$18.8	(\$0.4)	(\$1.2)	(\$1.4)	(\$0.6)	\$18.3	1%
23	Bristers - Ox	Line	Dominion	\$8.7	(\$7.4)	(\$0.9)	\$15.3	\$0.5	\$0.4	\$0.4	\$0.5	\$15.8	1%
24	North Seaford - Pine Street	Line	DPL	\$21.2	\$5.4	\$0.1	\$16.0	(\$1.0)	(\$0.6)	(\$0.1)	(\$0.6)	\$15.4	1%
25	Branchburg - Flagtown	Line	PSEG	\$12.2	(\$4.1)	\$0.2	\$16.4	\$0.5	\$1.0	(\$1.1)	(\$1.6)	\$14.8	1%

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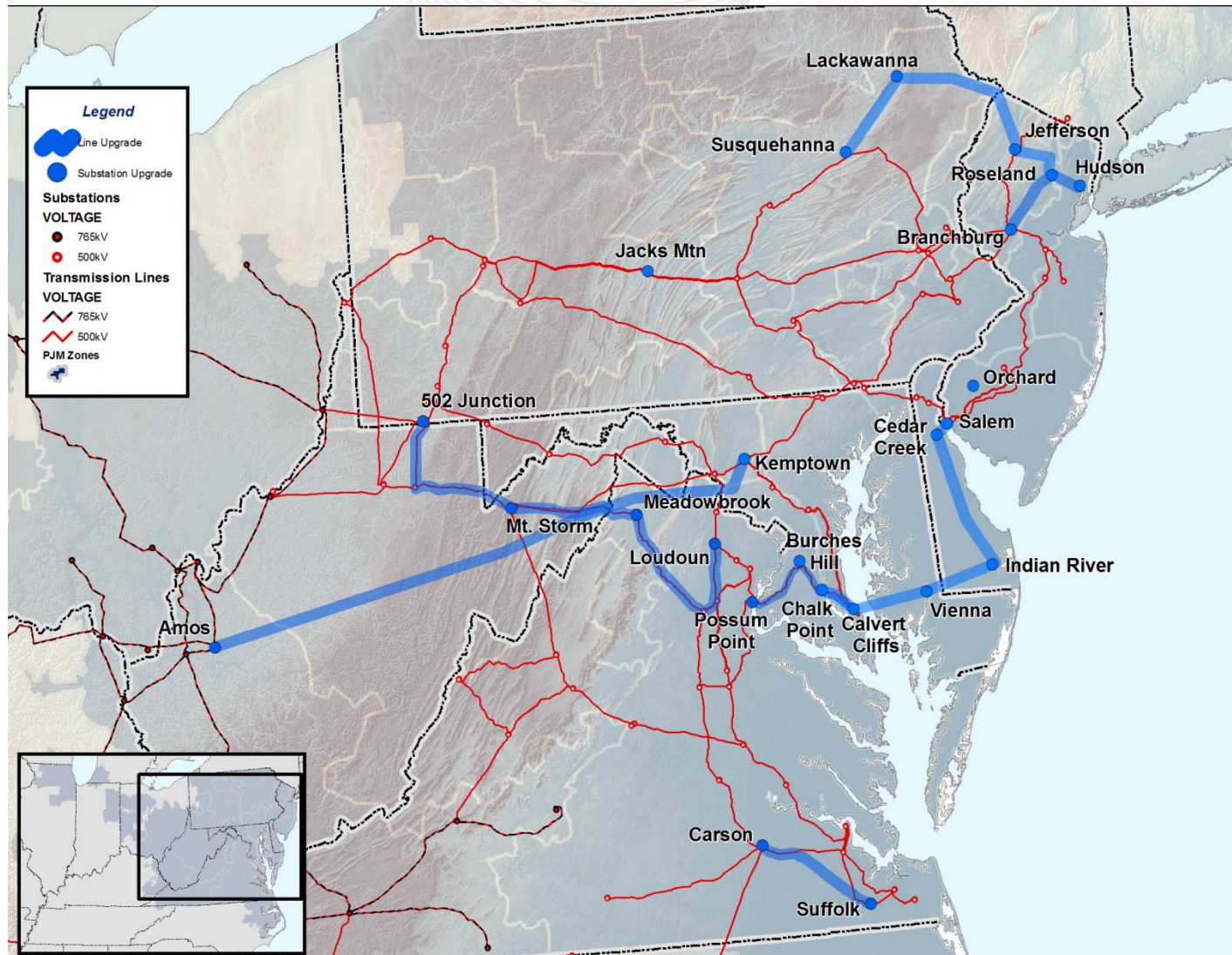


Top 25 constraints affecting annual PJM congestion costs (By facility): Calendar year 2007

No.	Constraint	Type	Location	Congestion Costs (Millions)								Percent of Total PJM Congestion Costs	
				Day Ahead				Balancing				Grand Total	2007
				Load Payments	Generation Credits	Explicit	Total	Load Payments	Generation Credits	Explicit	Total		
1	Bedington - Black Oak	Interface	500	\$865.4	\$171.2	\$43.4	\$737.6	\$3.0	\$10.3	(\$16.2)	(\$23.5)	\$714.0	39%
2	Cloverdale - Lexington	Line	AEP	\$347.8	\$146.6	\$22.4	\$223.6	\$12.2	(\$13.7)	(\$22.5)	\$3.5	\$227.1	12%
3	5004/5005 Interface	Interface	500	\$30.0	(\$85.3)	\$5.7	\$121.0	\$0.4	\$4.7	(\$0.3)	(\$4.6)	\$116.5	6%
4	AP South	Interface	500	\$87.0	(\$7.0)	\$4.3	\$98.4	\$2.2	\$0.1	\$1.0	\$3.1	\$101.5	5%
5	Kammer	Transformer	500	\$137.3	\$89.6	\$11.6	\$59.2	\$2.0	(\$6.7)	(\$3.7)	\$5.1	\$64.3	3%
6	Branchburg - Readington	Line	PSEG	(\$187.3)	(\$278.7)	\$9.4	\$100.8	(\$16.4)	\$12.9	(\$8.4)	(\$37.6)	\$63.1	3%
7	Bedington	Transformer	AP	\$39.2	(\$21.1)	\$2.9	\$63.1	(\$3.9)	(\$2.5)	(\$2.0)	(\$3.4)	\$59.7	3%
8	Meadow Brook	Transformer	AP	\$20.4	(\$23.8)	\$0.7	\$44.9	(\$0.5)	(\$1.0)	(\$0.4)	\$0.0	\$44.9	2%
9	Central	Interface	500	(\$29.9)	(\$59.7)	\$2.5	\$32.4	\$0.0	\$0.0	\$0.0	\$0.0	\$32.4	2%
10	Atlantic - Larrabee	Line	JCPL	\$20.1	(\$8.5)	\$1.7	\$30.3	(\$3.2)	\$3.2	(\$0.8)	(\$7.2)	\$23.1	1%
11	Branchburg - Flagtown	Line	PSEG	\$12.5	(\$8.7)	\$0.4	\$21.5	\$0.2	\$0.9	(\$1.3)	(\$2.0)	\$19.5	1%
12	Wylie Ridge	Transformer	AP	\$68.4	\$47.1	\$10.1	\$31.3	(\$2.2)	\$0.6	(\$9.6)	(\$12.4)	\$18.9	1%
13	Brunner Island - Yorkana	Line	Met-Ed	\$11.4	(\$3.4)	\$0.1	\$14.9	\$1.9	(\$1.7)	\$0.1	\$3.7	\$18.6	1%
14	East	Interface	500	(\$8.9)	(\$25.6)	\$0.8	\$17.5	(\$0.0)	(\$0.0)	(\$0.0)	(\$0.0)	\$17.4	1%
15	Amos	Transformer	AEP	\$9.7	(\$8.8)	\$0.5	\$18.9	\$3.5	\$2.1	(\$3.4)	(\$2.0)	\$17.0	1%
16	Conastone	Transformer	BGE	\$7.5	(\$5.9)	\$0.4	\$13.8	\$1.6	\$0.3	(\$0.3)	\$1.0	\$14.8	1%
17	Kanawha - Matt Funk	Line	AEP	\$16.0	\$2.2	\$1.8	\$15.5	\$0.1	\$0.6	(\$0.3)	(\$0.8)	\$14.7	1%
18	Doubs	Transformer	AP	\$13.9	(\$0.9)	\$0.5	\$15.3	(\$0.5)	(\$0.7)	(\$0.7)	(\$0.5)	\$14.7	1%
19	Beckett - Paulsboro	Line	AECO	\$11.7	(\$4.5)	\$0.1	\$16.3	(\$2.5)	(\$0.5)	(\$0.0)	(\$2.1)	\$14.2	1%
20	Bedington - Nipetown	Line	AP	\$16.4	\$1.9	\$0.6	\$15.0	\$0.2	\$0.5	(\$0.8)	(\$1.1)	\$13.9	1%
21	Cloverdale	Transformer	AEP	\$14.5	\$1.5	\$1.5	\$14.5	(\$0.4)	(\$0.0)	(\$0.7)	(\$1.0)	\$13.5	1%
22	Darwin - Eugene	Line	AEP	(\$0.1)	(\$3.4)	\$0.1	\$3.3	\$0.6	\$6.6	(\$9.9)	(\$16.0)	(\$12.6)	(1%)
23	Unclassified	Unclassified	Unclassified	\$10.1	(\$1.0)	\$1.3	\$12.4	\$0.0	\$0.0	\$0.0	\$0.0	\$12.4	1%
24	West	Interface	500	\$5.5	(\$12.0)	\$2.0	\$19.4	\$0.3	\$5.1	(\$3.6)	(\$8.4)	\$11.0	1%
25	Axton	Transformer	AEP	\$10.2	\$0.8	\$1.1	\$10.5	\$0.0	\$0.0	\$0.0	\$0.0	\$10.5	1%

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- 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 500kV SVC (12/2007) - 502 Junction-Mt. Storm-Meadowbrook-Loubun 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-Loubun 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 500kV and install 400 MVAR capacitor (6/2010) - Airydale 500 kV SVC (5/2010 and 5/2011) - 502 Junction-Mt. Storm-Meadowbrook-Loubun 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-Loubun 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 500kV 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
Bandburg-Flagtown	Line	230	PSEG	104	\$ 196	1.1%	- New Bandburg-Flagtown 230kV section (6/2011)
Wylie Ridge	Transformer	345	APS	681	\$ 189	1.0%	- 4th Wylie Ridge 500/345kV Tfr (12/2007)
Burner Island-Yorkana	Line	230	METED	194	\$ 186	1.0%	
East	Interface	500	500	5	\$ 176	1.0%	- Whippany 500kV/S.C (6/2009) - Whippany 130MVAR capacitor (6/2010) - Whippany 500kV/S.C (6/2011) - Bandburg 500kV Capacitor (6/2010) - Susquehanna Roadland 500kV (6/2012) - MFP (6/2013)
Amos 345/138	Transformer	345	AEP	136	\$ 170	0.9%	- Install a 765/138kV transformer at Amos (6/2008)
Crastone	Transformer	500	BGE	56	\$ 148	0.8%	- Replace Crastone Tfrs (6/2009)
Keravha-Mitt Furk	Interface	345	AEP	93	\$ 147	0.8%	- 502 Junction M. Storm Meadowbrook Loudun 500kV (6/2011) - Amos-Bedington 765kV - Bedington-Kempton 500kV (6/2012)
Dubs	Transformer	500	APS	101	\$ 146	0.8%	- Replace Dubs #2, #3 & #4 Tfrs (6/2011)
Bedett - Paulsboro	Line	69	AECO	417	\$ 142	0.8%	- Recirculator Bedett-Paulsboro 69kV (12/2007)
Bedington-Noroton	Line	138	APS	175	\$ 139	0.8%	- Recirculator Bedington-Noroton (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

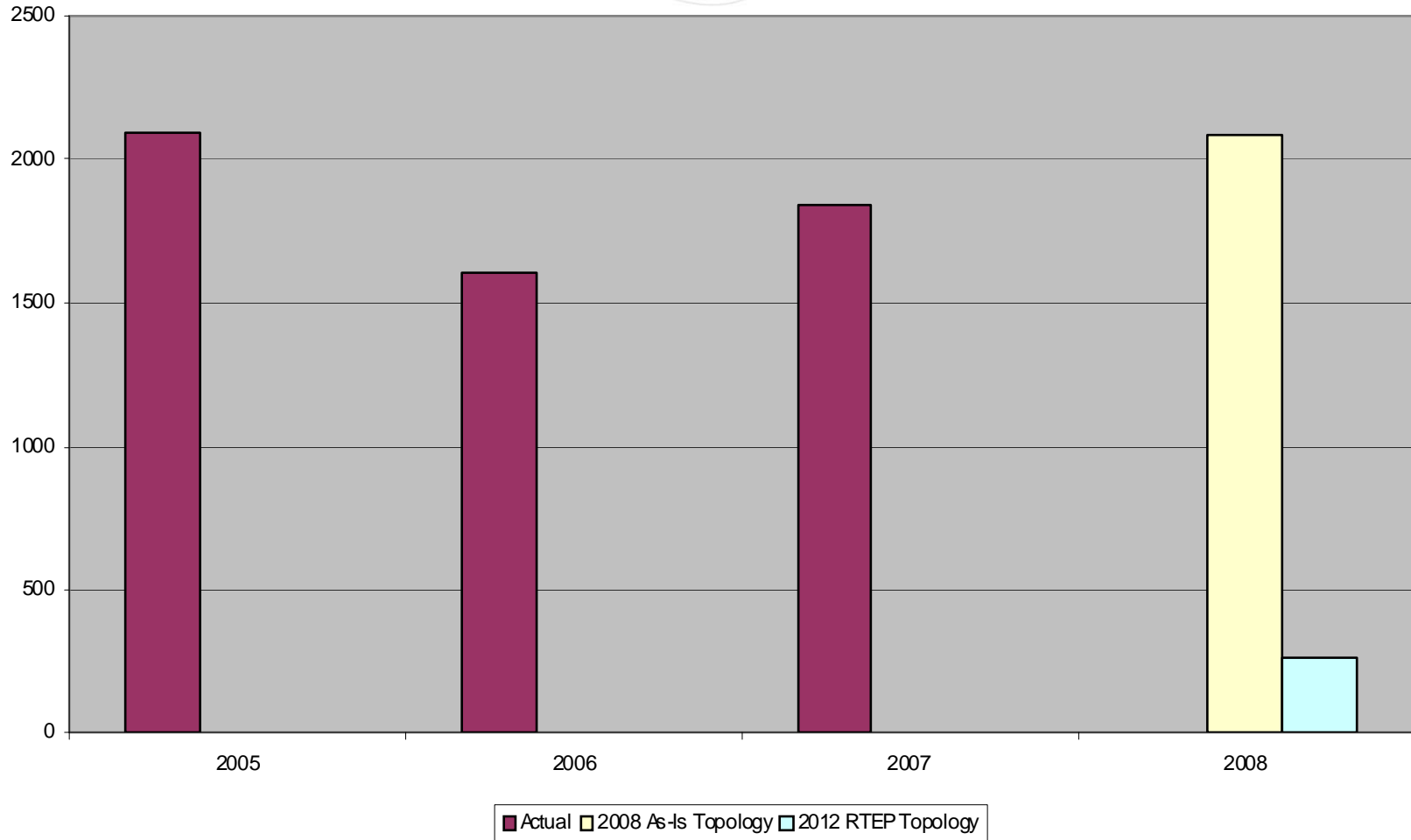


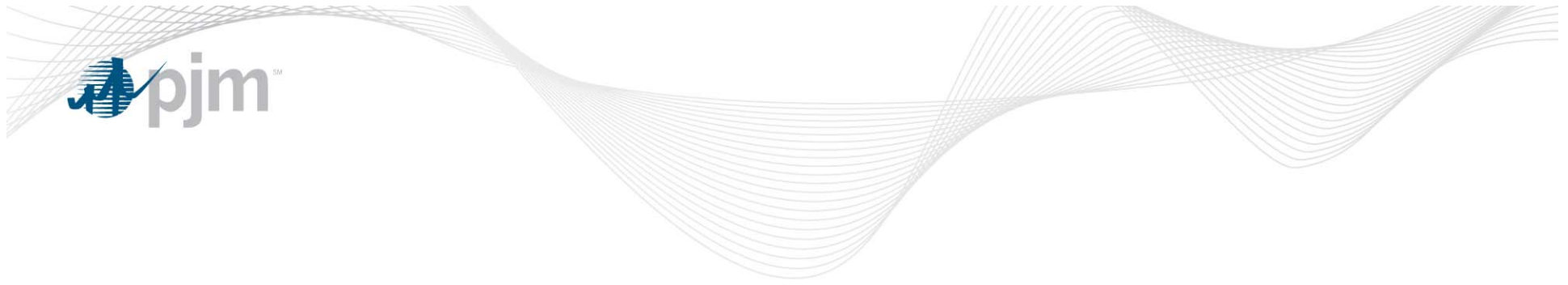
Market Simulation Results 2008 Generation and Load Scenario

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

Impact of 2012 RTEP Upgrades on Total PJM Congestion Annual Congestion Costs (\$Millions)





Questions?