



Market Efficiency Analysis Preliminary Results

PJM Planning Committee
Transmission Expansion Advisory Committee
February 21, 2007

- Review initial market simulation analysis results
- Review sample calculation of upgrade impact on RPM
- Discuss comments on market simulation assumptions
- Discuss next steps

- Analysis conducted using a market simulation tool which models the hourly security-constrained commitment and dispatch of generation
- Economic benefits of transmission upgrades are determined by comparing results of simulations which include the study upgrade to results of simulations which do not include the study upgrade
- Study Years: 2007, 2010, 2013, 2016, 2021
- Sensitivity analysis:
 - High/Low fuel prices
 - High/Low demand
 - High/Low future generation scenarios
 - High/Low emission costs
 - High-Low discount rates



Market Simulation Metrics

- For each upgrade studied, the change in the following metrics will be calculated:
 - Total PJM Production Costs
 - Load Payments (total system and zonal)
 - Total PJM Generator Revenue
 - FTR Credits (total system and zonal) (existing FTRs plus incremental FTRs created by upgrade)



Status of Market Simulations

- PJM has recently completed initial analysis of the 502 Junction-Loudoun 500 kV Line
- Analysis conducted using base input assumptions for 2007 and 2010 load and generation models
- Initial simulations and results still under review by PJM staff
- FTR credit impact of upgrades not yet quantified
- PJM will provide periodic status updates as analysis progresses



Market Simulation Scenarios

Sensitivity	Year				
	2007	2010	2013	2016	2021
Base Assumptions	X	X	X	X	X
High Fuel	X	X	X	X	X
Low Fuel	X	X	X	X	X
High Load	X	X	X	X	X
Low Load	X	X	X	X	X
High Emissions	X	X	X	X	X
Low Emission	X	X	X	X	X
High Generation	X	X	X	X	X
Low Generation	X	X	X	X	X
Others ??	X	X	X	X	X

Network topology studied so far:

- (1) as-is system
- (2) 2011 RTEP system (minus 502 Junction-Loudoun line)
- (3) 2011 RTEP system



Economic Impact of 2011 RTEP Upgrades

Upgrades	Change in Production Cost (\$Millions)		Change in Load Payment (\$Millions)		Change in Generation Revenue (\$Millions)		Change in Congestion Costs (\$Millions)	
	2007	2010	2007	2010	2007	2010	2007	2010
502 Junction Line	-153.2	-140.4	-726.0	-621.2	83.4	168.8	-809.4	-790.1
All Other 2011 RTEP Upgrades	-80.7	-99.9	-314.5	-292.1	-106.4	24.9	-208.1	-316.9
Total 2011 RTEP Impact	-233.9	-240.7	-1,040.5	-913.3	-23.0	193.7	-1,017.5	-1,107.0

Table summarizes the economic impact of all upgrades associated with the 2011 RTEP



Economic Impact of 502 Junction-Loudoun Line

Change in load payment for 2007 load and generation scenario - base assumptions

Zone	2011 RTEP w/o 502 Junction Line		2011 RTEP w/ 502 Junction Line		Delta Load Payment	Delta LMP (load-weighted)
	Load Payment (\$)	\$/MWh	Load Payment (\$)	\$/MWh		
ACE	618,618,364	51.82	603,210,345	50.53	-15,408,019	-1.29
AEP	5,371,261,726	38.64	5,595,666,290	40.26	224,404,564	1.61
APS	2,339,348,764	45.29	2,382,018,354	46.11	42,669,590	0.83
BG&E	1,978,166,180	56.11	1,760,499,769	49.94	-217,666,411	-6.17
COED	4,164,080,516	39.18	4,310,488,946	40.56	146,408,430	1.38
DOM	5,183,001,308	54.51	4,627,398,244	48.67	-555,603,064	-5.84
DAY	724,908,697	38.66	752,371,800	40.12	27,463,104	1.46
DPL	1,027,352,040	51.93	997,157,085	50.40	-30,194,955	-1.53
DQE	558,563,943	38.06	617,669,745	42.09	59,105,802	4.03
JC	1,306,051,858	52.09	1,282,434,900	51.15	-23,616,958	-0.94
ME	793,076,158	50.33	770,322,760	48.89	-22,753,399	-1.44
PECO	2,139,352,180	51.56	2,086,785,257	50.29	-52,566,923	-1.27
PEPCO	1,933,019,895	57.97	1,676,834,934	50.29	-256,184,961	-7.68
PN	771,591,700	42.62	810,742,112	44.79	39,150,412	2.16
PPL	2,091,095,307	49.06	2,052,912,311	48.16	-38,182,996	-0.90
PSEG	2,501,099,258	51.53	2,454,367,529	50.57	-46,731,729	-0.96
RECO	79,706,373	52.27	78,395,461	51.41	-1,310,912	-0.86
Neptune	283,516,438	47.25	278,529,398	46.42	-4,987,040	-0.83
Grand Total	33,863,810,704	46.72	33,137,805,238	45.72	-726,005,466	-1.00



Economic Impact of 502 Junction-Loudoun Line

Change in load payment for 2010 load and generation scenario - base assumptions

Zone	2011 RTEP w/o 502 Junction Line		2011 RTEP w/ 502 Junction Line		Delta Load Payment	Delta LMP (load-weighted)
	Load Payment (\$)	\$/MWh	Load Payment (\$)	\$/MWh		
ACE	671,388,269	52.98	657,709,982	51.90	-13,678,287	-1.08
AEP	5,712,966,567	39.64	6,007,048,922	41.68	294,082,355	2.04
APS	2,433,314,704	46.12	2,465,869,138	46.74	32,554,434	0.62
BG&E	2,057,861,123	56.07	1,831,066,216	49.89	-226,794,907	-6.18
COED	4,649,026,192	40.46	4,836,536,840	42.09	187,510,648	1.63
DOM	5,470,369,736	54.46	4,915,671,308	48.94	-554,698,428	-5.52
DAY	782,936,504	39.93	817,207,244	41.67	34,270,740	1.75
DPL	1,100,833,445	52.98	1,073,818,619	51.68	-27,014,826	-1.30
DQE	607,187,665	40.07	666,674,396	43.99	59,486,731	3.93
JC	1,417,717,441	53.16	1,397,019,164	52.38	-20,698,277	-0.78
ME	845,243,090	50.95	822,188,529	49.56	-23,054,561	-1.39
PECO	2,281,873,278	52.55	2,234,720,980	51.46	-47,152,298	-1.09
PEPCO	2,017,978,686	57.79	1,748,981,269	50.08	-268,997,417	-7.70
PN	835,659,270	43.69	874,841,019	45.74	39,181,750	2.05
PPL	2,222,213,080	49.88	2,184,896,805	49.05	-37,316,275	-0.84
PSEG	2,679,454,940	52.61	2,638,734,858	51.81	-40,720,082	-0.80
RECO	81,383,695	53.37	80,262,070	52.63	-1,121,625	-0.74
Neptune	290,479,120	48.41	286,236,258	47.70	-4,242,863	-0.71
VFT	140,956,134	48.76	138,124,889	47.78	-2,831,245	-0.98
Grand Total	36,298,842,937	47.53	35,677,608,503	46.71	-621,234,433	-0.81



Economic Impact of 502 Junction-Loudoun Line

Change in PJM production cost, generation revenue and congestion costs for 2007 and 2010 load and generation scenario - base assumptions

Change in Production Cost (\$Millions)		Change in Load Payment (\$Millions)		Change in Generation Revenue (\$Millions)		Change in Congestion Costs (\$Millions)	
2007	2010	2007	2010	2007	2010	2007	2010
-153.2	-140.4	-726.0	-621.2	83.4	168.8	-809.4	-790.1



Economic Impact of 502 Junction-Loudoun Line

- Majority of economic benefits of 2011 RTEP upgrades associated with 502 Junction-Loudoun line
- Economic benefits of 502 Junction-Loudoun 500 kV Line associated with alleviation of following constraints:
 - Bedington-Black Oak 500 kV
 - AP South Interface
 - Cloverdale-Lexington 500 kV
- New line alleviates West, Central and Eastern Interface limits but these interfaces remain as significant economic bottlenecks
- New line aggravates Kammer Xfmr and El Rama-Mitchell constraints
 - Additional benefits could be derived from upgrades at these locations



Sample Calculation of Upgrade Impact on RPM Results

Change in Load Payments for incremental 100 MW increases in LDA
Import Limits for 2007/08 RPM Simulation

	CHANGE IN LOAD PAYMENTS FOR 100 MW IMPORT LIMIT INCREASE	CHANGE IN LOAD PAYMENTS FOR 200 MW IMPORT LIMIT INCREASE
RTO	5,846,133	6,718,999
Eastern MAAC	-68,247,691	-132,634,094
Southwestern MAAC	-55,674,248	-133,202,020
TOTAL	-118,075,806	-259,117,115



Review of Market Efficiency Analysis Assumptions

- Written comments on market efficiency analysis assumptions submitted by 3 parties
- Issues raised:
 - Need to maintain generation reserve levels at IRM in later simulation years
 - Evaluate over-build scenarios related to certain fuel price and emissions allowance price levels
 - Model carbon emissions costs
 - Model greater fuel cost uncertainty
 - Ensure fuel costs reflect locational premiums
 - Model wider range of generation reserve levels
 - Model a wider range of discount rates
 - Use RPM price signals in modeling future generation location



Review of Market Efficiency Analysis Assumptions (cont.)

- written comments do not explicitly recommend a change to base input assumptions but suggest that additional sensitivity analysis may be needed
- PJM does not recommend modifying base input assumptions or sensitivity scenario assumptions at this time
- Additional sensitivity scenarios may be needed depending on the outcome of initial sensitivity analysis results and further stakeholder discussion

- complete review of initial simulations
- calculate FTR credits for each simulation
- continue sensitivity analysis simulations for various upgrades
- calculate impact of upgrades on RPM costs
- provide status updates as analysis progresses