

The background of the slide is a photograph of several high-voltage transmission towers (pylons) stretching across the frame. The towers are silhouetted against a bright blue sky filled with scattered white clouds. The perspective is from a low angle, looking up at the towers, which creates a sense of height and scale. The overall color palette is dominated by blues and whites, with some grey from the towers.

# Transmission Expansion Advisory Committee Meeting

## 2014 Market Efficiency Analysis

September 02, 2014

- To review simulated congestion results for all Market Efficiency study years
- To provide an explanation of the drivers of congestion based on transmission topology and economic fundamentals
- To discuss next steps

- 2015 and 2019 for study of approved RTEP projects for accelerations and modifications.
  - Compare market congestion for near term vs. future topology
  - Estimate economic impact of accelerating planned upgrades
- 2019, 2022, and 2025 for study of new enhancements.
  - Review results to identify future constraints causing significant congestion
- All base congestion results posted on Market Efficiency website at below link:
  - <http://pjm.com/~media/planning/rtep-dev/market-efficiency/2014-market-efficiency-analysis-base-congestion-results.ashx>



# 2015 Load, Generation and Economic Assumptions

## Top 25 Market Efficiency Constraints

Facility Name	AREA	TYPE	2015 Input Assumptions with 2015 Topology		2015 Input Assumptions with 2019 Topology	
			Frequency (Hours)	Market Congestion (\$ Millions)	Frequency (Hours)	Market Congestion (\$ Millions)
AP SOUTH L/O BED-BLA	PJM	INTERFACE	1627	\$103.6	1448	\$79.4
Braidwood to East Frankfort 345 kV	CE	LINE	147	\$18.0	215	\$26.0
Monticello to East Winamac 138 kV	M2M	LINE	2569	\$99.0	65	\$2.9
Hennepin to Hennepin 138 kV	M2M	LINE	570	\$5.9	1374	\$12.6
AEP-DOM L/O BED-BLA	PJM	INTERFACE	706	\$26.7	587	\$19.3
Miami Fort to Willey 138 kV	DEO&K	LINE	310	\$20.0	308	\$25.0
Oak Grove to Galesburg 161 kV	M2M	LINE	3281	\$60.0		
Crescent 345 kV	DLCO	XFMR	9	\$2.6	4	\$0.5
Elliot to Elliot 138 kV	AEP	LINE	338	\$30.0	27	\$2.0
Cordova to Nelson 345 kV	CE	LINE	333	\$9.9	817	\$21.1
Worcester to Ocean Pines (I) 69 kV	DP&L	LINE	42	\$4.7	88	\$11.9
Graceton to BAGLEY 230 kV	BGE	LINE	826	\$22.0		
Dravosburg to West Mifflin 138 kV	DLCO	LINE	1275	\$14.4	937	\$8.5
Cloverdale to Lexington 500 kV	AEP - DVP	LINE	631	\$37.0		
Wurno to Claytor Lake 138 kV	AEP	LINE	84	\$11.0	99	\$5.0
Woodville to 15USAP 138 kV	DLCO	LINE	449	\$5.0	431	\$6.0
Hunterstown 230 kV	ME	XFMR	254	\$18.0		
WESTERN INTERFACE	PJM	INTERFACE	257	\$7.1		
6EDFERRY to Dickerson Station "D" 230 kV	PEPCO - DVP	LINE	39	\$6.3		
Staley North to Lafayette 138 kV	M2M	LINE	283	\$4.0		
Tiltonsville to Windsor 138 kV	AP - AEP	LINE	36	\$12.4	7	\$0.4
Cherry Valley to Cherry Valley 138 kV	CE	LINE	119	\$5.3	15	\$0.2
Cherry Valley 345 kV	CE	XFMR	119	\$4.0		
Belvidere to Marengo Tap 138 kV	CE	LINE	227	\$8.0		
Alpine to Belvidere 138 kV	CE	LINE	62	\$4.0		
<b>Total Congestion (Top 25)</b>				<b>\$538.9</b>		<b>\$220.8</b>
<b>Total Congestion (All Facilities)</b>				<b>\$593.0</b>		<b>\$285.0</b>



# 2019 Load, Generation and Economic Assumptions

## Top 25 Market Efficiency Constraints

Facility Name	AREA	TYPE	2019 Input Assumptions with 2015 Topology		2019 Input Assumptions with 2019 Topology	
			Frequency (Hours)	Market Congestion (\$ Millions)	Frequency (Hours)	Market Congestion (\$ Millions)
AP SOUTH L/O BED-BLA	PJM	INTERFACE	1705	\$99.0	1535	\$87.3
Braidwood to East Frankfort 345 kV	CE	LINE	271	\$32.0	452	\$51.0
Monticello to East Winamac 138 kV	M2M	LINE	1736	\$79.0	13	\$0.4
Hennepin to Hennepin 138 kV	M2M	LINE	596	\$7.0	2016	\$29.2
AEP-DOM L/O BED-BLA	PJM	INTERFACE	508	\$19.0	552	\$21.4
Miami Fort to Willey 138 kV	DEO&K	LINE	347	\$23.0	267	\$17.0
Oak Grove to Galesburg 161 kV	M2M	LINE	2987	\$66.0		
Crescent 345 kV	DLCO	XFMR	123	\$29.0	67	\$18.3
Elliot to Elliot 138 kV	AEP	LINE	497	\$44.0	104	\$9.0
Cordova to Nelson 345 kV	CE	LINE	201	\$6.0	538	\$15.2
Worcester to Ocean Pines (I) 69 kV	DP&L	LINE	28	\$4.0	76	\$13.8
Graceton to BAGLEY 230 kV	BGE	LINE	3080	\$54.0	8	\$0.0
Dravosburg to West Mifflin 138 kV	DLCO	LINE	1456	\$19.0	894	\$8.3
Cloverdale to Lexington 500 kV	AEP - DVP	LINE	435	\$32.0		
Wurno to Claytor Lake 138 kV	AEP	LINE	136	\$8.0	158	\$7.0
Woodville to 15USAP 138 kV	DLCO	LINE	541	\$8.0	364	\$6.0
Hunterstown 230 kV	ME	XFMR	372	\$25.0		
WESTERN INTERFACE	PJM	INTERFACE	958	\$25.0	270	\$3.3
6EDFERRY to Dickerson Station "D" 230 kV	PEPCO - DVP	LINE	792	\$11.0	125	\$0.2
Staley North to Lafayette 138 kV	M2M	LINE	453	\$12.0		
Tiltonsville to Windsor 138 kV	AP - AEP	LINE	4	\$1.0		
Cherry Valley to Cherry Valley 138 kV	CE	LINE	89	\$3.0	44	\$0.4
Cherry Valley 345 kV	CE	XFMR	156	\$6.0		
Belvidere to Marengo Tap 138 kV	CE	LINE	46	\$1.0		
Alpine to Belvidere 138 kV	CE	LINE	57	\$4.0		
<b>Total Congestion (Top 25)</b>				<b>\$617.0</b>		<b>\$287.8</b>
<b>Total Congestion (All Facilities)</b>				<b>\$671.0</b>		<b>\$395.0</b>





# Upgrades responsible for Congestion Reduction 2015 and 2019 Simulations

Facility Name	Area	Upgrade Responsible for Congestion Decrease
Monticello to East Winamac 138 kV	M2M	MISO MVP Project: Reynolds to Greentown
Oak Grove to Galesburg 161 kV	M2M	MISO MVP Project: Fargo-Galesburg-Oak Grove 345 kV Line
Graceton to BAGLEY 230 kV	BGE	PJM Project: Rebuild Graceton - Bagley 230 kV as double circuit line using 1590 ACSR
Cloverdale to Lexington 500 kV	AEP - DVP	PJM Project: Rebuild line, add 765 kV XFMR, replace 6A/6B Xfmr
Hunterstown 230 kV	ME	PJM Project: Install 2nd Hunterstown XFMR and reconductor Hunterstown- Oxford Line
Elliot to Elliot 138 kV	AEP	No upgrade Identified
AP SOUTH L/O BED-BLA	PJM	
WESTERN INTERFACE	PJM	
6EDFERRY to Dickerson Station "D" 230 kV	PEPCO - DVP	Reconfigure Line #203 to feed Edwards Ferry sub radial from Pleasant View 230 kV
Dravosburg to West Mifflin 138 kV	DLCO	Projected Congestion rises in future year simulations
Staley North to Lafayette 138 kV	M2M	MISO Project: Reconductor Lafayette 230 to Staley
Tiltonsville to Windsor 138 kV	AP - AEP	Projected Congestion in 2015/2019 reduced per removal of LTE rating Operational derate (2014)
Crescent 345 kV	DLCO	Projected Congestion expected to rise without 3rd XFMR
Cherry Valley 345 kV	CE	PJM Project: Construct a new Byron to Wayne 345 kV circuit
Belvidere to Marengo Tap 138 kV	CE	
Alpine to Belvidere 138 kV	CE	
Cherry Valley to Cherry Valley 138 kV	CE	



# Market Efficiency Simulation Results 2019, 2022, and 2025 Simulation Years

Facility Name	AREA	TYPE	2019 Input Assumptions with 2019 Topology		2022 Input Assumptions with 2019 Topology		2025 Input Assumptions with 2019 Topology	
			Frequency (Hours)	Market Congestion (\$ Millions)	Frequency (Hours)	Market Congestion (\$ Millions)	Frequency (Hours)	Market Congestion (\$ Millions)
AP SOUTH L/O BED-BLA	PJM	INTERFACE	1535	\$87.3	1326	\$117.3	915	\$83.8
Braidwood to East Frankfort 345 kV	CE	LINE	452	\$51.0	284	\$36.0	176	\$22.0
Hennepin to Hennepin 138 kV	M2M	LINE	2016	\$29.2	2276	\$55.1	2169	\$49.5
AEP-DOM L/O BED-BLA	PJM	INTERFACE	552	\$21.4	577	\$31.4	544	\$39.6
Miami Fort to Willey 138 kV	DEO&K	LINE	267	\$17.0	251	\$27.0	210	\$30.0
Crescent 345 kV	DLCO	XFMR	67	\$18.3	82	\$38.7	73	\$31.2
Elliot to Elliot 138 kV	AEP	LINE	104	\$9.0	151	\$13.0	176	\$15.0
50045005 L/O RCKSPG-KEENY	PJM	INTERFACE	858	\$17.6	730	\$29.6	798	\$38.9
Cordova to Nelson 345 kV	CE	LINE	538	\$15.2	483	\$21.6	408	\$18.2
Worcester to Ocean Pines (I) 69 kV	DP&L	LINE	76	\$13.8	96	\$19.6	128	\$30.8
Dravosburg to West Mifflin 138 kV	DLCO	LINE	894	\$8.3	889	\$10.8	916	\$13.7
Sub 56 (Davenport) to East Calamus 161 kV	M2M	LINE	247	\$4.2	704	\$19.7	971	\$30.7
Wurno to Claytor Lake 138 kV	AEP	LINE	158	\$7.0	205	\$12.0	110	\$7.0
Woodville to 15USAP 138 kV	DLCO	LINE	364	\$6.0	371	\$10.0	306	\$10.0
Peach Bottom 500 kV	PECO	XFMR	117	\$5.0	139	\$7.0	206	\$22.0
CENTRAL INTERFACE	PJM	INTERFACE	118	\$0.9	616	\$7.7	659	\$11.2
Krendale to Shanor Manor 138 kV	AP	LINE	513	\$3.0	783	\$13.0	810	\$15.0
Brunner Island to Yorkana 230 kV	ME - PPL	LINE	315	\$8.8	243	\$9.2	269	\$15.7
Claytor Lake to South Christiansburg 138 kV	AEP	LINE	145	\$3.0	355	\$16.0	205	\$9.0
Fieldale to Thornton 138 kV	AEP	LINE	135	\$4.0	170	\$9.0	224	\$11.0
Conastone to Northwest 230 kV	BGE	LINE	56	\$3.1	50	\$4.4	76	\$20.3
Safe Harbor to Graceton 230 kV	PPL - BGE	LINE	800	\$8.8	671	\$8.2	433	\$5.6
Taneytown to Carroll 138 kV	AP	LINE	532	\$10.2	419	\$5.9	163	\$2.8
CLEVELAND INTERFACE	PJM	INTERFACE	4	\$0.3	17	\$1.9	107	\$11.6
Dooms to Crozet 230 kV	DVP	LINE	12	\$1.0	26	\$3.0	16	\$11.0
<b>Total Congestion (Top 25)</b>				<b>\$353.4</b>		<b>\$527.1</b>		<b>\$555.6</b>
<b>Total Congestion (All Facilities)</b>				<b>\$395.0</b>		<b>\$575.0</b>		<b>\$639.0</b>



# Observations for 2019, 2022 and 2025 Simulation Years

Facility Name	Area	Observations
AP SOUTH L/O BED-BLA	PJM	West to East transfers. North Anna #3 Nuclear Plant causes downward trend in congestion between 2019 and 2025, rises after 2025
Braidwood to East Frankfort 345 kV	CE	PJM owned facility near border with MISO - impacted by interchange and high wind output
Hennepin to Hennepin 138 kV	M2M	Potential Network upgrades associated with new generator interconnections may help
AEP-DOM L/O BED-BLA	PJM	Combination of West to East transfers, load growth, higher loop flows and higher gas prices causes an upward trend in congestion
Miami Fort to Willey 138 kV	DEO&K	Identified in Baseline Reliability analysis (Projects under consideration in Reliability Proposal Window)
Crescent 345 kV	DLCO	
Elliot to Elliot 138 kV	AEP	Identified as overload in Winter Analysis
50045005 L/O RCKSPG-KEENY	PJM	West to East transfers on 500 kV system associated with load growth and higher gas prices cause upward trend in congestion
Peach Bottom 500 kV	PECO	
CENTRAL INTERFACE	PJM	
Krendale to Shanor Manor 138 kV	AP	Higher gas prices drive higher coal output in western PJM
Cordova to Nelson 345 kV	CE	Near border with MISO - impacted by interchange and loop flows
Worcester to Ocean Pines (I) 69 kV	DP&L	Load growth with limited local re-dispatch options leads to very high shadow price
Dravosburg to West Mifflin 138 kV	DLCO	Higher constraint sensitivity due to load growth and gas prices causes steady increase in congestion over time
Sub 56 (Davenport) to East Calamus 161 kV	M2M	MISO owned facility Impacted by PJM/MISO interchange and loop flows
Wurno to Claytor Lake 138 kV	AEP	Identified as overload in Winter Analysis
Brunner Island to Yorkana 230 kV	ME - PPL	Higher gas prices cause higher constraint sensitivity
Fieldale to Thornton 138 kV	AEP	Congestion and binding frequency grows steadily with load
Conastone to Northwest 230 kV	BGE	Increase in constrained hours due to load growth
Safe Harbor to Graceton 230 kV	PPL - BGE	Downward trend in congestion offset by higher congestion in Peachbottom area
CLEVELAND INTERFACE	PJM	Load growth drives increase in number of constrained hours.
Dooms to Crozet 230 kV	DVP	Constraint sensitivity rises significantly over time reflecting higher redispatch costs



- Wind impacts local constraints in COMED region
- High efficiency gas-fired generation in MAAC and Southern PJM initially mitigate the rise in regional congestion
- Trend upwards for load and gas prices contribute to higher congestion regionally and for some local constraints in future years
  - Higher gas prices beyond 2020 cause uptick in coal generation as some units become economic over greater number of hours
  - Lower voltage (138 kV and below) tend to be more sensitive to small load changes especially when load pocket further electrically from inexpensive re-dispatch options
- Interchange rises steadily over period of 2015 to 2025 but doesn't appear to be a significant driver of congestion changes across PJM footprint

## Market Efficiency Next Steps:

- Stakeholder feedback on model 10/01/2014
- Finalize Proposal Document and Criteria  
criteria for project proposals October
- PJM review of acceleration candidates September - October
- Proposal window November 1 – March 1, 2015

- Market Efficiency Web Page located at <http://www.pjm.com/planning/rtep-development/market-efficiency.aspx>
- Market Efficiency Case Files have been posted for all study years
  - Access requires CEII confirmation
  - Access requires Vendor (Ventyx) confirmation
  - Access requires MISO approval confirmed through PJM
  - No confidential data provided or used in analysis (i.e. actual bid data)
  - XML Format
- Reference Files
  - Input Assumptions Summary
  - Updated Modeling Document provides details of setup and modeling methods
  - Steps to run Model Document
  - Market Efficiency Training Document
- Market Efficiency Questions
  - Please send to the RTEP e-mail distribution ([rtep@pjm.com](mailto:rtep@pjm.com)) with “Market Efficiency” in the subject line header