Kentucky State Report

July 2017

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Executive Summary

(July 2017)

- **Existing Capacity:** Coal represents approximately 55 percent of the total installed capacity in the PJM portion of Kentucky while natural gas represents approximately 42 percent. This differs from PJM where natural gas are relatively even at 35 and 34 percent respectively.
- **Interconnection Requests:** Natural gas represents 93 percent of new interconnection requests in Kentucky.
- **Deactivations**: 147 MW of capacity in Kentucky retired in 2016. This compares to 392 MW of capacity retirements PJM-wide during the same year.
- **RTEP 2016:** Kentucky RTEP 2016 projects total nearly $49 million of investment. Over half represents baseline-type projects.
- **Load Forecast:** Kentucky load growth is nearly flat, averaging between 0.3 and 0.5 percent per year over the next 10 years. This aligns with PJM RTO load growth projections.

Executive Summary Cont.

(July 2017)

- **2020/21 Capacity Market:** Only the Eastern Kentucky Power Cooperative transmission zone portion of Kentucky load participates in the capacity market. Compared to the PJM footprint, the distribution of generation, demand response, and energy efficiency in the EKPC zone is similar.
- **6/1/2014 – 5/31/2017 Market Performance:** Kentucky's average daily locational marginal prices were consistent with the PJM average daily LMPs.
- **Emissions:** 2016 carbon dioxide emissions are slightly up from 2015; sulfur dioxides saw a significant year-over-year drop; nitrogen oxides hold flat from 2015.

PJM Service Area - Kentucky

State-specific data in this deck applies only to the PJM portion of Kentucky

Planning

Generation Portfolio Analysis

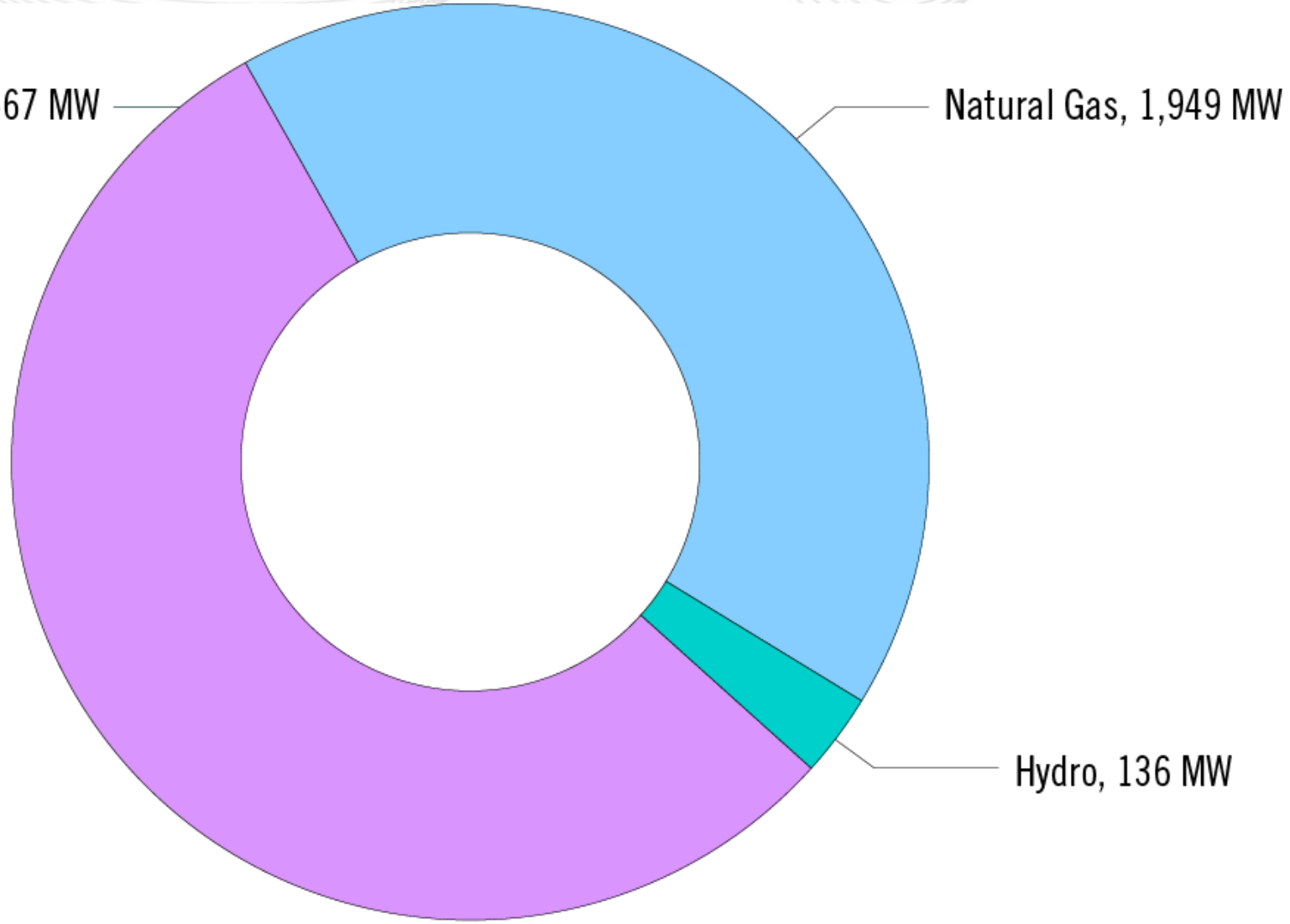
Kentucky – Existing Installed Capacity

(MW submitted to PJM, December 31, 2016)

Summary:

Natural gas represents approximately 42 percent of the total installed capacity in Kentucky while coal represents approximately 55 percent.

Overall in PJM, natural gas and coal are relatively even and 35 percent and 34 percent, respectively.

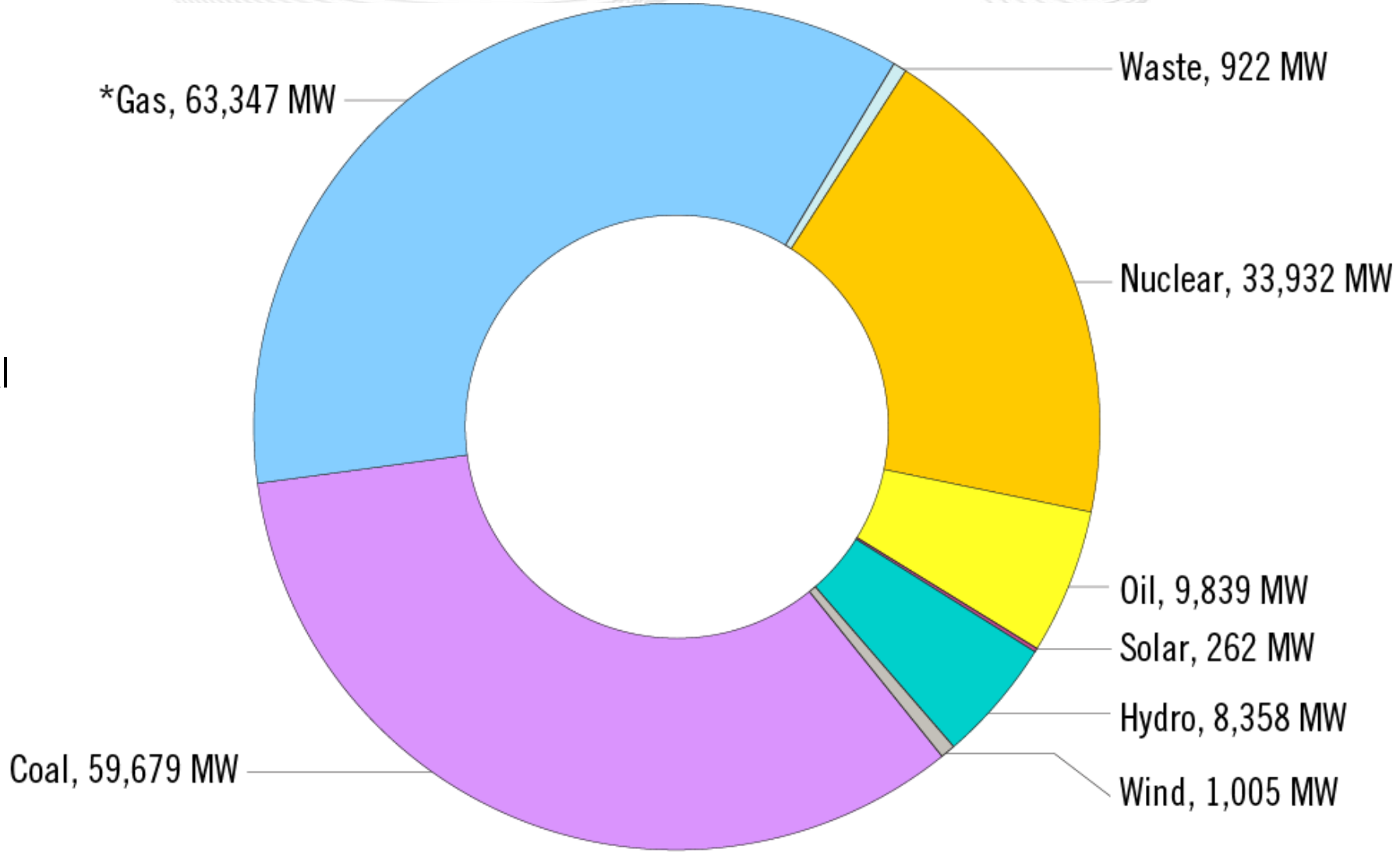


PJM – Existing Installed Capacity

(MW submitted to PJM, December 31, 2016)

In PJM, natural gas and coal make up nearly 70 percent total installed capacity.

* Gas Contains	
Natural Gas	62,941 MW
Other Gas	405 MW



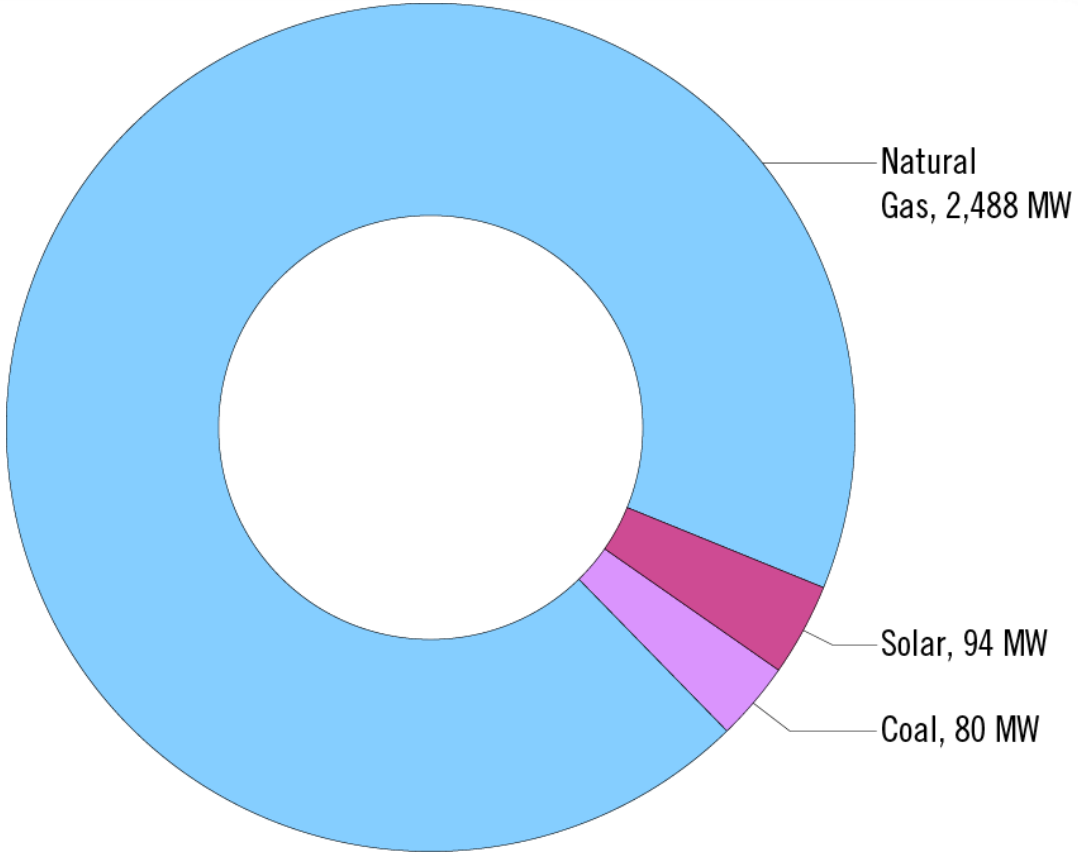
Kentucky – Interconnection Requests

(Requested Capacity Rights, December 31, 2016)

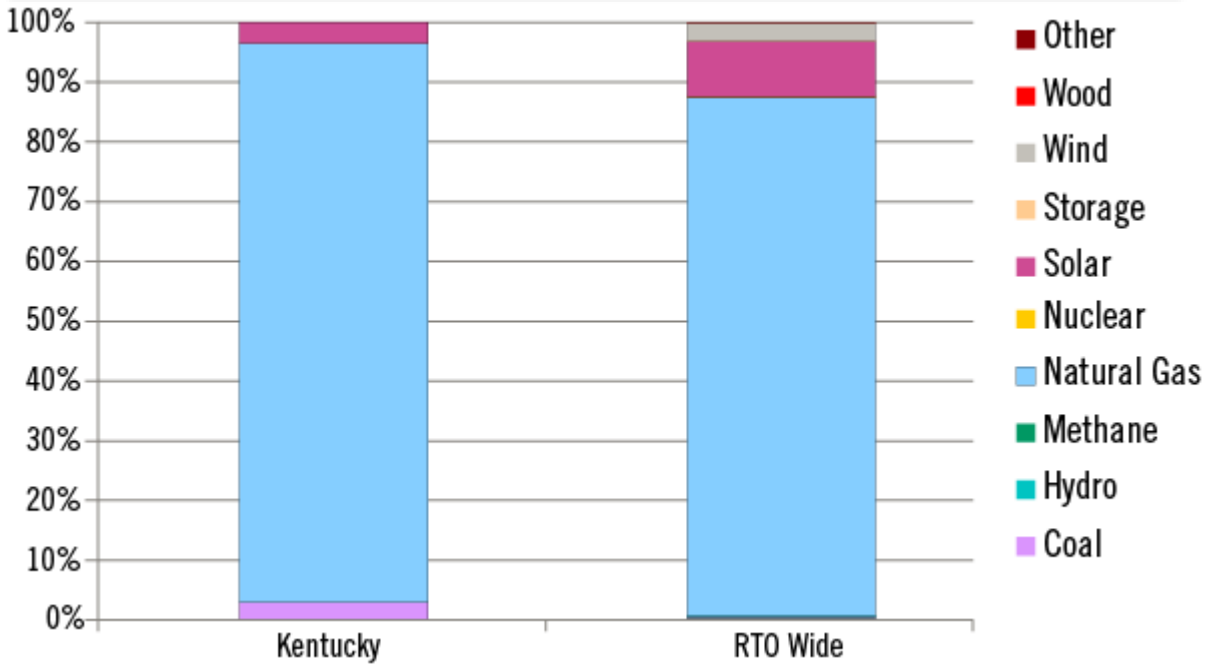
Natural gas represents more than 93 percent of new interconnection requests in Kentucky.

	MW	# of Projects
Active	1,991	6
Under Construction	6	1
Suspended	665	2
Total	**2,662**	**9**

Total MW Capacity by Fuel Type



Fuel as a Percentage of Projects in Queue



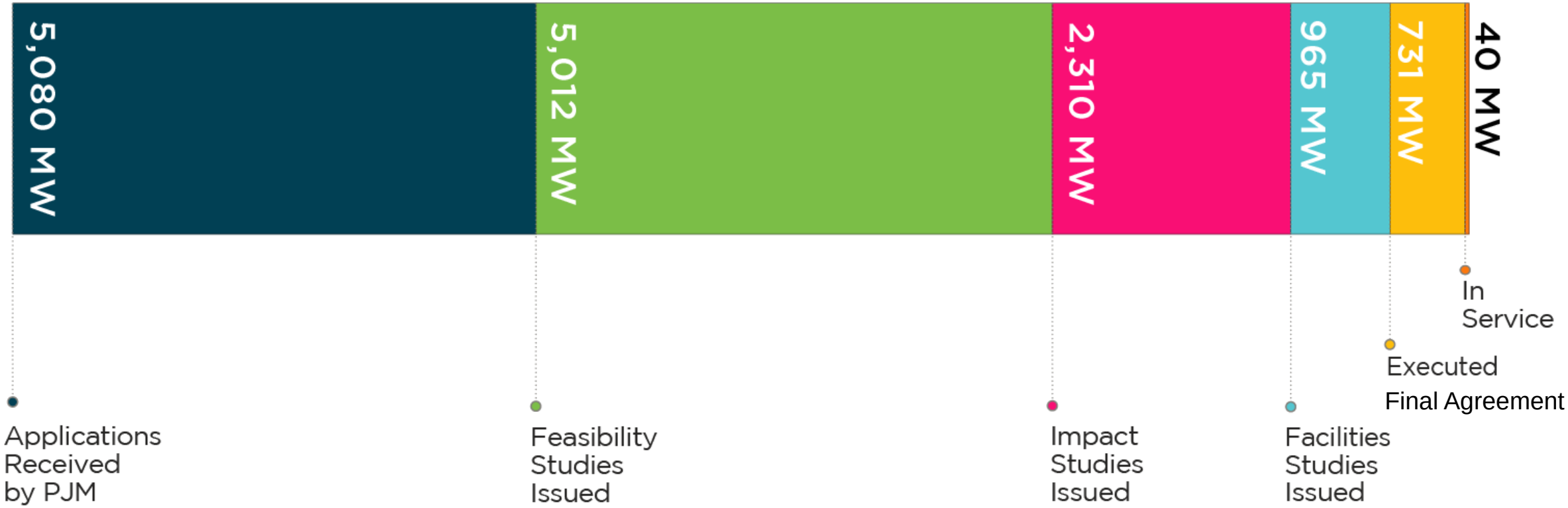
Kentucky – Interconnection Requests

	Active		In Service		Executed final agreement: Suspended		Executed final agreement: Under Construction		May have executed final agreement: Withdrawn		Total Sum	
	MW	# of Projects	MW	# of Projects	MW	# of Projects	MW	# of Projects	MW	# of Projects	MW	# of Projects
Biomass									198.5	5	198.5	5
Coal			20.0	1	80.0	1			2,889.0	5	2,989.0	7
Hydro									70.0	1	70.0	1
Natural Gas	1,897.0	3	20.0	1	585.0	1	6.0	1	1,127.8	3	3,635.8	9
Solar	94.0	3							56.0	4	150.0	7
Wind									27.3	2	27.3	2
Total	**1,991.0**	**6**	**40.0**	**2**	**665.0**	**2**	**6.0**	**1**	**4,368.6**	**20**	**7,070.6**	**31**

All MWs that enter the queue and either went into service, are near operation or withdrew. (**5,080** MW)

Kentucky – Progression History Interconnection Requests

(Requested Capacity Rights, 2004 - 2016)



Following Final Agreement execution, 20 MW of capacity withdrew from PJM's interconnection process. Another 671 MW have executed agreements but were not in service as of December 31, 2016. Overall, 1% of requested capacity MW reaches commercial operation. The PJM average is 10%.

Kentucky – 2016 Generation Deactivations

(Capacity, As of December 31, 2016)

Unit	MW Capacity	TO Zone	Age	Actual Deactivation Date
Dale 3	74	EKPC	56	4/16/2016
Dale 4	73	EKPC	53	4/16/2016

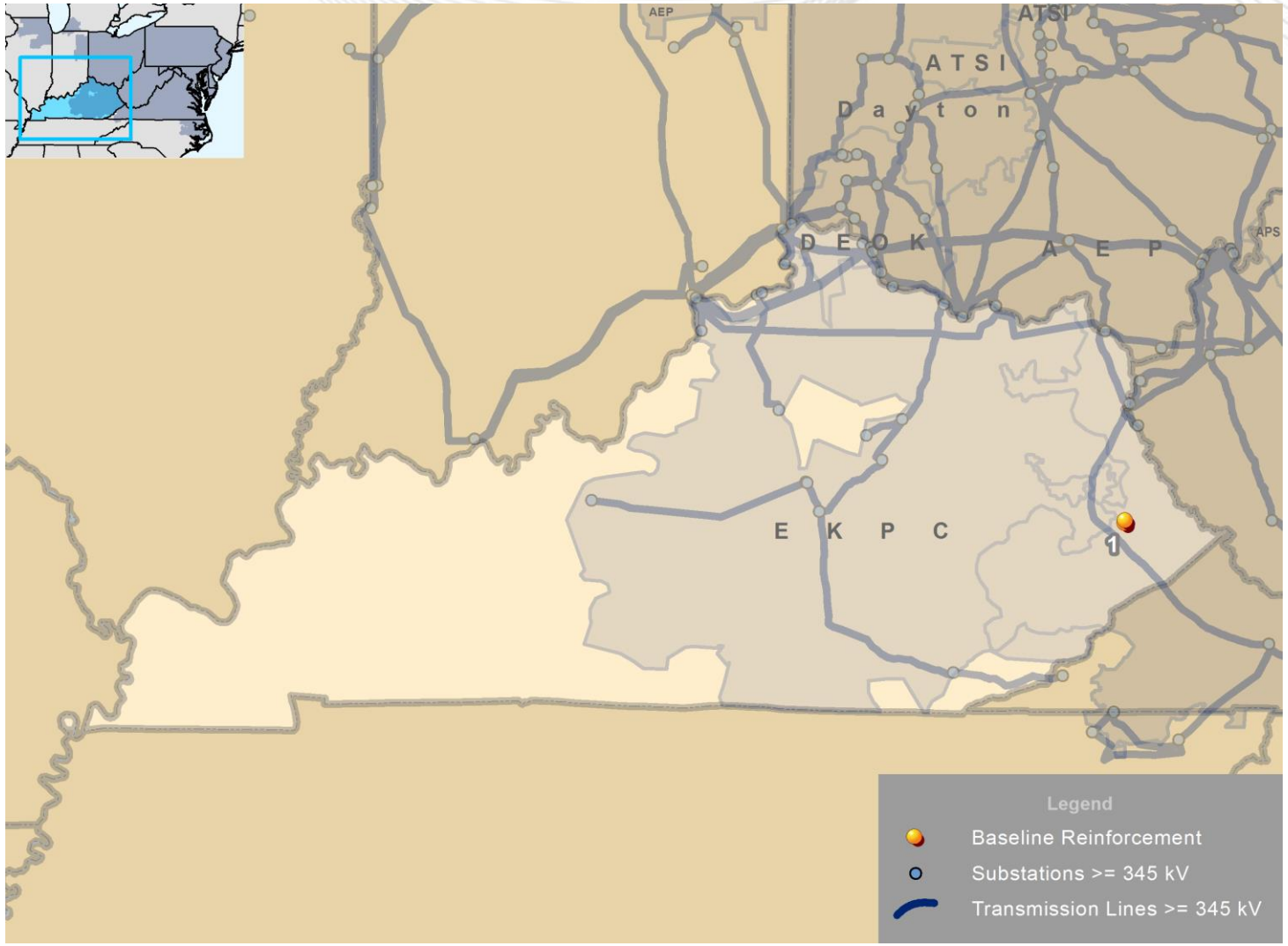
Summary:

- Two generating units in KY deactivated in 2016
- 11 generating units totaling 392 MW of capacity deactivated in PJM in 2016

Planning

Transmission Infrastructure Analysis

Kentucky – RTEP Baseline Projects



Kentucky – RTEP Baseline Projects

(Greater than $5 million)

Map ID	Project ID	Project	Kentucky Baseline Project Driver: Baseline Load Growth/ Deliverability & Reliability	Kentucky Baseline Project Driver: Congestion Relief - Economic	Kentucky Baseline Project Driver: Operational Performance	Kentucky Baseline Project Driver: Generator Deactivation	Kentucky Baseline Project Driver: TO Criteria Violation	Required Date	Cost ($M)	Designated Entity*	2016 TEAC Review
1	b2750.1	Retire Betsy Layne 138/69/43 kV station and replace it with the greenfield Stanville station about a half mile north of the existing Betsy Layne station					•	12/1/2016	$28.10	AEP	1/24/2017
	b2750.2	Relocate the Betsy Layne capacitor bank to the Stanville 69 kV bus and increase the size to 14.4 MVAR					•	12/1/2016	<$0 M	AEP	1/24/2017

Note: Baseline upgrades are those that resolve a system reliability criteria violation.

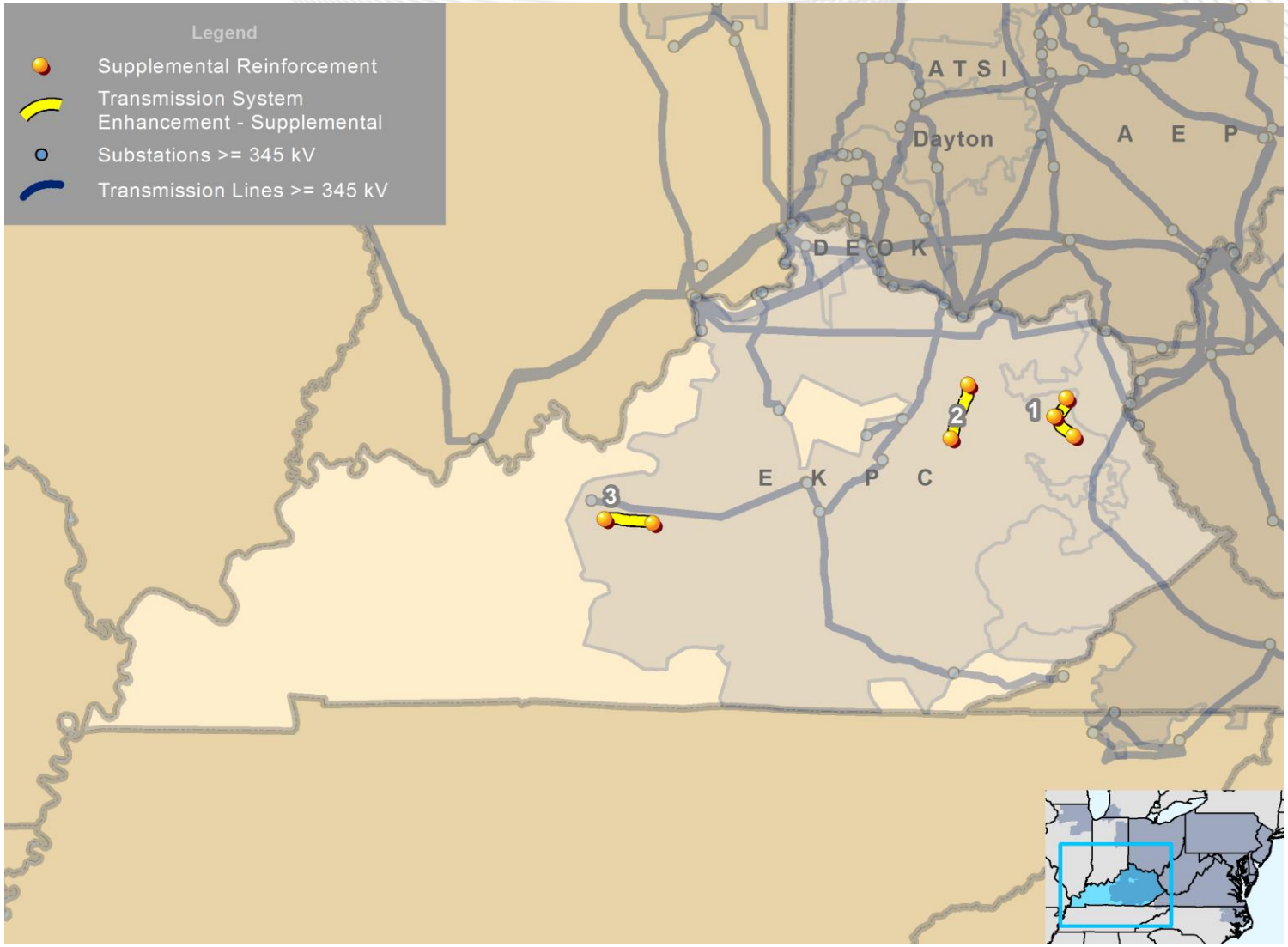
Kentucky – RTEP Network Projects

(Greater than $5 million)

			Kentucky Network Project Drivers						
Map ID	Project ID	Project	Generation Interconnection	Merchant Transmission Interconnection	Long-term Firm Transmission Service	Required Date	Cost ($M)	TO Zone(s)	2016 TEAC Review
		None							

Note: Network upgrades are new or upgraded facilities required primarily to eliminate reliability criteria violations caused by proposed generation, merchant transmission or long term firm transmission service requests.

Kentucky - TO Supplemental Projects



Kentucky – TO Supplemental Projects

(Greater than $5 million)

Map ID	Project ID	Project	Required Date	Cost ($M)	TO Zone(s)	2016 TEAC Review
1	s1163	Rebuild the existing 3/0 ACSR Airport Rd-Newfoundland-Mazie 69 kV, line section using 556.5 MCM ACSR/TW conductor	6/1/2021	$6.68	EKPC	7/26/2016
2	s1164	Rebuild the existing 4/0 ACSR Hope - Hillsboro 69 kV, line section using 556.5 MCM ACSR/TW conductor	12/1/2020	$8.32	EKPC	7/26/2016
3	s1165	Rebuild the existing 1/0 ACSR Stephensburg - Hodgenville 69 kV, line section using 556.5 MCM ACSR/TW conductor	12/1/2020	$5.88	EKPC	7/26/2016

Note: Supplemental projects are transmission expansions or enhancements that are used as inputs to RTEP models, but are not required for reliability, economic efficiency or operational performance criteria, as determined by PJM.

Kentucky – Merchant Transmission Project Requests

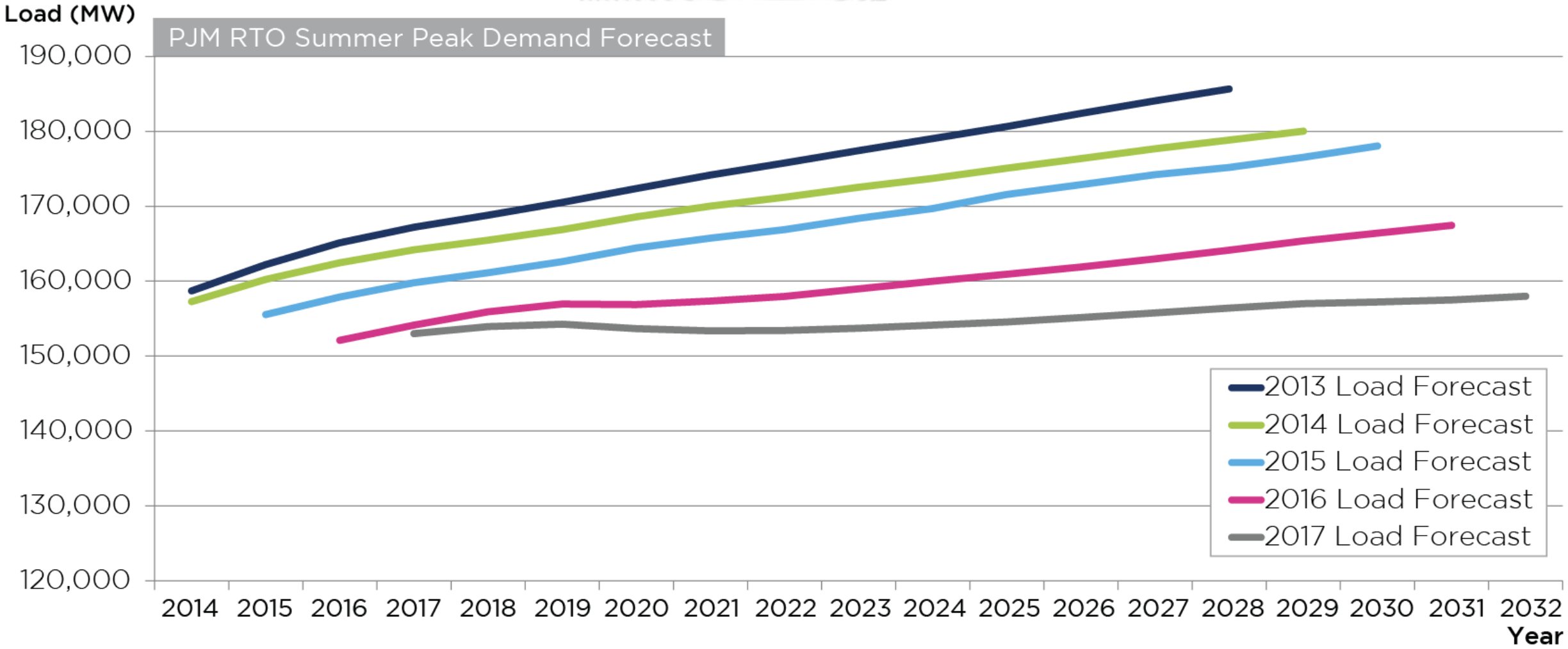
Queue	Project Name	MFO	Status	In Service Date	TO
	None				

Planning

Load Forecast

PJM Annual Load Forecasts

(January 9, 2017)



Kentucky – 2017 Load Forecast Report

	Summer Peak (MW)			Winter Peak (MW)		
Transmission Owner	2017	2027	Growth Rate (%)	2016/2017	2026/2027	Growth Rate (%)
American Electric Power Company *	949	988	0.4%	1,167	1,230	0.5%
Duke Energy Ohio and Kentucky *	969	1,012	0.4%	751	784	0.4%
East Kentucky Power Cooperative	1,948	2,010	0.3%	2,611	2,696	0.3%
PJM RTO	**152,999**	**155,773**	**0.2%**	**131,391**	**134,915**	**0.3%**

*AEP and Duke Energy serve load other than in Kentucky. The Summer Peak and Winter Peak MW values in this table each reflect an estimated amount of forecasted load to be served by each of those transmission owners solely in Kentucky. Estimated amounts were calculated based on the average share of each transmission owner's real-time summer and winter peak load located in Kentucky over the past five years.

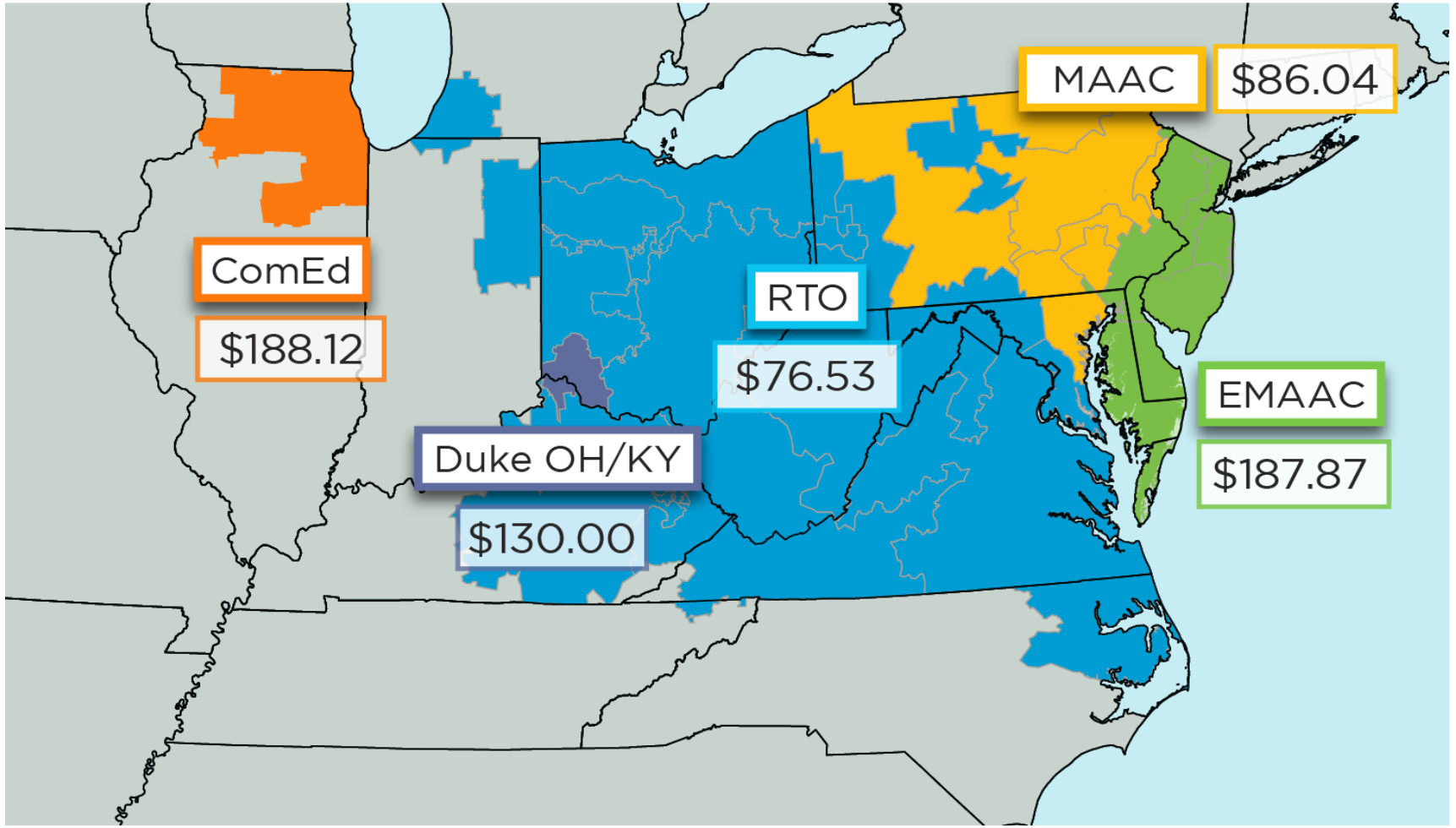
*PJM's 2017 forecast reflects methodology improvements implemented in 2016: variables to account for equipment and appliance saturation and efficiency, distributed solar generation adjustments and more refined treatment of weather data.

Markets

Capacity Market Results

PJM 2020/21 Auction Clearing Prices

(May 23, 2017)



The Kentucky Power portion of Kentucky is removed from the auction as part of AEP's Fixed Resource Requirement plan.

Kentucky - Cleared Resources in 2020/21 Auction

(May 23, 2017)

	Cleared MW (Unforced Capacity)	Change from 2019/20 Auction
Generation	3,640	(117)
Demand Response	195	(24)
Energy Efficiency	15	2.9
Total	3,851	(316)

RTO Locational Clearing Price	Duke Energy Ohio Kentucky Locational Clearing Price
$76.53	$130.00

NOTE: Demand Response and Energy Efficiency are reported to PJM by Transmission Zone. The numbers above reflect the state's pro-rata share of cross-state zones for illustrative purposes.

PJM - Cleared Resources in 2020/21 Auction

(May 23, 2017)

	Cleared MW (Unforced Capacity)	Change from 2019/20 Auction
Generation	155,976	882
Demand Response	7,820	(2,528)
Energy Efficiency	1,710	195
Total	165,506	(1,450)

Kentucky – Offered and Cleared Resources in 2020/21 Auction

(May 23, 2017)

		Unforced Capacity
Generation	Offered MW	3,796
	Cleared MW	3,640
Demand Response	Offered MW	217
	Cleared MW	195
Energy Efficiency	Offered MW	18
	Cleared MW	15
Total Offered MW		4,032
Total Cleared MW		3,851

NOTE: Demand Response and Energy Efficiency are reported to PJM by Transmission Zone. The numbers above reflect the state's pro-rata share of cross-state zones for illustrative purposes.

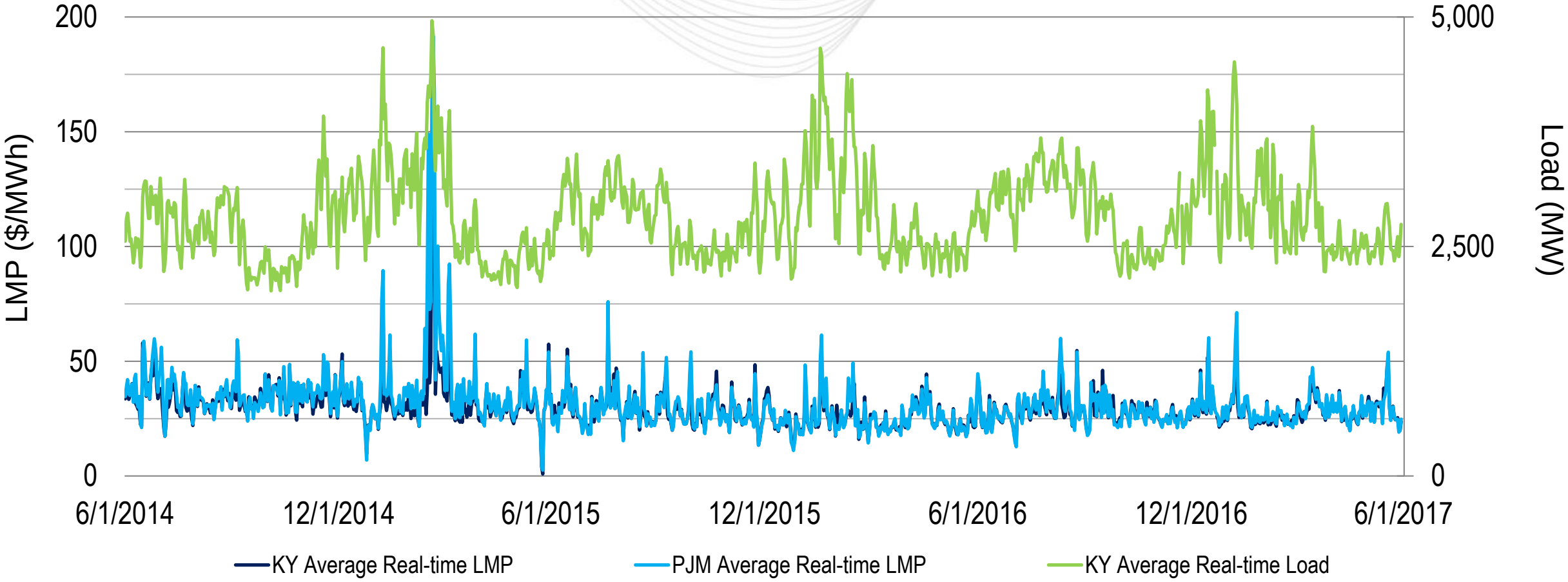
Markets

Market Analysis

Kentucky - Average Daily Load and LMP

(June 1, 2014 - May 31, 2017)

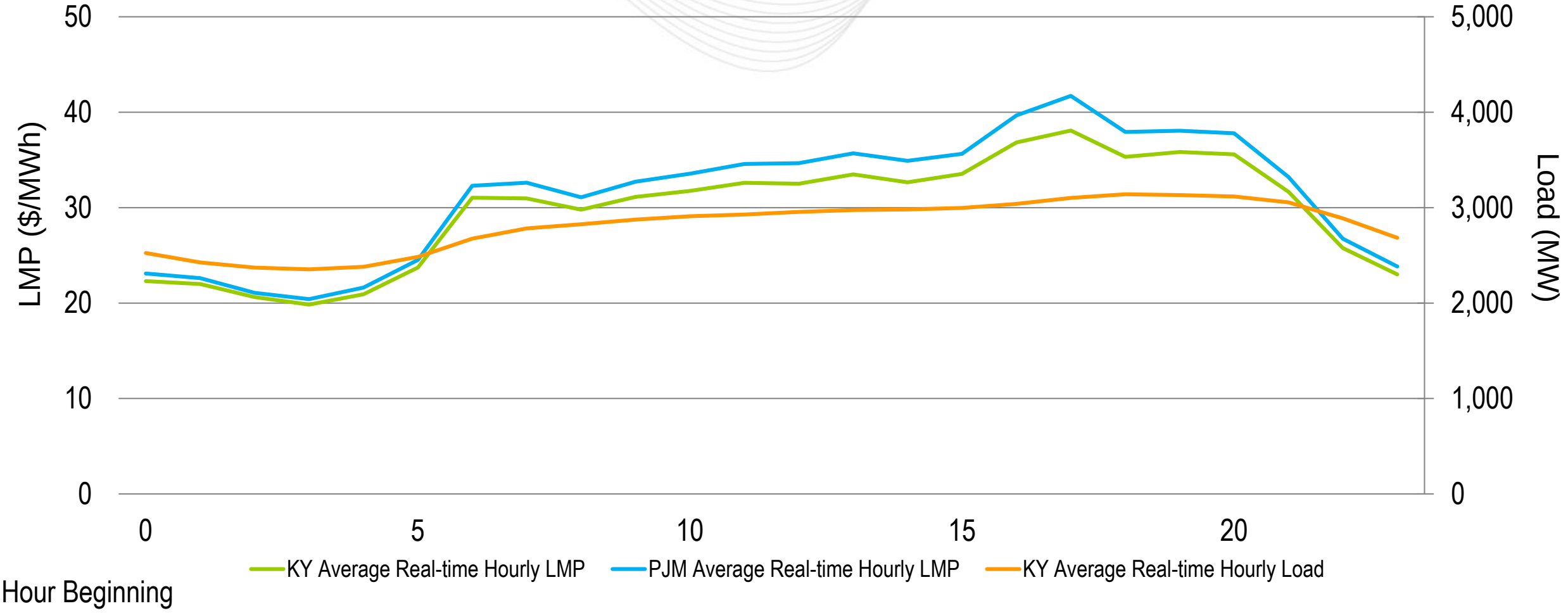
Kentucky's average daily LMPs generally align with the PJM average daily LMP



Kentucky – Hourly Average LMP and Load

(June 1, 2014 – May 31, 2017)

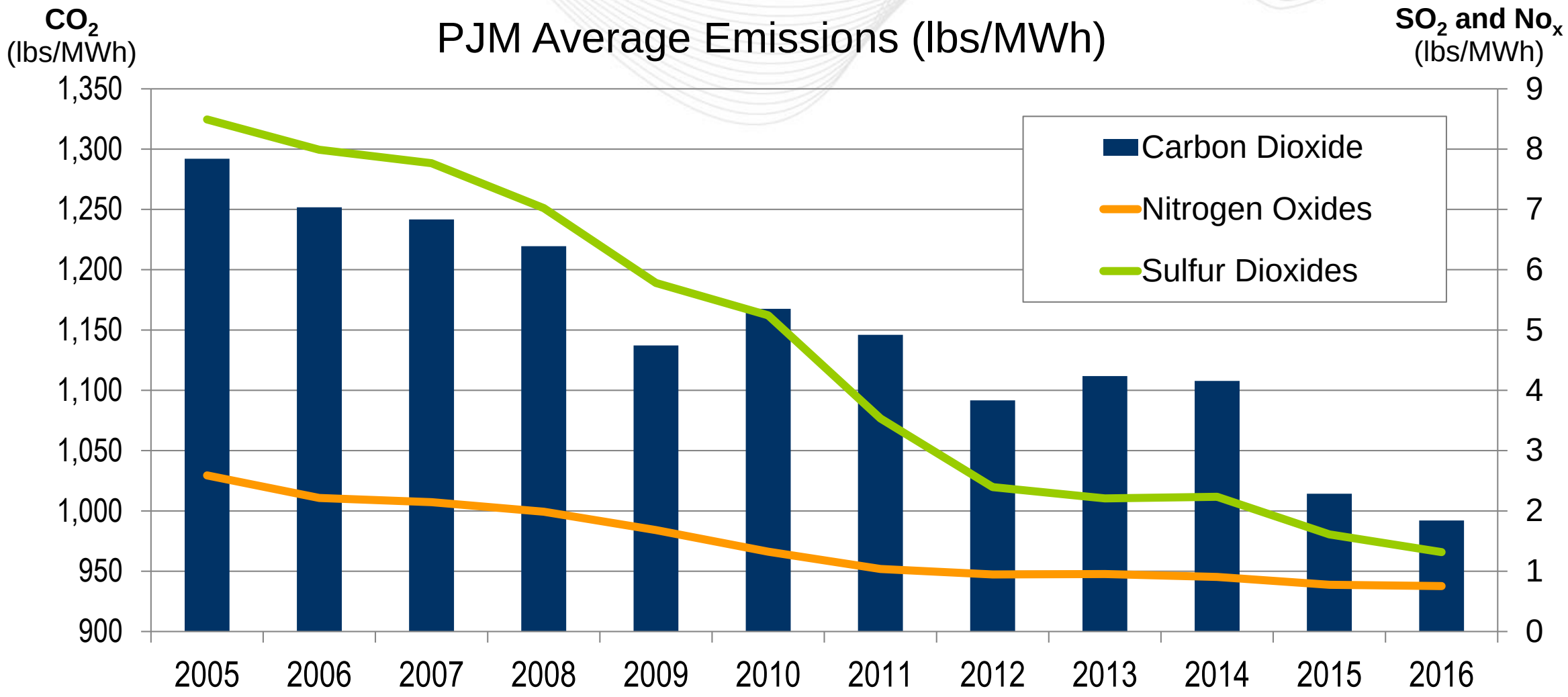
Kentucky's hourly LMPs were below the PJM average.



Operations
Emissions Data

PJM - Average Emissions (lbs/MWh)

(December 31, 2016)



Kentucky - Average Emissions (lbs/MWh)

(December 31, 2016)