



# 2018 Kentucky State Infrastructure Report

(January 1, 2018 – December 31, 2018)

May 2019

This report reflects information for the portion of Kentucky within the PJM service territory.

## 1. Planning

- Generation Portfolio Analysis
- Transmission Analysis
- Load Forecast

## 2. Markets

- Capacity Market Results
- Market Analysis

## 3. Operations

- Emissions Data

- **Existing Capacity:** Coal represents approximately 55.3 percent of the total installed capacity in the PJM portion of Kentucky while natural gas represents approximately 41.8 percent. This differs from PJM where natural gas and coal are at 40.2 and 30.7 percent of total installed capacity.
- **Interconnection Requests:** Natural gas represents approximately 69.2 percent of new interconnection requests in Kentucky.
- **Deactivations:** Kentucky had no generation deactivations or deactivation notifications in 2018.
- **RTEP 2018:** Kentucky RTEP 2018 projects total more than \$72 million in investment. Approximately 76 percent of that represents supplemental projects. These investment figures only represent RTEP projects that cost at least \$5 million.
- **Load Forecast:** Kentucky load growth is nearly flat, averaging between 0.4 and 0.5 percent per year over the next 10 years. This aligns with PJM RTO load growth projections.

- **1/1/2018 – 12/31/2018 Market Performance:** Kentucky's average LMPs were consistently at or below PJM average LMPs. Coal resources represented 47.7 percent of the generation used in Kentucky.
- **Emissions:** 2018 carbon dioxide emissions decreased from 2017; 2018 nitrogen oxide dioxide emissions fell slightly from 2017 levels while sulfur dioxide emissions remained steady.



# PJM Service Area – Kentucky

(March 2019)



**Legend**

**Substation**

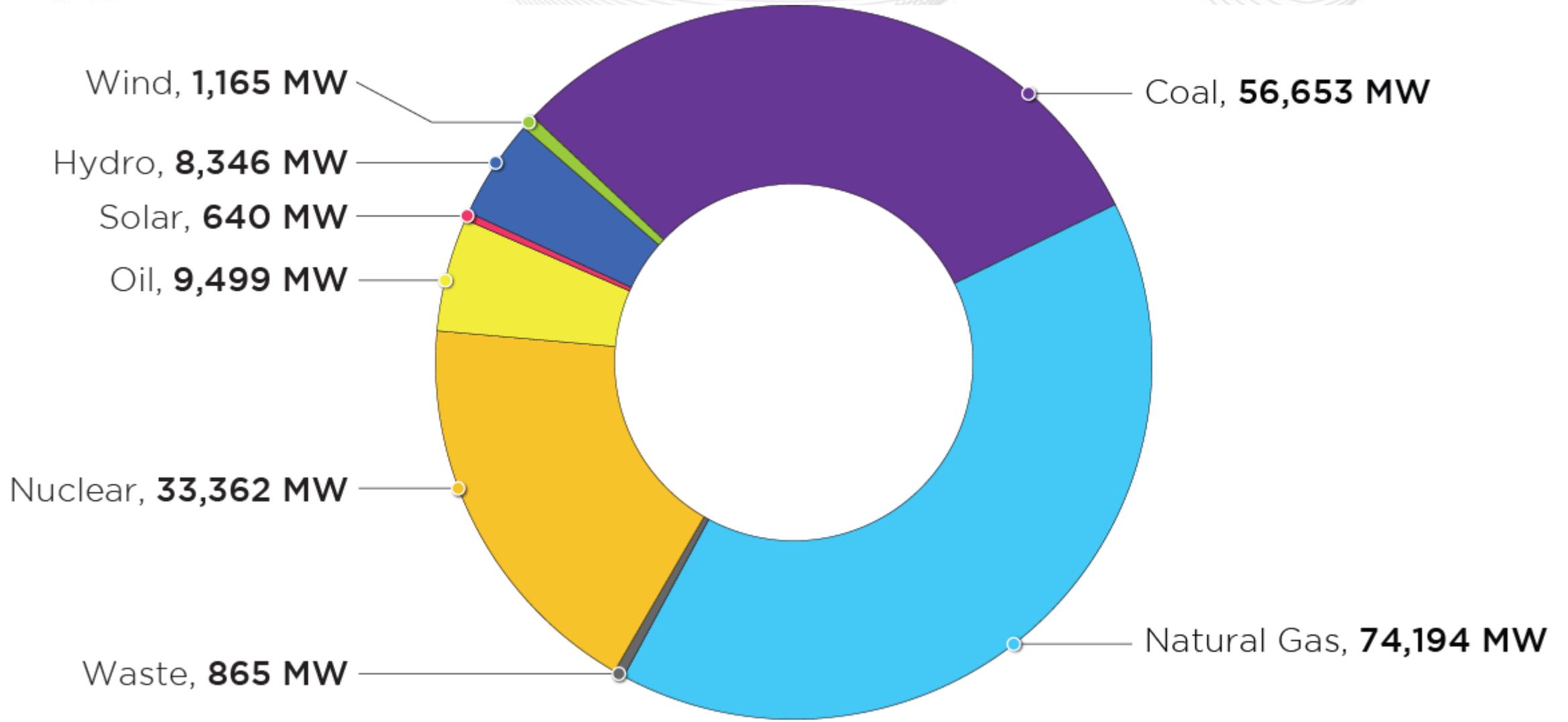
- 765 kV
- 500 kV
- 345 kV

**Transmission Lines**

- 345 kV
- 500 kV
- 765 kV

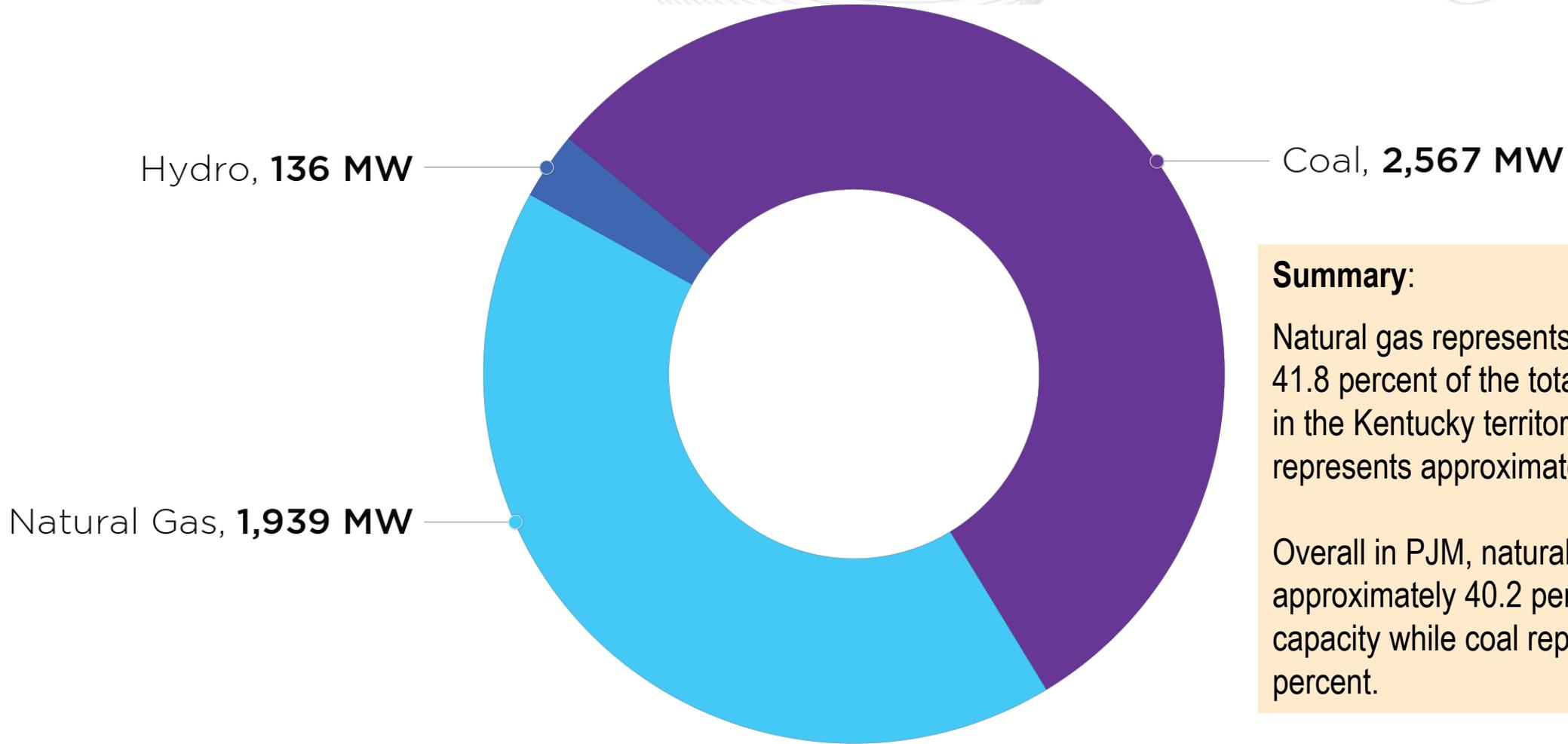
# Planning

## Generation Portfolio Analysis



# Kentucky – Existing Installed Capacity

(MW submitted to PJM, December 31, 2018)



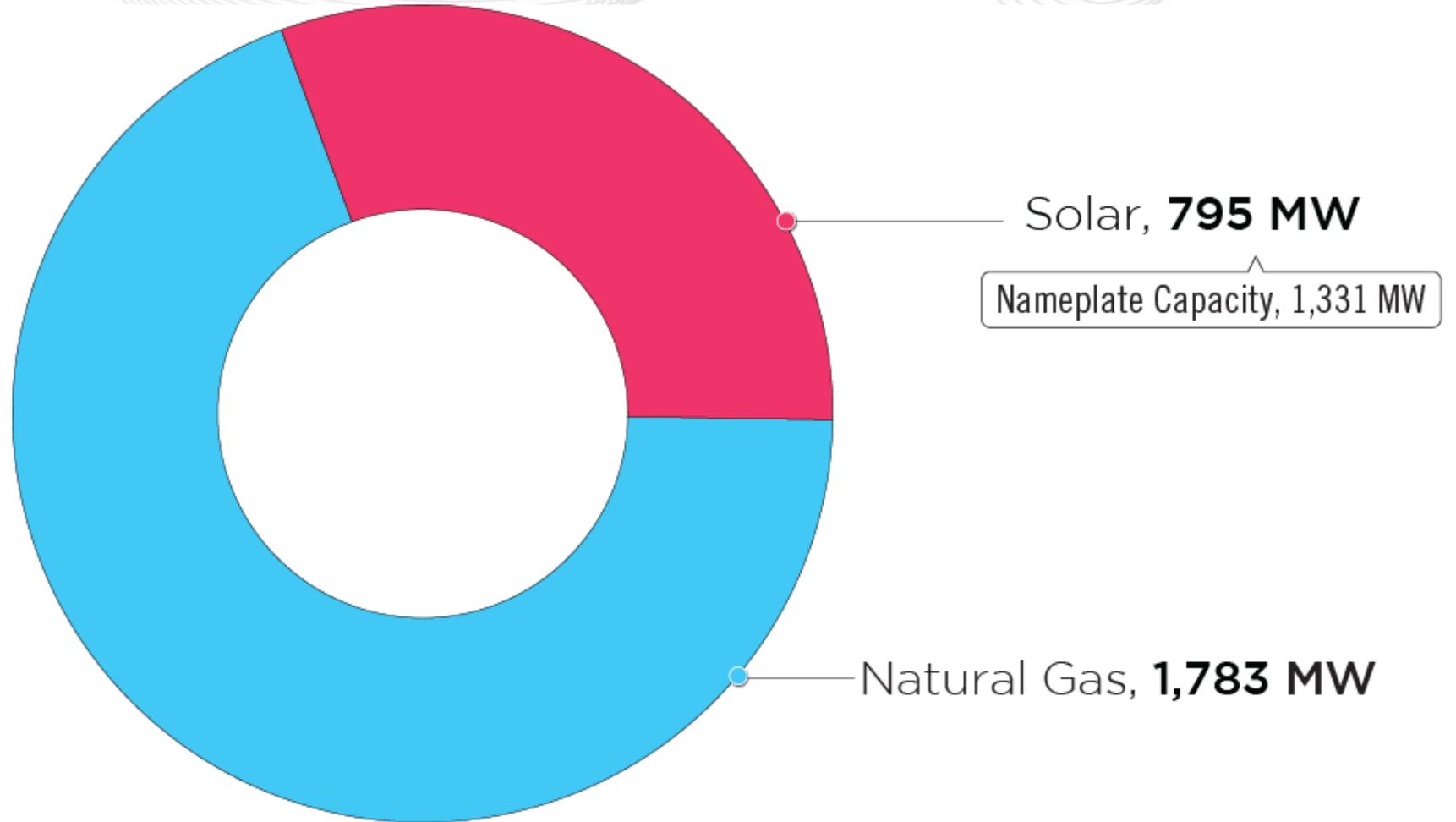
### Summary:

Natural gas represents approximately 41.8 percent of the total installed capacity in the Kentucky territory while coal represents approximately 55.3 percent.

Overall in PJM, natural gas represents approximately 40.2 percent of installed capacity while coal represents 30.7 percent.

# Kentucky – Queued Capacity (MW) by Fuel Type

(as of December 31, 2018)



Natural gas represents approximately 69.2 percent of new interconnection requests in Kentucky.

**\*Note:** Nameplate Capacity represents a generator's rated full power output capability.

# Kentucky – Percentage of Projects in Queue by Fuel Type

(as of December 31, 2018)





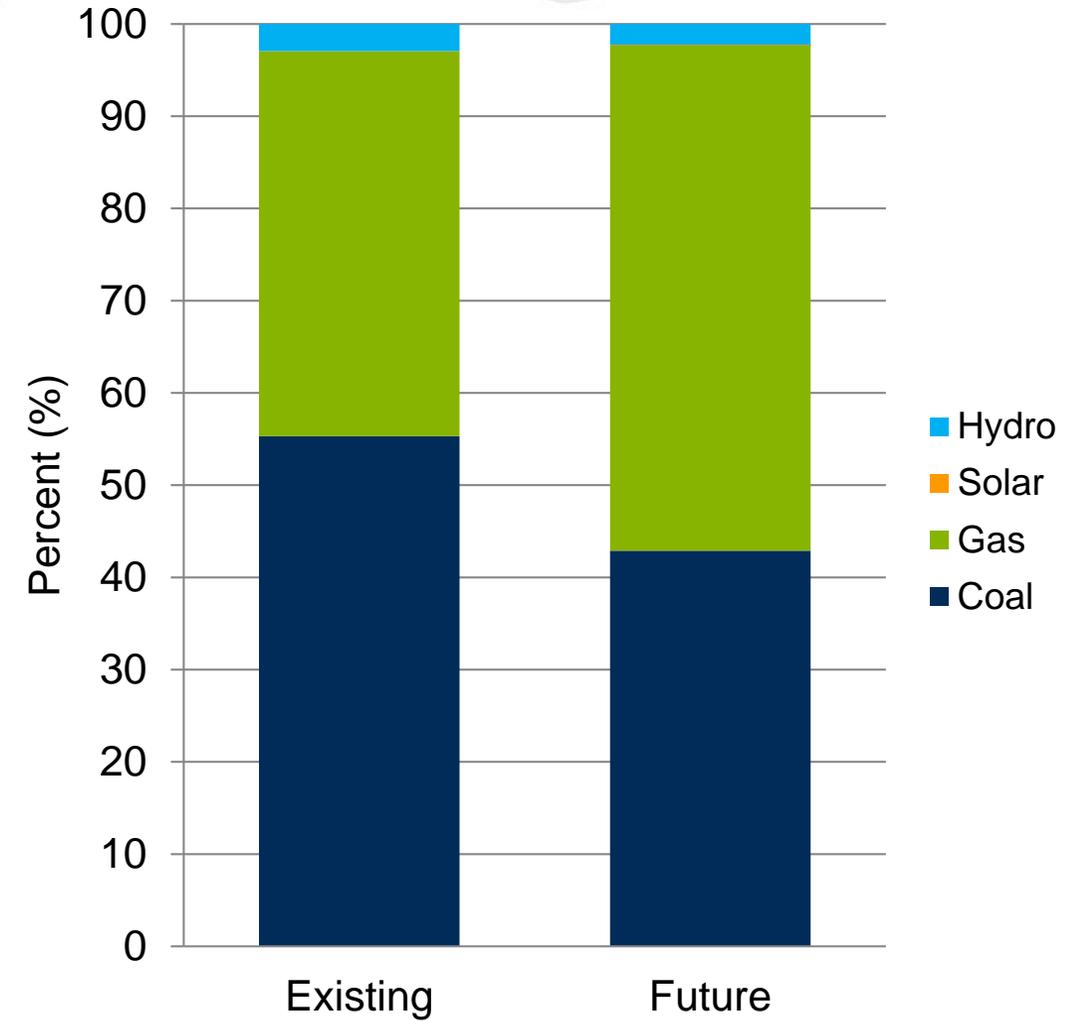
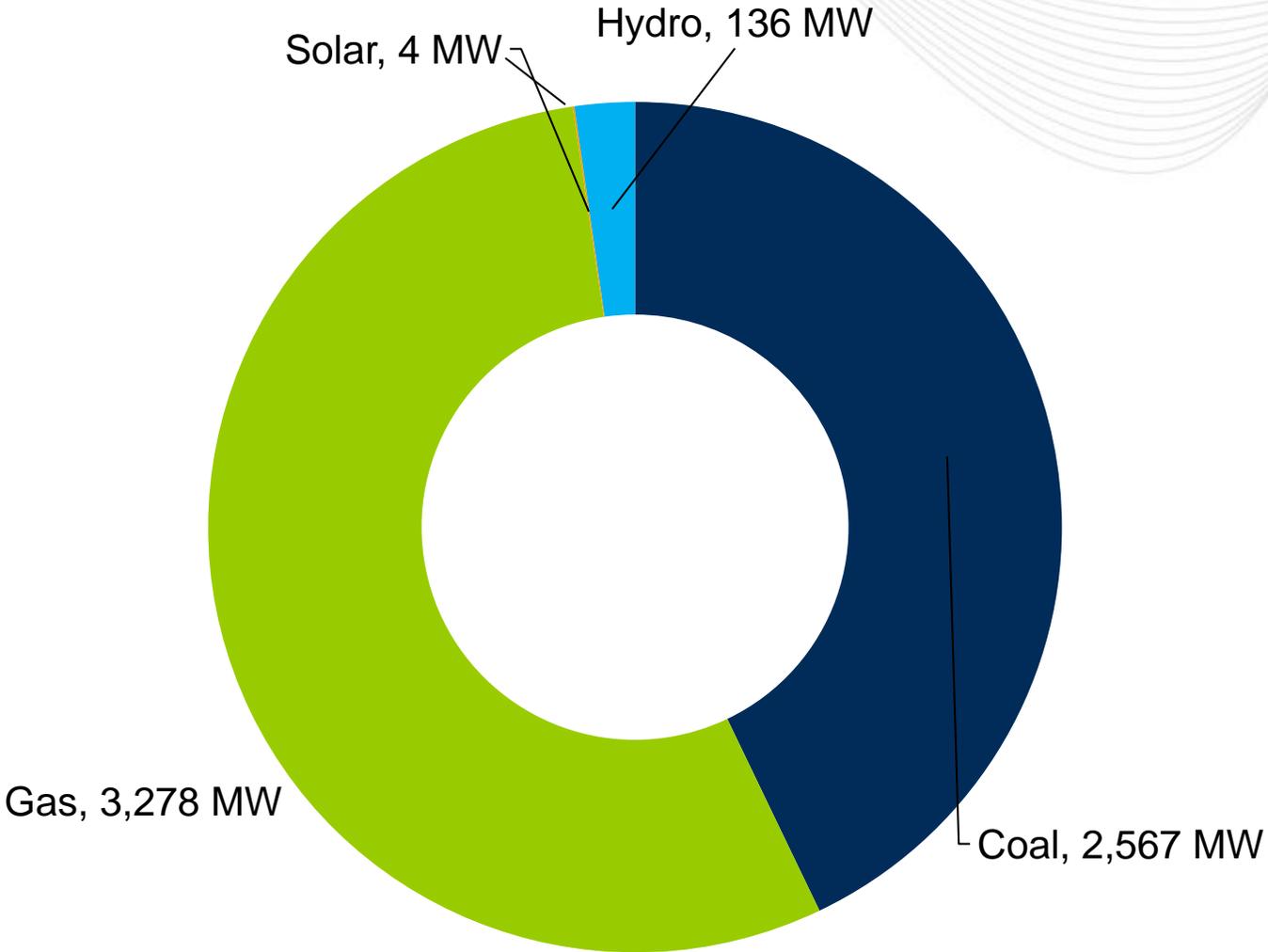
# Kentucky – Interconnection Requests

(Unforced Capacity, As of December 31, 2018)

	Complete				In Queue						Grand Total	
	In Service		Withdrawn		Active		Suspended		Under Construction			
	No. of Projects	Capacity MW	No. of Projects	Capacity MW	No. of Projects	Capacity MW	No. of Projects	Capacity MW	No. of Projects	Capacity MW	No. of Projects	Capacity MW
<b>Non-Renewable</b>	3	46	10	4,600.80	2	85.9	1	585	2	1,112.0	18	6,429.7
<b>Coal</b>	0	0	6	2,969.00	0	0	0	0	0	0	6	2,969.0
<b>Natural Gas</b>	3	46	4	1,631.80	2	85.9	1	585	2	1,112.0	12	3,460.7
<b>Renewable</b>	0	0	14	411.00	15	794.8	0	0	0	0	29	1,205.7
<b>Biomass</b>	0	0	5	198.50	0	0	0	0	0	0	5	198.5
<b>Hydro</b>	0	0	1	70.00	0	0	0	0	0	0	1	70.0
<b>Solar</b>	0	0	6	115.10	15	794.8	0	0	0	0	21	909.9
<b>Wind</b>	0	0	2	27.33	0	0	0	0	0	0	2	27.3
<b>Grand Total</b>	<b>3</b>	<b>46</b>	<b>24</b>	<b>5,011.70</b>	<b>17</b>	<b>880.7</b>	<b>1</b>	<b>585</b>	<b>2</b>	<b>1,112.0</b>	<b>47</b>	<b>7,635.4</b>

# Kentucky – Future Capacity Mix

Based on known queued interconnection requests and deactivation notices through December 31, 2022, adjusted to reflect the probability of commercialization as indicated by historical trends specific to an interconnection request's state/zonal location and fuel type.



# Kentucky – Progression History Interconnection Requests

Projects under construction, suspended, in service, or withdrawn (as of December 31, 2018)



**Projects withdrawn after final agreement**

- 1 Interconnection Service Agreement – 80 MW (Nameplate Capacity, 80 MW)

**Percentage of planned capacity and projects reached commercial operation**

- 0.7 % requested capacity megawatt
- 10 % requested projects

# Kentucky – Actual Generation Deactivations and Deactivation Notifications Received in 2018

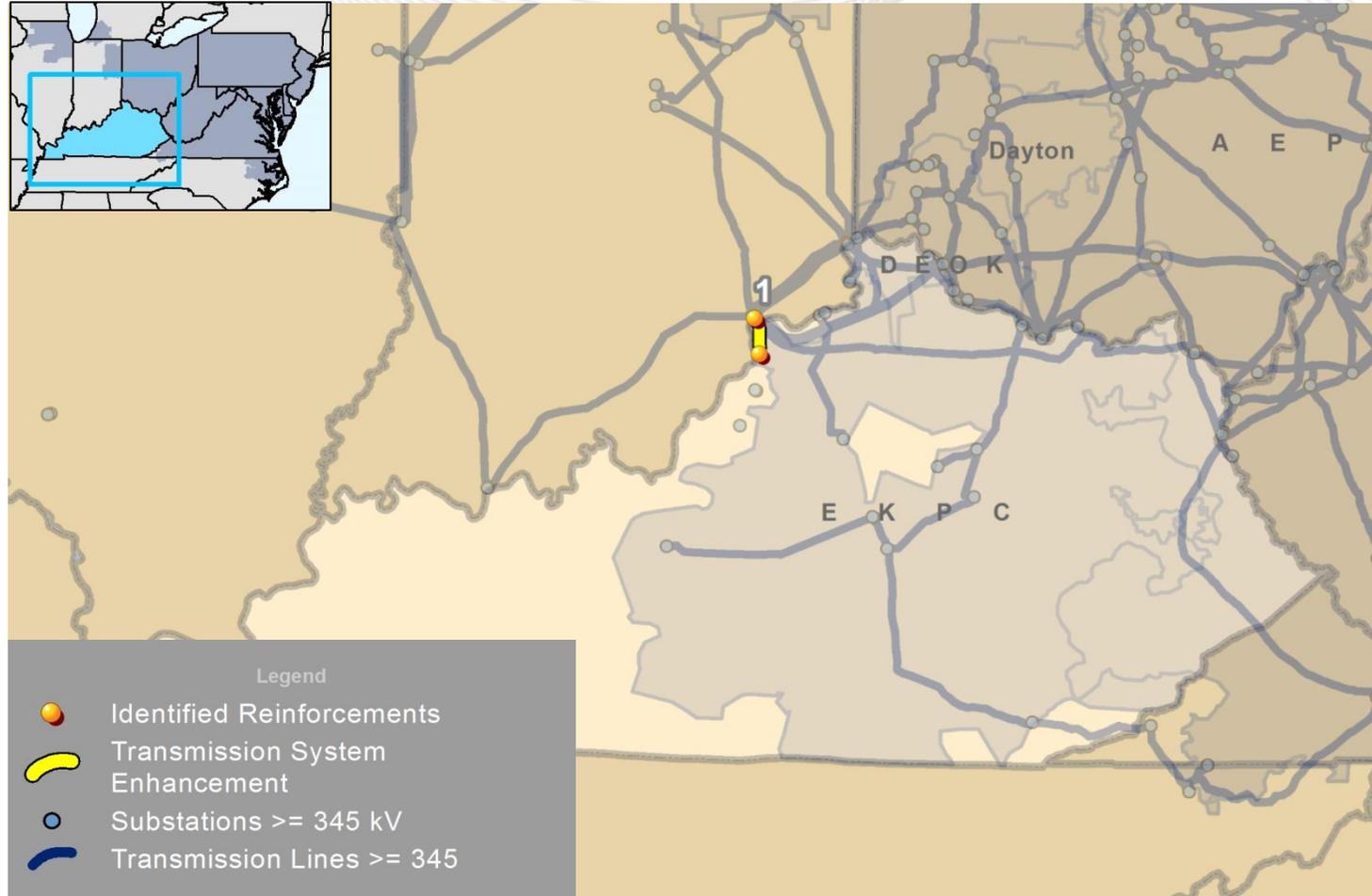
Kentucky had no generation deactivations or deactivation notifications in 2018.

# Planning

## Transmission Infrastructure Analysis

Kentucky had no baseline project upgrades in 2018.

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



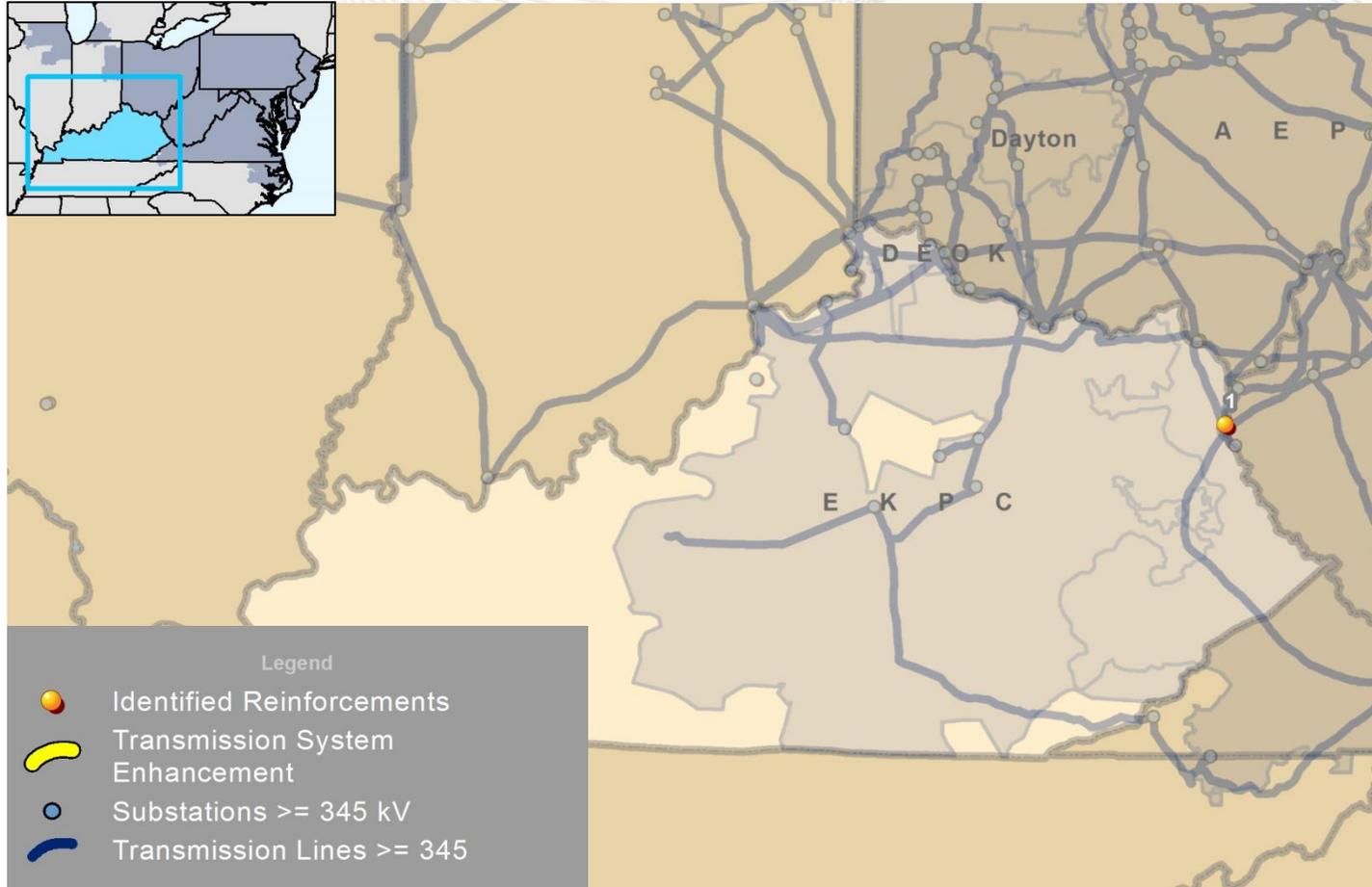
Note: Network upgrades are new or upgraded facilities required primarily to eliminate reliability criteria violations caused by proposed generation, merchant transmission or long term firm transmission service requests.



# Kentucky – RTEP Network Projects

(Greater than \$5 million)

Map ID	Project	Description	Project Driver	Queue	Required In-Service Date	Project Cost (\$M)	TO Zone	2018 TEAC Review
1	n5469	Reconductor Trimble-Clifty 345 kV line and upgrade any necessary terminals.	Merchant Transmission	X3-028	6/1/2021	\$17.4	LG&E	9/13/2018



Note: Supplemental projects are transmission expansions or enhancements that are not required for compliance with the following PJM criteria: system reliability, operational performance or economic criteria, pursuant to a determination by the Office of the Interconnection and is not a state public policy project.



# Kentucky – TO Supplemental Projects

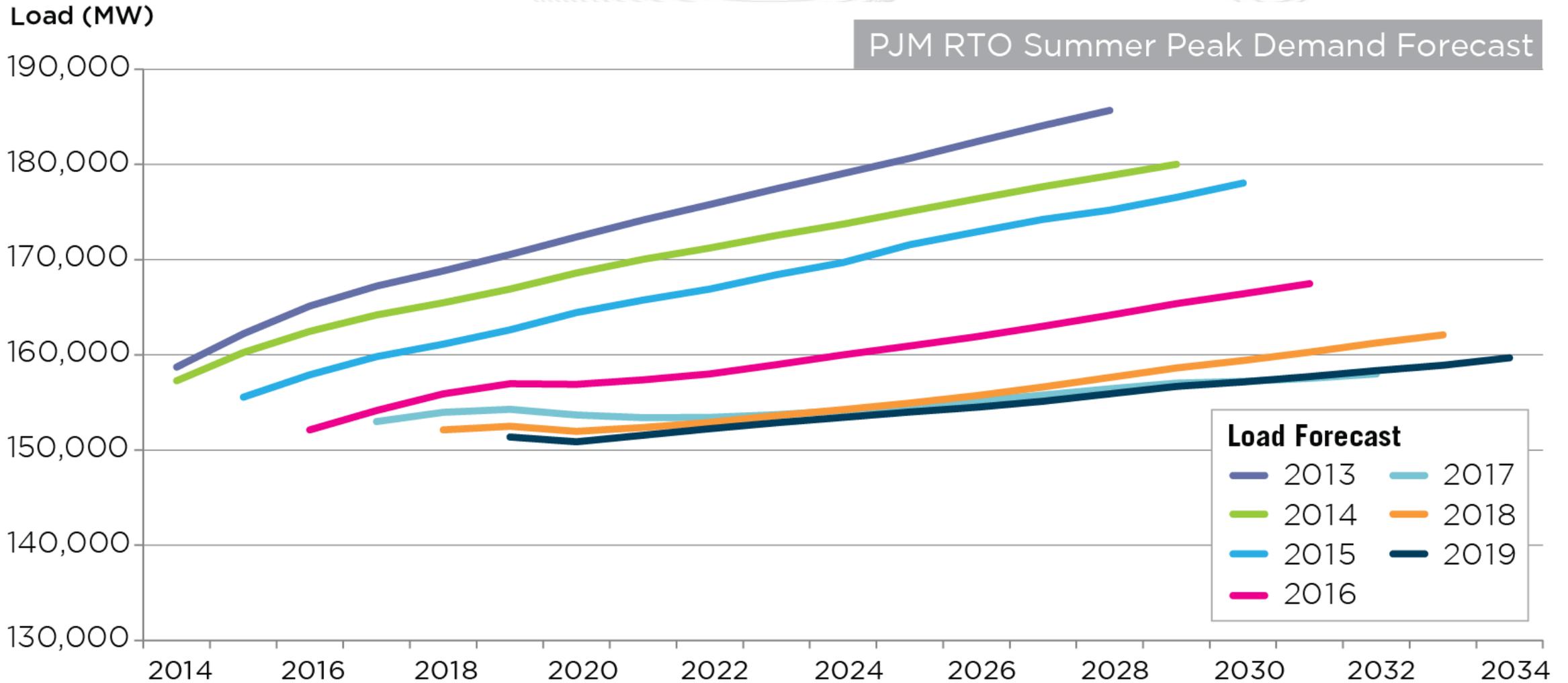
(Greater than \$5 million)

Map ID	Project	Description	Projected In-Service Date	Project Cost (\$M)	TO Zone	2018 TEAC Review
1	s1583	At Baker Station, replace three existing 765 kV 50 kA circuit breakers with new 765 kV 63 kA breakers. Install an additional new 345 kV 63 kA breaker. Replace the 600 MVA transformer with a new 345/138 kV 675 MVA unit that will be relocated to a new position between the existing and newly installed breakers.	11/20/2018	\$26.9	AEP	3/8/2018
	s1547	Replace existing 90 MVA Leslie 161/69 kV transformer with a new 130 MVA 161/69 kV transformer. A second 161/69 kV transformer will be purchased as a non-switchable spare on site. Replace Leslie 161 kV 3000 A 50 kA circuit breaker "K" with a new 3000 A 40 kA 161 kV circuit breaker.	8/1/2020	\$6.3	AEP	3/9/2018
	s1683	Silver Grove Replace 345/138 kV Transformer	12/31/2019	\$7.8	DEOK	7/27/2018
	s1687	Construct a 2.7 mile 138 kV line extension between Moore Hollow and Kentucky Electric Steel (KES). At this time the existing KES metering structure will be retired due to the announced closure of the KES plant.	2/1/2021	\$8.4	AEP	7/27/2018
		Convert Princess station to 138 kV by installing five 138 kV circuit breakers (3000 A 40 kA), a 138/69 kV transformer (to Coalton), and a 138/34.5 kV transformer	12/31/2020	\$5.7	AEP	7/27/2018

# Planning

## Load Forecast

## PJM RTO Summer Peak Demand Forecast





# Kentucky – 2019 Load Forecast Report

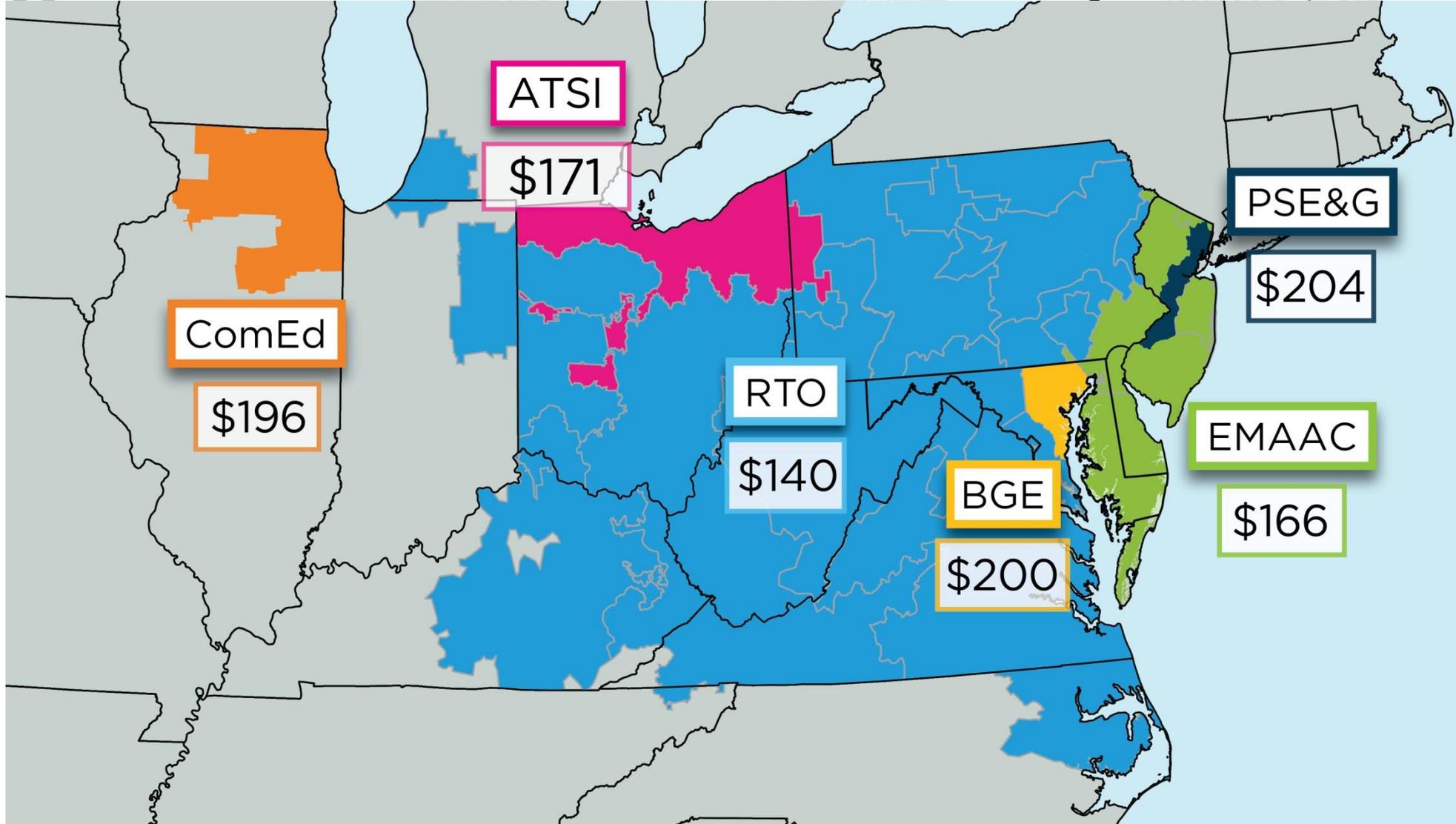
Transmission Owner	Summer Peak (MW)			Winter Peak (MW)		
	2019	2029	Growth Rate (%)	2018/19	2028/29	Growth Rate (%)
American Electric Power Company *	1,024	1,074	0.5%	1,260	1,320	0.5%
Duke Energy Ohio and Kentucky *	905	948	0.5%	745	774	0.4%
East Kentucky Power Cooperative	1,989	2,072	0.4%	2,620	2,722	0.4%
PJM RTO	151,358	156,689	0.3%	131,082	136,178	0.4%

\* PJM notes that 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.

# Markets

## Capacity Market Results

# 2021/22 Base Residual Auction Clearing Prices (\$/MW-Day)





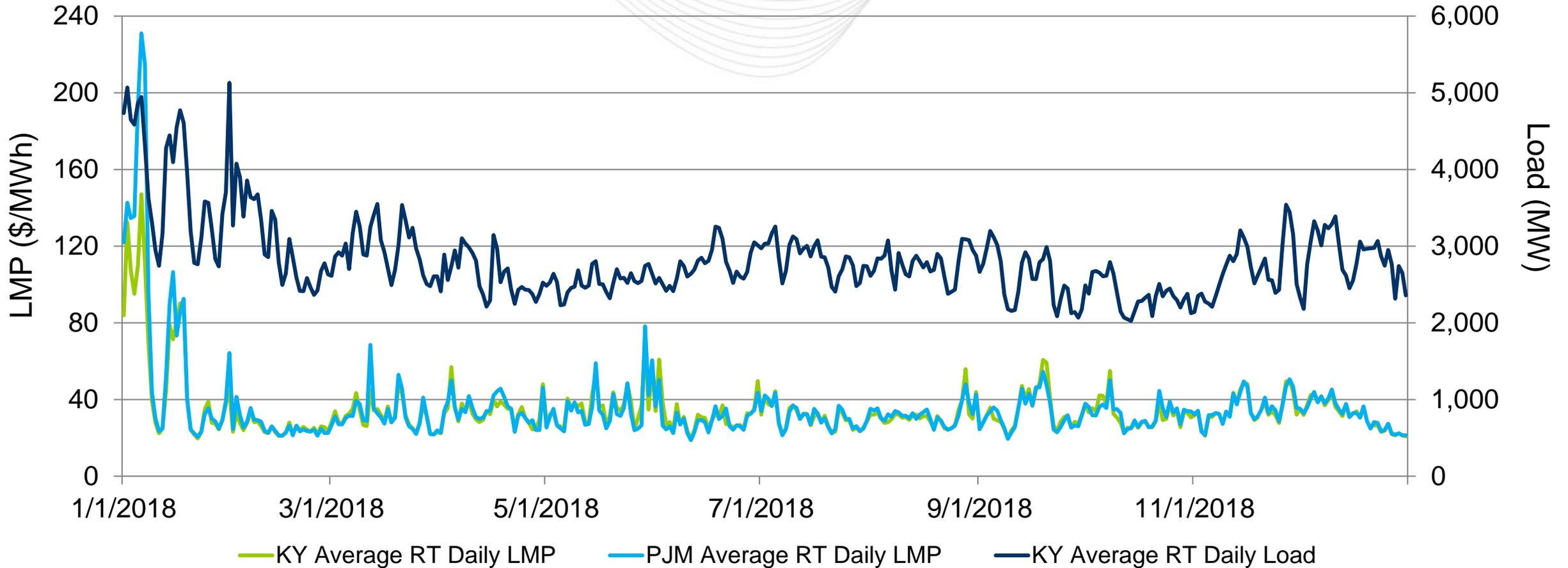
# PJM – 2021/2022 Cleared MW (UCAP) by Resource Type

	<b>Annual</b>	<b>Summer</b>	<b>Winter</b>	<b>Total</b>
<b>Generation</b>	149,616 MW	54 MW	716 MW	150,385 MW
<b>DR</b>	10,674 MW	452 MW	- MW	11,126 MW
<b>EE</b>	2,623 MW	209 MW	- MW	2,832 MW
<b>Total</b>	<b>162,912 MW</b>	<b>716 MW</b>	<b>716 MW</b>	<b>164,343 MW</b>

# Markets

## Market Analysis

Kentucky's average daily LMPs generally aligned with PJM average daily LMPs.

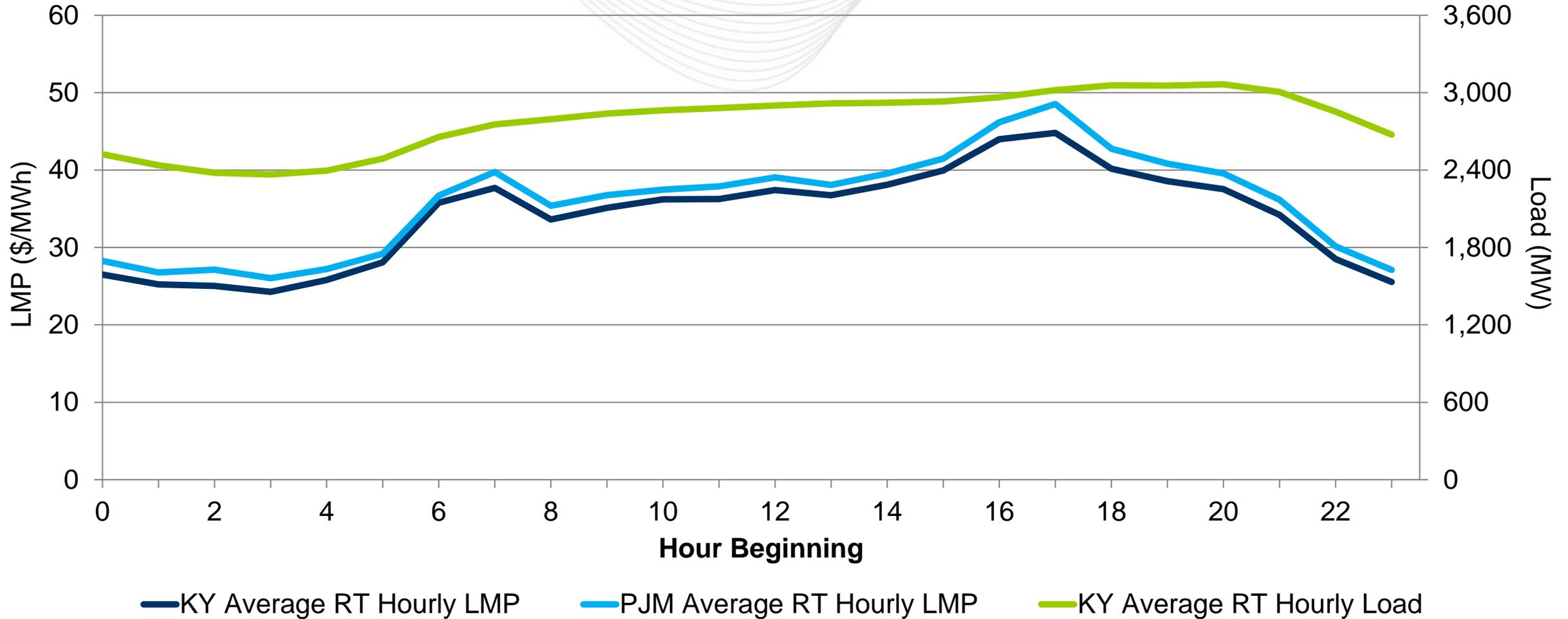


Note: The price spike in January reflects the Cold Snap that lasted from 12/28/17 to 1/7/2018.

# Kentucky – Average Hourly LMP and Load

(January 1, 2018 – December 31, 2018)

Kentucky's hourly LMPs were below PJM average hourly LMPs

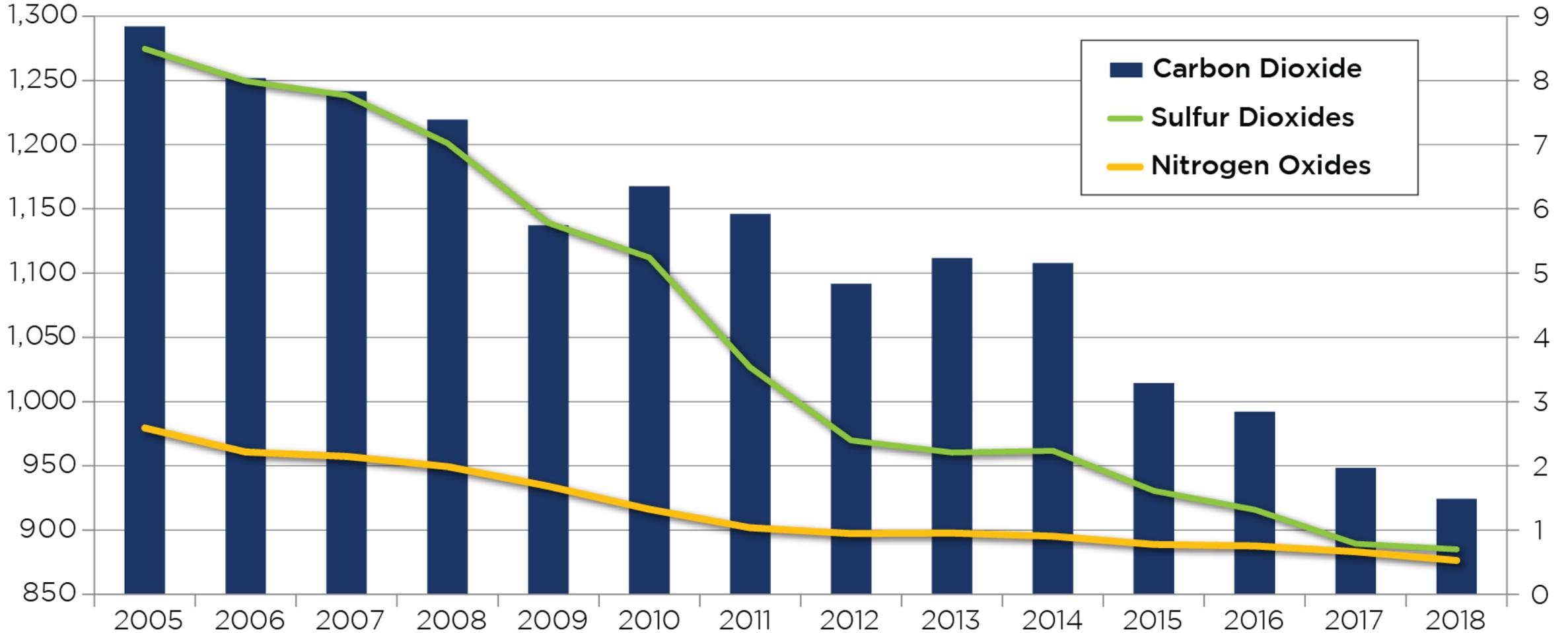


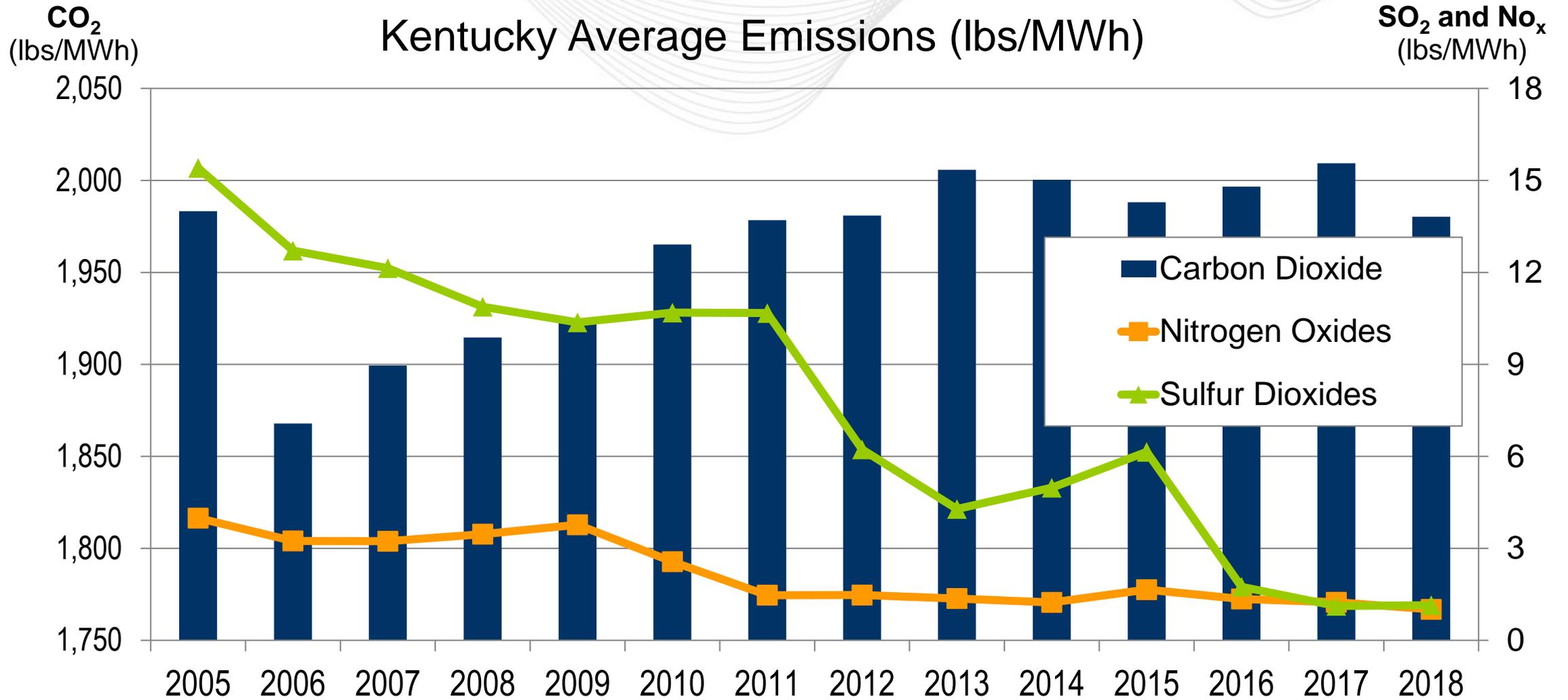
# Operations Emissions Data

# 2005-2018 PJM Average Emissions

CO<sub>2</sub>  
lbs/MWh

SO<sub>2</sub> and NO<sub>x</sub>  
lbs/MWh





Please note that PJM has historically used \$5 million as the threshold for listing projects in the RTEP report. Beginning in 2018, it was decided to increase this cutoff to \$10 million. All RTEP projects with costs totaling at least \$5 million are still included in this state report.

For a complete list of all RTEP projects, including those below the RTEP threshold of \$10 million, please visit the “RTEP Upgrades & Status – Transmission Construction Status” page on [pjm.com](https://www.pjm.com).

<https://www.pjm.com/planning/rtep-upgrades-status/construct-status.aspx>