



# 2021 Kentucky State Infrastructure Report

(January 1, 2021 – December 31, 2021)

May 2022

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

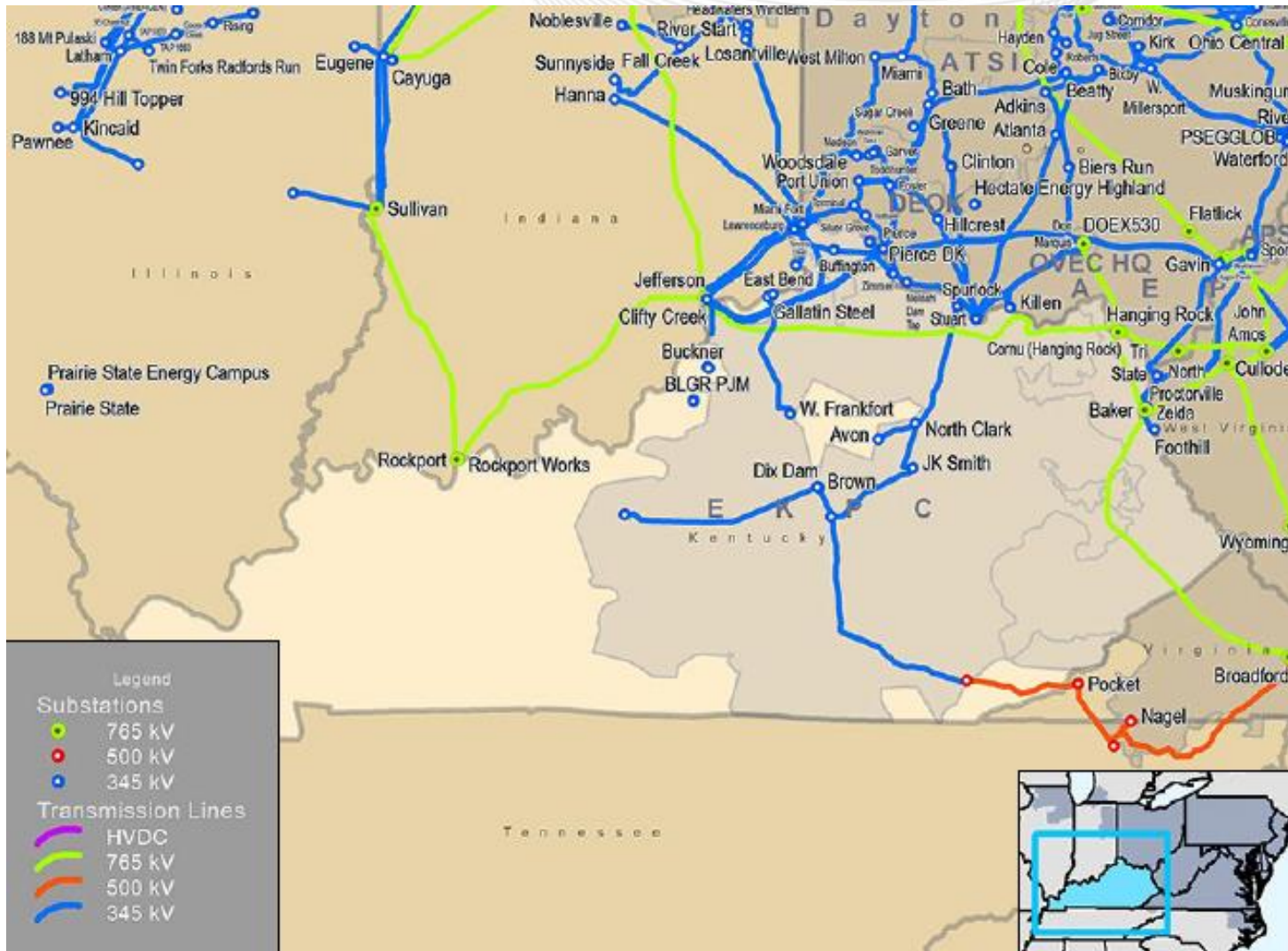
- Capacity Market Results
- Market Analysis
- Net Energy Import/Export Trend

## 3. Operations

- Generator Production
- Emissions Data

- **Existing Capacity:** Coal represents approximately 53.5 percent of the total installed capacity in the Kentucky service territory while natural gas represents approximately 43.7 percent. Comparatively across PJM, natural gas and coal are at 44.2 and 26.6 percent of total installed capacity.
- **Interconnection Requests:** Solar represents 83.3 percent of new interconnection requests in Kentucky, while natural gas represents approximately 12.6 percent of new requests.
- **Deactivations:** No generation in Kentucky gave notification of deactivation in 2021.
- **RTEP 2021:** Kentucky's 2021 RTEP project total represents \$415.1 million in investment.

- **Load Forecast:** Kentucky's peak load growth is projected to range between 0.1 and 0.6 percent annually over the next ten years, based on the service territory. The overall PJM RTO projected summer load growth rate is 0.4 percent.
- **1/1/21 – 12/31/21 Market Performance:** Kentucky's average hourly LMPs generally aligned with the PJM average hourly LMP.
- **2022/23 Capacity Market:** The portion of Kentucky within the PJM footprint cleared at the RTO price of \$50/MW-day and at \$71.69 within DEO&K for the 2022/2023 Base Residual Auction.
- **Emissions:** Kentucky's 2021 average CO2 emission levels remained fairly flat compared to 2020 levels.

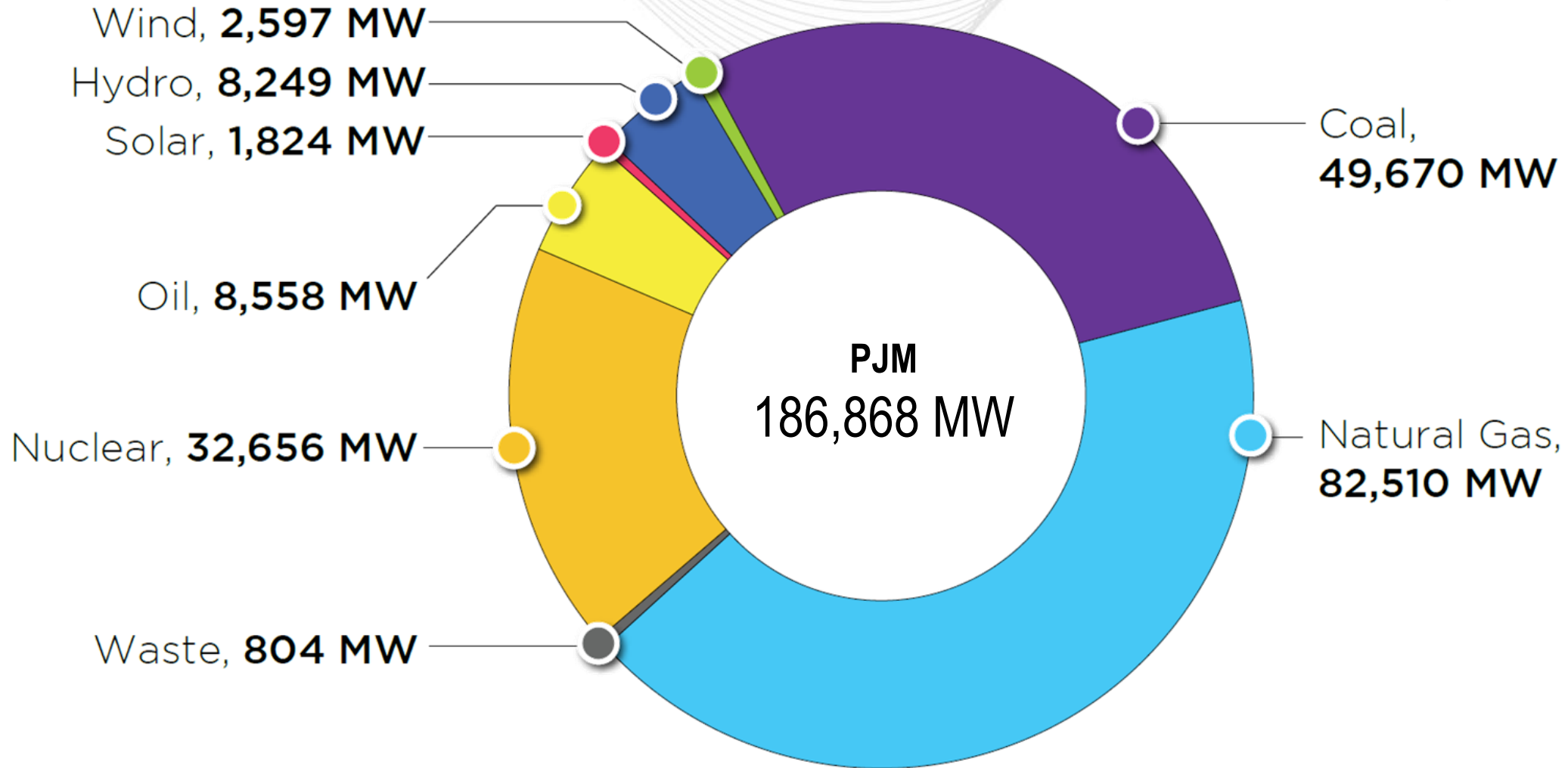


The PJM service area in Kentucky is represented by the shaded portion of the map.

PJM operates transmission lines that extend beyond the service territory.

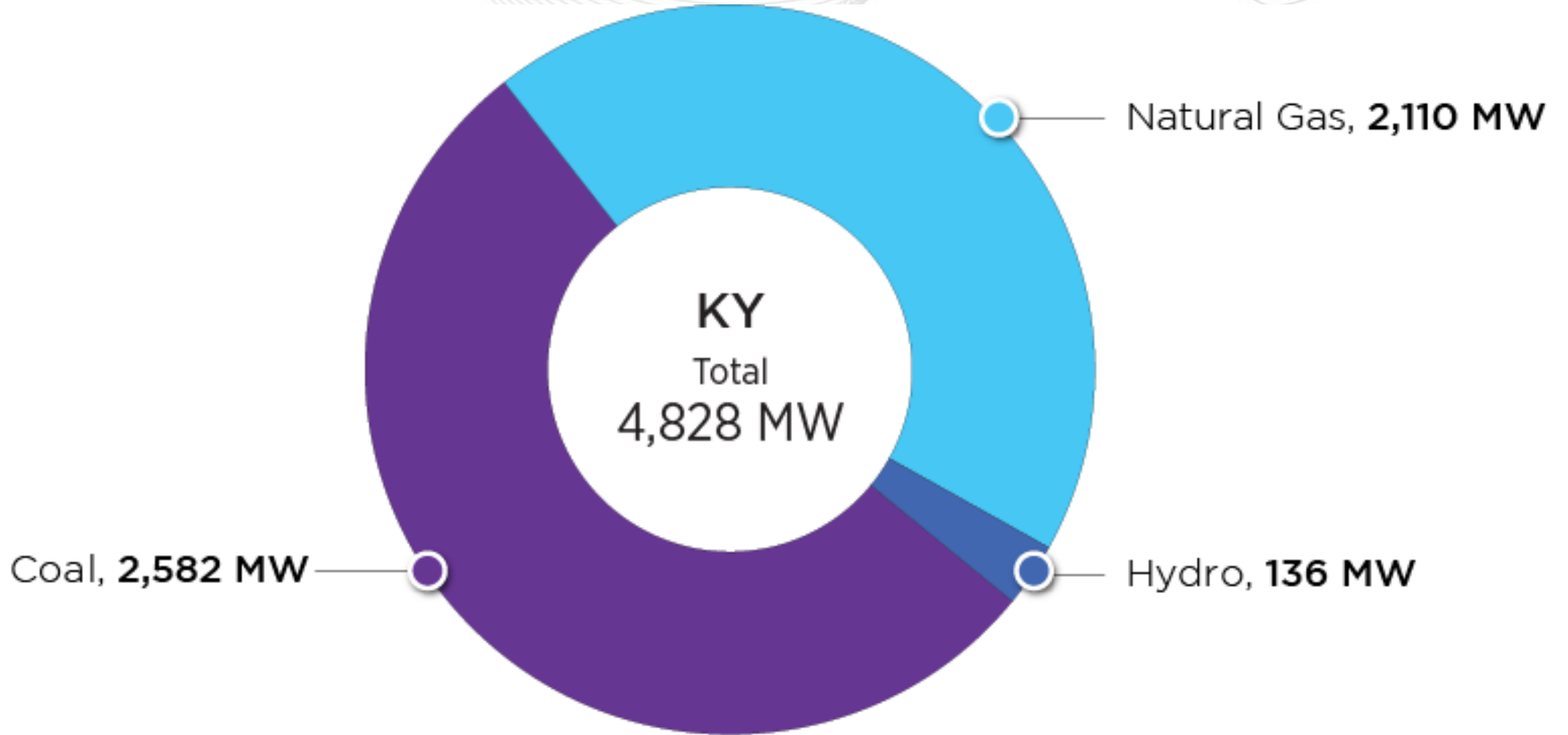
# Planning

## Generation Portfolio Analysis



# Kentucky – Existing Installed Capacity

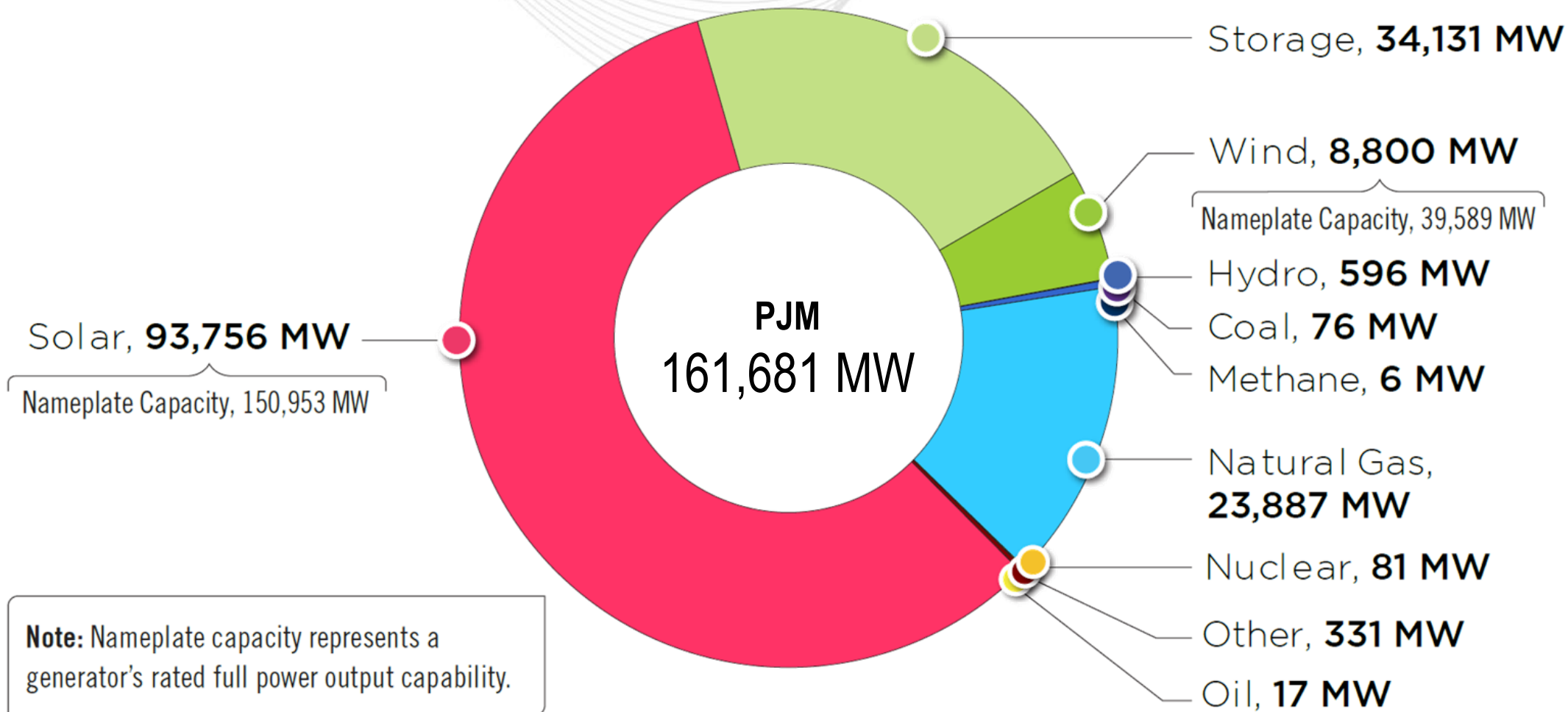
(CIRs – as of Dec. 31, 2021)





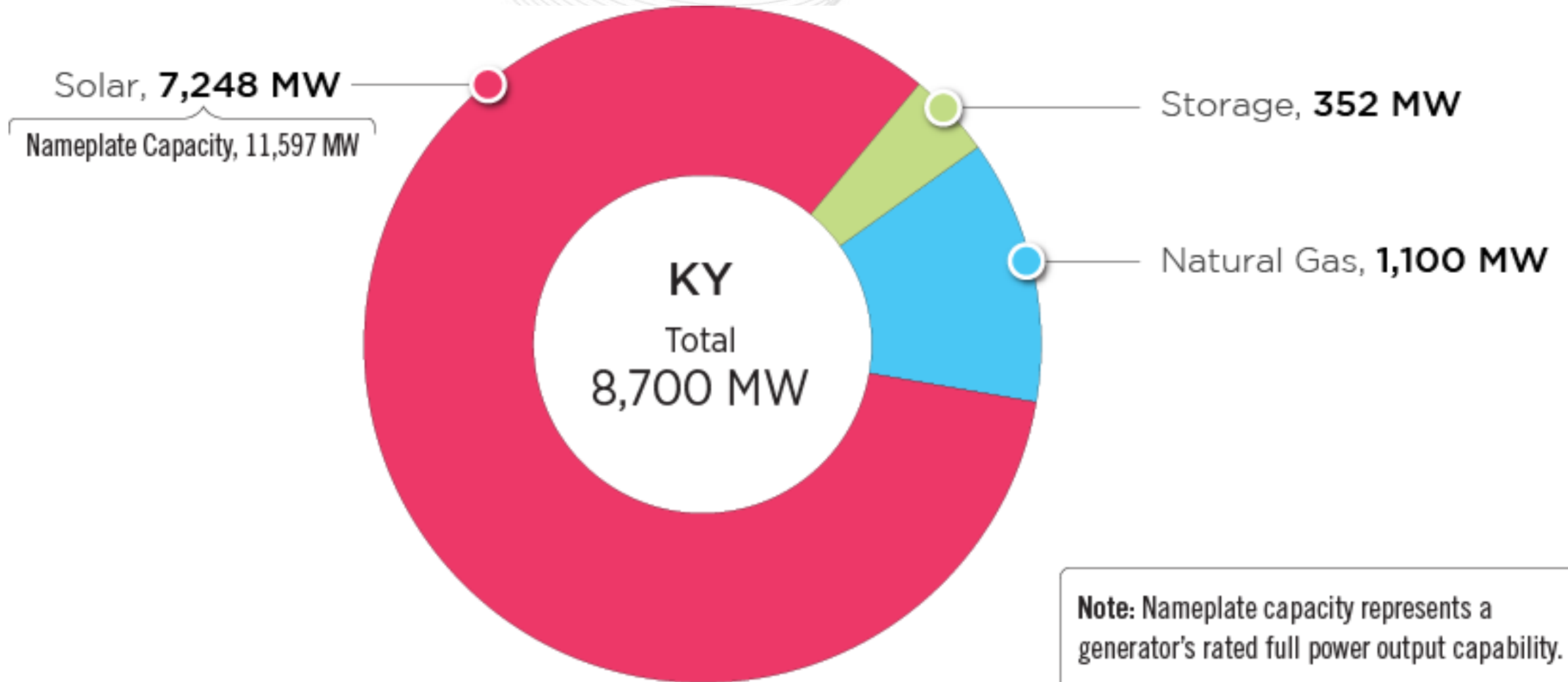
# PJM – Queued Capacity (MW) by Fuel Type

(Requested CIRs – as of Dec. 31, 2021)



# Kentucky – Queued Capacity (MW) by Fuel Type

(Requested CIRs – as of Dec. 31, 2021)





# Kentucky – Historical Interconnection Requests by Fuel Type

(as of Dec. 31, 2021)

		In Queue						Complete				Grand Total	
		Active		Suspended		Under Construction		In Service		Withdrawn		Projects	Capacity (MW)
		Projects	Capacity (MW)	Projects	Capacity (MW)	Projects	Capacity (MW)	Projects	Capacity (MW)	Projects	Capacity (MW)	Projects	Capacity (MW)
Non-Renewable	Coal	0	0.0	0	0.0	0	0.0	0	0.0	6	2,969.0	6	2,969.0
	Natural Gas	0	0.0	1	1,100.0	0	0.0	6	71.0	5	1,704.7	12	2,875.7
	Storage	9	352.0	0	0.0	0	0.0	0	0.0	3	106.2	12	458.2
Renewable	Biomass	0	0.0	0	0.0	0	0.0	0	0.0	5	198.5	5	198.5
	Hydro	0	0.0	0	0.0	0	0.0	0	0.0	1	70.0	1	70.0
	Solar	110	6,973.7	1	63.8	5	210.2	0	0.0	34	1,630.6	150	8,878.2
	Wind	0	0.0	0	0.0	0	0.0	0	0.0	2	27.3	2	27.3
Grand Total		119	7,325.7	2	1,163.8	5	210.2	6	71.0	56	6,706.3	188	15,476.9

**Note:** The "Under Construction" column includes both "Engineering and Procurement" and "Under Construction" project statuses.



# Kentucky – Progression History of Interconnection Requests



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

- 0.9%** Requested capacity megawatts
- 8.8%** Requested projects

Projects withdrawn after final agreement	Count	Reason	Capacity	Nameplate
1	1	Interconnection Service Agreements	80 MW	80 MW

*This graphic shows the final state of generation submitted to the PJM queue that completed the study phase as of Dec. 31, 2021, meaning the generation reached in-service operation, began construction, or was suspended or withdrawn. It does not include projects considered active in the queue as of Dec. 31, 2021.*

# Kentucky – Generation Deactivation Notifications Received in 2021

Kentucky had no generators give notice of deactivation in 2021.

# Planning

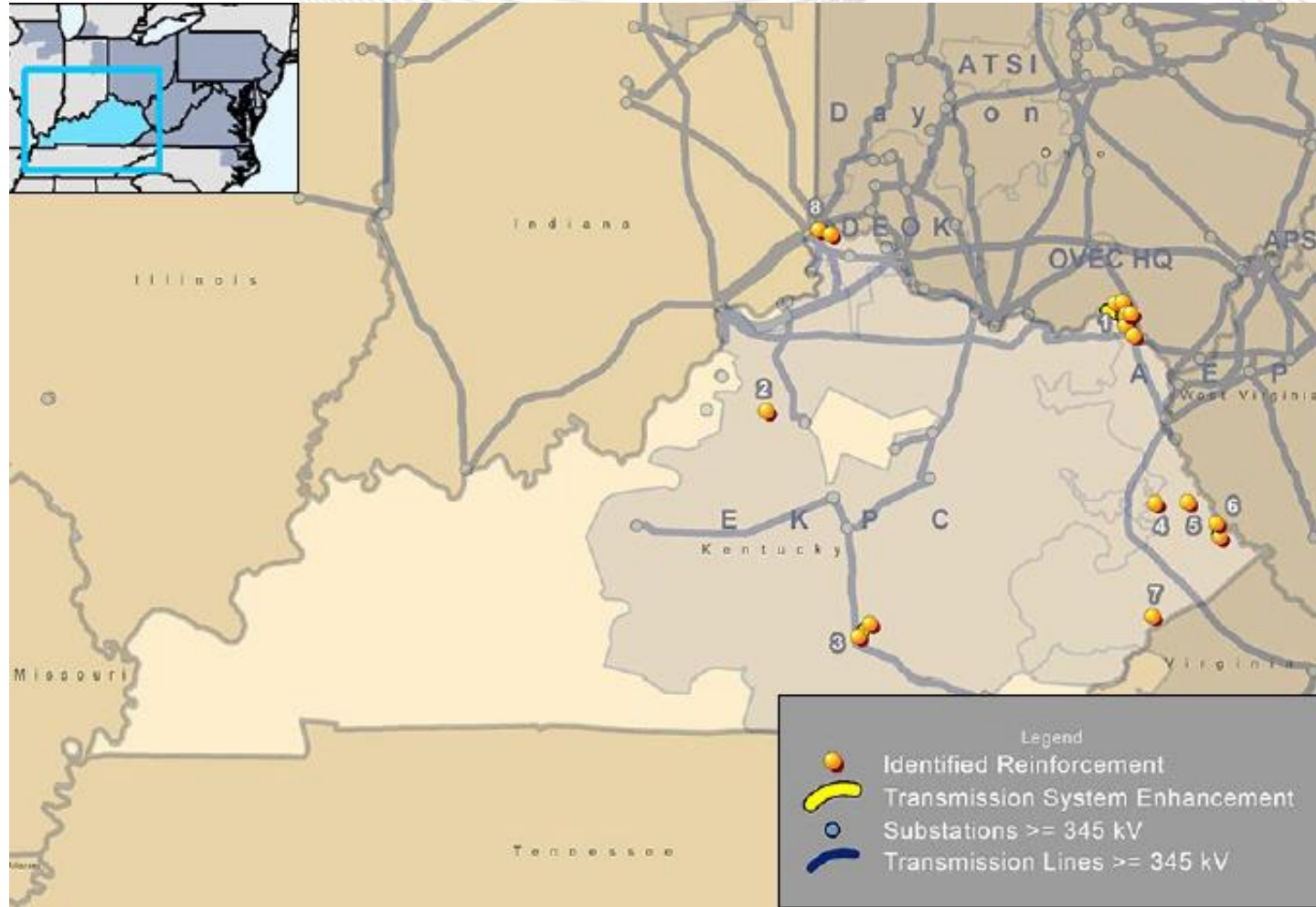
## Transmission Infrastructure Analysis



Please note that PJM is now listing all transmission projects in its Annual RTEP and state infrastructure reports, beginning with this year's 2021 Annual RTEP. In previous years only projects above a \$10 million threshold were listed in the Annual RTEP Report and projects above a \$5 million threshold were listed in the state infrastructure reports. This change may increase the amount of projects listed in these reports going forward now that smaller projects below the previous \$5 million cutoff are being included.

The complete list of all RTEP projects in PJM, including those from prior years, can be found at the “RTEP Upgrades & Status – Transmission Construction Status” page on [pjm.com](https://www.pjm.com/planning/project-construction).

<https://www.pjm.com/planning/project-construction>



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





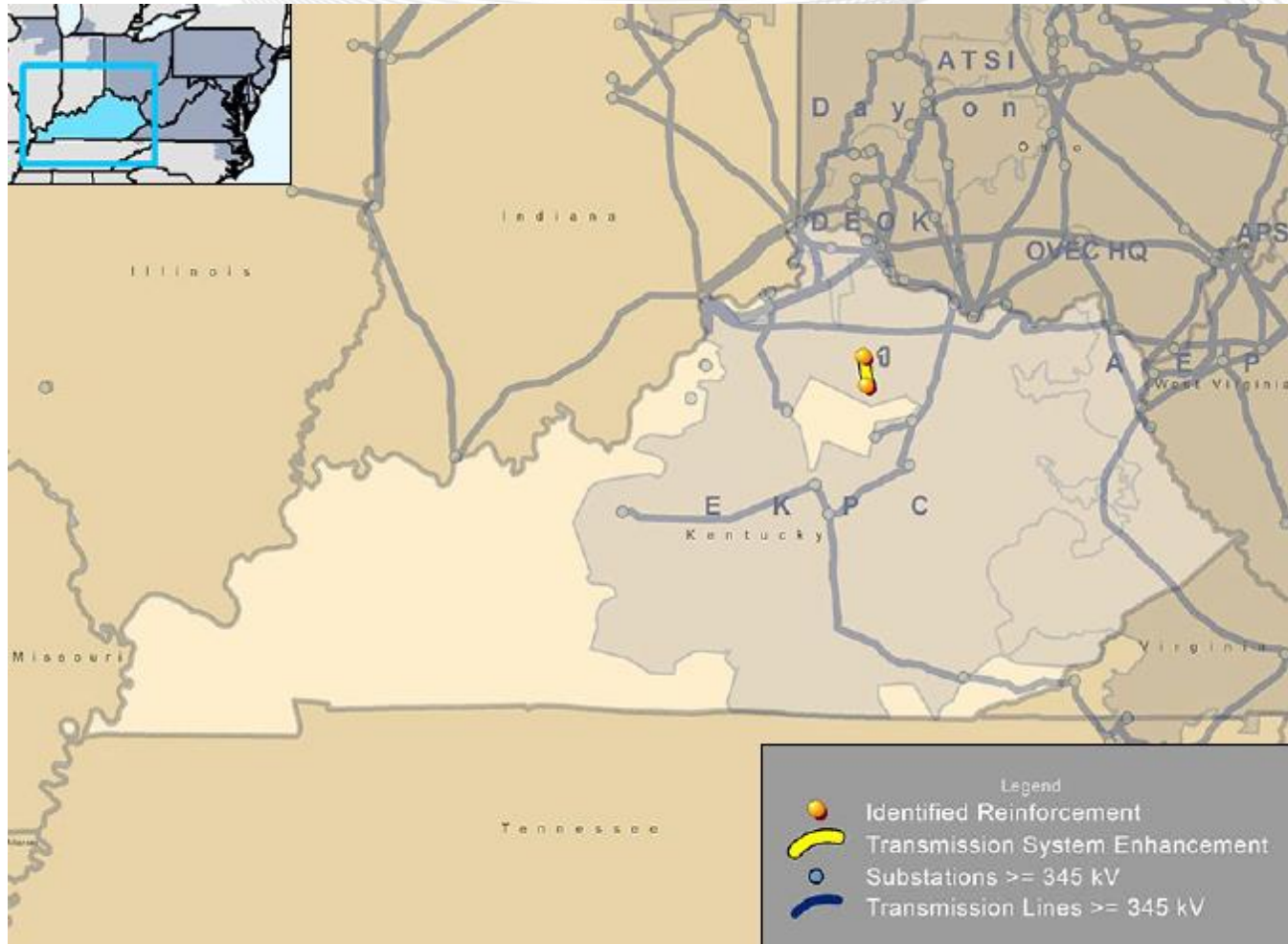
# Kentucky – RTEP Baseline Projects

Map ID	Project	Description	Required In-Service Date	Project Cost (\$M)	TO Zone	TEAC Date
1	b2604.1	Remove ~11.32 miles of the 69 kV line between Millbrook Park and Franklin Furnace.	6/1/2019	\$39.18	AEP	2/17/2021
	b2604.2	At Millbrook Park station, add a new 138/69 kV transformer No. 2 (90 MVA) with 3000A 40 kA breakers on the high and low side. Replace the 600A MOAB switch and add a 3000A circuit switcher on the high side of transformer No. 1.				
	b2604.3	Replace Sciotoville 69 kV station with a new 138/12 kV in-out station (Cottrell) with 2000A line MOABs facing Millbrook Park and East Wheelersburg 138 kV.				
	b2604.4	Tie Cottrell switch into the Millbrook Park-East Wheelersburg 138 kV circuit by constructing 0.50 miles of line using 795 ACSR 26/7 Drake (SE 359 MVA).				
	b2604.5	Install a new 2000A three-way phase-over-phase switch outside of Texas Eastern 138 kV substation (Sadiq switch).				
	b2604.6	Replace the Wheelersburg 69 kV station with a new 138/12 kV in-out station (Sweetgum) with a 3000A 40 kA breaker facing Sadiq switch and a 2000A 138 kV MOAB facing Althea.				
	b2604.7	Build ~1.4 miles of new 138 kV line using 795 ACSR 26/7 Drake (SE 359 MVA) between the new Sadiq switch and the new Sweetgum 138 kV stations.				
	b2604.8	Remove the existing 69 kV Hayport Road switch.				
	b2604.9	Rebuild ~2.3 miles along existing ROW from Sweetgum to the Hayport Rd. switch 69 kV location as 138 kV single circuit and rebuild approximately 2 miles from the Hayport Road switch to Althea 69 kV with double-circuit 138 kV construction, one side operated at 69 kV to continue service to K.O. Wheelersburg, using 795 ACSR 26/7 Drake (SE 359 MVA).				
	b2604.10	Build a new station (Althea) with a 138/69 kV 90 MVA transformer. The 138 kV side will have a single 2000A 40 kA circuit breaker, and the 69 kV side will be a 2000A 40 kA three- breaker ring bus.				
	b2604.11	Perform remote end work at Hanging Rock, East Wheelersburg and North Haverhill 138 kV.				



# Kentucky – RTEP Baseline Projects

Map ID	Project	Description	Required In-Service Date	Project Cost (\$M)	TO Zone	TEAC Date
2	b3266	Upgrade the metering CT associated with the Clay Village-Clay Village T 69 kV line section to increase the line ratings.	12/1/2021	\$0.03	EKPC	12/18/2020
3	b3267	Rebuild the 4/0 ACSR Norwood-Shopville 69 kV line section using 556 ACSR/TW.		\$3.79		
4	b3281	Install 138 kV circuit switcher on the 138/69 kV transformer No. 1 and 138/34.5 kV transformer No. 2 at Dewey. Install 138 kV, 2000A 40 kA breaker on Stanville line at Dewey 138 kV substation.	12/1/2025	\$1.40	AEP	2/17/2021
5	b3283	Replace the existing Inez 138/69 kV, 50 MVA autotransformer with a 138/69 kV, 90 MVA autotransformer.		\$2.96		
6	b3288.1	Construct ~2.75 mile Orinoco-Stone 69 kV transmission line in the clear between Orinoco station and Stone station.		\$21.47		1/15/2021
	b3288.2	Construct ~3.25 mile Orinoco-New Camp 69 kV transmission line in the clear between Orinoco station and New Camp station.				
	b3288.3	At Stone substation, circuit breaker A to remain in place and be utilized as T1 low-side breaker; circuit breaker B to remain in place and be utilized as new Hatfield (via Orinoco and New Camp) 69 kV line breaker. Add new 69 kV circuit breaker E for Coleman line exit.				
	b3288.4	Reconfigure the New Camp 69 kV tap, which includes access road improvements/installation, temporary wire and permanent wire work along with dead-end structures installation.				
	b3288.5	At New Camp substation, rebuild the 69 kV bus, add 69 kV MOAB W and replace the 69 kV ground switch Z1 with a 69 kV circuit switcher on the New Camp transformer.				
7	b3307	Rebuild Fleming station in the clear; Replace 138/69 kV Fleming transformer No. 1 with 138/69 kV, 130 MVA transformer with high-side 138 kV circuit breaker; Install a five-breaker 69 kV ring bus on the low side of the transformer, replace 69 kV circuit switcher AA, replace 69/12 kV transformer No. 3 with 69/12 kV, 30 MVA transformer, and replace 12 kV circuit breaker A and D. Retire existing Fleming substation.	\$21.10			
8	b3334	Rebuild the section of Miami Fort-Hebron Tab 138 kV.	6/1/2022	\$44.30	DEO&K	11/2/2021

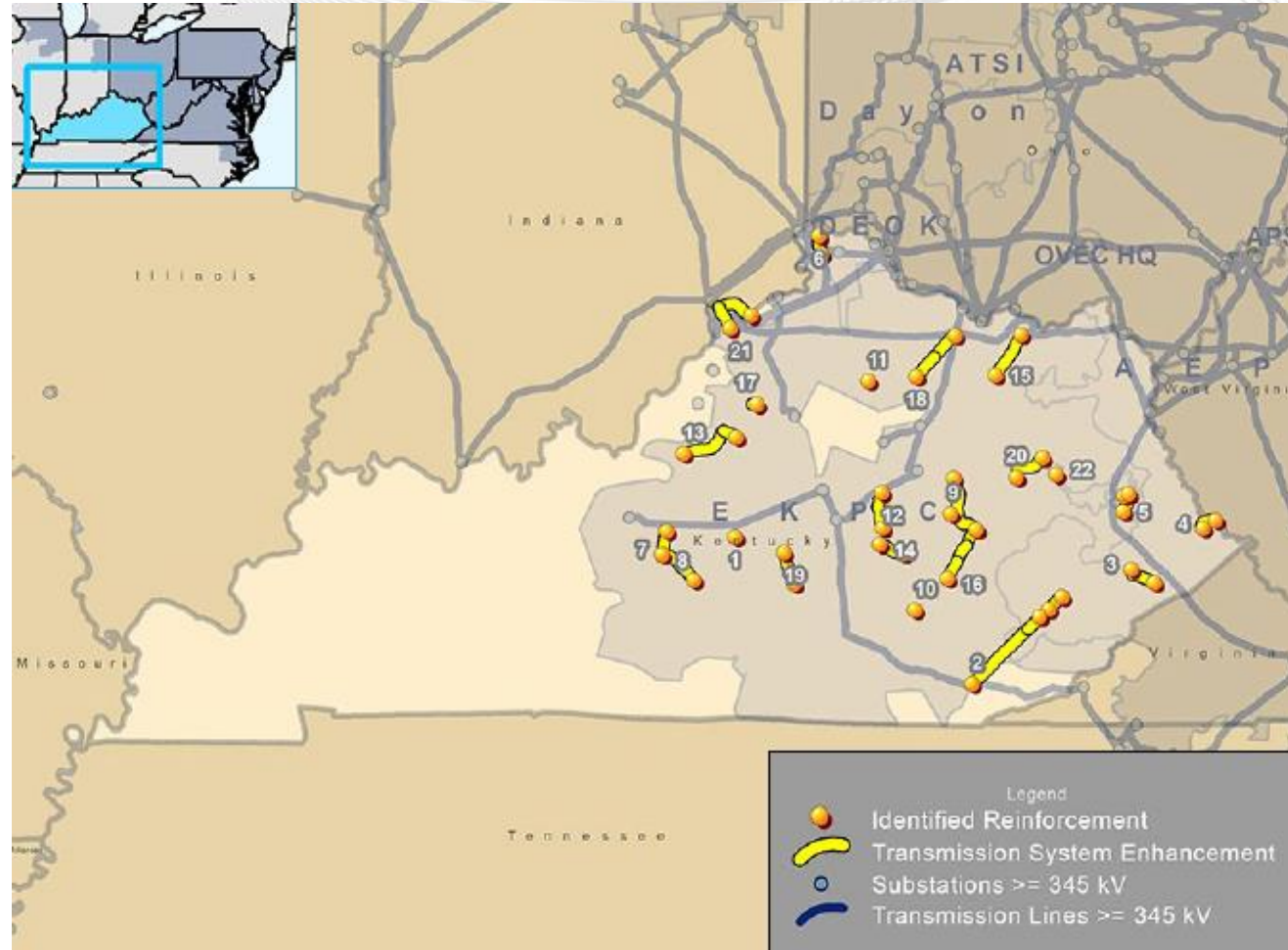


Note: Network upgrades are new or upgraded facilities required primarily to eliminate reliability criteria violations caused by proposed generation, merchant transmission or long term firm transmission service requests, as well as certain direct connection facilities required to interconnect proposed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



# Kentucky – RTEP Network Projects

Map ID	Project	Description	Generation	Required In-Service Date	Project Cost (\$M)	TO Zone	TEAC Date
1	n6276	Install OPGW fiber from the Harrison County-Renaker line section, which is ~9.35 miles in length.	AC1-074	6/1/2019	\$1.27	EKPC	11/30/2021



Note: Supplemental projects are transmission expansions or enhancements that are not required for compliance with PJM criteria and are not state public policy projects according to the PJM Operating Agreement. These projects are used as inputs to RTEP models, but are not required for reliability, economic efficiency or operational performance criteria, as determined by PJM.



# Kentucky – TO Supplemental Projects

Map ID	Project	Description	Projected In-Service Date	Project Cost (\$M)	TO Zone	TEAC Date
1	s2287	Build a new dual transformer 161/13.8 kV 50 MVA distribution station (South Marion County Industrial) and associated 0.25 mile 161 kV line tapping the existing Marion County Industrial 161 kV tap line. Distribution cooperative will lower distribution line to allow adequate clearance for the Marion Co-Marion Co Industrial tap 161 kV line to achieve a maximum operating temperature of 167 F to match the rest of the line section.	6/1/2021	\$0.00	EKPC	2/21/2020
2	s2428.1	At Wooton station – Upgrade relaying to accommodate new OPGW fiber protection.	11/30/2027	\$127.33	AEP	11/20/2020
	s2428.2	At Leslie station – Reconductor the 161 kV bus, relaying upgrades toward Wooton and Pineville, replace 161 kV MOAB W, replace 161 kV XF#1 high-side switch. Install DICM.				
	s2428.3	Perform remote end work at Hazard substation.				
	s2428.4	Rebuild ~40 miles of Wooton-Pineville 161 kV line to address the identified asset condition needs. This work also includes line removal work as well as access road construction. Majority of proposed line rebuild is to be constructed on existing center line.				
	s2428.5	Expand existing ROW for the Wooton-Pineville 161 kV line.				
	s2428.6	Relocate ~0.32 mile 69 kV Leslie-Clover Fork, which includes one structure and reconfiguration of the existing line to cross underneath the proposed Wooton-Stinnett 161 kV line.				
	s2428.7	At Stinnett station – Upgrade relaying to accommodate new OPGW fiber protection. Provide transition, entry and termination for OPGW connectivity to the Hazard-Pineville fiber route.				
	s2428.8	Provide transition, entry and termination for OPGW connectivity at Leslie substation.				



# Kentucky – TO Supplemental Projects

Map ID	Project	Description	Projected In-Service Date	Project Cost (\$M)	TO Zone	TEAC Date
3	s2436.1	Construct a greenfield 69/12 kV Osborne station to replace Burton station, including a high-side 69 kV phase-over-phase switch, fiber connectivity, a circuit switcher, and one 69/12 kV 12/16/20 MVA transformer and associated distribution feeders.	11/30/2024	\$26.16	AEP	12/18/2020
	s2436.2	Construct a greenfield 138 kV Myra station to replace Elwood station. Install 138 kV double box bay with two 138 kV circuit breakers and line exits to Fremont & Beaver Creek. Install 138/34.5 kV transformer with high-side circuit switcher and associated 34.5 kV breakers. Install fiber connectivity for upgraded relaying.				
	s2436.3	Perform remote end relaying work at Beaver Creek substation. Remove 46 kV Elwood line 46 kV circuit breaker "G" and associated equipment.				
	s2436.4	Perform remote end relaying work at Fremont substation.				
	s2436.5	At Burton station – Retire and remove all existing equipment.				
	s2436.6	At Elwood station – Retire and remove all existing equipment.				
	s2436.7	Construct a new ~0.5 mile double-circuit 69 kV line to the proposed Osborne substation.				
	s2436.8	Reconfigure the existing Beaver Creek-Fleming 69 kV line to facilitate the construction of the new double-circuit Osborne 69 kV line to feed the proposed Osborne substation.				
	s2436.9	Construct a new ~2 mile double-circuit 138 kV line to the proposed Myra substation.				
	s2436.10	Reconfigure the existing Beaver Creek-Fremont 138 kV circuit to facilitate the construction of the new double-circuit Myra Extension 138 kV line to feed the proposed Myra substation.				
	s2436.11	Install two replacement structures in order to bypass Elwood station. Transfer wires from old structure to new structure. Tie new structure to Cedar Creek-Henry Clay 46 kV line.				
	s2436.12	Retire ~10.48 mile Beaver Creek-Elwood 46 kV line.				



# Kentucky – TO Supplemental Projects

Map ID	Project	Description	Projected In-Service Date	Project Cost (\$M)	TO Zone	TEAC Date
4	s2446.1	Replace Belfry substation with Orinoco substation by installing a 69 kV box bay and 12 kV rural bay to be built in the clear southwest of existing Belfry station. Install 69/12 kV, 20 MVA transformer and two 12 kV breakers.	12/31/2024	\$9.11	AEP	1/15/2021
	s2446.2	Retire Belfry 46 kV substation.				
	s2446.3	Retire 46 kV equipment from Stone substation.				
	s2446.4	At Hatfield substation – Replace MOAB Y with a 69 kV circuit breaker toward Stone 69 kV line via New Camp and Orinoco.				
	s2446.5	Retire the 46 kV equipment at Sprigg station toward Stone (via Belfry).				
	s2446.6	Retire Turkey Creek Tap.				
	s2446.7	Retire the ~8.23 miles of the 46 kV Sprigg-Stone 46 KV circuit.				
5	s2470.1	A greenfield line is to be constructed (Kenwood 69 kV extension) and to be operated at 46 kV. The new extension will provide looped service into Kenwood substation. It will be approximately 2.25 miles of single-circuit construction through mountainous terrain in Floyd and Johnson counties in Kentucky. The extension will tap the existing Prestonsburg-Thelma 46 kV line around structure K346-50 (SN:53 MVA , SE:61 MVA, WN:67 MVA, WE:73 MVA).	11/30/2023	\$12.10	AEP	3/19/2021
	s2470.2	Rebuild the existing ~1.77 mile Kenwood Tap line from Kenwood to Van Lear Tap structure on the existing center line (SN:53 MVA , SE:61 MVA, WN:67 MVA, WE:73 MVA).				
	s2470.3	Provide splicing for 2.25 miles of 96ct OPGW on the Kenwood 69 kV extension line and 1.77 mile Kenwood Tap line. This extension spans from Kenwood station to the Prestonsburg-Thelma 46 kV line.				
	s2470.4	At Kenwood substation – Extend the walk bus and add second 46 kV line to set up Kenwood station as a looped station with MOABS protecting each exit. Add new H-frame dead end with MOAB and single-phase CCVT. Add MOAB and single-phase CCVT to existing line. Relocate three-phase CCVTs from cap bank AA to 46 kV bus. Add three-bay transclosure and separate battery enclosure. Replace battery and charger.				
	s2470.5	Retire Van Lear substation.				
	s2470.6	Perform remote end work at Prestonsburg substation.				
	s2470.7	Retire the ~1.5 mile 46 kV line section from str. 52 to Van Lear substation.				





# Kentucky – TO Supplemental Projects

Map ID	Project	Description	Projected In-Service Date	Project Cost (\$M)	TO Zone	TEAC Date
6	s2474	Rebuild the 6.4 mile Boone-Bullittsville 69 kV transmission line using 556.5 ACSR/TW conductor. Build a 69 kV box for a 69 kV breaker addition at the Boone switching station. Boone distribution will be served from this new breaker. 5.25 miles of single structures will be replaced. 1.15 miles of H-frame tangent structures will be evaluated on structure-by-structure basis.	6/1/2022	\$4.03	EKPC	3/19/2021
7	s2475	Rebuild the 8.49 mile Hodgenville-Magnolia 69 kV transmission line using 556.5 ACSR/TW conductor. 8.49 miles of single structures will be replaced.	6/30/2022	\$4.75		
8	s2476	Rebuild the 15 mile Summersville-Magnolia 69 kV transmission line using 556.5 ACSR/TW conductor. 10 miles of single structures will be replaced. 5 miles of H-frame tangent structures will be evaluated on structure-by-structure basis.	12/31/2023	\$8.16		
9	s2477	Build a new Millers Creek 161-25 kV distribution substation and associated 0.16 mile 161 kV tap line to the EKPC Beattyville-Powell County 161 kV transmission line. A three-way MOAB switch will be added at the tap point, and the existing distribution substation will be retired.	12/1/2021	\$0.40		
10	s2478	Remove the 16.2 MVAR capacitor bank at East Bernstadt 69 kV.	12/31/2022	\$0.00		
11	s2479	Remove the 10.72 MVAR capacitor bank at Lees Lick 69 kV.				
12	s2514	Construct new 69 kV-25 kV, 18/24/30 MVA distribution substation and associated 4.79 mile tap from the EKPC Crooksville's 69 kV tap line. Upgrade the existing West Berea 138/69 kV, 100 MVA to 150 MVA. Add a 2000A, 138 kV breaker to the 138 kV tie line between the EKPC Fawkes switching station and the LG&E/KU Fawkes stations.	7/1/2022	\$2.40	EKPC	4/16/2021
13	s2515	Rebuild and relocate the Taylorsville distribution substation. Build a new Taylorsville 161-25 kV distribution substation looping into the Bullitt Co-Little Mount 161 kV line section. The existing distribution substation will be retired.	12/31/2023	\$1.73		



# Kentucky – TO Supplemental Projects

Map ID	Project	Description	Projected In-Service Date	Project Cost (\$M)	TO Zone	TEAC Date
14	s2516	Rebuild the 9.3 mile Three Links junction-Three Links 69 kV transmission line using 556.5 ACSR/TW conductor. Single-pole tangent, angle & dead-end structures to be replaced; H-frame tangent will be evaluated on structure-by-structure basis.	7/31/2024	\$6.16	EKPC	4/16/2021
15	s2517	Rebuild the 16.99 miles of Goddard-Chartes 69 kV transmission line using 556.5 ACSR/TW conductor.	9/30/2024	\$9.73		
16	s2518	Rebuild the 29.29 mile Beattyville-Tyner 69 kV transmission line using 556.5 ACSR/TW conductor.	12/31/2028	\$22.00		
17	s2528	Rebuild the 1.6 mile Clay Village 69 kV tie line using 556.5 ACSR/TW conductor and steel poles & structures (1.25 miles of single structures will be replaced; 0.35 miles of H-frame tangent structures will be evaluated on structure-by-structure basis).	6/30/2025	\$1.05	EKPC	5/21/2021
18	s2529	Rebuild the 19.9 mile Headquarters-Murphysville 69 kV line using 556.5 ACSR/TW conductor and steel poles & structures (19.9 miles of H-frame tangent structures will be evaluated on structure-by-structure basis).	7/6/2027	\$13.74		
19	s2530	Rebuild the 14.2 mile Peyton Store-Liberty Junction 69 kV line using 556.5 ACSR/TW conductor and steel poles & structures (2.42 miles of single structures will be replaced; 11.78 miles of H-frame tangent structures will be evaluated on structure-by-structure basis).	10/26/2026	\$9.60		
20	s2531	Rebuild the 12.3 mile Maytown Tap-Hot Mix Road Tap 69 kV line using 556.5 ACSR/TW conductor and steel poles & structures (12.3 miles of H-frame tangent structures will be evaluated on structure-by-structure basis).	12/20/2028	\$8.78		
21	s2532	Rebuild the 22.1 mile KU Carrollton-Bedford 69 kV line using 556.5 ACSR/TW conductor and steel poles & structures (all of the single structures will be replaced; the H-frame tangent structures will be evaluated on structure-by-structure basis).	3/11/2026	\$12.30		
22	s2533	Build a new White Oak 69-25 kV, 12/16/20 MVA distribution substation and 0.1 mile 69 kV tap line using 266.8 ACSR. Install MOAB switches at the new tap point. Retire the existing South Fork substation.	12/31/2023	\$0.10		

# Planning Load Forecast

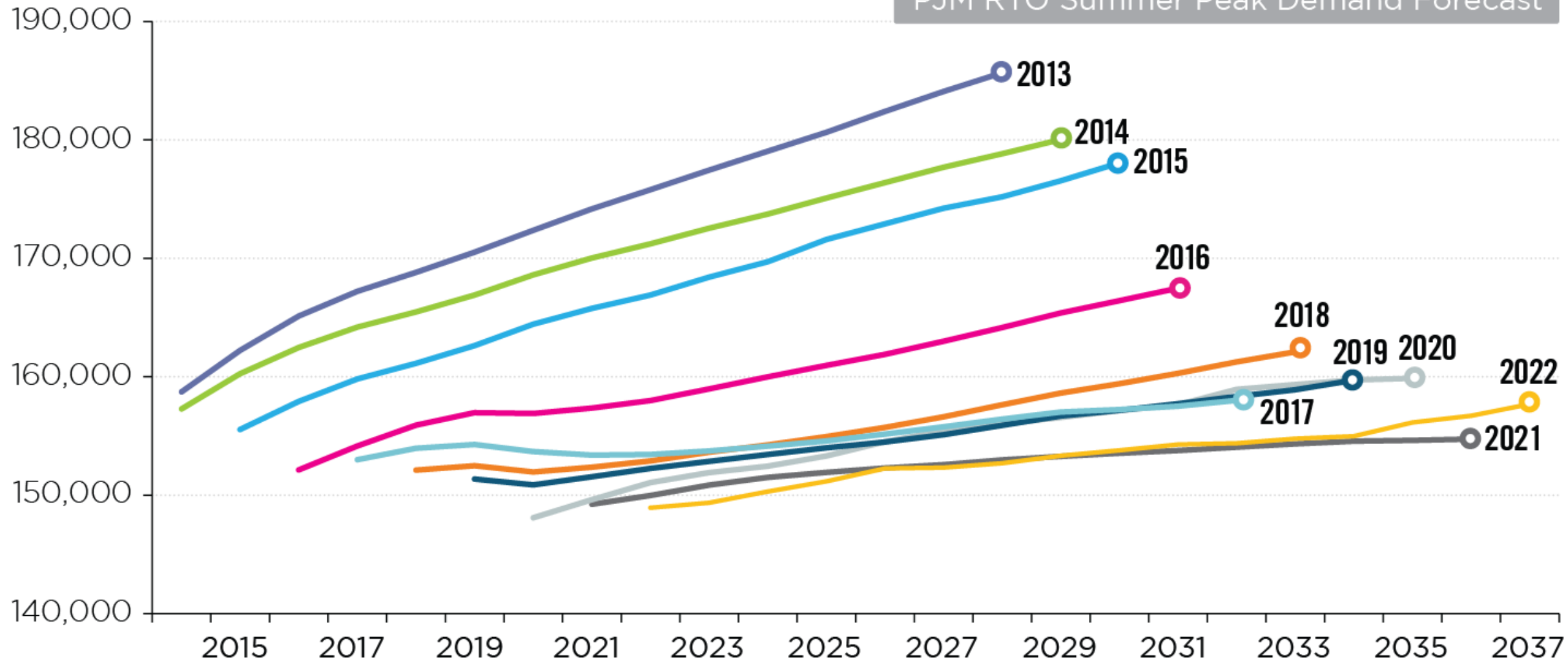


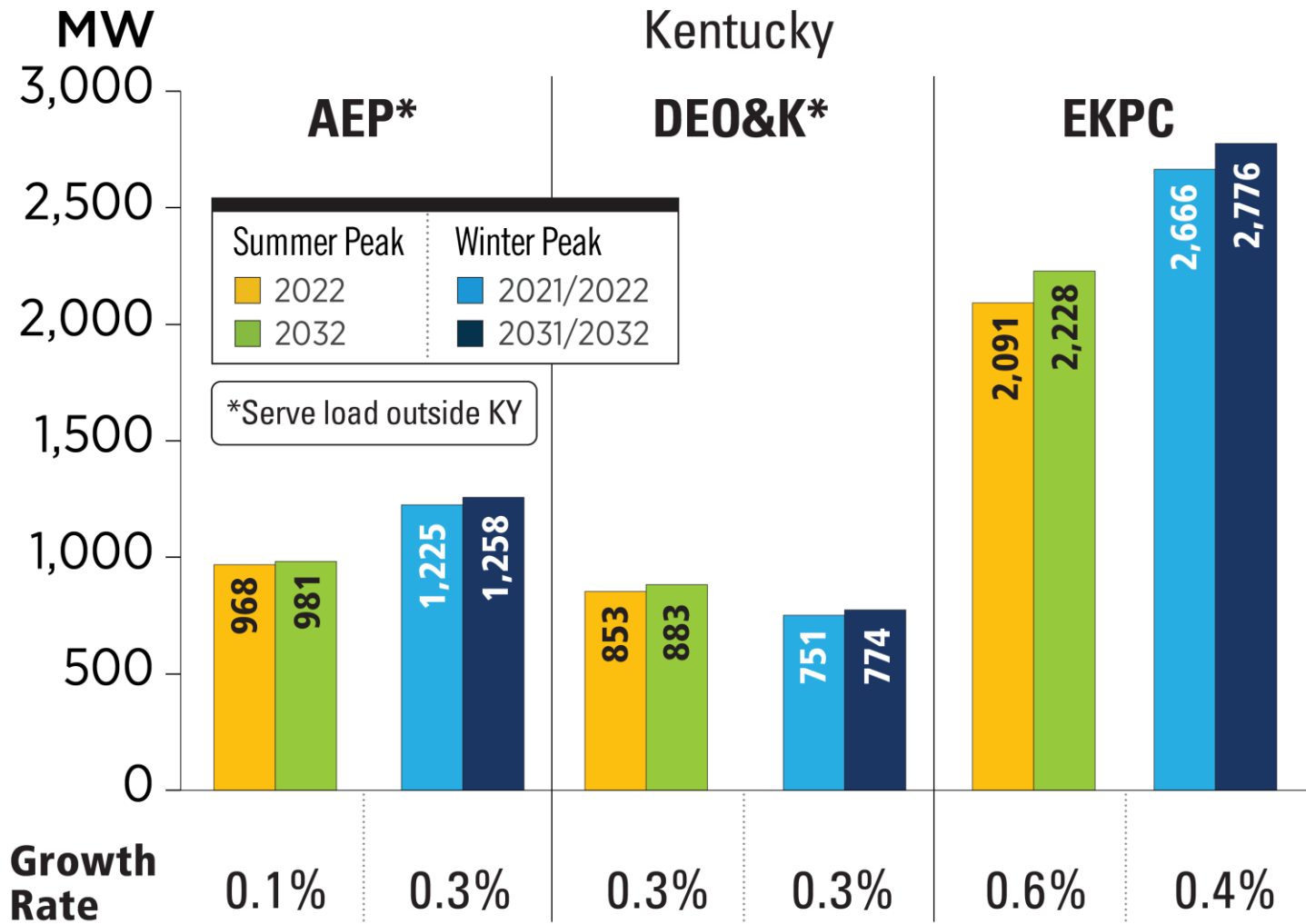
# PJM Annual Load Forecasts

(Jan. 2022)

Load (MW)

PJM RTO Summer Peak Demand Forecast





PJM RTO Summer Peak		PJM RTO Winter Peak	
2022	2032	2021/2022	2031/2032
149,938 MW	154,381 MW	132,102 MW	141,516 MW
Growth Rate 0.4%		Growth Rate 0.7%	

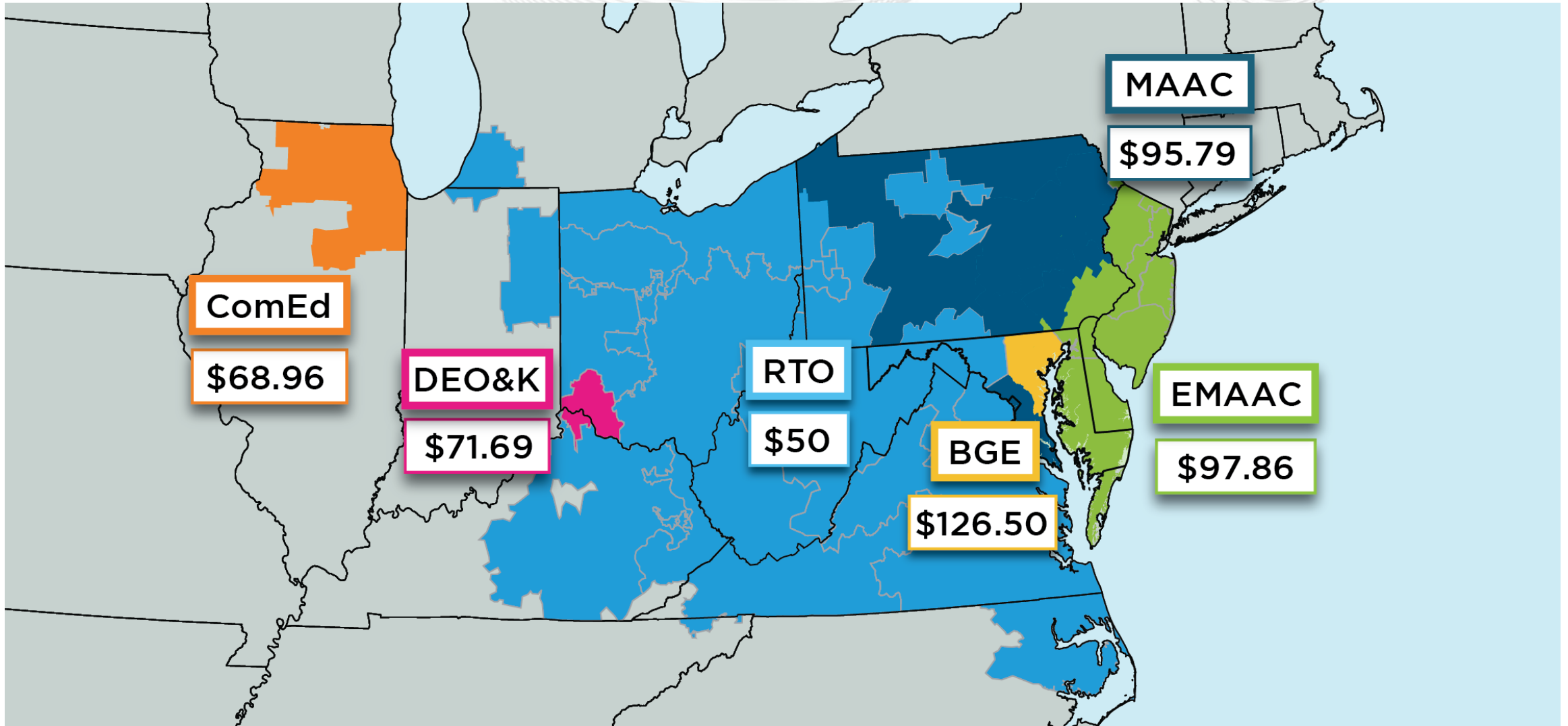
The summer and winter peak megawatt values reflect the estimated amount of forecasted load to be served by each transmission owner in the noted state/district. Estimated amounts were calculated based on the average share of each transmission owner's real-time summer and winter peak load in those areas over the past five years.

# Markets

## Capacity Market Results



# 2022/2023 Base Residual Auction Clearing Prices (\$/MW-Day)





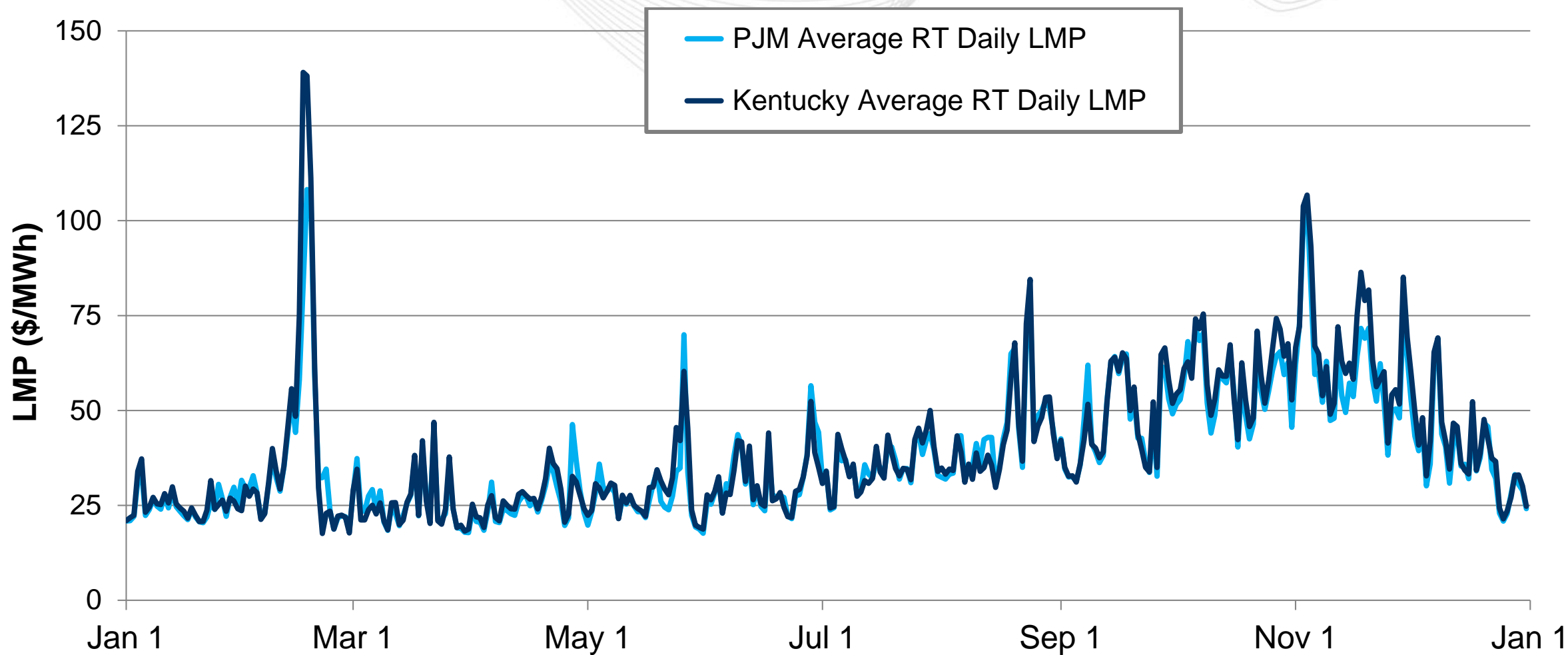
# PJM – 2022/2023 Cleared MW (UCAP) by Resource Type

	<b>ANNUAL</b>	<b>SUMMER</b>	<b>WINTER</b>	<b>Total (MW)</b>
<b>Generation</b>	130,844.9	9.9	686.8	131,541.6
<b>DR</b>	8,369.9	442.0	0.0	8,811.9
<b>EE</b>	4,575.7	234.9	0.0	4,810.6
<b>Total (MW)</b>	143,790.5	686.8	686.8	



# Markets

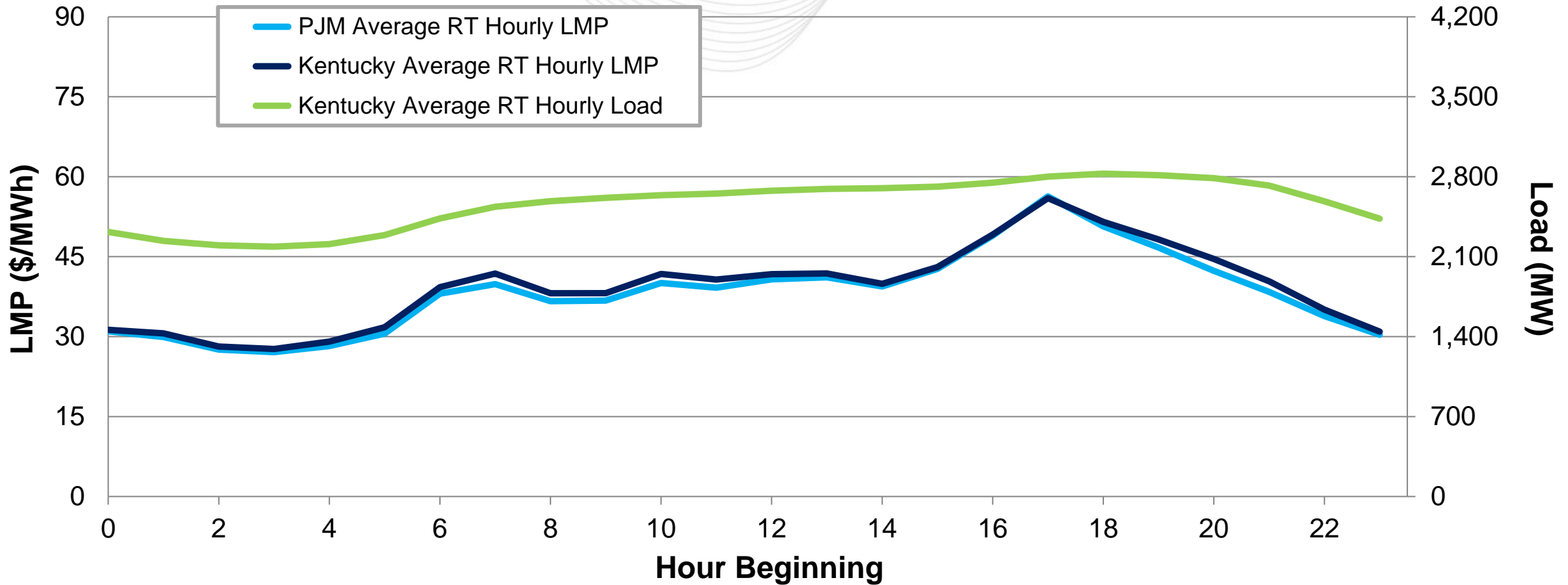
## Market Analysis



# Kentucky – Average Hourly LMP and Load

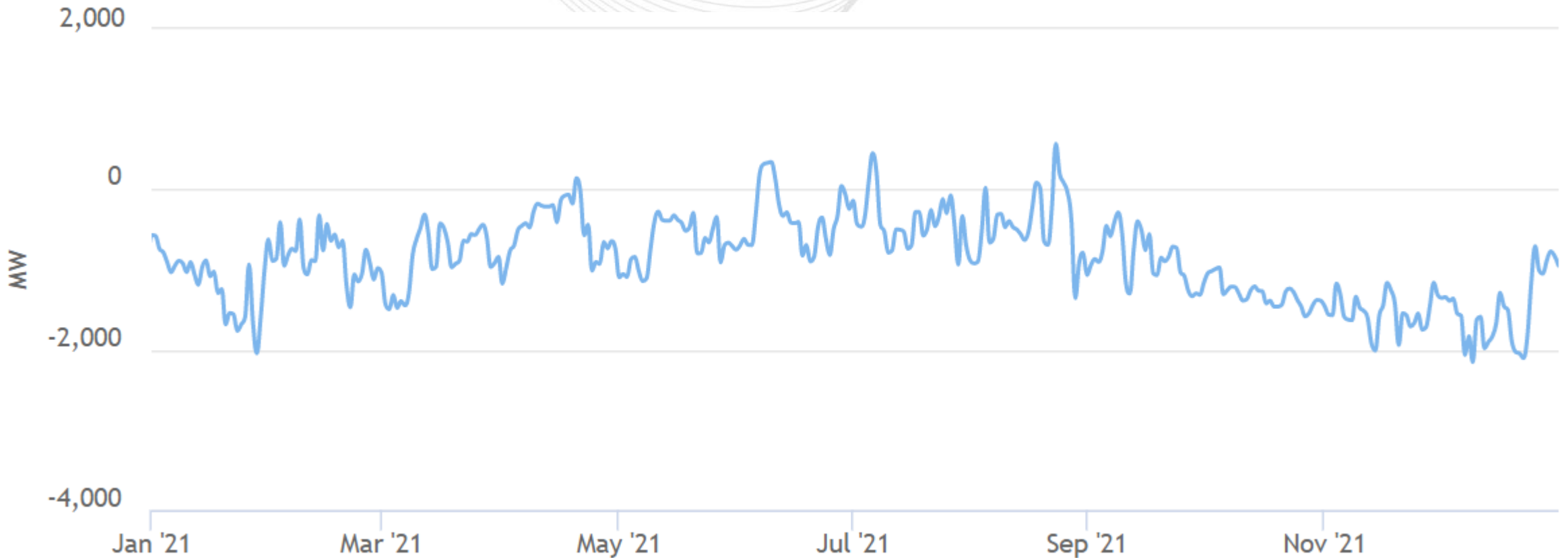
(Jan. 1, 2021 – Dec. 31, 2021)

Kentucky's average hourly LMPs generally aligned with the PJM average hourly LMP.



# Kentucky – Net Energy Import/Export Trend

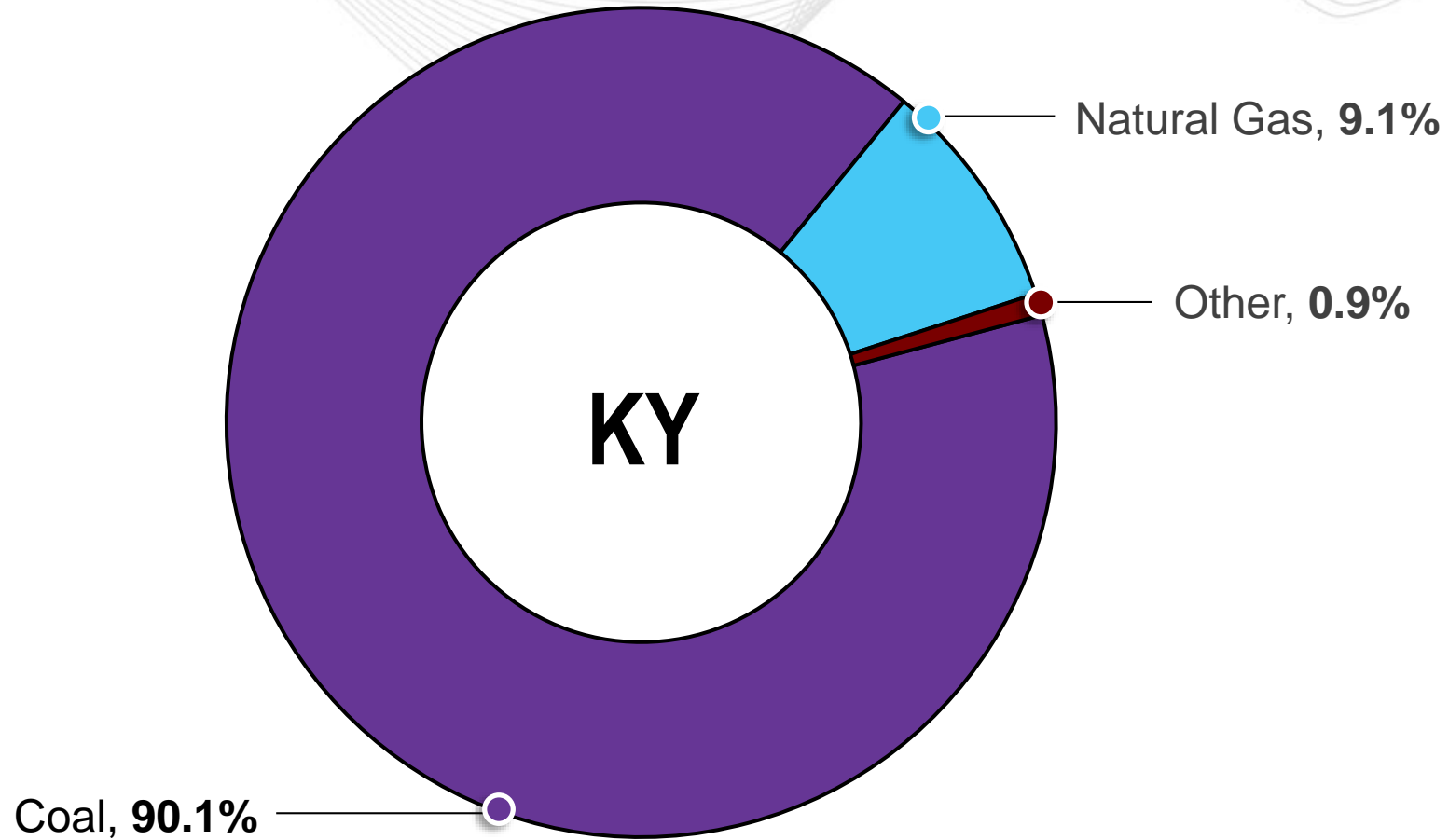
(Jan. 2021 – Dec. 2021)



This chart reflects the portion of Kentucky that PJM operates. Positive values represent exports and negative values represent imports.

# Operations

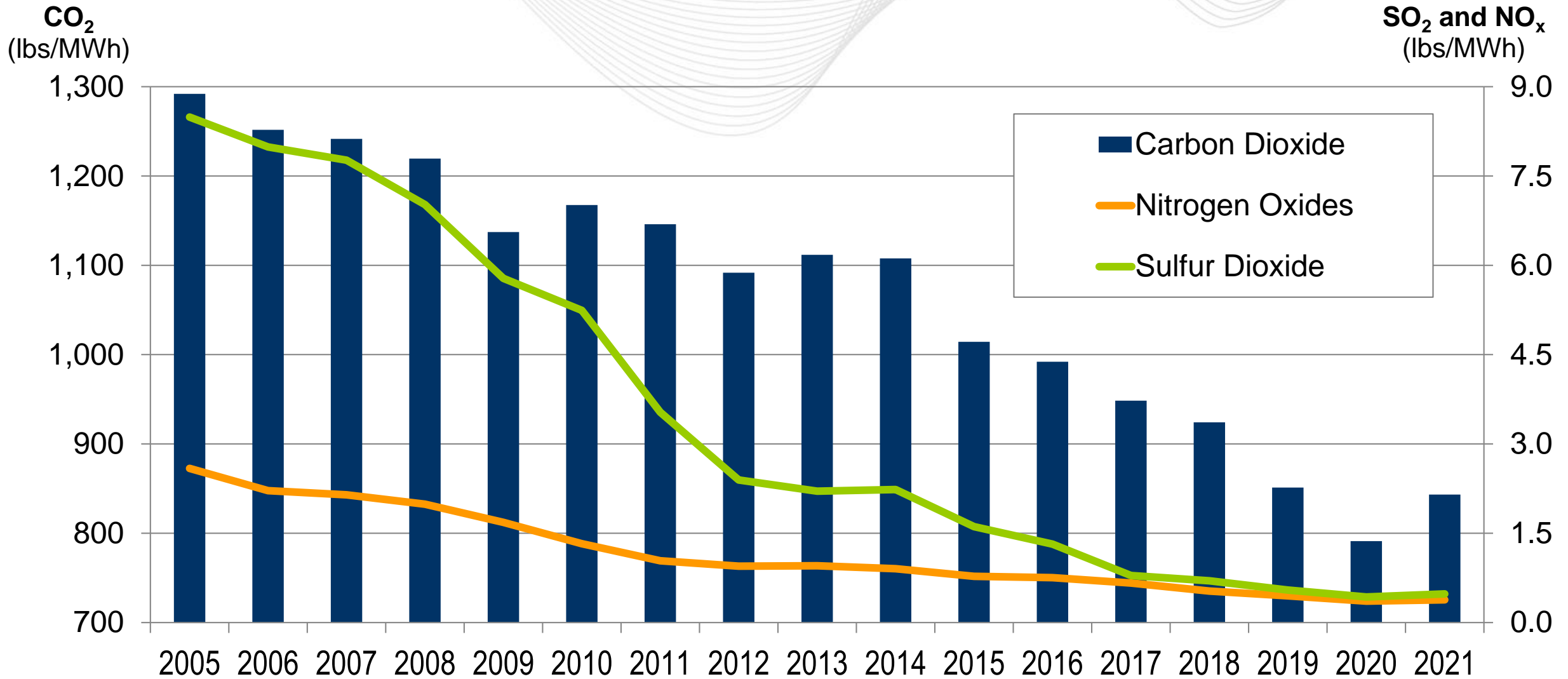
# Kentucky – 2021 Generator Production



The data in this chart comes from EIA Form 923 (2021) and represents only generators within the PJM portion of KY.



# 2005 – 2021 PJM Average Emissions



**CO<sub>2</sub>**  
(lbs/MWh)

**SO<sub>2</sub> and NO<sub>x</sub>**  
(lbs/MWh)

