
Changing Economics of the U.S. Coal Fleet

A Review of Coal Plants' Operating Costs and Market Dynamics

May 2025

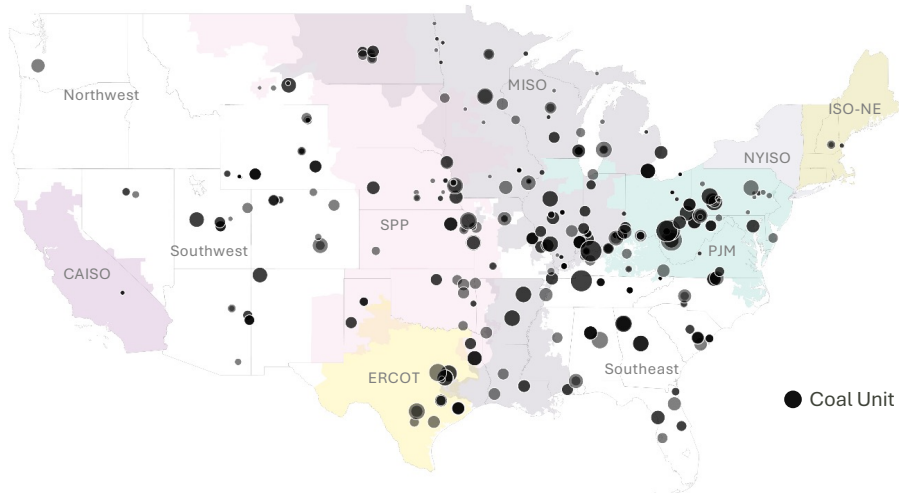


Center for Applied
Environmental
Law and Policy

Fleet Overview: The U.S. coal fleet is concentrated in four RTO/ISOs and two traditional wholesale electricity regions (Southeast and Southwest), with just three RTOs (MISO, PJM, SPP) accounting for ~60% of the remaining capacity

U.S. Electricity Regions and Current U.S. Coal Fleet

(both RTO/ISOs and traditional wholesale electricity regions are shown¹)

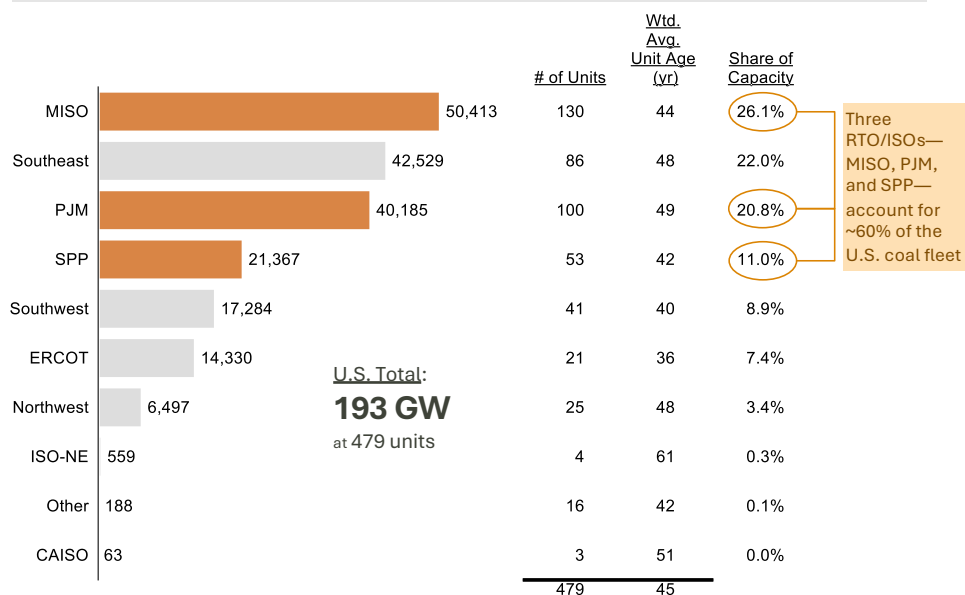


Source: FERC, EIA 860, 923, S&P

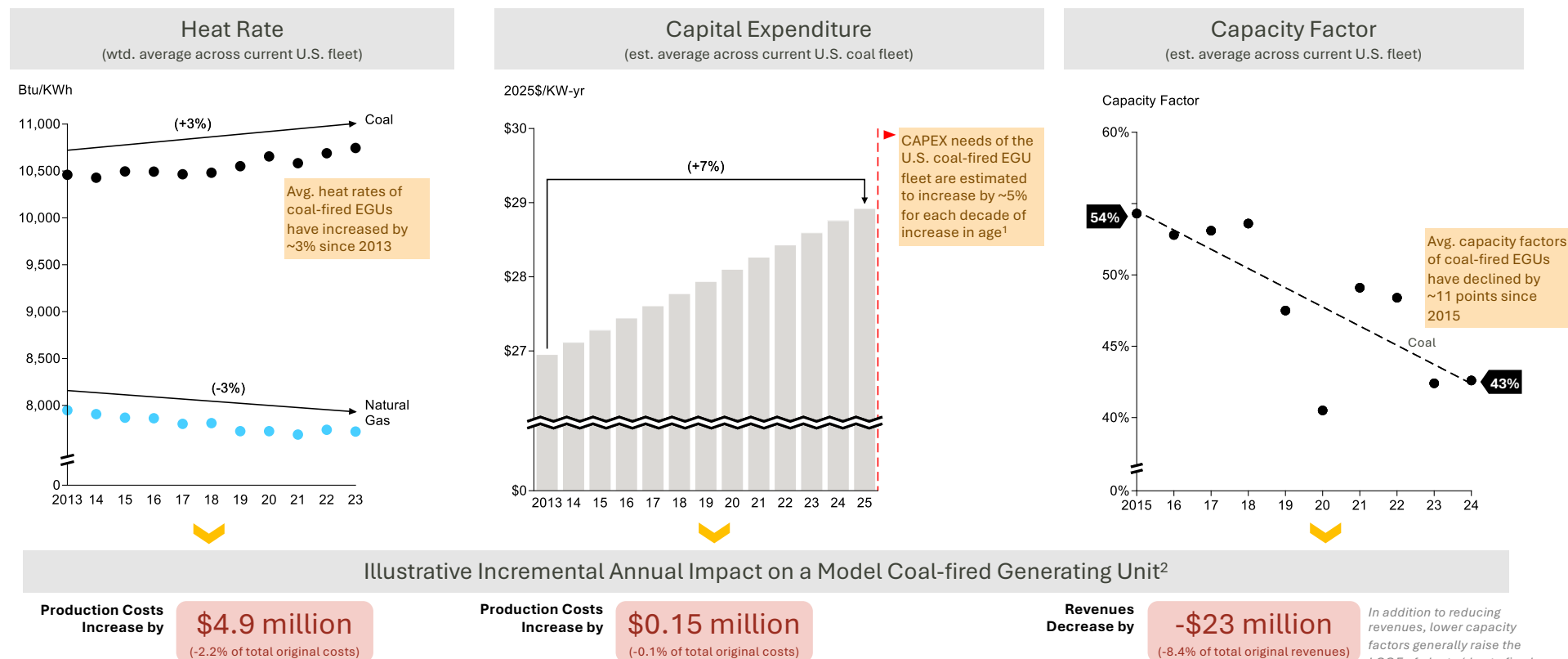
1. The Southeast, Northwest, and Southwest regions shown on the above map constitute the main traditional wholesale electricity regions in the U.S., where utilities are responsible for both system operations and providing electricity to retail customers. By contrast, in the RTO/ISOs (e.g., PJM, MISO, SPP, etc.), the RTO/ISO operates the bulk power transmission system and administers wholesale electricity markets separately from utilities that serve and deliver electricity to end customers.

Current U.S. Coal Fleet

(MW; final 2023 data from EIA 860 2023)



Declining Operating Characteristics: Key economic drivers of coal plants have all deteriorated over the last decade, due to coal plants' age-related impacts and rapidly declining costs of competing electricity suppliers



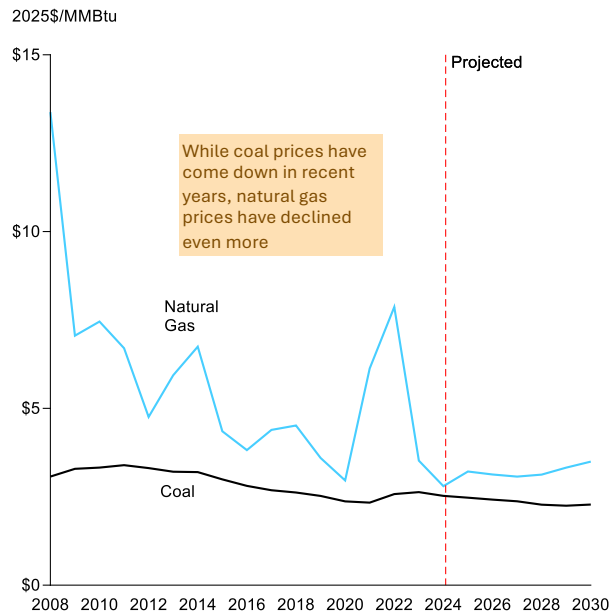
Source: Analysis based on data and information from EIA 923, EIA 860, Sargent & Lundy, AEO 2025, BLS

- Adapted for 2025\$ from the equation $CAPEX (2017\$) = 16.53 + (0.126 \times \text{age in years}) + 5.68 \times \text{FGD}$ (1 if a unit has one; 0 if not); for the purposes of this illustrative analysis the effect of FGD is ignored; see *Generating Unit Annual Capital and Life Extension Costs Analysis: Final Report on Modeling Aging-Related Capital and O&M Costs* by Sargent & Lundy (2018) and AEO 2025 EMM assumptions booklet for more information
- Illustrative impact analysis assumes a model coal electric generating unit 740 MW in size, 40 years of age in 2025, and operating at ~10,800 Btu/KWh heat rate and achieving an average of ~80% capacity factor prior to the above changes; changes are analyzed on an "all else remaining same" basis

Reduced Competitiveness: Worsening cost drivers have resulted in higher levelized cost of energy² (LCOE) of coal plants, making them increasingly uncompetitive relative to other sources of electricity

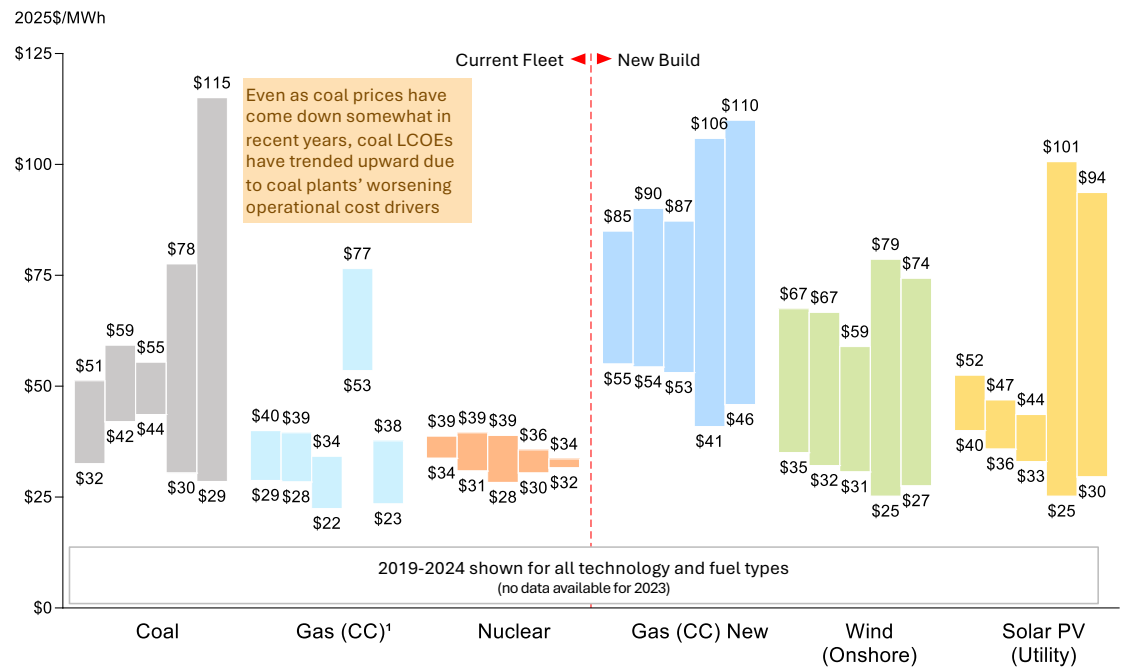
Natural Gas and Coal Prices

(Delivered Power Sector Price; U.S. Average)



Levelized Cost of Energy

(2019-22, 2024)



Source: Analysis based on data and information from EIA, Lazard LCOE (v. 13 through v. 17), AEO 2025, BLS

Note: Going forward LCOEs reflect Lazard's analysis of operating gas, nuclear, and coal electric generating units across the U.S. Low and high ends of the ranges shown correspond to capacity factors, fuel, variable, and fixed operating costs of the upper- and lower-quartile estimates included in each of Lazard's LCOE publications from v.13 (2019) through v.17 (2024)

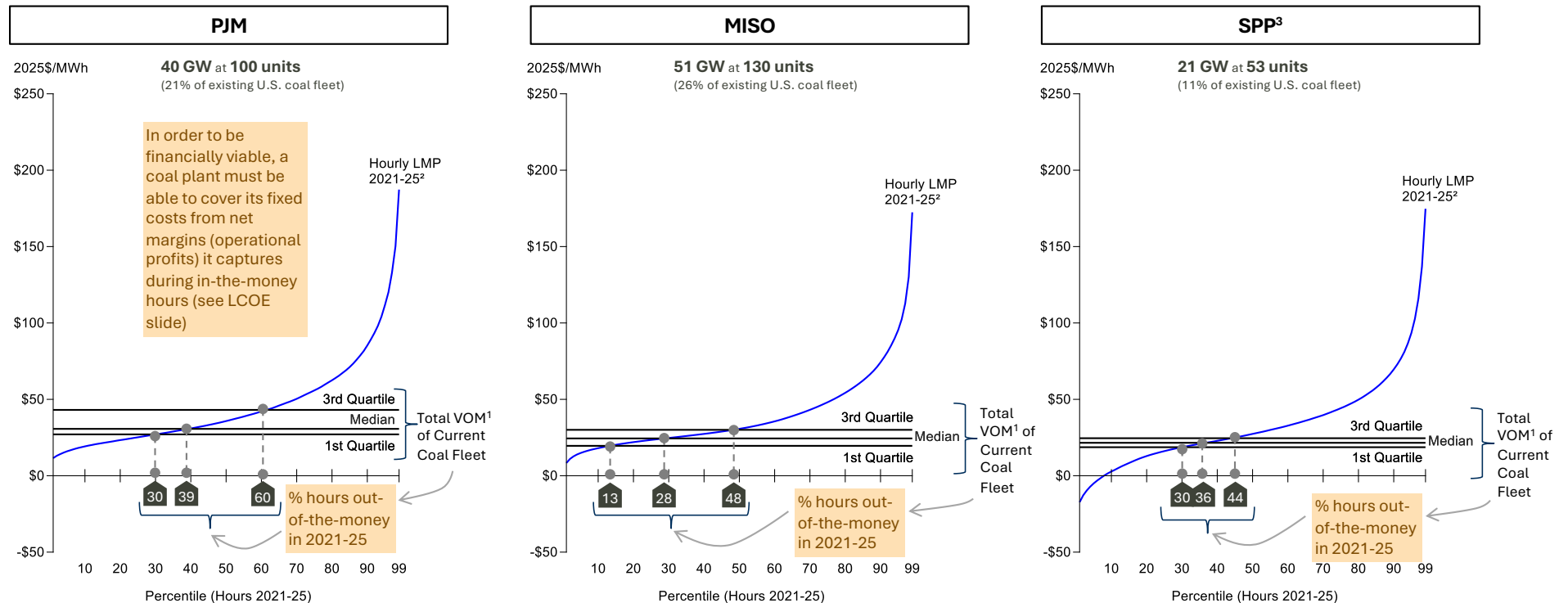
1. No LCOE data available for existing gas in 2019; chart reflects 2020 data adjusted for 2025\$

2. LCOE is a key metric that allows for the assessment of power plant economics. LCOE represents the average cost per unit of electricity generated by a power plant over a given time horizon, taking into account all forward-going costs including capital investments, fixed and variable operation and maintenance costs, and fuel, and dividing them by the total electricity output produced over that period.

Struggling Profitability: In PJM, MISO, and SPP, which together account for nearly 60% of the currently operational U.S. coal fleet, the median coal plant would be priced out of market during nearly 30-40% of hours in the five-year period 2021-25⁴

Total VOM¹

Hourly Locational Marginal Price (LMP) of Electricity and Variable Operating & Maintenance (VOM¹) Cost of Current Coal Fleet



Source: Analysis based on data from EIA, PJM, MISO, SPP, S&P

Note: Quartiles correspond to the dividing lines between quartiles. The first quartile means that 25 percent of units have lower total VOM, the median result means that 50 percent of units have lower total VOM, and the third quartile result means that 75 percent units have lower total VOM

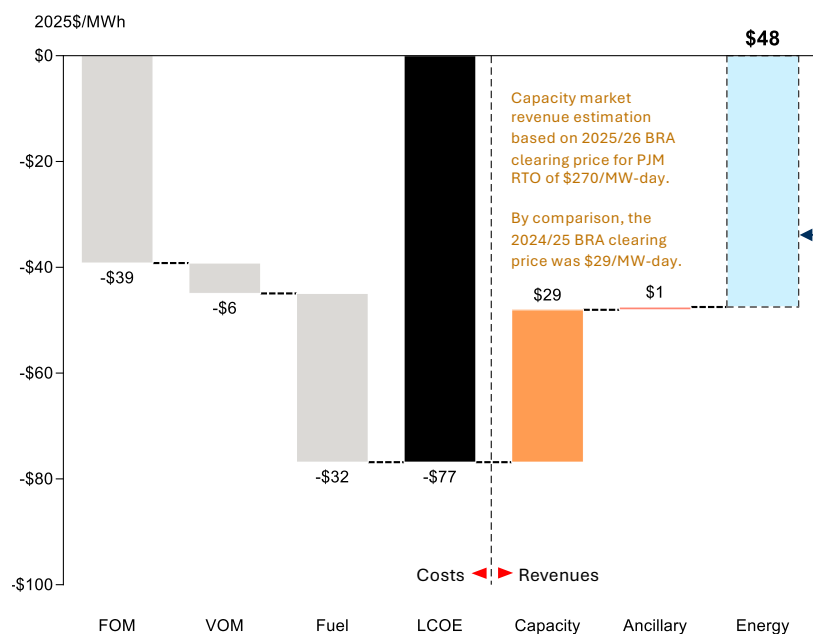
1. Total Variable Operating and Maintenance (VOM) costs include fuel costs
2. Plots "PJM Total" LMPs for PJM, average of LMPs at the eight MISO hubs (AR, IL, IN, LA, MI, MN, MS, and TX) for MISO, and the average of LMPs at the North and South hubs for SPP. Chart shows 99th percentile of hourly LMPs in the respective electricity regional transmission organization areas. However, during a very limited number of hours (representing less than 0.5% of the total number of hours during the 2021-25 period) LMPs exceed \$300/MWh. These high LMPs are not likely to meaningfully affect the economics of coal-fired generating units due to the very limited number of hours during which they prevail
3. Day ahead LMPs used for SPP; real-time LMPs for PJM and MISO
4. 2021 through last week of May 2025

Struggling Profitability [contd.]: In some regions coal plants may receive additional revenues from capacity and ancillary services markets. However, even with the very high 2025/26 PJM capacity prices, the average coal plant in PJM would still have needed energy market price levels that were reached in PJM during only ~33% of hours in the 2021-25² period

Capacity + Ancillary Market Revenues

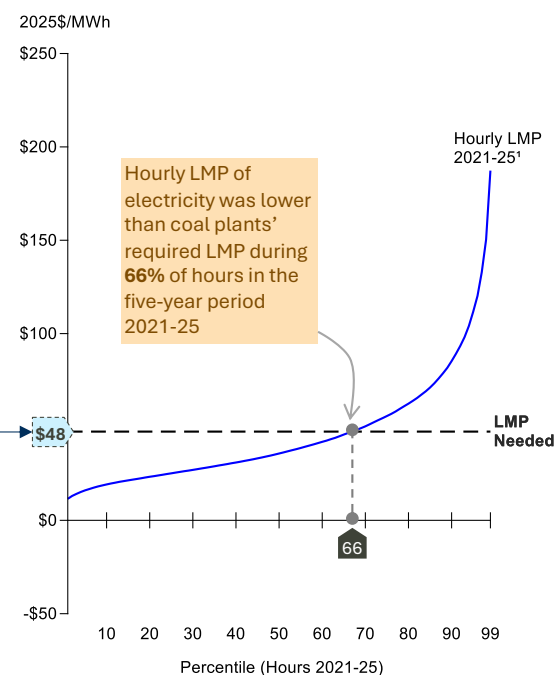
Illustrative Costs and Revenues of Average Coal Plant⁴ in PJM

(individual plants may have revenue requirements that are higher or lower than the averages shown here)



Hourly Locational Marginal Price in PJM

(2021-25; 2025\$/MWh)

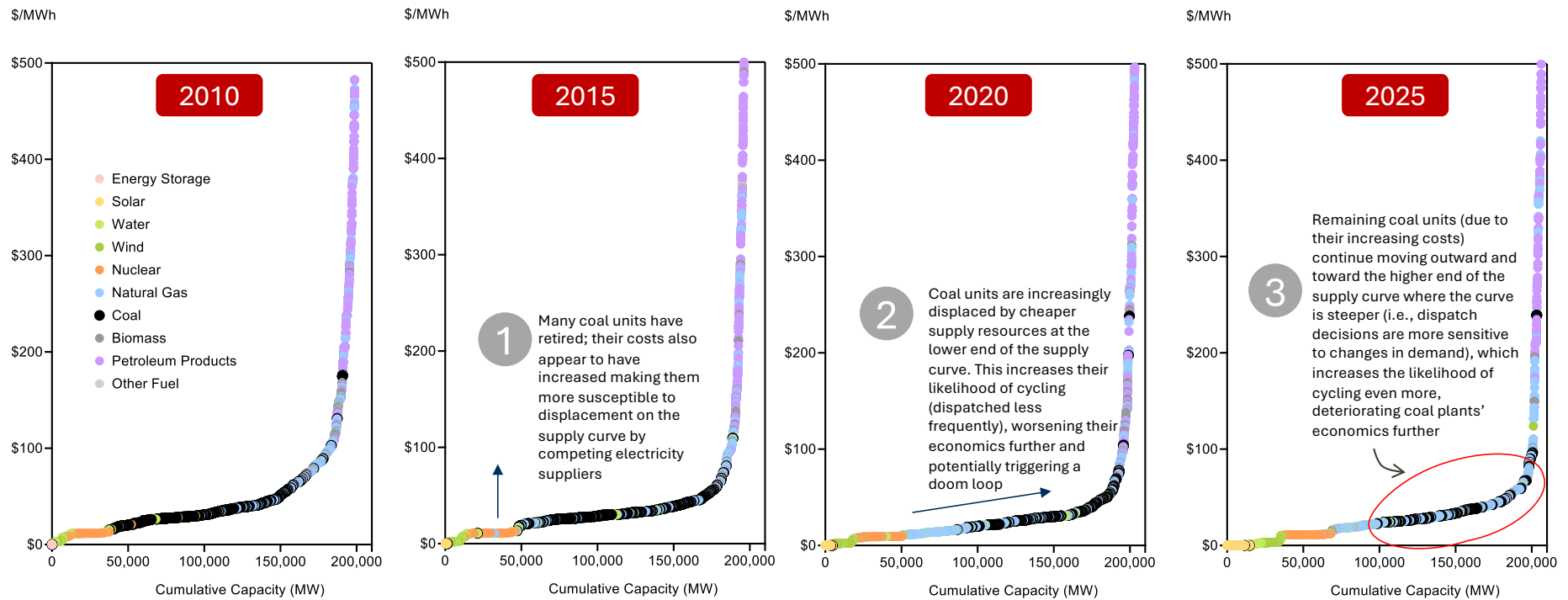


Source: Analysis based on publicly available data from EIA, PJM, Monitoring Analytics (SOM 2024)

1. Plots "PJM Total" LMPs for PJM. Chart shows 99th percentile of hourly LMPs. However, during a very limited number of hours (representing less than 0.5% of the total number of hours during the 2021-25 period) LMPs exceed \$300/MWh. These high LMPs are not likely to meaningfully affect the economics of coal-fired generating units due to the very limited number of hours during which they prevail
2. 2021 through last week of May 2025
3. Reflects avoidable costs on an ongoing basis; includes annualized fixed costs of incremental investments required on an ongoing basis to maintain resource capability to participate in capacity market
4. Assumes a 600 MW coal-fired electric generating unit with heat rate of 9,250 Btu/KWh and capacity factor of 33% based on PJM average for 2024; FOM (ACR) and VOM from Monitoring Analytics 2024 SOM; fuel costs reflect spot commodity prices (translates to ~\$3.39/MMBtu for coal in 2024\$), which may be different from bilateral contracts that individual plants may have in place

Generation Supply Curve Shifts: Coal plants' declining operating characteristics, changing market dynamics, and the availability of lower cost electricity suppliers have created self-reinforcing cycles that have led generation to shift away from coal pushing many plants into retirement

PJM: Generation Supply Curve by Fuel Type



Source: Analysis based on S&P Generation Supply Curve data