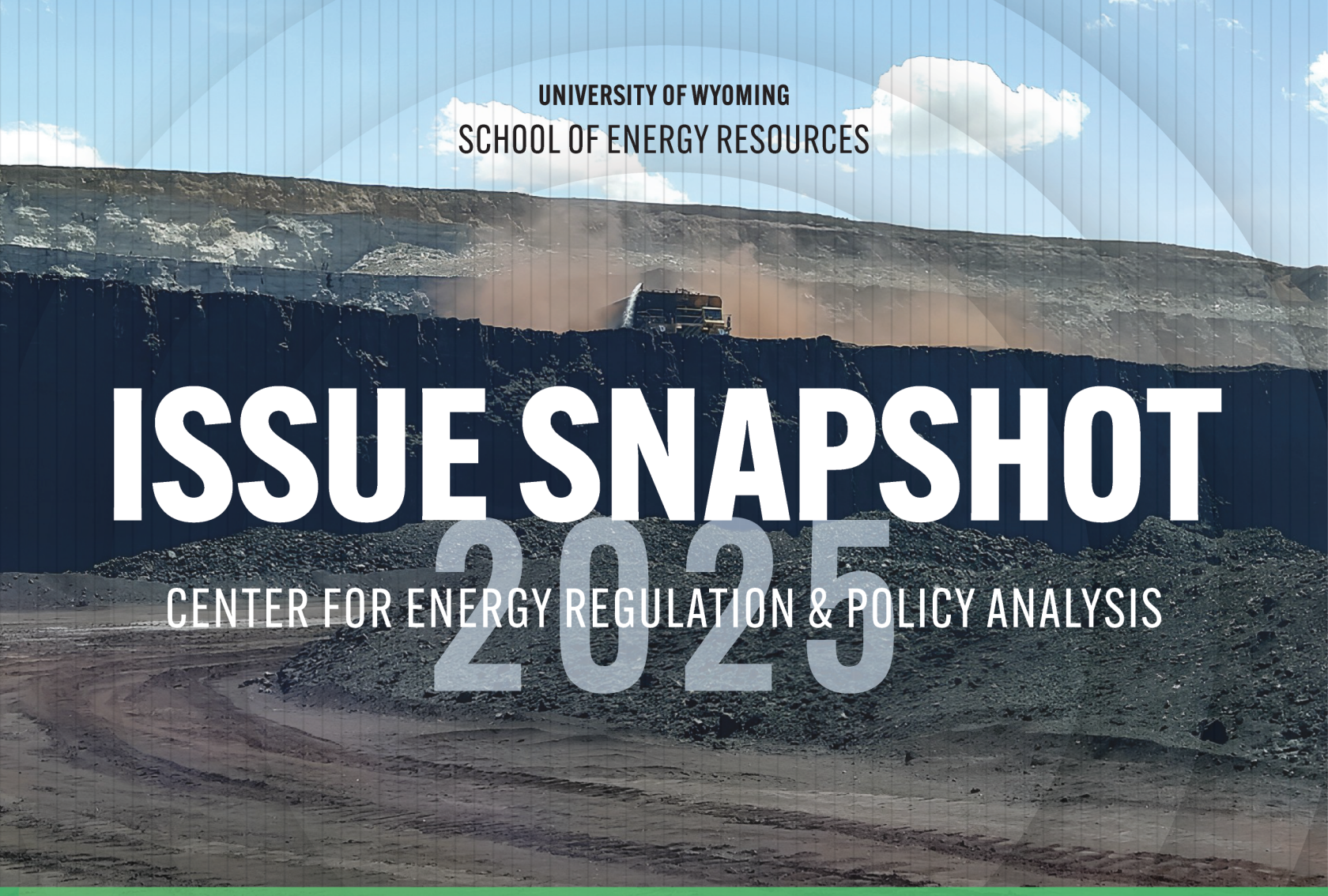

UNIVERSITY OF WYOMING
SCHOOL OF ENERGY RESOURCES

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CENTER FOR ENERGY REGULATION & POLICY ANALYSIS

WYOMING COAL MARKET DYNAMICS

ANALYZING THE DEMAND FOR WYOMING COAL

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ANALYZING THE DECLINE IN DEMAND FOR WYOMING COAL

ISSUE SNAPSHOT

School of Energy Resources
Center for Energy Regulation
& Policy Analysis

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INTRODUCTION

Wyoming has been the leader in U.S. coal production for decades, accounting for most of the country's coal production since 1986 (Wyoming State Geological Survey, 2024). Home to some of the largest coal mines in the world, the Powder River Basin is the primary area of extraction for Wyoming coal, which hosts relatively high-quality, low-sulfur content coal deposits that have historically made Powder River Basin coal desirable to markets in the United States (Wyoming State Geological Survey, 2024). This, coupled with lower prices compared to other U.S.-sourced coal, was an integral part of the early demand for Wyoming coal as environmental considerations became more stringent in U.S. electricity markets. With this, Wyoming coal has primarily been used as fuel for coal-derived electricity generation, with only a small fraction of Wyoming coal being sourced for industrial purposes (U.S. Energy Information Administration, 2024).

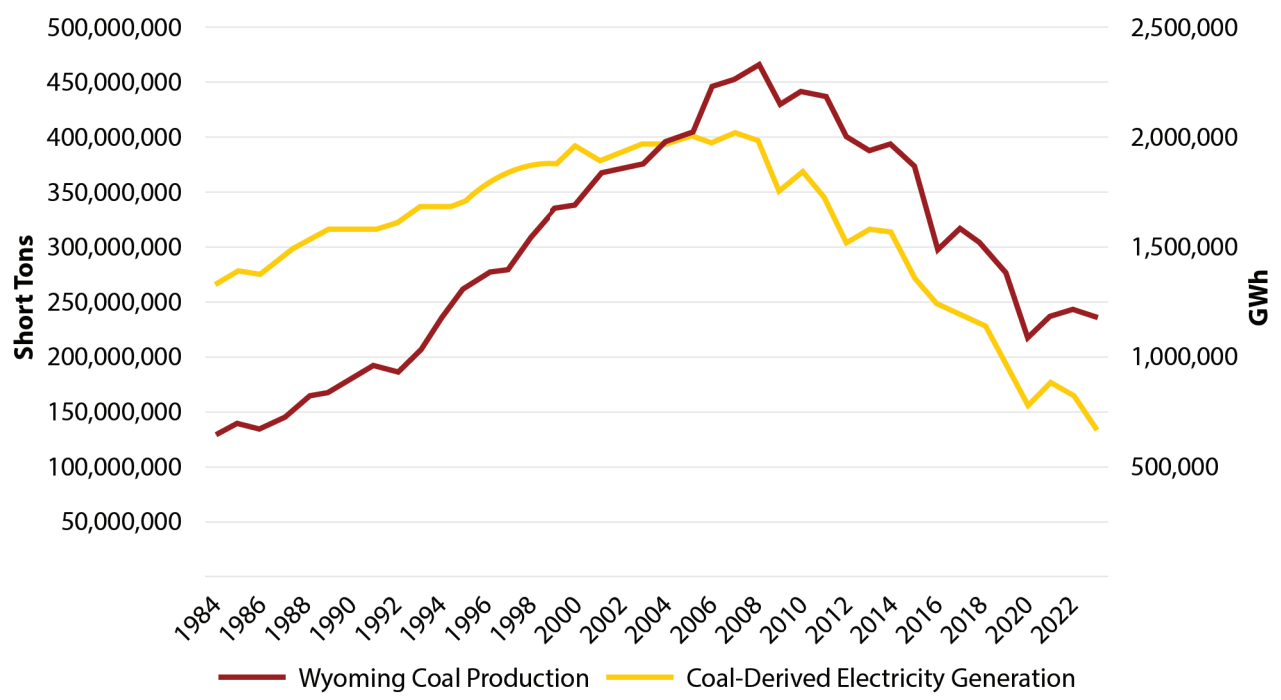
Demand for Wyoming coal continued to grow through the 20th century until its peak production in 2008. Since 2008, Wyoming's annual coal production has been in decline. Despite being the fourth largest consumer on average, Wyoming consumes relatively small amounts of the coal produced in the state with an average of 92.4% of Wyoming coal exported to other states between 2009 and 2023 (U.S. Energy Information Administration, 2024). Because of Wyoming coal's singular use as fuel for electricity generation and the heavy dependence on export markets to fill demand, this paper focuses on the decline in coal-derived electricity generation as a primary catalyst for the decline in Wyoming coal production.

When analyzing the electricity generation portfolios in the top ten states (see Figure 2) where Wyoming coal has historically been exported, a regression analysis was conducted to determine if there was a correlation between each state's imports of Wyoming coal and their coal-derived electricity generation. The results showed that there was a highly significant linear correlation, leading to the conclusion that the demand for Wyoming coal is beholden to state export markets and trends in their coal-derived electricity generation. Further analysis concluded that there has been a substantial shift in the makeup of these states' electricity portfolios, with collective downward trends in coal-derived electricity generation. This shift is likely driven by three main factors: (1) the increasing cost-competitiveness of alternative electricity generating sources, (2) the adoption of emission reduction targets and electricity portfolio standards by states that import Wyoming coal, and (3) the retirement and conversions of coal-derived electricity generation facilities to alternative fuel sources. In the last two decades, many actions have been taken by state, industry, and academic entities such as adopting favorable state policy, legal challenges of federal regulations, research in carbon capture, utilization, and storage (CCUS) technology, and research in alternative uses of coal in an effort to increase the demand for Wyoming coal. However, these efforts require more time to prove effective at market scale.

WYOMING COAL

Between 1984 and 2008, Wyoming coal production saw significant growth, going from less than 150 million tons produced in 1984 to over 450 million tons produced in 2008 as shown in Figure 1 (U.S. Energy Information Administration, 2024). This growth was due to large coal deposits in the Powder River Basin becoming increasingly desirable due to relatively lower prices coupled with lower sulfur content, making Powder River Basin coal a lower emission alternative compared to other U.S. coal sources (Wyoming State Geological Survey, 2024). In 2009, this growth was abruptly halted, with a decline trending rapidly towards pre-1984 levels of production. Though several factors likely contributed to this decline and were explored during the research process of this paper, a deeper understanding of the market dynamics of the Wyoming coal market was needed to determine the main catalyst of this decline.

Figure 1. Wyoming Coal Production and U.S. Coal-Derived Electricity Generation (1984-2023).

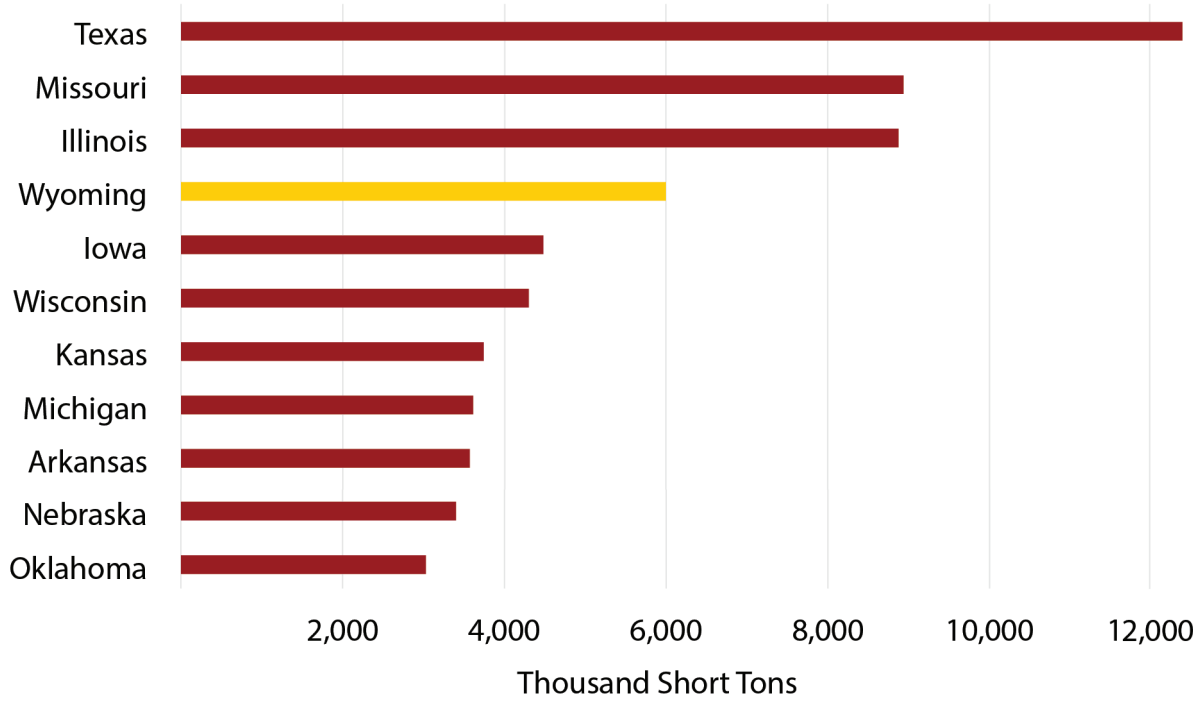


Source: U.S. Energy Information Administration. 2024. Weekly Coal Production; U.S. Energy Information Administration. 2025. Electricity Data Browser.

MARKET DYNAMICS

Wyoming has historically consumed a relatively small amount of coal in both industrial and electricity generation applications compared to the volume it produces. The state consistently consumed less than 10% of the total coal produced in Wyoming during the decline in production between 2009 and 2023, despite generating over 70% of its electricity from coal-derived generation (U.S. Energy Information Administration, 2025). For this reason, this analysis focuses on export markets as demand for Wyoming coal is almost entirely dependent on markets outside the state. The top ten states that import Wyoming coal accounted for an average of 70% of all Wyoming coal exports between 2009 and 2023, making these states critical markets for determining the future demand for Wyoming coal. These markets, as well as the rest of the states that import Wyoming coal, almost exclusively use coal as fuel for electricity generation with relatively small amounts being used for other industrial applications (U.S. Energy Information Administration, 2024).

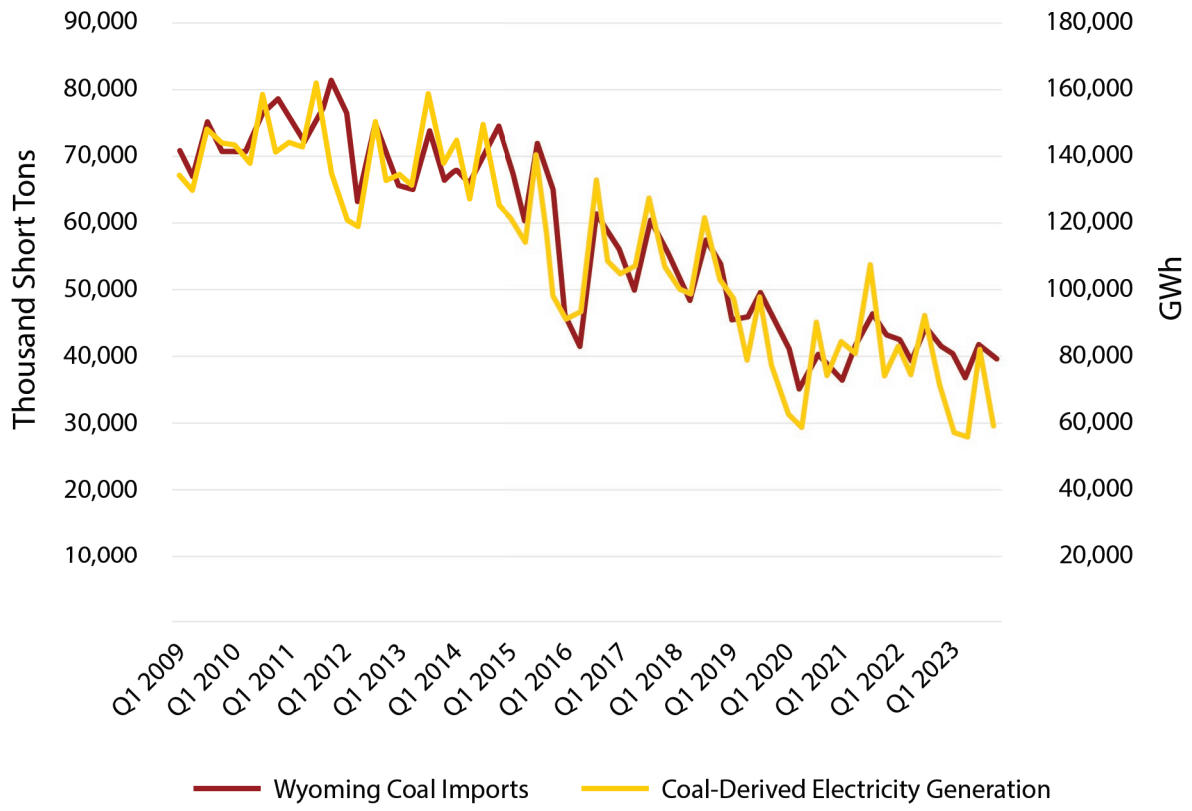
Figure 2. Average Quarterly Exports of Wyoming Coal of Top Ten Importing States plus Wyoming Consumption (2009-2023).



Source: U.S. Energy Information Administration. 2025. Quarterly Coal Distribution Report.

MARKET DYNAMICS

Figure 3. Wyoming Coal Imports and Coal-Derived Electricity Generation of Top Ten Importing States.



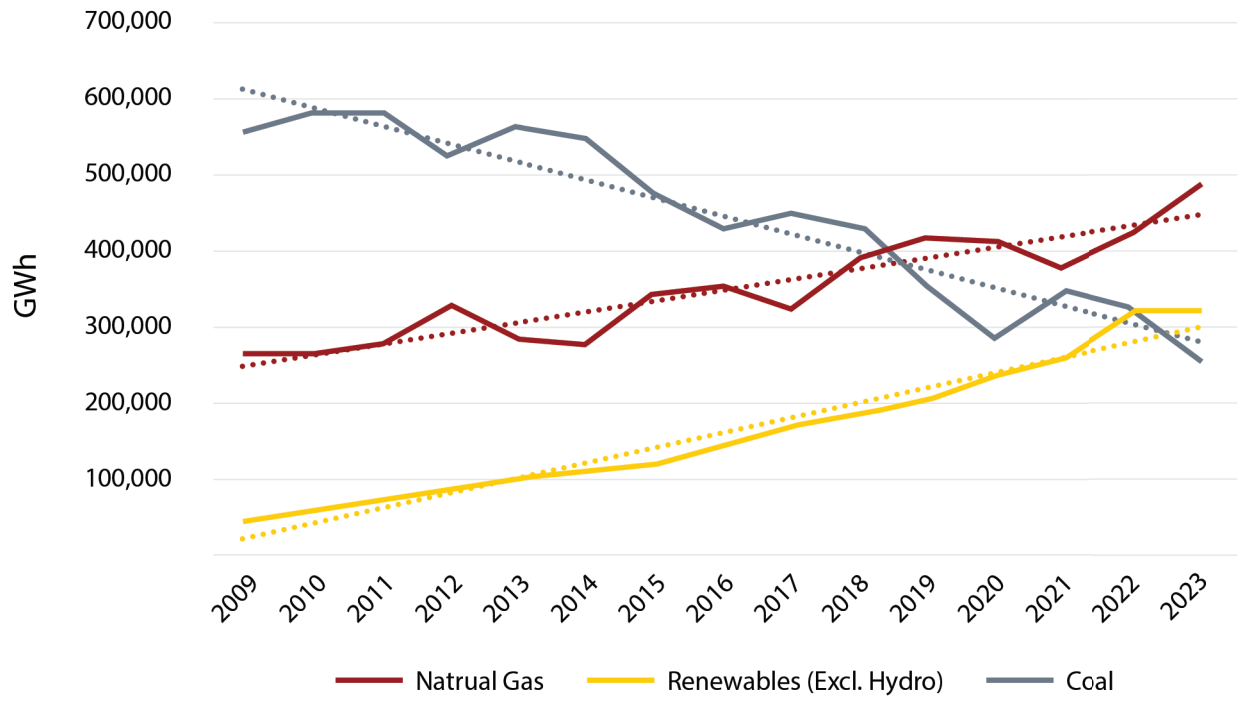
Sources: U.S. Energy Information Administration. 2025. Quarterly Coal Distribution Report; U.S. Energy Information Administration. 2025. Electricity Data Browser.

This analysis was based on the timeframe between 2009 to 2023 as the decline of Wyoming coal production occurred during this period. Although 2023 is the latest year used for this analysis, it should be noted that the decline in Wyoming coal production clearly persists today, providing an opportunity to update this analysis as more data becomes available. Using this timeframe, a regression analysis was conducted to determine if there was a correlation between Wyoming coal exports and coal-derived electricity generation among the top ten Wyoming coal export states. The results of this analysis determined that there was a highly significant linear correlation suggesting that increases in Wyoming coal imports to these states is associated with higher coal-derived electricity generation, with the inverse also being true (see Appendix). This supports the assumption that Wyoming coal demand is beholden to state export markets, and in turn their respective trends in coal-derived electricity generation. Figure 3 depicts the aggregated Wyoming coal exports and coal-derived electricity generation among these states for the same period.

ELECTRICITY GENERATION TRENDS

After determining that coal-derived electricity in states importing Wyoming coal drives demand for Wyoming coal, electricity generation within these states was further analyzed to better understand trends in their respective electricity generation portfolios. Among these ten states, the three major electricity generation sources – natural gas, renewables (excluding hydroelectric), and coal – experienced significant changes in terms of total output from 2009 to 2023. In 2022, both natural gas and renewable-derived electricity generation within these states surpassed coal-derived electricity generation for the first time as depicted in Figure 4. This reaffirms the notion that the states that import Wyoming coal are increasingly shifting away from coal-derived electricity and are choosing to invest in alternative electricity generation sources. Understanding the potential causes of this shift allows for a better understanding of the decline in demand for Wyoming coal.

Figure 4. Electricity Generation Trends of Top Ten Wyoming Coal Export States by Source.

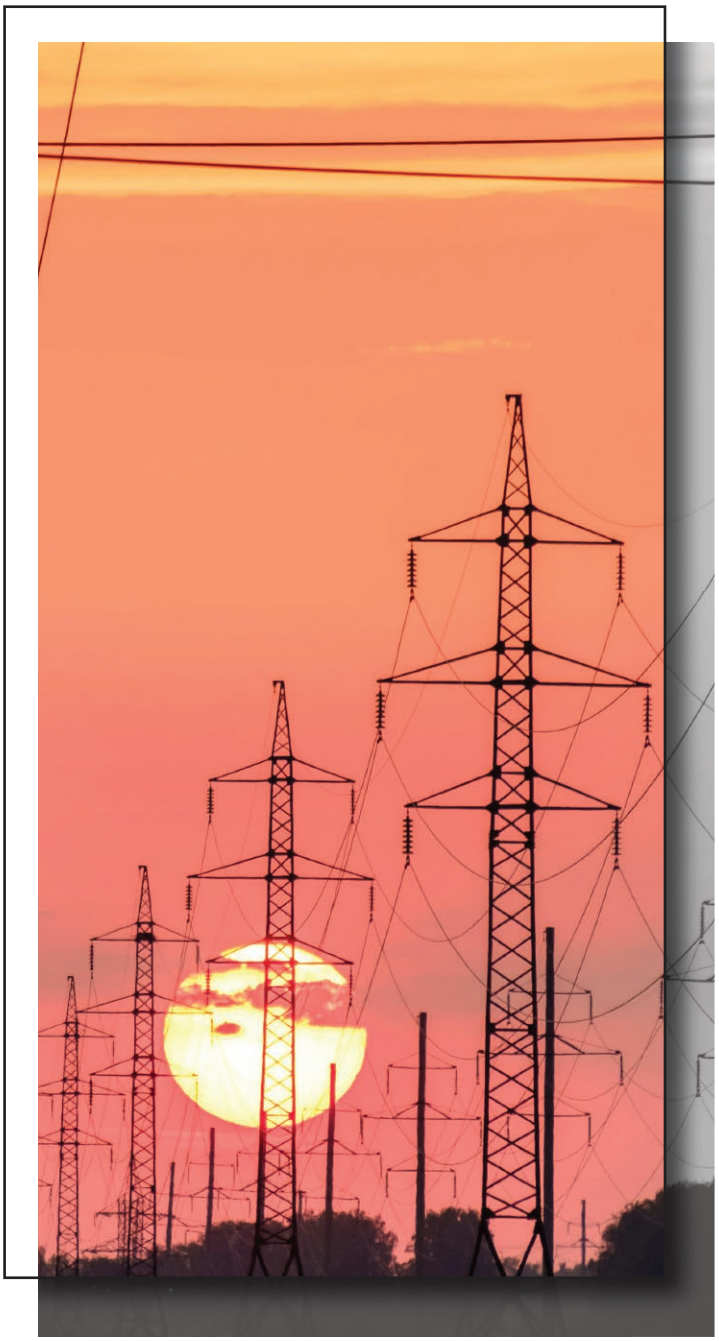


Source: U.S. Energy Information Administration. 2025. Electricity Data Browser.

COST COMPETITIVENESS OF ALTERNATIVE ELECTRICITY SOURCES

Several factors have likely contributed to other forms of electricity generation becoming increasingly cost-competitive with coal-derived electricity generation, including the growth of domestic supply chains, economies of scale with renewable energy development, and government incentives. Understanding the cost on a per megawatt-hour basis for all forms of electricity generation is the best way to compare the cost competitiveness of different electricity sources. Figure 5 shows the 2022 levelized cost of electricity (LCOE) by different technologies. The LCOE is the average cost per megawatt hour of electricity over the lifespan of a power-generating facility, accounting for all the different costs associated with a given project.[1]

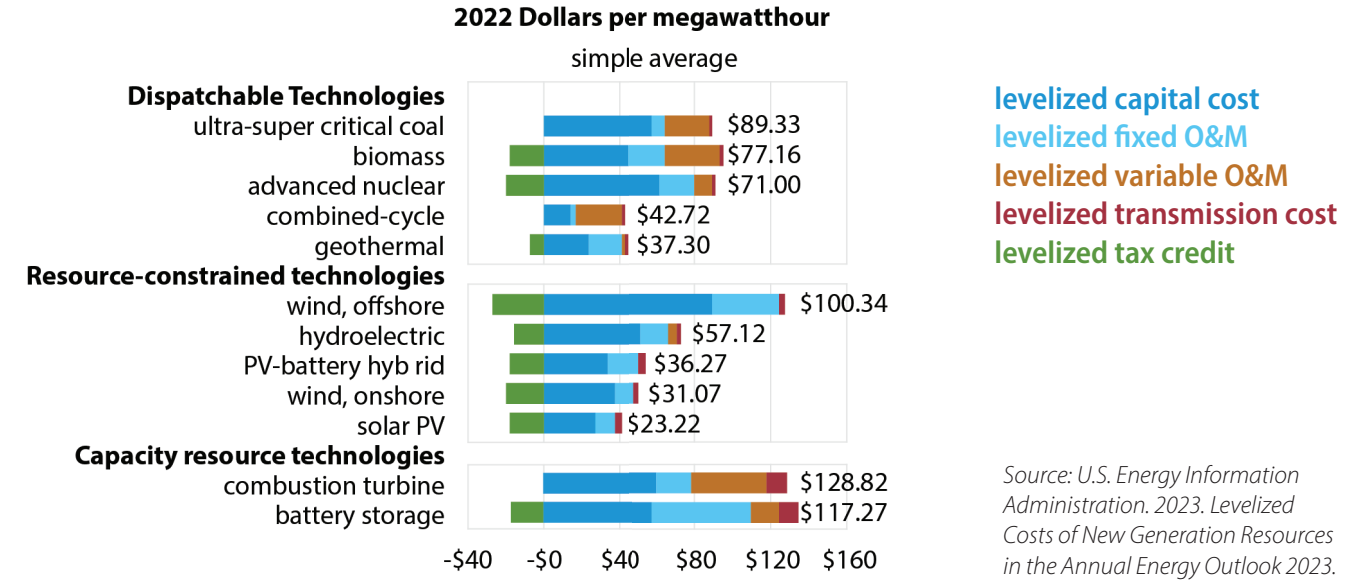
Natural gas is likely the most comparable alternative energy source to coal as it is also considered a baseload, dispatchable source of electricity while renewables are an intermittent, resource-constrained source of electricity, relying on uncontrollable factors such as sunlight and wind. Natural gas-derived electricity generation allows utilities to be more adaptive to the demand of electricity, providing the ability to proactively scale electricity generation up and down when needed. This capability is often associated with a more stable and efficient electricity grid, commonly used in tandem with intermittent energy sources that are less consistent.



[1] Cost competitiveness alone does not ensure a technology meets a specific grid's needs; LCOE enables cost comparisons but does not capture grid-specific requirements necessary to maximize cost efficiency.

COST COMPETITIVENESS OF ALTERNATIVE ELECTRICITY SOURCES

Figure 5. Estimated Levelized Cost of Electricity for New Resources Entering Service in 2028.

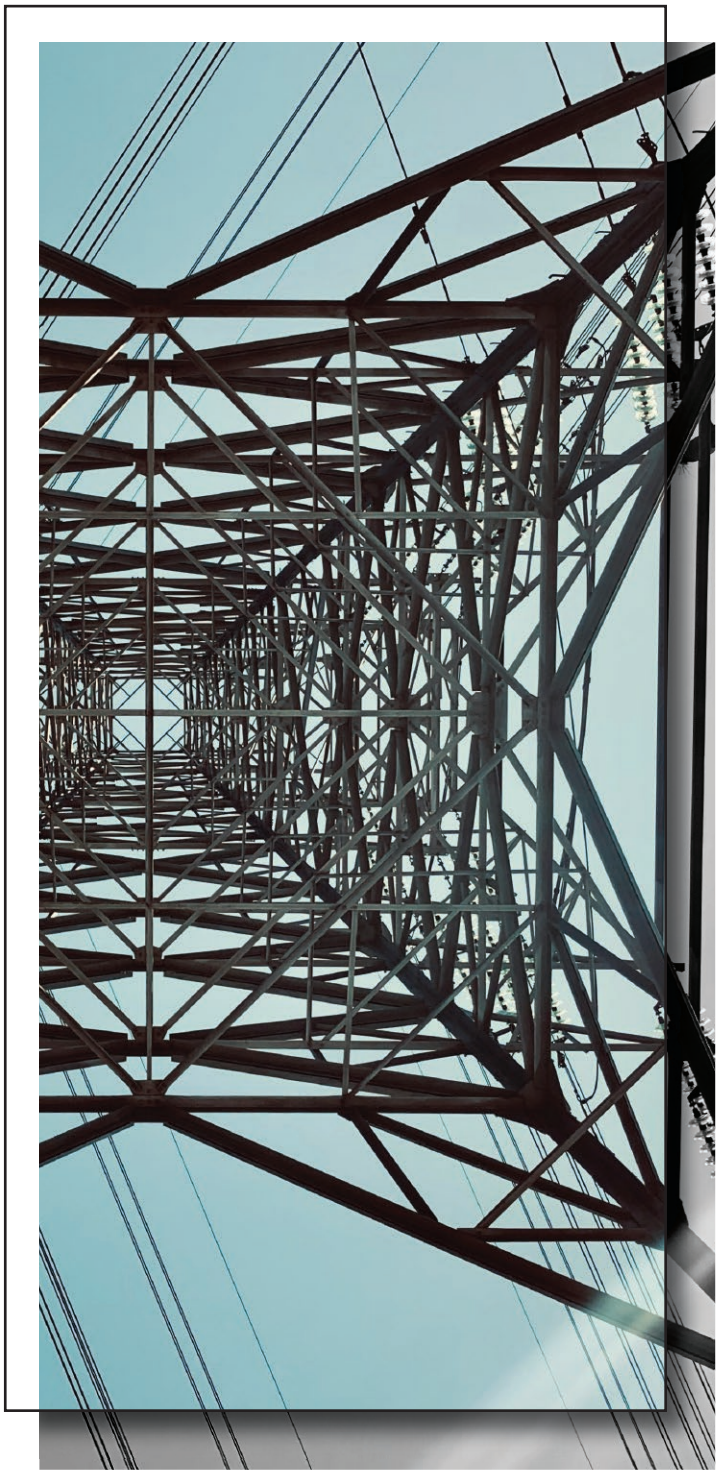


Source: U.S. Energy Information Administration. 2023. Levelized Costs of New Generation Resources in the Annual Energy Outlook 2023.

When comparing the LCOE on a per megawatt hour basis, combined cycle electricity generation (natural gas-derived electricity) is significantly cheaper than ultra-supercritical coal-derived electricity, with the former's simple average LCOE being approximately $43 per megawatt hour and the latter being approximately $89 per megawatt hour (U.S. Energy Information Administration, 2023).[2] When adding renewables such as onshore wind and solar into this same analysis, their simple average LCOE per megawatt hour are approximately $31 and $23 respectively when accounting for tax credits such as the Production Tax Credit (PTC) and the Investment Tax Credit (ITC), making both cost competitive with natural gas and coal-derived electricity generation (U.S. Energy Information Administration, 2023). Even without accounting for tax credits, both sources of renewable energy still retain their cost competitiveness compared to ultra-supercritical coal-derived electricity on a per megawatt-hour basis, as shown in Figure 5. The cost competitiveness of these alternative electricity sources, as well as regulatory requirements for regulated utilities to dispatch the lowest-cost power, will dictate much of the energy investment in the future. This, in turn, may further deepen the divide in electricity generation capacity from these different sources.

[2] Ultra-supercritical coal facilities are not reflective of the existing U.S. coal fleet and may not be the technology of choice for future investment in coal-fired power plants in the U.S.; However, they provide a fair point of comparison. Supercritical and subcritical coal-fired plants would have a similar LCOE, although capital costs would presumably be lower and fuel costs higher.

ADOPTION OF EMISSION REDUCTION TARGETS & ENERGY PORTFOLIO STANDARDS

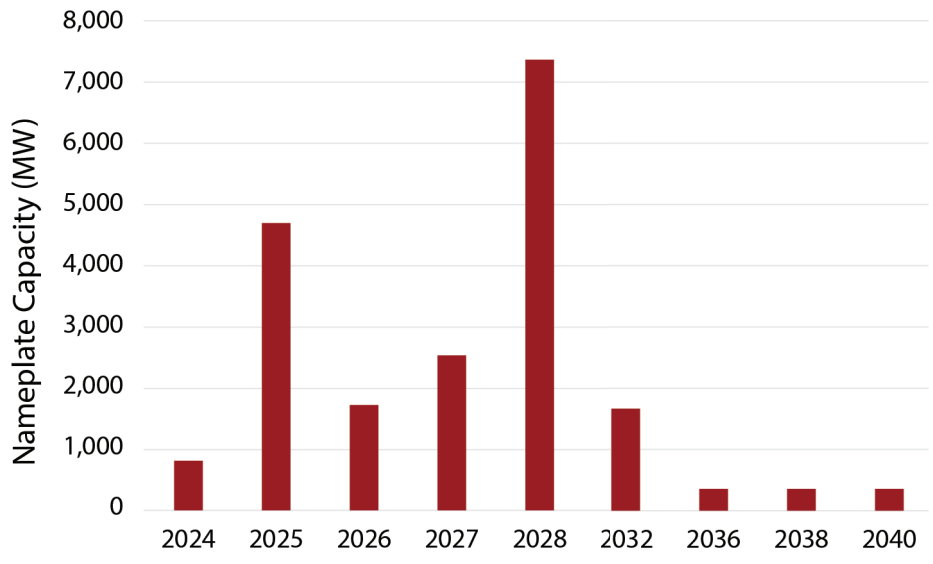


As of 2023, more than half of the states in the United States have adopted some form of energy portfolio standards, dictating the makeup of electricity generation sources within a given state's power sector (Center for Climate and Energy Solutions, 2024). These standards require utilities to derive a particular portion of their electricity from low-emission energy sources such as renewables or natural gas, often having stipulations for the inclusion of carbon capture technologies if future investments in coal-derived electricity are considered. Additionally, many of the same states have adopted emission targets that aim to lower or eliminate greenhouse gas emissions from the power sector. These standards and targets ultimately hinder the ability of utilities within these respective states to further invest in energy sources that do not meet said standards or regulations. This is obviously a challenge for coal-derived electricity generation as it stands today considering it generates higher direct emissions relative to alternative sources of energy. Among the states that have adopted these standards and regulations are several states including Texas, Illinois, and Michigan that are among the top ten importers of Wyoming coal, likely contributing to the trends shown in Figure 4 above (Center for Climate and Energy Solutions, 2024). Beyond this, it is likely that more states will adopt similar standards or regulations if current trends continue, directing more investment away from future coal electricity generation facilities in Wyoming coal export states.

RETIREMENT & CONVERSION OF COAL-DERIVED ELECTRICITY GENERATION FACILITIES

As of 2023, the average age of coal-derived electricity generators in the top ten Wyoming coal importing states was 41 years. These states have planned retirements for 19,878 MW of nameplate capacity by 2040, a majority of which is planned to occur before 2033 as shown in Figure 6 (U.S. Energy Information Administration, 2024). This accounts for 28.1% of total nameplate capacity for coal-derived electricity generation among these states. This aligns with expected retirements nationally and the subsequent decline in coal-derived electricity generation in the next decade if future investments fail to make up for this loss in generation capacity (U.S. Energy Information Administration, 2024). There is hope that the policies of the current federal administration will prolong the lifespan of these coal facilities, but their old age raises concerns about the long-term viability of extending retirement dates. To further this, converting coal-derived electricity generation facilities to use natural gas as fuel has become a common progression in the life cycle of these facilities as natural gas serves as a substitute source of baseload power that has become increasingly cost competitive as discussed above. These factors are a continuation of the historical trends in coal-derived electricity generation already discussed in this paper, likely being a catalyst for further decline in demand for Wyoming coal.

Figure 6. Expected Coal Facility Retirements in Top Ten Importing States.

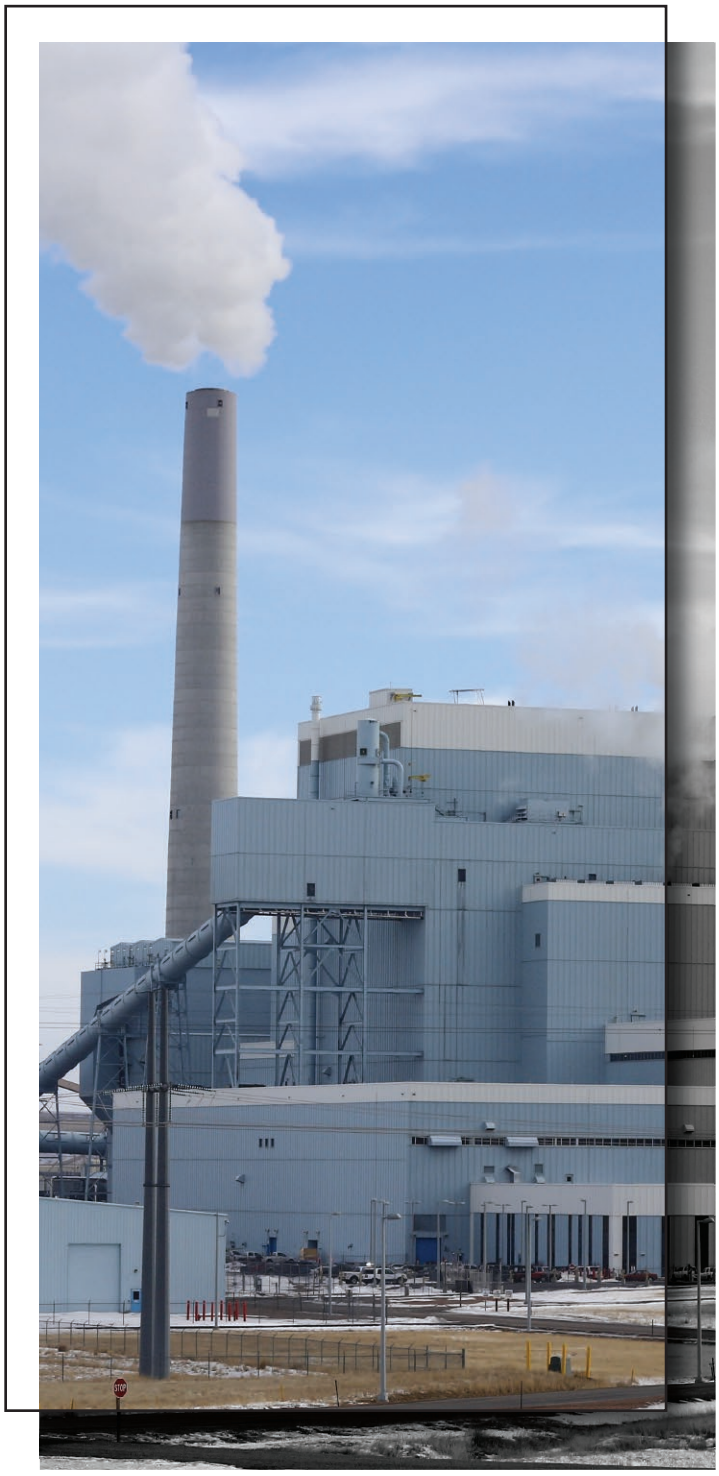


Source: U.S. Energy Information Administration. 2024. Form EIA-860 detailed data with previous form data (EIA-860A/860B).

CONCLUSION

This paper poses that the decline in Wyoming coal production is linked to the downturn in coal-derived electricity generation among its top export states. Regression analysis confirmed this correlation, reaffirming the notion that market forces outside of Wyoming largely dictate the future of Wyoming's coal industry. The shift towards renewables and natural gas as alternative sources of electricity driven by increasing cost-competitiveness and government incentives, the adoption of emission reduction targets and energy portfolio standards, and the retirement and conversion of coal-derived electricity generation facilities, further catalyzed the downward trend in Wyoming coal exports and in turn Wyoming coal production.

Despite ongoing efforts to mitigate the decline of Wyoming coal production – such as the adoption of favorable state policy, legal challenges of federal regulations, investment in carbon capture, utilization, and storage (CCUS), and the research of alternative uses of coal – these measures have yet to prove effective on the forces dictating the energy markets to which Wyoming is beholden. Regardless, it is apparent that adoption of these efforts by external markets is crucial for the long-term viability of Wyoming coal. Wyoming's dependence on these external markets, coupled with its limited ability to increase in-state coal consumption, underscores the challenges the Wyoming coal industry faces. As new regulations, market dynamics, and energy investments shape the future of Wyoming coal, the School of Energy Resources will continue to analyze these trends in order to provide technological and policy-based solutions to this complex and critical issue.



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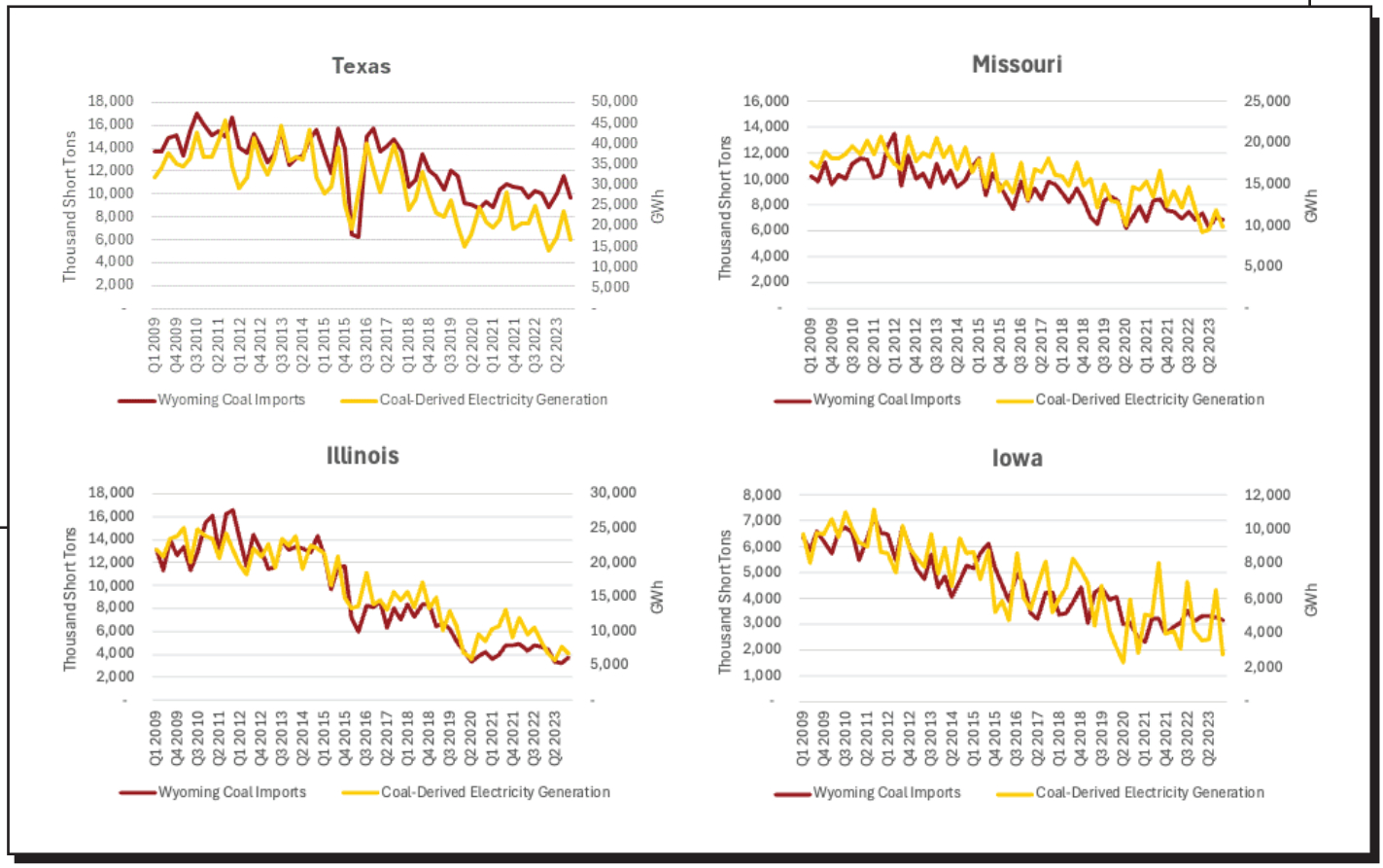
APPENDIX

METHODOLOGY AND SUPPORTING GRAPHS

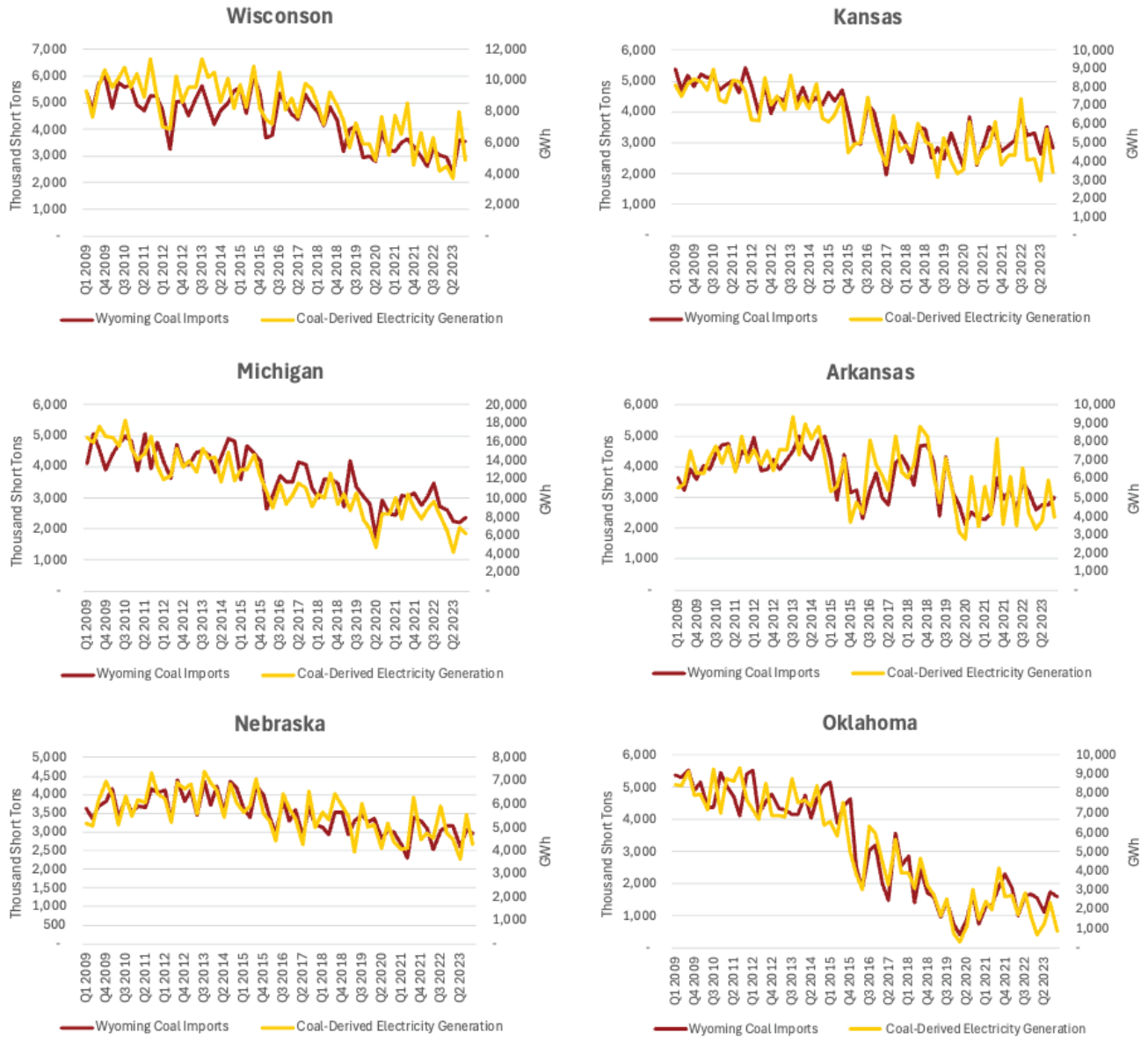
The basis of this paper consisted of an analysis looking to uncover underlying market dynamics that have led to the decline in demand for Wyoming coal. The outcome was a regression analysis that led to the confirmation of a significant linear correlation between states that import Wyoming coal and their respective trends in coal-derived electricity generation. Specifically, this analysis focused on the top ten Wyoming coal importing states and their coal-derived electricity generation trends. Figure A1 shows each state's coal-derived electricity generation and imports of Wyoming coal between 2009 and 2023, highlighting the noticeable similarities that led to the focus on these two factors.

Figure A1. Top Ten Wyoming Coal Importing States – Wyoming Coal Imports and Coal-Derived Electricity Generation.



APPENDIX

Figure A1. Top Ten Wyoming Coal Importing States – Wyoming Coal Imports and Coal-Derived Electricity Generation.

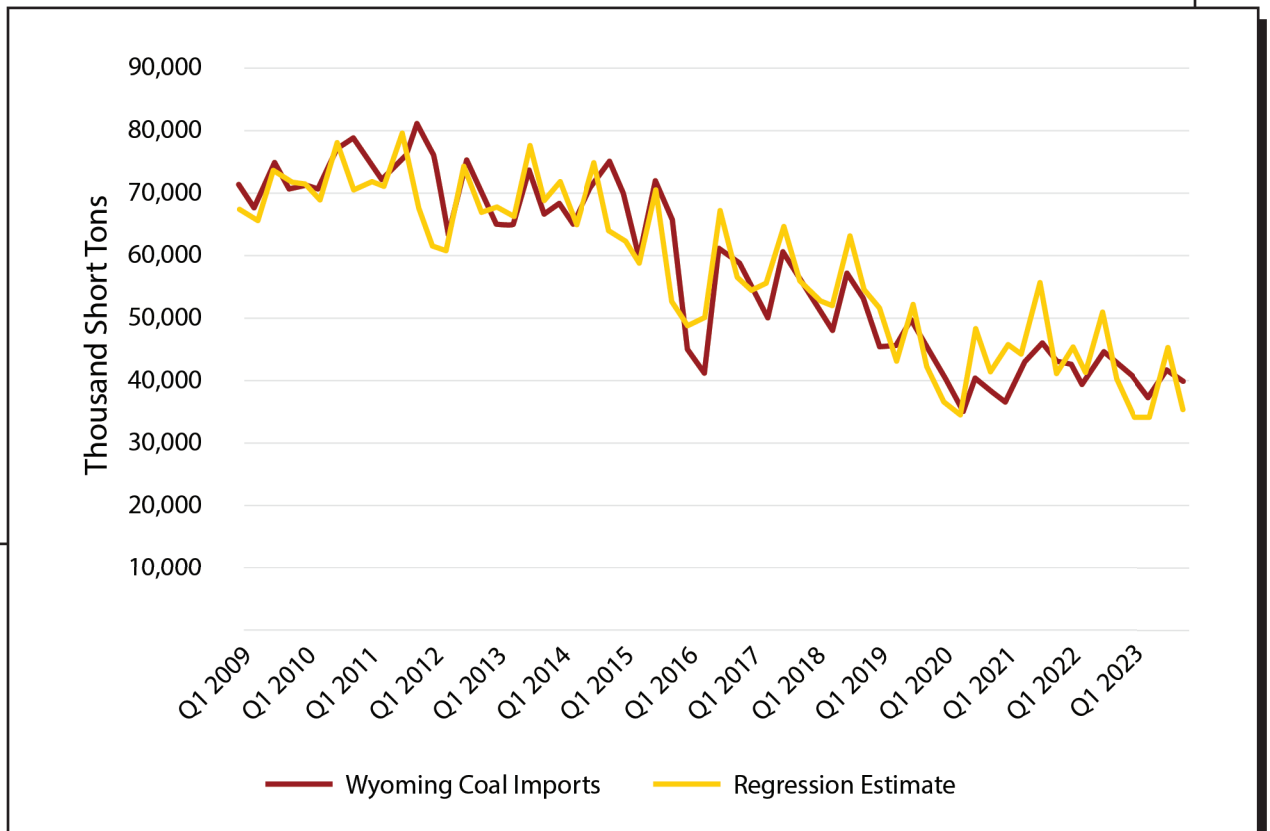


Sources: U.S. Energy Information Administration. 2025. Quarterly Coal Distribution Report; U.S. Energy Information Administration. 2025. Electricity Data Browser.

APPENDIX

The regression analysis that was conducted took the total Wyoming coal imports and coal-derived electricity generation of the top ten Wyoming coal importing states, giving an aggregated approach to determine the significance of the correlation between the two factors. The outcome of the regression analysis concluded that there was a significant linear correlation, $b = 0.43$, $p < .001$, $R2 = .85$, between Wyoming coal imports and coal-derived electricity generation among the top ten Wyoming coal importing states. Figure A2 shows the actual Wyoming coal imports to the top ten Wyoming coal importing states and the Wyoming coal imports estimated using the equation derived from the regression analysis.

Figure A2. Actual Wyoming Coal Imports to Top Ten Wyoming Coal Importing States and Regression-Estimated Wyoming Coal Imports.



Source: U.S. Energy Information Administration. 2025. Quarterly Coal Distribution Report.

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