

United States Energy Association

## Coal in the Northeastern United States: Legacy Infrastructure, Grid Reliability, and Emerging Industrial Pathways

### OVERVIEW

Coal fueled the industrial revolution of the Northeastern United States. From the anthracite fields of Pennsylvania to the steel mills and rail corridors of the Mid-Atlantic, coal powered heavy manufacturing, transportation networks, urban electrification, and residential heating for more than a century. It enabled the concentration of industrial capacity that defined the region's economic leadership from the late nineteenth through the mid-twentieth centuries. Although coal's share of regional electricity generation has evolved over the past two decades in response to market dynamics, fuel competition, and policy developments, its structural legacy remains a foundational asset that continues to support grid reliability, fuel security, and industrial resilience. Significant reserves remain in the Appalachian Basin, metallurgical coal production continues to support domestic and export steel markets, and existing coal-fired generation retains reliability value. Coal and coal byproducts are increasingly evaluated as feedstocks for critical minerals recovery and advanced carbon materials, aligning the resource with national supply chain and industrial priorities. This article provides a comprehensive overview of coal's historical development in the Northeast, assesses its current production and generation footprint, evaluates its role in reliability planning, and examines emerging non-combustion pathways that may shape coal's strategic relevance in the decades ahead.

### HISTORICAL CONTEXT: COAL AND THE INDUSTRIAL NORTHEAST

Coal development in the Northeastern United States was anchored in the anthracite fields of northeastern Pennsylvania, one of the most geologically distinctive and economically consequential coal regions in the world. Anthracite (characterized by high fixed carbon content, low volatile matter, and high energy density) was uniquely suited for 19th-century industrial applications, including boilers, rail locomotives, iron furnaces, and urban heating (U.S. Geological Survey). Commercial anthracite mining began in the early 19th century, accelerating rapidly after transportation infrastructure (particularly canals and railroads) enabled delivery to major urban markets. By the mid-to-late 1800s, Pennsylvania's coal fields had become a central driver of American industrialization.

Coal from the Appalachian Basin fueled:

- Iron and steel production in Pennsylvania and Ohio
- Railroad expansion throughout the Eastern Seaboard
- Heavy manufacturing in New York, New Jersey, and New England
- Residential and commercial heating in major cities including Boston, New York City, and Philadelphia

By the early 20th century, Pennsylvania was the leading coal-producing state in the nation (USGS historical mineral statistics). Anthracite and bituminous coal (a softer, more abundant coal with higher volatile content, widely used in power generation and steelmaking) together underpinned the rise of American heavy industry, naval production, rail transport, and electrification. Coal's dominance persisted into the mid-20th century, particularly in industrial and power generation applications. However, structural changes began after World War II. Oil and natural gas displaced coal in residential heating markets, nuclear power expanded beginning in the 1960s, and environmental regulation in the 1970s reshaped fuel economics. Beginning in the 2010s, competition from low-cost shale gas and the rapid

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expansion of wind and solar generation led to coal’s decline in electricity markets (EIA Annual Coal Report 2024; EIA Electric Power Monthly 2025).

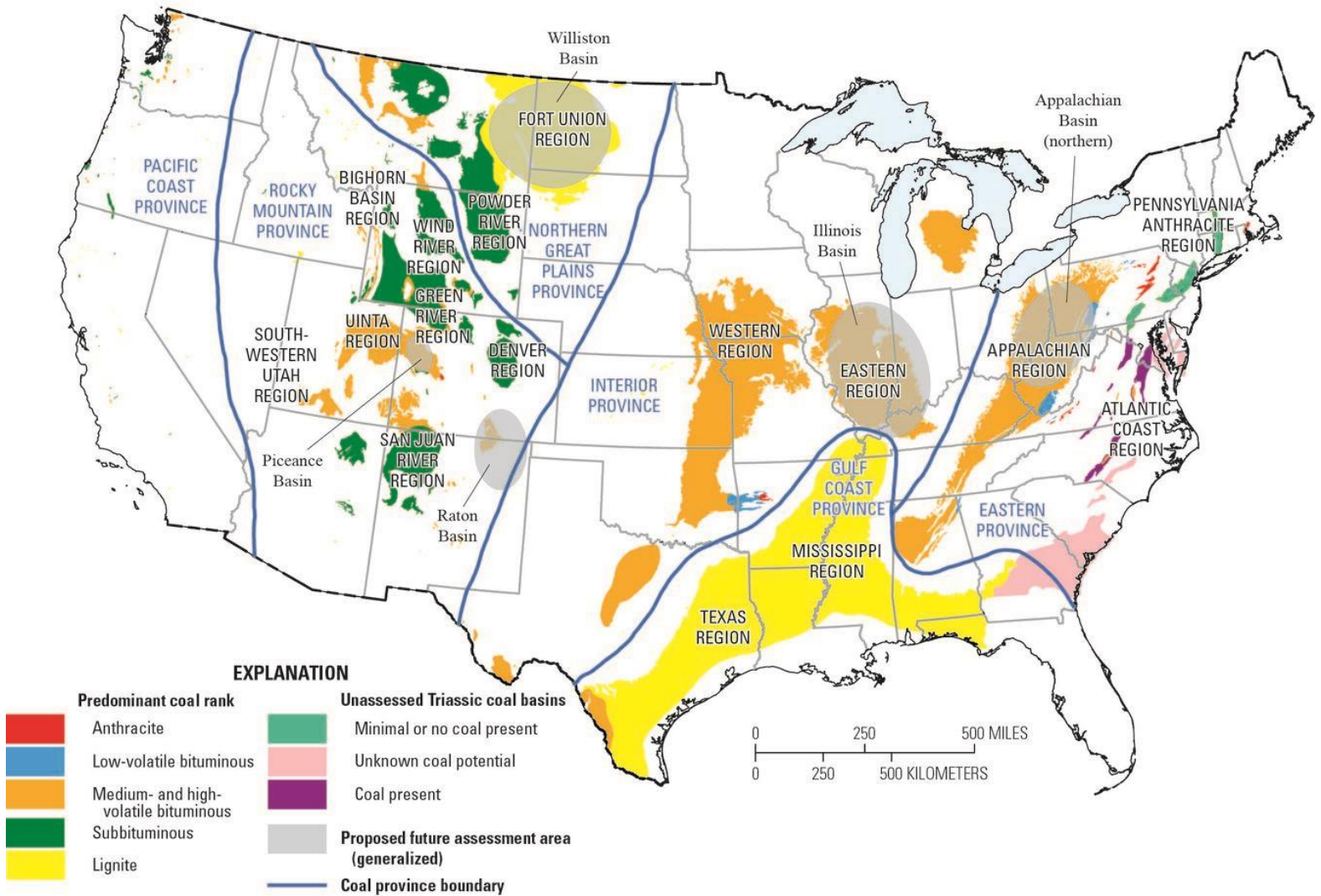
Phase	Period	Defining Characteristics	Policy / Market Drivers	Strategic Significance
<b>Early Commercial Development</b>	Early 1800s-1860	Initial anthracite extraction in northeastern Pennsylvania; canal and early rail transport enabled distribution to urban markets	Infrastructure expansion (canals, railroads); early industrial demand	Established coal as primary fuel for urban heating and emerging industry
<b>Industrial Expansion &amp; National Dominance</b>	1870s-1920s	Rapid growth of anthracite and bituminous production; coal powers steel, railroads, manufacturing	Industrialization; urban population growth; steel and railroad expansion	Pennsylvania becomes leading coal-producing state
<b>Electrification &amp; Wartime Production</b>	1930s-1945	Coal central to electricity generation and wartime industrial output	New Deal electrification programs; World War II industrial mobilization	Coal underpins military manufacturing and national electrification
<b>Postwar Peak &amp; Beginning of Diversification</b>	1946-1970s	High coal production; growth of coal-fired power plants; beginning displacement in residential heating	Oil and natural gas expansion; nuclear power development	Coal remains dominant in power sector but loses residential heating market
<b>Environmental Regulation &amp; Structural Adjustment</b>	1970s-1990s	Clean Air Act implementation; scrubber installations; productivity gains; mechanization	Federal environmental regulation; productivity improvements	Coal adapts technologically but faces compliance cost pressures
<b>Natural Gas Competition &amp; Market Restructuring</b>	2000-2015	Rapid expansion of shale gas; decline in coal generation share; electricity market deregulation (PJM, ISO-NE, NYISO)	Shale revolution; competitive wholesale markets	Significant coal plant retirements in Northeast
<b>Accelerated Retirements &amp; Policy Shifts</b>	2015-2023	Continued coal capacity retirements; state-level decarbonization policies; offshore wind development	State climate mandates; renewable portfolio standards; low gas prices	Coal’s regional generation footprint contracts substantially
<b>Reliability &amp; Industrial Repositioning</b>	2024-February 2026	Winter fuel security concerns; emphasis on baseload generation; federal support for domestic energy security and critical minerals research	NERC Winter Reliability Assessments (2024–2025); DOE programs on coal fleet optimization, critical minerals, and carbon materials; recent White House energy security directives emphasizing domestic coal.	In February 2026, the White House issued energy security directives emphasizing preservation of baseload generation capacity, support for domestic fuel production, and streamlined regulatory review for critical energy infrastructure

## CURRENT STATUS: COAL IN THE U.S. AND THE NORTHEAST

### NATIONAL COAL TRENDS

Although coal’s share of U.S. electricity generation has declined over the past decade as generation portfolios diversified, coal remains a core component of the nation’s fuel-secure power infrastructure. It continues to provide a substantial share of firm generating capacity and serves as a critical industrial input, particularly in steel manufacturing and export markets. Significant recoverable reserves remain concentrated in the Appalachian Basin (U.S. Geological Survey), and metallurgical coal production continues to support both domestic blast furnace steel operations and international trade flows (EIA Coal Data Browser 2024).

**Coal fields of the conterminous United States—National Coal Resource Assessment updated version**



**Image Source:** U.S. Geological Survey, "Coal Fields of the Conterminous United States," U.S. Department of the Interior

EPA announced on February 20, 2026 that it would revisit and ease recently tightened Mercury and Air Toxics Standards (MATS) requirements for coal-fired power plants. The agency framed the move as part of a broader effort to preserve generation and mitigate reliability and energy supply risks in regions facing tightening reserve margins. The decision signals a shift in the federal compliance landscape for coal operators, potentially affecting near-term operating costs, retrofit decisions, and retirement timelines. This action represents a material policy development in the 2025-2026 regulatory environment and warrants consideration in any forward-looking

assessment of the U.S. coal fleet. At the same time, federal research initiatives led by the U.S. Department of Energy's Hydrocarbons and Geothermal Energy Office, Office of Coal, are expanding the scope of coal-related innovation. Ongoing programs address critical mineral recovery from coal and coal byproducts, coal fleet optimization, and development of advanced carbon materials. These initiatives reflect a broader federal emphasis on using domestic resources as well as supply-chain security.

On February 11, 2026, the Presidential Executive Order 14240: "*Strengthening United States National Defense with America's Beautiful Clean Coal Power Generation Fleet*" highlighted coal-fired generation as a national security and reliability asset and directed federal procurement measures supporting coal-based electricity for critical facilities. The directive emphasizes coal's role as a domestically abundant resource capable of supporting grid reliability, industrial supply chains, and strategic materials development. In this policy context, coal is framed not solely as a legacy generation fuel, but as a component of broader domestic energy security and manufacturing objectives.

Coal's national trajectory is therefore best characterized as structural transition. While its share of bulk electricity generation has narrowed, coal continues to contribute in three principal areas: baseload generation capacity, metallurgical supply chains, and emerging non-combustion material applications.

According to the U.S. Energy Information Administration (EIA), *Annual Coal Report 2024*:

- **U.S. coal production (2024):** approximately 512.5 million short tons
- **U.S. coal consumption (2024):** approximately 410.9 million short tons
- **U.S. coal exports:** approximately 95-100 million short tons
- **Electric power sector share of coal consumption:** approximately 87.6%
- **Coal share of total U.S. electricity generation (2024):** approximately 15%  
(EIA Electric Power Monthly 2025)

Although total coal-fired generating capacity has declined by more than 40% since 2010 (EIA Preliminary Monthly Electric Generator Inventory 2025), coal remains one of the largest sources of on-demand capacity in the United States. Its defining operational characteristic (on-site fuel storage measured in weeks or months) distinguishes coal from generation resources that rely on continuous fuel delivery through pipeline or real-time market supply chains.

## RELIABILITY IN A WINTER-PEAKING REGION

The Northeastern United States is a winter-peaking power market, with system stress occurring during prolonged cold events rather than summer heat waves. Extreme cold drives lead to increases in electricity demand while simultaneously increasing natural gas consumption for residential and commercial heating. In periods of sustained cold, pipeline constraints can limit fuel deliverability for power generation. The North American Electric Reliability Corporation (NERC) has repeatedly identified winter fuel assurance considerations in ISO New England and portions of the Northeast (NERC Winter Reliability Assessment 2024–2025; Long-Term Reliability Assessment). During these conditions, generation resources with on-site fuel storage provide additional operational flexibility.

Coal-fired generation offers distinct reliability attributes in this context:

- On-site fuel inventories that reduce exposure to real-time pipeline constraints
- Independence from just-in-time gas delivery systems
- Firm capacity during multi-day cold events

EIA data indicate that coal plants maintain substantially larger on-site fuel inventories than gas-fired facilities (EIA Electric Power Monthly). This storage capability provides a resilience buffer during extreme weather and temporary supply disruptions. As electrification expands and offshore wind integration increases, maintaining adequate capacity remains central to regional reliability planning, with coal's contribution defined by fuel security and operational durability during winter system stress.

## AI, DATA CENTERS, AND LOAD GROWTH

In addition to winter peak stress, the Northeast is experiencing structural load growth associated with data centers, artificial intelligence infrastructure, advanced manufacturing, and electrification of transportation and building heating. Federal energy security discussions in 2025-2026 have increasingly linked generation adequacy to the power demands of AI and digital infrastructure. As data processing, cloud computing, and industrial electrification expand, maintaining reliable generation resources becomes a central planning consideration for regional grid operators.

## PATHWAYS TO STABILIZE AND OPTIMIZE THE COAL INDUSTRY IN THE NORTHEAST

Sustaining coal's economic and strategic relevance in the Northeastern United States requires a focused approach centered on stabilization, modernization, and industrial diversification. Stakeholders are concentrating on optimizing existing assets, strengthening reliability contributions, and expanding higher-value industrial applications. Recent federal energy and industrial policy signals emphasize preserving generation capacity, maintaining domestic energy security, supporting manufacturing competitiveness, and leveraging existing infrastructure. In 2024, Pennsylvania produced approximately 61.6 million short tons of coal, ranking among the top coal-producing states in the nation (EIA Coal Data Browser 2024). In this framework, coal assets in the Northeast, particularly in Pennsylvania, are viewed not as legacy remnants, but as components of a broader industrial ecosystem that includes steel production, materials processing, and emerging critical mineral supply chains.

### Modernization of Existing Coal Infrastructure

In the Northeast, remaining coal-fired facilities operate in competitive wholesale markets (PJM, ISO New England, NYISO), where operational efficiency, flexibility, and reliability performance are critical. Targeted modernization measures can enhance the performance of existing plants while aligning with evolving system requirements.

Key modernization pathways include:

- **Flexible operation and improved ramping capability**, enabling coal units to complement variable renewable generation while maintaining reliability during winter peak demand and prolonged cold events.
- **Digital optimization and advanced controls**, including predictive maintenance systems, data analytics, and heat-rate improvement technologies to reduce forced outages and improve cost performance.
- **Selective emissions-control upgrades and plant efficiency improvements**, preserving operational optionality for potential future carbon utilization technologies supported by DOE research programs.

These measures are consistent with federal priorities emphasizing baseload capacity preservation and infrastructure resilience. In a winter-peaking region subject to fuel assurance constraints, modernization can extend the operational value of existing assets.

## Industrial Integration and Asset Repositioning

Beyond electricity generation, stabilization in the Northeast involves integrating coal-related infrastructure into broader industrial value chains. Existing rail, river, and port networks can continue to support metallurgical coal exports and domestic steel production, while legacy power plant sites offer opportunities for repurposing into materials processing, advanced manufacturing, or critical mineral recovery facilities. U.S. metallurgical coal remains a globally traded commodity, reinforcing Pennsylvania's role in international steel supply chains. In addition, coal byproducts production can align with initiatives such as rare earth element extraction and carbon-based materials development. Together, these strategies enable coal-related assets to remain economically productive while reinforcing regional manufacturing.

## BEYOND POWER: INDUSTRIAL AND STRATEGIC PATHWAYS

In Pennsylvania and the broader Appalachian Basin, coal remains embedded in critical industrial value chains and emerging materials research. Metallurgical coal production, rare earth element recovery from coal-related materials, and development of advanced carbon products illustrate how coal assets are being repositioned within national manufacturing, supply-chain security, and industrial resilience strategies. Furthermore, Federal incentives for carbon capture and utilization technologies, including enhanced 45Q tax credits, may influence long-term operational decisions for select coal assets.

## STRATEGIC GROWTH PATHWAYS: POLICY AND MARKET CONSIDERATIONS

The future trajectory of coal and coal-related assets in the Northeastern United States will depend on policy alignment, market integration, and asset optimization. In competitive wholesale electricity markets such as PJM, ISO New England, and NYISO, coal's economic viability is shaped by capacity market structures, reliability requirements, and fuel security considerations. Ongoing discussions in PJM regarding capacity market reforms and resource adequacy timelines further underscore the importance of maintaining sufficient baseload capacity.

Growth opportunities in the Northeast are most likely to emerge through targeted actions that convert existing infrastructure, technical capabilities, and material resources into higher-value industrial applications:

- **Federal and state-supported demonstration initiatives** are critical to advancing critical mineral recovery and advanced carbon technologies from pilot-scale research toward early commercial deployment. In the Appalachian Basin, DOE-supported programs evaluating rare earth extraction from coal refuse and legacy ash materials can reduce technological risk and attract private capital.
- **Public-private partnerships** can accelerate commercialization by linking coal-derived materials with the Northeast's manufacturing base. The region's concentration of steel producers, advanced manufacturing firms, research universities, and national laboratories creates opportunities to integrate coal-based feedstocks into established industrial supply chains.
- **Market and regulatory clarity** remains essential in competitive electricity markets and materials sectors alike. Transparent capacity market signals, predictable environmental compliance standards, and consistent permitting frameworks for coal combustion byproduct reuse can lower investment uncertainty while preserving reliability and environmental safeguards.
- **Workforce alignment and industrial continuity strategies** can connect coal-sector expertise (mining operations, materials handling, mechanical systems, and process control) to adjacent sectors such as metallurgical processing, critical minerals separation, and advanced materials fabrication. This approach supports regional economic stability while reinforcing domestic manufacturing capabilities.

Together, these measures position coal in the Northeastern United States as a strategically integrated industrial resource. By focusing on reliability support, metallurgical production, and value-added material pathways, the region can preserve economic value, strengthen supply-chain security, and maintain grid resilience without relying on large new coal power builds.

## CONCLUSION

Coal in the Northeastern United States continues to serve as a critical, reliability-focused resource in the power system, supporting grid stability and fuel diversity. Its role in supporting winter reliability, metallurgical steel production, and emerging critical mineral and advanced carbon value chains remains significant. In a region facing winter fuel constraints, growing AI-driven data center demand, industrial reshoring, and broader electrification, baseload capacity continues to carry system value beyond simple generation share. Recent federal energy security directives reinforce the importance of domestic resource utilization, infrastructure resilience, and supply-chain strength. In this evolving framework, coal's future in the Northeast is defined not by expansion of past generation levels, but by disciplined stabilization, modernization of existing assets, and integration into advanced manufacturing and strategic materials ecosystems. The region's reserves, infrastructure, and workforce position coal as a consequential component of a diversified and reliability-focused energy system.

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