



U.S. ELECTRICITY MARKETS INCREASINGLY FAVOR ALTERNATIVES TO COAL

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ABOUT THE AUTHOR

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The U.S. electric power system is gradually shifting toward cleaner forms of generation. One sign of this transition is the declining use of coal for electric power production.

In 2011, use of coal for U.S. power generation dropped to its lowest level in more than a decade, according to the federal government's independent U.S. Energy Information Administration (EIA). In fact, the EIA reported¹ earlier in 2012 that coal's share of total U.S. electric power generation dropped below 40% for the last two months of 2011, the lowest level since 1978.

To understand the cause of this decline, it is important to examine contributing market forces. Doing so provides important context for recent coal plant retirement announcements, particularly given that some companies have attributed retirements to EPA rules that are still years away from going into force. For example, FirstEnergy Corp. announced in late January 2012² that it would retire several of its smaller coal-fired power plants, explaining that the decision was "based on the U.S. Environmental Protection Agency Mercury and Air Toxics Standards (MATS), which were recently finalized, and other environmental regulations." FirstEnergy, however, had previously cited a range of reasons³ for its decision to reduce operations at many of its smaller coal plants.

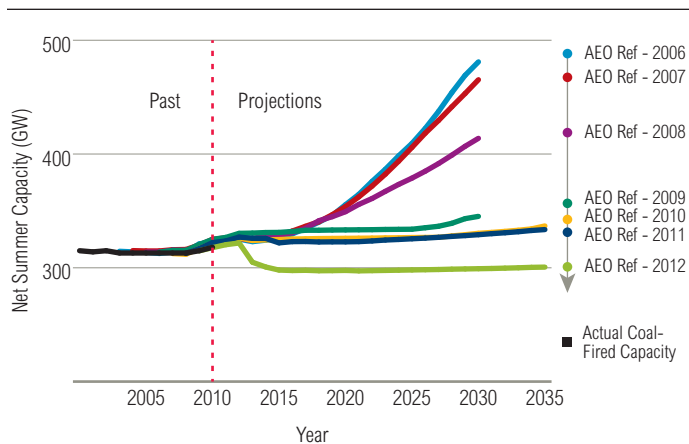
Furthermore, available evidence does not support the notion that regulations are the primary driver behind recent coal plant retirement announcements. These business decisions⁴ are heavily influenced by such market forces as lower natural gas prices, declining growth in electricity demand, rising coal prices, and increased cost-competitiveness of renewables.

A REDUCED OUTLOOK FOR COAL

In January, the EIA published the Early Release⁵ of its 2012 *Annual Energy Outlook* (AEO2012), which highlighted a range of factors causing its “Reference case” modeling projections to differ from the 2011 *Annual Energy Outlook* (AEO2011), in terms of coal’s role in the U.S. power sector. The following points quote directly from the AEO2012 *Early Release Overview*⁶:

- *For the most part, the reduced outlook for coal consumption in the electricity sector is the result of lower natural gas prices and higher coal prices that, taken together, support increased generation from natural gas in the AEO2012 Reference case.*
- *More generation from nonhydroelectric renewables and slightly lower overall demand for electricity, particularly in regions that rely heavily on coal-fired generation, also contribute to the reduced outlook for electricity sector coal consumption in the AEO2012 Reference case.*
- *With a more robust outlook for coal imports by Asian countries, AEO2012 shows higher coal exports than AEO2011.*
- *The combination of slow growth in electricity demand, competitively priced natural gas, programs encouraging renewable fuel use, and the implementation of new environmental rules dampens coal use in the future.*

Figure 1 | **Past and Projected Total U.S. Coal-fired Net Summer Capacity**

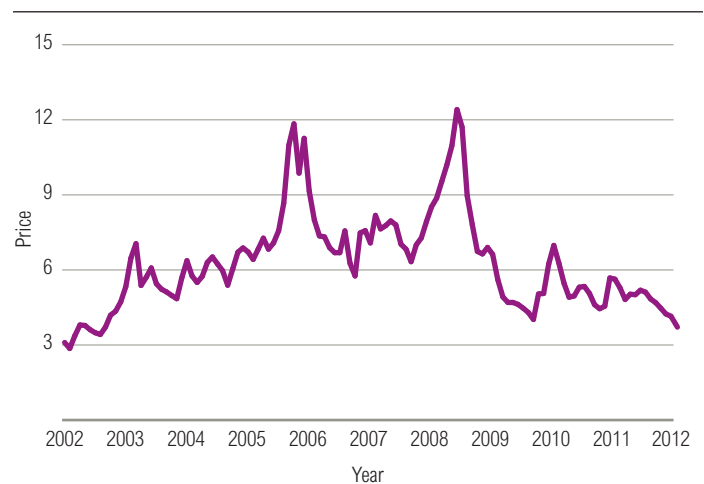


Source: EIA, Annual Energy Outlook

For years, coal capacity has been projected to grow in AEO “reference” forecasts of total U.S. electricity generation capacity. However, as shown in Figure 1, the projected growth rate for future coal-fired “net summer capacity”⁷ has been lower in each consecutive *Annual Energy Outlook* since 2006⁸. This trend was punctuated by the AEO2012 Early Release Reference case, which for the first time projects a near-term decline in coal-fired power capacity.

Regulations or no regulations, the EIA’s reduced outlook for coal is part of an ongoing trend. So, what’s behind it?

Figure 2 | **U.S. Natural Gas Electric Power Price (Dollars per Thousand Cubic Feet)**



Source: EIA

A CLOSER LOOK AT KEY MARKET DRIVERS

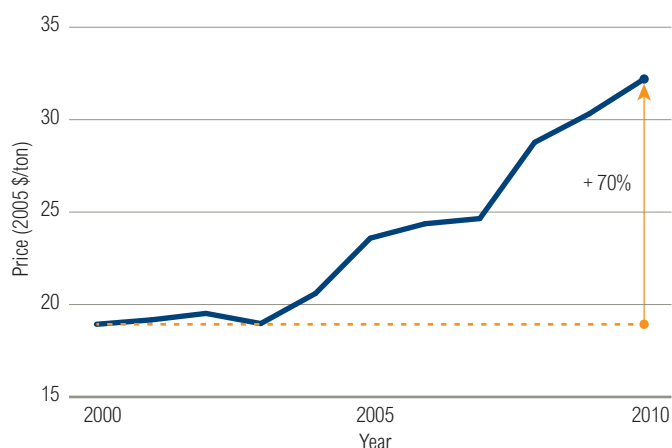
Following are some of the key drivers influencing the direction of the U.S. power sector:

- **NATURAL GAS PRICES ARE LOW.** Figure 2 shows that monthly average prices for natural gas delivered to electric generators are approaching a 10-year low, which is largely attributable⁹ to the shale gas phenomenon¹⁰. Since the price peak in 2008, the broader application of horizontal drilling and hydraulic fracturing technologies has led to a rapid increase in domestic natural gas production from shale rock formations, which is expected to continue for decades¹¹. As a result of lower natural gas prices, wholesale prices for on-peak electricity are down¹² in most parts of the United States.

The implications of increased domestic natural gas production extend well beyond the electric power market. One sector that benefits is chemical manufacturing¹³, which uses natural gas as a fuel and feedstock. Shell Chemical LP, for example, recently announced it is evaluating a site in southwestern Pennsylvania for a proposed multi-billion-dollar chemical plant¹⁴, bringing expectations of near-term economic opportunities for a region with a long history of coal mining.

- **COAL PRICES HAVE INCREASED SIGNIFICANTLY.** Figure 3 shows that U.S. average annual coal prices have increased¹⁵ by over 70 percent in the past decade (inflation-adjusted), driven in part by growing exports. Furthermore, this upward trend is now expected to continue. Whereas AEO2011 projected a modest 6 percent growth in coal prices over the coming decades, AEO2012 projects a 22 percent increase by 2035¹⁶.

Figure 3 | **U.S. Coal Price (Annual Average)**

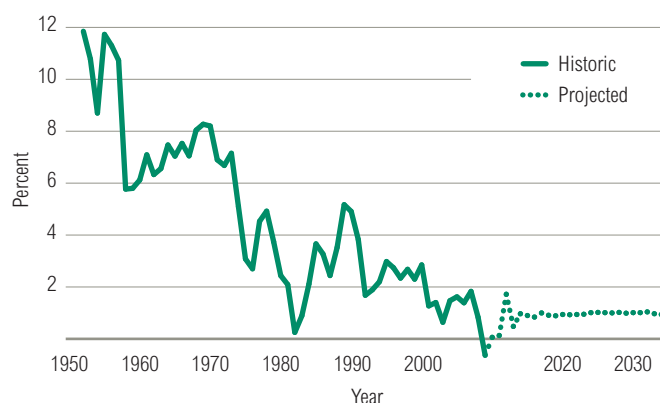


Source: EIA

Between 2005 and 2011 the volume of U.S. coal exports grew¹⁷ at an average annual rate of 14 percent. In addition to growing demand for coal in Asia¹⁸, rising U.S. coal prices have been attributed¹⁹ to declining productivity at U.S. coal mines, which dropped²⁰ on average by more than 20 percent between 2000 and 2010.

- **GROWTH IN ELECTRICITY DEMAND HAS SLOWED.** In the past couple of years, growth in U.S. electricity demand has declined in part because of the recession but also because of technology advancements, plus programs²¹ designed to promote energy efficiency and demand-side management. In fact, EIA data²² shown in Figure 4 illustrate that U.S. electricity demand growth has been in gradual decline since the 1950s.

Figure 4 | **Annual U.S. electricity demand growth, 1950-2035 (percent, based on a 3-year moving average)**



Source: EIA, AEO2011 (figure 76)

- **RENEWABLES ARE BECOMING MORE AFFORDABLE.** In some regions, renewables are already becoming cost-competitive. For example, the Public Service Commission of Michigan, which is responsible for approving new electric power contracts, recently found²³ that new contracts for electricity from new wind farms were up to 40 percent cheaper than the cost of building new coal-fired power in that state. The trend of increasingly affordable renewable electricity is also forecast to continue. The National Renewable Energy Lab²⁴ recently estimated that by 2015 solar photovoltaics would be competitive in utilities representing 67 percent of residential electricity sales. The EIA projects²⁵ new wind power to be more affordable than new coal-fired power in many regions of the U.S. by 2016.

GREATER ENERGY DIVERSITY IS A POSITIVE OUTCOME

Taken together, the trends described above fundamentally change the economics of where the next megawatt-hour of electricity is expected to come from and where new energy investments will be needed to keep the lights on. While each of these factors is important, the most significant development is the declining spread, or difference, between the price of energy from natural gas and the price of energy from coal. When also factoring in the higher efficiency of combined cycle natural-gas-fired plants and their lower construction cost, the result is market dynamics²⁶ that favor natural gas over coal.

The other factors are also important: electricity demand growth remains low and renewables are already proving to be more cost-effective than new coal plants in some markets. State and federal policies also continue to reflect the popularity of renewable energy sources, which has helped non-hydroelectric renewables become a growing share²⁷ of total U.S. electric power generation. Finally, with coal units generating just under half of U.S. electric power – while producing more than three quarters of the sector’s greenhouse gas emissions – these market trends toward a cleaner, more diversified electric power mix are also in the public interest.

With compliance deadlines still three or more years away – as is the case with MATS – and other market forces already contributing to declining U.S. coal use, available evidence does not support claims that new regulations are single-handedly causing coal plant retirements. By augmenting market shifts toward cleaner and more efficient energy sources, new EPA rules will provide significant benefits²⁸ to consumers, public health, and the environment.

NOTES AND REFERENCES

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2. https://www.firstenergycorp.com/newsroom/news_releases/firstenergy_citingimpactofenvironmentalregulationswillretiresixc.html
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7. The EIA defines “net summer capacity” as the steady hourly output that generating equipment is expected to supply to system load (exclusive of auxiliary power), as demonstrated by tests during summer peak demand. This discussion refers to net summer capacity to focus on plant retirements and construction. Another metric for coal-fired electric power is total annual generation. Between AEO2006 and the AEO2012 Early Release, projected coal-fired electric power generation in 2030 has dropped from 3,178 TWh to 1,814 TWh, a 43 percent decrease (<http://www.eia.gov/forecasts/aeo>).
8. AEOs released in the years 2006 to 2009 are based on modeling projections through the year 2030, while subsequent AEOs project out to 2035 (<http://www.eia.gov/forecasts/aeo>).
9. http://www.eia.gov/forecasts/aeo/er/early_prices.cfm
10. Prices will vary by customer and geographic location. For example, another measure of the natural gas market that has received a lot of attention is Henry Hub prices, which recently dropped below \$2.0 per MMBTU (http://www.eia.gov/dnav/ng/ng_pri_fut_s1_d.htm).
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