

The Future of the U.S. Coal Generation Fleet

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The recent experience of the coal-fired generation fleet in the United States has been either a catastrophe or a sign of progress, depending on one's point of view. Either way, it has been a reminder that unexpected and disruptive change can greatly impact an industry that was traditionally considered stable. The Trump Administration appears determined to arrest the decline of the coal (and nuclear) fleet, but the policies and proposals thus far have not produced a revival because the economic fundamentals for coal remain weak in the face of low-priced natural gas and other factors.²

SOME HISTORY

About a decade ago, the market and regulatory outlook was favorable for the existing coal fleet. Wholesale electric energy prices were buoyed by then-high natural gas prices which were expected to increase further. Load growth was steady if not spectacular and renewables such as solar and wind had not yet made significant inroads. While potential climate policy loomed, other environmental policies designed to reduce conventional pollutants (SO₂, NO_x, particulates, mercury) looked manageable with current technologies, and even CO₂ limits might someday be addressed with carbon capture – meaning coal use could increase even if emissions had to be cut.

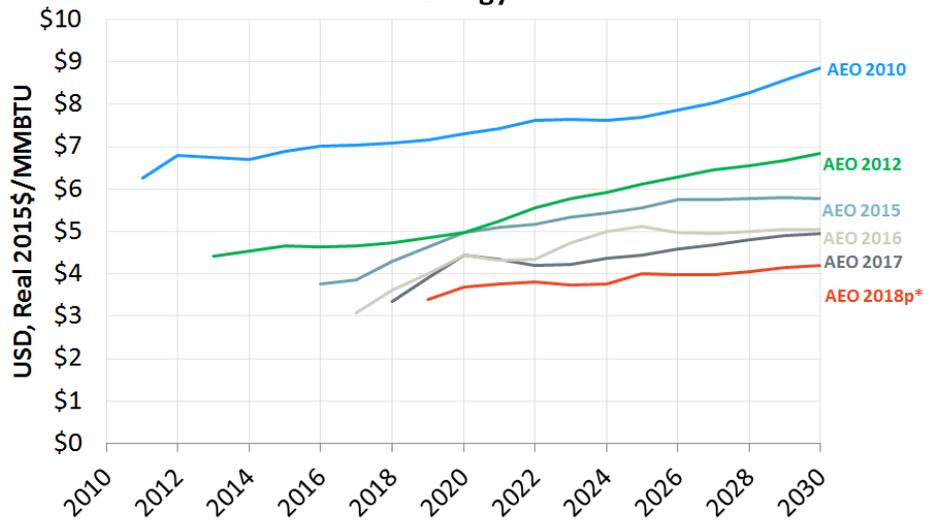
But since 2010, things have changed dramatically:

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² While the focus of this paper is on coal plants, nuclear plants face many of the same market challenges that are discussed.

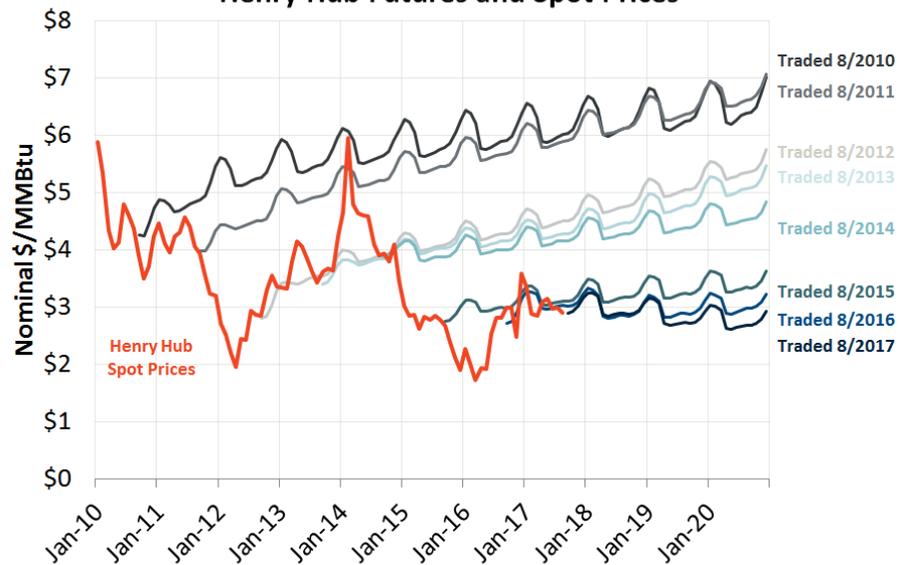
- Low Natural Gas Prices.** Natural gas spot prices fell from their peak levels of nearly \$13/MMBtu in June of 2008 to less than \$2.50 in 2016, driven by shale gas. Natural gas prices directly affect wholesale electric energy prices since gas-fired generation is often the marginal, price-setting source of energy. Thus, low gas prices have driven wholesale electricity prices to their lowest levels in many years. Since 2010, natural gas forward prices and most forecasts have dropped as the persistence of the shale gas phenomenon became clearer, and now natural gas prices are projected to remain low for the foreseeable future.

Henry Hub Natural Gas Price Forecasts
Annual Energy Outlook

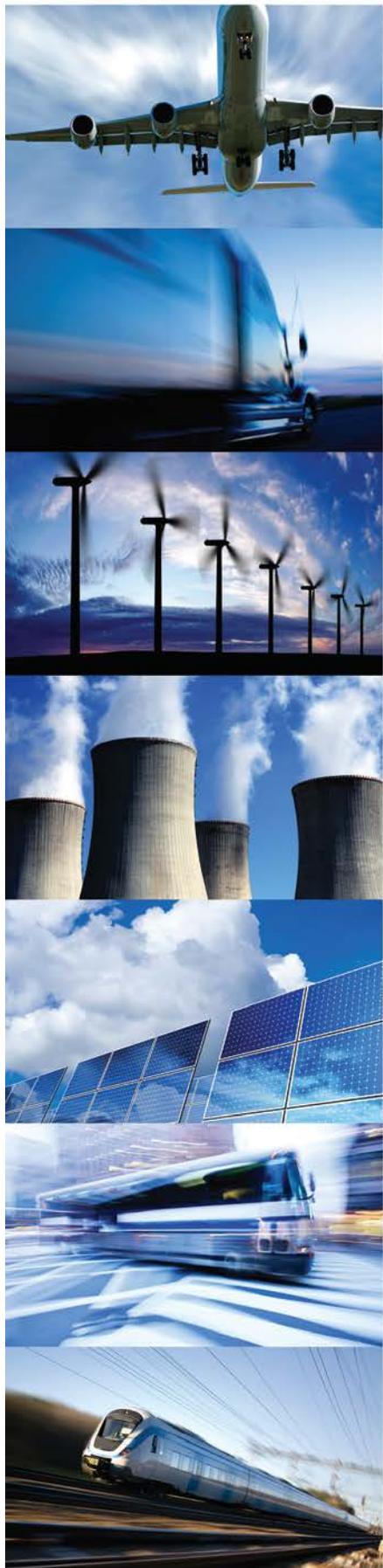


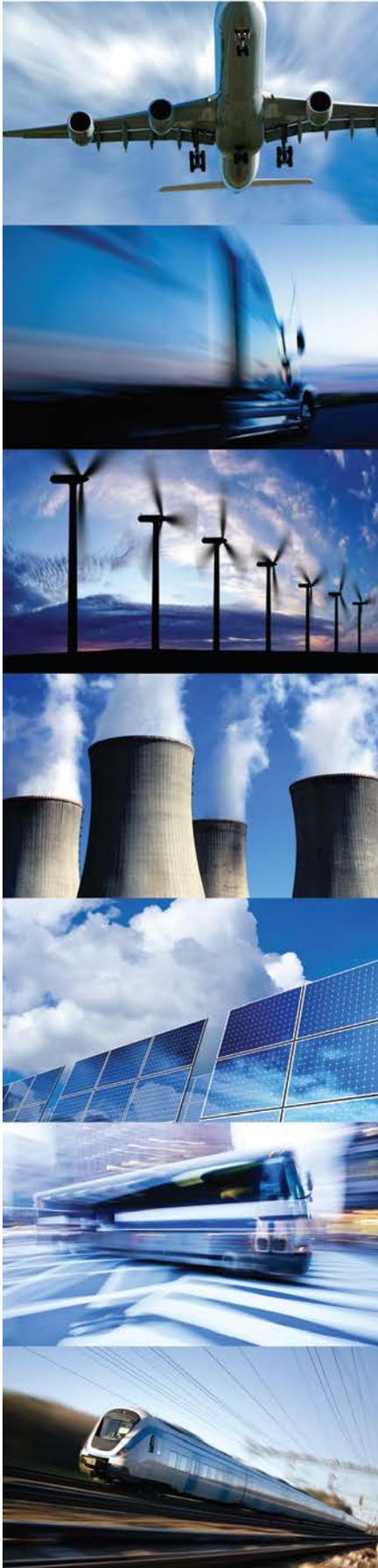
Source: U.S. Energy Information Administration, Annual Energy Outlook 2010, 2012, 2015, 2016, 2017, 2018 Preliminary

Henry Hub Futures and Spot Prices



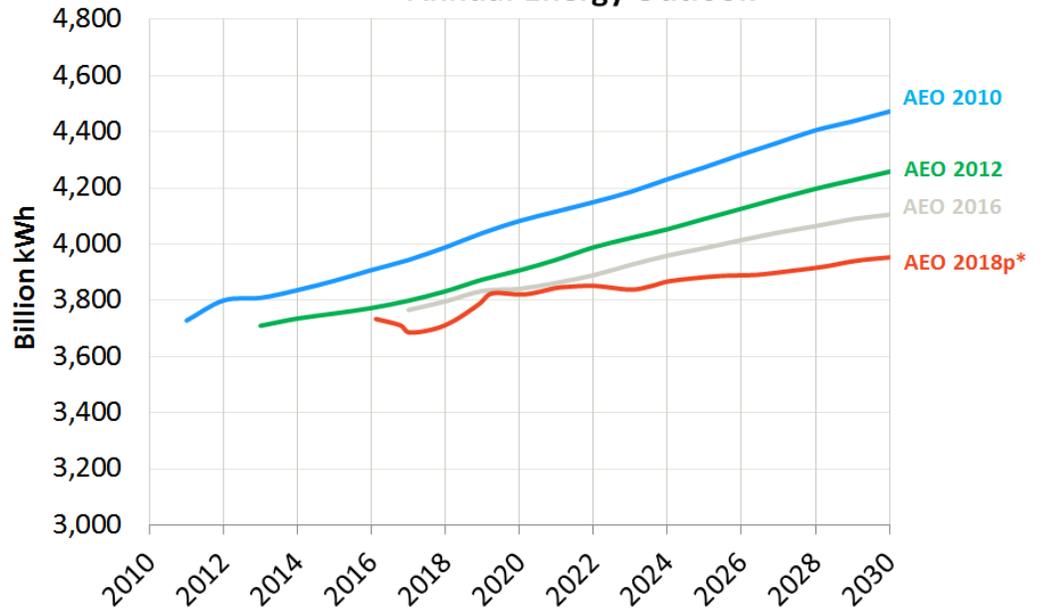
Source: SNL





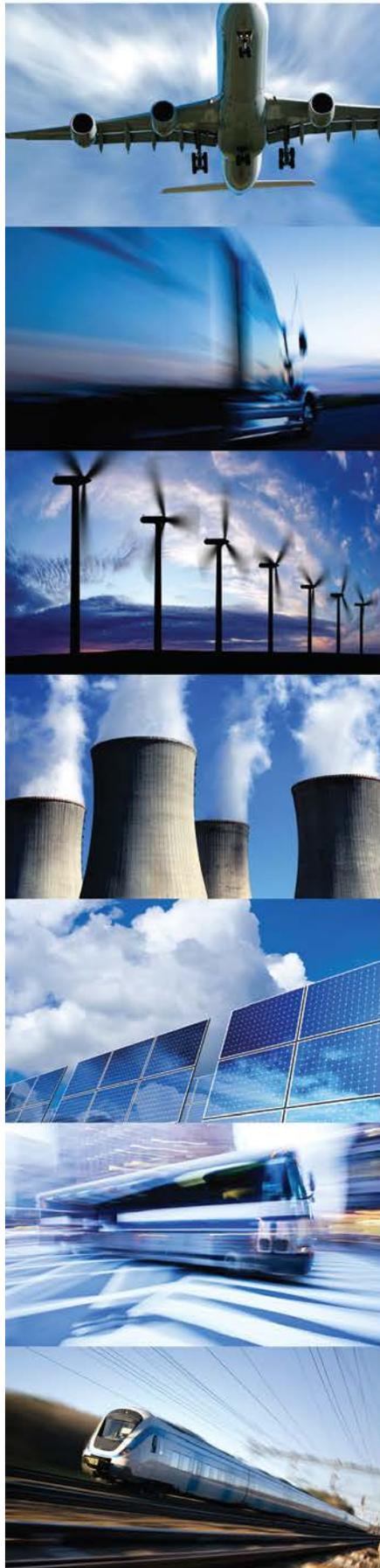
- *Stagnant Demand.* Total demand for electric energy fell with the Great Recession in 2007-2008. When the economy recovered, demand partially recovered. But since 2010, load growth in most regions has been on a new and very low growth trajectory, with more recent load forecasts slowly acknowledging the new reality.

U.S. Electricity Sales Forecasts
Annual Energy Outlook

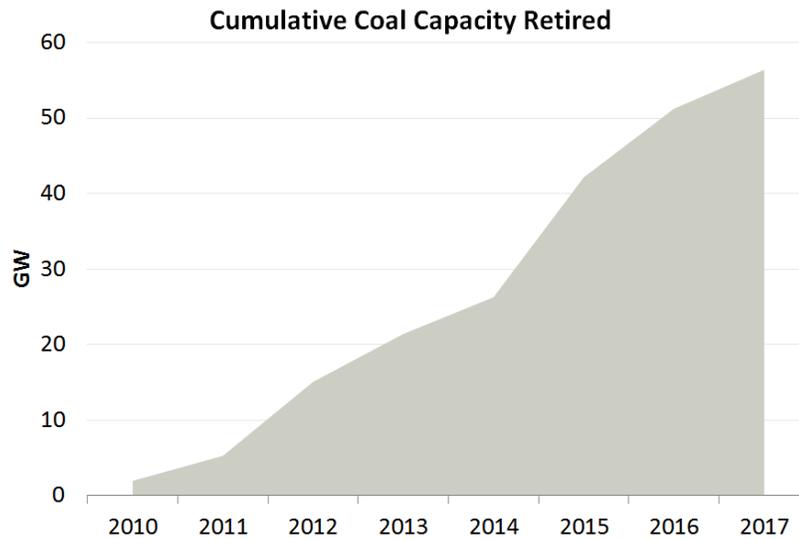


Source: U.S. Energy Information Administration, Annual Energy Outlook 2010, 2012, 2015, 2017, 2018 Preliminary

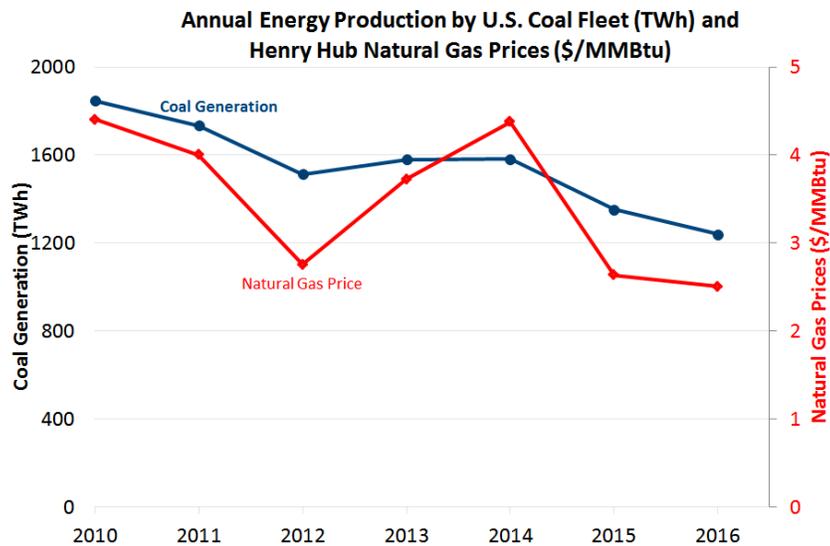
- *New Gas-Fired Generation.* Even with low electricity prices, generation developers have added large amounts of highly efficient gas-fired combined-cycle capacity with relatively low capital costs. This has been a much larger contributor to low prices than renewable generation in many regions. For example, PJM Interconnection’s last six forward capacity auctions cleared 25,800 MW of new capacity and contributed to low capacity clearing prices (and low energy prices).
- *New Renewable Generation.* Renewable electric generation has grown substantially, largely because of state renewable portfolio standards and federal and state subsidies, but also because of declining costs. This has increased generation surpluses in many regions and contributed to depressed energy prices in several regions.



- Environmental Regulations.** These weak market conditions prevailed at the same time that the Obama Administration’s Mercury and Air Toxics Rule (MATS) presented many coal plants with a choice between undertaking significant pollution control investments and retiring by April 2015.³ Many plants chose to retire, and by October 2017, 56 GW of coal capacity (about 15% of the U.S. fleet) had elected to close. In part because of these retirements, and in part because low-cost gas often made it more economic to operate gas plants rather than existing coal plants, the coal fleet’s production of energy has decreased by about 30% since 2010.

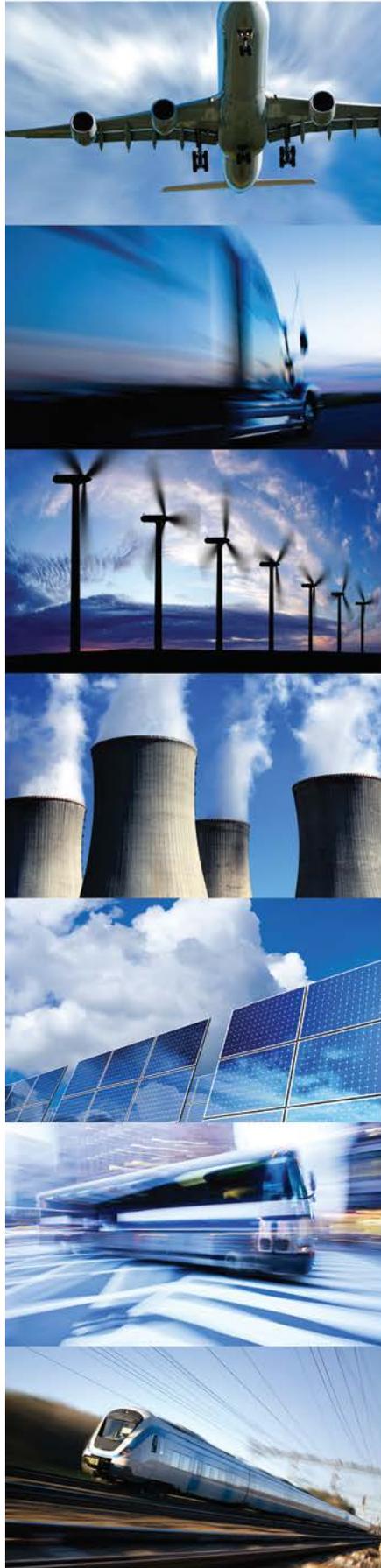


Source: Velocity Suite, "Generating Unit Capacity".



Source: Coal generation from U.S. Energy Information Administration "Net generation for all sectors monthly"; Henry Hub natural gas prices from SNL.

³ Some plants converted to natural gas to comply with MATS, and a few plants that were needed to maintain local reliability were allowed to generate past the April 2015 retirement date until alternative reliability solutions were implemented.



Thus, the last decade has been extremely challenging for coal generators, as well as associated industries such as coal producers. The fortunes of nuclear generators have suffered for many of the same reasons.

CURRENT SITUATION

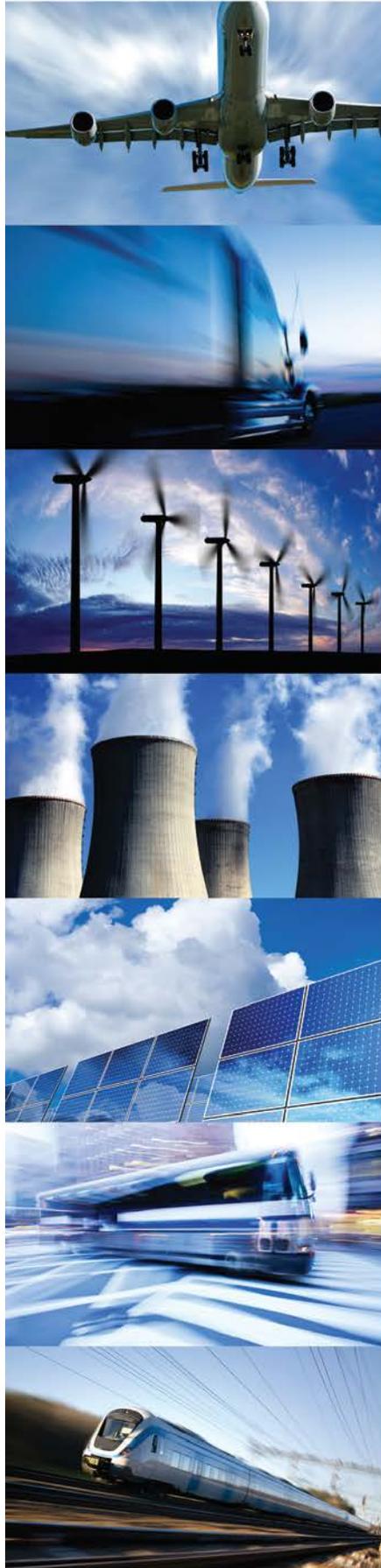
Gas prices seem to have bottomed out in 2016 when they averaged about \$2.50/MMBtu. Gas prices have recovered a bit in 2017 which caused a modest rebound in coal generation relative to the depths of 2016.

As shown in the graphics above, both futures markets and forecasters such as EIA for years were projecting a gradual upward trajectory for natural gas prices, but this has yet to materialize in any durable fashion. Although current prices are not quite as low as in 2016, the more recent projections that gas prices will stay low far into the future serves to diminish hope for sustained growth in coal generation, and some of the coal plants that managed to survive the MATS requirements are being threatened. In fact, about 20 GW of coal generation capacity is currently scheduled for retirement over the next three years.

Political conditions for coal have improved, however. President Trump promised to “end the war on coal” that he blamed on President Obama’s environmental agenda. Once in office, President Trump rolled back many of the proposed/pending rules that affected coal production and use, notably the Clean Power Plan as well as other environmental regulations on fossil fuel development. But those actions primarily quash future regulatory requirements rather than alleviate the relatively poor economics of many coal plants in a market with low-gas-prices, low-capital-cost gas-fired generation, anemic load growth, and increasing penetration of renewable generation.

After considering several options to help coal generation, the Secretary of Energy invoked a seldom used provision to initiate a FERC rulemaking process (notice of proposed rulemaking “NOPR”) on September 28, 2017.⁴ The DOE NOPR proposed the immediate creation of a FERC tariff to cover the full cost of service (capital and operating costs) for certain generating units that DOE claimed were needed to maintain the “resilience” of the grid. The affected plants, “merchant” plants that owners operated as unregulated assets and located in the Midwest, mid-Atlantic and Northeast regions, must demonstrate 90-day on-site fuel

⁴ The NOPR was published in the Federal Register on October 10, 2017. See 82 Fed. Reg. 46,940.



supply. In other words, these coal and nuclear plants would no longer be exposed to competitive market forces, but instead would be protected against “premature” retirement by the FERC tariff that would cover their full costs.

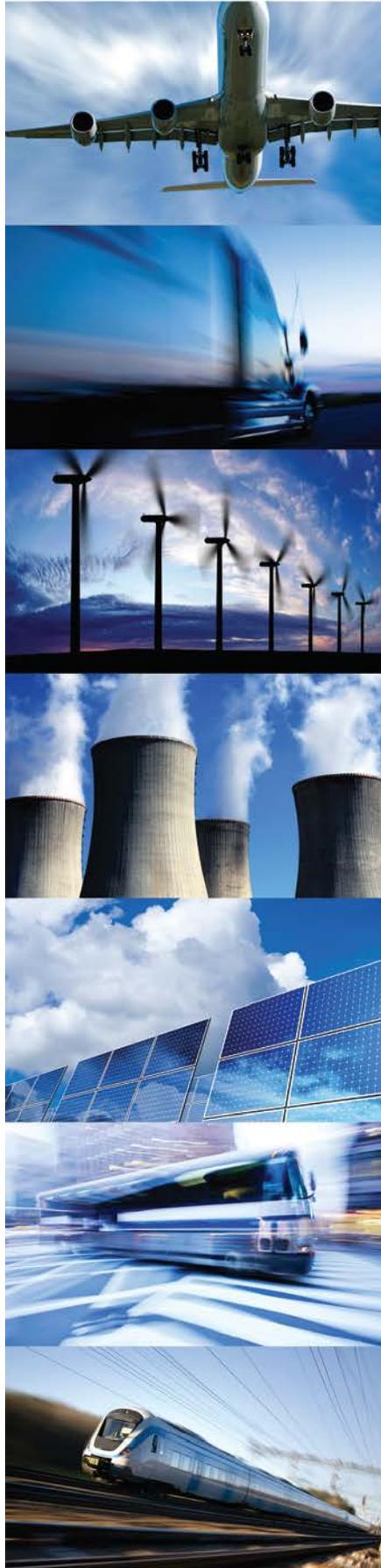
DOE pointed to four observations that formed the basis for the proposal: (1) coal and nuclear plants are retiring “prematurely” due to economic conditions; (2) severe weather conditions such as the January 2014 “Polar Vortex” demonstrated grid vulnerability to gas supply conditions; (3) coal and nuclear plants have “on-site” fuel, which DOE asserts is important for grid “resiliency”; and (4) resiliency is distinct from reliability and is not currently valued in organized markets, meaning that plants that provide resiliency are not adequately compensated. The proponents of the NOPR connected these observations to arrive at a conclusion that only immediate support for coal and nuclear plants will forestall a crisis of grid resiliency.

Not surprisingly, alternative views emerged even in the highly compressed comment period. One of these comments was submitted by a coalition that spanned a broad range of interests, and was accompanied by a Brattle Group analysis of the NOPR.⁵ The Brattle study examined the emerging concept of resiliency and whether and how it fits into the traditional framework of reliability. We concluded that while resiliency is an important emerging concept and reasonable planning objective, DOE did not adequately demonstrate a connection between system resiliency and preserving months of on-site fuel inventory in the regions affected by the rule. The study noted that the NOPR would prevent potential retirements primarily in the PJM market region, which currently happens to be the market with the *highest* proportion of coal and nuclear capacity in the nation, and which a recent PJM analysis⁶ shows would remain reliable in a repeat of the Polar Vortex weather conditions. Some of the difficulties endured during that event have since been addressed by improved operations and plant investments made in response to market-based incentives to be able to produce during shortages.

The study also analyzed the cost of the program at anywhere between \$4 billion and \$11 billion per year at the outset, primarily incurred in the PJM market where most of the affected plants are. The broad range of

⁵ Joint Industry Comments Opposing the DOE Proposal, Docket No. No. RM18-1-000, October 23, 2017. The report prepared by The Brattle Group experts is posted at http://www.brattle.com/system/publications/pdfs/000/005/530/original/Evaluation_of_the_DOE's_Proposed_Grid_Resiliency_Pricing_Rule.pdf?1509064658.

⁶ <http://www.pjm.com/~media/library/reports-notice/special-reports/20170330-pjms-evolving-resource-mix-and-system-reliability.ashx>



costs arises because assessing the cost of service for merchant plants involves unit-level determinations using proprietary data, which is not accessible; lacking this data we used a range of estimates from public sources. Finally, the study addressed the potential incompatibility of the proposed rule implementation with the principles of competitive wholesale power markets.

The DOE requested a very expedited schedule: the initial set of comments was submitted by October 23, with follow up reply comments on November 7. FERC has indicated its intent to issue some sort of decision by mid-December; that could take many forms from rejecting the DOE NOPR altogether to adopting it entirely (though FERC would need to fill in an enormous amount of detail lacking in the current proposed rule).

If FERC decided to adopt the proposed rule, opponents would likely file litigation to block implementation, so it is unlikely to have an immediate impact. Other avenues for incorporating resilience into organized markets via planning and/or pricing, or evaluating emerging proposals that might provide some additional revenue for coal and nuclear plants could take months or even years to implement, but these would be more consistent with the deliberative process currently in place at FERC and the RTOs.

SUMMARY

Coal generation economics are likely to remain weak as long as low gas prices continue and as long as total system generating capacity remains plentiful relative to demand. Absent intervention, additional retirements are likely to occur, although wholesale electricity market prices should provide a correcting force that limit retirements to some degree – the least economically efficient plants tend to retire first, putting upward pressure on capacity market prices, which helps the remaining plants.

The FERC proceeding triggered by the DOE NOPR has begun an important discussion about resilience that ultimately should encompass the entire grid, the attributes that various generators supply to the market that foster resilience and how to provide proper compensation for those attributes. Such deliberations can consider the attribute of fuel supply security within a broader context of system reliability and resilience and potentially lead to effective policy changes.