The National Coal Council
Power for America from America

Reliable & Resilient

The Value of Our Existing Coal Fleet

An Assessment of Measures to Improve Reliability & Efficiency While Reducing Emissions

www.nationalcoalcouncil.org/NEWS/NCCValueExistingCoalFleet.pdf

During the winter of 2013-2014, the National Coal Council (NCC) conducted a study for the U.S. Secretary of Energy assessing the value of the existing U.S. coal fleet and opportunities to enhance its capacity, efficiency, flexibility and emissions profile.

The value of the existing coal fleet is not an abstract concept. At a time of great stress on power demand in January-February 2014, coal produced 92% of the increase in U.S. electricity generation relative to January-February 2013.

The severe cold weather events experienced while the study was underway, reinforced the importance of retaining and maintaining coal generation assets in order to reliably and affordably meet the electricity needs of U.S. residents and businesses. The major lesson learned from the Polar Vortex experience is that the availability and operation of coal units now scheduled for retirement over the next two years enabled the power sector to meet demand during periods of harsh weather.

NCC's assessment of the existing U.S. coal fleet supports the findings that:

- The current 310 GW fleet of coal-fired power plants underpins economic prosperity in the U.S., providing direct economic and macroeconomic benefits; energy supply and price stability; environmental benefits through continuous technology advancements; and job-creating opportunities.
- Coal plant closures and increasing reliance on natural gas for power generation will adversely impact price stability and resource supply.
- New Source Review (NSR) regulations adversely impact generators' decisions and ability to enhance plant efficiency, reduce emissions and improve overall operations and capacity.
- Collaborative RD&D efforts (DOE and industry) can enhance the ability of the coal fleet to improve its flexibility and reliability, to increase its efficiency and to reduce its emissions profile.

  The need for RD&D is vital to support marketplace shifts and public policy objectives:
  - > Increasing deployment of intermittent renewable energy technologies, competition from other fossil fuels, use of non-design coals and continued use of older coal generation technologies will lead to increased operation of base load units in a cycling mode for which they were not designed.
  - > Modest improvements in efficiency are possible with existing technologies to improve heat transfer, reduce heat losses and make better use of low quality heat. More advanced improvements, if technically and commercially viable, could significantly enhance efficiency.
  - > Challenges arise in complying with emerging regulations for control of traditional pollutants when new control regimes create secondary, follow-on emissions issues.
  - > Existing coal plants were not designed or located with CCS in mind; the ability to retrofit these plants for CCS is problematic. More research is needed to commercialize CCS retrofit potential; improved efficiencies provide an interim path in the meantime.

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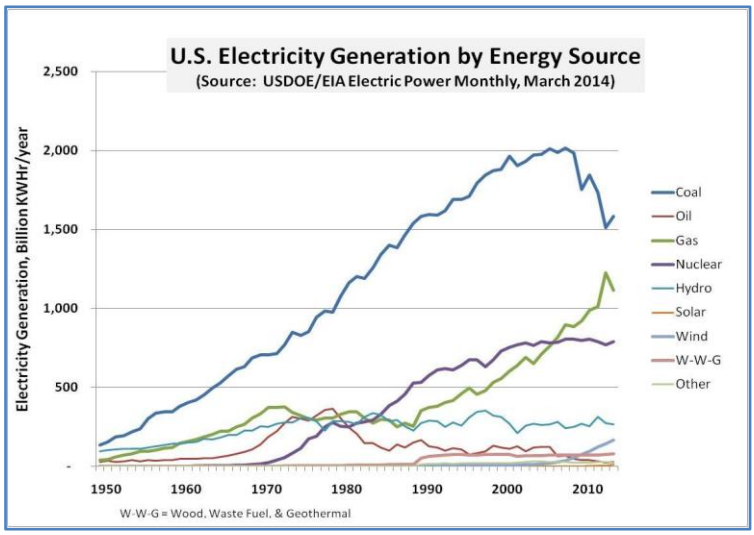
The Role & Benefits of the Existing Coal Fleet

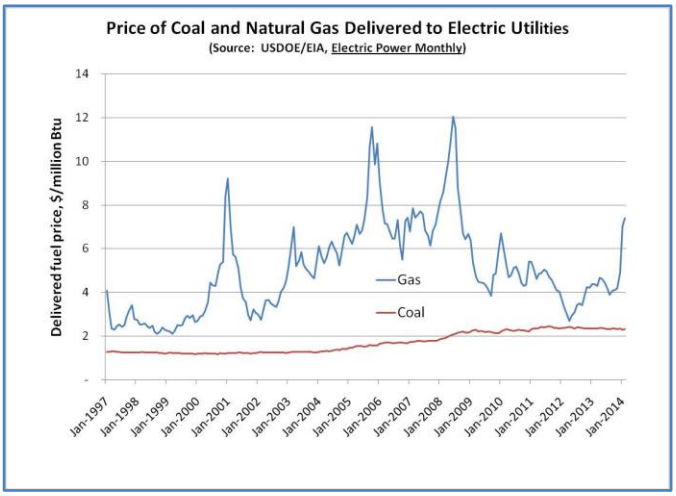


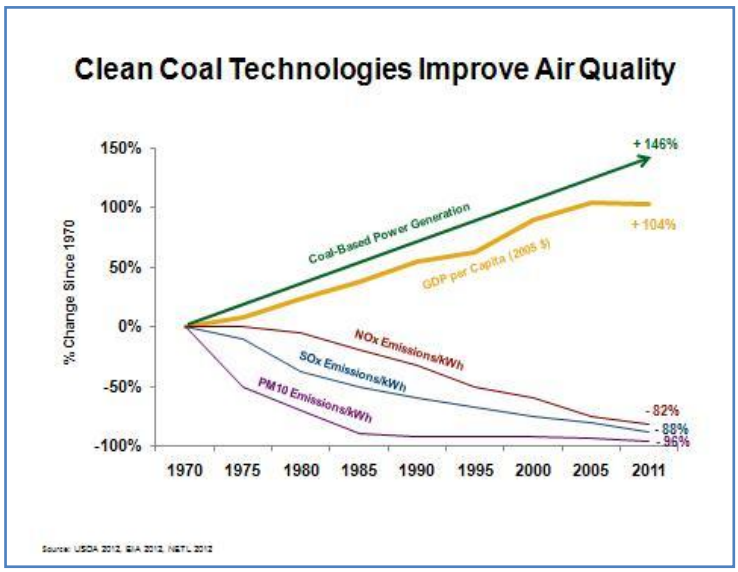
Coal has dominated electricity generation in the U.S. from 1950-2013. This dominance is a result of coal's domestic abundance, reliability, accessibility and low cost. Among the benefits offered by the current coal fleet (310 GW of generating capacity):

- Direct and macroeconomic benefits of low-cost electricity.
- The portfolio value of having a robust and reliable alternative for power generation.
- The energy security value of a generation fleet not confined to real-time fuel delivery-transport, and relatively immune to purposeful attack (terrorism).

Lower cost electricity acts as a stimulus to the economy, providing more disposable income to consumers and creating a competitive edge for U.S. manufacturers supplying global markets. Coal provides economic stability and has been a crucial buffer to spiking natural gas prices. Natural gas prices continue to be volatile, reinforcing an historical trend. The winter of 2013-2014 has demonstrated that large price spikes remain a characteristic of natural gas:

- In New England, natural gas prices reached $77/mcf or $435 per barrel in oil equivalent terms, causing switching from gas to oil power generation.
- In the Northwest, spot natural gas at Malin Hub in Oregon quadrupled from $7.70 to almost $30/mcf.

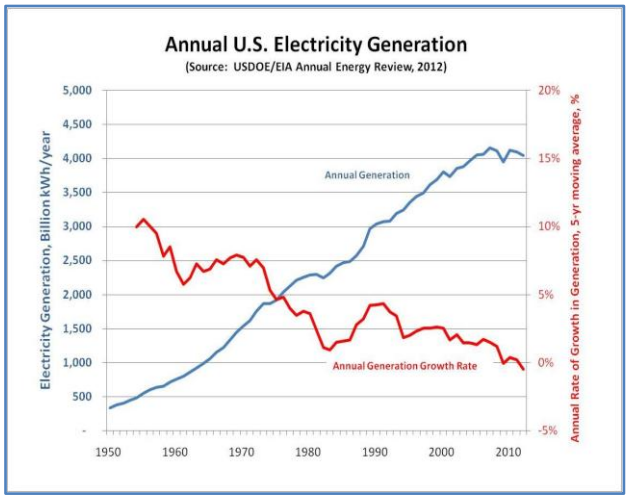




The historical deployment of advanced coal technologies demonstrates that coal generation can be increased while simultaneously reducing emissions. Since 1970, coal used for electricity increased substantially alongside a tripling of GDP as key emissions decreased almost 90%. Supercritical and ultra-supercritical plants are the technological pathway to even lower emissions and the necessary precursor to carbon capture and storage (CCS). Retrofitting advanced environmental technologies and enhancing efficiency at existing coal plants could result in the annual creation of 44,000-110,000 jobs, depending on the degree of efficiency improvement achieved.

Changes that Could Impact Benefits from the Existing Coal Fleet

Recent demand for electricity has declined from 6-11%/year increases of the 1950s and 1960s.

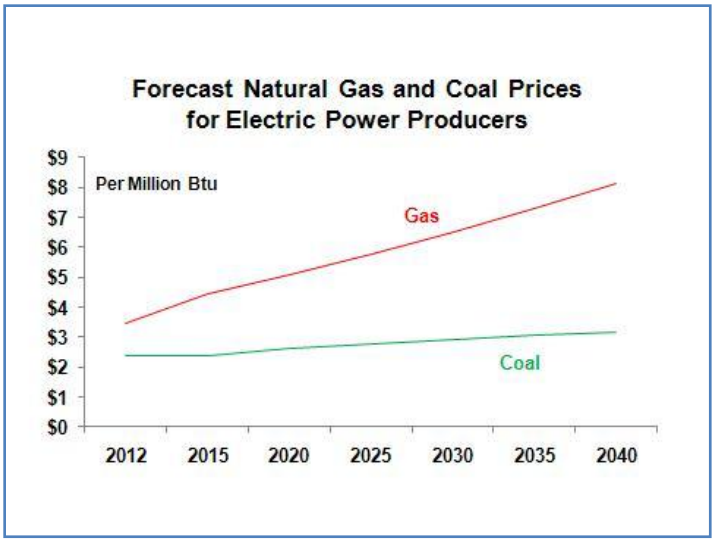


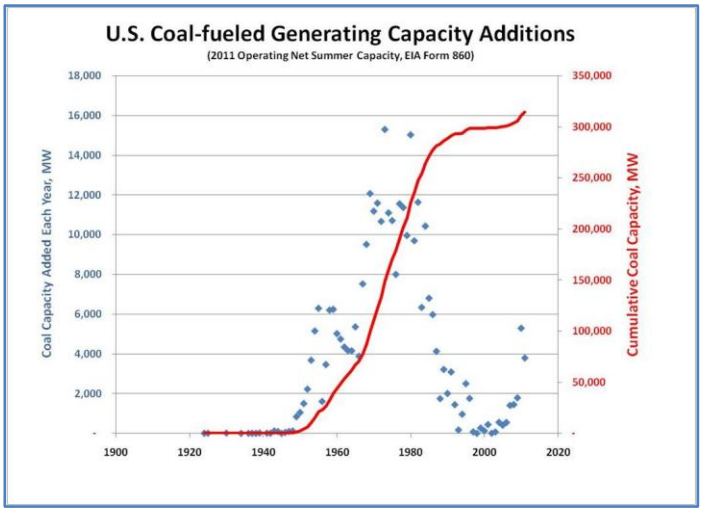
Today's more modest growth rates reflect economic conditions, effects of demand-side energy efficiency measures, a continuing shift from manufacturing to services and a transition to less energy-intensive industrial applications.

This relatively low rate of growth in electric power demand emphasizes the importance of advancing policies and technologies that preserve the existing coal fleet's benefits and portfolio value.

To advance its economic interests, the U.S. will need to start producing more and exporting more. Our nation will require significantly more reliable, reasonably priced electricity in the coming years – electricity not subject to cut-ofs and price spikes.

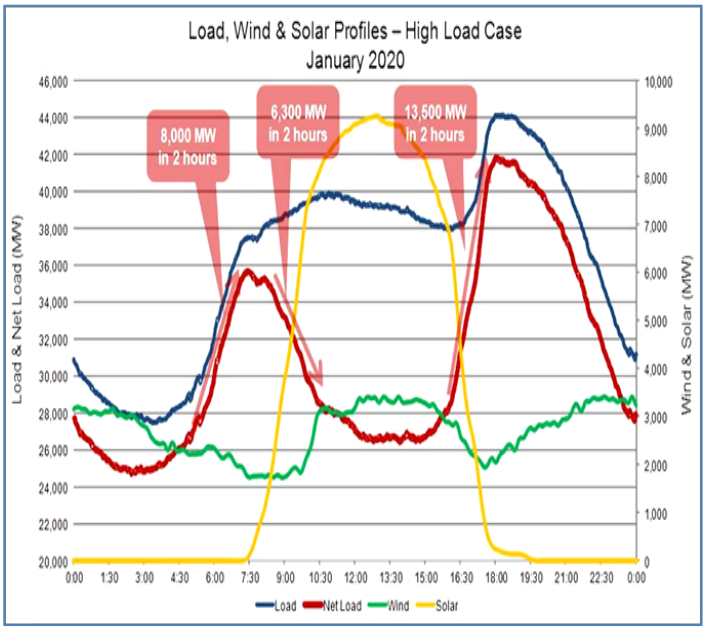
Recent use of the existing coal fleet has been impacted by a dramatic decrease in the price of natural gas. However, EIA's most recent projections for the price of delivered gas to electric utilities indicate an expected real (constant dollar) increase of 3.1%/yr for 2012-2040, versus 1%/yr for coal. Projections of future natural gas prices are relevant to the existing coal fleet because retirement decisions for existing coal capacity will rely in part on projected costs for coal and natural gas.





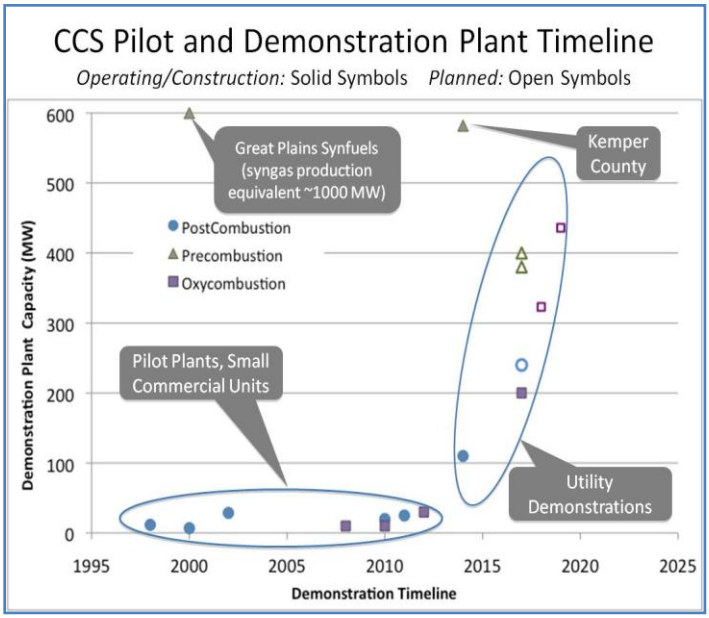
The intricacies of New Source Review (NSR) regulation are important to understand because they impact the development and potential use of technologies that could be used to improve plant efficiency, reduce emissions and enhance capacity. The uncertainties created by NSR rules, their enforcement by EPA and certain environmental groups against efficiency and capacity enhancing technologies, and the very substantial – even prohibitive – cost of NSR create strong disincentives to the widespread deployment of those measures.

Technology Responses to Maximize Future Benefits to Society



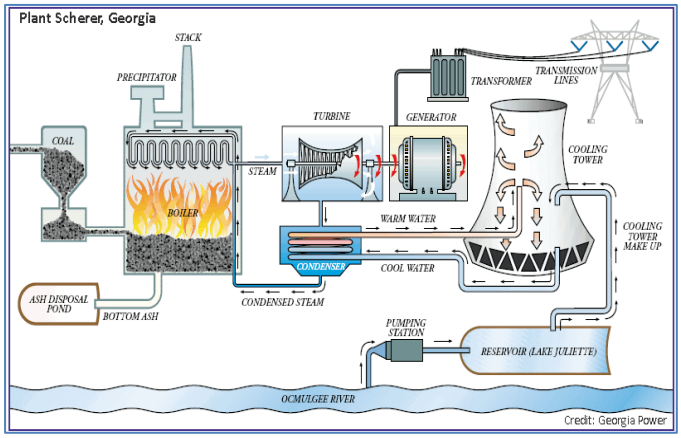
Increasing Existing Coal Fleet Efficiency

Improving the efficiency of today's power plants is critical to maintaining the value of the existing coal fleet. While many of the needed technologies already exist and are operating on some units, they are not a one-size-fits-all package of solutions that can be readily applied across the board. The degree of efficiency improvement possible at a given unit is highly site-specific. Some technologies could potentially achieve significant efficiency improvements – such as adding "topping" or "bottoming" cycles to existing units – but will require extensive RD&D efforts.



Improving Flexibility & Maintaining Reliability

Most large existing coal power plants were originally designed to run in base load mode. Changing market conditions and public policies suggest that many of base load units will, in the future, be used in a cycling mode resulting in significant operational and maintenance challenges. Various technologies may be able to address these issues, including improved materials, better sensors and monitors and treated coals to reduce mositure or trace element content. A greater understanding of failure mechanisms leading to tube leaks, component failures and other malfunctions resulting in forced outages and reduced equipment life are necessary to maintain system reliability.



Reducing Emissions at the Existing Fleet

The existing fleet is generally well equipped with systems designed to control emissions of PM, NOx and SO2. Recently proposed or adopted regulations, however, will lead to more stringent reduction requirements and often reduction of emissions in one media (e.g., air) will result in new pollution control issues in another media (e.g., wastewater). Additionally, regulatory efforts to reduce GHG emissions enhance the urgency of accelerating carbon capture and storage (CCS) solutions that will have applications for both coal and natural gas-fired power plants. More emphasis must be placed on commercial scale demonstration of CCS systems and more work is needed on issues related to cost reduction, systems integration and legal frameworks.