

The Importance of Fuel Diversity: Part 1

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Although natural gas has quickly become the fuel of choice for the power industry, there are dangers in relying on a single fuel source. This three-part series will explore the potential drawbacks of using a single fuel source and the advantages in expanding your fuel source options, including the emission-related factors. Parts 2 and 3 will discuss the importance of planning ahead for fuel diversity and provide specific recommendations to achieve a more balanced fuel source approach.

As the United States becomes more dependent on environmentally friendly fuel sources, natural gas appears to have a distinct advantage over coal. A recent study published in the American Chemical Society's *Environmental Science and Technology* journal found that the carbon footprint of the overall lifecycle of natural gas was 53 percent lower than coal.¹ While there is some disagreement on the impact of methane gas leaks from oil and gas drilling fields, the general consensus is that natural gas provides a cleaner energy alternative than coal.

Because the cost to build a natural gas power plant is less per kW of production capacity than a new coal plant, most new fossil-fuel-fired plants built in recent years use natural gas. Recent and proposed Environmental Protection Agency (EPA) regulations for coal-fired power plants have influenced decisions to retire a number of older coal-fired generating units. Sega is aware of 111 units retired since 2010, with another 145 announced or expected through 2022. Sega also is

aware of more than 35 units proposed for fuel conversion from coal to natural gas or biomass. Low to negative load growth since the Great Recession due to economic conditions, strong political support for renewable generation and energy-efficiency measures, and EPA regulations have combined to preclude construction of new coal-fired generating capacity.

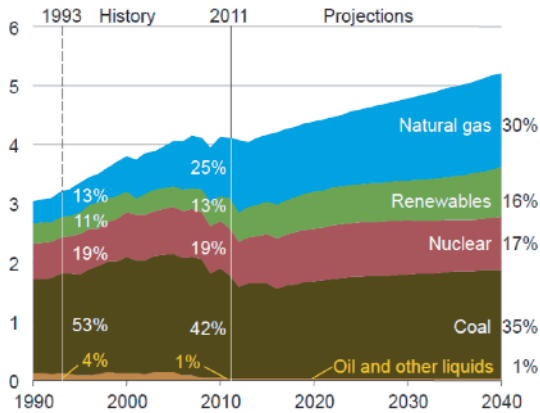
In addition to natural gas, renewable energy sources such as wind, solar, and biomass will play an increasing role in the world's future energy mix. Compared with natural gas, however, the growth of renewables will be much more gradual and not as significant in an absolute sense. The Energy Information Administration (EIA) estimates that in the next 25 years, coal still will be the primary energy source in the United States. (See Figure 1) In fact, the EIA's International Energy Outlook (2013) predicts that by 2040, nearly 80 percent of the world's energy use, including transportation and electricity, will come from fossil fuels.²

"Even achieving the goal of 50 percent of the U.S. power supply (coming) from solar and wind assumes that 100 to 150 gigawatts of energy storage, or roughly half the size of the country's coal capacity, will emerge to provide power when the sun isn't shining and the wind isn't blowing," says Matthew Stepp, a senior policy analyst at the non-partisan Information Technology & Innovation Foundation.³

The emergence of hydraulic fracturing has led to a natural gas boom in the United States. Lower capital costs of combined-cycle power plants vs. coal, comparable operating costs, and lower greenhouse gas

Figure 1

United States Electricity Generation by Fuel (Source: EIA Annual Energy Outlook, 2013)



(GHG) emissions vs. coal-fired generation also have had a positive impact on the natural gas industry. Additional EPA-proposed regulations on new fossil-fuel-fired power plants also tend to favor gas over coal. Natural gas is now virtually the only fossil fuel that can be used for new power generation projects, and many utilities are taking advantage of this new environment as load growth and the regulatory climate permit.

For plant owners and retail energy providers, such as utilities, however, there are downsides in relying too much on a single source of fuel. Price fluctuations, supply issues, extreme weather conditions, transportation constraints, and even political unrest all can pose challenges for any fuel supply.

Gas Supply Issues, Weather, and Transportation

On Feb. 1, 2011, the temperature in Houston, TX, plummeted 30 degrees in a 20-minute time span.⁴ The city's recorded temperature of 23°F was about 40 degrees cooler than normal for that time of year. The unusually cold conditions prompted a surge in demand for electric power and natural gas across the state. As a result, several electric utilities began instituting statewide rolling blackouts to conserve energy supplies. El Paso Co., a natural gas provider, could not keep up with demand. In addition to customers in Texas, El Paso Co. also provided natural gas to customers in neighboring states. Soon after the rolling blackouts, supply constraints had spread to New Mexico.

Two days later, New Mexico Governor Susana Martinez declared a state of emergency. Approximately

30,000 homes in New Mexico were suddenly without power due to the natural gas supply challenges.⁵ With supplies limited, the governor strongly urged New Mexico residents to conserve by turning down thermostats.

In early 2013, during an especially long and protracted winter, a similar event transpired in the northeastern United States. Dwindling supplies of natural gas used for power generation created a void that required some New England states to purchase electric energy from Indian Point, a nuclear power plant in New York. The severe winter weather, coupled with surging energy demand, caused electricity prices to swell four to eight times higher than normal.⁶ Besides facing a hard winter, many residents in New England faced the added complication of sticker shock from their heating bills.

For many plant owners (and their regulators), this provides a cautionary tale. Reliance on a single fuel source, coupled with an unpredictable event, can wreak havoc on the ability to meet energy needs. A *New York Times* article from Feb. 15, 2013, addressed New England's reliance on natural gas: "It is certainly true that a region like New England that relies on a single fuel source like natural gas for the bulk of its power does leave itself open for more disruptions than a region with a more diverse fuel mix. It's not a knock against natural gas; it's a knock against a single fuel source," said Jay Apt, executive director of the Electricity Energy Center at Carnegie Mellon University in Pittsburgh.⁶

While the severe weather incidents of Texas and New England exposed some natural gas supply constraints, weather was not the ultimate cause. Rather, insufficient pipeline capacity was to blame. There simply was not adequate pipeline volume to meet the surging demand. This begs the question: Without sufficient pipeline infrastructure, is the U.S. in danger of relying too much on natural gas? Some members of the energy industry believe so.

On the heels of the New England supply incident, members of the U.S. House of Representatives convened a hearing in Washington, D.C. Sponsored by the subcommittee on Energy and Power, the American Energy Security and Innovation hearing was held March 5, 2013. Its primary aim was to discuss the importance of promoting energy diversity in the U.S. Members of several power utilities voiced their concerns regarding the country's current energy portfolio and its future.

“Although natural gas has been a game changer, it is not the silver bullet. What many do not realize is coal remains a more competitively priced fuel for certain regions of the country due to the proximity of supply, especially in the central and western U.S. Natural gas may be a great option if your power plant is located near a robust network of gas pipelines, but, unfortunately, many of the existing coal plants do not have access to pipeline capacity to convert from coal to natural gas,” said John McClure, Nebraska Public Power district vice president.⁷

Despite industry warnings such as this, many electric utilities are proceeding with plans to build only natural-gas-fueled plants. The EIA estimates that by 2035, natural-gas-fired electricity will account for 80 percent of all added electricity generation (See Figure 2).⁸ The appeal of natural gas is strong. And while many utilities have chosen to abandon coal due to present economic conditions, many more are leery of what lies ahead in the future — environmental regulation.

Increased Environmental Regulations

Today, constructing a new coal-fired power plant is more expensive per kW of production capacity than building a gas-fired combustion turbine combined-cycle power plant by a factor of two or more. With new GHG environmental restrictions in place — and more on the horizon — that cost differential may be prohibitively expensive for most, if not all, utilities. Recent regulations issued by the EPA, including existing and proposed restrictions on CO₂ emissions and a push for carbon capture and sequestration, mark a substantial shift in environmental policy for the energy industry. Plant owners now have less flexibility in their fuel options than they had previously.

The proposed EPA rule on GHG emissions states that new coal-fired plants cannot discharge more than 1,100 pounds of CO₂ per megawatt hour. Comparatively, most coal plants currently emit about 1,800 pounds of CO₂ per megawatt hour.⁹ Experts concede that to meet such a standard, new coal plants would have to invest heavily in expensive carbon capture technology. These new regulations would put an end to virtually all new coal-fired power plant construction in the United States. Additionally, more restrictions may be coming. The EPA plans to address the emissions of all existing coal-fired plants, with the rule scheduled for release this month. This increased scrutiny could force existing coal-fired plants to shut down or decrease their overall GHG emissions.

A *Bloomberg News* report from Sept. 11, 2013, mentions the potential outcome: “The effect of the new standards would lock out coal over the long term. Once you set something in stone, you discourage investment in that sector, and you take a flexible market and ossify it. The market price of natural gas can change, but regulations don’t,” said Scott Segal, a legal analyst for the utilities.¹⁰

Gas Prices and Fracking

Indeed, the price of natural gas can change and has changed many times in recent history. Some of these fluctuations have been extreme. As Figure 3 shows, the historic price of natural gas has undergone many erratic spikes within the past 10 years. For example, in 2005, decreased natural gas supplies following Hurricanes Rita and Katrina caused drastic price increases.¹¹ More recently, the “polar vortex” weather pattern in early 2014 caused record demand for natural gas and, as a result, more price spikes. Many see price volatility as one of the weaknesses of natural gas as a fuel source, but many industry professionals believe they have found an effective counterweight to that price uncertainty with the advent of hydraulic fracturing.

The process of hydraulic fracturing, or “fracking,” sends a high-pressure mixture of water and chemicals into dense rock formations to extract natural gas. Previously, these deposits had been inaccessible due to the expense of the process. New technology, however, has led to a dramatic increase in the available domestic supply of natural gas. Some estimates list a greater than 100-year supply in the United States that remains untapped.

Figure 2

Electrical Generation Capacity Additions by Fuel Type, 2010-2035 (Source: EIA Annual Energy Outlook, 2010)

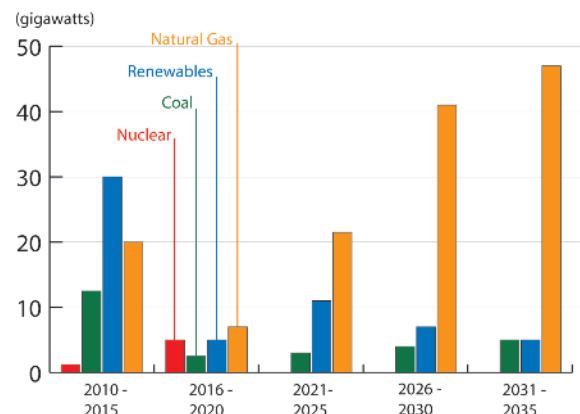
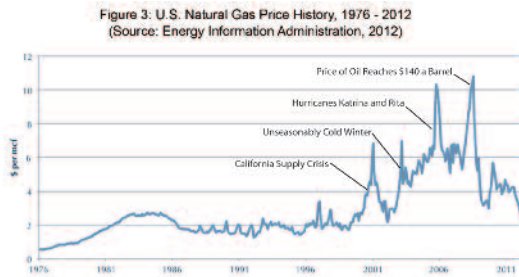


Figure 3

U.S. Natural Gas Price History, 1976-2012 (Source: Energy Information Administration, 2012)



Because the process is relatively new, fracking is largely unregulated at this point. Due to environmental concerns, however, the industry has faced some challenges. Recently, three cities in Colorado approved fracking bans in their communities. In California, Governor Jerry Brown ordered a year-long, comprehensive environmental review of the technique. In Bokoshe, OK, some residents have filed a class-action lawsuit against fracking companies, alleging pollution to drinking water as a result of the process.

Fossil-fuel sources face environmental hurdles, and natural gas is no exception. Ironically, the greatest liability of natural gas may not be related to environmental concerns at all, but, rather, to its own explosive growth due to the fracking phenomenon. For an industry that has experienced recent price volatility, the increased demand both domestically and overseas may trigger inflated prices.

Price increases may be the result of increased natural gas usage in transportation as well. The IEA predicts that natural gas usage in road and maritime transportation will rise to 98 billion cubic meters by 2018. This will comprise about 10 percent of the incremental energy needs in the transportation sector.¹² As the U.S. begins to export more quantities of liquefied natural gas (LNG), the threat of price volatility likely will increase — and it may be considerable.

“The combination of proposed exports and increased domestic demand could result in significant price increases,” says Dave Schryver, executive vice president of the American Public Gas Association. “It’s ultimately determined by how much natural gas is shipped overseas. This ongoing trend (of using more natural gas) in electricity generation is

going to continue, and the increased demand is going to have an impact on prices.”¹³

A Balanced Approach

Although the potential exists for higher natural gas prices, many large utilities remain undeterred. Last November, the Tennessee Valley Authority (TVA) announced plans to shut down eight of its coal-powered units. Additionally, TVA declared its intention to reduce usage of coal to 20 percent, roughly half of what it was in 2010.¹⁴ A notable exception to this declining trend, at least among the larger utilities, has been the Southern Company.

Based in Atlanta, GA, Southern Company is the fourth largest utility in the U.S. The firm uses a diverse mix of fuel sources, including the first nuclear power plants to be built here in more than 30 years. Southern Company’s comprehensive approach has earned it a reputation as being an energy innovator. More important, its broad energy program has helped to protect customers from the uncertainty of high fuel prices.

A profile of Southern Co., in *Electric Light & Power*, conveyed the importance of fuel diversity: “We must develop the full portfolio of energy resources, or all the arrows in the quiver — new nuclear, 21st-century coal, natural gas, renewables, and energy efficiency,” said Thomas Fanning, company president and CEO. “Fuel diversity helps us avoid becoming overly dependent on a single fuel source, helping protect our customers from the volatility of any one market.”¹⁵

While Southern Company has proven that a large utility can find success by using a fuel-diverse approach, what options do smaller plant owners have at their disposal? Like many large utilities, small plant operators face the same challenges that come with single-source fuel systems. Do viable solutions exist to lessen the effects of severe weather, supply constraints, and price fluctuations? In Part 2 of this series, scheduled for August APC, we’ll discuss the opportunities available to small plant owners and generators in planning for fuel diversity. **APC**

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