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Shale gas: An electric industry game-changer

Over the past several years, there has been a dramatic expansion in the supply of domestic natural gas from "unconventional" resources -- shale rock formations in North Dakota, the Gulf states, and, closest and most important to New England, the Marcellus shale, which lies 6,000 feet below large swaths of Pennsylvania, West Virginia, Ohio and New York.

Experts disagree about the potential size of total U.S. natural gas deposits. A 2010 MIT study suggested we have 650 trillion cubic feet of recoverable supplies, or 90 years' worth at present consumption rates, while a 2011 study for the Energy Information Administration estimated 750 trillion cubic feet -- more than a 100-year supply. Marcellus shale gas alone could extend our supply by almost two decades.

Dramatically increased gas supplies have resulted in dramatically reduced prices. The effects of low-cost domestic natural gas will ripple throughout the economy, from manufacturing to transportation to electric power generation, but the impact on energy production is already being felt.

Coal dominated U.S. electric power production for most of the 20th century and still accounts for some 45 percent of power production nationwide, with heavy concentrations in the South and Midwest. Until the last few years in New England, coal and nuclear have been the low-cost foundation of the region's "economic dispatch curve," meaning that nuclear and coal-fired generating plants have served as the region's "baseload" generating fleet.

Baseload plants are expected to run 24/7 throughout the year, except for scheduled maintenance. Although natural gas is considerably cleaner than coal - with no significant toxic air emissions and only half the CO₂ emissions of coal - coal plants have traditionally been dispatched before natural gas plants because coal units have historically had lower fuel costs and lower overall operating costs than gas-fired units.

Thus, gas plants have been higher on the economic dispatch curve, typically running "on the margin" - in other words, only when demand for electricity has exceeded the capacity of the region's nuclear and coal-fired baseload plants.

Within the last three to four years, ISO-New England's economic dispatch curve has been upended.

Due to lower natural gas prices, higher coal prices (reflecting global demand driven by China and India), and increased coal plant capital costs driven by stricter federal regulation of emissions from coal combustion under the Clean Air Act, gas-fired plants are now displacing coal plants as both cheaper and cleaner sources of electricity.

Gas now accounts for almost half of New England's electric power production, which has led ISO-NE to ask whether the region could become even too dependent on natural gas.

Increasingly, the region's coal plants are idle except when demand is relatively high, such as during winter heating and summer air conditioning seasons.

We have a good example of this phenomenon in New Hampshire. PSNH's coal-burning flagship units - Merrimack Station in Bow and Schiller Station in Portsmouth - have historically operated at very high "capacity factors" (80 percent to 95 percent of total hours per year), but now run continuously only during winter and summer periods when demand is high.

According to testimony in April before the state Public Utilities Commission, which is reviewing PSNH's five-year "Least Cost Integrated Resource Plan," average annual capacity factors for Merrimack and Schiller's coal-fired units have declined dramatically since 2008.

Capacity factors for Merrimack Units 1 and 2, which have traditionally been above 90 percent, are expected to decline to less than 50 percent in 2012, while the capacity factors for Schiller Units 4 and 6, which were at 80 percent in 2008, are expected to fall to 25 percent in 2012.

Effectively, PSNH's coal-burning units are no longer operating as baseload plants.

Meanwhile, New Hampshire's two independently owned gas-fired generating plants in Londonderry and Newington, which together can produce more than twice as much electricity as PSNH's coal-burning units, are running at or near baseload capacity factor levels.

Will natural gas prices stay low? No one knows for sure, of course, but industry experts expect they will not stay as low as they are today, for several reasons.

First, there is now such a glut that natural gas is being sold for less than it costs to produce it. Over time, prices will rise to cover costs plus a reasonable profit.

Second, the method of extracting shale gas (vertical drilling to reach the shale rock, followed by horizontal drilling within the shale rock layer combined with hydraulic fracturing or "fracking") is controversial because the water that is pumped into the wells at high pressure to crack the shale rock and release the gas includes traces of toxic chemicals, which many environmentalists fear could contaminate groundwater supplies above the shale rock. Although the industry maintains that "fracking" is benign, the EPA is now studying the issue, and there may well be some additional regulation of the extraction process at either the federal or state level, which will marginally add to cost and ultimately to price.

Third, as the U.S. and global economies slowly grow, prices of all fuel commodities, including natural gas and coal, are likely to rise.

All that said, industry experts expect that although the current historically low price of natural gas will rise gradually over the next few years, basic market supply and demand dynamics will keep gas prices low and gas plant economics favorable relative to coal.

According to a Nov. 7, 2011, Fitch Ratings summary, natural gas forward market prices suggest a steady but gradual rise from a little over \$4 per 1 million Btu (MMBtu) in 2012 to a little over \$5 per MMBtu in 2016. Over the intermediate term, analysts predict that gas prices will likely stay within a range of \$5-\$7 per MMBtu through the next 10 years.

Gas prices of \$4-\$6/MMBtu over the near term and \$5-\$7/MMBtu over the intermediate term are not likely to reverse the trend of gas displacing coal in New England's baseload generating fleet.

With additional environmental restrictions and operating costs, coal will not be able to compete with gas on economic terms. Thus most industry experts see increasing supplies and lower costs of domestic shale gas as a long-term trend, and a game-changer for the electric power industry, in New England as well as nationwide.

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