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The U.S. Natural-Gas Boom Will Transform the World

By John Deutch

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Two summers ago, natural gas cost \$4.50 per thousand cubic feet, which was less than half what it had cost two summers earlier. Today the price is under \$2.50, as unconventional natural gas production has increased to 20% of domestic supply from 5% in 2008, with 40% anticipated by 2020.

Meanwhile, North Dakota's Bakken/Three Rivers field produces 600,000 barrels a day of unconventional oil -- up from 250,000 barrels in 2010 and less than half that in 2008 -- making that state the second-largest U.S. oil producer. With such changes happening so fast, it's timely to consider their implications.

A United States hopelessly dependent on imported oil and natural gas is a thing of the past. Most energy experts now project that North America will have the capacity to be a net exporter of oil and natural gas by the end of this decade.

This new production depends on advances in directional drilling and hydraulic fracturing, the process that injects enormous amounts of fluid -- 90% water, nearly 10% sand, and less than 1% chemical additives -- into the ground below the water table, typically at depths greater than one kilometer, and laterally over distances of several kilometers.

To be sure, a North America independent of oil imports still isn't energy independent. The U.S. economy will continue to be subject to world oil prices, and supply disruptions in the world will still create price spikes. Close allies such as Germany and Japan will remain significantly dependent on oil imports from unstable regions, and their dependence will constrain U.S. foreign-policy choices.

Still, the security benefit of North America's new oil is significant. While this production will not be cheaper than conventional production from Saudi Arabia, the magnitude of North America's economically and technically recoverable oil resources (at, say, \$70 per barrel) is about 45 billion barrels, or 10% of the total North American oil in place.

This would exceed the magnitude available from the Middle East. Over time, it would yield a shift in global oil-market power from the traditional producers (OPEC, Russia) to consumers (such as Germany, Eastern Europe, China and India) that will benefit from the more diverse oil supply.

This revolution is not restricted to North America. Foreign activity lags behind, but during the past two years there has seen a surge of interest in shale and oil reserves believed to be in Europe (Britain, France, Poland, Russia), Latin America (Argentina, Brazil) and Asia (China, Kazakhstan, India). World-wide oil supply is likely to surge, accommodating demand growth and replacing depletion -- so that significant declines in prices are possible.

Demand for natural gas has not kept up with the phenomenal growth in supply. That's indicated by the extremely low current price and the thousands of recently developed unconventional natural gas wells that are shut-in. Unconventional natural gas production from "dry" wells (those that don't produce useful petroleum liquid products) is at a virtual standstill.

This signals that some recovery in North American natural gas prices is likely -- to the range of \$4 per thousand cubic feet, perhaps -- which would be welcomed by producers. Consumers who heat their homes with gas, and chemical companies and other manufacturers who rely on this raw material for producing petrochemical and polymers, should enjoy several decades of abundant supply.

It will take time for the demand for gas to grow, and it is uncertain how rapidly and how far it will. Incremental gas production will initially go the power sector, displacing coal-generating plants. Natural gas will offer the cheapest way to produce electricity, at six cents per kilowatt-hour -- more than 20% lower than new coal, nuclear or most renewable alternatives. Because of its low price, some natural gas will also be used to extract crude from Canada's oil sands. But the main question will be how much natural gas displaces higher-priced gasoline and alcohol fuels in transportation.

The historic ratio between the cost of natural gas and oil on an energy-equivalent basis -- one to six -- means that there is a tremendous economic incentive to develop new natural gas technologies for purposes including compressed natural gas vehicles, gas-to-liquid conversion, and methanol that could be used as a transportation fuel or blended into synthetic diesel fuel.

Then there's the potential for natural-gas exports from America, which is suggested by the massive discrepancy in prices between North America (\$2.50-\$4 per thousand cubic feet), Europe (\$10) and Asia (\$15). The U.S. government is likely to grant several export licenses for liquefied natural gas (LNG), but this promises to be politically controversial. If the U.S. takes a protectionist position, the North American gas market's integration assures that LNG will be exported from Canada and Mexico.

A critical point is the danger posed by public objections to hydraulic fracturing because of its environmental impact. Hundreds of thousands of wells will be drilled across the country, including in states unfamiliar with oil and gas activities, such as New York, Pennsylvania and Ohio.

The impact on air and water quality is significant. Above ground, the equipment needed to power drilling, fracturing and perforation emits pollutants that impair visibility and air quality. Production also yields significant amounts of water containing salts and dissolved organic compounds, which cannot be released into the environment. The venting of natural gas is a particular concern since methane is a potent greenhouse gas.

It's commonly said that the environmental impact is manageable with industry best practices and strong, independent regulation. Unfortunately, I do not yet see actions in the field that justify these statements of good intentions. Cooperation between the [Environmental Protection Agency](#) and state regulatory agencies, which share supervisory responsibility for oil and gas drilling on private lands, is strikingly contentious. Comprehensive air and water quality regulations are not set.

Industry should be commended for its initiatives to assure the public about its attention to environmental concerns, but industry leaders can go further. They should adopt a policy of measuring key environmental indicators such as water use and water composition throughout the process -- from initial acquisition to retention in lined surface ponds or tanks, disposition in deep waste water wells, re-use in subsequent fracturing operations, or treatment. The key is to gather performance data from the field, publicly disclose these measurements, and commit to continuous improvement as this industry grows.

Mr. Deutch, a professor at MIT, has served as undersecretary of energy, deputy secretary of defense, and director of the CIA. He serves on the board of directors of Cheniere Energy and previously sat on the boards of Schlumberger, [CMS Energy](#) and [Citigroup](#).

(See related letters: "Letters to the Editor: Natural-Gas Boom Still Leaves Unanswered Questions" -- WSJ Aug. 24, 2012)

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