Shale Development in Ohio:
Utica and Marcellus, Liquid Hydrocarbons and Gas

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26 October 2011

The National and Global Context

As explained in a companion paper,[1] the Natural Gas Policy Act of 1978 has had far-reaching ramifications for the U.S. energy sector. A direct result of the law was the creation of a nationwide market for gas, in particular due to the guarantee of universal access to the interstate pipeline system at rates approved by the Federal Energy Regulatory Commission (FERC). Deregulation, which few other countries have undertaken, subsequently encouraged energy companies to seek out and extract resources in new settings. Even more consequential has been the development and adoption of technology needed to exploit deposits formerly regarded as uneconomic.[2] By far the most important of these "unconventional" deposits are shale formations, which are the remnants of ancient ocean beds thousands of feet underground.

Shale formations, which contain enormous quantities of hydrocarbons, remained largely undeveloped as recently as 2001, when gas extraction from the Barnett "play" in northern Texas began. Since then, other deposits have been tapped, including the Haynesville in Louisiana and Arkansas and the Marcellus in Pennsylvania and neighboring states. Shale´s share of national gas output, which was little more than 4 percent in 2005, is currently approaching 25 percent.[3] Furthermore, all signs point to continued growth in shale gas output for decades to come – growth that will more than make up for decreasing supplies from conventional fields, on land and offshore.[4] So predictions of mounting gas scarcity, some dating back to the period when the NGPA was enacted[5] and others from just a few years ago,[6] are proving to have been off the mark.

As a rule, consumers benefit the most when resources become less scarce due to technological improvement, especially if the improvement is guided by market forces. In addition, the surest sign of diminished scarcity – not to mention the most tangible gain for consumers – is that prices fall. Certainly, the performance of U.S. energy markets is consistent with this general pattern now that gas extraction from shale has become significant relative to overall supplies. Since spiking above $10 per million British thermal units (mmbtu) in 2008,

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[1] Douglas Southgate, "Shale Development: Contexts and Consequences, National and Global," 25 October 2011.

[2] Examples of technological advances include improvements in hydraulic fracturing ("fracking"), which has been used since the late 1940s to extract hydrocarbons from impermeable geologic strata, as well as horizontal drilling, which is an alternative to the vertical boring that the oil and gas industry had relied on since its earliest days in places like Ohio and Pennsylvania. There also have been great strides in seismic reflection, which uses sound waves to locate promising resources with great precision, as well as micro-seismic technology, to guide hydrocarbon extraction from those deposits.

[3] The Economist, "The future of natural gas: Coming soon to a terminal near you," 6 August 2011, pp. 51-53.

[4] U.S. Energy Information Agency, Annual Energy Outlook 2011 with Projections to 2035 (Washington: 2011), p. 3.

[5] I.C. Bupp and Frank Schuller, "Natural gas: How to slice a shrinking pie," in Robert Stobaugh and Daniel Yergin (eds.), Energy Future: Report of the Energy Project at the Harvard Business School (New York: Random House, 1979).

[6] Associated Press, "Greenspan: Natural gas imports must grow," 27 April 2004 (http://www.msnbc.msn.com/id/4845905/ns/business-oil_and_energy/t/greenspan-natural-gas-imports-must-grow/).

when crude petroleum was being bought and sold for as much $146 per barrel, wellhead prices have remained low, never rising above $4 per mmbtu during the past three years.[7] And in the United States, which it must be emphasized pioneered the deregulation of gas prices and production as well as the technology for exploiting shale and other unconventional deposits, natural gas and oil markets have been decoupled. Since late 2008, the ratio of oil prices to gas prices consistently has stayed at elevated levels – levels not seen since the late 1970s and early 1980s, when petroleum values skyrocketed in the wake of the Iranian Revolution.

Challenges for the Natural Gas Industry

Needless to say, cheap natural gas is hardly the best of news for energy companies, which ironically enough are largely responsible for low prices by virtue of having invented or applied better techniques for exploration and extraction. Adding to their challenges is the sizable investment required to develop unconventional resources, especially shale. Whereas one million dollars or so must be spent to install a vertical well in Ohio, the up-front cost of a horizontal-drilling operation can be as high as $10 million.[8] Running expenses after a well is completed (i.e., ready for production) are also considerable.

Squeezed between low prices and up-front expenses, the natural gas industry also faces greater scrutiny from environmental regulators and organizations, not to mention the general public, as it taps into shale formations. Rarely if ever does fracking thousands of feet underground damage aquifers within a few hundred feet of the land surface, which provide water for many households and businesses. As a federal panel observes: "The risk of fracturing fluid leakage into drinking water sources through fractures made in deep shale reservoirs is remote."[9] However, hydrologic resources are adversely affected by surface spills of produced water, which comprises a mixture of fracking fluid[10] and the brine that comes out of shale along with gas and oil. Also, the concrete that encases wells is occasionally flawed, which creates the possibility of a direct release of produced water or hydrocarbons into aquifers. The odds of casing-failure may be small – smaller than the chances of a surface spill, for instance – yet the resulting costs can be much larger, in terms of obtaining water from other sources if aquifers have been polluted.

Facing a combination of low prices and sizable costs, including the expense of complying with regulations meant to contain environmental risks, natural gas producers are keen to expand into new markets. One option is to produce more electricity in gas-fired generators, as can be done with great efficiency.[11] Another is to run more fleet vehicles – for example, buses and mail trucks, which can return regularly to central facilities for refueling – on natural gas.

Other market opportunities exist beyond the U.S. border. Except for coal, this country has not been a net exporter of hydrocarbons for years. Yet foreign sales could outpace imports in the not-too-distant future if the shale gas industry continues to expand rapidly and if investments needed for the production of liquefied natural gas (LNG) are made.

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[7] Consumers are accustomed to volumetric pricing of natural gas, rather than pricing based on energy-content. However, this content varies, from 1.01 to 1.07 mmbtu per thousand cubic feet. A price of $4 per mmbtu is equivalent to $3.88 per thousand cubic feet for gas with 1.03 mmbtu per thousand cubic feet.

[8] Kleinhenz Associates, "Ohio's Natural Gas and Crude Oil Exploration and Production Industry and the Emerging Utica Gas Formation: Economic Impact Study," prepared for Ohio Oil and Gas Energy Education Program (OOGEEP), September 2011.

[9] Shale Gas Subcommittee of the Secretary of Energy's Advisory Board, "Ninety-Day Report," 11 August 2011.

[10] Primarily aqueous, fracking fluid also contains "propants" such as sand, needed to keep open the small cracks created by fracturing and through which gas and oil flow out, as well as chemicals in modest concentrations; many of these chemicals are not toxic, but others are.

[11] Matt Ridley, "The shale gas shock," The Global Warming Policy Foundation, London, 2011.

For companies that are highly specialized in the production of natural gas, however, the most promising adaptation to low prices is the diversification of output. The drive for diversification explains their presence in the Eagle Ford play of southern Texas. Along with "dry" gas (i.e., methane), which is suitable for heating homes and powering generators, this formation yields ethane and other natural gas liquids (NGLs), which the chemical industry uses as a feed-stock, as well as crude petroleum. Likewise, the interest of energy companies is substantial in the Bakken formation of western North Dakota, which is an important source of oil, as well as the portion of the Utica formation that lies under the eastern third of Ohio, which is expected to yield dry gas, NGLs, and petroleum.

Enter the Utica

No more than a year ago, expectations of shale development in Ohio focused largely on the Marcellus. But during the past few months, it has become clear that Marcellus-related drilling is unlikely to take place very far west of the state's borders with Pennsylvania and West Virginia. In contrast, drilling into the Utica is happening in a much larger area: around Canton, in the vicinity of Lake Erie, and even approaching Columbus's easternmost suburbs, among other places. In late July 2011, Chesapeake Energy, which is the second-leading U.S. producer of natural gas and has sunk more horizontal wells in Ohio than the rest of the industry combined, announced that shale deposits worth up to $20 billion underlie the 1.25 million acres it has leased in the state.[12] Since this announcement, articles about the Utica play in Ohio have appeared at least once a week in the local and national press.

Since moving gas from place to place is expensive, being able to tap into local supplies has important benefits. Mainly because of transmission costs, gas prices in Ohio used to exceed the reference-value in Henry Hub, in southern Louisiana. However, the price-gap, which was $1.00 per mmbtu or more in 2009, has declined by about half. This is because gas can now be obtained from nearby shale fields instead of being piped in from other parts of the country. Reliable, local supplies of affordable energy also diminish the need for storage capacity, which otherwise would be filled up during warm months when demand ebbs and then depleted when demand peaks during the winter. Moreover, local consumers are insulated from some of the variation in prices that occurs in national and international markets. They do not have to pay as much, for example, during episodes of spiking prices.[13]

Turning from dry gas to other hydrocarbons that will be extracted from the Utica play, Ohio's oil refiners look forward to complementing the crude petroleum piped in from Canada and coastal ports with local supplies. In addition, the chemical industry could experience a resurgence in the state if reliable supplies of energy and NGLs can be added to existing advantages – which include Ohio's central location and the state's hydrologic resources, which are important for navigation and as a source of process-water. According to one study, a new cracking plant, built for $3.2 billion on the Ohio River or one of its major tributaries and within easy reach of shale fields, would employ more than 2,400 workers. When all the additional business created by such a plant is taken into account, the overall impact on employment might exceed 15,000.[14] Industrialization resulting from shale development also will take the form of investment needed to meet the demand for tubular steel (used in wells and pipelines), increased orders for compressors and other equipment, and the like.

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[12] Dan Gearino, "Driller touts Ohio's gas and oil," Columbus Dispatch, 29 July 2011.

[13] Kleinhenz and Associates, op. cit.

[14] American Chemistry Council, "Shale Gas and New Petrochemicals Investment in Ohio," July 2011.

An Impending Shale Boom in Ohio: The Latest Evidence

Permitting data made available by the Ohio Department of Natural Resources (ODNR) underscore the importance of shale development in this state, particularly in the Utica play. According to figures released on 19 December 2011, five permits have been issued so far for vertical wells drilled into the Marcellus formation. Operations have proceeded at two of these five sites, mainly for the sake of resource assessment. Permits also have been issued for 11 horizontal wells penetrating the same formation. Actual production is under way at three of these locations and there is active drilling at another three. Practically all of the 16 Marcellus sites are on or close to Ohio´s border with West Virginia, in Belmont, Carroll, Harrison, Jefferson, and Monroe Counties.[15]

Although development of the Utica got a later start, more wells have been drilled, with a larger area affected. All told, 143 vertical and horizontal wells have been permitted. Horizontal drilling is taking place or has been completed at 22 of these sites in 18 counties: Ashland, Ashtabula, Belmont, Carroll, Columbiana, Coshocton, Geauga, Guernsey, Harrison, Jefferson, Mahoning, Medina, Monroe, Muskingum, Noble, Portage, Stark and Tuscarawas.[16] Moreover, initial results that Chesapeake released in September 2011 for three of its Utica wells demonstrate the formation´s importance – not just as a source for dry gas, but for NGLs and crude petroleum as well. Peak daily production consists of 3.1 million cubic feet (mcf) of gas and 1,105 barrels of liquids (oil and NGLs) at one of two wells in Carroll County and 3.8 mcf of gas and 980 barrels at the other. Peak daily output at another well, in Harrison County, is appreciably higher: 9.5 mcf and 1,425 barrels.[17]

At any oil or gas well, production drops from the initial peaks, sometimes very quickly. This is certainly true of horizontal wells drilled into shale formations, such as the Utica. But even if rates of decline turn out to be above the norm, initial results for the three wells demonstrate that Ohio´s gas and oil industry has embarked on a major expansion, which will have important ramifications within the state and well beyond its borders.

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[15] Ohio Department of Natural Resources, "Oil and Natural Gas Well and Shale Development Resources," http://www.ohiodnr.com/oil/shale/tabid/23174/Default.aspx.

[16] Ibid.

[17] Ohio Manufacturers´ Association Energy Management, "Initial Output of First Three Ohio Utica Shale Wells: Wow!" http://www.ohiomfg.com/communities/energy/.