Shale Development, Ohio Agriculture, and Natural Gas Utilization*

Hydraulic fracturing combined with horizontal drilling have unlocked untold volumes of oil and natural gas in deep shale formations – first in the United States, where the energy industry has taken the lead in this game-changing advance, and more recently in other parts of the world.

The impact on rural Ohio has been profound. In the eastern part of the state, hundreds of wells have been drilled into the Utica and Marcellus formations, with a thousand or more to follow. Pipelines have been or are being constructed within and beyond areas with active drilling, to carry the dry natural gas (or methane) used to heat homes and businesses and to generate electricity as well as the ethane and other natural gas liquids (NGLs) that the petrochemical and polymers sector transforms into myriad products. Rural landowners are reckoning with the consequences. Many of them have grown wealthy, thanks to the bonus and royalty payments received in return for the leasing of subsurface rights. All must deal with changes in the landscape as drilling pads, access roads, and pipelines are put in place.

For Ohio agriculture, shale development has another impact, one resulting from adjustments in the market for dry natural gas. As recently as 2008, gas prices in this country moved up and down with the value of crude oil and its derived products, such as gasoline and diesel fuel. Prices also spiked whenever hurricanes struck the Gulf Coast, where nearly one-fifth of this country's gas was produced before shale development began around the turn of the twenty-first century and where terminals for liquefied natural gas (LNG) imports are concentrated. But during the past five years, the markets for gas and oil have decoupled, with dry gas consistently changing hands for less than $4.00 per thousand cubic feet (MCF) in spite of swings in the price of oil – which currently exceeds $100 per barrel.

Inexpensive and reliably supplied from domestic sources, natural gas is getting another look from a variety of energy users. In the electric power industry, generating electricity from gas is cheaper than any of the alternatives, not only because of the low price of gas but also owing to the unmatched efficiency of gas-fired turbines. Also interested in fuel conversion are government agencies and private businesses with fleets of vehicles (e.g., city buses, delivery trucks, etc.) that can be re-fueled at a central facility during off-peak hours. Agriculture, which accounts for approximately 7 percent of all off-road use of fossil fuels in the United States, is another potential market.

Already, some agricultural operations in Ohio rely on natural gas. Greenhouses with a connection to the existing pipeline system are a case in point. Others will find it relatively easy to switch fuels, such as farms with propane-fired grain driers that are located alongside a gas line and can make a connection at a modest expense.

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Some of these farms might choose to retrofit driers so that either gas or propane can be used, whichever is more economical at any given time.

For operations that are farther from existing pipeline networks, fuel conversion requires a larger expenditure. Extending a gas line can cost up to $1 million a mile. Moreover, it is normal for agricultural demand for energy to fluctuate. For example, a lot of fuel may be needed to dry grain one year, but very little twelve months later due to limited precipitation during the fall. This fluctuation diminishes the economic attraction of extending the pipeline network.

Extensions in the pipeline network would not be required to run tractors, combines, and other farm machinery on gas. One option would be to operate mobile implements on compressed natural gas (CNG). However, that fuel's energy density is low, with a given volume of gas compressed to 3,600 pounds per square inch (PSI) containing approximately one-sixth the British thermal units (BTUs) of energy contained in an equal volume of diesel fuel. Furthermore, the only practical way to deliver CNG may be in canisters. If so, switching from diesel to CNG would require a series of adaptations and adjustments on the operator's part. For one thing, machinery would have to be retrofitted to accommodate canisters. For another, refueling would have to occur frequently (with full fuel canisters replacing empty canisters) during the peaks of planting and harvesting seasons, when tractors and combines stay out in the field for days on end. Frequent refueling would be a direct consequence of the low energy density of CNG.

Instead of CNG, LNG could be used to power farm machinery. LNG's energy density is about two-thirds the energy density of diesel fuel. However, liquefying natural gas costs is expensive, adding as much as $4 per MCF to the price of LNG. Distribution costs would be high as well. In addition, on-farm retrofitting would not be free.

Of all the farming areas in the United States, few are in as good a position as Ohio to benefit from the abundant supplies of affordable natural gas that are a product of shale development. With small and large cities scattered throughout the state and with a pipeline network that was extensive before shale development began and that is now expanding in response to shale gas extraction, many farmers in Ohio will find that the up-front costs of fuel conversion outweigh diminished expenditures on energy, so will continue to use diesel and other conventional fuels. But for other farmers, reduced energy expenditures will exceed up-front costs, thus favoring the switch to natural gas.