SERC*Note #4*

Shale Development, Ohio Agriculture, and Natural Gas Utilization

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The combination of hydraulic fracturing and horizontal drilling has 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" development, 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 hundreds 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. Farmers and other rural landowners are reckoning with the consequences. Many 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.

In the late 1940s and early 1950s, major manufacturers produced propane fueled tractors like this 1951 Farmall M for use in regions where the gaseous fuel was cheap and readily available. As shale drilling continues in several areas of the country, fuel prices and availability could warrant a revisit to offering farm equipment operated on compressed natural gas (CNG) or natural gas liquids like propane.

For Ohio agriculture, shale development has another consequence, one having to do with 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 U.S. gas production was concentrated before commercial shale development began around the turn of the twenty-first century and where terminals for liquefied natural gas (LNG) imports are located. But during the past five years, the markets for gas and oil have decoupled, with dry gas consistently changing hands for less than $5.00 per thousand cubic feet (MCF) in spite of swings in the price of oil – which in August 2013 reached $110 per barrel.

Inexpensive and reliably supplied from domestic sources, natural gas is getting a second, third, and fourth look from a variety of energy users. The electric power industry is the leading case in point; generating

electricity from gas is cheaper than any of the alternatives, not only because of inexpensive 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.

For some farmers, the switch to natural gas is easy. If for example a propane-fired grain drier is located alongside a gas line, a connection can be made at a modest expense. For a little more investment, the drier can be retrofitted so that it can run on either gas or propane, whichever is more economical. A larger expenditure is needed if the farm is outside the existing pipeline network. Extending a gas line, which can cost up to $1 million a mile, represents a significant economic impediment to fuel conversion for any operator who does not use energy in large quantities. However, local utilities or cooperatives might be able to extend service to a number of users simultaneously, thereby driving down up-front costs for each user.

Direct farm connections to pipeline networks would not be required to run tractors, combines, and other farm machinery on gas. One option would be to run 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 is in canisters. Accordingly, 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, the expense of on-farm retrofitting would have to be factored into decisions about fuel conversion.

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 created because of shale development. With small and large cities scattered throughout the state and a pipeline network that was extensive before shale development began, and that is now expanding in response to shale gas extraction, many Ohio farms will find that the up-front costs of fuel conversion are outweighed by diminished expenditures on energy resulting from that conversion.

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