Marcellus and Beyond

This column is presented weekly by the Public Education sub-committee of the Clinton County Natural Gas Task Force in an effort to provide accurate, up-to-date information on activities surrounding the Marcellus Shale formation and the natural gas exploration industry. For more information on Task Force activities, visit the Task Force page on the Clinton County government website at www.clintoncountypa.com.

The Marcellus Shale, by current estimates, is the largest unconventional natural gas field in United States and the second largest unconventional field in the world. The Marcellus is estimated to contain 489 trillion cubic feet of extractable natural gas from a formation that likely contains nearly 1.5 quadrillion cubic feet of natural gas. At 489 trillion cubic feet of extractable natural gas the Marcellus Shale ranks second only to a natural gas field in Iran.

Drilling for conventional gas and oil in the United States isn't new; it started in 1859 near Titusville, Pennsylvania. Conventional natural gas formations are generally found in some type of porous rock, such as sandstone, that will allow gas to flow with limited efforts to enhance the fracture network in the natural gas reservoir. Unconventional natural gas formations, like the Marcellus Shale, are rocks that tightly bind natural gas and require some form of reservoir enhancement to release the natural gas. Reservoir enhancement technologies use a variety of material such as water, nitrogen, propane, and Co^2, to form relatively small cracks in the rock that helps liberate natural gas. Based on current technology, some form of reservoir enhancement is required to enable unconventional shale natural gas formations to produce natural gas.

With the creation of new reporting requirements, we can now see a conservative estimate of how productive a Marcellus well can be. The estimate is conservative because many of the reporting wells are likely not producing at full capacity. During the last reporting cycle of July – December, 2010, the highest producing well in the state was in Greene County and had averaged over 19 million cubic feet of natural gas per day. Lycoming County had a Marcellus well producing 17.85 million cubic feet of natural gas per day, and Clinton County's top reporting well came in at 5.67 million cubic feet of natural gas per day.

To put 5.67 million cubic feet of natural gas in perspective, we can turn to information found at the United States Energy Information Administration (EIA). In 2007, the EIA estimated 56.68 million homes used natural gas for heating and 4.722 trillion cubic feet of natural gas was used for residential homes, indicating the average home with a natural gas heating system used slightly less than 100,000 cubic feet of natural gas per year. What we can learn from the EIA is the Marcellus well in Clinton County produced enough natural gas in just one day to meet the natural gas needs for between 45 to 65 homes for an entire year.

The level of production we are currently seeing from a Marcellus well is precisely why some geologists and engineers are talking about the Marcellus as the first of several potential shale

plays in Pennsylvania. An exploration and production company refers to the shale in Pennsylvania as a triple play of Marcellus, Utica and upper Devonian shale (Geneseo or Burkett). Likely, the Marcellus will drive natural gas development, but once natural gas infrastructure (well pads, pipelines, compressor stations, processing, etc...) is in place other shale formations will become far more economical to develop.

The developing story across much of Pennsylvania, eastern Ohio, New York, northern West Virginia, and southern Canada is rapidly becoming the Utica Shale. The Utica Shale formation is actually at least 2,000 feet deeper than the Marcellus. The Utica Shale is also thicker than the Marcellus and is anticipated to top more than 500 feet thick in some areas. Although the footprint of the Utica is similar or even slightly larger than the Marcellus Shale, it will likely have a different development footprint based on total depth, thickness of the shale and thermal maturity.

Thermal maturity is a representation on how Mother Nature has cooked the shale formation. A shale formation that has been undercooked will produce more oil, propane, butane, ethane, etc… with the methane (natural gas). When Mother Nature cooked a formation to perfection, we would expect to see the production of pipeline quality (dry) methane (natural) gas. Pipeline quality natural gas is what is found in the Clinton County Marcellus formation. When nature overcooked a formation, essentially all of the hydrocarbons (gas, oil, propane, etc…) are cooked-out of the formation and very little, if any, gas or oil will be produced.

Currently, most experts think Utica development will focus in western Pennsylvania and eastern Ohio. Early Utica wells drilled in eastern Ohio and Canada appear to indicate strong production potential. In fact, one well in eastern Ohio is reported to be producing more than 1.5 million cubic feet of natural gas per day leading to early speculation the Utica may meet or exceed the development potential of the Marcellus. For those interested in Utica development for Clinton County, the early indications are the Utica may be too far along the thermal maturity scale or overcooked, but far more geologic data is needed before any definitive statements on the potential of Utica in Clinton County or anywhere in the formation can be made. Much more Utica data will likely be available over the next several months.

The final ingredient in the Pennsylvania triple play is the upper Devonian shale. Generally, combinations of several thinner shale formations like the Genesseo/Burkett are lumped together when people discuss the upper Devonian shale(s). As an upper Devonian formation, these shale(s) are generally found just above the middle Devonian Marcellus. Similar to both the Marcellus and the Utica, the productivity of the upper Devonian shales will likely vary significantly across the state. To date only one company has reported drilling into the upper Devonian shale and the well has yet to report production results.

Until more exploration is completed on the triple shale play formations, especially Utica and the upper Devonian shale(s), many of the rumors will remain only rumors. There is clearly

momentum building for new shale exploration in some areas, especially the Utica, but not all shale will have the same production potential across Pennsylvania, nor will development be evenly distributed across Pennsylvania. More opportunities appear to be forming on the horizon, but more geological data is definitely needed. For more information on other shale development point your web browser to Marcellus.psu.edu or naturalgas.psu.edu.

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