Marcellus Shale and More: Layers of Gas-Bearing Strata Beneath our Feet

by Sue Smith-Heavenrich
Broader View Weekly, November 28, 2008

About 80 people filed into the auditorium at Newark Valley High School on Friday night, November 21 for a pair of informative programs hosted by the Tioga County Landowners Group. Nick Schoonover, founding member and spokesman for the group, opened the evening and explained the history of the landowner group. Later in the evening he presented a slide show illustrating "pitless closed loop" drilling.

Petroleum geologist Don Zaengle presented a lecture on the layers of rock beneath Tioga County. "Production in the Marcellus right now looks very good," Zaengle said, citing a recent recalculation of the amount of gas trapped in the shale. Earlier this month Penn State University scientist Terry Engelder told the press that he believes about 363 trillion cubic feet (tcf) of natural gas could be recovered over the next few decades from the nearly 34 million acres that make up the core of the Marcellus play.

Engelder's most recent figure is about seven times his earlier estimate of 50 tcf. "This puts Marcellus into the 'elephant class' of gas plays," said Zaengle. "It's huge!" But it's not just the Marcellus shale that gas companies are interested in. Zaengle listed a number of other gas-bearing strata beneath the surface: the tight sandstones including Oriskany, Herkimer, Oneida and Medina; black shales including Utica; and the Trenton Black River formation.

With so many potential gas-bearing layers under Tioga County, Zaengle said it is important for landowners who want to lease their mineral rights to be thinking long term. "For some of these formations you may see 20 years of production," he said.

Zaengle explained the differences between sandstone and shale formations. Both are sedimentary rocks, composed of layers of grainy particles deposited in layers and solidified under pressure. The difference is in the size of the grain. If you slice a piece of Oriskany sandstone very thin and stick it under a microscope, you can see the shapes of the sandy grains and the rather large spaces – or pores – between the grains.

The black shales are composed of clay particles, much tinier than sand particles. Clay particles are so tiny that if you could line them up it would take about 500 of them to encircle a sand grain.

Why is particle size so important? Because it is in the spaces between the particles – the pores – where the natural gas is trapped. Not only that, the smaller size of the clay particle affects how tightly it holds onto molecules of water – or gas. When extracting gas from rocks both porosity (the size of spaces between grains) and permeability (how tightly they are connected) is important. This is why Marcellus shale needs to be broken up, fractured, "fracked".

"The fortunate thing is that the Marcellus shale is brittle," Zaengle said. The shale is thin, easily broken, and leaves a black, powdery and slightly greasy residue on your fingers

when you handle it. That residue is what's left of ancient sea plankton – the stuff that died, fell to the sea bottom, and was trapped within the layers of clay. As it decomposed, it produced hydrocarbons – and there's a lot of it in the shale, Zaengle said.

Zaengle explained how technology has helped to make unconventional gas sources, such as black shale, more attractive to the energy companies. Accompanying his talk with slides, he walked the audience through the drilling process.

Nick Schoonover then took over to discuss one way that drilling companies could reduce overall water use and minimize the environmental impact on streams and land. The problem, Schoonover explained, is that conventional drilling, especially with the fracking, will require vast quantities of water, anywhere from 1 – 3 million gallons. A traditional well-pad has pits for storing both fresh water and the wastewater that comes back out of the well.

The water used for drilling must be trucked to the well site, requiring some 300 tanker loads. Then there's the wastewater – another 200 truckloads that must be trucked to a waste treatment facility.

At 60 tons per truck, that's a tremendous impact on local roads, Schoonover observed. He feels the solution is for companies to move to a closed loop system – one that provides mechanized and chemical separation of solids from liquids, allowing the water to be re-used.

The initial costs may seem high, but Schoonover believes the expenses will be offset by savings realized in less site preparation, a reduction in total water consumed, and reduced truck traffic. While he would like the DEC to encourage use of closed loop systems, Schoonover thinks it important to allow flexibility, as future technology may bring an even better solution to the industry.

"In fact, right now they are researching the use of nitrogen, instead of water, to fracture the shale," Schoonover said. Even so, a number of big energy companies, including Exxon-Mobile, Conoco, XTO, and Shell, use closed loop systems in their operations.

Read more about closed loop systems in the October 3 article archived online at http://www.tiogagaslease.org/broaderviewweekly.html