

PUBLISHED: JANUARY 30. 2011 12:01AM

# Times In-Depth: What is the Marcellus shale, and why is it so attractive now?

By VALERIE MYERS

[valerie.myers@timesnews.com](mailto:valerie.myers@timesnews.com)

The Marcellus shale is a vast underground rock layer known for more than a century to contain natural gas.

What wasn't known, until recently, is how to extract the gas from it.

With techniques learned along the smaller Barnett shale in Texas, drilling companies have been producing natural gas from the Marcellus formation in Pennsylvania since 2004.

"It's been work on the Barnett that's pushed the technology to where it's become profitable to extract natural gas from very impermeable shale," said Gary Lash, a geologist and director of the State University of New York at Fredonia's Shale Research Institute. "Now the Marcellus is becoming the classroom."

## Prospects

Lash and Pennsylvania State University geologist Terry Engelder helped spark the Marcellus gas rush in 2008 when they calculated that the formation contains a staggering 500 trillion cubic feet of natural gas -- more than 18 times the content of the Barnett shale, the formation currently leading the nation in natural-gas production.

Since 2008, Lash and Engelder have doubled their calculation to 1,000 trillion cubic feet. If only 10 percent of that natural gas could be extracted using current techniques, the Marcellus shale still would supply the nation for four years with gas valued at \$2 trillion, according to [Geology.com](http://Geology.com) estimates.

"Results that we're seeing indicate that the Marcellus is the real deal. Its potential for the extraction of natural gas is much greater than other formations, largely because it covers a much larger area," Lash said.

## Tapping in

In conventional natural-gas drilling, underground "pools" or "pockets" of gas are reached by a straight vertical shaft.

But two relatively new techniques are being used to extract Marcellus shale gas.

Hydraulic fracturing, also called "frac'ing" or "fracking," is a process of pumping water mixed with sand and chemicals

into the rock at high pressure until the rock cracks and releases natural gas. It takes about 1 million gallons of water to fracture the shale in a single Marcellus well.

A second method, called horizontal drilling, is used to access natural fractures across a layer of shale.

In horizontal drilling, a vertical shaft is drilled to within several hundred feet of the shale. From there, the bit is directed sideways to reach a range of fractures -- and more freed gas.

Horizontal shafts can be drilled in several directions from a single vertical well shaft.

What it is, and where

The Marcellus is an organic-rich layer of black shale formed about 385 million years ago, and today is located beneath portions of Pennsylvania, West Virginia, Ohio, New York and Maryland.

In northwestern Pennsylvania, the Marcellus shale is at the surface or not far below ground and in places only 20 feet thick. Generally, deeper and thicker layers of the shale contain more gas. It's why drillers so far are bypassing this area for other parts of the state.

The Pennsylvania Department of Environmental Protection in 2010 issued 3,314 permits for new Marcellus shale wells -- none of them in Erie, Crawford, Warren, Venango, Mercer or Lawrence counties.

In areas where the Marcellus is thicker and deeper, higher temperature and pressure have transformed organic content to oil and later to natural gas. And at greater depths, greater pressure holds the gas in place.

"When you drill into these deep intervals, the gas is heavily pressured and flows to the surface more easily," Lash said.

In southwestern and northeastern Pennsylvania, the shale is up to 9,000 feet below the surface and up to 250 feet thick -- and Marcellus wells are numerous.

"It's not likely that we'll see a lot of activity here for the Marcellus," Lash said of northwestern Pennsylvania and eastern New York. "But there are other black shales that there's been some interest in, and that interest may return when gas prices come back up."

Other shale prospects

The Utica shale, located below the Marcellus, is larger, thicker and could contain even more natural gas. Because it extends beneath the easternmost Great Lakes, offshore drilling in Lakes Erie and Ontario could be a possibility.

But while excitement about its potential is growing, little is yet known about the Utica's organic content and how it might react to current drilling methods.

"Though there's been some exploration of the Utica shale, it's largely unproven. We're still moving up the learning curve on that one," Lash said.

The Rhinestreet shale, located above the Marcellus, may be a more immediate prospect for natural gas in Crawford and Chautauqua counties.

"It doesn't have the amount of gas that the Marcellus has, but wells may be cheaper to drill and we may be able to fracture them with nitrogen, which gets around the whole water issue," Lash said.

New techniques and technology in use in the Marcellus "classroom" will continue to evolve and to reach more layers of shale, Lash said.

"Operators are becoming very good, very adept at extracting Marcellus gas. As techniques continue to improve, other shales should also become accessible," he said.

VALERIE MYERS can be reached at 878-1913 or by e-mail.