Pennsylvania's History of Oil and Gas Development

PIOGA
Pennsylvania Independent Oil & Gas Association

Pennsylvania has been a leader in the production of oil and natural gas, dating back to Col. Edwin Drake's well, drilled near Titusville. This first well was called "The Pennsylvania Start-Up that Changed the World" by a Forbes Magazine columnist in 2009. The state's independent oil and gas industry has provided tens of thousands of good-paying jobs and contributed billions of dollars to local economies for decades, while producing an indigenous source of energy.

(Photo courtesy of the Drake Well Museum)

The world's first commercial oil well was drilled in 1859 in Titusville, Venango County, and natural gas production in Pennsylvania dates back to 1881. Over the years, the industry has provided good jobs and contributed significantly to local economies while safely and successfully producing the crude oil and natural gas that is essential to our way of life.

Thanks to technological advances in finding and producing natural gas, Pennsylvania again is playing a key role in meeting the nation's energy needs. A rock formation approximately a mile below the surface known as the Marcellus Shale has become one of the world's largest natural gas fields, containing over 500 trillion cubic feet of natural gas. A significant portion of Pennsylvania is underlain by the Marcellus Shale, and drilling activity targeting this formation is taking place in more than 25 counties. A few thousand feet below the Marcellus is another formation called the Utica Shale that could ultimately become another huge natural gas resource for Pennsylvania, as could Upper Devonian formations just above the Marcellus.

The real story of oil and gas in Pennsylvania is much broader, however. Businesses ranging from small family operations up to huge multinational corporations drill for and produce crude oil and natural gas in about half of the state's 67 counties. Most of the crude oil comes from the counties of McKean, Warren, Forest and Venango in northwest Pennsylvania, with additional production in the counties between Butler and Greene in the southwest part of the state. Natural gas also is produced in a wide swath of Pennsylvania: draw a diagonal line from the very northeast tip of the state down to Somerset County in the southwest, and nearly everything north of that line is a part of the Commonwealth's gas- producing region.

In 2017, operators drilled 913 oil and gas wells. Of that total, 810 were in "unconventional" shale formations such as the Marcellus, while 103 were drilled in shallower "conventional" formations. Dating back to the commencement of shale gas drilling in the state in the mid 2000's, operators have drilled more than 11,100 unconventional wells, with 2011 being the year with the greatest number of wells at 2,090. Producers have steadily worked to improve the production capabilities of wells during those years of production, through a better understanding of the state's geology and the ability to drill longer laterals and improve completion techniques.

FAST FACTS

- **The world's first commercial oil well was drilled near Titusville, Venango County, in 1859, and the Haymaker Well, drilled in Murrysville in 1881, was the birthplace of the modern commercial natural gas industry. Once gas from that well was controlled, it was piped 14 miles to light streetlamps in the City of Pittsburgh.**
- **Pennsylvania had to import almost 75 percent of the natural gas it consumed each year from other states prior to the emergence of the Marcellus Shale. The Commonwealth now produces more than 20 percent of the natural gas needed across the country and is a net exporter of natural gas.**
- **The Pennsylvania Public Utility Commission estimates that the average household in the state saves $1,200 annually in reduced heating and electricity costs, thanks to the low cost of natural gas generated by producers in Pennsylvania and other Appalachian Basin states.**
- **Oil and natural gas have been extracted over the years from a variety of geologic formations in 34 of Pennsylvania's 67 counties, from the southwestern portion of the state to counties to the north and east, ending near the northeast corner in Susquehanna County.**

Here's a closer look at the Keystone State's oil and gas production:

- Natural gas. Producers operated in excess of 67,200 wells in 2017, delivering over 5.36 trillion cubic feet (tcf) of gas to the market, which is the largest amount of gas ever produced in the state. Pennsylvania became the second-largest natural gas-producing state in 2013 and has remained in that position since, lagging only behind Texas. Natural gas is used to heat homes and businesses, generate electricity, power vehicles ranging from transit buses to family cars, and by industries to create a wide variety of consumer products. Additionally, natural gas is being increasingly recognized as a clean-burning fuel. The U.S. Energy Information Administration reports that between 2005-2017, carbon pollution from power plants declined 14 percent due to the growing use of natural gas.
- Crude oil. Pennsylvania oil producers operated more than 7,100 oil wells in 2017 to produce over approximately 6.5 million barrels of Pennsylvania Grade crude oil. Penn Grade Crude is a superior quality, paraffin- based crude oil that is refined primarily into lubricating base stocks. Lubricants made from Pennsylvania Grade crude oil have been the choice of equipment manufacturers and consumers more than 100 years.
- Coalbed methane. Pennsylvania producers are also involved in developing coalbed methane resources in the state. Coalbed methane, the natural gas from underground coal seams, is an energy source that rivals conventional natural gas in composition and heating value. Coalbed methane is commonly used like other natural gas supplies for domestic, commercial and industrial fuel. There are approximately 1,000 coalbed methane wells in Pennsylvania.

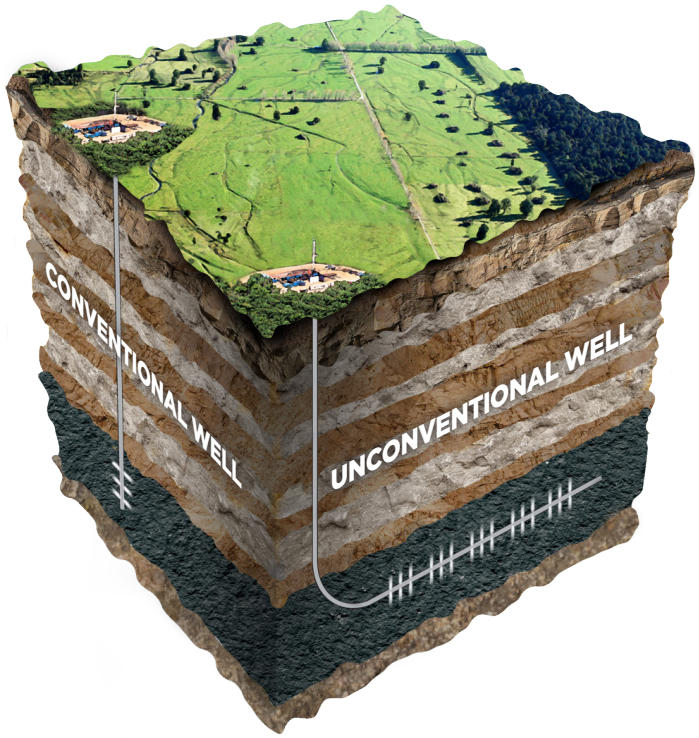
What is the difference between "conventional" and "unconventional" wells?

Pennsylvania law defines an unconventional gas well as a well drilled into a shale formation below the base of the Elk Sandstone or its geologic equivalent where natural gas cannot be produced by horizontal or vertical well bores except when stimulated by hydraulic fracturing. Essentially, these wells are drilled into a shale that is so dense that the gas trapped inside cannot be released except by cracking the rock by means of hydraulic fracturing.

A traditional, conventional well is usually drilled into a sandstone formation that can range from as shallow as 1,500 feet to as much as 21,000 feet deep. Oil and gas are able to pass through these formations without hydraulic fracturing, but nearly all wells are stimulated through fracturing to improve production. Conventional wells have been drilled vertically, although a few operators are experimenting with horizontal drilling techniques in conventional formations. An estimated 350,000 conventional oil and gas wells have been drilled in Pennsylvania over the years (most of which were plugged and abandoned as their useful lives came to an end), compared to the current total of more than 11,000 unconventional wells.

Conventional oil and gas wells can be found in parks and on public land, along highways, even in residential neighborhoods. A well pad cleared for a conventional oil or natural gas well is smaller than that of a deep well and requires a smaller drilling rig to drill vertically and reach the targeted formation. It typically takes less than two weeks to drill these wells, with a few additional days required to stimulate and complete the well. Since the number of fractures into the rock are fewer than those of a horizontal well, the scope of the well stimulation operation is not as significant and does not require as much equipment or water.

The average conventional gas well in Pennsylvania produces less than 13 thousand cubic feet (mcf) per day, compared against 2,000 mcf for the average unconventional well. A typical oil well yields about one-third to one-half a barrel or crude oil daily. Consequently, even though conventional wells cost a fraction of unconventional wells to drill, the lower production rates mean a smaller rate of return on investment. This translates into reduced profitability from these wells, and the influence that oil and natural gas commodity prices and other market forces have on their viability. If either the cost to drill these wells increases, or if the cost of oil and gas decreases, to certain levels, conventional wells become less viable.



(Information sources: US Department of Energy, Energy Information Administration and the Pennsylvania Department of Environmental Protection)