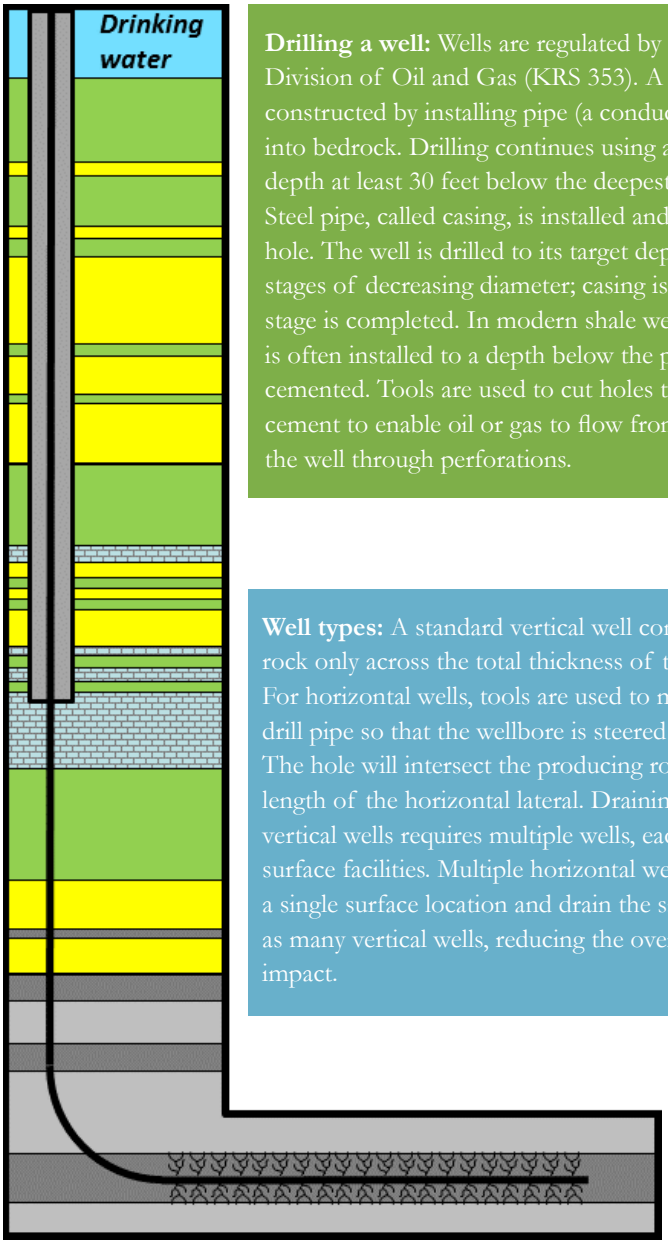
Hydraulic Fracturing in Kentucky

History

Pumping fluid under pressure (hydraulic fracturing) was first used in Kentucky in 1953 and used mixtures of crude oil and sand. Beginning in the 1960s, mixtures of water and sand were used in Kentucky shales, but shale absorbs water, causing it to swell, resulting in mostly poor production. Today, most Kentucky wells are fractured with nitrogen or a nitrogen foam mix if the treatment uses sand. A nitrogen foam frac requires only 2 to 4 percent of the 5 to 8 million gallons of water often used in large hydraulic fracs like those in the Marcellus Shale of Pennsylvania.



Drilling a well: Wells are regulated by the Kentucky Division of Oil and Gas (KRS 353). A typical well is constructed by installing pipe (a conductor) through soil into bedrock. Drilling continues using air or fresh water to a depth at least 30 feet below the deepest known fresh water. Steel pipe, called casing, is installed and cemented into the hole. The well is drilled to its target depth in one or more stages of decreasing diameter; casing is installed when each stage is completed. In modern shale wells, production casing is often installed to a depth below the producing zone and cemented. Tools are used to cut holes through the casing and cement to enable oil or gas to flow from the reservoir into the well through perforations.

Well types: A standard vertical well contacts the producing rock only across the total thickness of the perforated zone. For horizontal wells, tools are used to make a bend in the drill pipe so that the wellbore is steered into the reservoir. The hole will intersect the producing rock along the entire length of the horizontal lateral. Draining a reservoir with vertical wells requires multiple wells, each with its own surface facilities. Multiple horizontal wells can be drilled from a single surface location and drain the same reservoir volume as many vertical wells, reducing the overall environmental impact.

Background

Kentucky's shale-gas resource was first used as fuel for manufacturing salt from brines during the Civil War. In 2015, the shale resource accounted for more than 75 percent of the 192 billion cubic feet of combined natural gas and associated liquids produced in Kentucky.

Fracture stimulation

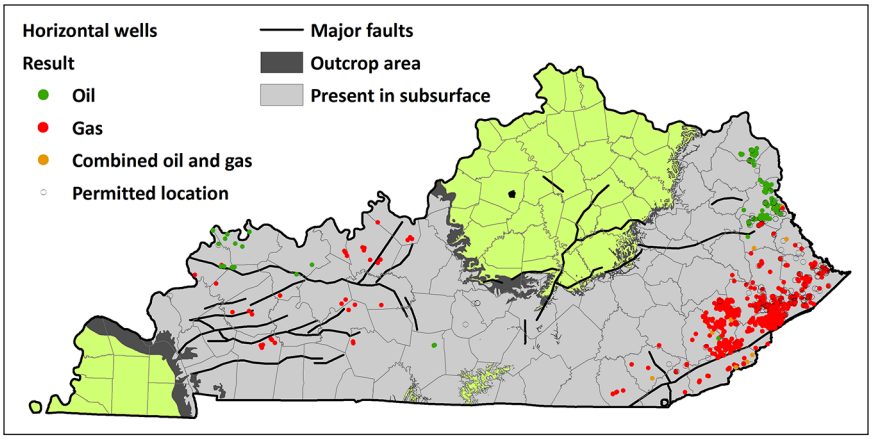
In shale, gas and liquids don't flow freely into the well. Pressurized fluids can be pumped into the rock to create fractures that increase the number of paths in the rock for gas and liquids to flow through. Sand is often pumped into the fractures and props them open after the fracturing fluid flows back to the surface. The Federal Safe Drinking Water Act prohibits discharge of the fluids collected during flowback. These wastewaters must be treated, recycled, or injected underground in wells that comply with U.S. EPA Underground Injection Control Class II regulations.

Hydraulic fracturing regulations

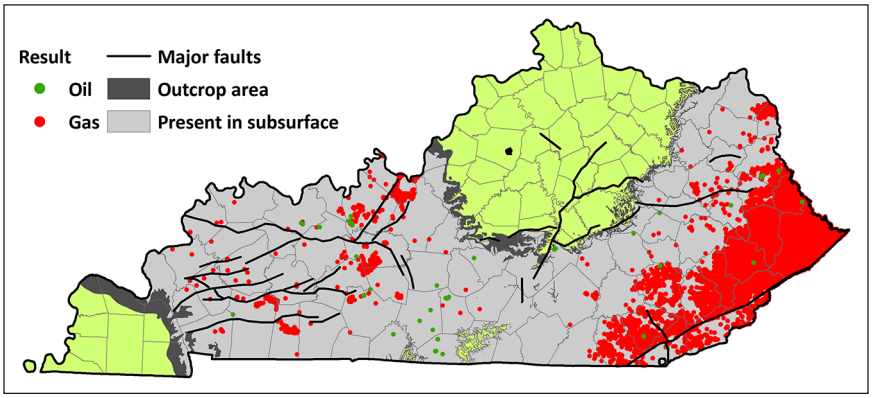
In Kentucky, fracking is regulated. High-volume hydraulic fracture stimulation is defined by state law as any treatment that uses more than 80,000 gallons of fluid in any stage or exceeds 320,000 gallons for all stages. Regulations require advance notification to the surface owner, baseline water-quality testing, post-HVHF water monitoring, and public disclosure of the chemicals used at FracFocus.org.

Kentucky Geological Survey

www.uky.edu/KGS



Horizontal wells drilled or proposed in Kentucky. Most are shale gas wells in eastern Kentucky. Recently, horizontal oil wells have been drilled in northeastern Kentucky.



Shale gas wells have been drilled in Kentucky for more than 100 years. Most are in the Big Sandy region of eastern Kentucky.

Underground sources of drinking water

Most drinking-water wells in Kentucky are less than about 500 feet deep. Kentucky's shale gas reservoir is typically deeper than 2,000 feet. The rocks between freshwater sources and gas shale often contain oil or brine or are reservoir seals that prevent migration of natural gas, nitrogen, or foam upward into water sources. Wells that are improperly cased and cemented or old can leak into water sources. Kentucky has a plugging fund to remediate problem wells when they are identified.

A recent study by KGS collected background water-quality information in a region of northeastern Kentucky with active oil and gas drilling and hydraulic fracturing. The study found most water wells exhibit biologic influences (microbial gas) and chemicals associated with shallow, natural water sources.

Earthquakes

Studies have found that most induced earthquakes result from underground injection of wastewater, not fracking. KGS has a closely spaced network of instruments to study earthquakes in an area with active drilling, fracking, and wastewater injection. The network has detected the demolition of a cooling tower, but no events associated with fracking or injection.

Search for oil and gas well data: kgs.uky.edu/kgsweb/DataSearching/OilGas/OGSearch.asp
Interactive oil and gas well map: kgs.uky.edu/kgsmap/kgsgeoserver/viewer.asp

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