

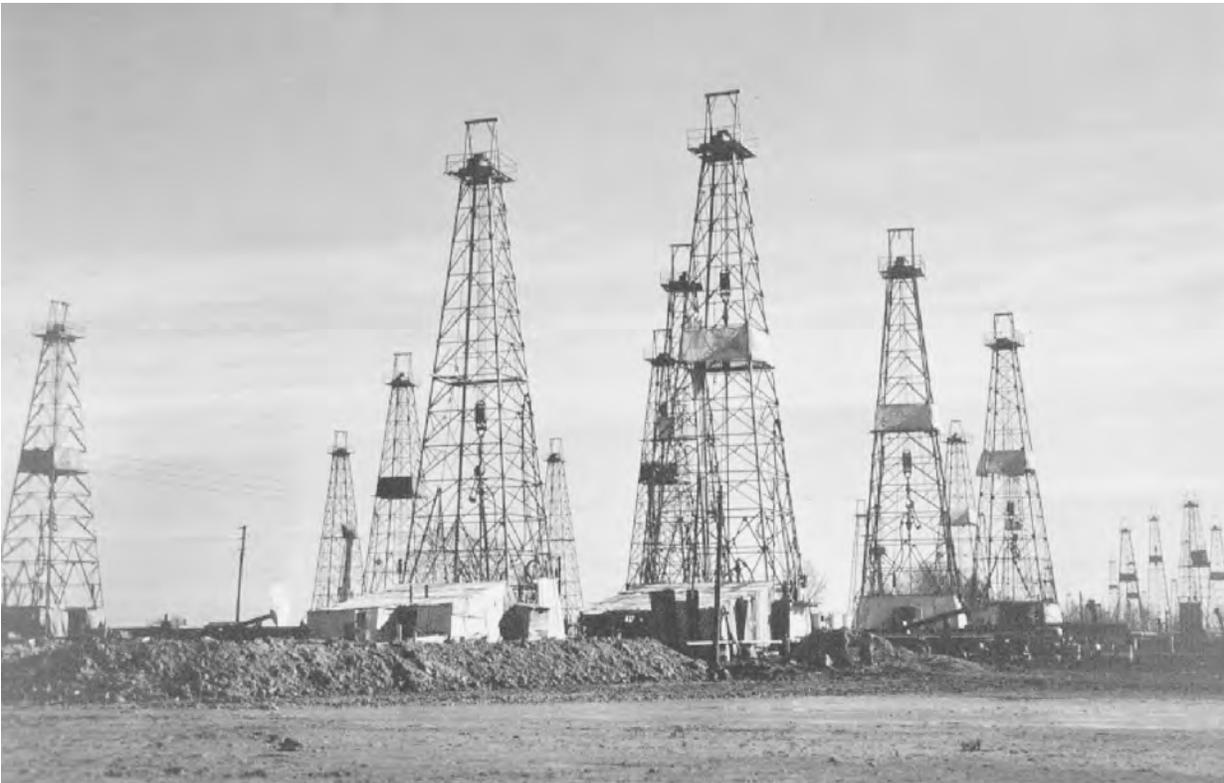
History of Oil and Gas Production in Illinois

The early days—Accidents and seeps

Oil or gas production in Illinois began in 1853 when marsh or drift gas was produced from two wells drilled near Champaign. This gas came from rotting vegetation buried in the glacial deposits. At the time, people knew little about where gas or oil came from, or how to search for it.

In the early 1860s, several holes drilled in Clark County produced enough oil for the name “Oilfield” to be given to a small town there, even though commercial-scale production in the area did not begin until 40 years later. The search for oil and gas began in earnest there in 1866 when the Clark County Petroleum and Mining Company established its headquarters at Marshall. Natural gas seeps near Oilfield led the company’s owners to believe that commercial quantities of oil and gas were there. However, because well casing technology did not yet exist, water from drilled-through upper layers of earth flowed into the wells and prevented most of the oil in deeper layers from seeping out of the rocks.

Farther to the west near Litchfield, holes drilled in the late 1860s to search for coal leaked oil and water into the workings of a mine, and for several years people skimmed oil off the water and sold the oil. By the early 1880s, natural gas had been discovered in the area and was being piped to Litchfield for domestic use. Continued drilling in the area eventually established oil production, and in 1889 wells produced 1,460 barrels. By 1902, when production ceased, the wells had produced only 6,576 barrels of oil. (The barrel equals 42 U.S. gallons and is a standard unit of volume measurement in the petroleum industry.)

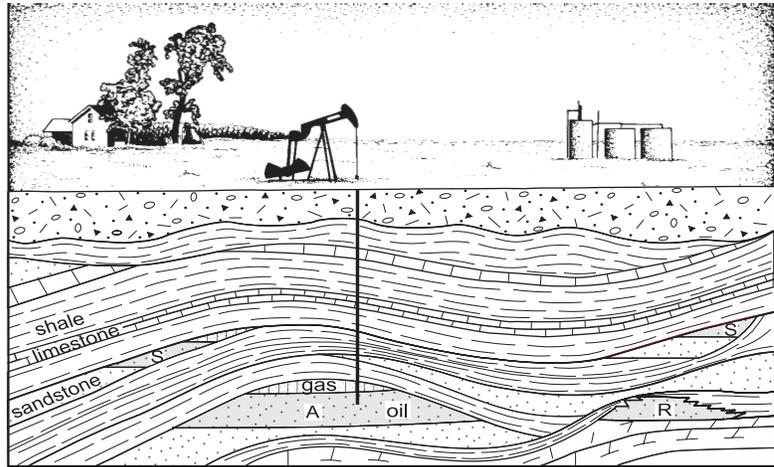


Salem Oil Field—1943, Marion County, Illinois.

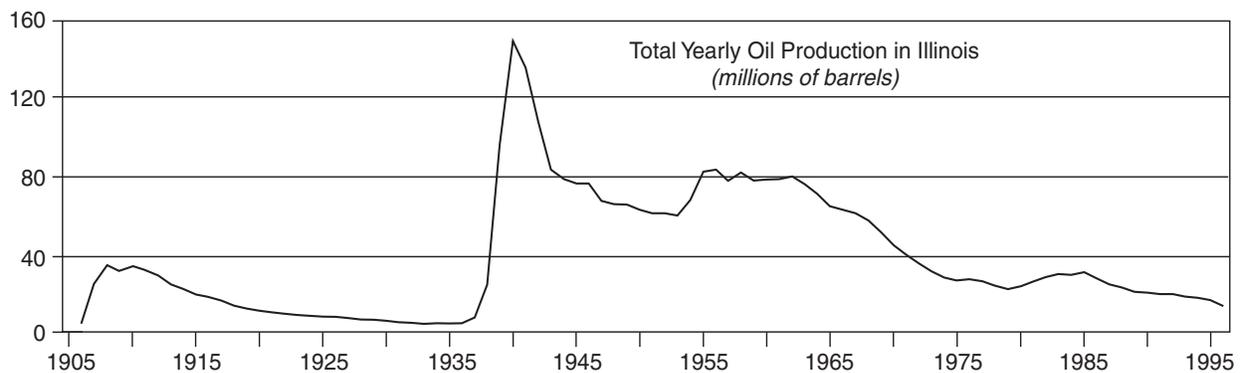
Technologies improve—Anticlines become targets

By the turn of the century, new well casing technologies solved the problem of water flowing into oil wells. Producers also now recognized that oil and gas collected at anticlines, or the crests of upwarps in the rock layers. From 1904 to 1910, numerous shallow oil and gas reservoirs were discovered in the many anticlines in a large structure now known as the La Salle Anticlinorium, which lies beneath eastern Illinois. With these discoveries, Illinois leaped to third among states as its annual petroleum production rose from 181,000 barrels in 1905 to 33 million barrels by 1910.

Yet by 1913, with all the easily discovered anticlines drilled, the heyday of the oil fields in Clark, Cumberland, Edgar, Crawford, and Lawrence Counties was essentially over. By 1936, with few new discoveries to replace fields already pumped dry, the state's total oil production had dropped to less than 4.5 million barrels.



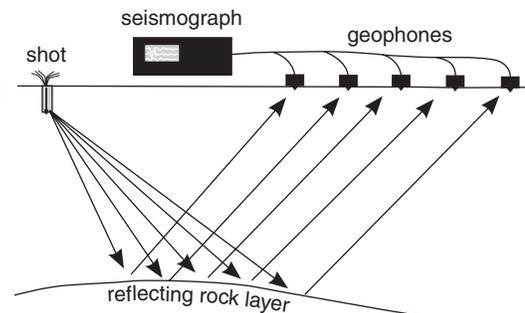
Impervious rocks like shale trap oil and gas in crests or upwarps of rock layers. Traps: A = anticline, R = reef, S = stratigraphic.



Seismic exploration—Sounding the depths brings an oil “boom”

In the late 1930s, a new technology called seismic exploration allowed geologists to find hidden anticlines—structures too deeply buried or too subtle to be found otherwise. Still used today, this technique uses sensitive microphones called “geophones” to record sound waves from ground-level dynamite blasts as they “echo” off the tops of the successive rock layers below. The echo data are then used to form a picture of the rock layers below.

With seismic exploration, hundreds of new anticlines and other types of oil traps were found and drilled in many areas of southern Illinois. In 1940, the state's total oil production rose to 147.6 million barrels, the largest in the state's history. Some of the largest oil fields—in area and volume of oil produced—were discovered in this period. These include the Clay City Field, which covers parts of Clay, Richland, and Jasper Counties, the Salem Field in Marion County, and the Loudon Field in Fayette County. Although intensive exploration with the



seismic technique continued during World War II, production declined after the 1940 peak as the size and number of new fields found each year fell. All the large and easily found targets had already been drilled, and even with the new technologies, the new fields being discovered did not hold enough new oil to replace the production from increasingly depleted old fields.

“Deflating the balloon”



Oil “gusher” from an old Ohio Oil Co. derrick, about 1910.

A familiar oil-well image is an uncontrolled “gusher” spewing oil high into the sky to rain down on the joyous drillers. Oil gushes because it is under pressure in the ground. In a reservoir, oil and water fill the open pores between the grains of the reservoir rock, much as a drink fills the spaces between ice cubes in a glass. The weight of all the rock on top of a reservoir applies pressure on the reservoir rock, as well as on the oil, water, and gas within it. When a well penetrates a reservoir, the pressure in the reservoir drives the oil and gas toward the lower pressure of the open well. As the oil or gas is withdrawn, reservoir pressure falls as the volume of oil between the grains of the reservoir rock is reduced. Somewhat like a balloon whose neck is opened, the reservoir gradually “deflates.” In some very large oil fields, this deflation has actually caused the land surface to subside. In some areas of Long Beach, California, for example, subsidence due to oil withdrawal exceeds 10 feet.

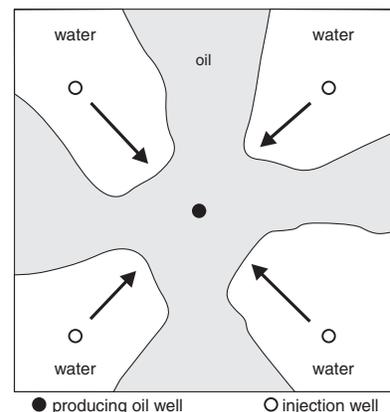
As the pressure in the reservoir falls, the flow of oil into the well slows to a trickle—and, eventually, to nothing. Oil produced under this natural driving pressure is the “primary recovery” or “primary production” of a field.

Squeezing out more oil—Fracturing rocks and sweeping up with waterfloods

Two new technologies developed in the 1950s let producers force more oil out of newly discovered and existing fields. In the first process, called hydraulic fracturing, powerful pumps at the surface inject a fluid, commonly with the consistency of a milkshake, into the oil-producing reservoir rocks. The pressure exerted by the fluid, is great enough to fracture the rocks around the well, and sand grains injected with the fluid keep the cracks propped open once the pumping stops. The newly opened fractures make the reservoir rocks more porous, and oil can flow more easily into the well.

In the second technique, called waterflooding, water is injected into the reservoir rocks to maintain reservoir pressure as the oil is withdrawn, and to sweep the oil out of the reservoir rocks and toward the well. In the most commonly used technique, the five-spot pattern, water is pumped into the reservoir rocks at four wells arrayed around a central producing well in an arrangement like the five dots on the face of a domino or die.

Using techniques to maintain reservoir pressure and drive the oil out of the reservoir rocks is called “secondary” recovery or production. With hydraulic fracturing and waterflooding, Illinois’ total oil production rose to about 82.3 million barrels in 1956, a peak from which it has been declining almost continuously ever since.



Water pumped into wells forces oil to the oil well.

The oil price roller coaster

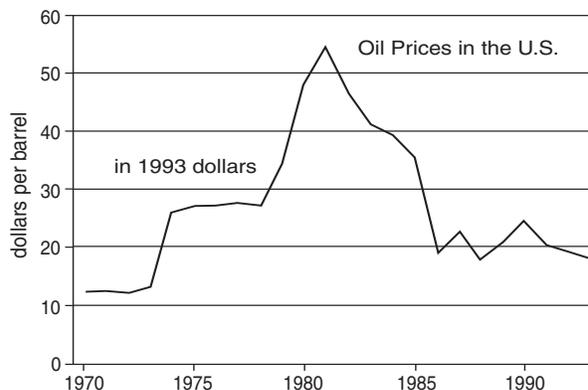
Since 1973, Illinois oil producers have confronted wide swings in oil prices due to world and national events. The price of oil in the United States nearly doubled during the 1973–74 Arab states oil embargo. To try to protect the economy from this shock, the government imposed price controls that lasted until 1978. When the controls were lifted, the price of crude oil more than doubled again to an inflation-adjusted peak of nearly \$55 per barrel in 1981.

In response to these high oil prices, Illinois' producers drilled many new wells, and production rose slightly in Illinois in the early 1980s. In 1981, however, an economic recession began, and increased energy costs caused a large decrease in energy consumption through efficiency improvements and conservation techniques. A major factor in this decrease in oil demand was the dramatic improvement in the fuel efficiency of U.S. automobiles.

By July 1986, reduced oil demand and major additions in supply, such as the North Sea oil field, had driven the price of crude oil down to about \$19 per barrel.

In 1998, the price of Illinois crude oil sank to less than \$9 per barrel, a level where many of Illinois' small, independent producers cannot make a profit. Because the price of oil is determined in world commodity markets, Illinois' producers must constantly seek ways of reducing their exploration and production costs and increasing the amount of oil they recover to survive in this highly competitive market.

The Illinois State Geological Survey works to assist this Illinois industry by studying the geology of Illinois' reservoir rocks, modeling the characteristics of reservoirs, advising the industry about new technologies that can solve production problems, and helping make exploration for new oil reservoirs more successful. In these ways, the ISGS is helping to sustain the oil production industry in Illinois.



Contributed by B.G. Huff and J.H. Goodwin

ILLINOIS STATE GEOLOGICAL SURVEY
615 East Peabody Drive
Champaign, IL 61820-6964
217/353-4747 FAX 217/244-7004



Released by authority of the State of Illinois 2004