

# Local gas play brings business and new technology

The Barnett Shale play is one of the most exciting and prolific natural gas plays in the U.S. It is centered in Tarrant County but encompasses more than 12 counties and extends south and west into Wise, Denton and Johnson Counties. According to IHS Energy production figures, total production from the Barnett Shale play from 1991 through October 2005 was 5.6 million barrels of oil and 1.6 trillion cubic feet (Tcf) of gas from 4,426 producing wells. Through November, the average daily gas production rate in 2005 in the Barnett Shale is approximately 962,263 million cubic feet (Mcf) per day and approximately 3,367 barrels of oil per day. There is an estimated 26 Tcf of gas recoverable in the play.

The Barnett Shale's status as a major gas play has attracted numerous operators, which until Shell Exploration and

Production entered the play last month, was largely limited to more than 80 independent operators, including Burlington, Antero (bought by XTO), Chief, Hallwood/Chesapeake, Encana and EOG. Shell's entry, when most other "majors" have exited the U.S. onshore, indicates the potential of the Barnett Shale. Two of the newest "hot" players include Quicksilver SW and Infinity.

Houston oilman George Mitchell was the first to explore the Barnett, and during the 1980s, his firm, Mitchell Energy (now part of Devon Energy), developed the technology to fracture or "frac" the shale reservoir as a means to stem declining production from traditional wells. Today, Devon is by far the largest operator in the Barnett Shale and accounts for more than half of the play's production.

Without Mitchell's innovations in "frac" technologies, which involves pumping large quantities of high-pressure sand, water, and other materials down a well to break open the unforgiving shale rocks that lock in the gas, much of these resources would still be uneconomic today, and it can be argued there would be no Barnett Shale boom.

The Barnett Shale is considered an unconventional reservoir because it is tight or impermeable and lacks visible pores to store oil or gas. Natural fractures boost the capacity of the Barnett

Shale reservoir. But past, so-called conventional drilling and completion techniques were not able to unlock the shale to yield commercial rates of production. In addition to fractured shales, coal-bed methane gas, tight sands and fractured carbonates are all considered unconventional reservoirs. Many unconventional reservoirs have been known to contain oil or gas but were bypassed in favor of easier-to-produce conventional finds.

Much of the 'low-hanging fruit' has already been picked from conventional U.S. fields. As a result, operators are looking at unconventional reservoirs to help meet growing U.S. demand for energy. Three important elements have transpired to give the Barnett Shale and other unconventional reservoirs new life — improved fracturing techniques, horizontal drilling and sustained higher gas prices.

One of the most exciting developments in technology has been the improvements in fracturing techniques. Before 1991, approximately 500,000 pounds of sand were required to frac a well, which made the process very expensive. During the late 1990s, operators started using a gel or slick-water frac technique, which enabled the amount of sand used to be reduced considerably and cut completion costs per well by approximately 70 percent. As an unexpected, but positive benefit,

enhanced frac technologies allowed operators to boost apparently depleted conventional Barnett wells to their original production volumes while also decreasing original production-decline rates. As a consequence, operators essentially were able to "reset the clock" on their original conventional wells and to substantially increase the expected ultimate recoverable volume of gas from each well.

Today, operators have continued to decrease the amount of sand used and are moving from gel fracs to cheaper water fracs. They've also begun to apply fracs in stages to isolated zones in the Barnett reservoir. Staged fracs are more effective in increasing fractures and boosting flow rates across the span of the Barnett reservoir, thus increasing production and profits.

Another important technological innovation and a key to success in unconventional plays has been the use of horizontal drilling. Horizontal bore holes penetrate laterally through the reservoir, which results in a larger amount of the well bore coming in contact with the reservoir rock. Just like a fishing net that has been cast over a wider surface of the water is likely to catch more fish — a longer, horizontal well drilled across rather than through

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the shale reservoirs can mean more gas or oil is drawn into the well. Currently, 1006 or 22 percent of the 4,441 producing wells in the Barnett Shale are horizontal.

And today, the use of micro-seismic (imaging) techniques allow geoscientists and engineers to analyze the path of a fracture and monitor a frac in progress, which increases their ability to maximize results of the frac process.

As this amazing Barnett Shale play continues to expand, using production and well history data from IHS Energy's comprehensive U.S. database enables us to identify potential new unconventional plays throughout the Mid-continent

region. An analysis of hydrocarbon "shows" (minor indications of oil or gas during drilling) provide evidence that hydrocarbon-rich shales, similar or equivalent to the Barnett Shale, extend into west Texas, Oklahoma's Anadarko Basin and the Arkoma Basin in eastern Oklahoma and western Arkansas. These once bypassed unconventional opportunities are now likely to be given a second look as Americans continue to demand more oil and gas.

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