Tight Gas Sands

It has been estimated that total amount of natural gas in the United States may exceed 15,000 trillion cubic feet. Although the total resource is immense, the size, location, and quality of the individual occurrences vary. Some of the more extensive and accessible resources are found in tight gas sands, which are sandstone formations with very low permeability (less than 0.1 millidarcy).[1]

Tight gas sands are continuous reservoirs, in contrast to the discrete reservoirs that have provided most of the oil and gas production since the first well was drilled in 1859. Other types of continuous reservoirs are methane-producing coal beds and the Devonian Shale reservoirs of the Appalachian and Illinois Basins. Tight gas sands reservoirs occur in different types of rocks than the other continuous reservoirs, and their permeability is much lower.

Exploration for tight gas sand reservoirs differs from conventional gas exploration in that tight sands are continuous, consisting of stacks of sedimentary layers that are charged with oil or gas, much as an aquifer is charged with water. Conventional reservoirs have much more confined boundaries and are in contact with water, which is not the case with continuous reservoirs. Also, most continuous reservoirs are charged with gas, rather than crude oil.

The fact that a tight gas sand reservoir is continuous does not mean that a well drilled into any point in the reservoir will be as productive as a well drilled into a different point. There are *sweet spots,* where wells will have more productivity.

Finding sweet spots is crucial, and exploration teams use a range of sophisticated tools, including 3-D surveys (seismic, gravity, and magnetic), specialized wire line logs, conventional and sidewall cores, and reservoir engineering data. High gas prices and new technology have stimulated development activity in tight gas sands, resulting in production of around 2.5 trillion cubic feet of gas per year. This is about 13% of total gas production in the lower 48 states.

While some continuous reservoirs are relatively near surface, many are located at great depths: 15,000 to 20,000 feet. Drill teams use rotary rigs, as in conventional reservoirs. When drilling is finished, a reservoir will be *completed*: stimulated by hydraulic fracturing to enlarge existing natural fractures and create new ones, thereby increasing the production potential. Although drilling with techniques such as coiled tubing and down-hole hydraulic drill-motors has reduced the time and cost, drilling and completion costs are still very high. A typical well in Colorado's San Juan Basin may cost $800,000 to drill and $2 million to complete.

Spacing between wells decreased as knowledge was gained about how reservoirs produce. At one time, there might be only one well for each 640 acres of surface. Today, companies seek permits to drill one well for each 10 to 20 acres. High well density can disturb the surface owners and raise environmental concerns. Some operators avoid these issues by drilling several wells from one pad, thereby reducing visual pollution and impacts on the land.

[1] The millidarcy is a unit of measurement related to the ability of a fluid to pass through a porous medium. The degree of permeability depends upon the size and shape of the pores and the size, shape, and extent of their interconnections.