The Barnett Shale in the Fort Worth Basin – a Growing Giant

By Gene Powell, Editor, *Powell Barnett Shale Newsletter*© February 24, 2008

It all began when Mitchell Energy began flowing natural gas from the C. W. Slay #1 well in Wise County, Texas, 17-miles northeast of downtown Fort Worth in June, 1981. That first producing well began the saga which has developed into the biggest gas field in Texas and the 2nd biggest gas field in the country, and it is still growing. George Mitchell deserves, and has received, all the credit for the 'finding' and early development of this giant gas field.

How big has it become? When final production figures are calculated for 2007, natural gas production for the year will be 1.08 trillion cubic feet from about 8,500 active wells and total production of 3.6 trillion cubic feet of gas from about 9,000 total wells. Daily production in January, 2008, is estimated to be 3.7+ billion cubic feet of gas from almost 8,800 active wells. The Barnett Shale formation covers 20 counties with production and 5,000+ square miles. New well development is not slowing down with 195 drilling rigs running in 18 active counties as of February 1, 2008.

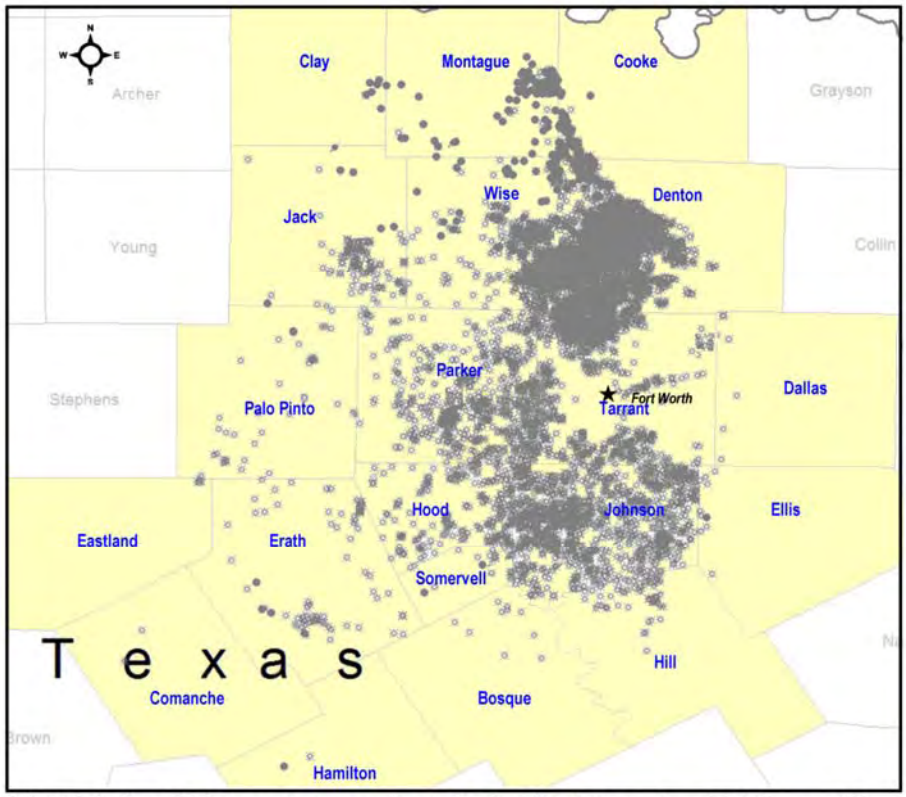

Figure 1. Barnett Shale producing counties in the Fort Worth Basin, Dec. 2007 Source: IHS

Counties with the most productive initial gas flows are Tarrant and Johnson. Fort Worth is the center of Tarrant County and the thickness of the shale under Fort Worth is about 375 feet. Some experts believe that the best quality rock lies beneath the Tarrant County Courthouse in downtown Fort Worth.

So how to drill under downtown of a large metropolitan city? Development of the technology of drilling and completion of the Barnett Shale changed from vertical wells to horizontal wells in 2002. Production of the wells, beginning in 2003, showed big improvements by combining horizontal wells and multi-stage fracturing of the formation with large amounts of fresh water 'slicked' by surfactants and combined with sand, as a proppant. This changed everything in the Barnett Shale development. Currently, 85% of all wells being drilled in the Barnett Shale are horizontal wells.

Under Fort Worth, the top of the Barnett Shale is about 1.5 miles deep. A horizontal well is drilled vertically then the bit at the end of the drill collars turns, guided by computers using GPS, and begins a 90° curve toward drilling horizontal to the earth's surface. It takes approximately 500 feet to go from vertical to horizontal. Once reaching horizontal, the lateral then is drilled up to a mile or more in length. Recent research indicates the optimum length for horizontal laterals may be about 3,500 feet. While drilling horizontally, a computer guides the motorized drill bit using GPS with gamma ray readings being sent continuously to the surface. The gases in the drill cuttings are being measured as they are received at the surface. Those gases are measured by chromatograph. The gamma ray and gas content are used to 'steer' the drill bit to stay in the richest portion of the shale while drilling.

Wise and Denton counties, to the north and northwest of Tarrant County, are the other two big Barnett Shale producing counties, primarily because they have more wells than any other county. The larger majority of the wells in these two counties are vertical as this was where the shale was first developed and vertical was the rule back then.

In Texas, the mineral estate is separate and takes precedence over the surface estate. In oil and gas producing counties in Texas when you buy a home or property you are considered fortunate if you are able to receive a percentage of the mineral rights. Tarrant County only had a few wells, in the far western part, prior to 2000. The gas production results of the new technology developed in 2003 were not year known and being used in 2000. Only a very few savvy persons retained their minerals in Fort Worth, Arlington or anywhere in Tarrant County that sold their property prior to 2003. This has resulted in almost every homeowner in the county owning their minerals. Today, if you buy or sell a home in Tarrant County, negotiation can be more about the value of the minerals than the home.

Minerals could be leased in Tarrant County in 2003 for a signing bonus to the mineral owner of about $150/acre and a royalty ranging from 12.5% to 18.75%. This past year, the city of Fort Worth bid one six acre tract, south of the city, for a lease signing bonus of $23,511/acre and a 26% royalty. Homeowners in the cities and towns are using neighborhood associations to negotiate leases for individuals in the neighborhood to sign. This has created competition among the exploration companies and raised the offers to homeowners. Individual homeowners in one neighborhood, through their homeowner association, negotiated a $15,311/acre lease signing bonus with a 28% royalty last fall. Another association has negotiated a lease signing bonus of $17,000/acre plus 25% royalty.

How does this affect the average homeowner in a city like Fort Worth or Arlington? The average homeowner owns an estimated .22 acres. When the gas lease is signed, the homeowner would receive a check at the lease signing of $3,740. The amount each month from each gas well in the unit in which his minerals are placed has several variables which affect the estimated amount. A recent study[1] estimated the income for an average homeowner in Tarrant County last

[1] Tarrant County Barnett Shale Gas Well Estimates, *Powell Barnett Shale Newsletter*, October 15, 2007, pp. 4-10, http://www.barnettshalenews.com

fall. It estimated a gross income of $15,591 with a net income, after state gas severance production tax and ad valorem tax, of $13,985 over thirty years. One third of the income would be in the first three years. These estimated amounts would be per well and total income would depend on the number of wells in the drilling unit and any refracturing.

The development of the Barnett Shale is moving to seek its commercial well limits. It is known that somewhere in Dallas County, east of Fort Worth, there is a geological structure named the Ouachita Overthrust. The Ouachita Overthrust sets the eastern boundary of the known productive Barnett Shale. Such an overthrust buries any subthrust shale very deeply and it may be too deep or altered to yield productive shale gas.

Drilling wells, to the east, will find where commercial Barnett Shale ends. Development east into Dallas County has started with 47 wells drilled at the DFW International Airport in extreme NE Tarrant County and NW Dallas County with another 250+ planned for the 18,000 acre airport. In west central Dallas County other wells are being drilled under the Lone Star Park Racetrack in Grand Prairie. Development in also ongoing in counties northwest, west, southwest and south of Fort Worth where the Barnett Shale thins to as little as 75 feet thick in the far outlying counties but may contain the same rich gas.

Drilling status in the city limits of Fort Worth finds 675 producing gas wells and 1,044 drilling permits. Fort Worth has issued 75 well drilling permits for wells classified as 'high impact', within 600 feet of a habitable structure. Wells are also drilled under churches, parks, lakes, rivers, golf courses, etc. Once a drilling unit pad area is established, as many as 30 wells may be drilled horizontally in all directions from about 5 acres of land and gas produced from leased mineral acreage.

Fort Worth is on the forefront of all U.S. cities adopting a set of drilling regulations that allow for drilling and production while insuring safety and protecting the high quality of life for its citizens. Other cities and towns have adopted many of their ordinances. Meeting all those current drilling ordinances increase well costs an estimated $200,000 - $300,000 per well. Availability of more drilling rigs and, most of all, drilling efficiency and new fracturing techniques have slightly dropped the estimated cost of a horizontal well in Fort Worth to about $2,750,000 - $3,000,000 per well to production. Some wells have cost up to $4,000,000 in the city.

Barnett Shale gas production continues to grow beyond the predictions. U.S. Geological Surveys (U.S.G.S.) estimates the future productivity of natural gas fields. The U.S.G.S. predicted in 1996 that the Barnett Shale in the Fort Worth Basin would produce 3 trillion cubic feet (TCF) of recoverable gas. Development increased this number to 26.2 TCF in 2004. The Advanced Resources International Inc., in a study for the Energy Information Adminstration's 2006 Energy Outlook in March, 2007, increased that number to 39 TCF[2]. It will be increased again when the U.S.G.S. does their next study. We made a prediction for a Canadian research firm in 2003[3] that

[2] Bigger In The Barnett by Gene Powell, Oil & Gas Investor, An Investor's Guide To SHALE GAS, January, 2007 pp 12-13 http://www.oilandgasinvestor.com/pdf/ShaleGas2007.pdf

[3] Barnett Shale Commentary From A Slightly Contrarian Perspective by Gene Powell, The O.I.L. Fort Worth Quarterly Letter, Oil Information Library of Fort Worth, Vol. 4.4, October – December, 2003

the Barnett Shale in the Fort Worth Basin would have a commercial life of 80 to 100 years and produce 94 trillion cubic feet of gas. New estimates are getting closer to our numbers each time they are recalculated for the field.

Today's focus is on urban drilling and production in the Fort Worth metropolitan area. The exploration companies continue to comply with the increasing requirements of the drilling and production ordinances. It has been a 'fine line' for the Fort Worth City Council, led by Mayor Mike Moncrief, to maintain. A safe and clean environment for its citizens is priority #1 but must be balanced with each homeowner's right to execute a gas lease with an exploration company to develop and produce the natural gas. Noise levels have been drastically reduced due to sound barriers, new types of quiet drilling rigs, and other measures taken by the exploration companies to be good neighbors. The same effort has been made in lighting of the rigs and production facilities at night so as not to be annoying. Landscaping of the production facilities is a requirement so the wells and facilities may blend into the environment. The current revised Fort Worth regulations went into effect in June, 2006 but a new Gas Drilling Task Force has been formed to review the current drilling ordinances in Fort Worth for further revisions.

Mayor Moncrief outlined, in his State of the City address February 13th, what he saw for the city and and its residents beginning with the observation that the *"Barnett Shale presents both extraordinary opportunities and extraordinary challenges"*. The mayor also talked about the challenges, especially trying to balance the economic benefits of gas drilling while not harming the quality of life for the city's citizens. *"In short, citizens want to realize the benefits of their minerals, but they aren't willing to do that at the expense of their community." GP*