

HAYNESVILLE SHALE GAS PLAY AND LOUISIANA COAL SEAM NATURAL GAS

by
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Coal seam natural gas (CSNG, known also as coalbed methane, or CBM) and shale gas development in northern Louisiana is taking off. Both have been identified and are being quantified in a large part of the state.

What they have in common is that the gas is trapped in a formation which is not porous. The coal beds are a sub-bituminous coal laid down in the Tertiary period between 2 and 50 million years ago, containing biogenic natural gas of high purity, greater than 98% CH₄. Biogenic methane is a waste product from certain bacteria that “eat” the carbon and release methane which is then adsorbed on to the coal. When the co-occurring water is removed from the coal, the gas is released. The water has to be pumped out and then is re-injected to a different strata. Shale is a rock formation mainly composed of consolidated very fine clay particles deposited and buried more than 170 million years ago during the Jurassic geologic time. It is characterized by ultra-low permeability compared to the conventional sandstone/limestone reservoir rocks that have high permeability. Shale methane is also of biogenic origin but may not be as pure as found in CSNG.

What is different about the two? CSNG is found at relatively shallow depth, 2500 to 4500 feet, while the shale deposits are much deeper, 10,000 to 14,000 feet. This obviously makes the shale deposits more expensive to produce, at least ten times more. CSNG underlies 70 or more percent of the state, while the gas bearing shale has only been found in the north west corner to date. Both require horizontal drilling and fracturing (“fracing”) of large areas of the formation to release the gas in economical quantities.

What do these discoveries mean to Louisiana in 2008 with natural gas selling for upwards of \$10 per thousand cubic feet (mcf)?

- The state receives royalties from the production which reduce the need for increased taxes.
- Each drilling rig operating means about 184 employees with high paying jobs.¹
- Chemical plants will still have locally available raw materials which means retaining good jobs.
- Land owners will receive lease payments that will go back into the local economy.
- Natural gas will continue to generate electricity and heat homes.

These are just some of the reasons to be interested in these natural resources.

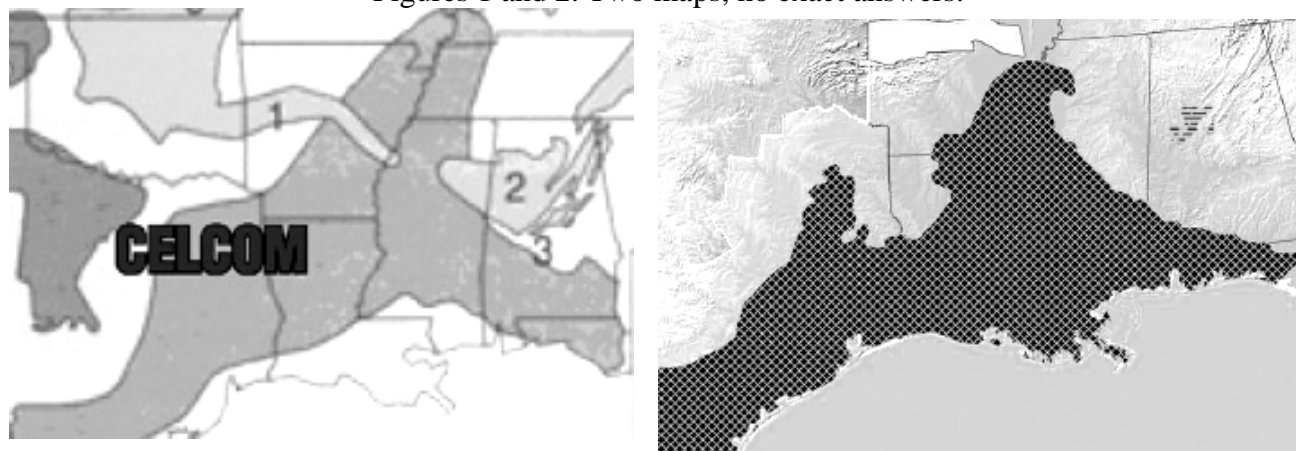
Coal Seam Natural Gas

Where Is It Located? The extent of the play is unknown, but is expected to be economic over a large section of the state. At present, exploration is being done in the north central portion of the state; Caldwell and LaSalle parishes and those surrounding them. Currently there are 44 producing wells that have produced from 10 to 250 mcf per day² according to some sources and 9 in various stages of dewatering. The companies drilling the wells have not divulged much information about the production or drilling details publicly. Figures 1 and 2 show the potential area being explored. Until many more wells are drilled, exact boundaries can not be determined.

¹ “Playing the Haynesville Shale” by Vickie Welborn, Shreveport Times May 4, 2008

² “North Louisiana CBM Play Could Someday Rival Powder River Basin” by John A. Sullivan, *Natural Gas Week* Monday, February 4, 2008 (Copyright © 2008 Energy Intelligence Group, Inc.)

Figures 1 and 2. Two maps, no exact answers.^{3,4}



Prior to 2005 Louisiana did not have law appropriate for these types of wells. Scott Angelle, Secretary of the Department of Natural Resources, Jim Welch, Commissioner of Conservation and Dr. Madhurendu Kumar, state geologist, worked with the industry to make changes. Don Briggs, president of the Louisiana Oil and Gas Association, along with Welch and Senator Robert Adley, successfully educated the legislature regarding the need for larger units and state regulations were changed. The horizontal wells these plays demand are expensive, but can effectively cover large areas, so up to 5000 acre units were created to maximize the potential of each location. These wells may intersect several beds as they go down and sideways.

What facts are known? Dr. Clayton Breland, with the Louisiana Geological Survey at Louisiana State University, involved Dr. Peter Warwick of the U.S. Geological Survey (USGS) and Dr. Gary Kinsland of the University of Louisiana at Lafayette to research results from test wells. They found these deeper coals at 2,500 to 4,000 feet, contain more gas per ton than is typically found in the prolific CBM fields of the Powder River Basin in Wyoming. Kinsland digitized 500 well logs across north Louisiana into a 3-D image that shows many of the coals cover a huge acreage. There may be 20 to 30 coal seams in a well, some very thin and some 30 feet thick.⁵

How do you get to it? A site may have six to eight wells that go down, then turn out approximately 90 degrees to run through the coal seam. This is called directional drilling. The laterals are “fraced” at various locations from the vertical well position to gather the gas. The fracturing creates cracks through the coal into which sand is forced to hold them open through which the water and gas can be extracted.

The technologies that enable directional drilling have been developing over the last 20 years and are now understood. The direction of a well bore can be controlled through the use of a motor attached above the drill bit that is powered hydraulically by the drilling fluid. This allows the drill bit to rotate without the rest of the drill string rotating. The motor has a slight “kink” built into it that causes the well bore to deviate in the direction that the kink is pointed in. Electro-mechanical instruments placed in the drill string above the

³ COALBED METHANE: LOUISIANA'S UNDEREXPLOITED ENERGY RESOURCE by John B. Echols¹ Search and Discovery Article #10011 (2000) Adaptation for online presentation of article of the same title by the same author published in Volume 9, pages 18-27 (June, 2000) of the Basin Research Institute Bulletin, a publication of the Louisiana Geological Survey. Website of BRI is www.lgs.lsu.edu.

⁴ SECARB Oil and Gas Reservoirs, NETL, U.S. DOE Carbon Sequestration Atlas of the United States and Canada pg 52 accessed at http://www.netl.doe.gov/technologies/carbon_seq/refshelf/atlas/Southeast%20Regional%20Carbon%20Sequestration%20Partnership.pdf <>

⁵ SHALE AND COALBED METHANE • *Oil and Gas Investor* • January 2008 page 30
“Louisiana CBM on the Cusp?” By Diana L. Chance

motor can measure and transmit precise position information back to the surface. These two technologies can be used in conjunction to steer a well to a desired location.

What does it cost? The major coals are at depths of 2,800 to 3,400 feet, so the average cost to drill and complete a well is only about \$250,000 per well and early test data has established the gas content in the coals as economical.⁶

Who Are The Players? Devon Energy Co. drilled the first pilot program in Caldwell Parish, where Devon and Donner Properties share a common interest in the minerals over a large area. After John Echols left Louisiana State University Basin Research Institute for private industry, he also drilled a test in Caldwell Parish. King Drilling drilled an interesting coal seam well in LaSalle Parish. Other players include GeoMet Inc., Mark V Petroleum Co., Harvest Gas Management, Vintage Petroleum Inc., EnerVest Operating Co., Samson Resources and other companies are acquiring leases. Southwestern Energy Co. has the most producing wells, 29, as of the first of May 2008. Most of these companies are keeping what they know to themselves.

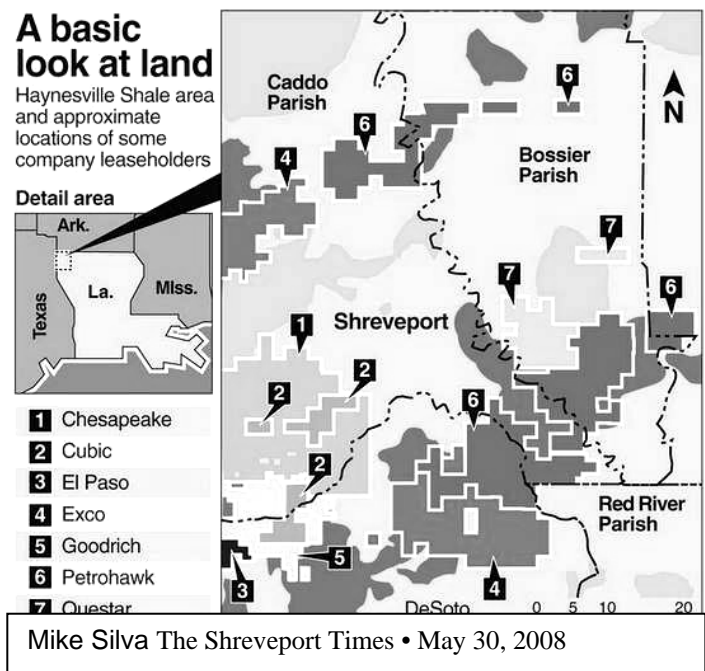
What Is A Shale Gas Play?

As described at the beginning, shale is compacted clay and fine material that also had carbon bearing material mixed in. Shale is formed where rivers deposit muddy water over many years such as a swamp or lake basin. When the water stops flowing, the clay and other matter settle out. If this area is “marsh” then plants grow very well. They usually have plenty of water and get “fertilized” with each flood. The plants become the source of carbon, that later, certain bacteria (methanogens) consume releasing methane (swamp gas). When such an area is buried under many feet of other material it is compacted to form a layer of shale with the methane and some water trapped in the tiny spaces between grains. Shale is not a very strong rock, but it does not permit the flow of water or gas through it. The Barnett Shale in Texas, the Fayetteville Shale in Arkansas and the Marcellus and Lower Huron Shales in Appalachia are the previously known shale gas plays. There are a number of others.

Where is it located and who are the players?

Chesapeake Energy has over 200,000 acres leased and is trying to lease 300,000 more in the northwest corner of the state. Petrohawk, Exco Resources, Questar and others are actively leasing acreage. Basically Exco and Petrohawk have said where they think it is, but the most telling fact that can be verified is where they are leasing mineral rights. Figure 3 above shows who has leased what area. Goodrich just merged their holdings with Chesapeake for cash to explore other strata. Industry officials say another company, Cubic Energy, has been drilling on the shale for four years.

Figure 3. Leasing activity for Haynesville Shale



⁶ SHALE AND COALBED METHANE • *Oil and Gas Investor* • January 2008 page 30
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What does it cost? These deep wells, drilled in hard rock, are expensive, typically over \$4 million. The tooling is high priced and the technology for this depth is new. On top of this, the play is not well defined so there is always the chance of coming up empty.

Chesapeake's CEO has said in published reports his company estimates the Haynesville Shale holds at least 7.5 trillion cubic feet of natural gas and maybe up to 20 trillion cubic feet. By comparison, Chesapeake at the end of 2007 reported proved reserves in the Barnett Shale at just over 2 trillion cubic feet, which until now gives it the reputation of being the largest onshore natural gas field in the United States.

Shale Play Economic Summary for several known plays based on \$70/bbl oil and \$7.30 Gas:⁷

Play Name:	Before Tax Rate of Return	After Tax Rate of Return
Barnett Core	102%	53%
Barnett Tier 1	56%	28%
Fayetteville	33%	14%
Barnett non-core	29%	13%
Woodford Arkoma	27%	11%
Montana Bakken	22%	10%
North Dakota Bakken	21%	10%

To date, there have been 30, 640 acre units formed for the Haynesville Shale in the Caspiana, Metcalf and Johnson Branch fields. Briggs said, "I think you will see at least 70 rigs running up there next year. That's a good number, with about 40 running now."⁸ It could take several years before the potential, or lack thereof, of the Haynesville Shale is fully realized. Predictions are it will take another year or so to know if it's a viable commercial opportunity. As can be seen in the table below, although expensive to drill, shale gas has strong incentives for development. With oil prices double those shown and gas 50 percent more the returns will be too good to resist.

According to State Mineral Board Secretary Marjorie McKeithen, in the July 9, 2008 lease sale, seven north Louisiana leases were located in Caddo Parish and averaged over \$30,000 per acre in bonus and 30 percent royalty. The total bonus money received for these leases amounted to \$17,683,171, covering approximately 585 acres. The other north Louisiana lease covered 1,045 acres in DeSoto Parish and brought in \$28,750,040 in bonus which tallies \$27,512 per acre and 27.5 percent royalty. The August sale brought similar rates on 4070 acres in this area as shown in the table below. This was the second largest sale in state history.

Results from the August 13, 2008 lease sale

Parish	Avg \$/acre	Low	High	Royalty %
Bossier	\$22,562	\$18,500	\$27,500	25-27.5
Caddo	\$23,019	\$16,550	\$27,500	25-30
Desoto	\$18,500	\$18,500	\$19,286	25-30
Red River	\$20,396	\$18,500	\$27,500	25-30
Bienville	\$24,162	\$18,500	\$27,500	25-27.5

\$92,224,110 for 4070.3 acres \$22,658.00

Louisiana is entering a new age of oil and gas exploration and production. There is much opportunity for those willing to gamble.

⁷ Accessed July 7 2008 from "Shale Plays Soar" By John White, Natixis Bleichroeder Inc. at http://www.oilandgasinvestor.com/pdf/OGI_2008-01_InvestorsguideToUnconventionalGas.pdf

⁸ "Playing the Haynesville Shale" by Vickie Welborn, Shreveport Times May 4, 2008