

LIGNITE ACTIVITY INCREASES IN NORTH DAKOTA

by Ed Murphy

Introduction

Over the past fifteen years or so, mine closings at Larson, Velva, Dickinson, and Gascoyne have dominated much of the news about the lignite industry in North Dakota. Now, for the first time in almost 20 years, there is serious discussion of construction of a new mine and lignite-fired power plant.

Utilities and the coal industry have not expressed this much interest in the State's lignite resources (total lignite) and reserves (mineable lignite) since the early 1980s. The reason is two-fold: 1) the North Dakota Industrial Commission's Lignite Vision 21 Program, managed by the Lignite Energy Council and 2) the coalbed methane (cbm) potential of North Dakota lignites. The Vision 21 project provides monetary incentives for companies to study and construct new state-of-the-art coal-fired power plants in the State. The electrical supply problem in California last winter underscored a major problem with the availability and distribution of energy and increased interest in new power plant construction. For the past four years, the success of the large number of methane wells drilled in sub-bituminous coals in the Powder River Basin near Gillette, Wyoming, has been one of the biggest domestic news stories in the oil and gas industry.

Strippable Lignite Deposits

The North Dakota Geological Survey has its historic roots in lignite investigations. Survey geologists spent most of their time studying coal from 1895, the year the Survey was established, through the 1920s. In the 1970s, the Survey

oversaw the drilling of thousands of test holes through a cooperative project with the United States Geological Survey. This program was undertaken to provide stratigraphic control in areas where few lignite exploration holes had previously been drilled. The Survey also completed several studies on coal stratigraphy and mined-land reclamation in the 1970s and early 1980s.

Since 1975, companies drilling exploratory test holes for coal outside of an active mine permit area have been required to obtain a permit from the North Dakota Geological Survey. To date, the 447 permits that have been issued under this program have resulted in almost 28,000 test holes (Figure 1). Companies are required to provide our office with copies of all data generated from these projects. This information automatically remains confidential for three years and the confidentiality period can be extended to a maximum of 10 years. In recent years, Survey personnel have entered over 18,000 data points (12,000 non-confidential coal test holes and information from 6,000 oil and gas logs, uranium holes, and water wells) into an electronic database with financial assistance from the U.S. Geological Survey under the National Coal Resource Database System and National Coal Assessment Programs.

Most of North Dakota's coal exploration took place in the 1970s when dozens of out-of-state companies drilled test holes throughout the western part of the State (Figure 2). During this period, it was not unusual for four holes to be drilled, by four different coal companies, at one section corner. Since the early 1980s, most test drilling has been done by

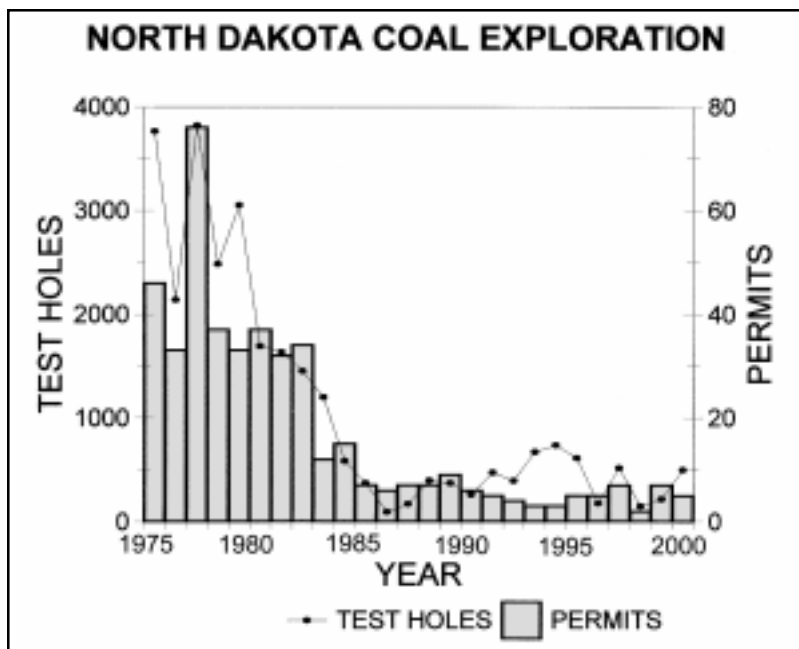


Figure 1. Graph of the coal exploration permits issued and the coal exploration holes drilled in North Dakota over the past 26 years. The recent interest in coal has not yet led to a significant increase in permit applications. The lack of drilling is due, at least in part, to the ND Geological Survey's coal database. Companies can now utilize this large database to identify areas of interest rather than resort to the often inefficient blanket drilling of the 1970s.



Figure 2. A truck-mounted rotary rig drilling for coal in western North Dakota.

local mining companies to guide future mine-expansion plans. In 1991, the Estevan Coal Corporation undertook one of the few multi-county exploration programs that has occurred during the past 20 years. The company drilled about 100 holes along a northwest trend in Divide and Burke counties. It has been almost 20 years since permits to explore for mineable coal were issued in the following coal-bearing counties; Billings, Burleigh, Morton, Dunn, Golden Valley, Grant, Hettinger, McKenzie, McHenry, Mountrail, Slope, Stark, Ward, and Williams.

Beginning last year, a number of coal companies, utility companies, consulting firms, and land companies have called or stopped by our office looking for information on the strippable lignite reserves of North Dakota. This summer, the Survey finished a complete reassessment of the strippable lignite deposits of North Dakota. It had been almost fifty years since W.A. Brandt of the U.S. Bureau of Mines completed a comprehensive study of North Dakota's lignite resource. In 1953, Brandt concluded that North Dakota's lignite resource amounted to 351 billion tons. Others used Brandt's report to conclude that North Dakota had strippable lignite reserves of between 7 billion (Ball, 1966) and 50 billion tons (Averitt, 1968). In 1972, Pollard estimated that sixteen major coal areas in North Dakota contained 4.1 billion tons of strippable reserves. The NDGS published detailed studies on specific areas, such as the Knife River basin, in the 1970s and early 1980s, but a detailed assessment of the State's strippable reserves had never been undertaken. The Survey's recently completed study used at least 10 times more data than had been available for previous studies. Our study used fairly conservative criteria to determine the economic viability of deposits. These criteria include a minimum cumulative coal thickness of ten feet—typically occurring in two beds or one (the more beds the higher the mining costs), a minimum individual bed thickness of 2.5 feet (it generally is not economical to strip a bed less than 30 inches thick), a maximum stripping ratio of 10:1, and a minimum of 25 feet of overburden (as cover decreases, the chance that the lignite has lost Btus due to weathering increases). As a result, our final estimate of 25 billion tons should be considered a conservative number.

The resulting maps have already proven beneficial to industry, private landowners, and holders of mineral rights interested in economic coal deposits.

Maps showing the strippable lignite reserves in 19 counties are available from the NDGS at a cost of \$5.00 per county (Murphy, 2001a-s). These maps will eventually be posted on our website where they can be downloaded to a print file for free. A 1:1,000,000-scale statewide map of strippable lignite deposits (Murphy, 2001t) is available for \$3.00.

Coalbed Methane

The development of coalbed methane in the Powder River Basin has been called one of the fastest growing gas plays in the United States. The play began in 1987 and has garnered much attention in the past five years. The coalbed methane (cbm) in this play is associated with sub-bituminous coals in the Fort Union Group. These Powder River coals are equivalent to (the same age and occur in rocks that are stratigraphically connected to) the coal-bearing Fort Union strata in the North Dakota part of the Williston Basin. For several years, the NDGS has been receiving inquiries on the coalbed methane potential of North Dakota lignites. Since 1998, we have written a half dozen open-file reports to address questions most frequently asked about North Dakota lignites and the location and depths of the thick seams in western North Dakota (Murphy, 1998; Murphy and Goven, 1998a; Murphy and Goven, 1998b; Murphy and others, 1999; Murphy and others, 2000; Murphy and others, 2002; Murphy and others, in prep.). To date, four companies have conducted canister tests to determine the gas potential of North Dakota lignites. Canister tests consist of placing the coal core in a sealed tube (typically 3-inch diameter by 24-inch-long) immediately after the core has been retrieved. The tube is then placed in a water bath to maintain downhole temperature and the gas pressure is periodically recorded by opening an access valve at the end of the tube. The timed readings are used to estimate the amount of recoverable gas in the coal. The information generated under the NDGS permits is currently confidential and will likely remain so for several more years.

Unlike the area near Gillette, Wyoming, the mineable deposits of lignite in North Dakota, i.e., those within about 170 feet of the surface, do not appear to have much cbm potential. Near Gillette, methane problems had been reported from water wells and homes in a subdivision near an active strip mine for decades. Coal companies in North Dakota have not encountered methane in their shallow observation wells at the mines. There are only a few sketchy incidents of methane being encountered in North Dakota underground mines from the 1880s to the 1950s. An elderly underground miner in northwest North Dakota recalled that when they encountered water in the coal while mining they would mine in a different direction. Water is an important component in

the process of trapping methane because it helps to hold gas in place against the cleats or fractures in the coal. The absence of groundwater in dry mines might explain the lack of methane. Although I have been unable to confirm, deaths due to methane gas reportedly occurred in underground mines at both Wilton and near Stanley. In 1984, the Survey encountered gas while installing a monitoring well near the town of Lignite in Burke County (Figure 3).

For the past four years, the ND Geological Survey has suggested that companies target deeper lignites due to the relatively few known incidences of gas in the shallow coals in North Dakota. We know very little about the deeper coals in the Williston Basin because they were seldom targeted for water wells and were too deep to be of economic importance in mining. The deeper parts of the Williston Basin contain lignite at depths close to 2000 feet. It may be that these deeper lignites are closer in character to sub-bituminous coals due to the increased burial depths. Within the next year, we should get a much better idea of the cbm potential of North Dakota lignites with the information that companies are currently generating.

Interest in both mineable lignite and the coalbed



Figure 3. Gas blows from a newly installed monitoring well near the town of Lignite in northwestern North Dakota. The 2-inch well, drilled in 1984, was screened in a three-foot lignite at a depth of 90 feet. Gas did not start blowing until we had bailed about half of the mud out of the well. The gas blew for three days before it dissipated to the point that we could place a temporary cap on the well. The methane content of the gas was not determined.

methane that might occur in deep lignites, have combined to create an interest in North Dakota coals that has not been seen for 20 years. Many long-term coal leases in North Dakota, with the exception of the current mine areas, were allowed to expire during the 1990s. At that time, little or no hope was expressed that those areas would be leased anytime in the near future. But, within the last year, interest has once again been expressed in leasing areas that are not within existing mine plans. It should be noted that the methane ownership is held by the oil and gas mineral rights, not the coal rights. A few years ago, this premise was challenged in a lawsuit between the Southern Ute Indian Tribe and Amoco Production Company but was eventually upheld by the U.S. Supreme Court. Therefore, farmers and ranchers whose land is underlain by thick seams of lignite, near the surface and at depth, may have an opportunity to lease both the oil and gas and the coal mineral rights.

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