IN FOCUS

Coalbed Methane Potential of Illinois Basin Coals

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Overview

Recently, the state geological surveys of Kentucky, Illinois, and Indiana, which collectively make up the Illinois Basin Consortium, were awarded a 1-year grant of $500,000 from the U.S. Department of Energy to evaluate the coalbed methane potential of Illinois Basin coal beds. The project has the potential of being extended for 2 more years, depending on results obtained during 2004. There has been a surge of nationwide interest in coalbed methane (CBM) in recent years because of increasing gas prices, declining conventional natural gas reserves, environmental concerns, and the realization that previously overlooked coal basins may have significant CBM reserves. As of the end of 2000, CBM met approximately 7 percent of the natural gas demand in the United States.

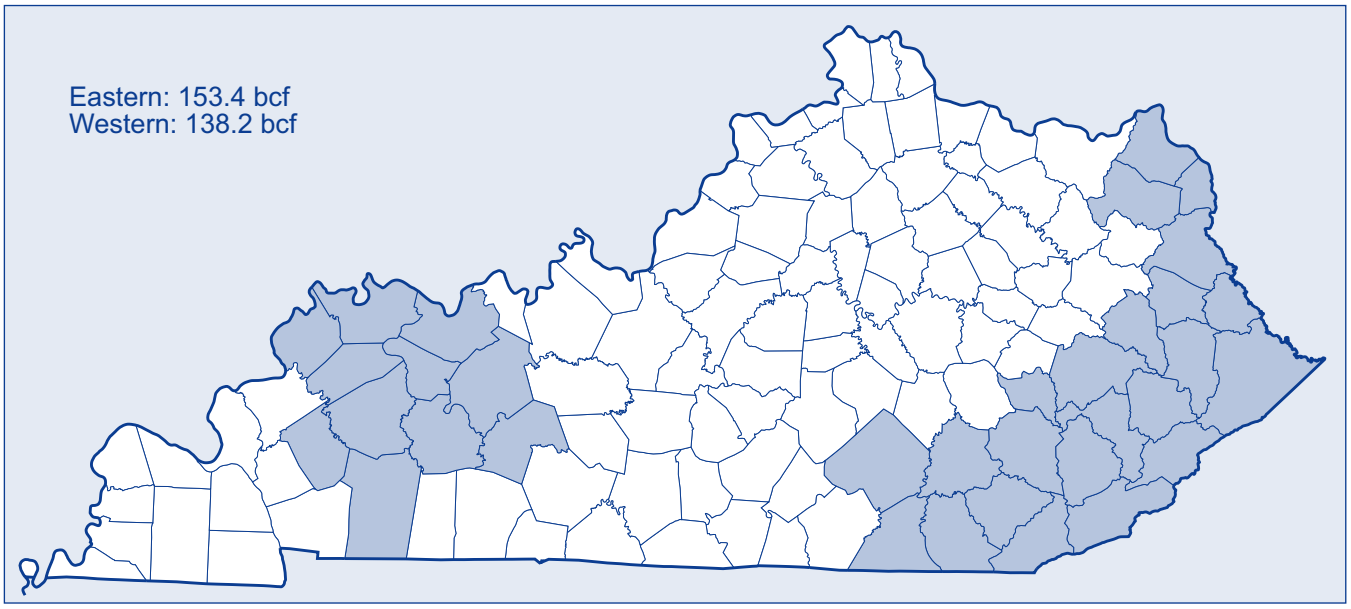
The Illinois Basin has more than 200 billion tons of remaining coal resources, which are estimated to contain 11 trillion cubic feet (tcf) or more of methane. As coal production in the basin continues to decline, mainly because of the high sulfur contents of most Illinois Basin coals, production of CBM may be an effective way to use this vast resource. Although there is currently little commercial CBM activity in the basin, CBM research at the state surveys of Illinois, Indiana, and Kentucky has been quite active.

Illinois Basin coal and coalbed methane

Although the Illinois Basin has historically been a major coal-producing region, air-quality standards for sulfur emissions outlined in the Clean Air Act Amendments of 1990 (CAAA90) have had a serious impact on production. For example, coal production in Illinois in 1991 was 60.3 million short tons, but by 2000, production had decreased to 33.4 million tons, a 45 percent decrease. Likewise, production in Kentucky declined 38 percent during the same period. The reason for this dramatic decrease is the high sulfur content of most Illinois Basin coals, commonly greater than 3 percent, and the fact that most coal-fired electric utilities have mainly switched from burning high-sulfur to low-sulfur coal to comply with CAAA90 SO_2 emission limitations. Although new "clean coal" technologies, such as fluidized bed combustion, and integrated gasification combined cycle, can readily use high-sulfur Illinois Basin coal in an environmentally acceptable manner, the widespread implementation of these technologies will not be seen for several years. As such, Illinois Basin coal is a vast energy resource that is being progressively idled.

CBM: an important energy resource

Coalbed methane is a natural byproduct of coalification, the geologic process that changes peat into coal, and also through a later process that involves bacterial generation of



Estimated CBM resources in Kentucky, in billions of cubic feet, from the USGS 1995 national assessment.

methane. Historically, methane gas in underground coal mines has been regarded as a hazard rather than a resource, being the cause of mine explosions that have killed and injured many miners. In fact, underground mines routinely vent the gas to the atmosphere in advance of mining to help prevent explosions. Only recently has the value of CBM been recognized, with annual U.S. production in 2000 being 1,379 billion cubic feet (bcf), or about 7 percent of the total U.S. gas production.

Recently, there has been considerable interest in expanding the role of hydrogen fuel cells to produce emission-free electricity for businesses, homes, and vehicles. If fuel cells begin to be widely used, then even more methane will be needed. Methane is a natural choice for obtaining hydrogen because of its hydrogen-rich methane molecule (CH_4). As the demand for natural gas continues to rise, CBM will likely play a role in satisfying this increased demand.

Environmental benefits

Coalbed methane has several environmental benefits. Methane is the cleanest-burning fossil fuel, with essentially zero emissions of sulfur dioxide (SO2) and nitrogen oxides (NOx). Methane also produces the least carbon dioxide (CO_2) for the amount of energy produced of any fossil fuel when burned. When considered on a heat-equivalent basis, methane produces about 1.4 pounds of CO_2 per million Btu generated, whereas coal emits about 2.2 pounds of CO_2 per million Btu. In addition, methane is a significant "greenhouse gas," with a far greater heat-trapping capability than CO_2, and active and abandoned coal mines are sources of methane emissions worldwide. Recovering the methane in coal prior to mining can significantly reduce methane emissions from coal mining, and improve underground mine safety as well.

Historical negative bias

Historically, the Illinois Basin has not been regarded as a significant CBM resource, mainly because the thermal maturity (rank) of the coal was thought to be insufficient for economic CBM, and the few coal samples that were tested for gas content showed low CBM contents (often less than 50 scf/ton). More recently acquired data by the Illinois and Indiana Geological Surveys, however, indicate far greater CBM contents in many coals (often greater than 150 scf/ton) from unstimulated test cores. According to the new data, the actual gas content of Illinois coals appears to be at least 50 percent greater than indicated by the historical data. Another factor previously unknown was the presence of significant quantities of biogenically derived methane in many coal beds (such as Powder River Basin coals), that do not require high thermal maturity levels to form. Preliminary data indicate that a significant portion of the methane in Illinois Basin coals may be of biogenic origin, making the gas content independent of the coal rank.

Program implementation

Illinois Basin Consortium geologists will evaluate all available data to select the best areas where coalbed methane potential is high. Once these areas have been identified, exploration wells will be drilled and cored, one for each state during the first year. If funding is extended for years 2 and 3, then additional test wells will be drilled.

Samples from coal beds that are encountered during the drilling and coring program will be placed in specially designed canisters to accurately measure the amount of gas being released from the coal. This release of gas is referred to as desorption, and can take several weeks, or even months. Some of the desorbed gas will be tested further for composition (relative proportions of methane, nitrogen, carbon dioxide, etc.) and origin (how much thermogenic versus biogenic gas). Other analyses, such as adsorption and petrographic composition analysis, will also be performed to help us better understand the nature and distribution of CBM in the Illinois Basin.

Anticipated products

All of the collected data will be made available to the public through publications, and presentations made available on the Web and in hard copy. Information will also be transferred through a series of workshops specifically aimed at the Illinois Basin energy industry (coal, oil, and natural gas).

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