

Learn from the Past: Economic Production of Coal Seam Gas

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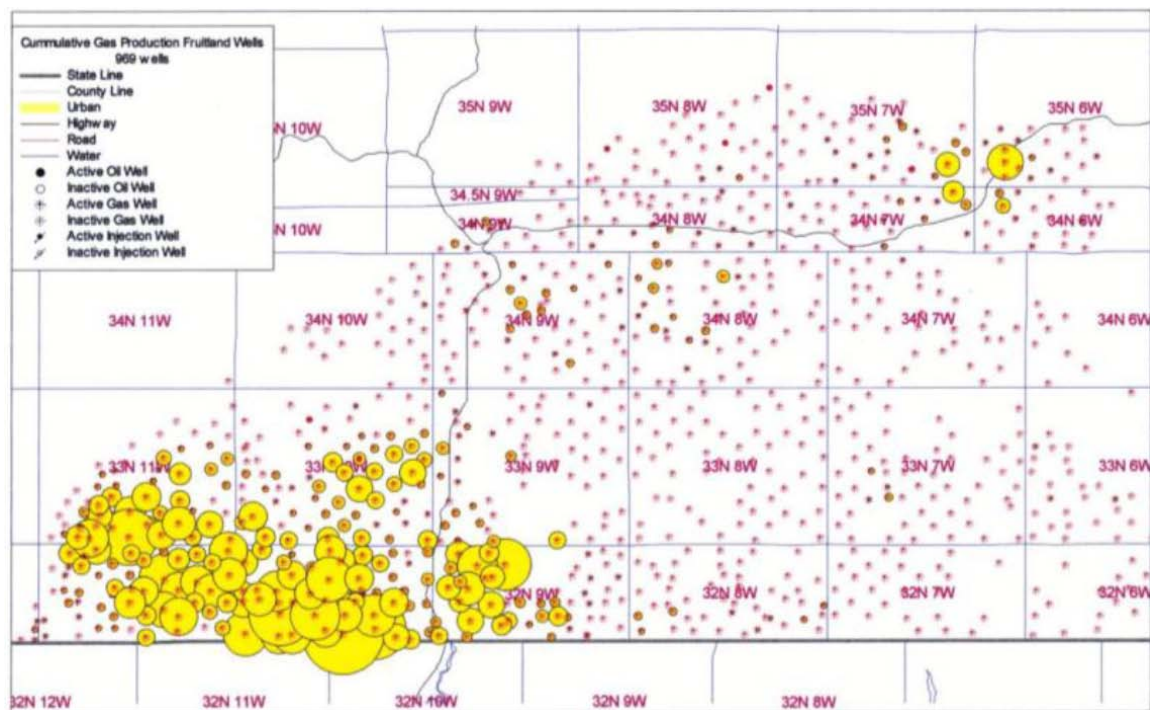
Abstract

Coal seam gas (CSG) represents a widely distributed potential source of natural gas. CSG was developed initially in the United States in the Black Warrior and San Juan basins in the 1990s, and then expanded to a dozen other basins in the US and Canada during the subsequent decade.



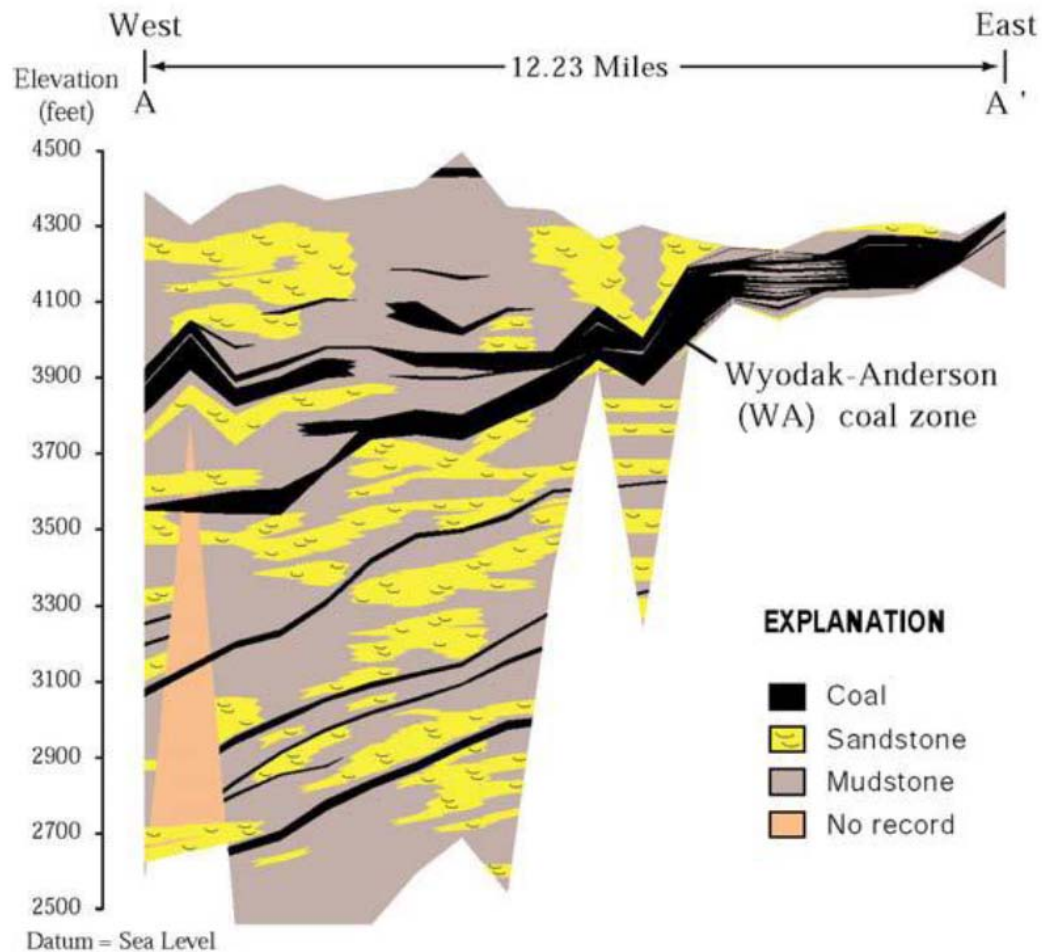
CSG is now under active development in many countries worldwide, with a large industry emerging in Australia in particular. However, few international CSG developers are aware of just how poorly CSG has fared in North America. In fact, only a few basins that were targeted in that region remain under active development. Of the 8,000 Bcm of CSG resources in the US, less than 1,000 Bcm has been produced.

The primary economic challenge to CSG in the US relates to variability in gas productivity across a field and between different seams in a particular location. That variability originates from a complex mix of reservoir conditions and completion/production techniques. However, it is observed even in areas that involve highly mature completion/production methods, such as the fairway of the San Juan basin, suggesting that reservoir variability is the dominant contributing factor.

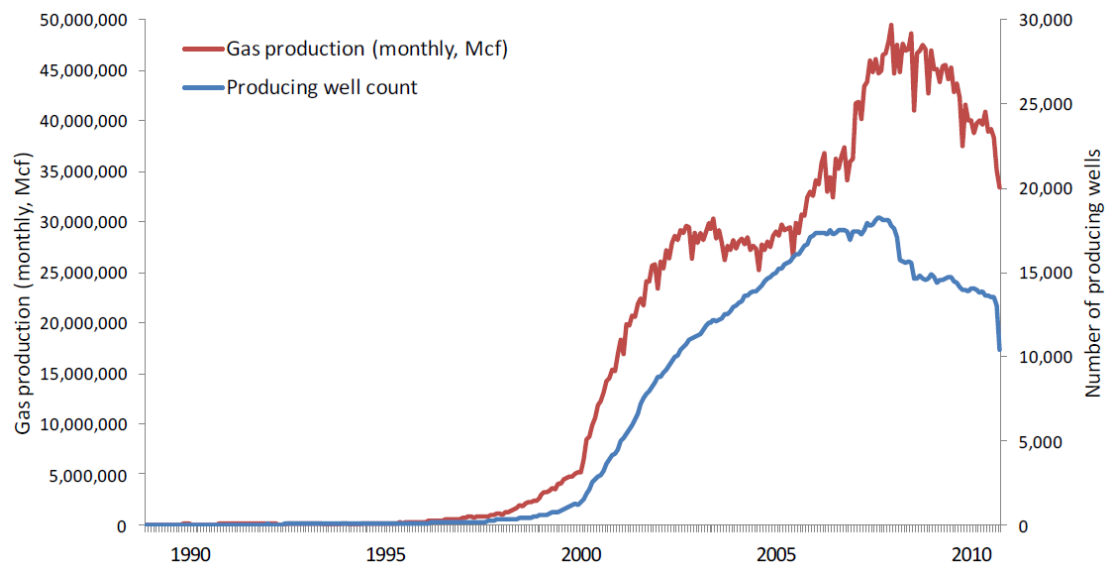


This presentation will relate the results of detailed financial and GIS analysis regarding development investment and revenues in the Powder River basin (PRB) of Wyoming, US. The PRB was the first basin to be drilled without US tax credits, and with 26,000 wells drilled remains the largest CSG development in the world by well count. Further, its relatively simple completion and production techniques allow ready connection of coal seam reservoir properties to financial outcomes.

PRB coal seam gas development efforts focused on producing gas from methanogenic coals that ranged in depth from 20 meters on the easternmost edge, adjoining some of the world's largest surface coal mines, to more than 1,000 meters on the westernmost edge, near the Big Horn Mountains. The target seams range in thickness from 60 meters to 1 meter. Primary completion techniques were open hole completions focused on one thick seam to cased and perforated completions focused on up to three seams or packages of seams.



Most PRB coal permeabilities range from 1 to 500 mD. Typical completions required one month to 30 months of dewatering in order to instigate gas flow. The basin was drilled heavily from 2000 to 2007, and has been in decline since. At its peak, the basin contributed 1.3 billion cubic meters per month of gas - 2% of US natural gas production



The State of Wyoming is now actively plugging abandoned wells at a rate of several hundred per year. A decade of water use and social license management efforts by the state have given way to more than four billion dollars of cased holes and artificial lift equipment, plus two billion dollars of installed gathering infrastructure, that is depreciating quickly and less than 11,000 wells still producing.

The presentation will review financial results of the PRB basin development through 2006, when significant development stopped. It will also relate reservoir heterogeneity as manifested through GIS mapping of production results by well. Finally, the presentation will use the benefit of hindsight to model how a different development approach based on reservoir properties might have improved overall development economics.