

Coal Mine Methane Drained from Surface Drilled Wells in the USA— No Longer an Unconventional Gas Resource

Coal Mining Methane Abatement Seminar

Sydney, Australia

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Acknowledgements and Thanks

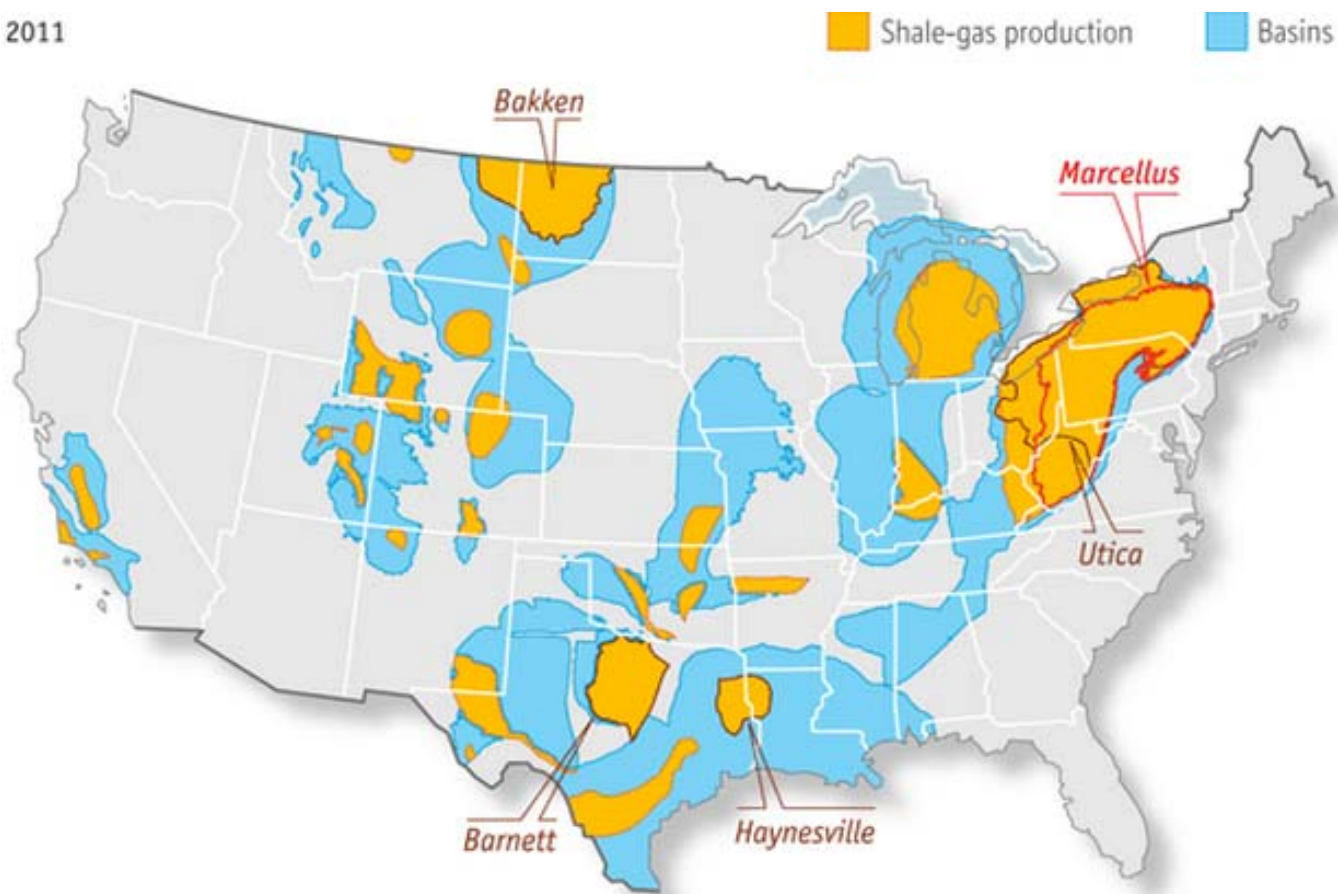
- Organizers of the Seminar
- Support from USEPA
- Co-workers at Raven Ridge

Overview of the Unconventional Gas Revolution

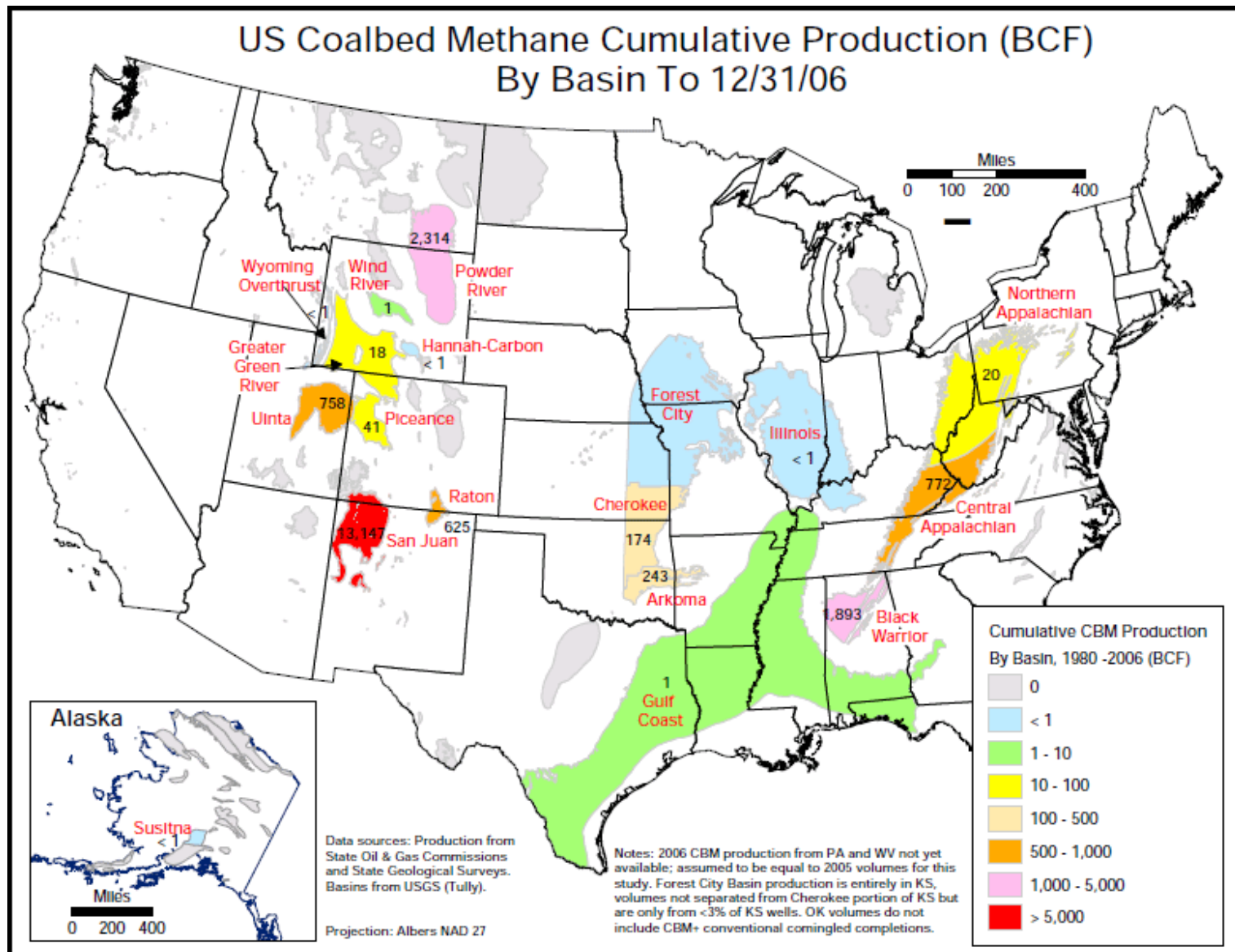


Location of Sedimentary Basins of the Lower 48 States of the USA

2011



Sources: Energy Information Administration; International Energy Agency

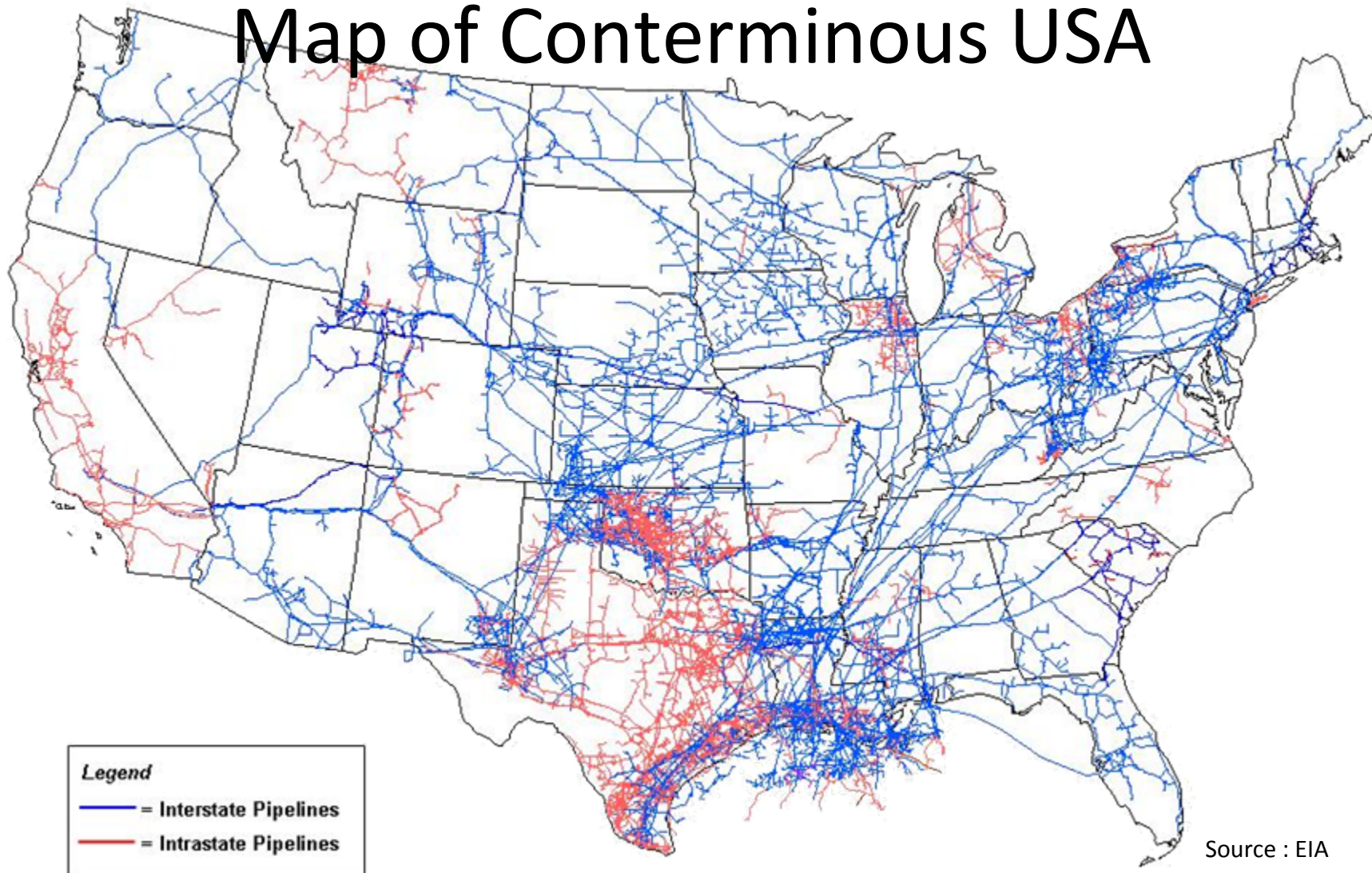


Source: EIA

What Spurred the Growth of CBM Development and CMM drainage from Surface Wells?

- Access to 300,000 miles of oil and gas transmission pipelines linking production to markets
- Economic Incentives- tax credits
- Technological breakthroughs in drilling and production as an outgrowth of public-private partnerships-i.e. USDoE and oil and gas industry partners; and the Gas Research Institute and industry partners

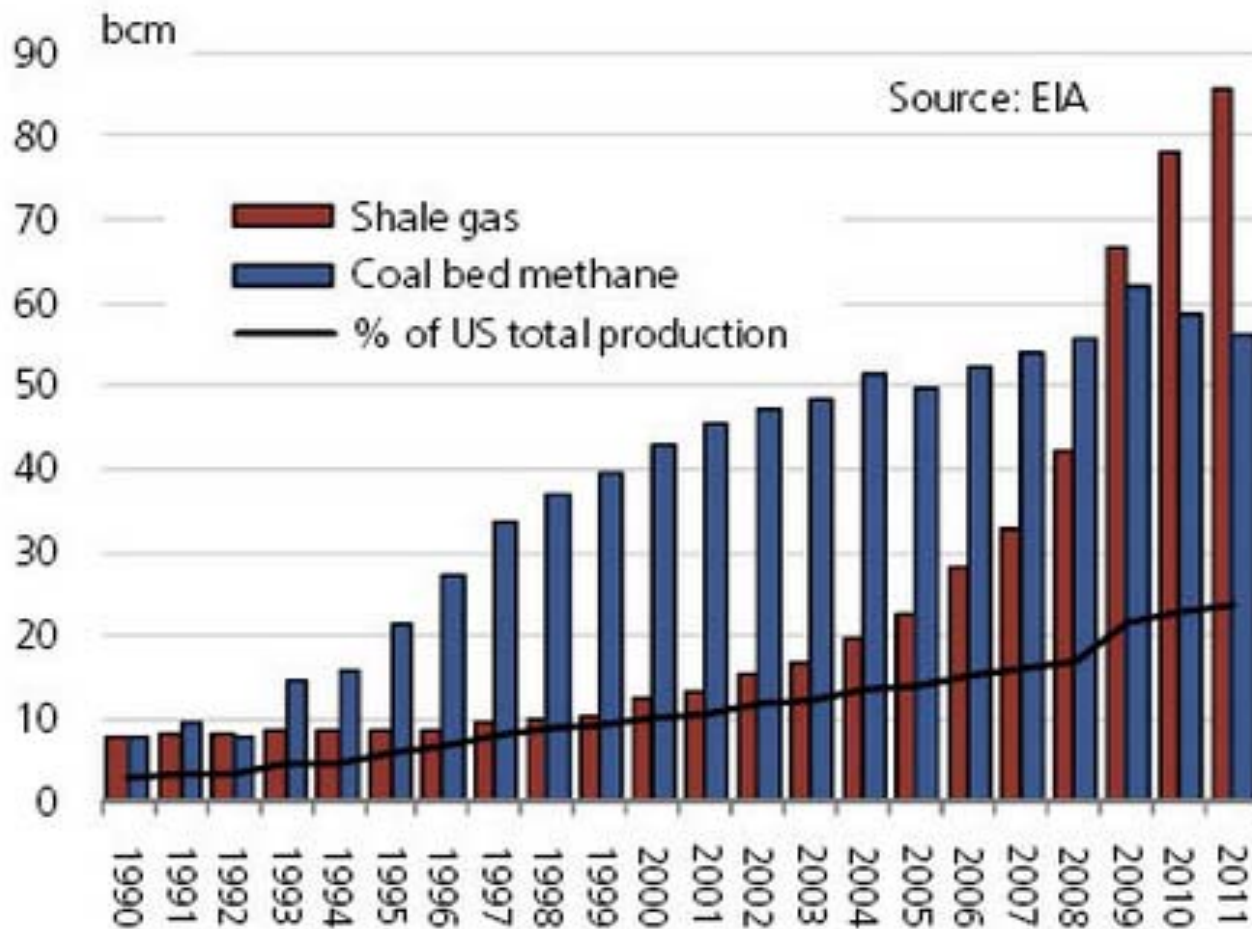
Natural Gas Transmission Pipeline Map of Conterminous USA



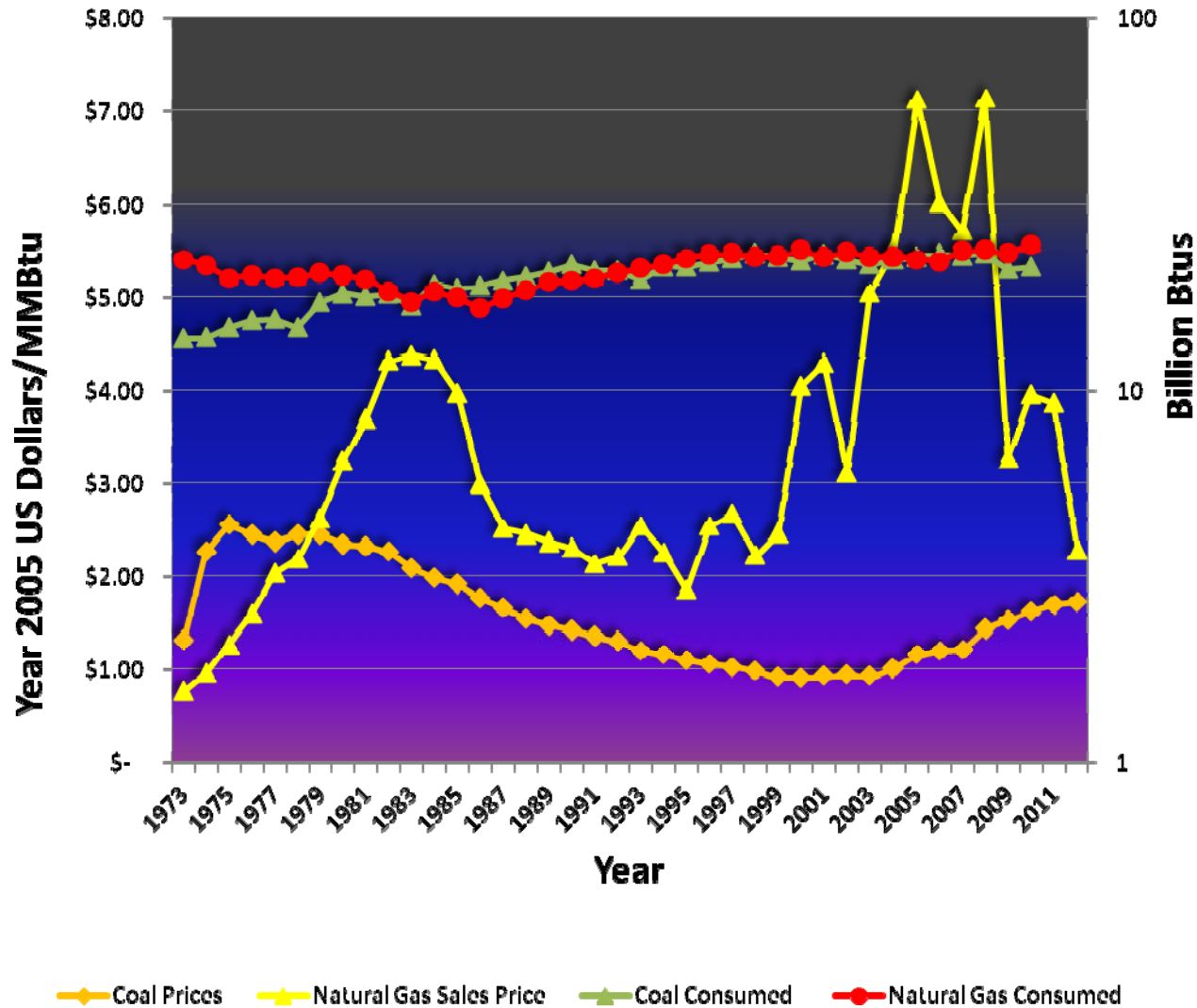
Economic Incentives

- **1978**-First, but modest incentives under the Natural Gas Policy Act which deregulated wellhead sales price for gas shales, coal seams and geopressured brines. Section 102 of the act enabled “tight gas” to be eligible for highest ceiling price in the regulated categories.
- **1980**-Greatest incentives for unconventional gas production were contained in Section 29 of the Crude Oil Windfall Profits Tax Act. Provide significant credits for specific formations and wells drilled before December 31, 1992: about \$1.00/Mcf. Tax credits expired in 2002.

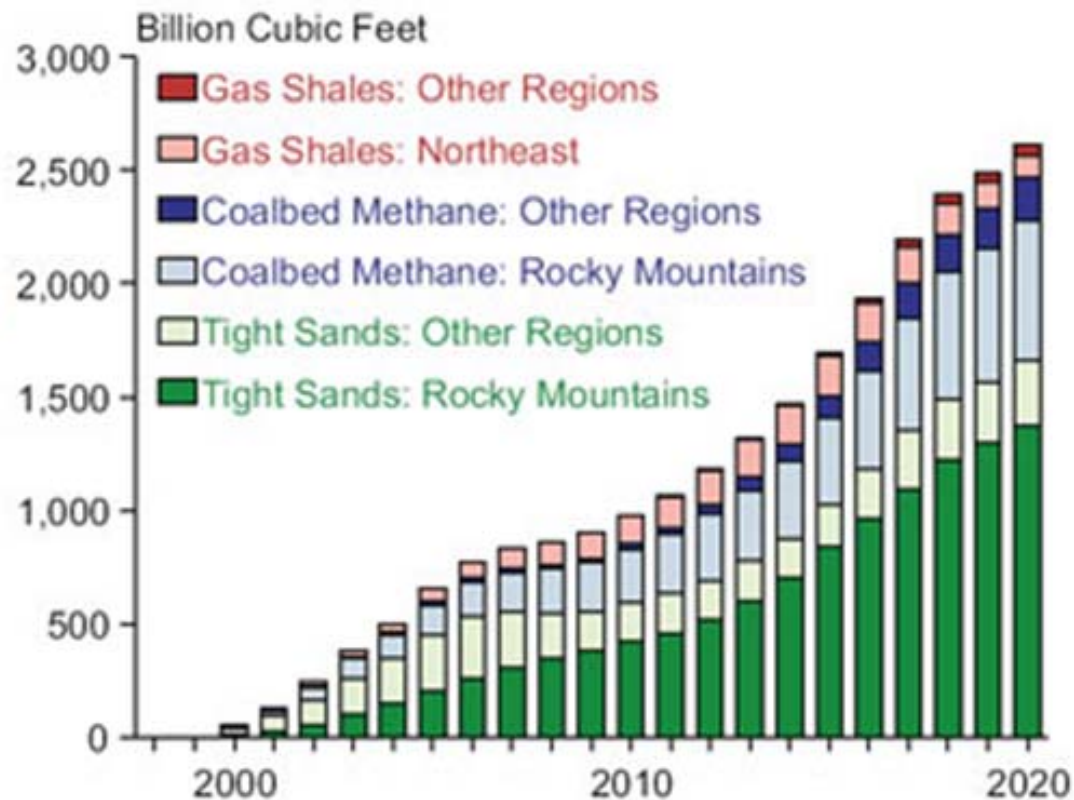
Growth in Unconventional Gas Production 1990-2011



Annual Production and Sales Price— Coal and Natural Gas on Heat Content Basis



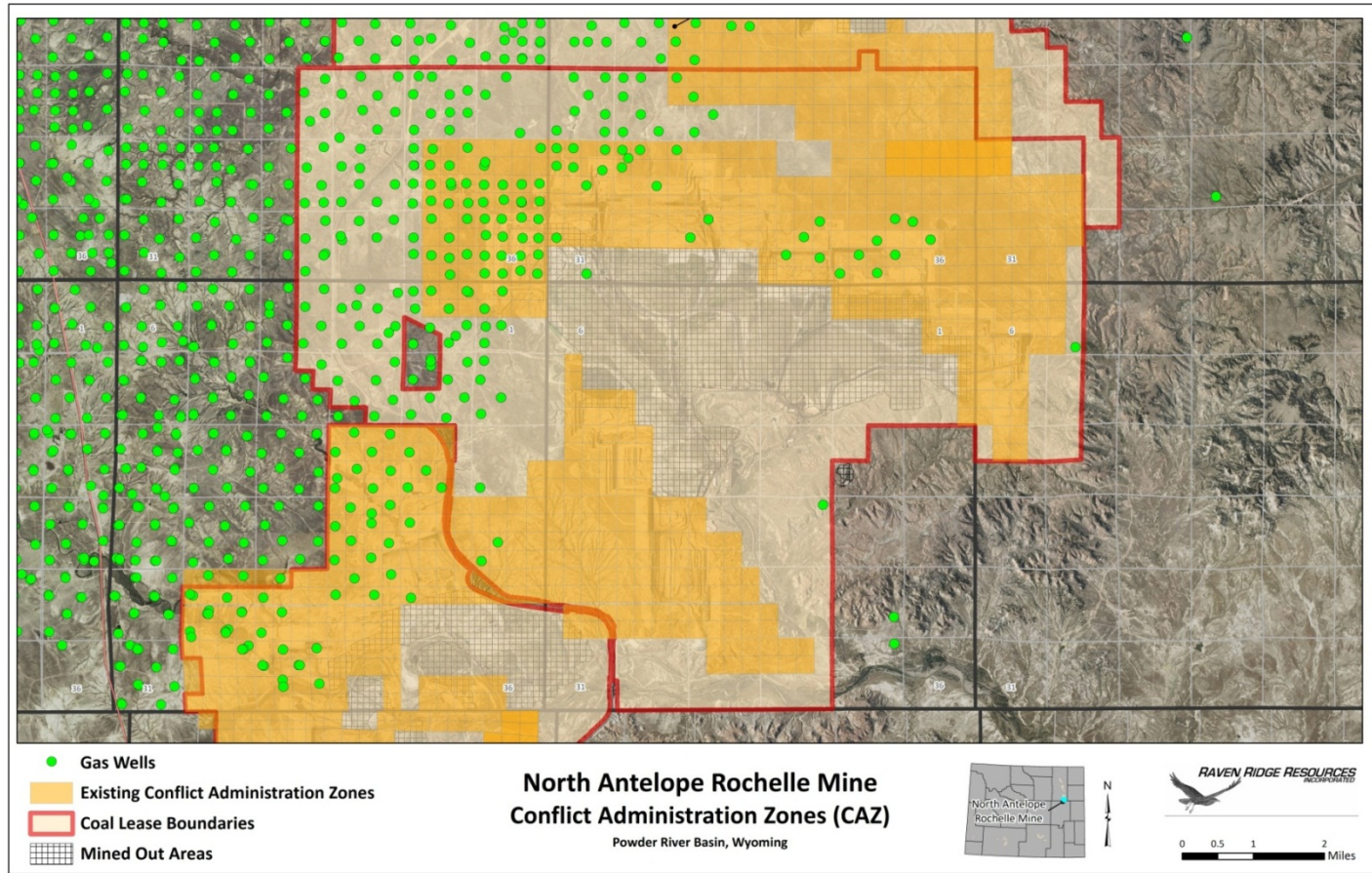
Forecast of Incremental Benefits Resulting from Improvements to Production Technology



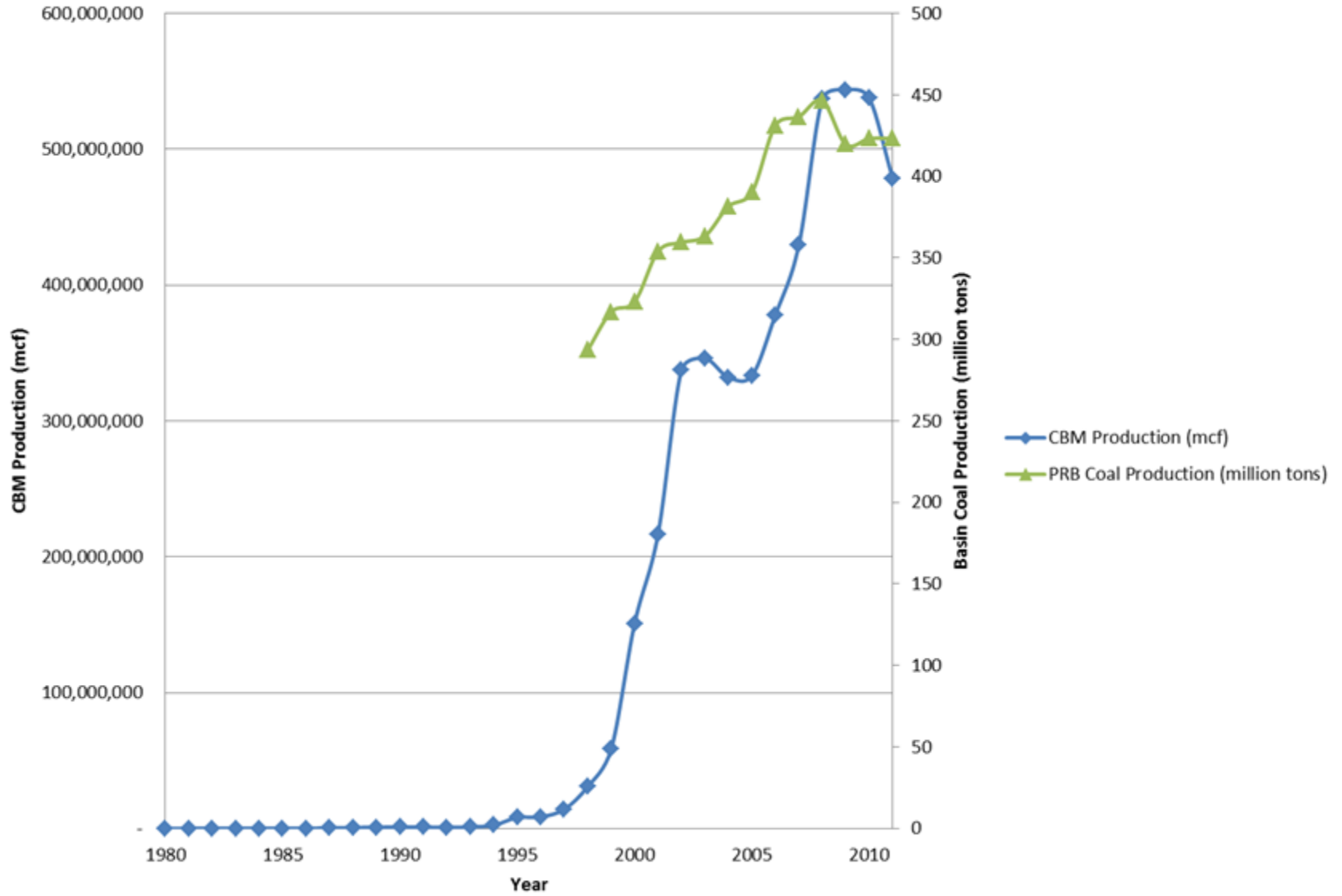
Source: AEO2000 National Energy Modeling System, runs BASIN.D060600A and UGRT04.D051600A.

Examples of Movable Coal Resources Drained by Wells Drilled From the Surface

Powder River Basin—Wyoming



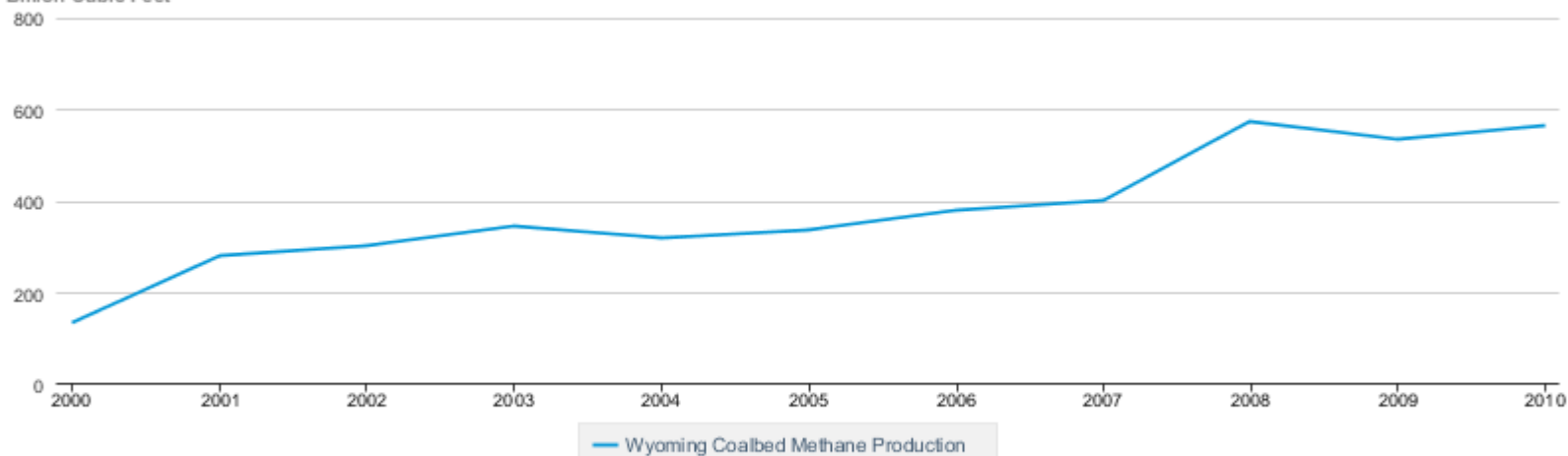
Powder River Basin CBM Production



Annual Wyoming CBM Production

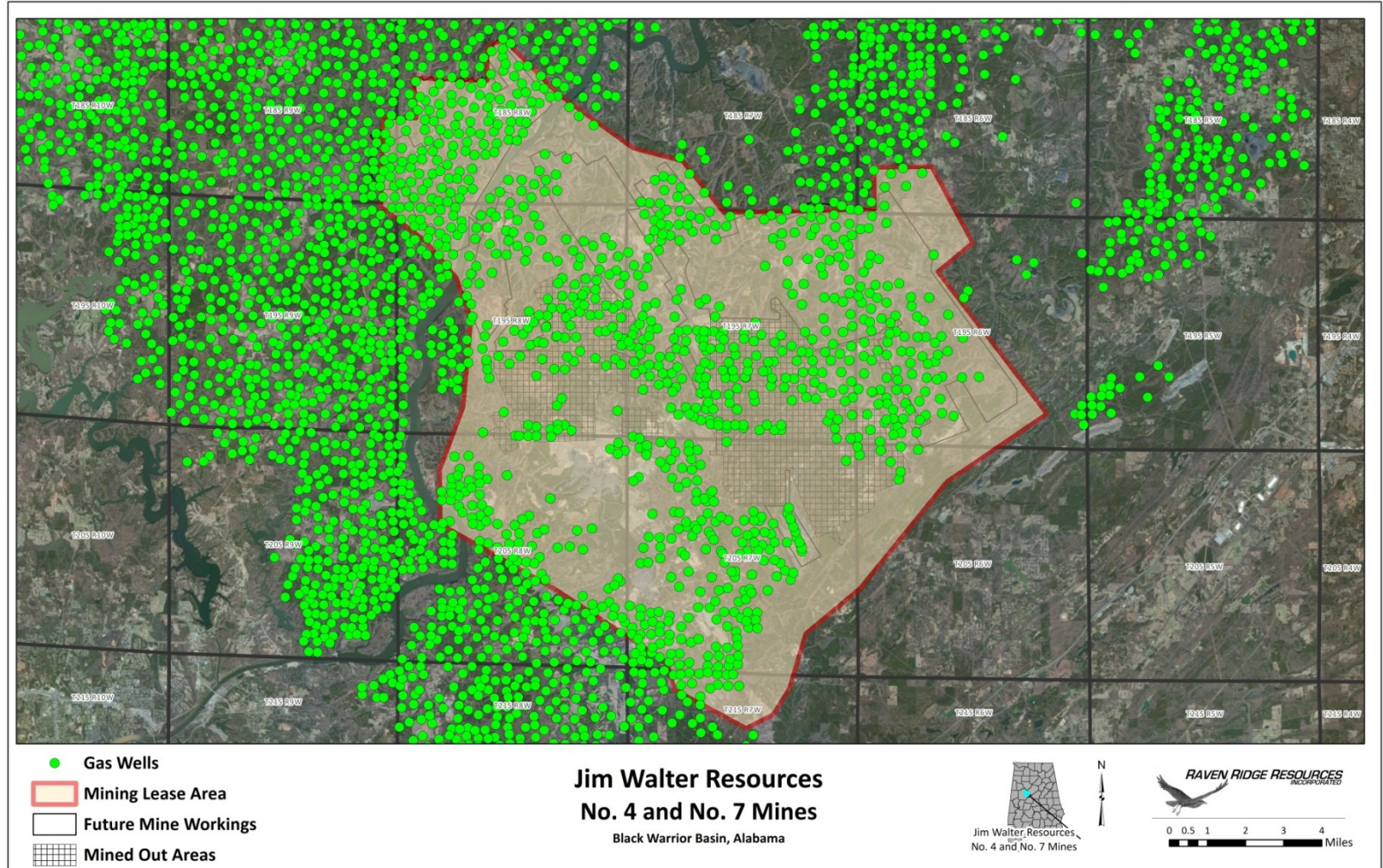
Wyoming Coalbed Methane Production

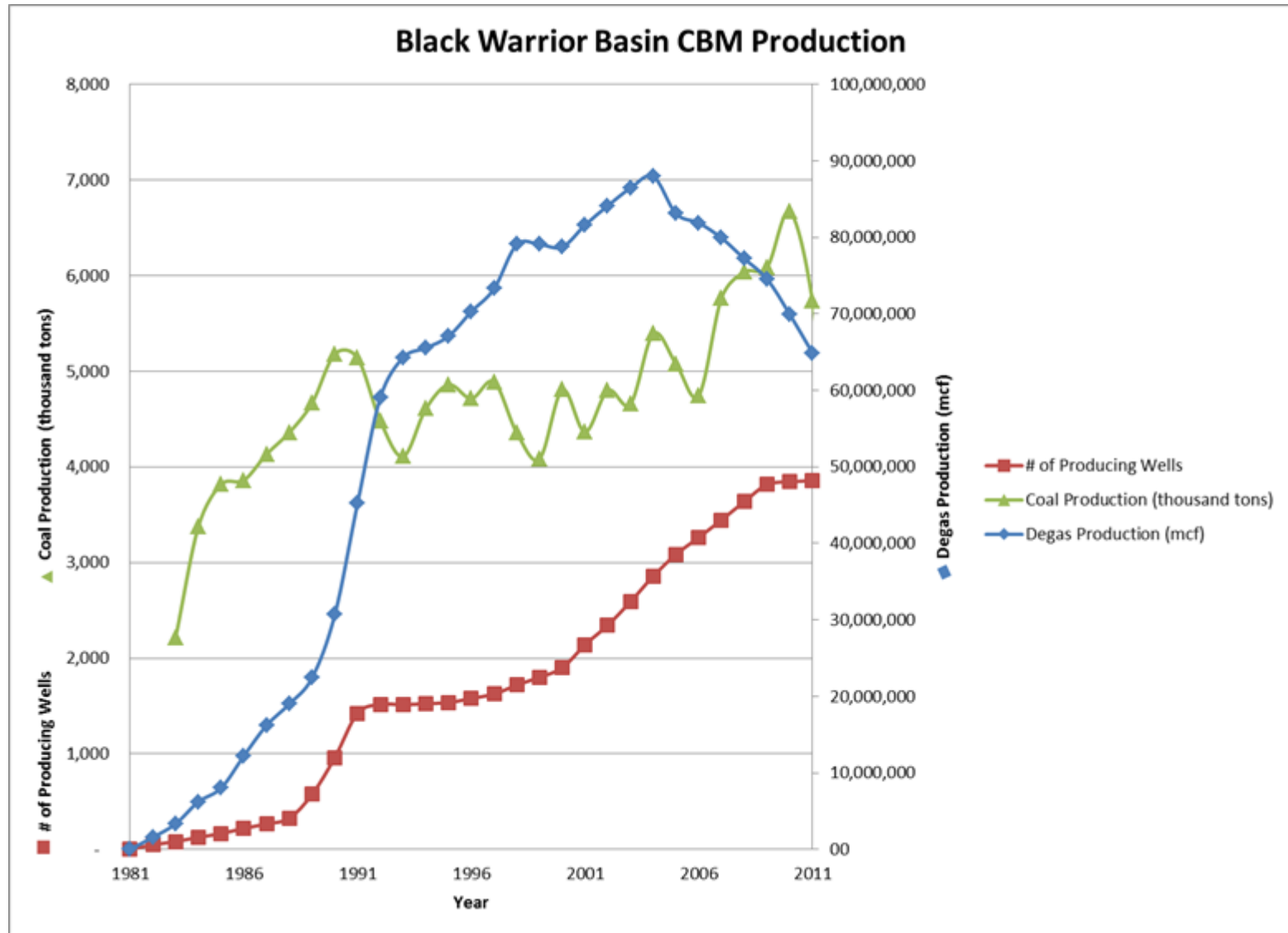
Billion Cubic Feet



Source: U.S. Energy Information Administration

Black Warrior Basin—Alabama

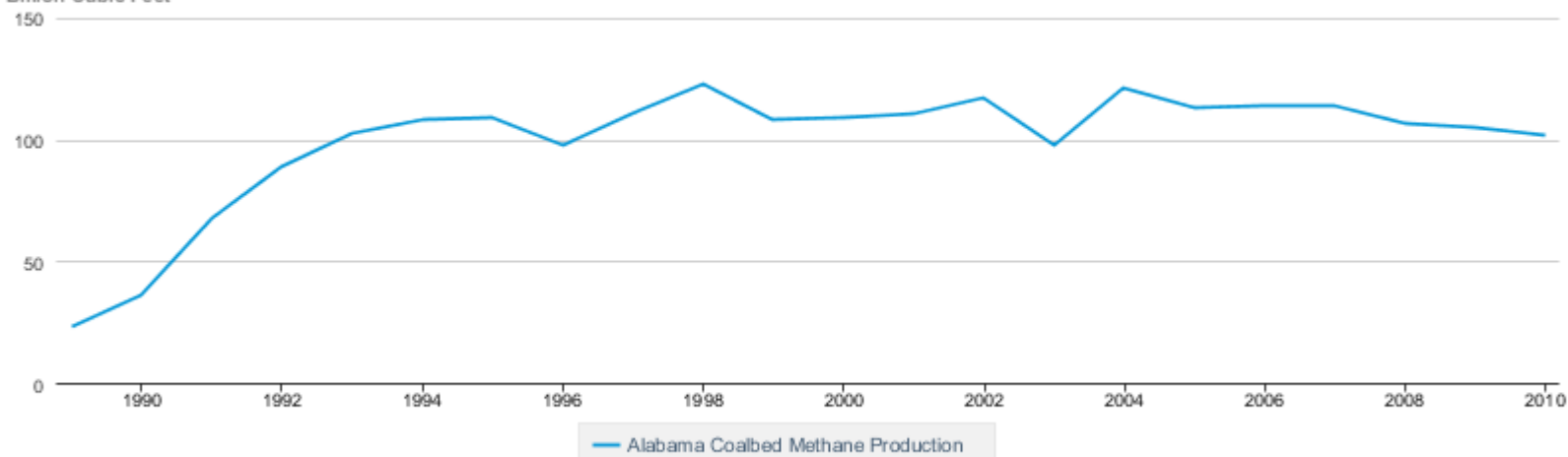




Annual CBM Production Black Warrior Basin—Alabama

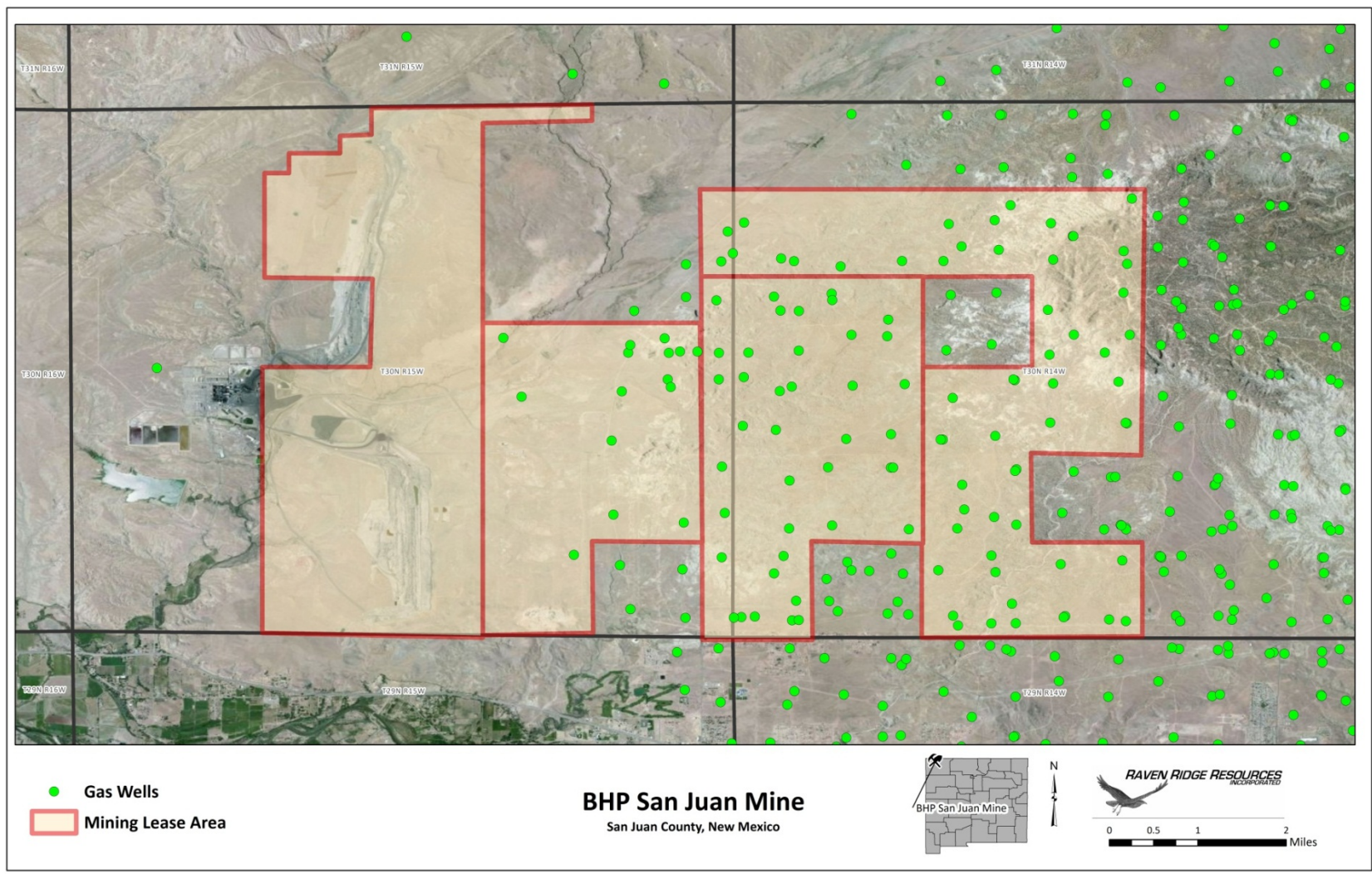
Alabama Coalbed Methane Production

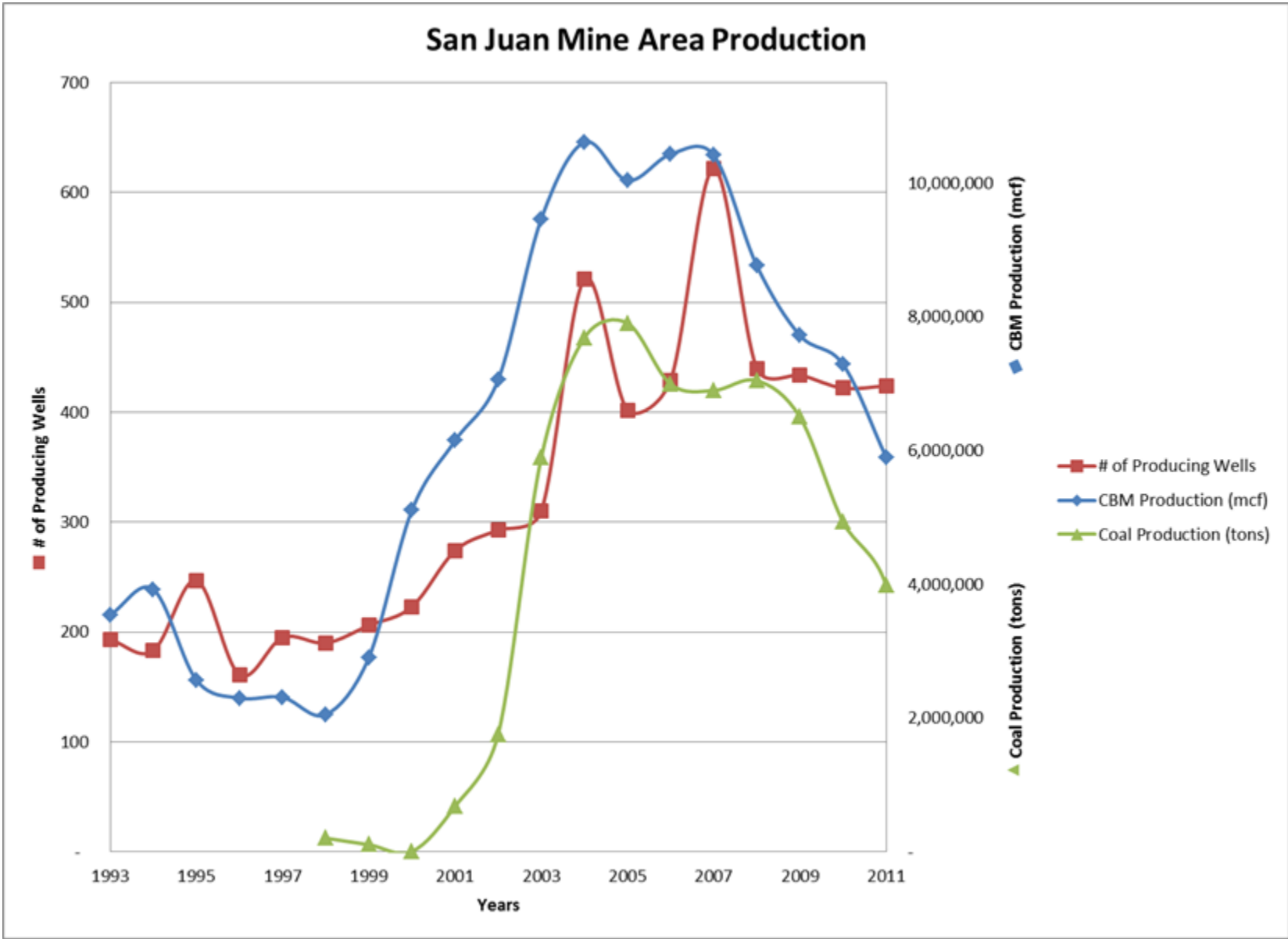
Billion Cubic Feet



Source: U.S. Energy Information Administration

San Juan Basin—New Mexico

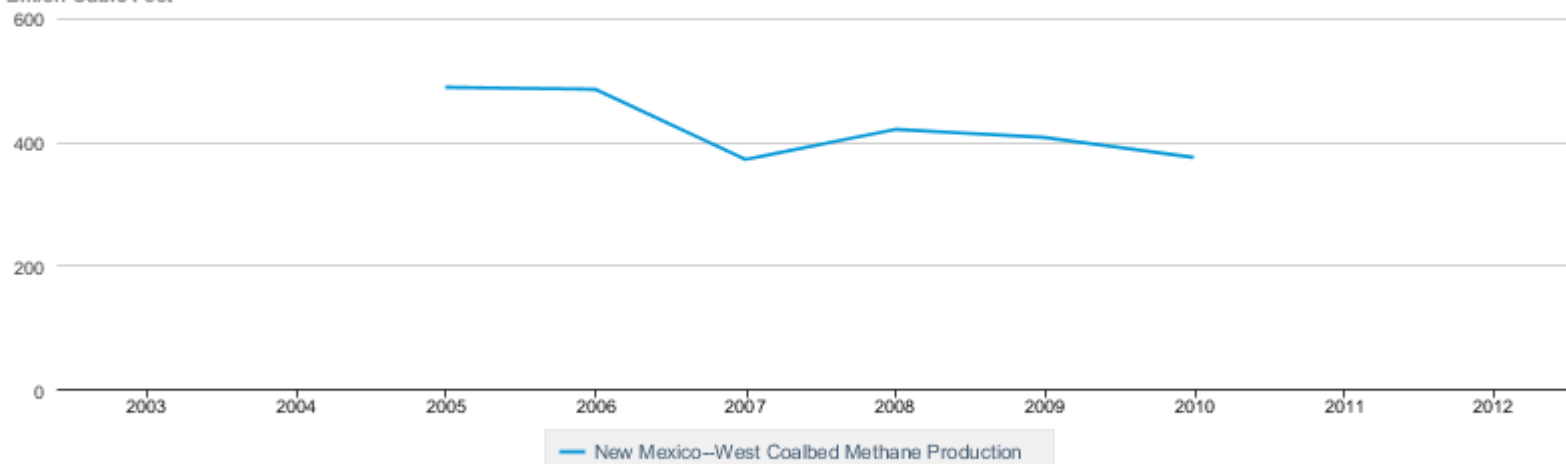




Annual CBM Production San Juan Basin—New Mexico

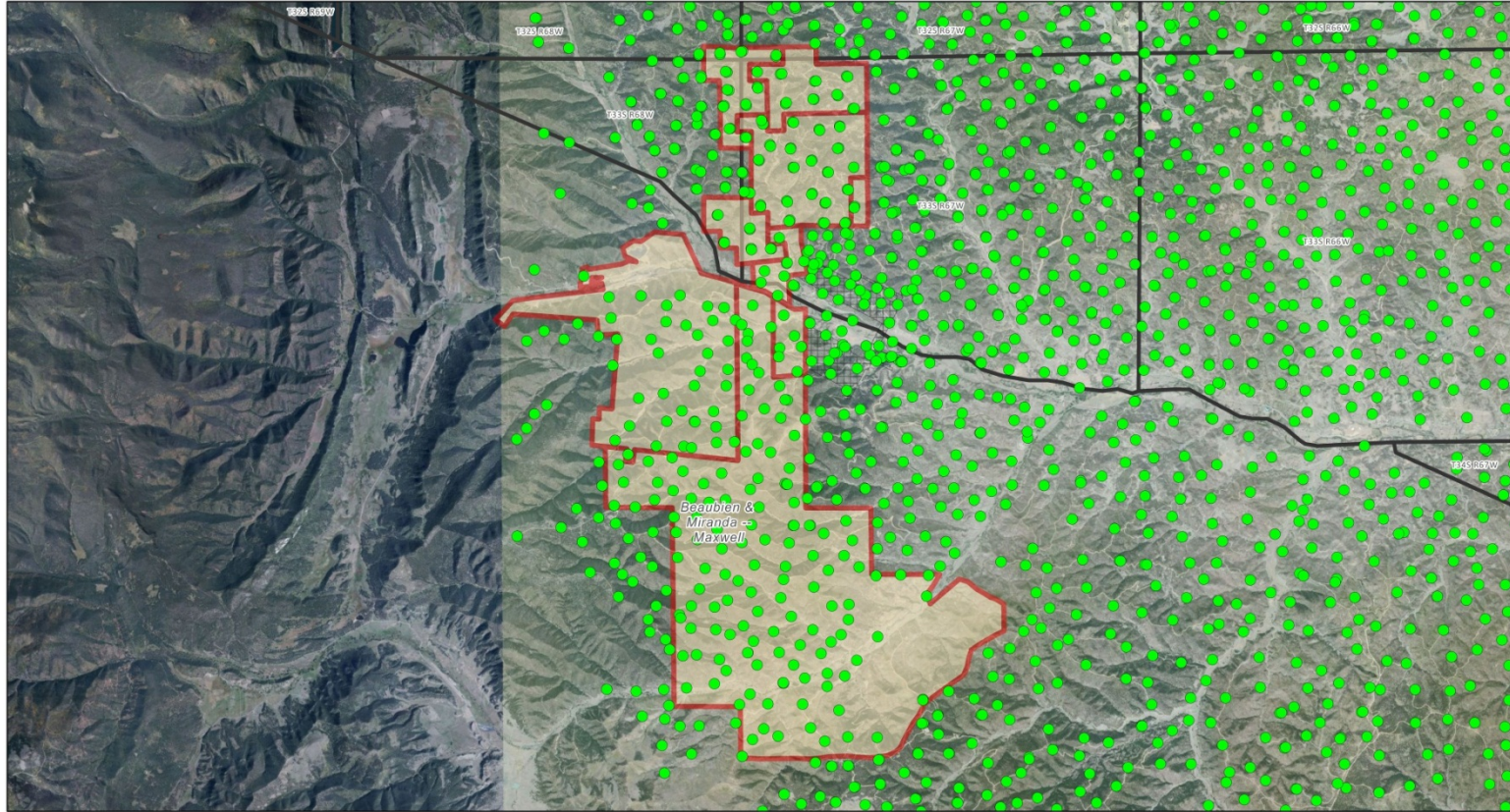
New Mexico—West Coalbed Methane Production

Billion Cubic Feet



Source: U.S. Energy Information Administration

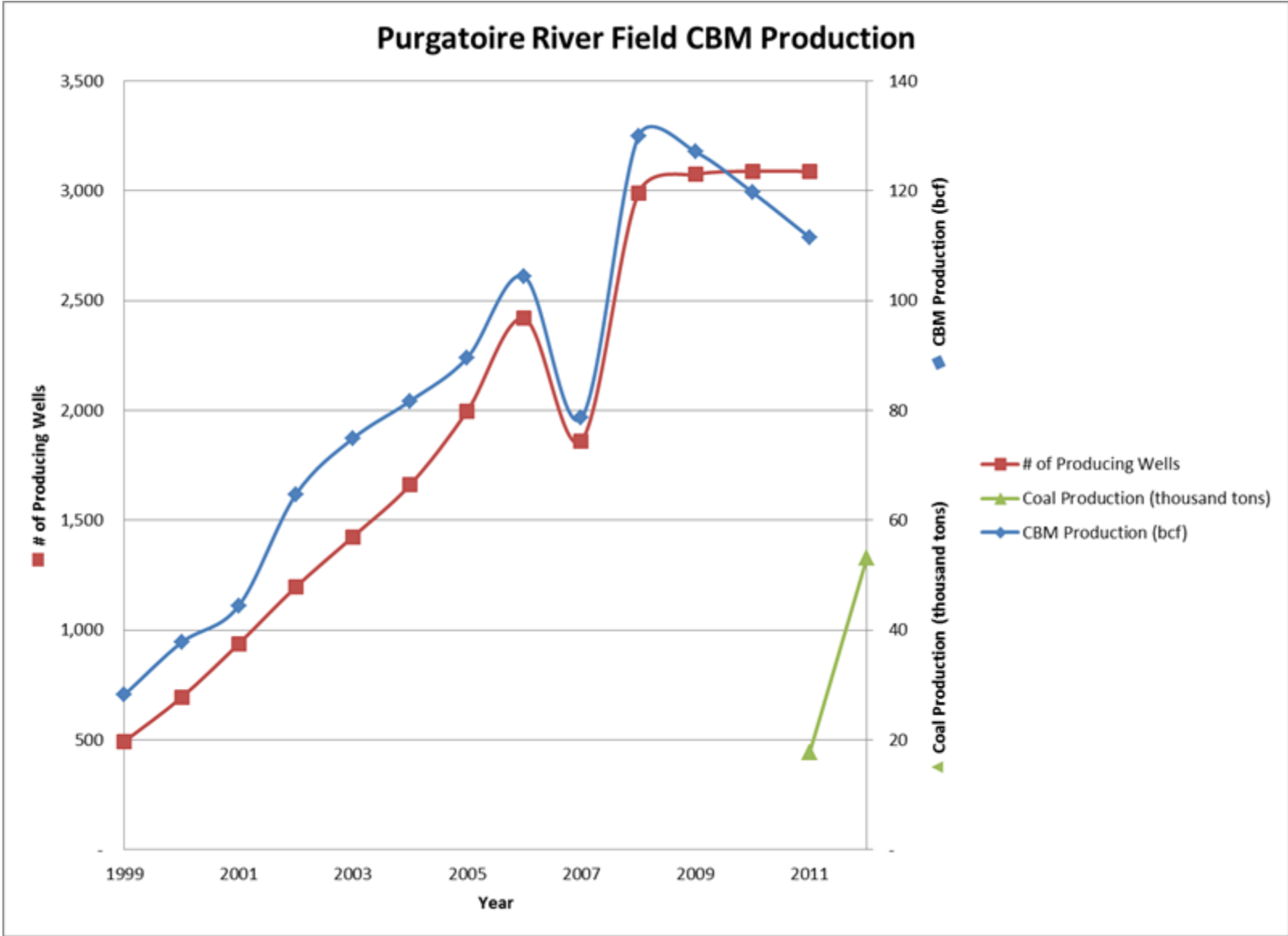
Ration Basin—Colorado



- Gas Wells
- Mining Lease Area
- ▨ Mined Out Area

New Elk Coal Mine
Las Animas County, Colorado

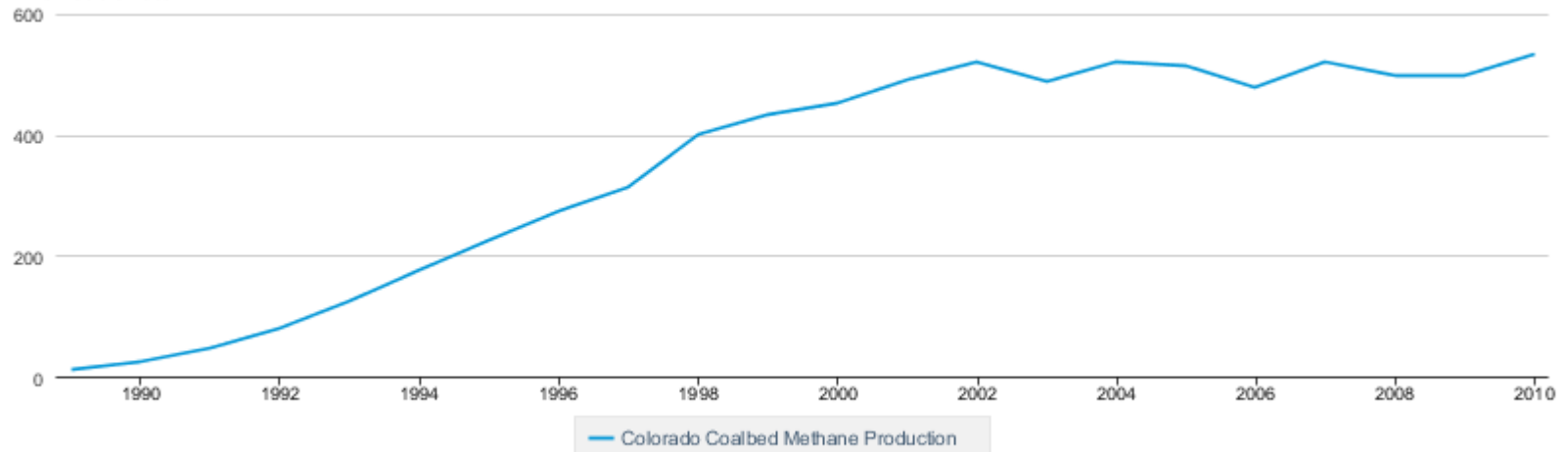




Annual CBM Production—Colorado

Colorado Coalbed Methane Production

Billion Cubic Feet



Source: U.S. Energy Information Administration

Closing Comments



Observations

- Unique set of circumstances in USA have led to effective development of unconventional gas resources—which are now not so unconventional
- Economic incentives are important for development of resources, but so is access to ready market—coevolution is key to sustainability
- Low energy price coupled with tight environmental oversight is key to commodity consumption being driven toward highest use—market selectivity

Thank You

For more information...

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