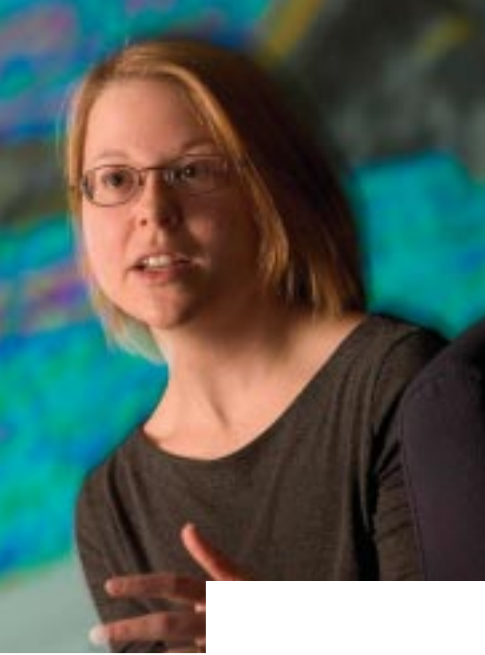


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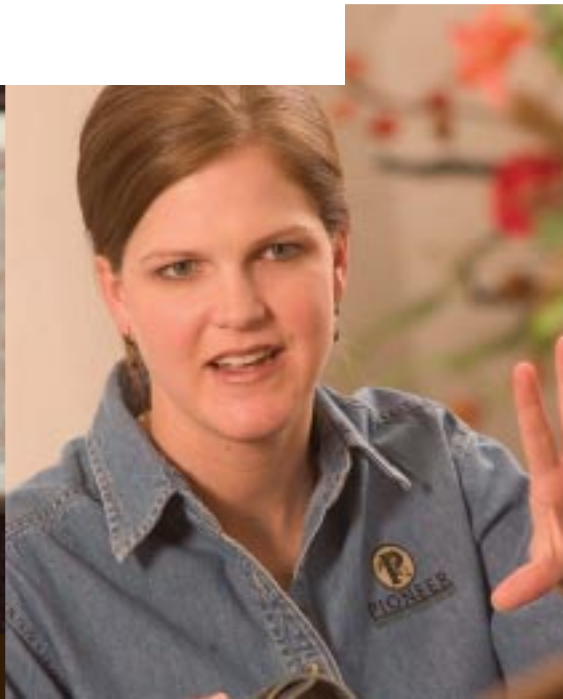
# Oil and Gas Investor

## COALBED METHANE

DECEMBER 2004



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ABOUT THE COVER: Water produced from coalbed-methane wells in the Powder River Basin flows into an existing streambed south of Gillette, Wyoming. (Photo by Lowell Georgia.)

# COALBED METHANE

**T**oday's robust economics and improved technologies such as multi-seam completions, and completions of gas from both coalbeds and nearby sands, CBM looks better than ever. It may be viable in some basins even if the price of gas falls back to \$3 or \$4 per thousand cubic feet.

Too, investors like longer-lived reserves—and CBM fits Pioneer Natural's new CBM assets, acquired from Evergreen Resources, have a reserve life of 31 years.

There is a lot more upside left in CBM plays throughout the U.S. For example, Evergreen says the coals on its acreage were only about 55% drilled—even though it had about 980 net producing wells there.

But every basin in which CBM can be found is different. Attention must be paid to the geology of the area, the thickness of the coals and many other factors. Operators and regulators continue to grapple with key issues including produced-water disposal, the permitting process, litigation from opponents to drilling, and adequate pipeline capacity for new production.

As the technology improves and geologists gain greater understanding of how CBM production really works, new areas are attracting industry interest. The Greater Green River Basin region appears poised to see much more activity, although drilling deeper to tap into higher-rank coals may be required. The Cherokee Arch, and Sand Wash, Washakie and Hanna basins are now being assessed for potential.

One estimate says there could be up to 314 trillion cubic feet of gas—more than all the other Rockies coal basins combined. Since 1999, some 500 new CBM well permits have been approved or are pending there, with roughly half drilled as of October 2004.

Local, state and federal regulation of CBM development has continued to be controversial. Rulings and appeals trade back and forth and stop much of the action. Producers complain that many of the restrictions now in place do not take into account the new technologies of the past 30 years. The Bush Administration encourages CBM development and has called for expediting permitting. It also wants to reverse some of the restrictions enacted by former president Clinton.

The most dramatic event, occurring in August 2004, in essence means the Bureau of Land Management has suspended issuance of new CBM leases in Wyoming until further environmental review is completed. But changes in Alaska's shallow-gas leasing procedures may allow CBM development to proceed in that state after controversy last year.

This special report on CBM, our third annual, will bring you up to date on these topics. As always, we welcome your feedback.

—Leslie Haines, Editor-In-Chief

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# Coalbed Stars

*High natural gas prices, better technology and increasing coalbed-methane production are lending more star power to these assets.*

**Article by David Wagman**

**A**s the economics of and demand for coalbed-methane (CBM) gas production rise, the acreage that could produce CBM is becoming more attractive. With gas prices now in the \$5- to \$6 range, market forces are well able to sustain CBM production, which only a few years ago had to be coaxed to life by a now-expired federal tax credit.

Advances in well fracturing technology, expanded pipeline takeaway capacity in the Rocky Mountains, and narrower price differentials between market hubs also make CBM-producing assets or undeveloped acreage seem a better bet.

"With today's economics, resources that were seemingly uneconomic are getting a new look," says Art Smith, chairman of research firm John S. Herold Inc.

Those factors, along with an abundance of cash and deal-friendly equity markets, are bolstering interest in CBM deals, as part of the growing interest in buying a position in all unconventional gas plays. Strong interest exists among many buyers either to acquire CBM assets, or entire companies with CBM prospects.

Unlike the rapid production declines seen in some conventional gas basins, reserve and production growth characterizes many of the largest CBM plays, including those in the San Juan, Raton and Powder River basins.

Even a coal producer is getting into the act. It is taking advantage of high commodity prices by partnering with a gas producer to drill in a coal seam it doesn't plan to mine for another 20 years, according to G. Warfield (Skip) Hobbs, managing partner with New Canaan, Connecticut-based Ammonite Resources. The E&P company holds a 70% interest in the gas and the coal

company stands to save on future expenses to degas the coal.

## M&A heats up

Denver-based Galaxy Energy Corp. has been actively buying acreage in the Powder River Basin, including CBM acreage. Founded last year by Mark A. Bruner, who sold CBM-heavy Pennaco Exploration to Marathon Oil in 2002 for \$500 million, Galaxy has either drilled or acquired 140 wells, spending \$20 million in the process.

The company recently arranged another \$20 million in financing to drill 100 additional wells through 2005. It plans to have some 285 wells operating in the Powder River Basin by the end of next year.

"We prefer to drill our way in," says Cecil Gritz, Galaxy chief operating officer. "We're getting into areas where the big guys have left to do something else."

In July, Galaxy agreed to acquire 4,400 net acres of prospective CBM properties in Campbell and Converse counties, Wyoming. Under terms of the deal, Galaxy must drill 12 new wells on the acreage to earn an initial 50% working interest in those wells along with a 50% working interest in nine existing wells, seven of which have already been completed.

Galaxy estimates it may need to spend \$1.2 million for drilling and associated infrastructure expenses. Chief executive Bruner estimates the company may have 600 CBM locations to drill on its acreage, including what came to the company in its recent acquisition.

A number of transactions have been announced that contain a CBM component. Among them:

— In December 2003, Quest Resources paid \$126 million to Devon Energy for CBM assets in the Cherokee

Basin in southeast Kansas.

— In May 2004, XTO Energy paid between \$336- and \$341 million to ExxonMobil for properties in the Powder River Basin and elsewhere.

— Also in May, Pioneer Natural Resources acquired Evergreen Resources for \$2.1 billion, or \$7.34 per barrel of oil equivalent (BOE). In turn, in September, Heartland Oil & Gas paid \$22 million for Evergreen's Forest City Basin CBM acreage.

— In a third major deal in May, EnCana Corp. acquired Tom Brown Inc. for \$2.7 billion (\$12.38 per BOE), including properties in the Rockies.

— In October, Western Gas Resources paid \$82.2 million to four sellers in New Mexico's San Juan Basin for 24,000 net acres producing 11 million cubic feet a day net of CBM. Proved reserves were some 60 billion cubic feet (Bcf) with additional upside of 50 Bcf.

— And in November, St. Mary Land & Exploration closed on a \$23.1-million deal with Goldmark Engineering to buy an estimated 32 billion cubic feet equivalent (Bcfe) of proved oil and gas reserves in Wyoming's Big Horn Basin.

The pricing of CBM assets reflects their reserve life, which tends to be much longer than that of conventional gas reserves. A look at one deal may be instructive. Analysts at Raymond James & Associates suggest that Evergreen, entirely a CBM-focused company, was taken out for around \$1.43 per thousand cubic feet equivalent (Mcf) of proved reserves.

This was a discount to a comparative group of small-cap companies that Raymond James follows. Proved reserves among those companies had an average value of \$1.94 per Mcfe. Evergreen's purchase price was also a discount compared with the value of



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proved reserves across the entire E&P sector, which was \$1.82. Raymond James says the discount was the result of CBM's long reserve life. In the case of Evergreen, its reserve life at the end of 2003 was around 32 years.

Although CBM assets in general are popular acquisition targets these days, there are no guarantees. One high-profile asset that didn't sell recently was Marathon Oil's Pennaco Energy subsidiary.

Marathon is one of the largest CBM acreage-holders in the Powder River Basin, with more than 650,000 net acres in northeast Wyoming and southeast Montana. Production from these operations averaged a net of approximately 72 million cubic feet of gas per day during first-quarter 2004. At year-end 2003, Marathon's total resource base in the Powder River Basin was around 2 trillion cubic feet (Tcf) of gas, of which 388 Bcf was proved reserves.

The company took Pennaco off the market in October, saying the offers it received didn't match expectations. It appears the market recognized that the CBM production didn't appear to be growing as it was expected to do, and looked to be flat or even declining, Smith says.

### Cashing in

Still, with commodity prices up, many companies see this as a good time to take "some or all of the chips off the table," says Dane Isenhower, vice president and general manager for Houston-based Petroleum Place Energy Advisors.

Buy-and-sell activity is up. So are multiples. In 2003, dollar multiples per BOE were around \$7, Isenhower says. By late summer and early fall 2004 they had risen above \$8.

Buyers appear willing to pay for upside potential. In the past, sellers could seldom expect to get twice the value of an asset's proven developed (PDP) reserves. That isn't doctrine today, Isenhower says, as sellers increasingly are able to realize more than twice PDP.

M&A advisor Randall & Dewey says the implied average price paid in second-quarter 2004 for U.S. proved reserves was a record \$9.12 per BOE,

up from \$6.75 in 2003.

It's not all upside, however. Buyers, sellers and equity lenders alike recognize energy's cyclical nature. A warm winter, a drop in demand or a sizeable jump in rig count could help drive gas prices down from their current high levels. And even though CBM properties tend to be long-lived producers, they also take longer to bring into production, in part due to dewatering issues.

Hobbs doesn't see commodity prices dropping to where CBM becomes uneconomic to produce. "We made money at \$3 an Mcf," he says. With demand holding prices high, the key—as always—is owning the resource.

CBM is proving to be anything but homogeneous, a factor that can also lead a company into danger. "Coal can

## Is adequate pipeline capacity available to take gas to market?

be highly variable stratigraphically," Hobbs explains. Geological studies are critical to determine the thickness and quality of the coal within an asset.

"If a company acquires 20,000 acres on the strength of three wells and says they will put in 200 wells, they may run into trouble," he adds.

Sylvia Barnes of Petrie Parkman & Co. agrees. "Not all coalbed methane is created equal." During the 1990s she worked for an institution that bought CBM assets in the San Juan Basin. It proved to be "almost magic gas" with production that consistently exceeded independent engineering forecasts.

"It gets back to permeability and porosity. There are aspects of coalbed methane that are still not fully understood."

Having a good geological report is one part of buying an attractive CBM asset package. But at least four other factors must be considered:

— Can the associated water be disposed of on the surface (a cheaper

option) rather than through reinjection (a more expensive option)?

— Is the permitting process favorable?

— Is adequate pipeline capacity available to take gas to market?

— Is enough electricity available to operate the necessary equipment?

As for the latter challenge, Hobbs says so much production and compression equipment is running in the Powder River Basin today that some E&P firms are considering building power generators for their own use and for resale to neighbors.

High commodity prices cause buyers to think twice about acquiring proven reserves, whether conventional or CBM-based. "We don't recommend buying proven reserves at today's prices," says Hobbs. A better strategy might be to acquire unproven reserves and benefit from the upside when the asset moves to the proven reserves column.

Concerns also exist that commodity prices may be at or near the top. Last spring, Randall & Dewey wondered if 2002 and 2003 were the first stages of a multi-year, robust price scenario with mid-cycle prices well beyond historical averages. Or, the firm asked, is the market closer every month to a major cyclical peak? The answer might be "yes" to both questions.

Raymond James doesn't include itself among analysts predicting a gas-price correction in 2005. Instead, the firm believes that investors are comfortable with the commodity's ability to sustain current high prices. The firm is bullish on \$40 oil and \$6.65 gas.

Peter Dea, president and chief executive of Western Gas Resources, sees natural gas prices for the next few months hovering in the \$8 range, three to four times acquisition cost.

### Hedging and acquisition prices

Since no one is certain where prices are going, hedging strategies are being used to protect cash flows earmarked for debt repayment, and many companies also use hedging strategies to lock in a known rate of return for part of acquired production.

Pioneer Natural Resources hedged

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Fidelity Exploration & Production Company produces oil and natural gas from both conventional and nonconventional sources throughout the Rocky Mountain and Gulf Coast region. Approximately 30 percent of the company's 2003 natural gas production was coalbed natural gas from the Powder River Basin of Montana and Wyoming.



roughly three-quarters of Evergreen's production through 2005, says Barnes. When Kerr-McGee presented its offer to acquire Westport Resources, the purchase did not appear to be accretive using First Call earnings estimates. The deal looked more robust, however, once forward market price forecasts were included. Kerr-McGee's plan was to hedge as much as 90% of Westport's proved production through 2006, she adds.

When Quest bought Devon Energy's CBM assets, equity lenders required that 80% to 85% of production be hedged to guarantee cash flows for interest payments. At the time, Devon's assets were producing an average of around 19.6 million cubic feet per day, gross.

"It would have been our preference not to hedge," says James Vin Zant,

head of investor relations for Quest. During a three-year period, the company's hedges have an average value of \$4.70 per Mcf, which Vin Zant notes is "substantially below" current gas prices.

ArcLight Capital Partners provided \$51 million in financing for the deal. Banc One Capital Markets, now a part of JPMorgan, provided \$105 million of senior bank debt and mezzanine debt financing.

Even with a hedging strategy in place, buyers can make money on the spread between the commodity price and the gas forward strip price, Barnes says. That's because the wellhead price of gas rose by roughly \$1 to \$2 per Mcf between 1998 and 2004. At the same time, the spread on the Nymex blended forward strip with 70% gas and 30% crude has risen from roughly \$2.50 to \$6.25.

"That's what is driving the acquisition market," she says. For those who have sold into these market conditions, the result has been an "extraordinary return." She doesn't expect the margin to remain wide over the long term, however. Either acquisition prices will rise or the forward strip will flatten, narrowing what up until now has been a significant first-mover advantage.

Hobbs says that a good supply of assets may be available from the universe of relatively small, undercapitalized companies "that got in and ran out of money." He is aware of a "number of situations" in which well-capitalized companies are looking to buy small E&P firms that have potential reserves but lack access to capital.

"If you have proven reserves it's easy to get capital," he says. □

## Some Recent Deals Involving CBM Assets\*

Buyer	Seller	Price (\$MM)	Location of CBM Assets	Date Announced
Heartland O&G	Evergreen Resources	\$22	Forest City Basin, Kan.	Sept. 2004
Unidentified	Anadarko	\$850+	SE Colorado	Sept. 2004
XTO Energy	ChevronTexaco	\$912	Rockies	Aug. 2004
Energen Corp.	Unidentified	\$263	San Juan Basin	Aug. 2004
Petro-Canada	Prima Energy	\$534	Rockies	July 2004
Kerr-McGee	Westport Resources	\$3,400	Rockies	June 2004
EnCana	Tom Brown	\$2,700	Rockies	May 2004
Pioneer Natural Resources	Evergreen Resources	\$2,100	Rockies	May 2004
XTO Energy	ExxonMobil	\$341	Rockies	May 2004
Quest Resource	Devon Energy	\$126	Cherokee Basin, Kan.	Dec. 2003
Evergreen Resources	Carbon Energy	\$110	Rockies	Oct. 2003
XTO Energy	Unidentified	\$100	San Juan Basin	Oct. 2003
XTO Energy	Markwest Hydrocarbon	\$61	San Juan Basin	June 2003
XTO Energy	Williams	\$381	Raton and San Juan basins	May 2003
XTO Energy	J.M. Hube	\$154	Southwestern Colorado	Dec. 2002
XTO Energy	Marathon Oil	\$42	San Juan Basin	July 2002

\* Some of these deals involve assets besides CBM and are in areas other than that named as the location of the CBM assets.

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# The Greater Green River Region

*Five basins hold a trillion tons of coal and 300 trillion cubic feet of gas, but coalbed-methane prospectors will have to drill deeper to get it.*

**Article by Stephen D. Schwochow**

**C**ould the Green River region become the next big coalbed-methane (CBM) play in the Rockies? Signs are pointing that way, but it probably won't look like the Powder River or San Juan basins.

This vast area, made up of five subsidiary basins, is not just coal-rich, it's downright coal-rampant. The ubiquitous Mesaverde group and other Cretaceous strata contain numerous seams throughout the region, with 135 to 250 feet of coal. Add another 200 feet of coal in the younger Paleogene Fort Union and Wasatch formations. Cretaceous and Paleogene coals also abound in the adjoining Hanna basin—450 feet of coal in more than a hundred seams. Altogether, that's more than a trillion tons of coal!

How much gas might all of this coal contain? The Gas Technology Institute estimates 314 trillion cubic feet (Tcf) in place—more than all other Rocky Mountain coal basins combined. Add to that 15 Tcf for the Hanna Basin. About 85% is contained in strata at depths below 6,000 feet.

What portion of all that gas might be recoverable is a different story. To date, estimates are rather conservative because of the lack of reservoir and production data. The U.S. Geological Survey's latest assessment, exclusive of Hanna Basin, totals 1.89 Tcf in combinations of seven different stratigraphic units. The Potential Gas Committee estimates 2.5 Tcf from the equivalent area, but the two organizations' figures are not directly comparable because they use different estimation methodologies.

## **A disappointing start**

Nearly all the early attempts to produce CBM in the region were un-

successful. Developers understandably were attracted to these basins in the early 1990s because of the vast coal resources, activity in other Rocky Mountain basins at the time and the rush to drill Section 29-qualified wells before year-end 1992.

A number of reasons contributed to their failure. There was no field-specific data on gas content, permeability and other coal properties; poor understanding of basin hydrodynamics; a lack of effective well completion and stimulation procedures; and discouraging well test results. Added to those issues were the high cost of produced-water disposal and weak gas prices.

Consequently, most efforts ended up as expensive water wells.

From 1989 into the late 1990s, only about 2.6 billion cubic feet (Bcf) of gas was credited to coalbed or dually completed coal-sandstone wells in the region—in Table Rock Unit (Washakie Basin), Dixon Field (Cherokee Arch) and Fortification Creek Field (Sand Wash Basin).

Now, armed with better geology, the latest in multi-seam completion technologies and strong gas prices, developers are returning to the Green River in full force, looking at all the principal coal horizons in all five basins and even in the Overthrust Belt.

Since 1999, 500 new CBM exploration permits have been approved or are pending, and about 215 wells had been completed as of October 2004. Two operators are producing gas into sales lines.

## **Washakie Basin**

Southwest of Rawlins sits Atlantic Rim, a prominent mesa capped with Mesaverde sandstone. The name has been given to the largest comprehen-

**Nearly all the early attempts to produce CBM in the region were unsuccessful...A number of reasons contributed to their failure.**

sive CBM exploration project in the Green River region.

The Atlantic Rim trend follows the Mesaverde outcrop and the Savery fault system. Geologists postulate that a potential gas-production fairway may exist along the trend. In simplest terms, the fault system acts as a barrier that forces basinward-flowing groundwater (from recharge areas along the mountains to the east) and biogenically generated coalbed gas to flow upward, creating artesian overpressuring. Hydrocarbon overpressuring dominates west of the fault.

The development was proposed to the Bureau of Land Management (BLM) in July 2001 by Petroleum Development Corp. and other operators who had pilot projects in the area. PDC believed 3,880 wells could be developed along the trend over six to 10 years. The BLM concluded that a full-scale environmental impact statement (EIS) would be required. The study area encompasses 310,335 acres.

In order to evaluate reservoir, production and operational data for its EIS, the BLM adopted an interim drilling policy under which it has allowed about

# Southwest of Rawlins sits Atlantic Rim, a prominent mesa capped with Mesaverde sandstone.

200 wells to be drilled within nine plans of development, or "pods," identified by the operators. Initial exploration in each generally is limited to 22 gas wells and two water-disposal wells.

Operators have, to date, proposed drilling seven pods, for which the BLM has released interim environmental

assessments covering 15,600 acres, or 5% of the study area. More than 85 wells have been drilled, and about 40 are dewatering or in production.

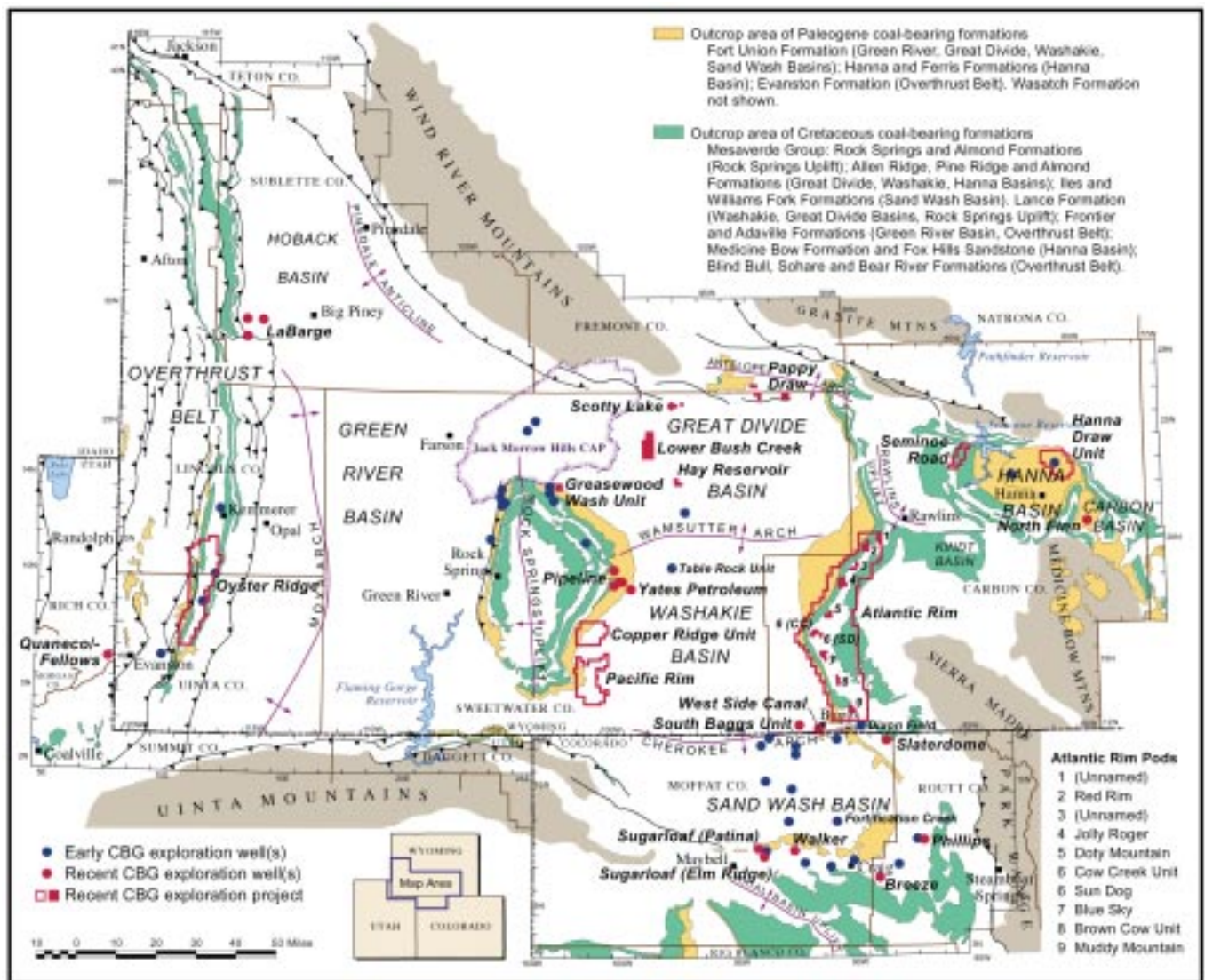
Anadarko Petroleum will operate several of the pods. As a result of its merger with Union Pacific Resources in 2000, Anadarko acquired 1.8 million acres of land grant originally ceded to the railroad. Casper, Wyoming-based independent Warren E&P Inc., a subsidiary of Warren Resources Inc., has joined Anadarko in developing the Atlantic Rim properties as well as other prospects across the region.

Cow Creek Unit, the only pod for which detailed information has been released, is fairly representative of the overall geology and objectives. Initial efforts target multiple seams aggregat-

ing to 20 to 50 feet in the Almond formation. Deeper prospective coals lie in the Allen Ridge formation. Depending on structural position, the pods will test the coals at depths between 650 and 5,400 feet.

Coal rank varies from subbituminous to high-volatile B bituminous. At Cow Creek, desorbed gas contents were found to range from 120 to 450 standard cubic feet/standard ton, generally increasing with depth, with an average of 241 scf/st from whole core.

Double Eagle Petroleum & Mining Co. acquired Cow Creek Field in 1999 to redevelop it into a CBM field. The 14 wells operating today were fracture-stimulated with sand-nitrogen foam treatments and produce gas for sales through perforations in three to six



Coalbed-methane exploration projects abound in the Greater Green River region.

seams in any given well. Producing depths range from 900 to 1,400 feet.

With just over 2.5 years of production history, the trends from several wells look very encouraging. Average per-well rates in July were about 260,000 cubic feet of gas and 1,200 barrels of water per day; total production was 6.577 million cubic feet of gas and 18,400 barrels of water.

In a nonproducing area on the west flank of the Washakie Basin, appropriately named Pacific Rim, Warren E&P proposes a four-year program that could result in 120 wells. At three sites within the 47,600-acre assessment area, several companies are drilling shallow Almond coal and sandstone objectives at 2,400 to 3,400 feet, but a deep (6,350-foot) coal-sand test also has been scheduled.

Immediately north of Pacific Rim, Anadarko has formed the Copper Ridge unit, another shallow coal-sand gas

## Drilling deeper ...may be warranted in the Green River region.

prospect that, according to the environmental assessment, could support 89 wells on 25,000 acres. The first 11 wells were drilled in 2003.

Infinity Inc. is another operator to have established Mesaverde coalbed gas production in the current round of activity. Wells at the company's Pipeline project on the Wamsutter Arch produce from Almond and Lance coals and from Almond sands. Earlier this year,

the company concluded that the field may not be a blanket-type CBM accumulation, as originally believed, but more likely a conventional sand reservoir with gas sourced from adjacent coals. The project is unusual in that it produces condensate.

### Great Divide Basin

The final EIS for the Jack Morrow Hills (JMH) coordinated activity plan was generating controversy even before it was released in July. Its five resource-management alternatives have profound impacts on future petroleum and CBM development in the western Great Divide basin.

The 622,000-acre assessed area partly overlies what geologists have found to be the thickest net-coal accumulations in the Rock Springs (Mesaverde) and Fort Union formations—100 feet in each.

In the early 1990s several companies

### U.S. Geological Survey ("Undiscovered" Resources, Bcf)\*

Petroleum System/Assessment Unit	Fractile				Mean
	F95	F50	F5		
<b>Green River Coal Region</b> (Green River, Washakie, Great Divide and Sand Wash basins):					
<i>Mesaverde TPS</i>					
Mesaverde Coalbed Gas AU	126.1	232.1	427.3		248.7
<i>Mesaverde-Lance-Fort Union Composite TPS</i>					
Mesaverde Coalbed Gas AU	13.7	25.4	47.3		27.3
Fort Union Coalbed Gas AU	35.3	73.2	151.9		80.8
<i>Lance-Fort Union Composite TPS</i>					
Lance Coalbed Gas AU	78.2	152.0	295.5		165.0
Fort Union Coalbed Gas AU	513.9	891.2	1,545.4		942.5
<i>Wasatch-Green River Composite TPS</i>					
Wasatch-Green River Coalbed Gas AU	27.8	58.4	122.6		64.7
Subtotal Green River Coal Region	795.0	1,432.3	2,590.0		1,529.0
<b>Hams Fork Coal Region</b> (Wyoming-Utah Overthrust Belt):					
Frontier-Adaville-Evanston Coalbed Gas TPS	148.8	323.1	701.7		361.1
<b>Total Green River and Hams Fork</b>	<b>943.8</b>	<b>1,755.4</b>	<b>3,291.7</b>		<b>1,890.1</b>

### Potential Gas Committee ("Most Likely" values, Bcf)\*\*

Area	Resource Category			Total
	Probable	Possible	Speculative	
Green River Coal Region (Green River, Washakie, Great Divide and Sand Wash basins, Overthrust Belt)	NE	375	2,135	2,500
Hanna-Carbon Coal Fields	NE	NE	6,138	6,138
<b>Total Green River &amp; Hams Fork Coal Regions</b>	<b>NE</b>	<b>375</b>	<b>8,273</b>	<b>8,638</b>

TPS=total petroleum system. AU=assessment unit. NE=no estimate.

\* Assessment of Undiscovered Oil and Gas Resources of the Wyoming Thrust Belt Province, 2003: U.S. Geological Survey Fact Sheet FS 2004-3025.

Also, Assessment of Undiscovered Oil and Gas Resources of the Southwestern Wyoming Province, 2002: U.S. Geological Survey Fact Sheet FS-145-02.

\*\* Potential Supply of Natural Gas in the United States (Dec. 31, 2002): Potential Gas Committee, 2003.

Recoverable coalbed-methane resources in the Green River coal region.

tested gas at depths of 3,400 to 6,600 feet in both intervals, inside the JMH plan boundary and updip on the Rock Springs Uplift. The most recent effort, The Williams Cos.' Greasewood Wash Unit, targeted Rock Springs coals but was terminated in 2001.

Under the proposed activity plan, only two 25-well coalbed exploration projects would be permitted between now and 2021. Besides the higher costs associated with the proposed impact-mitigation requirements, overall limitations on leasing could preclude a developer from assembling a large enough land position for a viable CBM field. More than 238,000 acres would be withdrawn from new leasing and additional restrictions placed on 234,000 acres.

Three operators hope to find gas in Fort Union coals in an area previously untested for CBM. The BLM has released environmental assessments for Kennedy Oil's three pods at Lower Bush Creek and Hay Reservoir (4,780 acres) and Hudson Group LLC's plans for Scotty Lake (2,880 acres). Patina

## Three operators hope to find gas in Fort Union coals in an area previously untested for CBM.

Oil & Gas has amassed 51,000 gross acres for its Pappy Draw venture to evaluate conventional gas in Cretaceous sands (Lance, Shannon and Frontier) and Fort Union CBM.

### Hanna Basin

One of the most ambitious coalbed projects in the region could result in as many as 1,240 wells. Denver independent Dudley & Associates LLC is testing 16 wells in an 8,320-acre pilot project near Seminole Reservoir.

The coal is abundant—up to 20 seams in the shallow Cretaceous

Medicine Bow formation, one in the underlying Fox Hills sandstone and at least six in the deep Almond formation. In the pilot wells the Almond, Pine Ridge and Allen Ridge formations have been perforated at depths between 4,300 and 5,800 feet.

To minimize the surface footprint of 1,200 or more wells, Dudley intends, whenever possible, to drill the shallow Medicine Bow wells from the same pads used for the Mesaverde wells, thereby reducing the number of sites to about 785 on 160-acre spacing.

In 2001 and 2002, the BLM released two environmental assessments—one for the pilot wells and a second for gas-gathering and compression facilities and a 20-mile-long pipeline that will deliver gas to the interstate transmission lines at Walcott.

For the full-scale development, the BLM is preparing an EIS covering 137,000 acres.

It's now round three for Hanna Draw, a project designed to produce gas from multiple seams in the



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Paleogene Hanna. The first contender, MetFuel Inc., suspended its efforts in 1993 after three years of testing.

Then in 1999, Barrett Resources established a 38,000-acre federal unit on which it drilled nine of 36 permitted wells. Several coals were perforated between 3,100 and 4,300 feet. One of the noteworthy seams, Hanna #2, reaches a thickness of 38 feet in the surrounding coal field.

Tipperary Corp. joined the project in early 2000. The next year, Barrett submitted to the BLM a development plan for 25 wells and ancillary facilities, including a 20-mile pipeline to the interstate transmission system. Early in 2002, the BLM released an environmental assessment for the proposals. Soon thereafter, the companies concluded that dewatering had not progressed satisfactorily and suspended their activities.

Now, Anadarko has proposed to drill and test up to 16 new wells in an undrilled section inside the original 5,682-acre exploration area. The com-

pany also plans to test horizontal drilling technology. In the interim, the BLM is preparing a new environmental assessment for the project.

### Sand Wash Basin

At least 10 companies are exploring Mesaverde and Fort Union coals or evaluating leaseholds around the basin. Four new projects, together with the productive Fortification Creek well, are located, not coincidentally, within or near the Cedar Mountain fault system north and west of Craig, Colorado.

Working in the operators' favor here is a seemingly fortuitous combination of thick Williams Fork coals (60 to 80 net feet), active aquifer recharge, pressure convergence and upward flow along structural boundaries, a hydrodynamic setting analogous to that at Atlantic Rim.

Companies currently testing wells include KLT Gas Inc. (Breeze Lease), Tipperary Corp. and Koch Exploration (Walker Lease), and Elm Ridge Resources Inc. and Patina Oil & Gas (Sugarloaf prospect). Target well

**One of the most ambitious coalbed projects in the region could result in as many as 1,240 wells.**

depths range from 3,200 to 6,000 feet.

CDX Gas LLC of Dallas has proposed to use its patented Z-Pinnate multilateral drilling technology in 4,000-foot-deep Mesaverde coals on leases it acquired at Patina's Sugarloaf prospect.

The Cherokee Arch is another area of high interest. Optimum hydrodynamics there may be responsible for the prolific oil and gas produced from Mesaverde and Fort Union sandstone reservoirs. Several operators are betting that those conditions will apply to coalbed gas as well.



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At Slaterdome Field, for example, Slaterdome Oil & Gas Inc. (a subsidiary of Toronto-based Dover Petroleum Corp.) and Cedar Ridge LLC found encouraging gas shows in several of nine Mesaverde tests that Phillips Petroleum drilled in 2000. One well reportedly has tested at 1.5 million cubic feet per day from Iles Formation coal. The companies completed another well this year and may drill ten more in 2005. Meanwhile, Dover has begun planning construction of an 18-mile pipeline to a gathering station near Baggs.

Also on the arch, Merit Energy Co., which operates Atlantic Rim pod No. 8, has completed wells at West Side Canal and Baggs South fields in the lower Wasatch formation (presumably coals) as well as the Fort Union.

**The outlook**

Drilling deeper to tap higher-rank coals and optimum hydrodynamic conditions—for a potential fairway or even

a “sweet spot”—may be warranted in the Green River region. Recent experience in the Piceance Basin shows that CBM production below 6,000 feet certainly is possible. Drilling in the range of 4,000 to 6,000 feet may become the norm for many parts of the Green River.

So, what does the Green River have to offer CBM prospectors? It’s an extremely large area almost entirely underlain by abundant coals containing more than 300 Tcf of gas resources. Furthermore, thanks to a well-established conventional gas infrastructure, CBM projects generally can be located within 25 miles of interstate pipelines.

As this is a gas-rich province, CBM project economics potentially can be improved by tapping both coalbeds and associated gas-charged sands in separate wells or through dual completions in the same well. Either way, multi-seam coal completions undoubtedly will be a standard practice.

While produced-water collection, treatment and disposal via injection wells are an added economic burden, the practice will, in the long run, lessen surface impacts and recharge aquifers, thus helping to counter at least some opposition to CBM development. Conditioned water would be surface discharged, with a national pollutant discharge elimination system (NPDES) permit, and the waste streams would be reinjected.

Some produced water could be used onsite and for livestock. The BLM favors this option for the federal wells in most of its assessments issued to date. An alternative would require nearly all produced water to be reinjected.

As the various pilot exploration projects gear up at a manageable pace and as new wells complete their dewatering, the next two to three years should tell us whether or not Green River “pods” will bear fruit. □



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# The Legislative and Regulatory Milieu

*For the industry to address the nation's current and future energy needs, restrictions on land access that have been in place for many years need to be reevaluated.*

**Article by Ann Preistman**

**A**s production rates in older U.S. fields continue to decline, the Rocky Mountain region is expected to be a growing supplier of natural gas, but only if development is not impeded by stipulations and restrictions.

Forecasts call for the Rockies' share of U.S. natural gas production to grow from 24% in 2002 to 39% in 2025. The greatest concerns for resource companies in the West, where the coalbed-methane (CBM) activity is the highest, revolve around unnecessary third-party lawsuits and the regulatory requirements from federal, state and local governments.

Fundamental differences exist between obstructionists who want more federal control and less production, and companies that are trying to provide a necessary resource in a timely and economic manner.

As the Federal Reserve's Alan Greenspan noted recently, the country is not running out of natural gas or places to look for it, but is running out of places where industry is allowed to look for natural gas.

## Ownership, split estates

A gas development cannot produce CBM without accessing the coal seam, and the coal operator must remove the CBM in order to mine coal. This unique relationship between coal and CBM has led to many legal disputes over who owns the methane gas contained in coal seams.

Separate parties often own land rights, coal rights, and gas and oil rights, and often none have clear legal ownership of the CBM. Mineral property rights take precedence over the overlying surface property right, called "severed estate." Split estate can also apply to mineral rights themselves, where the minerals can be owned in total by a single entity or can be owned

by the specific mineral commodity.

Federal laws regulating minerals vary depending on the date the surface was transferred to private ownership. Land patents issued to western settlers pursuant to the Coal Lands Acts of 1909 and 1910 conveyed the land and everything in it, except the "coal," which was reserved to the U.S. The concept of "split estates" has been challenged in the courts by coal companies believing the CBM and solid coal should be defined as one mineral.

*Amoco Production Co. v. Southern Ute Indian Tribe* is currently the defining case in the matter. The District Court ruled the gas was not part of the coal. The 10th Circuit Court of Appeals

reversed that ruling, concluding the acts' definition of "coal" was ambiguous and the Ute coal reservation encompassed CBM gas.

In 1999, the Supreme Court reversed the appellate court's decision, basing its decision on the question of not whether CBM gas is a constituent of coal based on today's knowledge, but how Congress regarded the matter in the 1900s. The common understanding at that time would not have encompassed CBM gas.

To prevent further conflicts, the Bureau of Land Management (BLM) sent letters in July 2004 to companies developing federal CBM gas reserves in front of progressing coal mines telling

## Canadian Situation

**A**cross the border, Canadian landowners have become alarmed by American horror stories and are distrustful of the energy industry, fearing CBM development will dry up their water wells and scar their landscapes. A conflict that threatened to become an international incident was averted when companies turned their backs on an August 2004 auction of CBM drilling licenses in southeastern British Columbia, north of Glacier National Park.

The British Columbia Ministry of Energy & Mines wants to promote CBM as a new source of energy and revenue. In July, Montana governor Judy Martz asked Ottawa to force the province to slow its plans for CBM development and conduct environmental assessment before auctioning off licenses in the southeast corner of the province, which borders Montana. Her grounds were that the auction contravened a 1909 treaty that prevents either country from polluting crossborder water bodies.

It appears bidders were chased away by the risks and costs. Among the likeliest bidders, Shell Canada is pursuing opportunities on private land; EnCana Corp. has established a joint venture with Fording Coal to drill five test wells on a lease next to the auction lands; and Chevron Canada Resources has drilled three test wells on the Tembec property flanking the bid properties.

British Columbia Energy Minister Richard Neufeld was undeterred, declaring that the government will post the land again when there is interest from the industry. □

# Wyoming is now considering a new watershed-based approach...to reduce conflicts of CBM drilling in the Powder River Basin.

them they had 90 days to either submit a plan to produce the resources ahead of the mining, reach a settlement with the coal producer or declare their leases uneconomical to produce.

In March 2004, the Virginia Supreme Court ruled that coal is distinct and separate from the CBM gas associated with it. The state high court ruled that the term "coal" in the late 19th century meant the solid rock used as the fuel and not the gas that escapes from it.

In Wyoming, a select "Committee on Split Estates" is working on a draft bill

to outline split-estate procedures for oil and gas operations in Wyoming. It is the third attempt to resolve an inequitable legal view of mineral and surface property rights. Case law during the past 50 to 80 years has established that the surface estate is subservient to the mineral estate.

However, supporters of reform say that view is antiquated, as Wyoming has doubled its natural gas production in the past 10 years. Under the current law, companies are not required to strike surface-use agreements. Many


believe the landowner should be part of the planning process and compensated for loss of value. Currently, many landowners expect exceptional income from operations on their property and minimal impact upon their land and upon other uses of their land.

## Access and permits

Restrictions on federal land access that have been in place for many years need to be reevaluated to allow the industry to increase CBM supplies, according to gas-industry advocates. Many of the current restrictions do not take into account important technological developments of the last 30 years.

Most of the 162 management plans covering scores of BLM districts have not been revised in three decades. In 2002, the BLM launched an effort to update the agency's management plans, setting a goal to revise all 162 within a decade.

In the more than three years that federal permitting was put on hold in Wyoming while environmental impact



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statements (EIS) were being prepared, producers operating on state and privately owned land drained substantial amounts of CBM from federal mineral leases. That drainage cost the federal government and Wyoming more than \$3 million a month in lost revenues, according to BLM officials.

Roadless areas are another hot-but-tion issue. The Bush National Energy Plan urges federal agencies to expedite permits, reassess lands withdrawn from exploration and simplify leasing policy. In July 2004, plans were announced to end the roadless rule adopted during President Clinton's final days in office. That rule made nearly 60 million acres of national forest lands off-limits to road-building and other activity. The present administration now plans to allow state governors to work with the federal government if they wish to keep certain forest areas roadless.

And, in a development that has broad implications for all federal leaseholders, on August 10, 2004, the 10th Circuit Court of Appeals ruled that the BLM sold three federal CBM leases in the Powder River Basin in violation of the law. The decision was a stunning reversal of the district court ruling that the leases were legal.

The appellate court ruled that there

was sufficient evidence that the environmental review was inadequate because it failed to address "significant new environmental concerns" associated with CBM production that were different from traditional oil and gas drilling.

Sources say the BLM will not issue any new leases until either a new EIS or environment assessment is complete, which could take a year or longer.

The BLM decision to suspend leases in Wyoming could affect other states, such as Colorado, New Mexico, Oklahoma and Kansas, to the extent that those states used the same environmental review standards to issue CBM leases as the BLM's Buffalo, Wyoming, field office used to issue the three leases in question.

### State outlooks

Alabama was the first state to sponsor CBM legislation in 1983, followed by Virginia in 1990 and West Virginia in 1994. Congress used Virginia's legislation as the basis for CBM statutes in the National Energy Policy Act of 1992 (EPACT). Key laws affecting CBM exploration and production are the National Environmental Policy Act (NEPA) and the Federal Land Policy and Management Act (FLPMA).

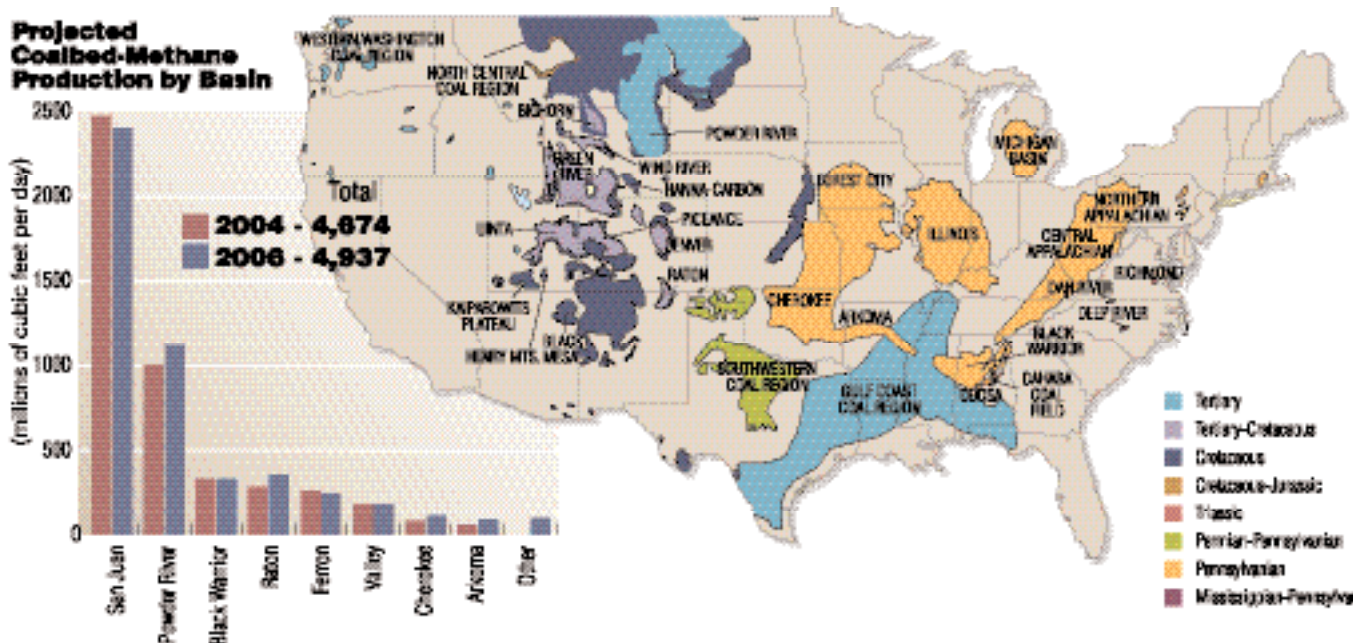
The most dramatic difference

between the early CBM exploration in the East and today's exploration in the West is the availability of federal lands. Most eastern states with coalbed-gas resources have enacted CBM legislation. In the West, however, only Montana has specific legislation; the other states rely on existing oil, gas and mining regulations and legislation.

Recently, Alaska has been caught in a swirl of controversy over proposed CBM development. In December 2003, opponents of CBM drilling appealed the state's decision to let Denver-based Evergreen Resources drill three test wells in the Matanuska Valley. A group of citizens said the property violated the constitution's mandate to manage the state's resources for the maximum benefit of the people.

In the fallout, state senator Scott Ogan, who had worked as a consultant for Evergreen, was forced to resign from the Alaska Senate and Evergreen backed off the project. The company was recently purchased by Dallas-based Pioneer Natural Resources.

Changes in Alaska's shallow-gas leasing procedures may help get the now-suspended program back on track. Recently approved Senate Bill 531 should resolve many objections to shallow-gas exploration made by citizen



The Rocky Mountains are expected to be a growing supplier of natural gas, but only if drilling is not impeded by stipulations and restrictions. (Map source: Gas Technology Institute.)

# The hydraulic fracturing issue appeared to be resolved....

groups. The bill calls for an end to the over-the-counter leasing procedure, bringing the program under the state's two other leasing programs.

The new legislation will also require extensive baseline water-quality testing before drilling for shallow gas, and stricter regulation of hydraulic fracturing, wide lease sales and exploration licensing. The programs involve extensive procedures for public review and comment through preparation of a

"best-interest finding," a kind of state-level environmental impact statement.

In other recent developments by state:

— Kentucky's governor signed his CBM development initiative (HB 577) into law April 7, following unanimous passage by both the Senate and House.

— In Indiana, HB 1224 would require the Center for Coal Technology Research to investigate the use and reuse of CBM. The bill allows the Indiana Utility Regulatory Commission to provide financial incentives for certain clean coal and energy projects involving CBM.

— In Pennsylvania, an appeal was filed challenging a Pennsylvania county assessment appeals board decision to tax CBM gas as real estate. Neither oil nor natural can be taxed as real estate, but coal can.

— New Mexico's SB 313 regarding CBM added a new provision on water rights permitting, a new definition of produced water and clarified authority over produced water.

— Kansas has proposed additional

legislation that promotes exploration and production of CBM gas by extending the period for severance tax exemption under KSA 79-4217.

## Pervasive litigation

Lawsuits, endless appeals and protests are delaying production throughout the Rocky Mountain region and straining the BLM's resources, testified Michel Caskey, executive vice president of Fidelity Exploration & Production Co., in a March 2004 appearance before the U.S. Senate Environment and Public Works Committee. Government staff are so occupied with litigation that the completion of environmental reviews and issuance of permits is being delayed.

In September 2004, the U.S. House approved legislation that would penalize organizations for filing "frivolous" environmental lawsuits. HR 4571, the Lawsuit Abuse Reduction Act (LARA), requires monetary sanctions against any party making a frivolous claim, including attorney's fees. At the

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Independent Petroleum Association of America's midyear 2004 meeting, U.S. Assistant Attorney General Thomas Sansonetti announced a record number of natural resources lawsuits (7,100) that his agency is now defending.

"Frivolous lawsuits filed under the guise of environmentalism actually hurt the environment and hinder economic growth at the same time," says House Resources Committee Chairman Richard W. Pombo (R-California). "Because the environmental organizations that file these suits are entitled to recover taxpayer-funded attorney's fees and court costs—win or lose—environmental litigation has become big business in America."

## Restrictions on federal land access...need to be reevaluated...

"Taxpayers bear the court costs when the government is sued and if the organization wins, the groups are rewarded financial judgments and court costs—all paid for by the taxpayer. Finally, to add insult to injury, many of these organizations operate on taxpayer-funded grants to begin with."

### Environmental concerns

Satisfying environmental concerns of disparate groups has been a monumental challenge for CBM developers, and that challenge continues. Still, progress is being made on some fronts.

Wyoming is now considering a new watershed-based approach to issuing water-discharge permits to reduce conflicts of CBM drilling in the Powder River Basin. The Wyoming Department of Environmental Quality planned to hold meetings in November 2004 with CBM producers, environmentalists and landowners to discuss streamlining the current system. Currently each permit is considered individually; the new system would authorize the state to evaluate permits sought for watersheds in 10 areas.

The proposed initiative is designed to

avoid conflicts over individual permit applications and to make it easier for concerned parties to provide public comments on potential impacts. The concept includes determining what is an appropriate volume of water for each watershed, a previously untried approach.

In May 2004, environmental groups sued the Bush administration over its push for CBM development in the Powder River Basin, charging that the aggressive energy production plan sidesteps key environmental laws, which would hurt public health and adversely impact nearby national parks. This was the first time these groups raised air pollution issues to rein in development in the Powder River. Previously, lawsuits have been filed against federal agencies over water quality.

### Hydraulic fracturing

In 1997, the 11th U.S. Circuit Court of Appeals in Alabama ruled that fracturing fluids must meet the standards mandated by the federal Safe Drinking Water Act. Currently, state governments regulate the practice of hydraulic fracturing through permitting programs. States also have underground injection control programs to manage liquid wastes and reinjection of produced waters.

The hydraulic fracturing issue appeared to be resolved when the EPA published a final report in June 2004 summarizing a study that evaluated the potential threat to underground sources of drinking water from the injection of hydraulic fracturing fluids into CBM production wells. The EPA concluded that the injection of frac fluids into CBM wells posed minimal threat to drinking water sources.

The EPA reported, "Unless we actually see threats to drinking water supplies, the Safe Drinking Water Act admonishes EPA not to regulate injection for oil and gas production unnecessarily."

The report did find that diesel fuel in fracturing fluid posed a risk to drinking water. But EPA officials said no regulatory action was necessary, because the three major fracturing companies voluntarily agreed to stop using the fuel in CBM operations.

However, in October 2004, an EPA

environmental engineer sought whistle-blower protection in a statement sent to the agency inspector general and members of Congress. The statement alleges that the study's findings were premature, may endanger public health, were approved by an industry-dominated review panel and did not include any field investigation.

EPA acting water chief Ben Grumbles has rejected the whistle-blower's concerns, and the inspector general has not yet decided whether to investigate the allegations.

### Sage grouse

In April 2004, the U.S. Fish and Wildlife Service announced that enough evidence existed to consider placing the sage grouse under some protection by the Endangered Species Act. Water ponds that offered great habitat for mosquitoes near a CBM site showed a negative correlation between sage grouse populations and West Nile Virus. To battle the virus, many producers are voluntarily treating their water reservoirs with mosquito larvicides, though the industry is under requirement to adapt their activities to mitigate the virus.

Industry is helping support a Coalbed Natural Gas and Sage Grouse Study, but so far science does not support a listing of the sage grouse as an endangered species. Indeed, sage grouse populations have stabilized in recent years and have actually increased in many areas of the west.

"It is local and state efforts that will protect the sage grouse," says Deena McMullen, director of regional advocacy at the Independent Petroleum Association of Mountain States.

"The fact is that the Endangered Species Act has failed to protect endangered species. At this point, the act has a 0.01% success rate for saving endangered species.

"The greater sage grouse has a better chance if left in the hands of the people who live in the West and care about the land and its inhabitants."

The Fish and Wildlife Service is in the process of reviewing the situation and expects to have a decision by December 29, 2004. □

# Recent CBM Rulings

Review Request or Document Challenged	Challenger	Field Office/Court	Issues
Powder EIA, ROD and RMP amendments	Environmental Defense, National Wildlife Federation, National Parks Conservation Association, and Montana Environmental Information Center	WY-Bufferalo Field Office; MT-Miles City Field Office/US District Court for MT	Sec of Interior failed to perform duties to protect air quality in Class 1 areas; Sec failed to prepare EIS that fully discloses cumulative adverse impact of emissions; failure to describe reasonable mitigation measures to prevent significant adverse impacts as required by NEAP; failure to provide adequate opportunity to review and comment on cumulative air quality analysis prior to FEIS
Desolation Flats EIS	Biodiversity Conservation Alliance, WY Wilderness Association, WY Outdoor Council, Center for Native Ecosystems, Wilderness Society	WY-Rawlins Field Office/Interior Board of Land Appeals	Drilling too close to Adobe Town Wilderness Study Area
Hay Reservoir Geophysical Project	Biodiversity Conservation Alliance; WY Wilderness Association; Sierra Club	WY-Rawlins & Rock Springs Field Offices/US Federal District Court, Washington, DC	BLM's rejection of lower impact alternatives
Fidelity's Coal Creek Plan of Development (POD)	Montana Environmental Information Center	MT-Miles City Field Office	Montana Board of Oil and Gas Conservation's failure to do Montana Environmental Policy Analysis prior to approval of POD
Fidelity's Badger Hills POD	Northern Cheyenne Tribe	MT-Miles City Field Office/US District Court	NEPA-Failure for Section 106 consultation
Epsilon POD EA	Powder River Basin Resource Council	WY-Bufferalo Field Office/State Director Review	NEPA, cumulative effects, number of alternatives, West Nile Virus, water, vegetation, soil impacts; impacts to existing uses, no air quality analysis\reclamation and bonding
Yates Ucross POD	Powder River Basin Resource Council	WY-Bufferalo Field Office/State Director Review	NEPA, failure to do "hard look" at downstream cumulative impacts from water discharge from CBM wells
Delta POD EA	Powder River Basin Resource Council	WY-Bufferalo Field Office/State Director Review	NEPA, range of alternatives, West Nile Virus, water, vegetation, soil impacts; wildlife habitat, no air quality analysis, reclamation and bonding
Fogarty Creek Wells 3133 & 3233	Defender of Wildlife and Wyoming Outdoor Council	WY-Pinedale Field Office/State Director Review	ESA, Riley Ridge EIS needs update, use of Sundry Notice, APD procedures etc.
Lower Prairie Dog POD EA	Powder River Basin Resource Council	WY-Bufferalo Field Office/State Director Review	NEPA, aquifer drawdown, loss of water wells, WMP inconsistent with NPDES permit, no air quality analysis, cumulative impacts, impacts to raptors & sage grouse, reclamation, bonding, gas migration
Copper Ridge Shallow Gas Unit	Biodiversity Conservation Alliance	WY-Rock Springs Field Office/State Director Review	Lack of public comment before issuing decision for activity in an existing gas field
Anadarko's Beta II Plan of Development (POD)	Powder River Basin Resource Council	WY-Bufferalo Field Office	NEPA, bald eagle surveys, invasive weeds, no air quality analysis, West Nile Virus, foot rot in cattle, cumulative impacts, permitting of water treatment facilities, lack of analysis of post-project impacts, water, vegetation, and soil impacts, failed to notify interested parties, compliance with Section 6 of lease form

*Litigation filed in the Powder River Basin just in 2004. There were 17 similar cases filed in 2003.*



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To find out about Schlumberger CBM services for your U.S. operations, contact us at [cbm@slb.com](mailto:cbm@slb.com).

**More information on Schlumberger answers to your CBM concerns is at [www.slb.com/oilfield](http://www.slb.com/oilfield).**

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