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# Oil and Gas Investor

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DECEMBER 2003



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ABOUT THE COVER: Raton Basin coal seams outcrop along the road near Cokedale, Colorado. The Raton Basin is among the country's sources of coalbed-methane. (Photo by Lowell Georgia.)

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# COALBED METHANE

## Building on CBM Success

**F**inding more reserves, applying new technology and building community relations. These are the tasks that occupy oil and gas companies today as they pursue coalbed-methane (CBM) reserves in this country and Canada.

Coal-gas production has grown steadily in the U.S., now representing about 10% of total U.S. gas production. But there could be a lot more to come. CBM is set to play a much more important role as traditional gas resources play out. Despite new gas output coming from the Gulf of Mexico deep water, conventional sources in the Rockies, and even from the Arctic regions of Alaska and Canada, CBM will be needed more than ever as U.S. consumption continues to climb during the next decade.

Many operators are pushing CBM drilling into new basins or extending drilling to the flanks of mature plays. Regulators are on the case: New Mexico has decided to allow infill drilling across the entire Fruitland coal trend. Colorado authorities are looking at requests for an additional 600 infill locations in the Raton Basin.

In addition to pushing the activity boundaries outward, operators want to drill deeper. The U.S. Geological Survey says that an additional 664 billion cubic feet of CBM could be economically recovered in the venerable San Juan Basin, but in the deeper Menefee coals. These coals differ enough from the already prolific Fruitland coal seams in this basin that new technology may be required.

It appears that's not a problem. In February and July 2004 two phases of a new joint venture will kick off. Operator Magnum Hunter Resources and technology guru CDX Gas LLC will test a newly patented horizontal drilling technology in the Menefee coals.

Because permeability is one of the top issues the industry faces, Schlumberger and other firms are addressing that with advanced ideas. As operators move away from the heavily drilled sweet spots in the San Juan and Powder River basins, they will eagerly adopt new ways to wring value out of lower-permeability and thinner coals.

Make no mistake, technology will make a big difference. Consulting firm Advanced Resources International says that if multi-seam completion techniques are applied in the Powder River Basin, another 21 trillion cubic feet of gas could be recovered.

Watching this with a keen eye are citizens and landowners in the west who remain concerned about many drilling rigs scattered across their landscape, and with water disposal associated with these wells. But the industry is working on these challenges too. This special report will give you an update on the latest players, technology trends and strategies.

—Leslie Haines, Editor

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# Major Plays

*Technology and innovation will be critical in sustaining production levels in the San Juan and Black Warrior basins and in continuing to support the economics in the Powder River Basin.*

**Article by Stephen D. Schwochow**

America's two premier coalbed-gas fields—the San Juan and Black Warrior—have not escaped the inexorable declines in productivity that come with age. However, producers are adopting new and enhanced technologies and innovative strategies to improve operating efficiencies and increase recovery rates in an attempt to slow the rate of decline.

## San Juan Basin

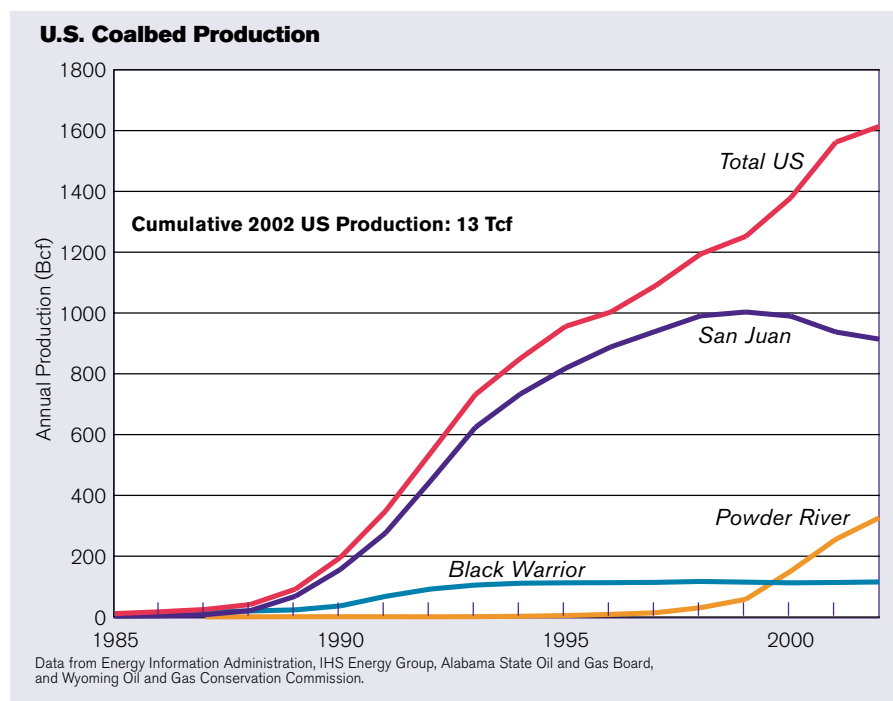
Coalbed gas actually was produced in New Mexico in the 1950s from both the Fruitland and Menefee formations. Not until the 1970s, however, were Fruitland coals specifically targeted for completion.

Annual production from the world's leading coalbed gas field peaked at 1 trillion cubic feet (Tcf) of gas in 1999. Since then, output has been declining slightly while the number of producing wells has climbed from 3,300 to 3,950. Cumulative production topped 10 Tcf in early 2003. In-place gas resources for the Fruitland coal-gas pool are estimated at 50 Tcf.

Strategies for increasing production include infill drilling and horizontal drilling. Infill drilling can incrementally boost gas recovery from a reservoir when a prevailing well-spacing unit proves to be inadequate.

During the last 10 years Colorado and New Mexico's state oil and gas agencies approved several special infill requests within the underpressured "low productivity" area of the non-prorated Fruitland coal-gas pool, that is, the area outside the designated limits of the prolific, overpressured production fairway.

Based on the results of those projects, each state amended its regulations to allow, subject to numerous conditions, drilling of a second optional



*Although production in the San Juan and Black Warrior basins is declining, the Powder River Basin is on a fast track.*

well within the standard 320-acre spacing unit of the underpressured Fruitland pool. That spacing unit was established in 1988.

Pending requests for infilling in Colorado could add 600 new wells during the next several years. However, coalbed-gas development has become such a highly contentious issue in Colorado's rural residential areas that continued protests and litigation may effectively preclude or delay a number of those requests.

Several horizontal multilateral wells have been completed in Fruitland coals, and an ambitious new joint-venture exploration effort will, for the first time, seek to tap coals in the underlying Menefee formation.

Sandstones in the Menefee and adjacent horizons have produced conven-

tional gas for years, but the potential of the interbedded coals was never adequately tested, even though they produced gas that was commingled in nitroglycerine-stimulated intervals through the sands.

For the joint venture, Irving, Texas-based Magnum Hunter Resources Inc., one of the nation's fastest growing independents, has teamed with Dallas-based CDX Gas LLC and its patented Z-Pinnate horizontal drilling technology. Magnum Hunter has contributed to the joint venture approximately 554,000 acres in McKinley, San Juan and Sandoval counties, New Mexico. Together with an additional 1 million acres from Magnum Hunter, acreage from CDX and other tracts won in recent lease sales, the companies have established a 6-million-acre area of

mutual interest.

Exploration will commence on the southern flank of the basin, near the limits of the Fruitland play, where the net (aggregate) thickness of the Menefee's coal seams averages 60 feet. Coals lying at depths of 3,000 feet and less will be targeted.

The first two phases of exploration drilling are scheduled to be completed in February and July 2004. Each will

include 25 boreholes—core holes initially, followed by stratigraphic tests, altogether costing about \$6 million.

Van Whitfield, CDX senior vice president, western operations, explained that coal-core tests are critical in determining key reservoir properties, namely sorption characteristics, gas content and permeability. This information is then correlated with logs of the strat wells to identify the most gas-prospec-

tive coals.

Phase 3, costing about \$5 million, will entail design and drilling of horizontal and vertical pilot projects to test productivity and evaluate reserve potential.

And what is the potential of Menefee coals? A 1990 investigation by the former Gas Research Institute estimated in-place gas resources of 22 to 34 Tcf—about half of what Fruitland coals con-

## TACKLING THE DECLINE

**C**oalbed-methane (CBM) production in the San Juan Basin peaked in the late 1990s. Since then, it has declined at a fairly predictable rate of between 14% and 20% each year.

Until now, that is. "We've begun to see decline rates flatten out," says Richard Fraley, Burlington Resources vice president, San Juan division. The company operates gross CBM production of 520- to 530 million cubic feet per day in the basin, and is its largest producer. "We've always predicted that the declines would become hyperbolic, and now that's happening."

Infill drilling is also shoring up the basin's production levels. In 2002, New Mexico approved an infill order that allowed an additional well in each 320-acre drilling unit in the lower-productivity area (LPA) of the Fruitland coal. This area rings the heart of the originally overpressured Fruitland play.

By year-end 2003, Burlington expects to drill as many as 50 infill wells in the LPA coals, adding both volumes and incremental reserves. "Our infill wells come in at rates slightly below what parent wells were making, and although it's still in the early days, we haven't seen indications of interference to date."

Recently, the state decided to allow infill drilling across the entire Fruitland coal trend. In 2004, Burlington plans to drill 80 to 120 San Juan wells, mainly in the originally overpressured area. The company operates about 1,000 CBM wells, and some 400 of those lie within the fairway. It estimates that it has several hundred locations in the high-potential area.

"The infill program will definitely help flatten the production decline, and we certainly expect good production rates and incremental reserves out of the infill wells."

The Pictured Cliffs formation is also poised to be a factor affecting future CBM development. Burlington is studying the possibility of commingling production from the Pictured Cliffs with that from Fruitland coals. Using the same wellbore would make economic sense, although the differing ownerships in the two intervals are an issue. The Pictured Cliffs drill blocks, which are 160 acres, may also be candidates for infill drilling.

And, the company strives to continually improve its processes and refine its techniques. It aligns its wellsite and gathering-system pressures to aid production flows, recavitates wells that have production problems, and sets pumps deeper in the wellbores to gain more lift and increase gas production.

It also experiments with such approaches as completing CBM wells with the underreaming techniques common in the Powder River Basin, instead of the traditional San Juan cavitations.

"With mature properties, it's all about optimizing production and protecting margins."

—Peggy Williams

**...An ambitious**  
*new...exploration*  
*effort will, for the first*  
*time, seek to tap coals*  
*in the underlying*  
*Menefee formation [of*  
*the San Juan Basin].*

tain. But that assessment was based on only scant gas-content measurements. The U.S. Geological Survey's 2002 assessment of the Menefee indicated 664 billion cubic feet (Bcf) of "undiscovered" (technically recoverable) coalbed gas.

Apart from this project, CDX has drilled several Fruitland lateral wells in the northern part of the basin, and others are on tap. But Whitfield expects to find enough differences between Menefee and Fruitland coals, even within the same basin, that drilling and completions will need to be tailored specifically to the Menefee. Compared with the Fruitland, Menefee coal seams generally are thinner, less continuous and distributed over a broader stratigraphic interval.

Magnum Hunter president and chief executive officer Gary Evans is enthusi-



astic about this potential play. “We’ve seen other basins in the U.S. and what coalbed gas can contribute in both reserves and production for those operators. We hope to be part of that in the San Juan Basin,” Evans says. “We believe CDX’s expertise and new technology are a perfect fit for this new play.”

### Black Warrior Basin

Commercial coalbed-gas production in Alabama began in 1980 as an outgrowth of a field demonstration of how surface-drilled wells could help degasify Pottsville formation coal seams in advance of underground mining.

Since then, 22 gas fields have been developed around the area of highest coal rank, the most abundant coals and the greatest net coal thickness at depths less than 3,000 feet. Twelve fields currently are producing.

Annual production has been at a plateau of 111 to 115 Bcf since the mid-1990s. Cumulative production through 2002 totaled 1.4 Tcf. Of the 6,000 coalbed wells drilled throughout the basin, 3,474 were listed as active in 2002, producing in aggregate 330 million cubic feet per day. Following the 1998 peak of 116.9 Bcf, production dropped. But that trend has reversed in the last two years.

Dennis Lathem, director of the Coalbed Methane Association of Alabama, notes that activity now is on the upturn. “We are seeing a significant increase in the number of new wells permitted in the basin and a halt to the recent decline in production.”

In 2002, 430 new well permits were issued by the State Oil and Gas Board; the number is the most in any year since 1990 (when 2,240 were issued). Nearly that many additional permits are expected in 2003, and another 525 could be forthcoming in 2004.

What’s driving this resurgence? Besides a welcomed firming of gas prices, Lathem cites two factors—first, availability of drillable acreage. Most new permits represent infilling at the prevailing 80-acre spacing within the established fields, as operators tap

proved but undeveloped reserves.

Second, producers continue to improve their operating costs and efficiencies. Typical gas-production rates from older wells are rather unremarkable—less than 150,000 cubic feet per day. As the play ages, operators are implementing improved drilling, completion and stimulation procedures to optimize production from widely sepa-

rated groups of thin coal seams.

Among the remediation techniques are multiple-seam recompletions within one group of seams, uphole recompletion in a different coal group, and high-injection-rate, simultaneous multiseam hydraulic fracture treatments.

Reevaluations are under way in several fields. For example, Houston-based Everlast Energy LLC is analyzing



*A Burlington Resources well is drilled in the San Juan Basin in New Mexico.*

the production histories of about 470 wells in Robinson's Bend Field to identify candidate wells that are underperforming due to poor initial fracs or deteriorating cement jobs. Everlast acquired the field from Torch Operating Co. in early 2003.

The success of such workover techniques is not assured, however. Coalbed well productivity in the basin is strongly controlled by local structure (folding and block faulting), permeability and proximity to recharge areas, more so than by completion procedures. Researchers at The University of Alabama and the Geological Survey of Alabama are providing critical new insights into the nature of the structural controls. Their findings can be invaluable in infill siting and design as well as remediation efforts.

Achieving operating efficiency is no small feat considering that Alabama's operators must meet the nation's strictest regulations for produced-water discharge and storm-water runoff.

Now, a new layer of regulation has been imposed as fallout from Alabama's infamous "LEAF" case, which argued that coalbed hydraulic fracturing should be subject to the federal regulations that govern underground fluid injection.

As a result, operators must secure approval from the state for each coal seam they propose to stimulate in a given well. Frac fluids also must meet federal drinking-water standards, which has forced some companies to purchase "certified" water and truck it 30 miles or more to a well site.

The federal government has retreated from its position on regulating hydraulic fracturing, but Lathem hopes an amendment to federal law will provide the more definitive legislative solution he believes is necessary.

Although regulating fracturing has profound implications for the entire petroleum industry, the impact on coalbed operators could be disastrous.

The U.S. Department of Energy has

**"We are seeing a significant increase in the number of new wells permitted...."**

**Dennis Lathem,  
Coalbed Methane  
Association of  
Alabama**

presented a frightening scenario—regulating hydraulic fracturing could, by 2010, curtail projected coalbed-gas production nationwide by a staggering 50%.

**Powder River Basin**

Although a long way from maturity, Wyoming's Powder River Basin is one of the oldest of the "second-generation" coalbed plays. It seemed improbable at the start, but several adventure-some operators made the economics work—open-hole completions through shallow, unusually thick but low-rank coal seams with pitifully low gas contents.

Since the late 1980s, the play has expanded sequentially in time and space, outward from Gillette along the eastern basin flank in Campbell County. Here, various individual coals are completed at 200 to 900 feet. In the heart of the play, two prominent seams coalesce into an unusually thick zone called the Wyodak. Westward into the basin interior, at 1,000 to 1,500 feet, companies have tapped a brutishly thick, coalesced seam called "Big George." Gas has been produced from 25 individual seams in the Fort Union formation and one in the overlying Wasatch formation.

Federal well permitting was slowed or stalled several times while the Bureau of Land Management completed successively larger environmental assessments, culminating in the Powder River Basin Oil & Gas final environmental impact statement (EIS) that was released in January 2003. That document anticipates addition of 39,400 new wells within the 8-million-acre planning area during the next 10 years.

Even with delays, coalbed-gas production has climbed rapidly since the mid-1990s. Annual production for 2002 totaled 327.4 Bcf from 10,700 wells. Cumulative production topped 1 Tcf in mid-2003, when 11,700 wells were operating.

Large leaseholds have been built on the Montana side of the basin. However, industry's efforts at development have been delayed in the past two years as a result of litigation by special-interest groups and work on a joint fed-

**Enhanced Recovery**

In a recent U.S. Department of Energy-sponsored study, Advanced Resources International Inc. found that the San Juan, Black Warrior and other U.S. basins have substantial potential for enhanced coalbed-gas recovery via sequestration of carbon dioxide.

The San Juan work was based on a detailed analysis of field tests conducted at Burlington Resources' Allison unit and BP's Tiffany Field, where injection of carbon dioxide and nitrogen has been demonstrated to increase gas recovery rates.

Whether this complex technology will lead to substantial incremental gas production in the San Juan Basin is, as yet, uncertain due to the spatial variability in coal reservoir properties; economical and logistical limitations on CO<sub>2</sub> availability and deliverability; difficulty in unitizing an area large enough for practical implementation; and the undetermined long-range effects of injection on groundwater quality.

In the absence of a national-level legal and regulatory framework for sequestration, CO<sub>2</sub> (and nitrogen) injection probably will evolve into a viable enhanced-recovery technology sooner than as a sequestration strategy.

—Stephen D. Schwachow





*Ice-covered Badwater Creek flows through Lost Cabin, Wyoming, near a rig drilling for gas in the Wind River Basin.*

**Even with delays,** *[Powder River Basin] coalbed-gas production has climbed rapidly since the mid-1990s.*

coal-rich stratigraphic section in this area may contain as many as 20 seams within a 1,200-foot interval.

This strategy is evident in two projects of U.S. Energy Corp. and Crested Corp. (USECC). Their subsidiary, Rocky Mountain Gas Inc. (RMG), is developing the 124,000-acre Castle Rock project in Powder River County; working interests are shared with Carrizo Oil & Gas Inc. and Quaneco LLC. The stratigraphic and production-test wells drilled since 2001 have confirmed up to 175 feet of net coal in multiple seams to an initial target depth of 1,300 feet, together with several gas-charged sandstones.

Pinnacle Gas Resources Inc., a company recently created by USECC, RMG and Carrizo, is developing several Wyoming Powder River Basin properties and the 80,000-acre Kirby tract (Montana) north of CX Field. Plans for an eight-well exploration pilot have been submitted.

Meanwhile, Pinnacle Gas is testing a multizone completion technique at its Bobcat project in Campbell County, which adjoins property now being operated through a joint venture with Gastar Exploration Ltd.

Protection of Indian trust assets under the EIS will be particularly important to Bill Barrett Corp., which last year negotiated an agreement with the Crow Nation for a massive economic development plan that could entail drilling 400 coalbed wells annually on 200,000 acres of reservation land. □

eral/state environmental assessment, not to mention the absence of pipeline capacity. Only Fidelity E&P has established commercial gas production there, from CX Field along the state line where about 250 wells have been permitted on an extension of the company's Wyoming property.

New projects are being geared up now that the comprehensive planning document—the Montana final statewide oil and gas EIS—is in place. It was released in January 2003. The analysis predicts a cumulative 26,475 coalbed wells and 1,775 conventional gas wells.

The issue that likely will affect project economics most profoundly deals with produced-water production, stor-

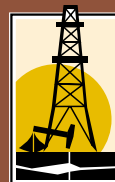
age, treatment and disposal. In addition to having an approved produced-water management plan emphasizing beneficial use, operators may have to secure either surface-discharge permits from the state, for treated or untreated water, or a finding of non-significance from the state.

Even though the EIS does not require multiseam completions under the preferred development alternative, Montana leaseholders, as well as those north of the Wyodak area, are carefully evaluating this option as a technology-based strategy for optimizing gas production from the low-gas-bearing Fort Union seams, for minimizing their surface "footprint" and for facilitating water production and disposal. The

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# Tackling the Tougher Tasks

*Producers are using innovation—and employing technology developed by service companies—to make coalbed-methane development more economic.*

**Article by Karl Lang**

**W**e all tend to put off the more difficult problems until later. Development of unconventional gas resources in the U.S. during the past two decades has been no exception; the gas industry began paying serious attention to tight sands, fractured organic shales and coal seams only after much of the easier-produced gas had been tapped.

Then, a combination of technological innovation, tax stimulus and favorable gas prices acted to move to center stage what had up until then been an “unconventional” gas resource. Today, the same story is playing out within the “now nearly conventional” coalbed gas plays around the country. Many of the sweet spots have been located and drilled, and the task of bringing new technology to bear on those not-so-sweet spots is here.

## Lower permeability

Chuck Boyer, principal consultant, Schlumberger Data and Consulting Services, Pittsburgh, says, “The answers to today’s coalbed natural gas challenges will follow the pattern of the past: incremental improvements in technology that open the doors to more difficult basins or more difficult areas within existing basins.”

Boyer sees permeability as the No. 1 issue. “The less attractive coal reservoirs have lower permeability and are often deeper or thinner. Finding new ways to economically drain this type of system is the primary challenge at this stage.”

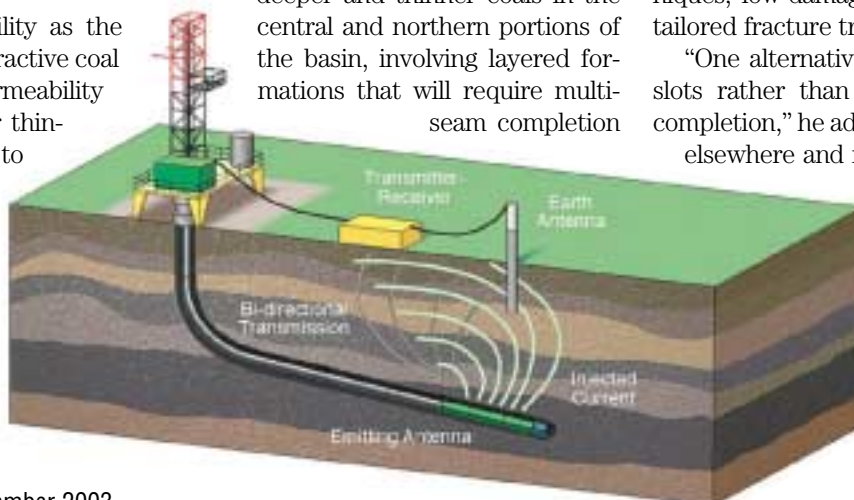
Boyer notes that this same challenge also exists in settings other than the U.S. “Operators have tested basins in



*CDX Gas says this pinnate drilling pattern maximizes CBM production.*

Canada and eastern Europe that are structurally complex, where the coal is highly deformed, and exhibits lower permeability. There is plenty of gas in the coal, but getting it out will require some new ideas.”

The Powder River Basin, the hottest coalbed-methane (CBM) play in the U.S. during the past five years, is a case in point. Thus far, development has targeted the easy-to-reach coal seams along the eastern edge of the basin. Now, operators are moving toward the deeper and thinner coals in the central and northern portions of the basin, involving layered formations that will require multi-seam completion



*Precision Drilling Co.'s real-time-oriented gamma ray tool and electromagnetic MWD tool mean wells may be drilled faster.*

(MSC) techniques to adequately develop the resource.

Advanced Resources International Inc., Arlington, Virginia, recently completed a study for the U.S. Department of Energy that quantified the potential benefit of applying MSC technologies in the Powder River Basin. The study suggests an incremental recovery of 21 trillion cubic feet (Tcf) of gas that would generate an added \$3.6 billion in federal and state royalty payments and \$4.1 billion in tax receipts.

“It’s a solvable problem,” says Vello Kuuskraa, Advanced Resources president. “The industry has been successful in finding ways to complete multiple zones in the Raton and San Juan basins, and to a certain extent in the Black Warrior Basin. In the Powder, the geology is different: underpressured, highly permeable, fractured coals that are very susceptible to drilling-induced damage and often sandwiched between water-bearing sandstones.

“The challenge is to find the right combination of technologies that will allow us to complete multiple seams without damage.”

Kuuskraa believes that combination could include improvements in short-radius and underbalanced-drilling techniques, low-damage drilling fluids and tailored fracture treatments.

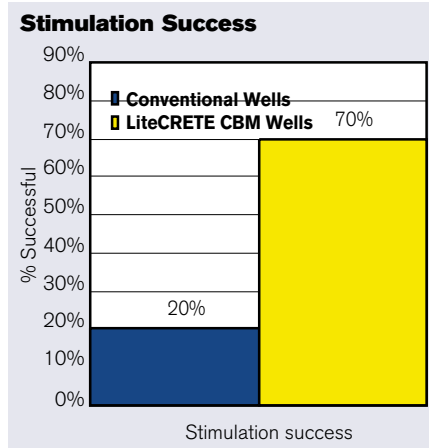
“One alternative may be the use of slots rather than perforations in the completion,” he adds. “This has worked elsewhere and reduces the problem

of perforation plugging by coal fines. The approach is to produce the fines and develop better ways of dealing with them in pumps rather than allowing them to reduce well productivity.”

Whatever the combination of improvements turns out to be, it is likely that new coalbed gas reserves will result from small but important advances on multiple technology fronts. There are several new ideas.

**Z-Pinnate drilling**

CDX Gas LLC, a privately held Dallas-based company formed in 1991, has developed a unique technique it claims will drain more of the gas from a coal seam, quicker and with fewer wells. The approach is based on first drilling a vertical well with an enlarged wellbore cavity at the coal seam, and then intersecting this well with a horizontal wellbore drilled from a nearby location that has multiple drainholes drilled from it in a leaf-shaped (pinnate) pattern.



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Depending on geology and other factors, each quarter (or perhaps third) of a drainage area could have its own horizontal drainhole with branches. According to CDX, these horizontal holes will allow recovery of 80% to 90% of the gas in place within three years, draining up to 1,200 acres per well at

rates of 1.2- to 2.5 million cubic feet per day. Such a large drainage system—as much as 25,000 feet of hole per “leaf”—would enhance recovery from lower-permeability coal seams by increasing both the wellbore area open to flow and the likelihood of intersecting natural fracture systems.

CDX developed and tested this technique as a means of degassing a coal seam prior to mining at the Pinnacle mine site in West Virginia. There, Z-Pinnate drilling successfully degassed an 800- to 1,700-foot-deep coal seam ahead of U.S. Steel’s mining operation, removing more than 80% of the gas-in-place in record time. Earlier vertical wells had only been able to recover 10% to 20% of the gas.

“We have now drilled Z-Pinnate wells in the Arkoma and San Juan basins, as well as two wells in Canada that are not yet online,” says Doug Wight, CDX vice president, corporate development. “Our average recovery is 88% of the gas in place.”

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The company has also drilled a pilot project in the Illinois New Albany Shale where production filled the pipeline capacity before CDX was able to complete the pattern.

Of course, horizontal drilling is not new technology. What CDX has done is to develop an alternative methodology for drilling wells underbalanced that employs the vertical well as a conduit to the annulus of the horizontal lateral during drilling. Returns, cuttings and eventually produced water and coal fines are pumped from the vertical well.

CDX is keeping the details of this methodology in-house; it operates nine of its own rigs, staffed by its own directional drillers, and hopes to have 20 rigs operating by year-end 2004.

“The combination of experience, some new tools and rig modifications, our unique methodology ... the ways we have of keeping the bit in the coal ... allows us to drill these wells efficiently,” says Wight. “In one of the West Virginia wells, we set a record of 17,099 feet of total horizontal hole in only 108 rotating hours. Our recent wells we’re drilling at rates of 1,000 to 1,500 feet per day on average.”

With a number of patents pending, rig sites are still off-limits to non-CDX personnel, but Wight promises that this is only the beginning of what CDX can offer in terms of productivity improvements from its research.

Irving, Texas-based independent Magnum Hunter Resources and CDX have recently formed a joint venture to apply Z-Pinnate technology across a 6-million-acre area of mutual interest in the Cretaceous Menefee formation in the southern San Juan Basin. A three-phase exploration and development program is already under way.

**OGR and EM-MWD**

Calgary- and Houston-based Precision Drilling has some unique technologies that are helping it lower the cost of horizontal coal-seam wells. Like CDX, Precision Drilling played a part in the development of the horizontal well methodologies used to degas mine coal seams in Appalachia.

The company relies on a real-time oriented gamma ray (OGR) tool and

**“The answers to today’s coalbed natural gas challenges will follow the pattern of the past....”**

**Chuck Boyer,  
Schlumberger**

electromagnetic (EM) measurement-while-drilling (MWD) technology to keep its horizontal laterals in the seam. The OGR, with a depth of investigation of six to 12 inches, indicates when the wellbore exits the seam by measuring azimuthal gamma counts.

Drilling can continue while the measurements are taking place, saving time. Prior to the introduction of this technology it was not uncommon for an operator to average one sidetrack for each branch of a multi-branch horizontal well. Today, with the use of the OGR tool, a typical 10-leg well may require only one sidetrack.

Electromagnetic MWD technology allows drillers to receive directional, pressure, gamma ray and resistivity measurements while drilling an underbalanced hole. Low-frequency electromagnetic waves transmit the down-hole-measured data in real time to a surface antenna.

EM-MWD (Precision Drilling’s EM-Pulse) can now be conducted in an air-drilled hole, according to Bob Stayton, Precision Drilling business development manager.

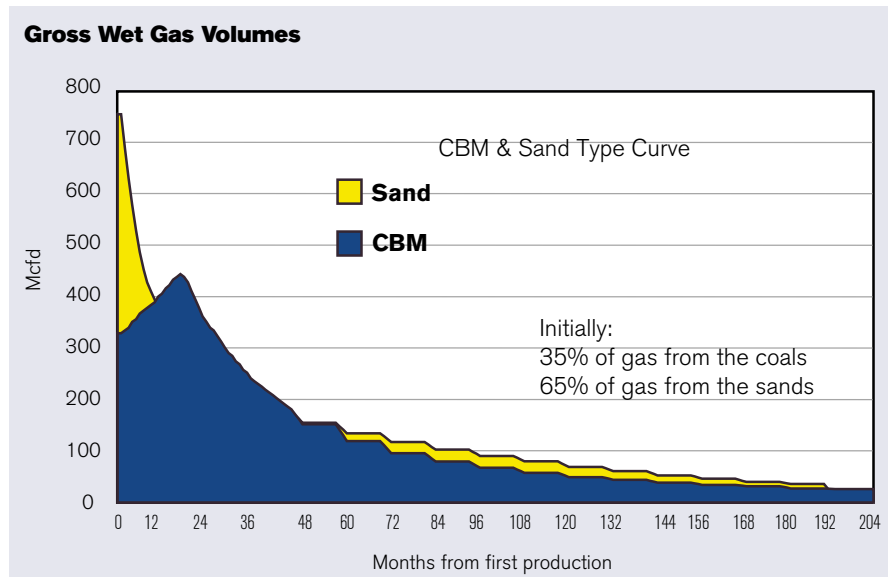
“This is a significant change over previous capabilities,” says Stayton. “OGR technology combined with EM-Pulse allows us to maximize in-pay footage and thus drill better, more productive wells, quicker.”

**LiteCRETE**

Innovative new products that address some of coalbed methane’s unique completion challenges are also being developed. At the White River Dome Field in the Piceance Basin of northwestern Colorado, Tom Brown Inc. is producing gas from coal seams that are deeper than anyone has previously been able to economically tap, some at 8,500 feet.

At a Society of Petroleum Engineers (SPE) meeting in Denver, Adam Sayers, a Tom Brown senior operations engineer, explained how his company struggled with conventional 13-pound-per-gallon (lbm/gal) cement systems and was unable to avoid lost circulation problems in the low-pressure, naturally fractured coal formations.

Attempts to deal with the problem using foam cements were unsuccessful. Two-stage cementing was only marginally successful but with the added costs



*New technologies improve the time to first production of coalbed methane after the sands in a CBM well begin to play out.*

of an additional completion rig. Finally, Tom Brown tried a 10.5-lbm/gal formulation of LiteCRETE, a new cement product from Schlumberger, that resulted in a significant reduction in hydrostatic pressure and a reduction in excess cement requirement of 25% to 15%.

In 2002, Tom Brown completed nine wells with LiteCRETE and five with their conventional cement system.

“The LiteCRETE wells exhibited a 75% cementing success rate and a 70% stimulation success rate with no screen outs,” says Sayers. “Only 20% of the conventional wells could be cemented and stimulated successfully. Four of the five screen-outs were due to cementing problems.”

During 2003, Tom Brown used LiteCRETE on all of its White River Dome wells and enjoyed an 80% suc-

cess rate. Tom Brown as well as other operators have successfully combined LiteCRETE with a loss circulation material, CemNET, to further reduce losses into the naturally fractured coals. This LiteCRETE CBM system has reduced the total volume of cement that is required to be pumped, reducing formation damage to the coals and improving well productivity in a number of different basins.

Based on the same principles as Schlumberger's CemCRETE formulation, LiteCRETE technology increases the solids content of the slurry using particle-size distribution. Smaller particles fill the void space between larger ones, resulting in a slurry that requires less water. The technology exerts a lower hydrostatic pressure on the coal formation—preventing breakdown. Such systems can be blended to produce slurries between 8 and 13 lbm/gal.

CemCRETE systems have higher solids content than normal Portland cements mixed at 15.8 lbm/gal and yet can have densities lower than extended slurries. Since solid content drives the set cement properties, LiteCRETE can have improved set properties than normal cement systems at far greater density ranges.

High packing volume fraction of solids in the cement result in low permeability and higher compressive strength at reduced slurry densities.

To reduce the hydrostatic pressure, a LiteCRETE formulation boasts more than twice the compressive strength of a 10-lbm/gal foamed cement and has only about one quarter the permeability of the comparable weight foam cement, even half the permeability of a 15.8-lbm/gal Class G cement.

## Vortex Flow

Vortex Flow LLC, an Aurora, Colorado-based company formed in 2001, has developed a tool for improving production by reducing flowline back-pressure due to flow turbulence. Its original device was designed to separate gas and liquids into a two-phase flow pattern with the liquids flowing in a spiral along the pipe wall and the gas flowing down the center.

This vortex pattern prevents liquids

## Key View

**A**s with any unconventional resource, coalbed-methane operators must be extremely conscious of cost. A CBM project typically has large numbers of relatively low-volume wells that require constant supervision. A new system promises to improve efficiencies and processes in well servicing.

Key Energy Services, one of the largest players in the well-servicing rig market, has taken a page from the drilling rig manual, analyzed some manufacturing-process management practices, and developed a data acquisition and analysis system that promises significant improvements in well-servicing costs.

“Drillers have been capturing drill floor data and using it to optimize drilling practices for a long time,” says Bruce Lowe, Key vice president, corporate development in Midland, Texas. “And drilling costs have dropped as a result. We’ve begun collecting and recording a number of rig-floor parameters, as well as some important details about the day-to-day process of servicing a well, and begun using some quantitative analytical tools to see how the process can be improved.”

While this sounds simple, the results can be surprising. For example, simply capturing the details behind “waiting on” comments in a daily report can lead to improvements in efficiency.

“When we accurately measure flat time and assign precise reasons to it, opportunities for process improvement begin to appear,” says Lowe. “Automobile assembly lines perform the same operation many times per day, and measure efficiency improvements in seconds per operation. We need to be looking for ways to cut hours or minutes, safely of course. To do that we need to collect the data on what is actually taking place.”

Quantitative rig parameters recorded via a sensor system are also part of the process mapping methodology. “When we began to record block speed, for example, we saw how keeping the speed within a certain range, not too fast and not too slow, can make a big difference in efficiency and safety.

“By building the sensing capability into the rig and coupling it with software algorithms, that let us know where we are operating relative to the optimum, we can do a better job of reducing accidents and reducing the time it takes to complete a well-servicing task,” adds Fred Newman, Key intellectual property development manager.

Other parameters can provide similar opportunities for process improvement, such as the torque applied to each rod or tubing connection during a workover or the tension applied in setting a packer or anchor. “By recording a lot of this information and then taking the time to go back and correlate the data with successes and failures in a systematic way, we’re taking a big step toward really using all the information that is available for optimizing our process,” says Newman.



from dropping out and hindering flow, even over long horizontal distances and substantial changes in elevation and direction.

Extensive data from installations in early 2002 have shown that the units are effective in lowering well back-pressure, increasing gas flow rates, improving liquid removal, eliminating flowline freeze-ups in cold weather, and reducing the need for line pigging.

In mid-2003, Vortex Flow began installing its Vortex DX Downhole Tools to attempt to apply the same vortex principle that was working so well in flowlines to vertical flow in tubing, including the removal of water from coalbed-gas wells.

The results of a dozen installations have shown that the Vortex DX downhole tool has been successful in improving production and/or reducing costs in three out of three Powder River Basin and four out of five San Juan Basin coalbed wells. While several of these wells have exhibited sustained increas-

**“The challenge is to...complete multiple seams without damage.”**

**Vello Kuuskraa,  
Advanced Resources**

es in gas flow rate, in some cases the benefit has been the savings in downhole pumping equipment maintenance and power costs, as the units replace existing PCP or ESP pumps with no loss in production performance. The tool has no moving parts and can be installed once and left in place.

Laboratory testing has reinforced the positive effects the downhole tools are demonstrating in the field.

“After close to one year of lab testing at a nationally recognized university, results show that the Vortex DX downhole tools consistently reduce the pres-

sure drop in tubing, leading to a full production stream of water, gas and oil,” says Brad Fehn, Vortex chief executive officer. The company is developing a model to better predict when VX tools can improve performance on a particular installation.

### **Worldwide development**

The technologies being employed to economically develop coalbed gas in the U.S. will also be applicable in coal basins that are being drilled around the world.

“China, Australia, India, Botswana and of course, Canada, all have coalbed gas resources that are being actively developed or investigated,” says Kuuskraa. “The important thing in every case is to first develop a solid understanding of the reservoir properties, and then apply the combination of drilling and completion technologies that fits those properties and effectively hooks up as many coal intervals as possible.” □



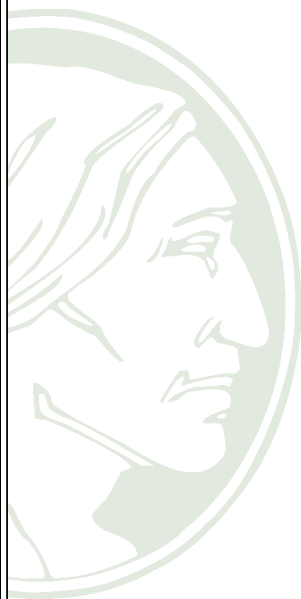
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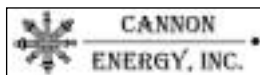
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# Building Community Relations

*One-on-one encounters are among the most important tools coalbed-methane producers have as they develop good relationships with their neighbors.*

**Article by David C. Wagman**

The picture of folks chatting around the kitchen table remains an enduring image of western U.S. neighborliness. The coffee's strong, the atmosphere's relaxed and the sense of community is genuine.

Small wonder, then, that coalbed-methane (CBM) producers in the western U.S. view such one-on-one talks with ranchers and farmers as their best tool in resolving issues related to developing and producing the gas.

Producers and farmers share a common geography. Producers focus their attention underground to produce gas, which lies atop coal seams. Farmers and ranchers work above the same ground, raising livestock and growing crops.

Room for conflict exists in such close quarters. In many cases, different owners hold surface rights and mineral rights. Each owner has specific rights protected by law, although mineral rights are almost always dominant. The



*Education helps build better relationships. Through its booth at the Northern International Livestock Exposition Rodeo in Billings, Montana, last fall, the Montana Coalbed Natural Gas Alliance educated ranchers, farmers, industry people and many other rodeo attendees about the CBM business. (Photo courtesy Energy Strategies and Solutions LLC, Billings.)*

challenge facing coalbed methane producers is to develop the gas resource—including building roads, power lines, compressor stations and pipelines, not to mention the wells themselves—while maintaining neighborly relations.

## Good for business

It isn't always easy. Devon Energy's current community-outreach effort, used in its Powder River Basin acreage in Wyoming, traces its origin to an effort started by predecessor company Mitchell Energy & Development Corp. in the mid-1990s. Mitchell developed extensive fractured-shale production in North Texas' Barnett Shale, another unconventional gas play that shares many surface-use and environmental-quality issues with coalbed methane.

"We've learned that good educational and community programs are good for business," says Brian Engel, Devon manager of public affairs.

**"One-on-one interactions are time consuming, but absolutely critical."**

*Sher Long, consultant*

One-on-one encounters are among the most important tools producers have as they develop community-relations programs in places like Wyoming, Montana, Colorado and Texas. Programs include educational fairs, town meetings, field trips, barbecues and the all-important kitchen table chats.

“One-on-one interactions are time consuming, but absolutely critical,” says Sher Long. Her Denver-based public affairs firm helps Calgary-based EnCana Corp. manage landowner and community relations in Colorado’s Piceance Basin where EnCana has 585 operating wells. The company has drilled a number of exploratory CBM wells there, in addition to its conventional production.

One recent October evening saw Long and an EnCana negotiator sit down over coffee with eight landowners. They were there to discuss company plans to use a private road to access a potential site in Garfield County,

**“We’ve learned that good educational and community programs are good for business.”**

*Brian Engel, Devon Energy*

Colorado. The next morning, the two met in the less congenial—but more neutral—setting of the county auditor’s office. Across the table were several other neighbors opposed to the proposed road use. The opponents earlier had threatened to call the sheriff, block the road and alert the local newspaper.

“We talked for 90 minutes,” Long says. At the end of the meeting, EnCana agreed not to proceed until questions about an easement were answered. “You can’t please everyone,” Long says. EnCana views its investment in community outreach as an exercise

in avoiding costly litigation and other delays that can hurt business.

Producers declined to disclose exact costs for their outreach and environmental-mitigation programs. But David Searle, Sheridan, Wyoming-based manager of health, environment and safety for Marathon Oil, says outreach represents “a tremendous cost” of his company’s CBM production. “We put a lot of energy and money into working with landowners [in the Powder River Basin],” he says.

The community-based issues vary widely. Some people worry about dust



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kicked up on dirt and gravel roads built by producers to reach well sites. Other people worry about potentially noisy compressors, or the possibility that a well might mar an otherwise good grazing pasture.

Community leaders sometimes worry about the effect increased employment will have on school enrollment, public services, even the county jail.

In one Wyoming county with a small tax base, community leaders worried that tax dollars might not flow in fast enough to keep pace with needed road improvements. To help out, J.M Huber Corp. contributed a grader to spread the county's road material. Fidelity Exploration & Production Co. contributed water to compact the new road surface.

**Water woes**

One of the most contentious issues in CBM development involves water, which must be pumped out of a well

before gas production can begin. That's because coal formations are layered with water holding the gas in place through hydrostatic pressure. Before gas production can occur, the water needs to be pumped out of the ground.

But even that seemingly simple act can be laced with controversy.

For one thing, controversy can erupt over the very act of pumping water out of the ground and into streams that otherwise would be dry for much of the year. Large swaths of CBM-producing country experience arid or semi-arid conditions. Pumping water continuously into normally dry streambeds may change natural balances, some environmentalists charge.

For another, the quality of the water being pumped into streams often is questioned, sometimes needlessly, developers say. Groundwater quality varies between basins and even within basins themselves. In some cases the water is fresh enough to irrigate crops. In other cases the water is as salty as

seawater, requiring reinjection into aquifers or treatment.

In Wyoming's Powder River Basin, coalbed-methane development began near Gillette, roughly in the basin's center. The land there is flat and the water quality generally good. As development has moved closer to Sheridan, on the basin's western edge, the water quality has declined somewhat, meaning much of it is unsuited for irrigation. Most of the variation in water quality stems from differences in sodium content and salinity. Too much sodium—either in absolute amounts or relative to other minerals in the water—can hurt crops and make the water undrinkable by livestock and humans.

Frustration over the water issue led one producer into a decidedly non-energy pursuit.

In Big Horn County, Wyoming, Fidelity Exploration & Production owns the 7,000-acre Seven Brothers ranch, named after an executive's favorite hiking spot in the Wind River



*In Montana, Fidelity E&P impounds or contains produced water, which then evaporates or infiltrates back into the aquifer, but is not dumped into streams.*

**“We were frustrated  
with the misinformation...with regard  
to water quality and quantity.”**

**Joe Icenogle,  
Fidelity E&P**

Mountains. In a role swap, Fidelity owns the ranch's surface rights but not its mineral rights. That may not matter because Seven Brothers wasn't purchased for its coalbed methane. Fidelity has been in the Powder River Basin since 1997 and has 1,100 producing wells in Wyoming and permits for 177 additional wells in Montana.

Instead, Fidelity uses the ranch to show that water pumped from CBM wells can successfully grow crops, including alfalfa, millet and rye grass, and benefit cattle, antelope and deer.

“The ranch adds to our cost and

pushes the envelope on our economics,” says Joe Icenogle, Fidelity regulatory and public affairs manager. But owning surface rights at the Seven Brothers ranch allows Fidelity to “control its own destiny” by providing a place to dispose of produced water. It also offers a visible piece of evidence that produced water can benefit agriculture.

“We were frustrated with the misinformation spread in the public with regard to water quality and quantity,” Icenogle says.

All across Wyoming, the produced


water issue has been “blown out of proportion,” says Don Likwartz, supervisor with Wyoming's Oil and Gas Conservation Commission. The agency's job is to guard against wasted water and to protect water rights.

In general, water pumped out of CBM-producing parts of the Powder River Basin is of good quality. In many cases livestock and even humans can drink it, Likwartz said. In other instances produced water reinjected into aquifers has actually improved the aquifer's overall quality, Likwartz says.

Since 2000, Marathon Oil has reinjected water pumped from 40 gas-producing wells into the Lower Fort Union Sands formation that holds Gillette's drinking water supply. When Marathon's reinjection program began, the wells produced around 400 gallons of water a minute, said David Searle. All of this water was pumped back underground. Once gas production was under way, the water flow gradually

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slowed. Today, around 60 gallons of water a minute is produced and reinjected into the aquifer. Marathon also uses produced water to irrigate Gillette's public golf course.

In Colorado's San Juan Basin, nearly 99% of all produced water must be reinjected into the ground because of its poor quality, says Richard Griebing, director of the state's Oil and Gas Conservation Commission. That means the water fails tests designed to see if it can support freshwater shrimp and minnows.

Water quality in the nearby Raton Basin is more mixed. About one third of the produced water must be reinjected because of its low quality. Another third can be drained into evaporation pits. The remainder can be discharged directly into Colorado rivers and streams.

In Montana, where coalbed-methane production is just getting started, the state has adopted what are

**“There’s been litigation over every other aspect of coalbed-methane development in the state. It is a litigious, high-stakes debate.”**

**Art Compton,  
Montana DEQ**

known as “numeric water standards” for water quality. On Montana's Tongue River, for instance, water discharged during irrigation season cannot increase the stream's salinity by more than 1,000 milligrams of sodium per liter.

The standard is designed to prevent producers from “simply dumping water into the river,” says Art Compton, a planner in the state's Department of Environmental Quality. Producers will have to use evaporation ponds, reinjec-

tion wells and water-treatment techniques to meet the standards, he said. Producers resisted the standards, he says, objecting they were too expensive. Agricultural interests complained, too, saying the standards were too lenient.

Compton says the standards might well be challenged in court. “There's been litigation over every other aspect of coalbed-methane development in the state,” he says. “It is a litigious, high-stakes debate.”

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## Split estates

Wyoming producers, in an alliance with farming and ranching interests, are working to take some of the legal sting out of another high-profile issue surrounding coalbed-methane development: split estates.

Split-estate issues arise because surface rights and mineral rights are often

owned by two entities. Mineral rights-holders expect to have reasonable access to their drilling pads, wells and other production assets. Surface rights-holders can expect to be paid for that access. But intractable issues still can arise.

“The breakdown comes in a lack of communication and understanding

[between the parties],” says Dru Bower, vice president of the Petroleum Association of Wyoming. That can lead to distrust on both sides and create situations where an agreement is impossible. Not that an agreement is legally necessary. Because mineral rights are dominant, producers could simply move in equipment and begin drilling



## “The breakdown

*comes in a lack of communication and understanding....”*

*Dru Bower,  
Petroleum Association  
of Wyoming*

## Cook-Offs and Scholarships

Landowners aren't the only ones who benefit from producers' Wyoming Powder River Basin community-outreach program. Residents in communities like Sheridan, Gillette and Buffalo benefit from producer-sponsored barbecues and educational fairs designed to put company officials in front of residents.

“We're part of these communities,” says David Searle, Sheridan, Wyoming-based manager of health, environment and safety for Marathon Oil. Companies belong to local chambers of commerce, sponsor youth baseball teams and 4-H clubs, hold chili cook-offs, sponsor rodeos and provide academic scholarships for college-bound high school students.

“Our primary focus is on education,” says Teresa Perry, Denver-based director of corporate communications for Western Gas Resources. Western has been in the Powder River Basin since 1979 as a midstream gatherer. It started coalbed-methane (CBM) production in the mid-1990s. During the past four years, Western has offered two \$2,000 scholarships to students in high schools in Campbell and Converse counties. To qualify, students must study geology, engineering or business administration at a local Wyoming college. The scholarships may be renewed each year, and the company hopes the first crop of scholarship awardees (who are graduating from college this year) will look for work in the energy industry.

“This is a primary growth area for us,” Perry says. “[The scholarships] allow us to step up our activity as a neighbor.”

For Joe Icenogle, Fidelity Exploration & Production regulatory and public affairs manager who has more than two decades in the business, the level of community outreach by coalbed-methane producers is unusual. But conventional oil and gas producers are feeling pressure to beef up their own community-outreach efforts. Both trends may be outgrowths of changing regulatory environments and a “changing court of public opinion,” which drives energy industry operations, Icenogle says.

Economic changes, perhaps most visible in Wyoming, also demand attention. Long known as a farming and ranching state, Wyoming's agricultural industries have suffered declines in recent decades. At the same time, the state's energy industry has boomed. The state is the nation's largest coal producer. And Gillette makes no apologies to Houston when it promotes itself as the nation's energy capital.

“You have two communities going in different directions,” says Stephen Reynolds, a former state land manager under Governor Jim Geringer and now a consultant based in Cheyenne. “One success has been for producers to reach out to stock associations and ranchers.”

The key, as Reynolds sees it, is for the energy industry to find ways to help agriculture be more successful. That eases conflicts, which in turn helps producers get on with the business of developing CBM resources. It builds neighborliness, too.



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*In some areas of the Powder River Basin, CBM-produced water is safe enough for these bison.*

and producing, so long as they meet statutory requirements and pay reasonable compensation to landowners.

By law, producers don't have to reach agreements with surface rights-owners "but in reality you do," says G. Bruce Williams, Fidelity vice president of operations. "We're going to be neighbors for five to 15 years and we don't want a bad relationship."

On occasion, some development foes have used the split-estate issue to "drive a wedge" between agriculture and industry in Wyoming, Bower says. "We believe some environmental groups used landowners to insinuate that individual situations were happening across the board," she says.

To protect against that, in June 2000 industry and agricultural interests got together to form the Split Estate

Initiative (SEI). The initiative is a voluntary arbitration and mediation service whose aim is to minimize conflicts between surface and mineral rights-holders.

"It's new, it's not been done anywhere," Bower said. After three years of development, SEI became operational in the fall of 2003.

Besides providing advisors, mediators and arbitrators, the initiative encourages early planning on the part of surface rights-holders. For example, landowners are encouraged to learn whether their property contains minerals and, if so, who owns them. Landowners are also encouraged to work with local conservation districts to devise a development plan for their land.

"We've provided advisory teams to facilitate land-use agreements," Bower

says. The initiative also provides for mediation and binding and non-binding arbitration. Program expenses of \$69,000 are paid through a two-year grant provided by the state's Department of Environmental Quality.

In addition to the Petroleum Association of Wyoming, principal members include the Wyoming Stock Growers Association, the Wyoming Farm Bureau Federation and the Wyoming Wool Growers Association. Through these organizations, around 90% of the gas and 80% of the oil producers in the state along with 90% of ranching and farm interests are represented.

Just how much business SEI arbitrators may get remains to be seen. Bower says that in 90% to 95% of the cases, rights-holders negotiate agreements satisfactory to both sides. That's where the kitchen table comes in handy and the real value of community outreach is demonstrated.

"We have a multiple number of tools we try to use [to work with landowners], says Williams. "We try to match our economic needs with the landowner and with what the regulations allow. It's a three-legged stool."

For example, a rancher might ask that a pond be dug to provide water for cattle. A farmer might want compressor stations located out of sight of his farmhouse. Another rancher might ask that development occur along fence lines wherever possible.

One landowner near Gillette didn't want a standard-issue highway snow fence along his property. So Marathon Oil provided trees to plant a living fence instead.

And in Garfield County, Colorado, a landowner complained that elk regularly knocked down a fence. EnCana offered to help put it back up even though the fence had little to do directly with producing coalbed methane.

"The cost to the company to accommodate what a landowner wants is not a great deal more than doing it the most efficient way," says Williams. "It's very advantageous for the landowner to take advantage of us spending capital dollars to enhance their property." □

**"We're going to be neighbors**

*for five to 15 years and we don't want a bad relationship."*

*G. Bruce Williams, Fidelity E&P*

# Call for Entries



**Oil and Gas Investor** announces its first annual **Excellence Awards** recognizing outstanding accomplishments in industry leadership, E&P success, and financial innovation.

Developed to congratulate and reward the driving forces behind the North American energy industry in 2003, we are proud to ask for your participation in identifying and nominating those who made an impact.

**Oil and Gas Investor editors will select winners for:**

- **BEST CORPORATE CITIZEN**—the company that has made the most significant impact in its community. **Criteria may include:** charity work, environmental responsibility, community outreach, networking.
- **BEST FIELD REJUVENATION**—the most innovative field rejuvenation in North America. **Criteria may include:** innovation in enhanced recovery techniques, impact on a basin or region, production volume growth, new application of drilling, workover or completion technology.
- **BEST DISCOVERY**—the most significant new field in North America. **Criteria may include:** distance from existing production, discovery of a new play or trend, reserve addition or production growth potential for the company driving the find, degree of risk involved in developing the project.
- **FINANCING OF THE YEAR**—the most innovative and high impact financing for a North American company. **Criteria may include:** deal structure, impact on financed company, resulting business growth, financial reward for investors.
- **BEST IR PROGRAM**—the most innovative, effective, and unique investor relations campaign by a North American E&P or Service and Supply company. **Criteria may include:** market impact and stock appreciation, new IR strategies development, use of traditional and alternative tools, appeal to the investment community.
- **M&A DEAL OF THE YEAR**—the most innovative and highest impact acquisition or divestiture by a North American E&P company. **Criteria may include:** size and scope relative to previous company profile, ability to grow the company after acquisition, innovative deal structure or execution, impact on the A&D marketplace.

• **EXECUTIVE OF THE YEAR**—Oil and Gas Investor's premier award recognizes 2003's most inspirational, innovative, and high-impact executive in the North American energy industry. **Criteria may include:** This E&P or Service and Supply executive demonstrates leadership, company growth skills, and innovative business strategies and provided overall high impact on the industry during 2003.

## Entry Form

**must be received by December 15, 2003**  
**Oil and Gas Investor • attn: Leslie Haines, Editor**  
**4545 Post Oak Place, Ste 210 • Houston, TX 77027**  
**713.993.9320, ext. 151 • 713.840.8585 fax • lhaines@chemweek.com**

- Mail or fax the completed form below or use your letterhead and include all requested information.
- Alternatively, provide all information by email to lhaines@chemweek.com – enter "Oil and Gas Investor Excellence Award Nomination" as the subject of your email.
- You may provide as many entries as you like. Please submit individually.
- If your nominee is a finalist, we will contact both you and the nominee for additional information about the project to determine final winners.

### AWARD NOMINEE

Company name .....

Contact name..... Title .....

Address.....

Phone..... Email .....

Category (please check one category for each nomination)

BEST CORPORATE CITIZEN     BEST FIELD REJUVENATION     BEST DISCOVERY     FINANCING OF THE YEAR

BEST IR PROGRAM     M&A DEAL OF THE YEAR     EXECUTIVE OF THE YEAR

### SUBMITTED BY

Company name .....

Contact name..... Title .....

Address.....

Phone..... Email .....

DESCRIBE WHY YOUR NOMINEE SHOULD BE RECOGNIZED. LIMIT TO 50 WORDS.

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