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The oil and gas industry swarms to the Marcellus shale-gas potential.

MARCELLUS SHALE

The Marcellus shale marks a new epoch in the distinguished history of Appalachian Basin natural gas production.

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The Marcellus shale's enormous extent coincides with a dense web of infrastructure and proximity to the world's best gas markets. Facing page, the size of the frac stack on EQT Corp.'s #590218 J.E. Mitchell Marcellus well, in Morgan Township, Greene County, Pennsylvania, attests to the size and complexity of Marcellus completions.

In autumn of 1753, George Washington was camping at a spring in the Allegheny Mountains on his first trip to Fort Le Boeuf in the Ohio country. Washington, then a major in the British army and adjutant general to Governor Dinwiddie of Virginia, had been dispatched to confront the commander of the French fort. The offending structure had been built to advance claims by France over disputed lands along the Ohio and Allegheny rivers. An ember from Washington's campfire dropped into the bubbling water, and the spring burst into flames. It was one of the first times natural gas was noted in the region that would one day yield the great Appalachian Basin gas fields.

A century and a quarter later, the phenomenal Haymaker well blew in at Murrysfield in Westmoreland County, east of Pittsburgh, Pennsylvania, at the rate of 34 million cubic feet per day. The wildcat catapulted natural gas into the region's consciousness, and marked the birth of a thriving business that would deliver fuel to Pittsburgh's mighty iron and steel mills, glass kilns, and the homes, schools and churches of its residents.

Now, another 130 years have passed, and another great well has been brought in. Range Resources Corp., after four years of efforts, gauged a horizontal Marcellus well in Washington County, Pennsylvania, at a peak 24-hour

rate to sales of 26 million cubic feet equivalent per day. The landmark well averaged 10.8 million per day for 30 days, and it heralded the dawn of another great age of Appalachian natural gas.

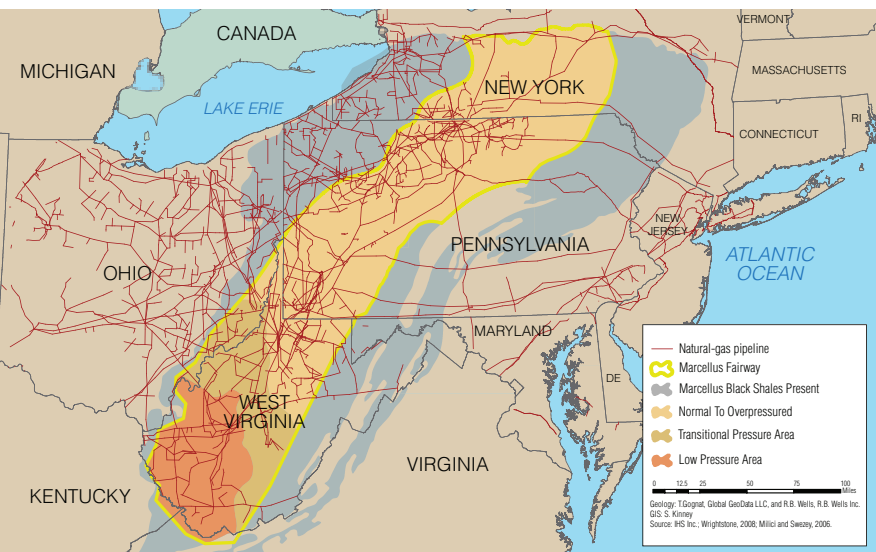
Many-faceted shale

The Middle Devonian Marcellus shale reservoir responsible for the excitement today takes its name from a surface exposure in west-central New York State, near the small village of Marcellus on the west side of Syracuse in Onondaga County. The organic-rich shale underlies more than two-thirds of Pennsylvania, portions of New York, most of West Virginia, and runs into eastern Ohio. It even edges into the fringes of Maryland, Virginia and Tennessee. Within the confines of the basin, the Marcellus can be found at depths down to 9,000 feet, and can attain thickness in excess of 250 feet.

Across its impressive extent, the black shale has many faces. Part of the Marcellus play is overpressured, some areas are normal, and others exhibit very low pressures. Certain areas produce dry gas while others make rich, wet gas.

Drilling results are beginning to reveal some broad divisions within the play, and two main areas of activity have coalesced. In the southwest side of the fairway, where Range hit its huge horizontal producer, industry has already delineated a giant gas field. More than 200 wells show the Marcellus is productive across an ample swath of counties in southern Pennsylvania and northern West Virginia. Depths to the shale run from 5,500 to 8,500 feet in this region, and its western parts feature wet gas that requires processing. This area of the Marcellus play is coincident with thousands of wells, both shallower and deeper than the shale, drilled for traditional Appalachian targets. Low-pressure gathering infrastructure laces through the undulating hills.

Some 150 miles away, in northeast Pennsylvania and southern New York, another prime Marcellus area has emerged. This region yields dry gas from overpressured Marcellus occurring at vertical depths between 4,500 and 9,000 feet. Terrain, water resources and infrastructure





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issues pose unique challenges in this part of the play, which largely lacks prior gas-industry development.

Concept to fruition

Appalachia was a quiet, faded corner of the Oil Patch in the early 2000s. But, across the country in North Texas, rapidly evolving completion techniques were beginning to yield surprising wells from the Mississippian Barnett shale.

Fort Worth independent Range Resources, based in the heart of the Barnett shale, was familiar with those novel completions. It also had deep roots in Appalachia, from predecessor company Lomak Petroleum.

“Once the Barnett worked, everyone was looking for the next big shale,” says Jeff Ventura, president and chief operating officer.

In early 2004, company geologist Bill Zagorski looked at a deal that featured a shale play in Alabama. Zagorski, based in Ohio at Range’s Great Lakes subsidiary, had devoted his entire career to Appalachia. The Alabama shale deal didn’t interest him, but he started to think about the Appalachian Marcellus shale and the parameters of thickness, porosity, thermal maturity and depth.

Zagorski put together a concept for Range management: he wanted the company to explore for Marcellus gas. “Bill thought characteristics of the Marcellus compared favorably to the Barnett,” says Ventura. The Marcellus had a long history of minor production, and from the industry’s earliest days drillers knew the shale was prone to significant shows. Still, commercial volumes had not been achieved.

The idea had huge upside, however. The Marcellus covered a vast area, had excellent gas in place and was close to premium markets. Range also had a plentitude of acreage in the basin, and an available wellbore it could use for a shale test.

Later in 2004, the company plugged back the Renz Unit #1, a vertical well in Washington County, Pennsylvania, and pumped the first Barnett-style slick-water frac job east of the Mississippi. It was a success. The Renz Unit #1, the first commercial Marcellus well in the new-era play, was put on line in 2005.

Range followed that initial test with a series of vertical wells. In 2006, it drilled the first horizontal Marcellus well in Pennsylvania. Its three inaugural horizontal attempts were disappointments, but the fourth was a bonanza. The Gulla #9, also in Washington County, came on line in August 2007 for 3.4 million cubic feet a day. It has produced for two years, and its decline curves compare favorably to Barnett wells.

“Our vertical wells were economic, but what really mattered was the ability to ramp up rates significantly with horizontal wells,” says Ventura. “Horizontal wells also improved the eco-



Jeff Ventura, Range Resources Corp. president and chief operating officer, accepted Oil and Gas Investor’s 2008 Best Discovery award for Range’s leadership in the 54,000-square-mile Marcellus play. Facing page, the eight-stage frac job on EQT’s #590218 took two days; each stage required six hours to complete.



Pittsburgh-based Atlas Energy Resources views the Marcellus as a transformative play, says Rich Weber, president and chief operating officer. The company honed a successful vertical-well strategy, and is now moving into horizontal work. Facing page, a perf gun sits at the ready on a Marcellus stimulation in southwestern Pennsylvania.

nomics, as well as minimized surface use.”

By the close of 2007, Range had drilled 44 vertical and 15 horizontal wells in the Marcellus play and invested about \$200 million. The Marcellus was real, although it took some in the industry another year to fully appreciate the black shale’s potential.

Partly, that was because the Marcellus is far from simple. Range’s pioneering experiences have driven home that lesson. “Where you are in the play really matters,” says Ventura. “The pressure gradient in the Marcellus isn’t constant across the fairway, and the pressures are related to organic content, thermal maturity and the deformational history of the basin. You have to be in the right spots, at the right thermal maturities and right depths.”

Other important characteristics that vary across the play are porosity, permeability, clay content and the relationship of fractures to productivity. Drilling depths add an additional factor to the commercial equation.

“Simplistically, we want the areas with the highest gas in place where we can have the highest recovery factors. It all relates back to economics.”

On average, across its 900,000-acre Marcellus position, Range expects to spend about \$1 million per 1 billion cubic feet equivalent (Bcfe) of recoverable gas, although its early wells have clearly exceeded those assumptions. The company estimates that its leases in the shale fairway hold potential unrisks recoverable gas of between 15- and 22 trillion cubic feet (Tcf). And that’s solely from Marcellus. Other shale targets with large potential include the deeper Utica shale and shallower Rhinestreet, Genesee and Burket shales.

So far, Range has drilled more than 100 Marcellus wells, more than half of which are horizontal. Much of its attention has been devoted to its 550,000 net acres in southwest Pennsylvania, where it launched its shale efforts. It currently runs three big horizontal rigs there, and will exit the year at six.

At present, the company’s pad-drilled horizontal wells in southwest Pennsylvania cost \$3.5 million, at true vertical depths around 6,500 feet. Its horizontal wells boast estimated ultimate recoveries of between 3 and 4 Bcfe and possibly higher.

To handle the gas flowing from the new shale wells, Range and Denver-based MarkWest Energy Partners formed a venture last fall. MarkWest installed a gas-processing plant with capacity of 30 million a day, the first in the area, and Range closed 2008 producing a little bit under that volume. In April 2009, MarkWest added another 30 million per day of capacity.

Range’s gas leaves the processing plant at 1,150 Btu per thousand cubic feet, and that’s a key factor in its Marcellus economics. “We get Nymex times 1.15, plus 35 cents for the basis

premium,” he says. “Our gas is tremendously advantaged coming out of the Marcellus.”

Additionally, Range holds 350,000 acres in the northeast portion of the play. It drilled a vertical well that tested 6.3 million a day, the best vertical test across the entire Marcellus. The company plans to start horizontal work in this region this year.

“We expect to exit this year at 80- to 100 million per day of net production,” says Ventura. “The Marcellus has size and repeatability. Right now, it has the best-in-class economics of any play in the U.S.

“I couldn’t be more excited.”

Down-home properties

Pittsburgh-based Atlas Energy Resources was an early mover in the Marcellus. It spudded its first well in 2006, after hearing news of Range’s success. Since then, Atlas has drilled 150 Marcellus wells, mainly vertical holes. All but two are in southwestern Pennsylvania.

The company has worked in Appalachia for more than 40 years, specializing in syndicated drilling programs. It holds 550,000 acres in the Marcellus play, and some 274,000 acres of that are in western Fayette County, western Westmoreland, eastern Washington and eastern Greene counties, Pennsylvania.

It owns some 2,400 Upper Devonian wellbores in that area, giving it tremendous well control and a clear picture of the subsurface at the Upper Devonian level, which is reflective of the deeper Marcellus.

“We started out with a vertical strategy, and we have achieved industry-leading results from our vertical program,” says Rich Weber, president and chief operating officer. “We constantly focus on improving our drilling, completion and production techniques, and we feel that we have developed a proprietary process.”

Atlas’ vertical wells currently come onstream at initial rates of approximately 2 million a day, and are solidly economic. Per-well costs are a little more than \$1.5 million, and its reservoir engineers estimate average ultimate recoveries at 1.4 Bcf per well.

The company is shifting toward horizontal work, however. In early 2008, it participated in a horizontal well with another operator. During the next 12 months, it studied the play intensively and added staff with horizontal drilling and completion experience.

Six months ago Atlas kicked off its own horizontal operations. To date it has drilled eight horizontal Marcellus wells, and four are producing. “We are quite pleased with the results,” says Weber. Indeed, one well came on at more than 10 million a day.

For the balance of the year, Atlas intends to drill another seven horizontals.

Its costs on pad-drilled horizontal wells are running about \$4 million in the deeper, dry-gas area, where the Marcellus occurs at depths of 7,800 to 8,200 feet and pressure gradients are





A packer will separate stages in the Marcellus lateral during the frac job. EQT is fracturing the #590218 with about 100,000 barrels of water and 300,000 pounds of sand for each of eight stages.

more than 0.6 psi per foot. To the west, in the wet-gas area, the shale is around 6,500 feet deep and wells run \$3.5- to \$4 million.

In fact, the Marcellus potential is so substantial that it motivated Atlas to look at its entire capital structure. At present, it drills Marcellus wells through its syndicated program, which increases its rates of return and reduces its capital investment. In the future, however, it intends to use its own capital to develop the Marcellus horizontally. This will allow Atlas to grow cash flow and reserves more quickly than through the syndicated programs.

To that end, Atlas Energy Resources is merging with its parent Atlas America Inc. The renamed entity, Atlas Energy Inc., intends to reinvest a substantial majority of its cash flow into the development of its Marcellus position, while continuing its syndicated programs.

In 2010, Atlas plans a two-rig horizontal program that will be funded entirely through internal cash flow. "We are going to staff to handle at least a six-rig horizontal program in 2010, however, so that we can accelerate the program if we choose," says Weber.

Finally, infrastructure is one of Atlas' strengths. Thanks to its high activity levels during the past decade, it has an existing gathering

system in southwestern Pennsylvania. The low-pressure system has 20 interconnections with interstate pipelines and is capable of moving volumes of up to 200 million a day. To ready this system for Marcellus gas, Atlas Pipeline Partners recently entered into a joint venture with the Williams Cos. Williams has purchased 51% of the system, and Williams will operate Laurel Mountain Midstream LLC, the new joint venture.

"To reach our production-growth objectives, we need a high-pressure gathering system. Williams has the capital resources to dedicate to the build-out of a high-pressure system, and the technical know-how and experience," says Weber. Atlas will be the anchor shipper on the gathering system, which will also seek significant third-party volumes.

"The Marcellus is a transformative play for Atlas," says Weber. "It offers us the potential for explosive growth."

Highest returns

That potential is undisputed. Chesapeake Energy Corp., the nation's most active driller and producer of natural gas and a company that bills itself as America's champion of natural gas, thinks highly of the Marcellus. The Okla-

homa City-based mega-independent places the Marcellus in league with its other three major U.S. shale plays, the Barnett, Fayetteville and Haynesville.

Chesapeake's entry into the Marcellus was preceded by a strong interest in the Appalachian Basin. "The genesis of the play for us started in 2001 when Tom Ward and I made a trip to the Rockies to look at coalbed-methane and other plays," says Aubrey McClendon, chairman and chief executive officer. Company executives came away with the assessment that the Rockies were long on gas, but short on pipes: it would be easy to find gas but tough to make money producing it. They beat a retreat back to their Midcontinent hunting ground. If Chesapeake looked for gas in the mountains, it would be in the privately owned Appalachians, close to gas markets, and not the federally owned Rockies.

"Appalachia reminded us a bit of Oklahoma. We reinvigorated deep-gas exploration in the Anadarko Basin after 2000; we thought we might be able to do the same thing in Appalachia," says McClendon. Chesapeake saw Appalachia as a dormant basin that had potential to be resurrected through application of modern technology, especially horizontal drilling and 3-D seismic. The seed was planted: it wanted a stake.

That desire was realized in late 2005, when Chesapeake bought Columbia Natural Resources for \$2.2 billion, plus an \$800-million hedge liability. Chesapeake gained 3.5 million acres and became the second-largest producer in the Appalachian Basin.

It focused on the basin's Marcellus potential in 2006, and started to drill the formation in 2007. "Historically, Columbia was strong in Kentucky, West Virginia and New York. We had to start from scratch in Pennsylvania," says McClendon. Chesapeake, in its own illimitable fashion, quickly amassed some 1.8 million acres in the broad Marcellus fairway.

To date, the company has drilled some 30 horizontal Marcellus wells. Currently it runs 11 rigs in the Marcellus, and expects to be at more than 20 at the end of this year and more than 30 at the close of 2010. "We've had very strong results in northern West Virginia and northeastern Pennsylvania," says McClendon. "We're building an important area of focus in southwestern Pennsylvania as well, where Range has been very successful."

Last winter, Chesapeake made an arrangement with StatoilHydro that brought the major multinational corporation into the Marcellus, and firmly pushed the shale onto the world stage. The Norwegian operator paid Chesapeake \$3.25 billion for a 32.5% interest in its Appalachian leases.

"My view is StatoilHydro got a bargain: it got 600,000 prime net acres focused in the heart of the play, operated by the most experienced shale driller in the world," says McClendon.

Chesapeake's well costs are coming down in

the Marcellus, as they are across the country. "We drilled some \$7-million wells initially, but we will be \$4- to \$4.5 million per well going forward." The operator sets up its Marcellus wells on multi-location pads, but due to lease expiration considerations most pads just host one or two wells at present. Full development will come in the future.

Three years ago, Chesapeake bought local driller Yost Drilling, based in Mount Morris, Pennsylvania. That entity is now part of Nomac Drilling, Chesapeake's 100%-owned drilling subsidiary. Of Nomac's 90-rig fleet, around 20 have each received \$1.5-million modifications to suit them for work in Appalachia. Currently its drilling crews fly in bi-weekly from the Midcontinent, but Chesapeake is setting up local training programs and plans to build crew camps at several locations in Pennsylvania and West Virginia.

Chesapeake's challenges in the Marcellus primarily revolve around topographic and regulatory issues. "It's a hard place to get around in, and if we could figure out a way to smooth out the hills and straighten the roads, that would be most helpful!" says McClendon. Regulatory delays are easing, however, because the company and other major shale operators have lots of boots on the ground and are spending lots of money and time to work through issues with local regulators, environmental groups and other stakeholders.

The play is already economic across a broad area, from Bradford and Susquehanna counties, Pennsylvania, to Wetzel and Tyler counties, West Virginia, says McClendon. "The Marcellus is potentially 10- to 15 million acres in size, compared with the Haynesville at 3 million acres and the Fayetteville and Barnett at 1.5 million acres each. It's an extraordinary play because of its size. And it receives the best gas prices in North America."

McClendon says the Marcellus is very important to Chesapeake's long-term growth. "Right now, the Marcellus is our highest-return play. Its returns are twice as good as the Fayetteville and 50% better than the Haynesville and Barnett. We plan to be the most active operator in this play for decades to come."

Long on experience

For some firms, the Marcellus shale has been a surprising and welcome supplement to long-pursued objectives. EQT Corp. has worked in Appalachian gas since the dawn of the industry, and specifically in shales for more than 50 years. The integrated Pittsburgh-based company is the largest firm solely focused in the Appalachian Basin, where it holds 3.4 million acres of leases.

EQT has an immense presence in Lower Huron, a subnormally pressured Devonian shale that occurs across much of its traditional focus area in Kentucky and West Virginia.



The economic returns in the Marcellus play are twice as good as the Fayetteville and 50% better than the Haynesville and Barnett shales, says Aubrey McClendon, chairman and chief executive officer of Chesapeake Energy Corp.

Overleaf: Patterson-UTI Energy's Rig #738 is drilling the curve on a Marcellus well for EQT Corp. in Morgan Township, Greene County, Pennsylvania. The #59001 J.S. Thistlethwaite is the second well on a multiwell pad. Top of the Marcellus is around 8,000 feet in this area, and the lateral will extend more than 3,000 feet.







This year, EQT Corp. will spend \$150 million to drill 40 horizontal and five vertical Marcellus wells, says Murry Gerber, chairman and chief executive officer. Right, the company estimates a horizontal Marcellus well takes about 21 days to drill. Vertical portions are air-drilled, and the curve and lateral portions are mud-drilled.

Now, it's adding the Marcellus onto its formidable Lower Huron program.

This year, EQT will spend \$150 million to drill 40 horizontal and five vertical Marcellus wells. Of its enormous land position, 400,000 net acres lie in the Marcellus normal- to high-pressured fairway, and an additional 300,000 acres are in low-pressured Marcellus. The latter is mainly an add-on to its Lower Huron activities.

"In 2009 we plan to confirm the variability within the normal and overpressured Marcellus across our leasehold," says Murry Gerber, chairman and chief executive officer. "We want to establish whether the Marcellus will be a 'hot-spot' play, with good and bad areas, or whether wells will perform similarly across broad trends."

To date, EQT has drilled 18 vertical and 12 horizontal wells in the normal- to overpressured Marcellus. By year-end, it will have 65 such Marcellus tests and an excellent view of the play.

EQT geologists think important mechanisms that affect Marcellus productivity are matrix porosity and catagenic fracturing, which can translate to flatter decline rates than those experienced in other shale plays. "That's what we are already seeing, as compared to our Lower Huron wells," says Gerber. It prefers to land its laterals in highly organic zones in the Lower Marcellus that are rich in biogenic quartz; this combination seems to result in rock that is both naturally fractured and amenable to induced hydraulic fractures.

Still, controls on well quality are not fully understood. "It's going to take some time to figure out the drivers of excellent production."

In addition, the company wants to confirm the technology that will deliver the lowest well costs. EQT estimates that the Marcellus will generate wells that average 3.5 Bcfe apiece, and its goal is to drill and complete wells for \$3- to \$3.5 million, versus current costs of \$4.5- to \$5 million. "Our greatest challenge is getting well costs down, and a corollary to that is increasing the volume of fractured rock at the lowest possible cost."

The company has experimented with both cemented completions, popular among some operators in the play, and the external packer assemblies that have worked so nicely for it in the Lower Huron. The best method is still being debated.

Within the broad Marcellus fairway, limits to the play will revolve around well costs and midstream issues, thinks Gerber. Water-handling issues are already being resolved. EQT is having a 5,000-barrel-per-day distillation and recycling plant built in West Virginia, and plans to combine on-site recycling with a limited amount of downhole injection.

On the midstream front, EQT is working on its Equitrans system, a pipeline network that was built decades ago to deliver gas to Pittsburgh's industries. The system is a major asset,





and one that is extremely well placed for Marcellus gas. EQT is reversing the flow of Equitrans, to take gas from Marcellus wells in northern West Virginia and southern Pennsylvania to major interstate pipelines. Current capacity is 450 million cubic feet a day, and EQT can double that if the need arises.

Clearly, its Marcellus position is a blessing, and EQT expects the reservoir to contribute increasingly large shares to its production, says Gerber. "It's icing on the EQT cake."

Low and high pressure

The Marcellus has also been a boon to another durable Appalachian player. Private companies are integral to the fabric of the Appalachian industry, and one of the largest privates is ECA, Energy Corporation of America. The 40-year-old firm has assets in the Gulf Coast, the Rockies and overseas in New Zealand, but its Appalachian properties comprise about 75% of its value.

"We hold about 1 million net acres in Appalachia, most of which is held by production," says Denver-based chief executive officer John Mork.

The company targets both the low- and high-pressure Marcellus plays, and has drilled 155 wells into the shale. The bulk of its drilling has been in Boone, Logan and Lincoln counties, West Virginia, in the low-pressure sector. "Economics in this area are exceedingly good, in the finding-cost range of \$1 per thousand cubic feet," he says.

Additionally, the company is active in Greene County, Pennsylvania. ECA has operated a dozen and a half wells in the high-pressure Marcellus, the last four of which are horizontal. Going forward, the company is running two rigs in that slice of the play. During the next three to five years, it plans to spend \$300 million in Greene County.

"We get much stronger economics from horizontal wells," says Mork. "Three years ago, we didn't drill any horizontal wells in Appalachia, and from now on 80% of our drilling will be horizontal."

Northeast dry-gas play

Cattycorner across the Keystone State from Greene County is the other burgeoning area of Marcellus activity. This wedge of the Marcellus extends from northeastern Pennsylvania into New York, but the Empire State is not issuing permits for wells that require large-scale hydraulic fracs, pending completion of an environmental review.

Cabot Oil & Gas Corp. works in Pennsylvania's Susquehanna County, an area it picked because the Marcellus reaches more than 300 feet in gross thickness, says Mike Walen, senior vice president and chief operating officer.

The Houston-based company leased its first 20,000 acres in the play in 2006; today it holds more than 160,000 net acres. On its holdings the Marcellus is 7,300 to 7,500 feet deep and



Energy Corporation of America successfully works across the range of pressure regimes found in the Marcellus play, says chief executive officer John Mork.



Cabot Oil & Gas Corp. is already producing some 35 million cubic feet per day from its Marcellus acreage in Susquehanna County, Pennsylvania, says Mike Walen, senior vice president and chief operating officer.

Facing page, a connection is made by rig hands on Patterson-UTI Energy's Rig #738 during drilling operations on EQT Corp.'s #590001 Marcellus well.

significantly overpressured, a factor that Cabot thinks is a key contributor to high-quality wells.

Cabot initially drilled vertical wells, and these posted rates into the sales line ranging from 600,000 to 1.7 million cubic feet per day. In 2008, Cabot drilled 15 vertical and five horizontal Marcellus wells. Its 30-day average for the verticals was more than 1 million cubic feet per day, and estimated ultimate recoveries are 1.4 Bcf per well.

Cabot's 2008 horizontal tests were sterling, however. They flowed into sales at rates between 6.4- and 8.8 million cubic feet per day. "Our initial horizontal wells are north of 4 Bcfe, and our results are consistent," says Walen. "We are already seeing flattening on the decline curves on our older wells."

This year, Cabot plans to drill 35 horizontal and 22 vertical wells. It operates eight rigs, split between horizontal and vertical drilling. The verticals are useful for land issues, and also as go-by wells for offset horizontals, but horizontals are the moneymakers. Costs are currently \$3.3- to \$3.5 million for a horizontal well. "We've drilled and completed one at \$3.2 million and one at \$3 million, so costs are coming down quite a bit," says Walen. Cabot generally drills the vertical portions of its holes on air, and switches to mud for the curve and horizontal sections. For completions, the company prefers external packers.

"The risks to drill and complete wells are lower in the Marcellus than they are in plays like the Haynesville. We have limited issues with getting the wells down and completed," he says.

Two years ago, Cabot anticipated that the much-discussed water issues in the Susquehanna River Commission district could develop into formidable obstacles to development. But an emphasis on communication and education between industry and regulators has resulted in a consensus. "As long as industry complies with existing regulations, files its paperwork on time and answers the appropriate questions, we get the permits." An average Marcellus permit now requires just 30 days.

Cabot's current production is in the 35-million-per-day range. The company continues to lay its gathering system; when completed, it will have 25 miles of 10-inch, 8-inch and 6-inch lines. It recently completed its first station, with 100-million-a-day capacity. The pad and headers for a second 150-million-a-day station are in the works as well, which will bring the company's capacity to 250 million a day.

And it will need all that room: Cabot estimates that 18 to 27 Tcf of in-place gas resides in the Marcellus in its leases, and between 4 and 6 Tcf are recoverable.

"This is probably the best play Cabot has in the States," says Walen. "It's truly world-class."

Huge potential

That view is validated by the presence of a number of firms with international experience,

including Houston-based Anadarko Petroleum Corp. The company began acquiring acreage in the Appalachian Basin about three years ago, and today holds roughly 300,000 net acres in Centre, Clinton, Lycoming, Sullivan and Bradford counties, in north-central Pennsylvania.

"We were initially attracted to the Appalachian Basin because of the potential for multiple plays there, and the Marcellus shale has emerged as the best commercial opportunity," says Chris Doyle, general manager, Appalachian Basin. Anadarko's acreage appears to be in a favorable position within the basin in terms of shale thickness, thermal maturity, and significant overpressure.

Anadarko recently completed drilling its first horizontal well in Clinton County. "We have one operated rig running now, and, with continued success, we will have three to four rigs running by the end of the year," says Doyle.

Additionally, Anadarko has participated in approximately 20 horizontal wells in Bradford County, part of a large area of mutual interest with Chesapeake. Currently, the parties have seven horizontal wells on production.

A key challenge that industry faces in developing the Marcellus is water management. According to Doyle, Anadarko will employ a portfolio of water-management solutions that will likely include significant water reuse and recycling.

"Anadarko has a strong track record for finding responsible water solutions in other areas where we operate, and evaluation of these options in Pennsylvania is a near-term priority. In the Greater Natural Buttes gas field in Utah, we created a program to reuse frac water that garnered a Utah Division of Oil, Gas and Mining 2008 Earth Day Award," he says.

As with any other play, Anadarko is approaching the Marcellus with the goal of balancing development that enhances state and local economies with the protection of Pennsylvania's other natural resources. Anadarko is creating community advisory groups to keep key stakeholders informed about its activities. Local residents, officials and regulators have been invited to participate in meetings and engage in discussions that update operations, gather feedback and guide decisions.

"We have been active in involving local stakeholders in the initial phase of our operations," says Doyle. "We want to develop this resource responsibly."

And that's the way business is done in the Appalachian Basin's Marcellus shale in the 21st century. The vast play in the breast of the oldest producing basin in the world is surprisingly easy to drill and complete, robustly economic, and tied directly to the nation's prime gas markets. And its development can be accomplished in harmony with the environment.

Truly, the Marcellus is the latest realization of the promise once glimpsed by our Founding Father while he was still a young officer in King George II's service. □

