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# Utica Shale

*The Playbook — with Marcellus Shale Updates*

A supplement to

Oil and Gas Investor | E&P | MIDSTREAM Business


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Utica Shale:
*The Playbook*

**A supplement to *Oil and Gas Investor, E&P,* and *Midstream Business***

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A Chesapeake rig works the rolling countryside of eastern Ohio as the operator builds a strong program in the Utica Shale. *(Photo courtesy of Chesapeake Energy Corp.)*

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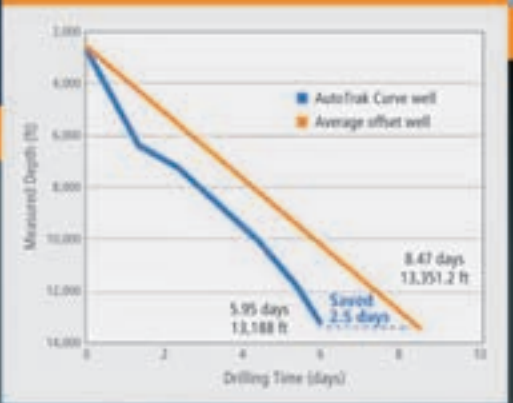


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### THE JUICY DUVERNAY: A GIANT IN THE MAKING

The Devonian Duvernay is an up-and-coming unconventional play in Western Canada, and recent well results are fueling particular interest in its rich-gas window.
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### GOVERNMENT, INDUSTRY SHOULD ADJUST POLICIES TO MAXIMIZE SHALE POTENTIAL

"The public's concerns about a potentially adverse environmental impact must be taken seriously," says MIT professor John Deutch.
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While water quantity and alleged quality issues can create issues for oil and gas lessees, certain provisions can help prevent disputes.
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## MOST READ ON THE WEB

1. A Quick Update on Devon's Efforts in Ohio And Michigan
2. Who is Liquids Rich?
3. NAPE 2012: Tight Oil, Shales Impact Domestic Production
4. Teak Plans South Texas Pipeline Construction
5. Cabot Announces Joint Venture Pipeline

## WEBINARS

**T. Boone Pickens: A Conversation about Energy Policy, Natural Gas and Jobs**

T. Boone Pickens, oilman, entrepreneur, and natural gas advocate, spoke at Hart Energy's 3rd annual DUG East Conference and Exhibition in Pittsburgh in November. Since July 2008, US energy policy has been Pickens' focus, and his opening remarks updated the audience on the Pickens Plan, which promotes greater use of natural gas, and the NAT GAS Act working its way through Congress. Pickens then participated in a question-and-answer session with *Oil and Gas Investor* Editor-in-Chief Leslie Haines.
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**Energy Outlook 2012: Where are Oil, Gas and NGL Prices Headed?**

There is a lot of uncertainty over prices heading into 2012. Will crude prices surpass US $100 per barrel? Will liquids prices be able to continue their winning streak? Can gas prices rebound? What regions have the most untapped potential for production and demand? What infrastructure projects have the potential to change the outlook for prices? This 55-minute webinar includes a Q&A moderated by Frank Nieto, editor of Hart Energy's *MidstreamBusiness.com* and *Midstream Monitor.*
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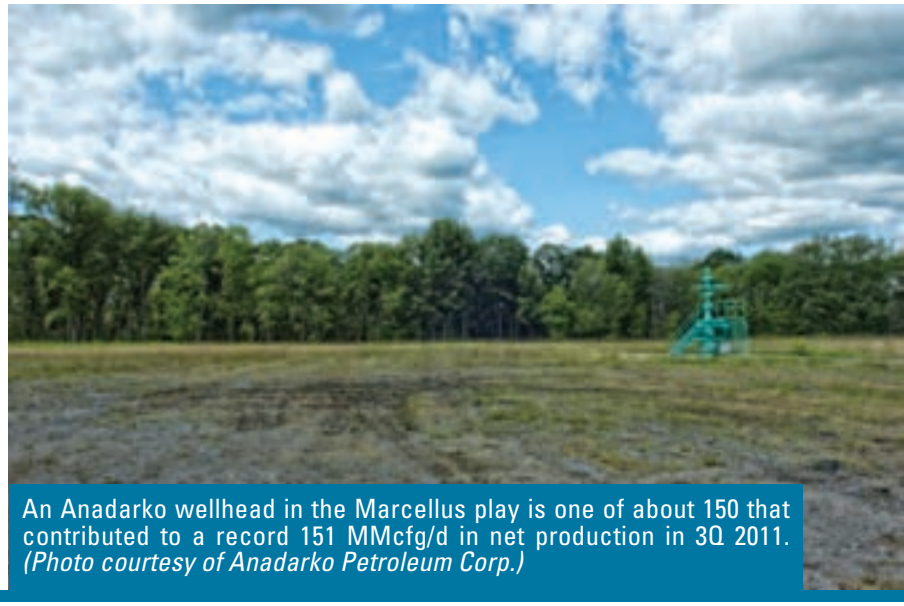


An Anadarko wellhead in the Marcellus play is one of about 150 that contributed to a record 151 MMcfg/d in net production in 3Q 2011. *(Photo courtesy of Anadarko Petroleum Corp.)*

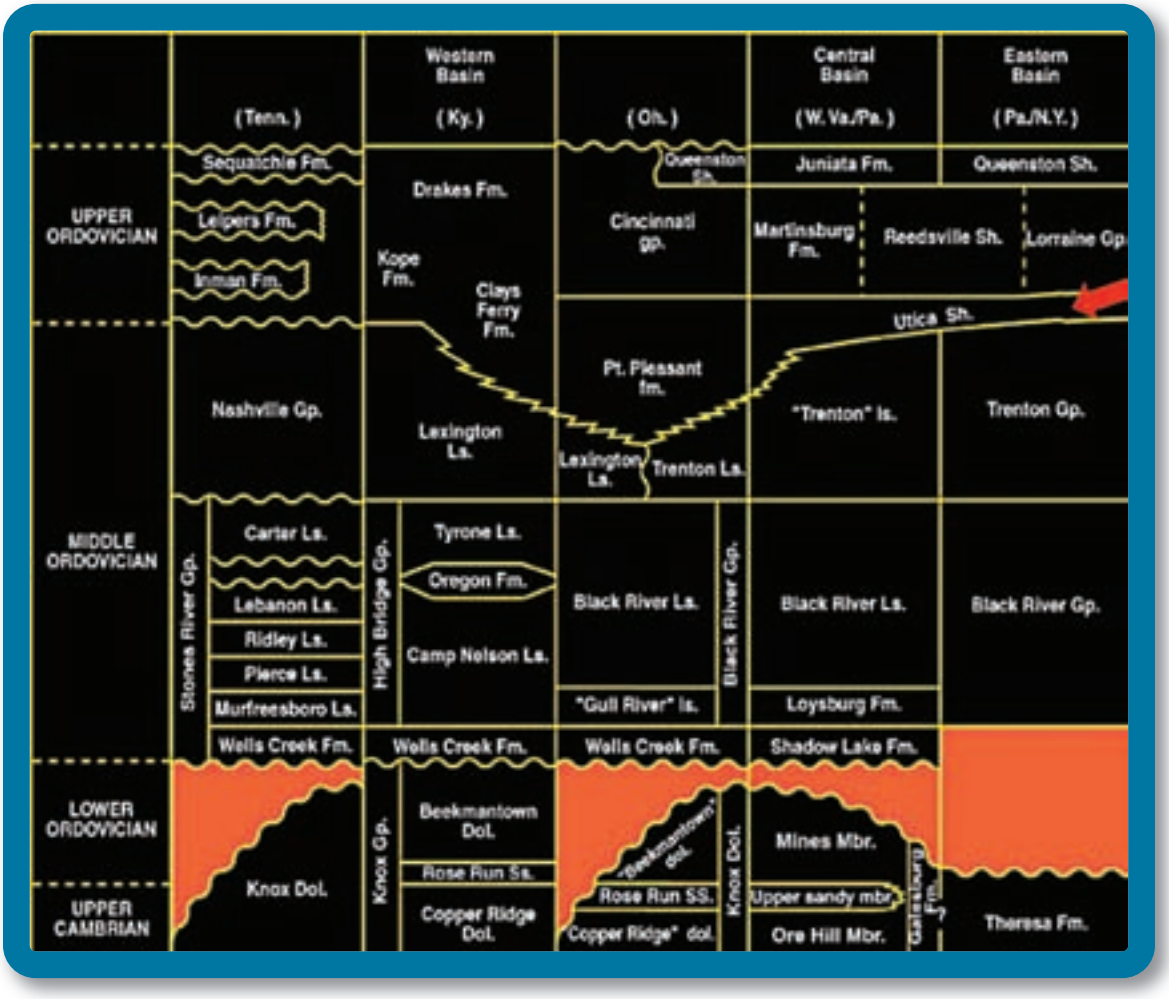
# The Utica: Game On

From grassroots leasing to commencement of infrastructure build in 18 months, this new, liquids-rich shale play is already being compared with the Eagle Ford — possibly, as superior to it.

**By Nissa Darbonne**
Contributing Editor

*Editor's Note: Some commentary is from operators' quarterly earnings conference calls and other transcripts at* SeekingAlpha.com.

"Shazam!" That was the response from equity analysts at Tudor, Pickering, Holt & Co. Securities Inc. upon Chesapeake Energy Corp.'s September announcement of initial results from four horizontal Utica Shale wells in eastern Ohio and western Pennsylvania.




Utica and Point Pleasant thicken in Ohio and sit on top of Trenton Lime. *(Source: Wickstrom et al, 1992, Ohio Dept. of Natural Resources)*

The sentiment was echoed throughout the investment community and industry. Immediately, the gas-liquids results were being compared to that of the behemoth Eagle Ford liquids play.

Jeff Dietert, managing director and co-head of institutional research at Simmons & Co. International Inc., said, "The well costs ranged between US $5 million and $6 million, indicating that they will have economics that are likely more favorable than those in the Eagle Ford condensate window."

Irene Haas, senior vice president and senior equity analyst at Wunderlich Securities, said, "Based on the early IP (initial-production) rates...these wells are indeed in the same league as some of the best Eagle Ford wells, if not better."

Industry speculation had been rampant about the play already. Michael Bodino, head of energy research for Global Hunter Securities LLC, said of the wells, "They lived up to the hype."

The news heard around the oil and gas world was this:

- Buell 10-11-5 8H in Harrison County, Ohio, had a peak 24-hour rate of 9.5 MMcf/d of gas and 1,425 bbl of gas liquids and oil or 3,010 boe.
- Mangun 22-15-5 8H in Carroll County, Ohio, made 3.1 MMcf and 1,015 bbl or 1,530 boe.
- Neider 10-14-5 3H, also in Carroll County, produced 3.8 MMcf and 980 bbl or 1,615 boe.
- Thompson 3H, in Beaver County, Pennsylvania, peaked at 6.4 Mmcf of dry gas alone.

The average of the three wet wells was 2,052 boe/d.

"Uticulous," Bodino said. "...If the play wasn't on your radar screen before this announcement, it definitely should be now."

Here's how the Utica — what Chesapeake chairman Aubrey McClendon believes will be the most profitable play in the US — came to be.

## Beginning in 1860

There's certainly oil and gas in Ohio. Since 1860, beginning in Noble County, the state has produced more than 8.5 Tcf of gas and 1.14 Bbbl of oil from formations ranging from the shallow Devonian-age Berea sandstone and Ohio shale to the Silurian-age Clinton and Medina sandstones to the deeper Ordovician-age Queenston silty shale, Trenton Lime, and Knox Group of sands.

**Ohio Utica Well Forecast, 2011-15**

| | 2011 | 2012 | 2013 | 2014 | 2015 | 5-Yr Total |
|---|---|---|---|---|---|---|
| Drilled | 27 | 161 | 785 | 1,386 | 1,644 | 4,003 |
| Completed | 20 | 123 | 608 | 1,171 | 1,501 | 3,423 |

*Source: Kleinhenz & Associates Ltd.*

From just 27 initial wells drilled in Ohio's Utica Shale play in 2011, the state may host 4,000 by the end of 2015.

Pervasive under the state, hydrocarbons have been produced from most of its 88 counties, according to consulting firm Kleinhenz & Associates Ltd.

In 2010, some 78 Bcf of gas and 4.7 MMbbl of oil were made from nearly 70,000 wells still in operation, many of them marginal. More than half (53%) of the wells drilled in Ohio have produced from shallow Clinton sandstone.

"The natural gas and crude oil industry in Ohio is mature and enjoys a well-developed Infrastructure," Kleinhenz reported to the Ohio Oil & Gas Energy Education Program in September when calculating for the economic impact of the new Utica play. "...The industry helped establish Ohio as an industrial base in the 1860s and continues to contribute to the economy."

As the Utica Shale sits below the Lower Ordovician and Upper Cambrian Knox Group, the presence of hydrocarbons there has long been known; however, unconventional technology has been necessary to make production from it commercial.

## Enter EnerVest Ltd.

Prior to Chesapeake's entry to the play in mid-2010 with an intense leasing effort described by Bodino as "Occupy Ohio," Houston-based EnerVest Ltd., and later its EV Energy Partners LP (EVEP) master limited partnership (MLP), were already on the ground. EnerVest entered Ohio in 2003 with the acquisition of Columbus-based CGas, which was drilling wells in Knox.

"We had actually been looking at Ohio and West Virginia for just old, conventional production for a long time," said Mark Houser, EVEP president and CEO and EnerVest executive vice president and

COO. It added to its position in 2005 when buying longtime Appalachian operator Belden & Blake Corp., in 2009 when buying Exco Resources Inc.'s position there, and in 2010 when buying Range Resources Corp.'s Ohio production. The deals totaled some $600 million combined.

From what it inherited and from drilling 20 to 50 Knox wells a year, EnerVest had a database of more than 600 vertical well bores into Knox, thus through Utica. And it also noted a couple of vertically productive Utica anomalies.

"Back in 1997, Belden & Blake had actually drilled a well — the Leitenaker well — in central Ohio that produced 52,000 barrels of oil from the Utica without any sort of fracture stimulation," Houser said. Then, in 2005, while EnerVest was drilling what would be a dry hole in Knox, the vertical well encountered oil and gas from the Utica.

"So, we've had a couple of indications of productivity from it. But with all of these logs we have, we've done some detailed interpretation and they've given us a good idea of Utica. This opportunity really has developed over time," Houser said.

Enter Chesapeake. While Chesapeake's land team was putting together what would eventually become a 1.5 million net acre position over Utica, it entered some of EnerVest and EVEP's 1.4 million gross acre foothold in a joint venture (JV). The three liquids-rich wells it reported in September are part of that JV.

## Geology

In Ohio, the Utica Shale play is really a Point Pleasant carbonate play, Houser explained. There, the interbedded limestone and calcareous shale of Point Pleasant is a more than 200-ft-thick, organic-rich marine facies that was deposited during the end of the Middle Ordovician and sits below the younger, Upper Ordovician Utica Shale that is between 150 and 300 ft thick.

Beneath Point Pleasant is Trenton Lime. "We feel like the Trenton is a real effective frac barrier and it shows low water saturations overall," Houser said. "The Point Pleasant itself has low water saturations and reasonably good permeability. Some folks are likening it in some ways to the Eagle Ford, although that's still to be determined. It's quite early."

In western Pennsylvania, the Utica is also present, beneath the Marcellus Shale. And Utica is found in West Virginia, Kentucky, New York and Quebec, although Point Pleasant virtually disappears outside of Ohio and western Pennsylvania, where "Utica Shale play" is really a misnomer.

Dan Morrison, Global Hunter Securities (GHS) managing director and senior research analyst, said, "While the North American gas shale plays are pretty much shales, so far every 'shale' liquids play has a reservoir 'kicker' that makes them work. For example, the Bakken play is really a shale/dolomite sandwich — the Middle Bakken — or, in the case of the Sanish/Three Forks, a sandstone with shale on top. Eagle Ford is hardly a shale at all; with over 70% calcite, it's really a 'dirty chalk.'

"Even the Utica in Ohio is actually produced from a carbonate — Point Pleasant — underneath the shale section."

Bodino noted the Ohio play has three windows: the volatile oil and condensate window the industry is focusing on now, the down-dip dry-gas window that has already been encountered in western Pennsylvania, and an up-dip oil window in which Chesapeake is doing initial testing.

"Perhaps the most important variable is the high organic content in the black shales as well as the high calcite percentage, which allows fracability (fracture stimulation). Unlike much of the Eagle Ford Shale play, many other horizons could be economically viable across much of the Utica play," Bodino said.

He added:

- Total organic content is typically greater than 1% and averages 2% to 3%;
- The Utica's thickness is from 150 and 300 ft and Point Pleasant is 200 to 250 ft thick in the core of the play where Utica is at 6,000 to 8,000 ft; and
- The core counties in Ohio may be Carroll, Columbiana, Jefferson, Harrison, Belmont, and eastern Tuscarawas and Guernsey.

"This organic-rich rock has high calcite content, low clay content, reasonably good porosities and low water saturations," Bodino said. He estimates wells will cost some $6 million each and make between 3.6 and 5.4 Bcfe or between 600,000 and 900,000 boe each.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"Not only is the depth setting similar to the Eagle Ford in the higher-liquids-yielding window, there are several other corresponding characteristics," he added. "For example, the Point Pleasant member of the Utica is similar to the Eagle Ford, although it is characterized as having a higher carbonate content and a low clay content — a factor instrumental to the success of the Eagle Ford.

"In fact, in many areas, the Utica/Point Pleasant exhibits around 50% calcite and 20% clay content, just slightly higher than the Eagle Ford. Porosities are in excess of 5% — just lower than the Eagle Ford — and permeabilities are similar to or slightly better to that of the Eagle Ford shale, but with lower water saturations."

Range Resources Corp., the founder of the Marcellus Shale play next door, made the first horizontal Utica well in Pennsylvania, Zahn Lloyd Unit 1H, in 2010, testing an average 4.4 MMcf/d in its first seven days. However, Range is focused in Appalachia on proving its Marcellus shale potential to hold its acreage by production before expiration; where both Utica and Marcellus exist on its leasehold, it may come back for Utica another day.

In late 2010, Consol Energy Inc. further contributed to Utica expectations when its vertical test in Ohio made 1.5 MMcf during its first 24 hours — unstimulated.

More recently, 11 miles north of Range's Zahn well, Rex Energy Corp. reported a horizontal test in Point Pleasant in Butler County, Pennsylvania. Its Cheeseman 1H made 9.2 MMcf in a 24-hour test from a lateral of 3,551 ft with 12 frac stages. Like the Chesapeake well in adjacent Beaver County, it was also primarily dry gas.

What is the best ZIP code for Utica? Wunderlich's Haas said, "By mapping the overlap between areas with high total organic carbon contents, proper thermal maturity and presence of the Pleasant Point Formation, we can narrow the Utica 'sweet spot' in Ohio into a list of counties: Noble, Monroe, Guernsey, Belmont, Jefferson, Harrison, Tuscarawas, Carroll, Stark, Columbiana, Mahoning, Portage, and Trumbull.

"The wet gas window for the Utica can potentially extend into these counties in western Pennsylvania: Beaver, Lawrence, Mercer, and Crawford. We expect a ramp up in drilling and testing this year and we should see a more accurate map defining the exact boundary of the wet gas belt. Our 'best ZIP codes' list could shift with new data."

## M&A, JVs

A landslide of Ohio acreage has changed hands in the past few years. EnerVest and EVEP, which has become the largest oil and gas producer in Ohio in the past decade, made four purchases. Royal Dutch Shell gained Utica acreage when it bought East Resources Inc. in 2010 ($4.7 billion). Chevron Corp.'s purchase of Atlas Energy Inc. ($4.3 billion) included Utica acreage.

**Play Comparison: Utica, Eagle Ford, et al.**

| Play | Depth (ft) | Thickness (ft) | Porosity (%) | Permeability (md) | TOC (%) |
|---|---|---|---|---|---|
| Utica (Core) | 6,000-8,000 | 80-120 | 6-12% | TBD | 3+% |
| Utica | 500-14,000 | 50-500 | 3-12% | TBD | 0.3-4.26% |
| Eagle Ford | 8,000-14,000 | 75-300 | 3-15% | <0.0001-0.003 | 0.6-7% |
| Monterey | 3,500-16,000 | 500-3,500 | 5-30% | <0.0001-2 | 0.1-12% |
| Bakken | 7,000-11,000 | 20-100 | 3-12% | 0.05-0.5 | 2-18% |
| Marcellus | 2,500-8,500 | 25-250 | 1.5-12% | 0.0002-0.02 | 2-14% |
| Barnett | 6,500-9,000 | 100-700 | 3-7% | 0.01-0.1 | 2-7% |
| Haynesville | 10,500-12,700 | 150-350 | 8-12% | 0.0001-1 | 4% |

TBD=To be determined. *Source: GHS Research with PDC Energy*

Characteristics of the Utica Shale appear to measure up well against already-proven horizontal producers.

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And ExxonMobil Corp. gained exposure to the Ohio play last year when buying Appalachia-based Phillips Resources Inc. for $1.7 billion. The 45,000 net acres prospective for Ohio Utica it gained as part of that deal has since been increased to 75,000 net. Through its unconventional-resource unit XTO Energy Inc., it expects to drill its first horizontal Utica well in the first half of this year.

JVs have been abundant as well. There is Chesapeake's $2.32 billion arrangement with Total SA on its as well as some of EnerVest and EVEP's leasehold. Hess Corp. entered the play in acreage held by legacy coal company Consol, which also is in a JV in the Marcellus with Noble Energy Inc.

Hess CEO John Hess noted it now holds some 185,000 net acres over Utica in eastern Ohio: 100,000 of it from the 50% interest in Consol's nearly 200,000 net acres, on which it will spend some $600 million during five years, and another 85,000 net acres it leased. It plans to run three rigs in Utica this year.

"In the last couple of years, we've increased our exposure — happily so — to unconventional," said Greg Hill, Hess executive vice president and president, worldwide E&P. "About 40% of our spending now is on unconventional."

Consol will spend $50 million as its share in Utica for a planned 22 gross wells with Hess. GHS vice president and senior E&P analyst Mike Kelly said, "All of the Utica drilling is expected to occur in either the liquids-rich area or the oil window of the play...[Consol and Hess] should be one of the more active operators in the play — still a distant second behind Chesapeake, of course." Chesapeake plans to have 20 rigs working Utica this year and possibly as many as 40 in 2014.

Anadarko Petroleum Corp., which also began leasing over Utica in 2010, has put together 300,000 gross, approximately 200,000 net, and Bob Daniels, Anadarko senior vice president, worldwide exploration, said, "We're not done yet." Anadarko was drilling its first horizontal Utica this past fall and news was anticipated at press time.

"We've taken several cores from the Utica over this past year to get our science done," Daniels said. It may run two rigs in the play this year to further test its acreage. "We do think it's in the liquids-rich window of the Utica. That's what we were targeting."

Meanwhile, Devon Energy Corp. has placed its Utica leasehold — along with other US new-venture acreage over Tuscaloosa Marine Shale, Niobrara, and Mississippi Lime and in the Michigan Basin totaling some 1.2 million acres — in a $2.5 billion JV with Sinopec. Across the five plays, the partners expect to drill about 125 wells by the end of this year and possibly as many as more than 350 in 2014.

Devon has 235,000 net over Utica. Tudor, Pickering, Holt managing director and head of E&P research, David Heikkinen, said, "The majority of the expected activity is in the Mississippi Lime, the Niobrara, and the Utica."

Meanwhile, an operator already in Eagle Ford and Marcellus, Magnum Hunter Resources Corp., continues to add acreage over Utica, amassing 16,000 net through 4Q 2011. "We expect Magnum to test its Utica acreage in 2012 with two wells. This would give the market an idea of the potential of its acreage and the production composition," said Gabriele Sorbara, analyst and vice president, E&P, for Caris & Co.

Funding may come from selling an interest in its Eureka Hunter pipeline in Appalachia and from creating an MLP for its midstream assets this year, Sorbara added.

Appalachia-headquartered energy conglomerate National Fuel Gas Co.'s E&P unit Seneca Resources Corp. noted it also has Utica exposure where it has been working the Marcellus. It is also interested in the Geneseo Shale. Dave Smith, NFG chairman and CEO, said, "We are very excited about our opportunities in the Utica...While it's admittedly early, it's fair to say that we like what we've seen thus far."

Matt Cabell, Seneca president, said its Mount Jewett area is particularly interesting. "In that, we have potential in the Marcellus, the Geneseo, and the Utica. Our Utica vertical well that we drilled (in mid-2011) found 400 ft of Utica and Point Pleasant pay. We plan to frac and flow-test this well soon, and we will drill a horizontal Utica test here in the second quarter." It will follow the Utica horizontal with a Geneseo horizontal.

PDC Energy Co. plans to take on a JV partner this year on its Utica leasehold, where it has acquired over 40,000 net in Noble, Monroe, Washington,


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Morgan, Belmont, and Guernsey counties. It aims to increase its position to between 80,000 and 100,000 net this year and has two horizontals planned. To fund this and other programs, it plans to sell 10,200 net acres prospective for Wolfberry in the Permian Basin to Concho Resources Inc. for $188 million.

Chesapeake's deal with Total SA was at $15,000 an acre undiscounted and analysts' discounted value ranges from $12,000 to $13,500. Bernstein Research senior analyst Oswald Clint said Total expects its share of Utica production to be 30,000 boe/d in 2014 and 100,000 by 2020. "The deal gives Total access to a significant stake in the one of the hottest developing shale plays in North America," he said.

Energy conglomerate NiSource Inc. is another prominent acreage-holder. Bob Skaggs, president and CEO, said the company is assessing its mineral rights over Utica Shale, which it owns as a result of storage fields, compressor stations, and other assets in its Columbia Gas Transmission business unit. Current estimates are that it holds between 100,000 and 200,000 net acres.

With certainty, however, it won't drill its acreage itself; like in arrangements for its Marcellus land, it will lease it to an E&P, instead. Skaggs said, "We're not a commodity business; we're a fee-for-infrastructure, investment-driven company, so we don't anticipate participating in production and commodity sorts of activities."

## Stacking Marcellus, Utica

Like NFG's Seneca Resources, many Appalachian operators may have the opportunity to stack their shale plays in eastern Ohio and western Pennsylvania, where Upper Devonian/Burkett, Marcellus, and Utica — from shallowest to deepest—converge, such as in Butler and Beaver counties.

In the 20,000-net core of Rex Energy's Forward Township acreage area, it has some 385 Marcellus drilling locations. "We feel the Upper Devonian/Burkett is pervasive to that same acreage, and now we've got the Utica through it. So I guess you can take the 385 and multiply it by three," said Patrick McKinney, Rex president and COO.

Range Resources, which tested the Utica with its Zahn well already, plans additional horizontal tests. It is expecting other operators' work on Marcellus, Upper Devonian, and Utica to further prove up its own acreage. Very few wells have been drilled to Utica in Pennsylvania, as it is deeper than Marcellus, while thousands of wells have been drilled through Upper Devonian on their way to Marcellus and other formations.

"If you go way to the east (in Pennsylvania), you're going to lose the Utica (window). If you go far west, you'll lose the Marcellus and Upper Devonian," noted Jeff Ventura, Range president and CEO. The economically productive Upper Devonian, Marcellus, and Utica appear to be stacked in southwestern Pennsylvania, the heart of the Marcellus play and Range's core area. "So a lot of our acreage in the Southwest could have stacked pay potential in all three horizons."

Ultra Petroleum Corp. is holding off as well on trying the Utica where it is drilling Marcellus. Bill Picquet, Ultra senior vice president, operations, said, "The Utica is active under our acreage. It's gas bearing, and it's got the kind of look you like to see, but it's deep. It's 11,000 ft to probably as deep as 14,500 or 15,000 in the southern part. It's out there.

"(But) you need better than $4 gas to make the Utica."

EQT Corp. has drilled one Upper Devonian in western Virginia and will drill one this year in southwestern Pennsylvania. Otherwise, said Phil Conti, EQT senior vice president and CFO, "our plans for the Utica right now are to sit tight and watch what our competitors are doing and, if that ends up being the next big thing, we'll be right there with them."

Meanwhile, Rex has approximately 85,300 gross, 58,700 net, acres prospective for Utica, at least. McKinney said, "As more production rates are disclosed (by other operators), we feel confident that our Butler County (Pennsylvania) acreage will be in the dry gas window and that all of our acreage in Carroll County, Ohio, will be at ground zero for the liquids-rich condensate window."

Tom Stabley, Rex CEO, said the Utica is an option for JV. It is already in JVs with Williams Cos. and Sumitomo Corp. in the Marcellus. It plans Utica wells in Ohio this year where it has 15,000 net in its Warrior prospect in Carroll County.


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Clinton sandstone has been the most common hydrocarbon-producing target in Ohio where oil and gas drilling began in 1860.

**Most Common Reservoir Targets of Ohio**

| Target | Wells |
|---|---|
| Clinton Sandstone (Silurian) | 78,025 |
| Berea Sandstone (Devonian) | 24,973 |
| Trenton Limestone (Ordovician) | 15,837 |
| Queenston Formation (Ordovician) | 5,479 |
| Ohio Shale (Devonian) | 4,344 |
| Trempealeau Formation (Cambrian) | 4,088 |
| First Cow Run Sandstone (Pennsylvanian) | 2,229 |
| Medina Sandstone (Silurian) | 2,197 |

*Source: Bernstein Research with US DOE*

## Take-away

Where to with all of these hydrocarbons? Chesapeake's figures for the three liquids-rich wells it reported in September assume maximum ethane recovery. Currently, some ethane is being recovered at a nearby facility, but there isn't full processing or shipping capacity for the volumes.

Liquids recovery greatly improves play economics. For example, Rex earned $54.10/bbl of natural gas liquids (NGLs) in the fourth quarter from its Marcellus production, compared with $4.57/Mcf for its dry gas. It earned $90.32 in the fourth quarter per barrel of oil it produced.

In short, some 50% of the price of a barrel of oil is worth 10 times more than 1 Mcf of dry gas. Ethane represents 40% of a barrel of NGL when fully recovered.

MarkWest Energy Partners LP is already working on shipping ethane from the Marcellus to Sarnia, Ontario, and via ship to the Gulf Coast or buyers abroad. Frank Semple, chairman, president, and CEO, said, "Connecting our Huron [Formation] and Marcellus NGL infrastructure would create enormous reliability and flexibility for Appalachian producers and could also provide an attractive option for producers in the Utica Shale, which is on the verge of explosive growth."

Enterprise Products Partners LP is also working on getting ethane out of Appalachia — both from the Marcellus and Utica — to the Gulf Coast via a pipeline project with Chesapeake.

Is there room for all of these? Semple said, "Absolutely. The more outlets for ethane out of the Marcellus and Utica, the better...Ethane is just becoming an increasing valuable commodity in the world markets ...It's just important that we stay ahead of the development of that valuable acreage up in the Northeast...including the Utica."

Wunderlich's Haas said, "The Utica is very much a midstream story." While drilling is still in early stages, "if successful, we expect the Utica to generate as much, if not more, NGLs than the neighboring Marcellus."

Each also makes dry gas and some of that dry gas production could be exported as liquefied natural gas (LNG) as Dominion Resources Inc. has applied for US Department of Energy approval to ship LNG out of its Cove Point, Maryland, terminal, which is currently a fairly fallow receiving facility. Exporting US gas as LNG out of the Gulf Coast is also being developed by terminal operators there.

Tom Farrell, Dominion chairman, president, and CEO, said, "With the continued successful development of the Marcellus and Utica Shale formations, interest in our potential Cove Point liquefaction project is growing as well. We are engaged in discussions with numerous potential customers in Europe and Asia, as well as with producers in the Appalachian Basin."

Dominion received DOE authorization in October to ship up to 365 Bcf of gas a year as LNG from the terminal to Free Trade Agreement countries, such as Morocco and Australia, which mostly do not need gas. It is waiting now for authorization to ship to any country with which the US allows trade; the reply is expected by June.

## Regulatory

EVEP's Houser said the regulatory environment in Ohio is tough but fair. "It is generally pro-

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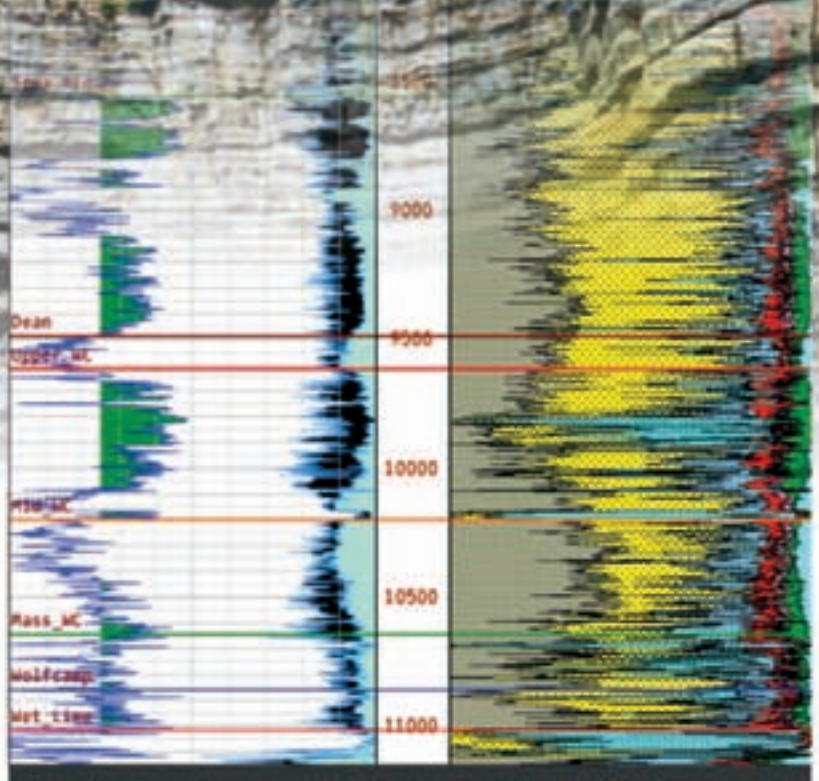


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business. We have to continue to demonstrate that we will behave responsibly as an industry."

While oil and gas drilling in Pennsylvania became virtually extinct in the past century, E&P has been ongoing in Ohio, so legislators and landowners are more familiar with operators and with the business in general.

Houser said, "I don't think the Utica development has been a surprise to Ohio as the Marcellus was to Pennsylvania. They saw their neighbors in the Marcellus play and they've had oil and gas development continuously since the mid-1800s. It didn't completely die out there like it did in Pennsylvania."

In January, there weren't enough Utica wells to forecast average rates of return in the play, "but if I compared it to anything, it might be the Eagle Ford," Houser said.

"They're going to be strong rates of return, but we're pretty early. I'd add that we're close to the Northeast market, especially for natural gas, so that should be a benefit. On the other hand, some midstream infrastructure has to be put in place and that's going to be a challenge to the economics."

Neither EnerVest nor EVEP is the wildcatting kind of E&P company: EnerVest seeks to produce returns for its institutional funds, while EVEP distributes its income to unit-holders. The pair just happened to be the largest operator in the most intriguing new shale play of 2011.

Houser said there could be an outright sale or another JV of the balance of its Utica exposure this year. "The idea is that we are going to look towards some sort of monetization event...The bottom line is we feel like, as an MLP, our job is not to be a shale developer. Our job, traditionally, has been to buy into shale plays once they have been developed.

"But we were blessed with this huge position in Ohio and we want to take advantage of it for our unitholders."

## Next for the play

Much E&P work remains to be done. Jefferies & Co. estimates drilling and completing the expanse of the Utica play will cost $263 billion or about as much as drilling and completing the Eagle Ford play. And, the Eagle Ford play is already more than three years old, hosting hundreds of wells. To date in Ohio's Utica, only a couple dozen horizontals have been drilled and completed.

While the core will be worked first, GHS' Bodino said that, moving north, the Point Pleasant Formation tends to disappear into Mahoning, Portage, Trumbull, and Ashtabula counties in Ohio and Mercer and Crawford counties in Pennsylvania. So, Utica development there would have to target the costlier Utica Shale itself.

South of the core, leasing has focused in Muskingum, Noble, Monroe, Morgan, and Washington counties. "With more wells permitted in this direction, de-risking this acreage could happen sooner than in the north."

However, infrastructure in the Utica play will develop quicker than it has in the Marcellus as many services have come into Appalachia because of the Marcellus play. Also, gas-directed rigs are being laid down in the Haynesville and elsewhere, so rigs might become more available to Utica operators.

McClendon said, "The Utica is the biggest thing to hit Ohio since the plow. And, back in the day, that was a very big deal, indeed...."

He likened Utica to the Eagle Ford in that it has a dry gas window in the east, liquids in the middle and oil in the west, but the rock quality and the location are better, he said. He added that there is plenty of water for fracing in Ohio, the topography is less challenging than the Marcellus' hills and mountains of West Virginia and Pennsylvania, and labor is plentiful.

There is also the Ohio River, "so if we need to barge oil out tomorrow, we can do that."

Also making it a good play for Chesapeake is that a great deal of the acreage it has amassed is HBP. "We went in early and made deals on deep rights with a lot of shallow producers," McClendon says. Net revenue interest is mostly the standard 85%. Terms on other leases are five years with an option for a five-year renewal, "so we feel like we'll have no trouble getting it all HBP and won't have to be in as big a rush as we were on the Barnett or the Haynesville, although we certainly do have more acreage here."

He believes the Utica will be the most profitable play in the US. "When we've said we thought that the big plays were over, I always said I thought there was one more, and that was the Utica." ■

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# A Giant Emerges in Shale Country

## Big operators want a piece of the Utica action.

**By Don Lyle**
Contributing Editor

The Utica Shale is the newest giant in the shale inventory of the US and Canada, and, like the giants in legends, people – principally regulators – are approaching it with caution.

This up-and-coming shale extends across 170,000 sq miles, which is approximately twice the size of the Marcellus Shale. It stretches into parts of West Virginia, New York, Pennsylvania, Ohio, and Michigan in the US and Quebec and possibly into Ontario.

Typically, it is associated with and feeds other formations that are the drilling targets: the Point Pleasant in Appalachia, the Collingwood in Michigan, and the Lorraine Shale in Canada.

Like other shales, including the Marcellus and Eagle Ford, the Utica has an oil window, a high-liquids-content gas window, and a dry gas window in Appalachia, with gas toward the east and wet gas and oil moving westward into Ohio.

According to a Magnum Hunter presentation, initial production rates from wells have been as high as 9.5 MMcf/d of gas and 1,425 b/d of oil.

Governmental units associated with the Utica already are counting blessings and curses. Taking a cautious approach to Utica Shale, New York set a moratorium on fracturing in both the Marcellus and the Utica while it investigated the impact of developing these plays. The state has assessed the impacts and posted rule proposals. It is now sifting through comments and should come up with the final go-ahead decisions by March 2012 (after press time). That is particularly important to operators with Utica land in New York, since the Point Pleasant Formation is thicker here than it is in Ohio.

Quebec has taken an even more cautious approach. It is studying potential impacts with help from operators and oil and gas associations and plans to issue rules and regulations no later than June 13, 2014.

Though there are negative aspects to the Utica, a Quebec fact sheet titled "Economic Benefits of Utica Shale Development" estimated development would create between 5,000 and 19,000 new jobs a year, could add US $280 million to $1.1 billion in economic value each year during full field development, and contribute more than $25 million in fees and property taxes on production facilities each year.

### Key Players in the Marcellus Shale

**Following are the top 25 players operating in the Marcellus Shale as of Jan. 31, 2012:**

Anadarko Petroleum
Cabot Oil & Gas
Carrizo Oil & Gas
Chesapeake Energy
Chevron Corp.
Chief Oil & Gas
CONSOL Energy
Energy Corp. of America
EnerVest/EV Energy
EOG Resources
EQT Corp.
Exco Resources
ExxonMobil
National Fuel Gas
Newfield Exploration Co.
Noble Energy
PDC Energy
Pennsylvania General Energy
Range Resources
Rex Energy Corp.
Shell
Southwestern Energy
Statoil
Talisman Energy
Ultra Petroleum

The first recorded production from the Utica occurred in 1934 in Pottawatomie County, N.Y., but no development projects have been recorded.

Operators consider Ohio the sweet spot for the Utica, and many of the nation's largest operators have assembled land packages, primarily in the wet gas and oil slices. The Utica in Ohio lies 2,000 ft below the Marcellus, but it is still shallower than in the eastern states. Depths to the base of the Utica in Ohio can lie as shallow as 3,000 ft and as deep as 9,000 ft, with shallower zones yielding wetter products. Thickness ranges from 200 to 400 ft in the state in the more economic portions of the play.

Chesapeake Energy, the top acreage holder in the Utica in Pennsylvania and Ohio, called the Utica "analogous but economically superior to the Eagle Ford in South Texas."

Questerre Energy estimated the Utica Shale in Quebec could hold up to 20 Tcf of gas.

The following profiles of operators working the Utica play also include updates on the Marcellus Shale activities of those companies, since this shale lies under the Marcellus in most areas.

The Marcellus has its own dynamic impact. A new study from Pennsylvania State University titled "The Pennsylvania Marcellus Natural Gas Industry: Status, Economic Impact and Future Potential" reports the economic impact of the Marcellus could be greater than $20 billion and it could produce more than 156,000 jobs in the state by 2020.

Building off an earlier US Department of Energy study, the report notes the Marcellus in Pennsylvania could produce nearly a quarter of US gas by 2020, allowing the state to overtake Texas as the nation's top gas producer. The formation already turned Pennsylvania from a gas importing state into a self-sufficient state for natural gas. More than 1,405 Marcellus wells produced nearly 2 Bcf/d of gas at the end of 2010, and 2,300 wells could produce almost 3.5 Bcf/d of gas by the end of 2011. The study said the Marcellus had the potential to produce 17.5 Bcf of gas a day, or 6.4 Tcf of gas a year.

According to the study, gas prices in the state dropped 12.6% in 2010, largely due to Marcellus development, and saved the state's consumers almost $633 million in utility bills.

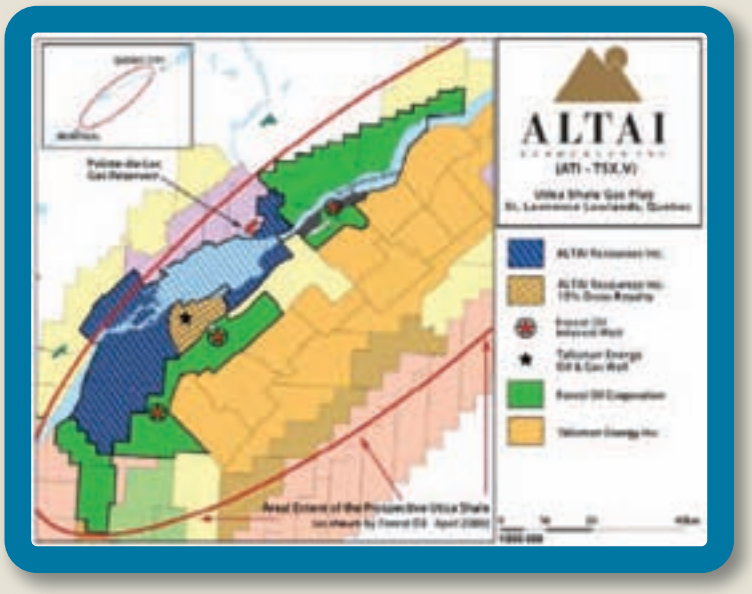
## Key Players

### Altai Resources Inc.

- *Has been working the area since 1984*
- *Holds sizeable interests in the St. Lawrence Lowlands of Quebec*

Altai Resources Inc. boasts whole and part interests in a sizeable land package in the heart of the Utica Shale play in the St. Lawrence Lowlands of Quebec.

Current holdings include 100% of 169,221 acres in five permits on its Sorel-Trois properties and a 15% gross royalty interest in the adjoining 30,477-acre permit held by Talisman Energy Canada.




A permit map of the area with Utica Shale potential in the St. Lawrence Lowlands shows properties held by Altai, Forest Oil, and Talisman Energy. *(Map from Forest Oil, courtesy of Altai Resources Inc.)*

The company held more property but said in July 2011 the Quebec National Assembly had revoked all oil and gas exploration permits without compensation in the St. Lawrence River west of Anticosti Island. That affected 115,000 of Atlai's 288,000 net acres of permits at the time. That legislative action also

Anadarko lowered drilling times to about 20 days as it worked the learning curve on its Marcellus operations in Appalachia. *(Photo courtesy of Anadarko Petroleum Corp.)*

exempted holders of exploration permits from performing work that was required under the Mining Act, possibly until June 13, 2014. That provision affects approximately 174,000 acres of exploration permits that Altai continued to hold in the St. Lawrence Lowlands.

The legislation move affects other operators in the lowlands as well, effectively blocking development in the area until Quebec adopts regulations controlling operations.

Altai has been working the area since 1984, when it collected shallow marine seismic in the area. It entered the earn-in agreement with Talisman in 2004, and Talisman drilled the first well on the property in 2006 with good gas shows, according to a 2010 Altai presentation.

At that time, it compared the Utica in Quebec with the gas-prone area of the Barnett Shale in North Texas. The Utica is 2,300 to 6,000 ft deep, compared with the Barnett's 4,500- to 9,000-ft depth. The Utica is 500 to 700 ft thick, compared with the Barnett's 150- to 700-ft section. Total organic content for the Utica is 1% to 3.1%, compared with the Barnett's 3% to 5%. A key point in that information gave the Utica a gas price of more than 50 cents/MMBtu more than the New York Mercantile Exchange (NYMEX) price, whereas the Barnett suffered with a price 53 cents/MMBtu less than the NYMEX quote.

## Anadarko Petroleum Corp.

- *Has acquired interests in 300,000 gross acres of the Utica*
- *Spudded 37 wells in 3Q 2011*

Anadarko Petroleum Corp. controls approximately 300,000 gross acres on land prospective for the Utica Shale in Ohio, and the company has started evaluating the play.

In an Oct. 31, 2011, report, Anadarko chairman and CEO James Hackett said, "Additionally, in US onshore, we've been

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assembling a position in Ohio's Utica Shale, and over time, we have acquired interests in approximately 300,000 gross acres in the prospective liquids-rich window at attractive entry costs. We've recently spud our first well in the play and look forward to an active drilling program in this emerging area."

According to Ohio records, Anadarko has taken out permits to drill the FREC Guernsey Spencer A3H and the Frec Guernsey A5H, both horizontal wells and both in Spencer Township in Guernsey County in the liquids-rich portion of the Utica.

### Marcellus update

Anadarko held 760,000 gross, 260,000 net, acres in the Marcellus play in Bradford, Centre, Clinton, Lycoming, Sullivan, and Tioga counties in Pennsylvania. Part of that gross holding is in a partnership with Chesapeake Energy Corp., with Chesapeake operating the northwestern portion of the venture holdings and Anadarko operating the southeastern area. The company was working seven rigs in the popular shale and said it held 1 boe (more than 6 Tcfe) in net risked resources in the play.

In a December 2011 presentation, Anadarko said its average well in the play came in at more than 5 MMcf/d of gas and declined slowly to about 4 MMcf/d over the first 200 days.

With US $36 million in spending during the third quarter, the company operated seven drilling rigs to set a weekly production record of 566 MMcf/d, 151 MMcf/d net, from about 150 producing wells. It finished the quarter producing more than 600 MMcf/d, up about 30% from the end of 2Q 2011.

Anadarko spudded 37 wells in the third quarter and participated in another 37 wells with about 13 non-operated rigs.

The company lowered average drilling time to about 20 days on its operated wells in the quarter, a 33% operating improvement from the same period in the previous year.

Anadarko increased it production potential in 2010 when it signed a joint venture agreement with Japan's Mitsui E&P USA LLC to make Mitsui a 32.5% partner in Marcellus operations as it spends $1.4 billion to earn approximately 100,000 net acres by funding all of Anadarko's development costs in the Marcellus in 2010 and 90% through 2013.

## Avista Capital Partners

- *15,000 acres in the Utica Shale*
- *Continues partnership with Carrizo*

Avista Capital Partners joined Carrizo Oil & Gas Inc. in a joint venture to acquire and develop land in the liquids-prone portion of the Utica Shale. The companies' first acquisition announced in September 2011 gave them 15,000 net acres of land in eastern Ohio and northwestern Pennsylvania for less than US $1,500 an acre.

The agreement between the two companies gives Carrizo an initial 10% interest in the venture properties. Avista has the right to contribute up to a total of $200 million to the partnership.

Carrizo, however, has the option to increase its participation to 50% in properties acquired by the joint venture for 18 months following the agreement at preapproved increments above acreage costs and improvements.

Carrizo initially will operate the venture's properties.

"Avista is pleased to continue its partnership with the Carrizo team and build upon the great success we have achieved together in the Marcellus Shale," said Avista partner Robert L. Cabes Jr. "We are excited about our prospects in the Utica Shale and look forward to the successful growth of this venture."

## Breitburn Energy Partners LP

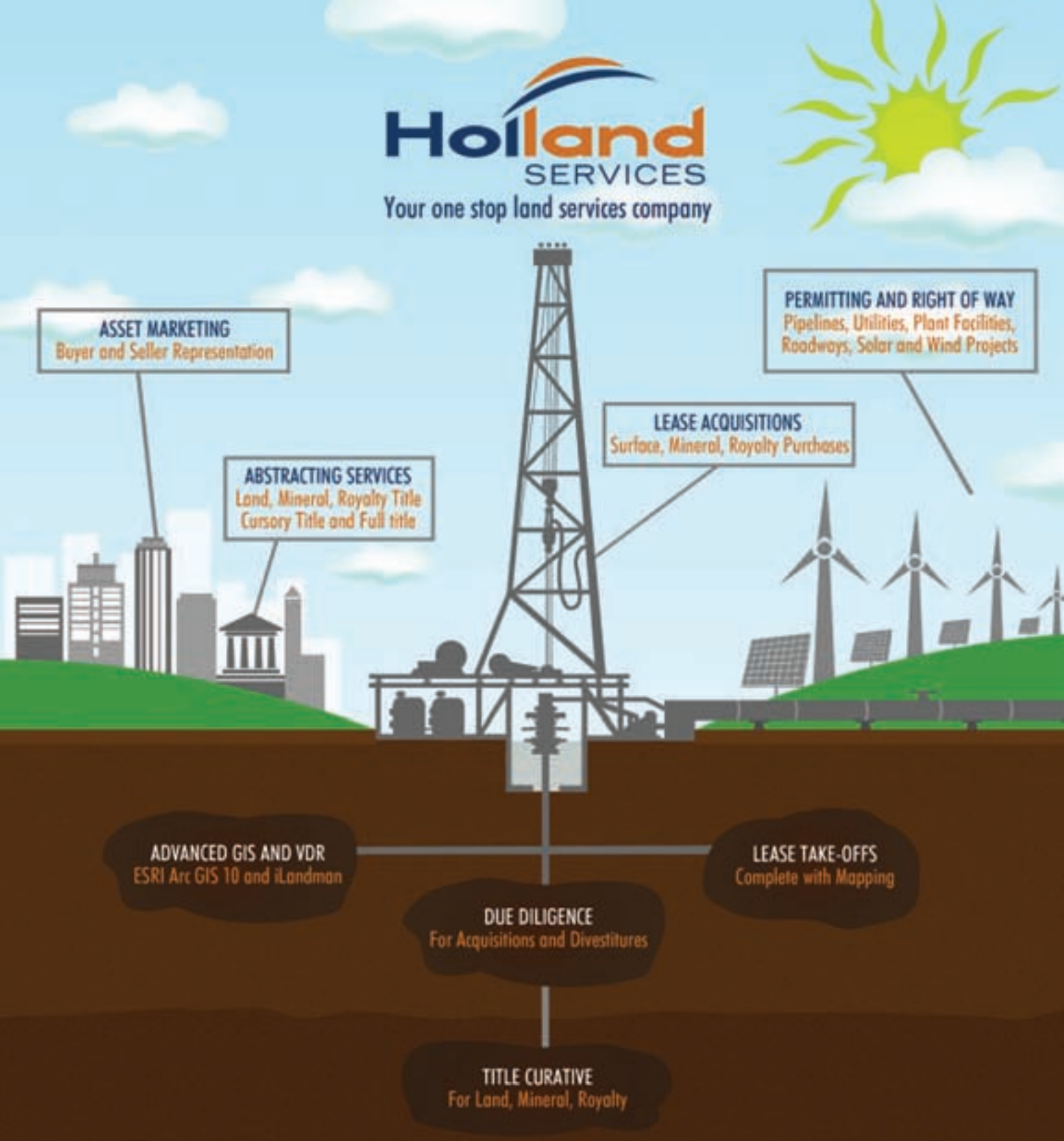
- *68% of reserves in Michigan in 2010*
- *Holds properties in six areas*

Breitburn Energy Partners LP likes producing properties in established plays while focusing on cash flow, and that strategy sometimes offers upside benefits.

The company holds properties in the Los Angeles Basin in California, the Wind River and Big Horn basins in Wyoming, the Sunniland Trend in Florida, the New Albany Shale in Indiana and Kentucky, and the Antrim Shale in Michigan.

The company estimated 68% of its total estimated proved reserves at the end of 2010 existed in Michigan. That property offered access to the Utica/Collingwood trend as well as long-term production from the Antrim Shale.

The Antrim produced 10,683 boe/d from proved reserves of 80.3 MMboe in 2010 from property that was 89% developed, comprising 45% of the company's total production.

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Brietburn is not yet working the Utica/Collingwood, but according to COO Mark Pease in a 4Q 2010 report, the company was actively acquiring leases in the play in addition to properties already held by Antrim production. At that time, it held approximately 125,000 net acres in the Collingwood/Utica trend after picking up 4,400 net acres for about US $51 an acre.

## Canadian Quantum Energy Corp.

- *Holds interest in four permits of the Utica Shale*
- *Partners include Talisman Energy, Questerre, Junex, and Sundance*

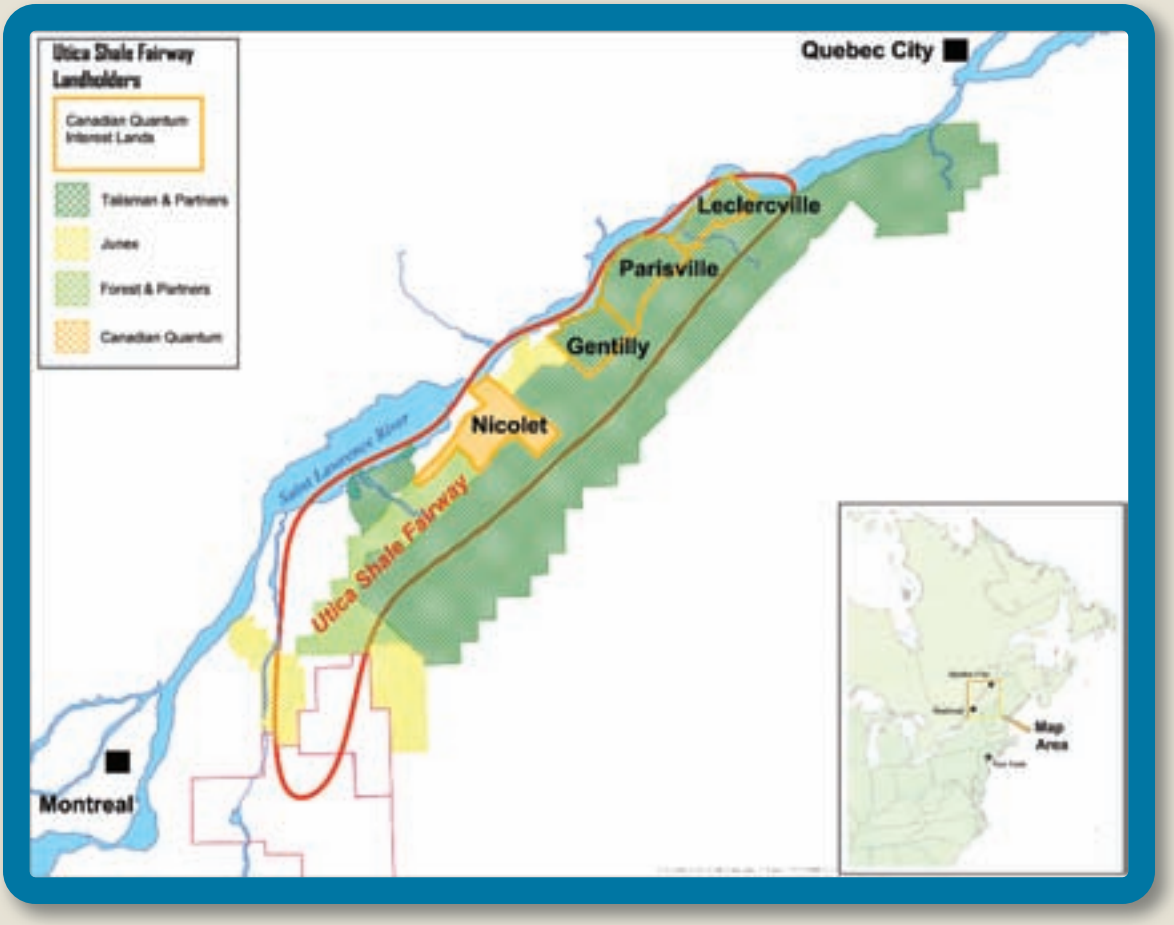
Canadian Quantum Energy Corp. combined partnerships into a significant position in the Utica play in the St. Lawrence Lowlands of Quebec.

The company holds interests in four permits totaling 174,000 gross, 37,100 net, acres with some 5 Tcf of gas resources in place, according to a Netherland Sewell engineering report. Its partners are Talisman Energy, Questerre, Junex, and Sundance.

The play opened as a commercial possibility in March 2008 when Forest Oil successfully fractured the Utica and tested two wells at rates to 1 MMcf/d of natural gas after cleanup. Talisman, in partnership with Questerre and Canadian Quantum, followed up with the 800 Mcf/d of gas from the Gentilly #1 well. Additional vertical wells in the area tested at rates between 300 and 800 Mcf/d.

In this area, the Yamaska Fault forms the Utica's northeast boundary along the St. Lawrence River, and the Logans Line fault system forms the southwestern boundary. The play extends roughly from Montreal to Quebec City, or 1.1 million acres (2,400 sq miles) according to the Canadian Quantum website. Ultimate recovery from the shale could reach 25 Tcf of gas from some 93 Bcf of gas in place per square mile.

Canadian Quantum holds a half interest in 59,090 gross acres, or a full interest in 29,545 net acres, in the Nicolet permit with Junex to the base of the Utica, and 100% below that level. It owns a 3.75% interest, or 1,315 net acres, in the 35,600-gross-acre Gentilly permit with Questerre and Tal-




A small number of companies control a large portion of the land in the Utica Fairway south of the St. Lawrence River in southern Quebec. *(Map courtesy of Canadian Quantum Energy Corp.)*

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isman. The company holds the same interest, 1,879 net acres, with the same partners in the 50,100-gross-acre Parisville permit and has a 15% interest (4,350 net acres) with Questerre and Talisman in the 29,000-gross-acre Leclercville permit.

Like other companies working the Canadian section of the Utica play, Canadian Quantum and its partners are waiting for the Quebec government to set up regulations for development of the formation, but the companies could potentially stimulate the Ste. Gertrude well as early as spring 2012, according to Canadian Quantum in an October 2011 presentation.

## Canbriam Energy Inc.

- *Holds 122,494 net acres in St. Lawrence Lowlands*
- *Estimates 14 Tcf of original gas in place*

Canbriam Energy Inc. anticipates production from the Utica and Lorraine formations on its 122,494 net acres of land in Quebec's St. Lawrence Lowlands.

The company farmed into the play in late 2008 with 80% and 60% interests in two separate parcels, and took over as operator. It drilled and completed wells in late 2009 and planned to continue drilling until the Quebec government declared a moratorium on fracturing in the Utica. Canbriam plans to continue working when the government enacts regulations for the play.

The company estimates its properties contain as much as 14 Tcf of original gas in place.

## Carrizo Oil & Gas Inc.

- *Began work on the Utica Shale play in September 2011*
- *Holds 100,595 net acres in the Marcellus play*

Carrizo Oil & Gas Inc. is a newcomer to the Utica Shale play, joining a host of other companies after it signed a joint venture in September 2011 with Avista Capital Partners to work the emerging play. Carrizo and Avista already had a joint venture agreement for development of the Marcellus Shale.

The new agreement will target the liquids-prone portion of the Utica in Mercer County in northwestern Pennsylvania and Trumbull County in eastern Ohio. The companies started with the acquisition of 16,000 net acres of land at an average cost of less than US $1,500/acre.

The agreement gave Carrizo a 10% interest in the venture with Avista holding the remaining 90%, but Carrizo will act as operator.

Avista can contribute as much as $200 million to the venture, and Carrizo controls options to increase its participating interest up to 50% in the 18 months following September 2011. If Carrizo chooses not to exercise those purchase options, the company will receive a share on any cash distributions that Avista gives its partners after Avista gets a specified return on its investment.

By year-end 2011, Carrizo had not outlined specific plans for drilling in the play, but in September, Carrizo president and CEO S.P. "Chip" Johnson IV said, "We are excited about this joint venture with Avista, which should allow both companies to quickly grow a meaningful position in one of the highest potential liquids-rich shale plays in the US."

### Marcellus update

In a January 2012 presentation, Carrizo said it held 100,595 net acres in the Marcellus play in New York, Pennsylvania, and West Virginia, most of that property on five-year leases with an optional three-year extension. The company estimated 2 Tcfe of gas in probable and possible reserves with no posted proved reserves.

It also estimated 75% of its northeast Pennsylvania properties are drillable with 80-acre spacing at 5.3 Bcfe in net reserves per well. The same percentage of properties on 80-acre spacing are drillable on its C-county properties (Clearfield, Centre, and Cambria) in Pennsylvania with 4 Bcfe per well. Some 25% of its West Virginia properties were calculated as drillable on 80-acre spacing with 3.5 Bcfe net reserves per well.

The company planned to spend $30 million drilling on the Marcellus in 2011 and another $15 million on land acquisition and seismic acquisition in the Marcellus and Utica plays.

Its most active operations are in its joint venture with India's Reliance Industries Ltd. (RIL) in which Carrizo operates with a 40% share. That deal includes 16,300 acres in northeastern Pennsylvania with two rigs running, one each in Susquehanna and Wyoming counties where the

company is drilling wells on five- to six-well pads with 5,000-ft laterals and completing them with 18-stage frac treatments.

In January 2012, Carrizo's two-well Bonnice pad and its three-well Baker South pad were on production with 60 gross operated wells planned for the county. Production flows into the Laser gathering system that dumps into the Millennium Pipeline. At the same time, the company planned 35 wells on six pads in Wyoming County with hookups to sales planned as early as April 2012.

Those properties offer a 29% internal rate of return with a NYMEX price of $4/MMBtu.

RIL also is Carrizo's partner in the C counties on 92,800 acres. The companies are evaluating that area with two drilling rigs.

Carrizo also signed a joint venture agreement in November 2008 to work Marcellus properties. That agreement covers 16,000 acres in New York and another 106,800 acres in West Virginia. Carrizo contributed the land in that agreement and Avista paid to earn a half interest.

## Chesapeake Energy Corp.

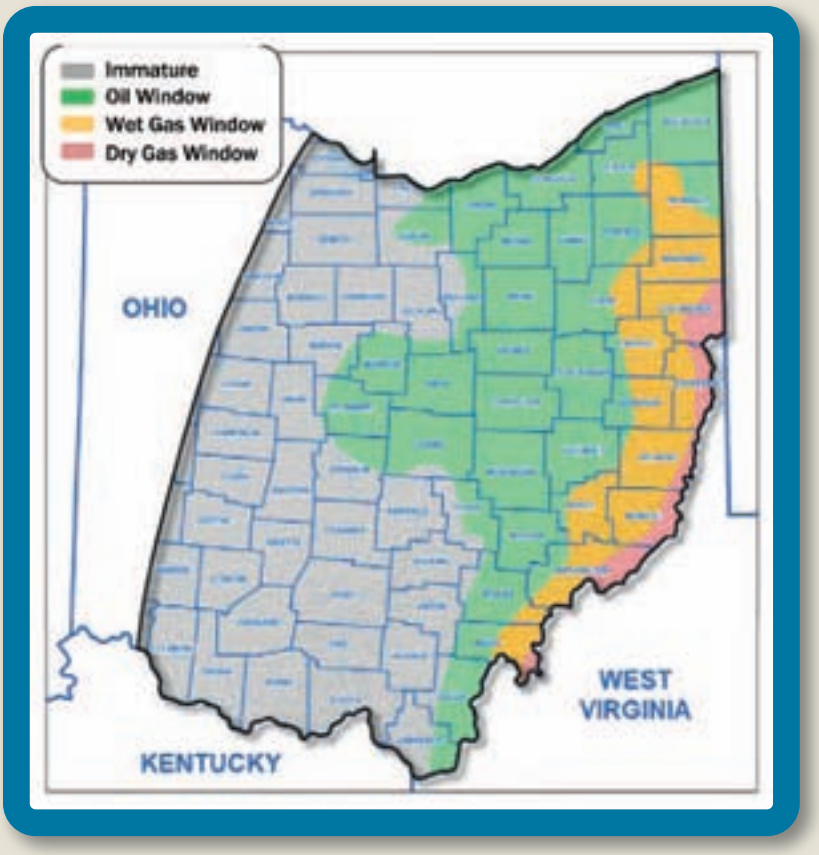
- *Sold a 25% interest in Utica acreage in 2011 to Total E&P USA*
- *Created a new company: CHK Utica LLC*

Chesapeake Energy Corp. built a reputation as one of the top leaseholders in all of the most significant shale plays in the US and enhanced that reputation by capturing the top acreage position in the Utica Shale.

The company began leasing Utica properties in Ohio in mid-2010 and added them to Pennsylvania properties already prospective for both the Marcellus and Utica. By the end of 2011, it had accumulated 1.36 million acres with Utica production potential in both states. Approximately 80% of the acreage is in the wet gas and oil area on the Ohio side of the border.

Those acquisitions included 3,200 ft of proprietary core samples from nine wells, 2,000 well logs and full petrophysical data on approximately 200 wells. Since then, Chesapeake increased its core samples to 4,000 ft from 11 wells.

Chesapeake also has a reputation for designing innovative ways to finance the development of its properties, and the Utica is no exception.




The Utica Shale in Ohio offers oil, wet gas, and dry gas windows with economics potential superior to the Eagle Ford. *(Map courtesy of Chesapeake Energy Corp.)*

The company closed a joint venture transaction in December 2011 to sell a 25% interest in approximately 619,000 net acres in the liquids-rich slice of the Utica in 10 eastern Ohio counties to Total E&P USA Inc. Chesapeake contributed 542,000 net acres to the venture and EnerVest Ltd. and an affiliate added 77,000 net acres. Chesapeake valued the agreement at US $2.32 billion, with Chesapeake getting $2.03 billion and EnerVest $290 million. Chesapeake received $610 million in cash and will get $1.42 billion in drilling and completion carries, which should carry the program through 2014. Chesapeake is operator of the venture.

Chesapeake currently has similar agreements with China's

CNOOC and Norway's Statoil. The Statoil venture covers properties in the Marcellus play.

The cost carries will fund 60% of drilling and completion costs assumed under Chesapeake's formation of CHK Utica LLC. CHK Utica covers all of the joint venture land and more. Chesapeake will operate all the properties. The price implied a value of $6 billion for Chesapeake's retained acreage in the wet gas area.

Chesapeake created CHK Utica LLC, a new company with both common and preferred shares and 700,000 net acres in 13 counties in eastern Ohio and western Pennsylvania. Chesapeake kept all the common stock, which offers upside potential. It sold preferred stock to EIG Global Energy Partners for $500 million in November 2011 and another $750 million in preferred stock to EIG limited partners and employees and two other investment companies in December 2011. Those shares offer a 7% annual return and a 3% overriding royalty interest in the first 1,500 net wells drilled on the properties. Chesapeake committed to drill at least 50 wells a year, up to a cumulative 250 wells, through 2016 under the agreement.

Chesapeake can buy back the preferred stock for cash before Oct. 31, 2018, if its valuation exceeds a 10% internal rate of return or a return on investment of 1.4 times to the investor.

The operating company estimated it could drill approximately 10,000 net wells on the property covered by that agreement.

As an overview, Chesapeake retained an average net revenue interest on its Utica Shale properties of some 83%, a stronger position than the approximately 75% net revenue interest it kept in the Haynesville, Barnett, and Eagle Ford plays.

## Marcellus update

Even after turning over 32.5% of its land holdings in a venture with Norway's Statoil, Chesapeake remained the largest leaseholder in the Marcellus play with a net 1.78 million acres in New York, Pennsylvania, and West Virginia. The company claims 7,850 net risked undrilled well locations on 90-acre spacing in the play where it holds more than 1.2 Tcfe in proved reserves. Risked net unproved resources totaled 37.8 Tcfe and unrisked unproved resources could give the company 95.3 Tcfe. Chesapeake produced 370 MMcfe/d in October 2011 and operated approximately 30 drilling rigs.

## Chevron Corp.

- *Acquired Atlas Energy in 2010*
- *Acquisition included 623,000 net acres of Utica Shale interests*

Chevron Corp. entered the Utica play with its late 2010 acquisition of Atlas Energy, one of the most active and largest leaseholders in the Marcellus Shale play in Appalachia.

That acquisition gave Chevron 486,000 net acres of Marcellus Shale properties, 623,000 net acres of Utica Shale interests, and a 49% share of the Laurel Mountain Midstream LLC joint venture in the Appalachian Basin. The US $4.5 billion purchase also included some 271,000 acres of Antrim properties and 100,000 net acres of Utica/Collingwood properties in Michigan.

Michigan records revealed Chevron permitted 10 Utica/Collingwood horizontal and vertical wells by late December 2011, later abandoning one of those permits. It drilled and plugged wells in Antrim, Kalkaska, and Missaukee counties.

### Marcellus update

Chevron Corp.'s early 2011 acquisition of Atlas Energy for $3.2 billion in cash and $1.1 billion in debt obligations made it a major shale player as it took over operations on more than 700,000 net acres of land in the Marcellus Shale. Those leases held an estimated 850 Bcfe of proved reserves and 14 Tcfe of potentially recoverable reserves, the company said. Atlas also had 80 MMcf/d of production when the Chevron acquisition took place. Chevron said it would begin an aggressive program to develop those properties, but it had not released details about that program at the time of publication. Chevron announced in May 2011 it would buy an additional 228,000 aces of Marcellus properties from Chief Oil & Gas LLC and Tug Hill Inc. Most of those properties were in the southwestern liquids-rich segment of the Marcellus.

## CONSOL Energy Inc.

- *First E&P company to drill a discovery well into the Utica Shale*
- *Developing 200,000 acres in the Utica/Point Pleasant*

CONSOL Energy Inc. was the first E&P company to drill a discovery well into the Utica Shale. The company drilled the well in Belmont County, Ohio, and the well tested at an open flow rate of 1.5 MMcf/d of gas for 24 hours from a 200-ft section of the Utica with no stimulation.

The company originally planned to have one rig working the play full time by October 2011.

In September 2011, CONSOL signed a 50-50 joint venture deal to develop 200,000 acres in the Utica/Point Pleasant in eastern Ohio with Hess Corp. According to a November 2011 presentation, Hess paid $60 million when it signed the agreement and agreed to pay US $554 million to cover half of CONSOL's drilling and completion costs. CONSOL valued the agreement at $6,000/ acre.

Under the agreement, Hess will operate in the liquids-rich gas window of the Utica. That includes approximately 80,000 acres in Belmont, Harrison, Guernsey, and Jefferson counties in Ohio. It also has operating rights in the dry gas window in parts of Belmont, Jefferson, and Monroe counties.

CONSOL operates the wet gas properties in Columbiana, Carroll, and Noble counties.

It holds land in the oil window in Stark, Carroll, Tuscarawas, Holmes, Coshocton, Muskingham, Noble, and Morgan counties and properties in the dry gas window in Noble County. In a January 2012 report, CONSOL said it had one drilling rig working in Tuscarawas County.

The company also will explore properties outside of Ohio for Utica potential.

The companies planned to average two drilling rigs in the Utica in 2011, on average three-and-a-half rigs in 2013, and hold steady five rigs in 2016 on their jointly held properties.

### Marcellus update

CONSOL Energy was the second company to produce hydrocarbons from a Marcellus horizontal well, drilling in October 2008. It also was the first company to use rotary tools in the Marcellus, fully lined drilling sites, closed-loop drilling in the play check-valve plugs to head off wellhead leaks, and the first to drill a 10-horizontal-well pad in the Marcellus.

With its large land position in Appalachia, it sold an overriding royalty interest in Marcellus properties to Antero Resources Corp. for $200 million.

Its latest deal to ramp up Marcellus development occurred when it signed an agreement to share a half interest in 628,000 gross acres of land in Marcellus' wet and dry gas areas in Pennsylvania and West Virginia with Noble Energy for $3.3 billion.

Under than arrangement, CONSOL operates 487,000 acres in the dry gas area where it has 3,100 locations and takes an 85% interest.

Noble operates on 161,000 acres in the wet gas area where it has 1,000 locations and gives CONSOL a 15% interest.

In January 2012, CONSOL said it drilled 78 gross wells in the partnership area, including 19 in central Pennsylvania, 50 in liquids-rich southwestern Penn-

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sylvania, and nine in northern West Virginia. By the end of 2011, it nearly doubled Marcellus production from 40 MMcf/d of gas at the end of 2010 to 77.5 MMcf/d of gas at the end of 2011.

CONSOL put 57 wells online during 2011 at an average cost of $5 million per well and an initial production rate of 5 MMcf/d per well.

The companies plan to ramp up activity from four rigs drilling 35 gross wells in 2011, to eight rigs drilling 140 wells in 2012, to 12 rigs drilling 227 wells in 2013, to 15 rigs drilling 318 wells in 2014 and to 16 rigs drilling 354 wells in 2015.

## Devon Energy Corp.

- *Signed agreement with Chinese company Sinopec in early January 2012*
- *Expects to drill 125 gross wells in five plays through 2012*

Devon Energy Corp. is among one of many companies targeting the Utica Formation for its growth potential. As "boss of the Barnett," Devon brings plenty of shale development experience to the play, and it is focusing that experience on Utica Shale in Ohio and Michigan.

It lists the Utica among its new ventures, which include the Niobrara in Wyoming, the Mississippi Lime and Woodford Shale in northern Oklahoma, the Tuscaloosa Marine Shale, and the Utica in Ohio and Michigan. In early January 2012, Devon signed an agreement with Sinopec International Petroleum Exploration & Production Corp., allowing the Chinese company to participate for a one-third interest in Devon activities in the Tuscaloosa Marine Shale, Niobrara, Mississippian, Ohio Utica Shale, and Michigan Basin, where Devon has properties prospective for the Utica/A1 Carbonate.

The deal reimburses Devon for drilling costs before closing and acreage acquisition costs after the effective date of the agreement. Sinopec will pay US $900 million upfront cash and $1.6 billion in drilling carries that should be used by the end of 2014. Those carries represent 70% of Devon's capital requirements in the plays, which

means Sinopec will pay 80% of the overall development costs during the carry period.

The companies, with Devon as operator, expect to drill 125 gross wells in the five plays through 2012.

In its announcement of the joint venture, Devon reported the addition of 125,000 acres to its lease position in the Ohio Utica, bringing the new partnership's total acreage in the play to 235,000 net acres.

According to a November 2011 presentation, Devon held 110,000 net acres of land prospective for the Utica in Ohio. The venture pays an average 16% royalty on the Ohio properties. Devon controls 340,000 net acres of land in Michigan with the A1 Carbonate and Utica Shale as targets. Some 300,000 net acres cover the Utica. Those properties come with a 17% royalty rate.

## Eclipse Resources I LP

- *Holds 27,000-acre position in southeastern Ohio*
- *Is actively soliciting lease offers*

Eclipse Resources I LP, formed in 2011, lined up 27,000 net acres of land in the Utica Shale play in Ohio, drilling its first well and putting out a call for investment partners.

The 27,000-acre position lies in southeastern Ohio and is prospective for the Utica/Point Pleasant Formation. According to the company website, Eclipse is trying to increase its land position and is actively soliciting lease offers.

Eclipse started drilling its first well to the Utica, the Miley 5H, in Seneca Township in Noble County, Ohio. It completed and cored the vertical section in late 2011 and planned to drill and complete the horizontal leg of the well in 1Q 2012.

Meanwhile, Eclipse said in December 2011 it contracted with RBC Richardson Barr to find a joint venture (JV) partner to work the Utica, primarily in Noble County. That is a 50-50 JV offer for the full 27,000 acres, including 350 net mineral acres. Most of that land is in contiguous leases in the wet-gas window with five-year lease terms and five-year

optional extensions and an average net revenue interest of more than 81%.

Other operators in the area include Chesapeake Energy, CONSOL Energy, and EnerVest.

Eclipse estimated a net resource potential of 148 MMboe, based on potential from 225 wells on 120-acre spacing for an average well with a 5,000-ft lateral and 15 fracture stages. That equates to estimated ultimate recoveries of 811,000 boe.

It opened the data room on Jan. 5, 2012, and anticipated a bid due date of Feb. 2.

## Encana Corp.

- *Entered the play in early 2010*
- *Initial discovery tested for 2.5 MMcfe/d of gas, gas liquids, and condensate*

Encana Corp., operating as Petoskey Exploration LLC, kicked off the Utica/Collingwood play in Michigan in early 2010 with the Pioneer 1-3HD1 discovery that tested for 2.5 MMcfe/d of gas, gas liquids, and condensate through a 30-day test period.

The horizontal well reached the Collingwood Shale at a vertical depth of 9,500 ft.

That discovery also kicked off a land rush as the May 2010 Michigan land auction earned more than US $178 million in bonus payments for the state. For perspective, the previous record auction netted $23.6 million and the combined total for all previous auctions since 1929 reached only $190 million. The May 2010 auction brought in an average price of $1,507 per acre with a high of $5,500 an acre. Average bids in previous auctions reached only $26 an acre.

That first well had some production from the Utica, but most came from the underlying Collingwood Formation, according to IHS Inc.

Encana said it had accumulated 425,000 net acres in the play in nine counties around Cheboygan, Kalkaska, and Missaukee counties, a cost of about $200 an acre by late 2011. It only had 250,000 net acres in May 2010, which it acquired for about $150 an acre. The discovery was in Missaukee County.

In that acreage, a single well can hold 7,500 acres.

Encana said the play still is in early stages but it drilled two vertical pilot wells in the northern oily portion of the play and two horizontal wells in the southern liquids-rich gassy segment of the play. Its early wells showed promise, the company said. The second horizontal well reached a total depth of 16,900 ft, including a 7,500-ft lateral leg.

The Petoskey subsidiary started acquiring Michigan land in 2008 and collected additional properties through state land sales over subsequent years.

### Marcellus update

Unsuccessful wells prompted Encana Corp. to remove the Marcellus from its active program list. Through a joint venture agreement in February 2010, the company held 19,000 net undeveloped acres in the play in Pennsylvania and planned to evaluate the program that year.

It started exploratory drilling and worked with local hydrologists from Wilkes University and RETTEW Associates. It conducted baseline studies for water quality and quantity.

According to the company's website, "Although the wells we drilled in the Marcellus Shale formation were unsuccessful, and we are no longer pursuing opportunities in Pennsylvania, this project clearly demonstrates our commitment to building trust in the communities where we operate."

## EnerVest Ltd./EV Energy Partners LP

- *Largest producers in Ohio*
- *EnerVest operates 60% of the Ohio properties*

EnerVest Ltd. and its EV Energy Partners LP investment arm are locked in a substantial position in the Utica play in eastern Ohio. The companies, with help from EnerVest's acquisition of Belden & Blake, are the largest producers in the state with 8,713 wells and 780,000 net acres of land which primarily produce from formations shallower than the Utica. That shallower production holds the land for future Utica production. The companies put 314,733 of those acres into a joint venture partnership with Chesapeake Energy.

The EnerVest properties produce 54 MMcfe/d from 307 Bcfe in reserves from the state.

EnerVest operates 60% of the Ohio properties and EV Energy Partners operates the remaining 40% in the area with Utica potential. The Chesapeake agreement gives that company the right to

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operate about 40% of the EnerVest and EV Energy Partners properties. That left EV Energy Partners with 22,000 net working interest acres in the venture and a 7.5% overriding royalty interest.

Chesapeake was working the properties with an eight-well program in the oil, gas liquids and dry gas windows in December 2011, up from five rigs in July. It paid US $731 million and will pay $1.7 billion in carries on the joint venture (JV) property, or about $15,000 an acre on 650,000 acres, mostly in the liquids-rich segment of the play. Of that, EV Energy Partners captured $15 million and $10.5 million in carries for operations.

EnerVest acts as operator on more than 400,000 net acres in the Ohio play that was not included in the Chesapeake JV. EV Energy partners holds an average 33%, or a net 137,000 working interest acres, in that portion of the play along with a 7.5% royalty interest on 160,000 net acres.

In that program, EnerVest permitted 10 wells and planned two or three Utica horizontal tests in 2011 and early 2012, but the company said it was learning from Chesapeake and other operators before starting a full-scale development program.

In a December presentation, EV Energy Partners said it acquired land in the Utica play, primarily in eastern Ohio, for $31.1 million. That property contains an estimated 73% gas and 27% oil and is about 40% operated with more than 8,000 gross productive wells in Ohio and 85 MMcfe/d of gross, 51 MMcfe/d net, production to give the company interests in 1.2 million gross acres.

Chesapeake committed to drill at least 50 wells a year on the properties through 2016.

Chesapeake closed an agreement in December 2011 to sell a 25% interest in approximately 619,000 net acres in the liquids-rich slice of the Utica in 10 eastern Ohio counties to the Total E&P USA Inc. subsidiary of Total S.A. Chesapeake contributed 542,000 net acres to the venture and EnerVest Ltd. and affiliates, added 77,000 net acres. Chesapeake valued the agreement at $2.32 billion, with Chesapeake getting $2.03 billion and EnerVest $290 million. Chesapeake received $610 million in cash and will get $1.42 billion in drilling and completion carries, which should carry the program through 2014. Chesapeake is the operator of the venture.

### Marcellus update

EnerVest and its EV Energy Partners affiliate were among the Appalachian Basin's biggest producers in 2008 early in the development of the Marcellus and before the start of the Utica boom. Their production came from shallower zones but gave the company a solid land position in the Marcellus held by production from those shallow formations.

EnerVest held 250,000 acres and EV Energy Partners 35,000 acres with Marcellus production potential.

The companies signed an agreement in December 2009 giving PetroEdge an interest in 9,400 net acres of land in Harrison, Marion, Doddrige, Barbour, Upshur, and Randolph counties with Marcellus potential in northern West Virginia.

Under that agreement, PetroEdge earned a 75% working interest on each well it drilled and a three-quarter interest in the full land package when it spent $33 million on drilling and related activities in four years.

## Epsilon Energy Ltd.

- *Holds 178,141 net acres in the Utica*
- *Has 5,750 net acres in the Marcellus*

Epsilon Energy Ltd. entered a partnership with Gastem Inc. on a large parcel of land in Quebec. Like other companies in the Canadian portion of the play, Epsilon has suspended operations until the Quebec government publishes regulations for developing the shale.

Epsilon holds a net 191,850 acres in the area as its elective 25% interest in 920,319 gross acres, but only some of that property is prospective for Utica Shale production.

In the Utica focus area, Gastem is the operator on 64,831 gross, 8,104 net, acres in the St. Jean area where Epsilon has a 12.5% share and more than 25 net potential drilling locations. Also in the area with Utica potential, Lone Pine Resources, formerly Forest Oil Co., is the operator in the Yamaska area where Epsilon holds a 5% working interest, or 5,605 net acres, of an 112,091-gross-acre tract with more than 15 net potential drilling sites. Forest Oil tested two wells in the Yamaska area for initial production rates up to 1 MMcf/d and an estimated 4 Tcf of gas resource in the area and effectively proved up commercial potential for the Quebec portion of the Utica Shale play.

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Outside the area with primary Utica potential, Epsilon holds 178,141 net acres in a 743,327-gross-acre package operated by Gastem. Those properties are on the Gaspe Peninsula and in the St. Jean and Dundee permit area in the St. Lawrence Lowlands, but only some of that acreage is prospective for Utica production.

## Marcellus update

Epsilon also holds 15,380 net acres of land in New York with potential for the Utica in addition to the Trenton-Black River and Marcellus formations. However, in early 2012, the state still held a moratorium on fracturing, so those properties were inactive, even though they held 100 MMcf of proven gas reserves and more than 115 potential locations.

Epsilon's active list for the Marcellus included 11,500 gross, 5,750 net, acres in prime Marcellus country in Pennsylvania where Chesapeake operated its properties and earned a half interest. Under the agreement, Chesapeake paid US $5 million upfront and carried Epsilon for $95 million. Those properties produced 4 MMcf/d of gas in August 2011 and 14 MMcf/d of gas in December. At that time, production was increasing monthly as multi-well pads came onstream.

By that time, the properties held 67 gross, 17.7 net, wells with 10 gross, 2.2 net, wells producing;14 gross, 3.2 net, wells awaiting pipeline connections; 35 gross, 9.9 net, wells drilled and waiting on frac treatments; and 8 gross, 2.4 net, wells being drilled by three rigs.

## EQT Corp.

- *Not planning new activity in the Utica*
- *20 Tcfe in resource potential in its Marcellus reserves*

EQT Corp., a major force Appalachian drilling and production activity, owns more than 3.5 million acres of land and holds interests in more than 14,000 gross productive wells with 5.2 Tcf of gas reserves. It has a major campaign in action in Pennsylvania and West Virginia, but it has barely tested the Utica for pay potential.

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At this point, the company is not planning additional Utica activity, although the potential remains under some of its property. The company's spending plans for the Appalachian Basin include spending 80% of its drilling capital on 132 Marcellus wells. It also plans to drill 120 Huron Formation wells.

EQT drilled an exploratory Utica well in 1Q 2008 to find US $6.9 million in proved reserves. It spent an additional $1 million on the well in 2009. According to the 2010 annual report, EQT plugged the well back and completed it as a horizontal Marcellus producer. It wrote off $2.9 million in additional costs it spent to evaluate the Utica.

In 4Q 2008, the company said it planned to drill a second Utica well in 2010 and complete it and the 2008 well at the same time, but EQT's public releases do not mention drilling the second Utica well at the time of publication.

### Marcellus update

EQT's Marcellus acreage covers 253,000 acres in Pennsylvania and 279,000 acres in West Virginia, a 532,000-acre package with 4,370 drilling locations. That acreage includes 190,000 net acres in the wet gas area and 342,000 acres in the dry gas area.

In January 2012, the company said it had 2.9 Tcfe in proved Marcellus reserves, 12.2 Tcfe in proved, probable, and possible reserves and 20 Tcfe in resource potential.

According to the company, the Marcellus horizontal play is driving its growth. Its average estimated ultimate recoveries on wells with 5,300-ft laterals range from 6.4 Bcfe in the northern section of its western Pennsylvania properties to 7.4 Bcfe in the center of the band of properties to 9 Bcfe in extreme southwestern Pennsylvania and northern West Virginia.

The average estimated ultimate recovery is 7.3 Bcfe on wells that cost $6.7 million to drill and complete. EQT plans 132 wells in 2012, including 17 in northern Pennsylvania, 74 in southwestern Pennsylvania and 41 in northern West Virginia. Its all-in after-tax rate of return at a New York Mercantile Exchange gas price of $4.50/MMBtu is 41%.

EQT also developed a new frac design that adds to the initial potential of its wells at a cost of $1.8 million. Standard frac treatments use 300-ft stages with five clusters of treatments on 60-ft spacing. It plans 49 wells with the new design in 2012. Those wells will use 150-ft stages with 30-ft spacing. It used the new technique on 24 wells in 2011.

## Exxon Mobil Corp./XTO Energy

- *Will drill its first well in the Utica in 2012*
- *Uses recycled water, closed-loop drilling in its Marcellus operations*

Exxon Mobil Corp. dipped a toe into the Utica Shale play to test the waters in 2011 with its acquisition of Phillips Resources in June, and it plans its first well in the formation in 2012.

That acquisition expanded the company's Appalachian Basin presence, which it started with its acquisition of 152,000 acres of land from Linn Energy in 2008.

The Phillips Resources purchase gave ExxonMobil 45,000 net acres of land in Ohio that is prospective for Utica production, but the company also had been talking independently with leaseholders in the Utica area, and, with the Phillips acquisition, raised its lease position to more than 75,000 net acres, according to an ExxonMobil spokesman. He also said the company will drill its first well in 2012.

### Marcellus update

ExxonMobil built a position of more than 700,000 acres in the Marcellus play in only three years, starting with the acquisition of 152,000 acres of properties, some with Marcellus potential, from Linn Energy in 2008, adding 145,000 acres from Pennsylvania General Energy in 2009 and another 280,000 acres in its merger with XTO Energy.

In June 2011, it acquired properties from Phillips Resources Inc. and TWP Inc. to add a combined 317,000 acres in the Marcellus play. The net result was more than 700,000 acres with Marcellus potential by mid-2011.

The company uses recycled water and closed-loop drilling in its Marcellus operations.

## Gastem Inc.

- *Holds interest in 34,400 gross acres in N.Y.*
- *Received state approval to fracture the Marcellus*

| | Barnett (Horizontal) | Barnett (Vertical) | Fayetteville | Woodford | Marcellus | Haynesville | Utica Fairway* (Horizontal) |
|---|---|---|---|---|---|---|---|
| Thickness (ft) | 100 – 500 | 100 – 500 | 20 – 200 | 150 | 50 – 200 | 200- 240 | 500 – 700 |
| Completed Well Cost ($MM) | $2.7 | $1.7 | $3.0 | $4.3 | $3.8 | $8.5 | $8.0 |
| Initial Production Rate (MMcf/d) | 2.4 | 1.6 | 3.0 | 6.2 | 3.1 | 10.7 | 6.0* |
| EUR (Bcf) | 2.4 | 1.1 | 3.0 | 4.5 | 4.0 | 6.0 | 5.0 |
| Well Spacing (acres) | 20 - 80 | 10 - 40 | 80 | 40 - 180 | 80 | 160 | 80 |
| Royalty (%) | 23% | 23% | 19% | 19% | 17% | 25% | 12,5% |

The Utica Formation in Quebec compares favorable with other popular shale plays in the US. *(Table by Enercom, courtesy of Gastem Inc.)*

Gastem Inc. faces regulatory barriers in developing its major position in the Utica play in Quebec and in its smaller holdings on land with Utica potential in New York.

In Canada, the company's 1.1 million gross acres cover parts of the St Lawrence Lowlands, the Gaspe Peninsula, and the Magdalen Islands in Quebec. The location enabled the company to pioneer the Utica play when it drilled and cored two wells directed at the Utica Shale on the Yamaska permit in 2007.

It also took into consideration the Utica in New York when it tested its Sheckels No. 1 well. It holds interests in 34,400 gross acres in New York.

Unfortunately, both New York and Quebec declared moratoria on fracture treatments in the Utica Formation while they investigated potential ramifications of fracture treatments and drew up regulations for development of the shales. New York plans to publish its regulations in the first quarter of 2012, while Quebec may not set its rules until 2014.

In Quebec, Gastem has a 20% interest in 112,139 gross acres in the Yamaska area with Forest Oil (60%) and Questerre (20%) as partners. Gastem drilled two vertical wells in this area in 2007, and Forest fractured a Utica well in 2007 and 2008. Forest shot a 2-D seismic survey in the area in 2010 and spun off its properties in Canada into Lone Pine Resources.

Gastem has a 16.575% interest in 92,039 acres in the St. Hyacinthe area in Quebec with partners Canbriam (68%), Lone Pine (0.425%), and Suncor (15%). Gastem and Canbriam formed a joint venture and farmed out the Suncor properties to test the Lorraine and Utica shales. The companies drilled two vertical wells in 2009 and one vertical and three horizontal wells in 2010. The companies stimulated one of the horizontal wells in 2010. The first two vertical wells drilled by Gastem tested at rates to 1 MMcf/d of gas.

On the St. Jean East permit, Gastem and its 12% partner Epsilon hold a half-interest in 125,203 acres operated by Questerre. The companies await government regulations before testing that property.

At St. Jean North, Questerre holds an 80% interest and Gastem the other 20% in 53,953 acres. The companies drilled a Utica test and stimulated the well in 2009. They currently are reviewing the property's potential and do not plan any significant exploration spending.

Until the regulatory boundaries are decided, Gastem is working on conventional targets.

## Marcellus update

Gastem's New York properties, mostly in Otsego County, are prospective for both the Marcellus and the Utica shales under an 80-20 partnership with Utica Energy LLC, formerly Covalent Energy.

Covalent drilled two wells on the property in 2007, and Gastem earned its 80% position by drilling a vertical well in addition to stock and US $35,000 in 2009.

Gastem received state approval to fracture the Marcellus in the Ross No. 1 and the Upper Utica in the Sheckels No. 1 well in 2010. The companies also shot a 2-D seismic survey in Otsego County and an aeromag survey over all of their properties in New York. Further land acquisition and drilling will depend on well results, regulations, and funding, Gastem said.

## Recent Transactions

**Aggregator**

Divests 5,000 Wells in 5 States

**$6 Million**

**E&P Owner**

Monetizes Royalties and Overrides in East Texas

**$15 Million**

**E&P Company**

Monetizes Non-Core Overrides for Drilling Capital

**$25 Million**

**Owner/ Operator**

Monetizes Non-Core Assets in East & West Texas (3,000 wells)

**$31 Million**

**Petroleum Engineer**

Sells ORRI's for Estate & Tax Savings Purposes (5,000+ wells)

**$28 Million**

**E&P Company**

Carves out ORRI in 100,000 net acres to buy more leases

**$7.5 Million**

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Industry experts compare the emerging Utica Shale play with the established Bakken and Eagle Ford liquids-rich shale plays. *(Table courtesy of Gulfport Energy Corp.)*

| | Utica Shale[1] | | Bakken[1,2] | Eagle Ford[1,2] |
|---|---|---|---|---|
| | Low | High | | |
| Well Cost ($MM) | $6.0 | $6.0 | $7.0 | $5.5 |
| Total Vertical Depth | 7,500 – 9,500 Feet | 7,500 – 9,500 Feet | 10,000 Feet | 11,000 – 13,000 Feet |
| Lateral Length | 5,000 Feet | 5,000 Feet | 9,700 Feet | 5,000 Feet |
| Frac Stages | 12 Stages | 12 Stages | 25 Stages | 15 Stages |
| OOIP per Section | 36.4 MMBO | 36.4 MMBO | 9.0 MMBO | 9.0 MMBO |
| Recovery Factor | 5.0% | 10.0% | 4.0% | 4.0% |
| Well Spacing | 160 Acres | 160 Acres | 1,280 Acres | 80 Acres |
| EUR per Well | 455 MBO | 910 MBO | 720 MBO | 595 MBO |
| Formation Thickness | 140 Feet | 140 Feet | 100 Feet | 100 Feet |
| Porosity | 8.0% | 8.0% | 5-8% | 5-8% |

## Greencastle Resources Ltd.

- *Holds permit to work in the Utica*
- *On hold in area; working properties elsewhere*

Greencastle Resources Ltd. of Toronto, Ontario, Canada, holds a 14,826-acre permit to work the Utica Shale in the St. Lawrence Lowlands area of Quebec.

The permit is in the Longueil area, east of Montreal and southwest and on trend with Lone Pine Resources' (formerly Forest Oil) Utica properties.

The company applied for an exploration permit on its property in June 2008 but the company's website did not report on any activity on the property. Generally, the property lies southwest of properties that have produced wells with proven commercial potential.

The company still held its Utica properties in March 2009.

With the Quebec government holding up fracture treatments until as late as 2014, Greencastle is looking at its other properties for income until it can go to work in Quebec. In Greencastle's case, those alternatives are oil and gas properties in Saskatchewan and gold properties in Nevada and West Africa.

## Gulfport Energy Corp.

- *Holds 62,500 net acres in the Utica/Point Pleasant Formation*
- *Budgeted US $75 million to drill 20 wells*

Gulfport Energy Corp. joins a host of companies with growing land positions in the Utica Shale and plans to work those positions.

The company held 30,000 net acres in the eastern Ohio portion of the Utica in August 2011 and raised that land position to 62,500 net acres in the Utica/Point Pleasant Formation by November 2011 as it assembled land in the wet gas, condensate, and mature oil window in Belmont, Carroll, Columbiana, Guernsey, Harrison, Jefferson, Monroe, and Tuscarawa counties. That land position lays under 125,000 gross acres.

It tried to put together segments contiguous enough to support wells with laterals of 5,000 ft or more.

Gulfport picked up its land with five-year leases and five-year extension options. Although it holds a half-interest in the acreage it operates 100% of the properties.

The company said its all-in cost was $2,850 an acre. It expects estimated ultimate recoveries of 455 Mbo to 910 Mbo per well from property that contains some 36.4 MMboe original oil in place, and it could reach that potential with horizontal wells costing $6.5 million to $7.5 million each. Its property provides 781 gross drilling locations on 160-acre spacing.

It budgeted $72 million to $76 million to drill approximately 20 gross wells to the Utica starting with a one-rig program in January 2012. It planned to add a second rig to the program in April.

Gulfport also said it is "evaluating other potential opportunities relating to its Utica acreage."

## Hess Corp.

- *Laying plans for an aggressive drilling program in the Utica*
- *Spent about US $800 million on the Utica in 2011*

Hess Corp. parlayed two transactions into a substantial land position in the Utica Shale play in Ohio and laid plans for an aggressive drilling program into the emerging play.

The largest transaction gave the company a half-interest in nearly 200,000 acres of CONSOL Energy land. Under that program, Hess put US $59 million upfront and agreed to pay half of CONSOL's working interest drilling and completions costs up to $534 million. That purchase equaled $6,000 per net acre.

The agreement gave Hess the right to operate in the liquids-rich window of the Utica in Belmont, Harrison Guernsey, and Jefferson counties, while CONSOL will operate in Portage, Tuscarawas, and Mahoning counties in the oil window and in Noble County. Much of that land is owned in fee, which offers the companies an average 90% net revenue interest.

In a January 2012 release, Hess said it would spend $2.5 billion in 2012 on unconventional production and development, including appraisal wells in the Utica Shale in Ohio.

In the second transaction in September 2011, the company acquired Marquette Exploration and other leasehold interests totaling another 85,000 net acres at a cost of approximately $750 million.

Hess planned to start an appraisal program on the 185,000 net acres of properties in 4Q 2011. In a September presentation, Hess said it would spend $800 million on the Utica in 2011.

Hess planned to work an average three rigs in 2012. On the properties shared with CONSOL, the companies planned to operate three-and-a-half rigs, three by Hess, on average in 2013; four-and-a-half rigs, four by Hess, in 2014; and five rigs, four by Hess, in 2015.

## Marcellus update

Hess Corp. holds 74,000 acres in Wayne County, Pa., in a 50-50 joint venture agreement with Newfield Exploration with Newfield as the operator. The company controls another 52,900 acres of Marcellus land, mainly in northern Wayne County outside the partnership, and Hess is sole operator of that property. It planned four to six vertical wells on its operated properties in 2011. According to the Hess website, "Only after this initial work and completion of a number of horizontal assessment wells will we determine a development plan."

## Junex Inc.

- *Has interests in 5.2 million acres on the Quebec side of the Appalachian Basin*
- *Alternative investments include holdings in the Macasty Shale*

Junex Inc. joins the other operators with territory in southern Quebec as it concentrates on its other assets while awaiting rules and regulations for fracturing the Utica Shale, a process that may not be complete until June 13, 2014.

Among those alternative investments are the company's holdings in the Macasty Shale on five permits on 233,275 net acres on Anticosti Island in Quebec with 12.2 billion bbl of oil in place. In late December 2011, the company was finalizing its 2012 exploration program for the island.

The Macasty Shale is the stratigraphic equivalent of the Utica, and Junex is the largest landholder in the liquids-rich part of the Utica.

The Macasty is brittle with 50% quartz and feldspar, 35% carbonate, and 15% clay with an average porosity of 6.3%

Overall, Junex has interests in 5.2 million acres of land on the Quebec side of the Appalachian Basin, much of it in the center of the Utica Shale play in the St. Lawrence Lowlands. A Netherland Sewell & Associates report gave the company's Orleans permits in the St. Lawrence Lowlands a volume of 5.58 Tcf of original gas in place. That, added to gas-in-place estimates of 48.34 Tcf for the rest of the company's Utica-prospective properties, totaled 53.92 Tcf of gas.

Gross unrisked prospective resources for the company's Utica Shale acreage on Apr. 19, 2010 ranged from a low of 1.42 Tcf of gas with a 4% recovery to a high of 12.7 Tcf with a 25% recovery and a best estimate of 4.26 Tcf with an effective 10% recovery, net to Junex, from the Lowland permits.

The Netherland Sewell evaluations covered 705,096 gross acres, or about 66% of the 1.06 million gross acres Junex held in the Utica Shale play.

## Lario Oil & Gas Co.

- *Plans to raise holdings in Utica to 50,000 acres by the end of 2012*
- *Turned operations of the Niobrara play over to ConocoPhillips*

Lario Oil & Gas Co. moved into the Utica play in Ohio in the same way it successfully assembled acreage positions in the Bakken Shale in the Williston Basin and the Niobrara Shale in the Denver-Julesburg Basin; it let science lead the way, followed by aggressive leasing.

In September 2011, the company began pursuing Utica acreage in select high potential counties in eastern Ohio. By February 2012, it had acquired commitments for nearly 20,000 acres of land and planned to raise its holdings to 50,000 acres by the end of the year. At press time, according to Mike O'Shaughnessy, president and CEO, company officials were in negotiations that would allow them to achieve that goal.

In North Dakota in 2007, Lario started with a small acreage holding in the Bakken, and it has built that position to 185,000 gross acres with more than 500 producing wells, with plans to reach a net 5,000 boe/d by the end of 2012, up from 4,000 boe/d in February. Along the way, Lario participated in the Windsor acquisition of Bakken properties with Slawson Exploration, and divested of select properties as part of the Tracker sale to the Hess Corp., with a total price tag of more than US $1 billion.

In the Niobrara play in 2009, Lario started with 15,000 acres just east of Denver and built it to a total of 46,000 acres. Lario subsequently turned operations over to ConocoPhillips for a figure rumored to be close to $200 million. Since then, ConocoPhillips is finalizing the lease of the adjacent 21,000 acre decommissioned Lowry Bombing Range from the Colorado State Land Board for $6,500 an acre.

## LINN Energy LLC

- *300 drilling and optimization prospects*
- *26,000 net acres prospective for the Utica/Collingwood*

LINN Energy LLC set its sights on company potential in the Utica/Collingwood combination in the Michigan Basin, but it has not yet started an active campaign.

The company is currently preoccupied with major programs in the Granite Wash, Wolfberry, Bakken, and Cleveland plays.

Plenty of potential for the Utica/Collingwood exists in the company's April 2010 acquisition of producing natural gas properties in the Antrim Shale in northern Michigan where it holds 266 Bcfe of proved reserves and operates more than 1,300 wells. It also has identified approximately 300 drilling and optimization prospects as cash flows from wells with a decline rate of 6% and a reserve life of approximately 24 years.

Even greater potential for LINN comes from more than 26,000 net acres prospective for the Utica/Collingwood.

According to the company, its planned $880 million oil and gas capital program for 2012 will concentrate on low-rise, high-rate-of-return liquids drilling, which puts the gas-prone Utica/Collingwood on the back burner.

It plans to either drill or participate in 340 wells during the year with 53% of its capital directed at the Granite Wash, 23% to the Permian Basin, and 6% each to the Bakken and Cleveland plays. The rest of the capital will go to workovers, recompletions, optimization, and facilities projects.

## Lone Pine Resources Inc.

- *Completed operations in its Canadian properties in September 2011*
- *Plans to work on oil plays at Evi and Narraway in Alberta, Canada, in the future*

Lone Pine Resources Inc., formerly the Canadian operations of Frontier Oil Corp., took the same position as other companies with land in the Utica play in the St. Lawrence Lowlands of Quebec. It directed its attention

to other properties with potential as it waited for the Quebec government to formulate regulations for fracturing and developing the emerging shale, expected by June 2014.

In December 2011, it planned to work on oil plays at Evi and Narraway in Alberta and a high-impact-potential Muskwa Shale well in the Liard Basin, north of the Horn River Basin in the Northwest Territories.

When the regulatory shut-down occurred, Forest had drilled the St. Denis vertical well and the St. Louis, St. Francois, and Champlain horizontal wells, all significant wells that produced as much a 1 MMcf/d of sweet, dry gas. It transferred those wells and information to Lone Pine along with 298,850 gross, 240,320 net, acres of land in the area.

Forest's work in successfully fracturing the Utica for commercial quantities of gas initiated the land rush in the play before the Quebec government declared its moratorium.

Forest announced the spinoff of its Canadian properties in June 2011 and completed the operation in September 2011.

## Magnum Hunter Resources Corp.

- *Utica properties total 20,000 gross, 16,000 net, acres in the wet gas area*
- *Has 58,048 net acres of land in the Marcellus*

In December 2011, Magnum Hunter Resources Corp. said it planned to concentrate its Appalachian activities on its Marcellus, Huron, Weir, and Utica properties. The Utica portion of those properties totals 20,000 gross, 16,000 net, acres in the wet gas area.

Overall, the company has 58,048 net acres with 265 MMboe in resource potential in the four Appalachian plays. In late 2011, it controlled more than 2,000 wells producing from the Huron, Weir, and Marcellus in Ohio, Kentucky, and West Virginia.

By early 2012, it had not drilled any Utica wells. It held properties with Utica potential in Monroe, Noble, and Washington counties in Ohio, and Tyler and Pleasants counties in West Virginia along the Ohio border.

Magnum Hunter directed US $50 million of its 2012 capital budget to Triad Hunter, the subsidiary that operates its Appalachian properties.

### Marcellus update

Magnum Hunter, through its Triad Hunter arm, had 58,048 net acres of land with 305 gross, 290 net, locations in the Marcellus in January 2012, and its primary target was liquids-rich Marcellus in northwestern West Virginia. By that time, it had drilled and completed 10 Marcellus wells: four in Tyler County, five in Wetzel County in West Virginia, and one in Monroe County, Ohio. The Ohio well, the Ornet #1H, was a tight hole. Among its operated West Virginia wells, the Roger Weese #1110H in Tyler County tested at a 30-day initial production rate of 5.8 MMcf/d of gas and the WVDNR #1103 in Westzel County tested for nearly 7.1 MMcf/d over its first 30 days online. Magnum Hunter was testing three more Marcellus wells and was drilling the second of four pad wells in Tyler County.

Part of the company's Marcellus acreage, 1.925 acres, is in a joint venture with Stone Energy as operator. The companies plan 19 horizontal wells on that property over the next two years.

## Molopo Energy Ltd.

- *Southern Quebec operations on hold*
- *Utica/Lorraine properties have prospective resource potential of 5.5 Tcf of gas*

Molopo Energy Ltd. holds full working interests and is operator in 1.4 million acres of land in Quebec with potential targets in the Potsdam, Beekmantown, Trenton-Black River, and Utica/Lorraine shales.

It and other operators in southern Quebec in the Utica/Lorraine were put on hold on June 13, 2011, by the government while it sets rules and regulations for fracturing the formation. Those regulations are scheduled for enactment no later than June 13, 2014.

The company's properties are in the center of the Utica/Lorraine play south of the St. Lawrence River in the St. Lawrence Lowlands, and Molopo is working with the Quebec government through the Quebec Oil & Gas Association to establish sustainable regulations for development of the shale gas.

According to a January 2012 release, Molopo had a prospective resource potential in the area of 5.5 Tcf of gas.

## Mooncor Oil & Gas Corp.

- *Created DRGN Energy Inc., a wholly owned subsidiary of Mooncor*
- *DRGN property consists of 22,425 net acres*

While the bulk of Utica Shale attention focuses

on Quebec, Michigan, Pennsylvania, Ohio, and New York, Mooncor Oil & Gas Corp. set its sights on the Utica-type Collingwood/Blue Mountain Shales in Norfolk County, Ontario.

In 2008, it planned to drill a well to the Trenton-Black River in the county but take advantage of the test to core the Collingwood/Blue Mountain combination. At that time, the company had interests in 25,000 acres of undeveloped land in the area, and said it planned to acquire 100,000 acres.

In 2011, the company created a spinoff of its southwestern Ontario properties into a new company called DRGN Energy Inc., a wholly owned subsidiary of Mooncor. The financing program for the spinoff was oversubscribed.

The spinoff, the company said, would allow Mooncor to concentrate on the Muskwa/Duvernay Shale play in Alberta.

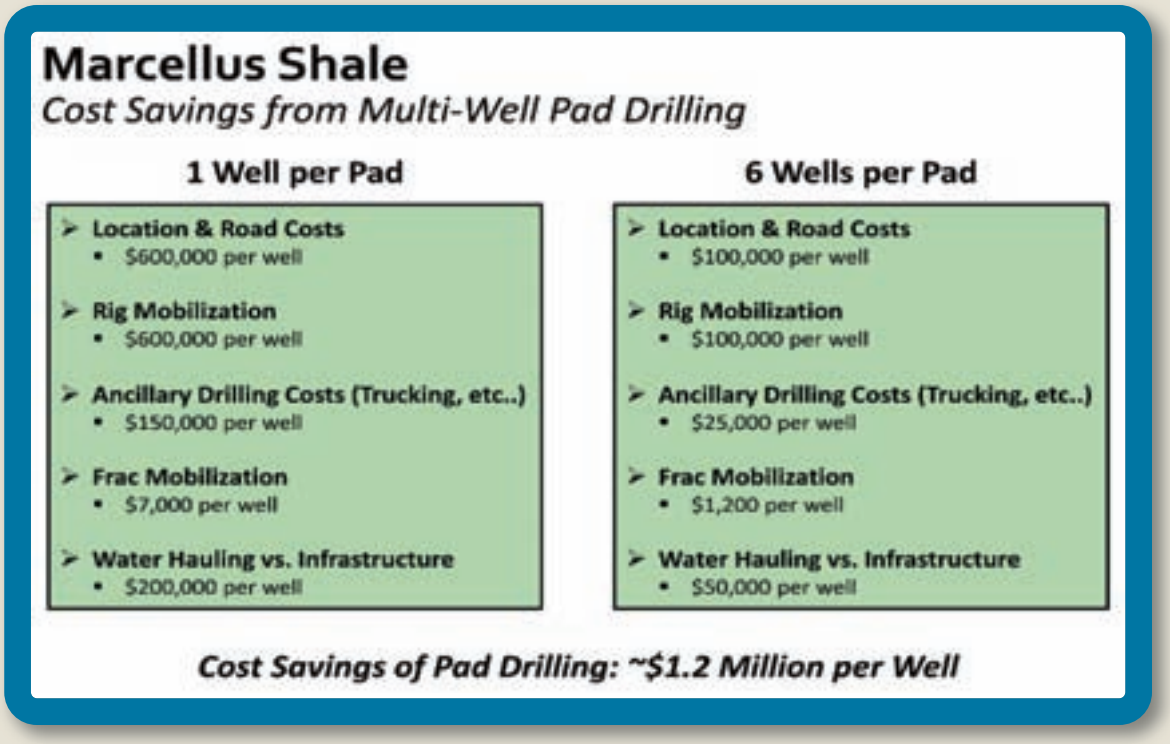
It said the DRGN property consisted of 22,425 net acres with potential for conventional Ordovician, Silurian-Salina, and Devonian formations and for unconventional Kettle Point (Antrim equivalent) and Collingwood (Utica equivalent).

A technical evaluation of the property showed 22 oil drilling locations.

## National Fuel Gas Co./ Seneca Resources Corp.

- *Drilled a Utica well in Pennsylvania in April 2011*
- *Plans a horizontal Utica test in its Tionesta area during 2012*

National Fuel Gas Co. operates its oil and gas properties through its Seneca Resources Corp. subsidiary. Those properties include more than 3,000 shallow wells in western New York and western Pennsylvania including 745,000 net prospective acres in the Marcellus fairway in Pennsylvania, or, a major portion of its one-million-acre position in the basin. It owns 80% of that acreage in fee with no royalty obligations or lease term limits.




Pad drilling in the Marcellus Formation saves Seneca Resources approximately US $1.2 million per well on six well pads compared with single-well locations. *(Table courtesy of Seneca Resources Inc.)*

The company knows the territory. It has been exploring and producing in Appalachia for more than 100 years.

Some of the acreage carries potential for Utica Shale production beneath the Marcellus Formation, and Seneca already has started evaluating that potential. During a December 2012presentation, the company said it had 300,000 net acres in the shallower Geneseo Shale, but it had not yet determined the acreage or potential resources in the Utica.

It drilled a Utica well at Mt. Jewett on the border of Elk and McKean counties in western Pennsylvania in April 2011 and was preparing to test the well in January 2012. The company planned to move in a rig to drill a horizontal section in 2012. It drilled another vertical Marcellus well in the Henderson area in August 2011, completed it in December and was moving in a rig to drill the horizontal section in 2012.

It planned a horizontal Utica test in its Tionesta area during 2012.

## Marcellus update

National Fuel and Seneca held more than 700,000 Marcellus acres before other companies started to pay attention to shale. The companies have since added 45,000 net acres and booked 491 Bcfe in proved reserves.

Now the company is aggressively developing its Lycoming and Tioga leases in its eastern area. It has developed its Covington Tract in Tioga County with 47 Marcellus wells and produces more than 100 MMcf/d of gas. It is developing the DCNR Tract with 19 wells drilled and four wells producing 10 MMcf/d gross. It will run two rigs in the area in 2012.

In Lycoming County's DCNR Tract 100 it drilled five wells and completed one for an initial potential of 15.8 MMcf/d of gas. It also will run two rigs in that area.

In the western area, Seneca operates Mt. Jewett in McKean County where it is delineating three wills with initial potentials around 3 MMcf/d. It also operates Owls Nest in Elk County with three wells drilled. There, it expects initial potentials of 4 MMcf/d of gas to 5 MMcf/d. It is acquiring 3-D seismic data and plans to operate one rig in 2012.

It also operates Boone Mountain in Elk County and is testing three horizontal wells. The first two tested for 3.8 MMcf/d of gas and 4.2 MMcf/d, respectively.

Seneca also has a joint venture with EOG resources. EOG operates the Punxy area where it has drilled 63 wells with 33 producing 42 MMcf/d of gas in January 2012. EOG planned to run two rigs in the area in 2012. It also operates the West Branch, Clermont, Brady, and other properties for a total of 168,500 net acres.

Seneca planned to spend $740 million to $820 million on the Marcellus in 2012 and produce between 62 and 72 Bcfe of gas from the Marcellus during the year.

## NiSource Inc

- *Plans to grow Utica and Marcellus operations*
- *Holds significant midstream presence in the area*

Merrilville, Ind.-based NiSource Inc. has no current plans to work the Utica Formation in Appalachia, but a key part of its 2012 business investment plan will leverage the Utica and Marcellus plays to grow its operations. The company is assessing opportunities in the Appalachian shale plays.

In a February 2012 presentation, president and CEO Robert C. Skaggs said the company's US $340 million capital investment program for the year — up 43% from 2011— will focus on Marcellus and Utica opportunities.

The company's NiSource Gas Transmission & Storage system already has a significant presence in the two shales, estimated between 100,000 and 200,000 acres in the Utica, according to Nissa Darbonne, editor-at-large for Hart Energy's Oil and Gas Investor group.

The natural gas and electrical service provider has a $145 million investment in 20 miles of pipeline plant in western Pennsylvania, anchored by a major Marcellus shale producer. That project will connect with multiple interstate lines. It expects to put that line in service late in 2012.

Its Columbia Gas of Ohio operation is the largest gas provider in Ohio with more than 19,000 miles of pipeline, and its Columbia Gas of Pennsylvania arm is the third largest gas provider in Pennsylvania with 7,400 miles of pipeline.

## Norse Energy Corp.

- *Controls 110,000 net acres prospective for the Marcellus and Utica*
- *80% of the company's central New York properties contain the Point Pleasant layer*

Norse Energy Corp. controls 130,000 acres of leases in central New York with triple-stacked pay in the Marcellus, Herkimer, and Utica formations and another 50,000 acres in western New York.

Approximately 110,000 net acres of that land is prospective for the Marcellus and Utica formations.

Unfortunately, it is unable to fracture wells on the property until the New York issues regulations for frac treatments.

The New York Department of Environmental Conservation issued those regulations in January 2012. Now, it must review 20,000 public comments and complete the Supplemental Generic Environmental Impact Statement and associated regulations. It should publish those rules and begin issuing permits mid-2012, the company said.

Norse is looking forward to development because the Point Pleasant section of the Utica in New York is thicker than that segment in Ohio, and 80% of the company's central New York properties contain the Point Pleasant layer.

In a November 2011 presentation, Norse said it had 2,200 sites prospective for the Marcellus and Utica formation with potential production of 4 to 5 Bcf per well, or a net present value discounted at 10% a year of US $3 million to $5 million per well.

Earlier it said, when the regulations are issued, it planned to put one rig each to work in the Marcellus and Utica in 2012, increase the rig count to four in each play in 2013, to six rigs each in 2014, to eight rigs in each formation in 2015, and to 10 rigs in each play thereafter.

It also said successful drilling to the Utica in Ohio and Pennsylvania makes its New York properties more attractive.

Norse had been working the Herkimer Formation between the Marcellus and Utica since the fracturing restrictions did not apply there, but it suspended that program in 2Q 2011.

According to the Norwegian company affiliate, a Schlumberger analysis showed its properties held resources of 1.2 Tcf in the Marcellus, 200 Bcf in the Herkimer, and 2.5 Tcf in the Utica in December 2010.

The company drilled two wells into the Utica to find 49 Bcf of gas in place per square mile in one well and 30 Bcf in place per square mile in the other.

## PDC Energy

- *US $36 million may be invested in acreage of the Utica*
- *50-50 venture spudded 10 horizontal Marcellus wells*

Petroleum Development Corp., which operates as PDC Energy, plans to focus on the Marcellus and the Utica formations in its Appalachian activities, the company said at Hart Energy's Developing Unconventional Gas conference in November 2011.

The company got its start in shallower Appalachian zones and later moved to Denver. It currently works shale plays in the Piceance and Denver-Julesburg basins in the Rockies and in the Permian Basin.

PDC held 30,000 acres in the Utica Shale until its latest acquisition gave it another 10,000 aces in the Utica. It bought new acreage in Belmont, Noble, Monroe, Washington, Morgan, and Guernsey counties in Ohio for US $70 million, or an average price of $1,750 per acre.

PDC operates in Appalachia through the PDC Mountaineer joint venture (JV), which planned to drill two horizontal Utica wells in 2012 with an option to drill two additional vertical wells. It planned to spend $50 million to acquire acreage and fulfill its drill-to-earn commitment.

The company said it wanted to raise its lease position in the Utica from 80,000 to 100,000 acres.

According to an early 2012 company report, "Depending on the timing, structure, and size of the company's consummation of a joint venture in the Utica Shale, the remaining capital budget of $86 million may be invested in Utica acreage purchases and development of a second rig in the liquids-rich horizontal Niobrara play in the Wattenberg Field (of northeastern Colorado), or used to fund the purchase of additional partnerships."

## Marcellus update

The PDC Mountaineer JV holds 90,000 acres in the Marcellus. The 50-50 PDC Mountaineer venture spudded 10 horizontal Marcellus wells and completed six horizontal wells during 2011, according to the January report. It also started midstream projects. The most recent three-well drilling pad came online in early 2012 at an initial combined rate of about 18 MMcf/d of gas.

The JV will spend $12 million for drilling and midstream operations in 2012.

## Petrolympic Ltd.

- *Has an interest in 139,920 acres on the Lowlands carbonate platform*
- *Estimates 90 to 150 Bcf of gas per section in the Utica*

Petroloympic Ltd. concentrates its exploration activity on an 8,000-acre lease position in the Maverick Basin of South Texas as it awaits Quebec government regulations that allow it to work its larger land position in the Utica trend in Quebec.

The company holds a 100% interest in 240,883 acres and a 30% share of another 1.66 million acres on the Gaspe Peninsula and in the St. Lawrence Lowlands.

In the St. Lawrence Lowlands, prime country for Utica Shale development, the company has a 30% share in 536,941 acres with joint venture partner Ressources et Énergie Squatex Inc. It also has a 12% interest in 19,768 acres through a farmout from Canbriam Energy Inc. and a 100% interest in 139,920 acres on the Lowlands carbonate platform. After government approval, those properties offer access to the Utica-Lorraine and Trenton-Black River plays.

The companies ran a geochemistry program over the St. Lawrence Lowlands area in June 2009 to help evaluate drilling locations, and Petrolympic followed up with a second round of geochemical sampling on its own permit areas later in the year. At the same time, Squatex put together an exploration program.

Squatex conducted a 600-sample geochemical survey over three permits southwest of the St. Lawrence Lowlands. Results from the chemical analysis received in March 2010 showed large anomalous gas seepage zones, including one that coincided with an anticline fold near a major basement fault.

Canbriam drilled the Farnham No. 1 well in the area to the top of the Trenton and found gas shows in the Lorraine Shale.

The company estimated 90 to 150 Bcf of gas per section in the Utica and another 200 Bcf per section in the uphole Lorraine Shale on its properties.

The companies were looking for venture partners to help develop the properties when the government approved development.

## Questerre Energy Corp.

- *Has 340,000 acres in the Utica*
- *Quebec moratorim halted two completions in 2011*

Questerre Energy Corp. spends its resources developing the Bakken play in Saskatchewan since Quebec declared its moratorium.

The company claims more than 1 million gross, 340,000 net, acres in the heart of the Utica and Lorraine shales play in the St. Lawrence Lowlands south of the St. Lawrence River.

Even though it is unable to work those properties, it formed a stakeholder committee to conduct a strategic environmental assessment of Utica development and plans to turn the findings of that committee over to the government to help the regulatory process.

Meanwhile, the Quebec government allows fracture treatments only on pilot projects.

Questerre, with its partner, Talisman Energy, hold a potential 18 Tcfe in recoverable resources on their Utica/Lorraine property, and Questerre holds rights to that land until 2021.

The partners began testing the Utica in 2008 and 2009 when Talisman drilled the St. Edouard No. 1 well with a 3,281 ft lateral. That well offered an initial potential of more than 12 MMcf/d and an average flow of 5.7 MMcf/d over its first 30 days online.

The companies scheduled two more completions in 2011 when the moratorium halted operations. The companies also participated on a 2-D seismic survey initiated by Forest Oil.

## Range Resources Inc.

- *Utica remains on company's active list*
- *Marcellus activity remains its primary focus*

Range Resources Inc. pioneered the Utica play in the US with its Renz No. 1 vertical well in Pennsylvania in 2004. Since that time the company spread its corporate mantle over a host of additional shales, but the Utica remains on its active list.

In addition to the Utica Shale, other unconventional plays pursued by Range include the Avalon/Bone Spring, Cana Woodford, Granite Wash, Marcellus, Mississippi Lime, and Wolfcamp/Penn Shale.

Range completed its first modern Utica well in 2010 for a seven-day rate of 4.4 MMcf/d. In late 2011, it planned two to four Utica wells over the next couple of years but no concentrated development activity. Its Utica properties are in the dry gas window in Pennsylvania, and its Utica land is held by production from its 790,000 net acres of land in the shallower Marcellus Shale which overlies a significant portion of properties with Utica potential. Since its Utica land is held by production from other zones, Range can afford to concentrate on others plays before embarking on massive Utica development.

Its Marcellus activity remains a high-focus area for the company, directing 86% of its capital budget to development drilling in that formation.

It also is working Upper Devonian formations, all under the Range Resources Appalachia LLC operating division.

Range estimated its net unproven Appalachian resource potential at 20 to 28 Tcf of gas and 409 to 545 MMbbl of liquids.

### Marcellus update

Range's activities in Appalachia essentially kicked off the Marcellus play, and it remains one of the largest leaseholder and owners of properties in the prime production areas within its 1.1-million-acre empire. That empire contains 22 to 32 Tcfe (20 to 28 Tcf of gas and 409 to 545 MMbbl of liquids) in net unproven resource potential in the Marcellus, and it plans to make the play self-funding by 2013.

The company drilled 141 wells in the southwestern Pennsylvania wet gas area through June 2011; they offered an average estimated ultimate recovery (EUR) of 5.7 Bcfe per well. It cost the company US $4 million to complete wells with a 2,802-ft average lateral and nine frac stages for a finding and development cost of 82 cents/Mcf. That offered Range a 79% return at a gas price of $4/MMBtu and a 134% return with a $6 gas price, including processing and pipeline costs.

It holds 550,000 net acres in the southwestern part of the play, and more than 1,000 wells by all operators have essentially derisked that area. That area gives Range room for 5,000 wells on 80-acre spacing, assuming the company drills on 80% of its acreage.

Work is less aggressive on the company's 240,000 net acres in the northeastern gassy part of the play where it brought 15 wells online by the end of 3Q 2011. Average reserves totaled 6.5 Bcf for a well with a 2,573-ft lateral with nine frac stages. It planned to bring another 23 wells online by the end of the year, according to a January 2012 presentation. It also was testing a horizontal well with a 4,500-ft lateral and 15 frac stages in late 2011.

Range ended 2010 with production of more than 200 MMcfe of gas from all of its Marcellus properties. It planned to double that production by the end of 2011 and add another 200 MMcfe/d by the end of 2012. It also planned to begin ethane extraction in 2013, a move that could add 500 MMboe of production potential, essentially doubling liquids potential.

## Ressources et Énergie Squatex Inc.

- *Has 988,609 acres of permits in the Lowlands and on Gaspe Peninsula*
- *Acquired 12 new permits in 2006*

Ressources et Énergie Squatex Inc. of Brossard, Quebec, is a private company with 988,609 acres of permits in the southwestern portion of the St. Lawrence Lowlands and on the Gaspe Peninsula.

It 2006 it took on an additional 673,021 acres as part of an acquisition of 12 new permits located between Montreal and Quebec City in the St. Lawrence Lowlands. As of June 2008, Squatex owned 70% of its land holdings, while Petrolympic held the remaining 30% of the joint venture properties.

Squatex conducted a 600-sample geochemical survey over three venture property permits southwest of the St. Lawrence Lowlands. Results from analysis of the survey delivered in March 2010 showed anomalous gas seepage areas, including one that matched up with an anticline fold near a major basement fault.

## Rex Energy Corp.

- *Holds 85,300 gross acres of land in the Utica play*
- *Has 70% interest with Japan's Sumitomo Corp. in 63,200 gross acres in the Marcellus Shale*

Rex Energy Corp. is taking an aggressive position as it builds its stake in the Utica Shale in Pennsylvania and Ohio.

In a December 2011 presentation, the company said it had 85,300 gross, or 58,700 net, acres of land in the Utica play. That includes 65,000 gross, 44,300 net, acres in Butler County and 9,300 gross, 3,400 net, acres in Mercer County in Pennsylvania. Also, it acquired 11,000 net acres of land in Carroll County, Ohio, late in the year and planned to raise that figure to 15,000 net acres by the end of 2011.

It calls the Ohio property its Warrior prospect and plans to begin drilling on the site in 2012. The Warrior prospect is close to existing pipeline and processing facilities and offers 80 net potential drilling locations. The additional 3,000 net acres would raise that number to 100 drilling sites.

Two Chesapeake wells in the area tested for 1.5 Mboe/d and 1.6 Mboe/d.

Operators call the Ohio acreage the Utica play, but the drilling target is the Point Pleasant Lime between the Utica and the lower Trenton Lime. That target zone is 140 ft thick with 8% to 12% porosity on the land held by Rex.

It drilled one well on its Butler County property, the Cheeseman No. 1H, in Section 6, Portersville 7.5 Quad, Muddy Creek Township on a 332.85-acre lease. Rex drilled the well to 12,990 ft, including a 3,551-ft lateral and completed it with 12 fracture stages.

That well tested at a stabilized 24-hour rate of 9.2 MMcf/d of dry gas. The company shut in the well but planned to put it into production in 2012 after completion of a gathering system. The test was good enough that Rex planned to drill additional Utica wells in Butler County in 2012.

### Marcellus update

In addition to its Utica holdings, Rex has a 70% interest with Japan's Sumitomo Corp. in 63,200 gross, 43,500 net, acres in the Marcellus Shale trend in Butler County, Pa. That venture includes midstream assets in which Stonehenge has a 60% share, Rex 28%, and Sumitomo 12%. The venture processed 28.4 MMcf/d of gas through the Butler County Sarsen plant in June 2011.

Rex and Sumitomo, with Rex as operator, drilled 22 Marcellus wells, fractured 11 wells, and put 13 wells on pipeline. They planned six more wells in the second half of the year. The venture has three multiwell pads on production.

Rex also had non-operated interest in properties operated by Williams Cos. Rex held a 40% interest in 41,900 gross, 16,600 net, acres in the Williams joint venture, with Sumitomo holding another 10% and Williams controlling a half interest in Westmoreland County, Pa. Through June 30, 2011, Williams had drilled 14 wells, stimulated eight wells, and put eight wells online with a five-day average flow rate of 3.3 MMcf/d of gas per well and a 2.7 MMcf/d average 30-day flow rate. Williams planned another eight wells by the end of 2011 with 18 total wells fractured and nine wells in service. June 2011 production from those properties reached 21.8 MMcf/d.

Williams also drilled three Marcellus wells in Clearfield County and placed one on service by the end of June.

## Shell Energy North America LP

- *Gained chunk of Utica and Marcellus properties with purchase of East Resources*
- *Drilled the first Marcellus well in Lawrence County*

The Shell Energy North America LP division of

Royal Dutch/Shell picked up a significant chunk of Utica and Marcellus properties when it bought East Resources in July 2010 for US $4.7 billion.

The purchase included more than 700,000 gross, 650,000 net, acres of leases in the Marcellus fairway in West Virginia, Pennsylvania, and New York.

It also included production from the Utica Formation from 70,000 acres in Butler and Lawrence counties in western Pennsylvania near the Ohio border. At least one successful Utica well has been drilled in Butler County by Rex Energy. Shell added another 30,000 acres in the Utica-prone area by mid-2011 and started delineation drilling.

Shell also drilled the first Marcellus well in Lawrence County on the western edge of the Marcellus play and near the liquids-rich section of the Utica Shale in Ohio.

Shell also announced plans to build a $2 billion ethane cracker plant, part of which would be dedicated to processing Utica production. Both Ohio and West Virginia have launched aggressive campaigns to lure Shell to their states.

Another strong asset in the East Resources purchase was Northern Pipeline Co., which included some 400 miles of gathering system in Butler, Clarion, Forest, McKean, Venango, and Warren counties in Pennsylvania. Although most of the line is in Marcellus country, parts of it run through land with Utica potential.

## Marcellus update

The East Resources purchase gave Shell more than 700,000 gross, 650,000 net, acres of land prospective for Marcellus production in Pennsylvania, West Virginia, and New York. Since the purchase, the major oil company has concentrated its development efforts on Tioga County, Pa., while delineating and analyzing its properties with wells around the fringes of the play.

Shell also has a 50-50 joint venture in Potter County, Pa., and additional properties in Bradford,Forest, McKean, Butler, Lawrence, and Jefferson counties in Pennsylvania with Ultra Petroleum.

According to the company, Shell recycles nearly all of its produced fluids in its drilling and fracturing operations.

## Talisman Energy Inc.

- *Has 756,000 net acres of land in the Utica/Lorraine Shale play*
- *Holds the record for production with a Utica well*

Talisman Energy Inc. entered the shale arena with positions in the Marcellus and Eagle Ford in the US and the Montney and Utica/Lorraine shales in Canada.

It spent US $1.6 billion on shale activity in 2010 and moved into 2011 with the Marcellus as a high priority. It held 223,000 net acres in the Marcellus fairway in Pennsylvania with 2,000 drilling locations and planned to drill approximately 100 net wells there in 2011.

The company had a history of several years drilling through the Marcellus and Utica to the Trenton-Black River Formation in New York through its Fortuna subsidiary, which made it the top producer in the state.



Regardless of whether or not the government has issued a moratorium on fracturing, the company claims there is no Utica potential in the area. It does claim 756,000 net acres of land in the Utica/Lorraine Shale play in the St. Lawrence Lowlands of Quebec, and it holds the record for production with a Utica well. Its St. Edourd horizontal well tested at 5.3 MMcf/d of gas for 30 days. It also drilled horizontal wells on the Gentilly and LeClercville permits but did not release test figures on those wells. It said the wells were being evaluated. Talisman said production on the vertical wells it drilled averaged 600 Mcf/d of gas.

The government moratorium on fracturing in the Utica play halted all drilling activity in the formation, probably until 2014. Talisman led the Quebec Oil and Gas Association's role in public hearings on fracturing requested by the Quebec government.

Talisman established its Utica/Lorraine position by drilling wells to take a 75% interest in a farmout from Questerre. Talisman said its Utica Shale activity still is in the pilot stage.

### Marcellus update

Talisman holds 223,000 net acres on land with Marcellus potential in southern New York and northeastern Pennsylvania. With a moratorium in effect on fracturing, the company is concentrating operations on Pennsylvania, which is in the development stage.

Activity included 22 Marcellus wells placed online in 2009, another 99 wells the following year, and planned 100 wells in 2011. Those wells produced 29 MMcf/d in 2009, 181 MMcf/d in 2010, and it reached record production of approximately 485 MMcf/d in 4Q 2011.

Those Marcellus wells are in the gassy portion of the play. Because of low gas prices, the company said in December 2011 it would reduce its activity from 11 rigs at the end of the year to between five and seven rigs in 2012. It expected to reach 500 MMcf/d by the end of 2012, even working on five drilling rigs. It estimated ultimate recoveries average 5 Bcfe per well with initial potential in the first 30 days of operations at approximately 4 MMcf/d.

It planned to spend more than $600 million in the play during 2012 but a significant amount of that money will go to infrastructure on newer parts of the play.

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## Total S.A.

- *Entered US shale arena in December 2011*
- *Took 25% interest in 619,000 net acres in the Utica*

French major Total S.A. entered the US shale arena through its Total E&P USA Inc. subsidiary in December 2011 as it signed a joint venture agreement to take a 25% interest in 619,000 net acres in the liquids-prone area of the Utica in eastern Ohio.

Under the agreement, Chesapeake Energy contributed its interest in 542,000 net acres and EnerVest Ltd. and affiliate EV Energy Partners put up their share in the remaining 77,000 net acres.

According to Chesapeake, it will receive US $2.03 billion, including $610 million in cash and $1.42 billion in drilling and completion carries through 2014. CHK is a new company with common and preferred stock, with Chesapeake retaining all the common shares. Chesapeake will operate the properties.

EnerVest and its affiliate received $290 million.

The agreement is similar to other agreements signed by Chesapeake with China's CNOOC in the Eagle Ford Shale play and with Norway's Statoil in the Marcellus Shale.

A fast-increasing number of wellheads dot the Ohio countryside as operators complete Utica wells and prepare them for hookup to pipelines. *(Photo courtesy of Chesapeake Energy Corp.)*

## TransAmerican Energy Inc.

- *Entered Utica Shale play via the St. Lawrence Seaway in Quebec*
- *Acquired 136,000 acres of Lacasse properties*

TransAmerican Energy Inc. moved into the Utica Shale play within and along the St. Lawrence Seaway in Quebec when it acquired its Lacasse properties covering 136,000 acres in 10 Utica- prospective permits. It specifically mentioned two permits, the Anticosti/Estuaire du St. Laurent with 19,560 acres and Bas St-Laurent with 9,744 acres.

The company said the Utica-equivalent Macasty Shale that lies under three-quarters of Anticosti Island has yet to be tested. ■

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# The Fledgling Utica

## Could it be the next Eagle Ford?

**By Jerry Greenberg**
Contributing Editor

Utica Shale exploration and production started about two years ago with the first well drilled and completed in 2010. Since then, operators have swarmed to the region, many of which already were active in the Marcellus Shale play. Chesapeake is the largest land leaseholder and the most active in terms of drilling permits obtained for future wells in eastern Ohio and western Pennsylvania where Utica's oil and gas condensate reserves lie. According to figures from the Ohio Department of Natural Resources, as of Jan. 1, 2012, the Bureau of Land Management has granted 98 permits for horizontal wells and operators have drilled 26 in the Utica/Point Pleasant Shales. The Bureau of Land Management also has awarded permits for 69 vertical wells (stratigraphic tests), of which 16 were drilled.

The most active area of the Utica play is in eastern Ohio and western Pennsylvania in the liquids-rich portion of the formation. Operators are adapting some drilling technologies from the Marcellus and applying them in the Utica. Additionally, many oil companies and service contractors are comparing this portion of the Utica play to the Eagle Ford Shale in Texas, and they have been applying technologies and lessons learned from the Eagle Ford to the Utica.

High build-rate rotary steerable systems (RSS) are relatively new and operators began using them in the Eagle Ford last year. Baker Hughes drilled several Utica wells with their high-angle RSS during field tests of the system prior to its official launch and commercialization. Turning to Utica completions, operators have completed all of the wells with a cased-hole and plug and perf (PNP) method. This method will continue at least until mid-2012 when Packers Plus is expected to perform several openhole completions.

Experts look for Utica drilling and completion activity to increase significantly in 2012 and, if operators realize the expected liquids-rich reservoir characteristics and production, for many years to come. However, dry gas areas of the Utica are another matter. Low natural gas prices and increased production from the Marcellus resulted in some operators such as Chesapeake to pull back on exploration and production activities there.

### Matched drilling system results in extremely fast Utica wells

Halliburton has been active in the Utica Shale since the beginning of the fledgling play a couple years ago, but the service company plans to go "all in" this year. Halliburton purchased land in Zanesville, Ohio, for a new operations center dedicated to the Utica play, and already has hired more than 70 new employees in the state. They are training in the Marcellus and then will be

The SperryDrill XL positive displacement motor and bit system. *(Image courtesy of Halliburton)*

dedicated exclusively to the Utica as activity increases. The company expects all of its product lines to be represented there.

Halliburton has clocked some extremely fast drilling runs with a matched combination of positive displacement motor (PDM) and drill bit. The company also has completed several wells with the PNP method. As for drilling, Sperry Drilling has been successful using its SperryDrill XL PDM coupled with Halliburton's Drill Bits & Services FXD54M matrix body bit. The same bit has experienced record runs in the Eagle Ford, which so many service companies equate with the Utica.

"Our average (Utica) well now typically is drilled in one run for the build and 6,000-ft lateral, and that takes about seven days," said Randy Guice, of Sperry Drilling's Northeast Business Development Group in Canonsburg, Pa. "Our fastest well was drilled in 74 hours for drilling the 8 degree per 100-ft build section of 1,100 ft of MD and a 4,000-ft lateral."

Guice noted that the company adapted its best practices from its Marcellus wells, where Sperry also is drilling using this particular motor/bit matched system, and optimized a few parameters as far as the PDM is concerned.

"Drilling has been easier in Utica because we don't have the complex geology seen in some of the northern Marcellus wells," Guice explained. "The Utica tends to shear and drill faster than Marcellus in the areas that we are currently working in."

Guice also attributed the faster runs to a directionally friendly bit as well as better engineering of its mud motors. Halliburton drilled its first Utica well off a whipstock milled through 7-in. casing. According to Guice, the company drilled a 6 ¾-in. section with a 4¾ mud motor in about 3½ days.

"We were amazed at how fast we drilled our build section and lateral once we set the whipstock and the window milling operation commenced," Guice said.

While the company is not going to change its drilling technique as long as the lateral length of the horizontals is within about 4,500 to 5,500 ft, it may have to use RSS when that length increases to about 8,000 ft or longer due to difficulty sliding. Upcoming wells the company expects to drill for a new customer could approach about 6,600-ft lateral length. However, Guice noted, laterals have not extended far enough yet, from a Sperry Drilling Operations perspective, for RSS to pay for themselves.

Halliburton Drill Bits & Services used its FXD54M bit for Utica's 8½-in. section and used a version of that bit to drill 8¾-in. holes in the Utica. While all of the wells Sperry drilled in the Utica required the PDM and FXD54M combination, several operators who used RSS in the Utica also used the bit with different pad lengths and different bit profiles.

According to the company, the matrix body bit is more durable and erosion- and abrasion-resistant than steel body bits. However, the bit is somewhat limited on the blade height-to-width ratio compared with steel, noted Guy Lefort, Halliburton's drill bit technology manager for the Northeast, Permian, and Southeast regions.

"We found what we believe is the optimum blade height and that we don't need the advantages of steel from a hydraulic cleaning standpoint," Lefort said. "We have an advantage of the durability of the body material to prevent erosion, lost cutters, and damage to the bit from lateral vibration."

Lefort also noted that the bit's tungsten carbide matrix is more durable from a bit life standpoint. "The bits come out of the hole with less damage and they seem to drill very fast," he said.

That could be due more to the similarity of the Utica to the Eagle Ford rather than the Marcellus. The company has set record bit runs in Eagle Ford with its FXD55M and FXD54M bits.

In one Eagle Ford well, an 8¾-in. FXD55M bit drilled 8,701 ft in the vertical, curve, and lateral sections at an average ROP of 91.1ft/hr while drilling the curve and building to 10 degree/100 ft at 64.6 ft/hr. The bit lateral performance included 40% sliding to maintain the tight target window and recorded instantaneous rates of penetration for 210 to 250 ft/hr.

Halliburton's Design at the Customer Interface (DatCI) process helped achieve these record bit runs, explained Ryan Hettinger, the company's Northeast area drill bits and services operations manager. DatCI is a continuous improvement loop that uses a global network of trained Application Design Evaluation (ADE) specialists who work directly with the customer to define application-specific bit solutions. According to Hettinger, the development process reduces the chance of misinterpreting the customer's needs. The ADE specialists work with IBitS 3D bit design software to optimize the design and provide the ADE with a direct link to manufacturing.

Sperry plans to use LWD tools during drilling operations to evaluate the formation and reservoir to optimize the completion. "A lot of formation evaluation will take place this year in the Utica and that will phase out once operators obtain a good picture of the reservoir," said Richard Vaclavik, Halliburton's Northeast area vice president. "When we do an evaluation, we develop what we call a ShaleLog service to determine and identify the brittleness of the formation for the best fracture to perforate."

Vaclavik said that while the Utica is still being evaluated, he believes that completion methods there will become similar to what is used in the Eagle Ford. "We will see the completion technique in the dry gas portion of the Utica similar to Marcellus completions, but as we move toward the liquids-rich Utica they will be more similar to those in the Eagle Ford.

"That means higher concentrations of larger proppants, typically with either a fully crosslink gel-type system or a hybrid gel system," Vaclavik continued. "The proppant size in the Marcellus is 40/70 and 100 mesh, with some 30/50. For proppants in the liquids-rich Utica we will see a lot more usage of 20/40, which is what is used in Eagle Ford."

The preferred Utica completion method presently is the cased-hole PNP technique "to ensure that the stimulation is going where the operator wants it to go," Vaclavik said.

"I do see some opportunity for a packer and sleeve potentially in some (Utica) completions going forward, but that technique has not been used much in the Northeast. A couple (openhole completions) were attempted in the region a few years ago that were not very successful, but they also were not in the Utica."

## High build-rate rotary steerables, hybrid completion systems

Operators typically use a PDM to drill the vertical section of the well, and, at times, use it to begin the kickoff for the curve. Operators then pull the bottomhole assembly (BHA) out of the hole and replace it with an RSS with reservoir navigation capability to complete the curve and the horizontal lateral sections. Switching to an RSS can save the operator time and money, as it can become difficult to keep up the efficiency of a PDM and bit through the entire curve and lateral. Sliding with a PDM can be challenging due to toolface control and drag issues. These often result in lower ROP while trying to steer through the sweet spot of the reservoir while drilling long horizontals. Though it is not impossible to drill and remain in the horizontal sweet spot using a PDM, an RSS typically is more efficient because of continuous near-bit information and automatic steering capabilities.

"We have seen increased demand for RSS in a majority of the shale plays," said Rajdeep Gupta, Baker Hughes' manager for drilling services in the company's unconventional resources unit. "Every play is different and needs unique treatment. Our primary objective is to help operators optimize days on wells by offering fit-for-purpose solutions and bringing in our experience from different areas to reduce drilling cost."

The company drilled the curve and lateral sections of several Utica wells with RSS in a single run for Chesapeake with outstanding results, Gupta noted, not only with the company's AutoTrak RSS but its high build-rate system as well. Baker Hughes has been field testing the high build-rate RSS, which it expects to officially launch and commercialize at the IADC/SPE Drilling Conference this month.

"Previously with RSS, we would drill the curve with a 4 to 6 degree per 100 ft dogleg severity," Gupta said. "With the high build-rate system, we have achieved 15 to 16 degree per 100 ft, which helps the operator to extend the lateral section exposure within the lease line boundaries. We also saved the operator five to six days per well."

Baker Hughes initially aimed to drill the Utica wells using high build-rate RSS with 10- to 12-degree curves; however, the company wanted to test the limits of the system, which exceeded expectations. The wells included a 1,000- to 2,000-ft curve and about 6,000 ft of horizontal lateral. While these results are impressive, Gupta explained that use of any RSS will be application-specific and likely will not phase out PDMs. He also noted that if an operator does not require a high build-rate RSS but still needs LWD tools to characterize the reservoir, then a standard RSS will provide more flexibility than a PDM.

According to Baker Hughes, its StarTrak high-definition LWD imaging system, while not having an opportunity yet to run in Utica, offers detailed reservoir characterization, structural classification, and wellbore integrity management in real time. The system obtains knowledge of faults and bed boundary orientations while drilling in complex reservoirs with a high degree of uncertainty, enabling the operator to optimize completions and production. Operators can only run the tool in water-based drilling fluids.

"When it is time to complete the Utica well, operators are casing the well and using the PNP technique," said Aaron Burton, business development manager, unconventional resources for Baker Hughes. "Starting out with this technique seems to be the trend because this method has more flexibility and contingencies should something go wrong.

"It is a very effective completion technique for appraisal. As operators learn more about the formation, techniques that are more efficient during the fracturing process will be considered, such as FracPoint and OptiPort multistage fracturing systems," Burton said.

As for drilling and completing longer laterals, once operators exceed the limit of coiled tubing or wireline, the completion methods are limited, Burton noted. That situation eliminates several completion methods that can be effective for shorter laterals. "Even with a ball drop system like the FracPoint system, once the operator goes out a certain length, the stages at the toe become difficult due to friction loss and ball seat orifice restrictions," he said. "If operators want a full production diameter, milling out the smaller ball seats require tripping in and out of the hole with a workover rig, and can be very time consuming and costly."

Service companies have created several hybrids of these completions as technology in shale plays have evolved. One method uses openhole packers rather than cement to provide annular isolation, and then use frac plugs and perforations to isolate and communicate to each stage though the tubing, which is essentially an openhole PNP completion. The cemented ball-activation system is another hybrid creation. This technology uses ball-activated frac sleeves, which are an integral part of the FracPoint system. The operator cements the assembly in the well bore for isolation rather than openhole packers. "Ultimately, the completion method should be chosen based on what is best for the formation and what meets the operators logistical and efficiency expectations," Burton said.

The company has performed several hydraulic fracturing jobs in Utica. "The Utica wells are treated essentially the same as in the Marcellus and that is with slickwater fracturing," said Eric Luckey, region engineer for Baker Hughes in Canonsburg, Pa.

"We are challenged slightly by the depth (of the Utica Formation), and friction pressures can be higher depending on lateral length," Luckey continued. "But I think one of the biggest considerations we need to make is in the chemical system

because we are encountering liquid hydrocarbons within the Utica."

Luckey noted that there are two ways to help mitigate the issue. Using non-emulsifiers is one way to make sure the frac fluid is compatible with the wellbore fluids, and another is pumping clay stabilizers with the frac fluid. "We haven't received mineralogy reports from the operators, so pumping clay stabilizer is insurance to make sure we don't have issues with swelling clays."

Proppant type is another issue operators are facing. "We are pushing closure pressure limits in the Marcellus with the proppants used there," Luckey said. "We have not seen any issues yet with the proppant crushing or flowing back, but since we are facing potentially higher closure pressures in the Utica, it is certainly a consideration moving forward as far as job designs." If necessary, the challenge could be met with higher strength proppants, ceramics, resin-coated sands, etc., essentially using different proppants with higher crush resistance.

## Channel fracturing stimulation method

Operators and service companies continue comparing the Utica Formation to the Eagle Ford Shale in Texas. "We are concentrating on this particular part of Ohio because it is the liquids-rich part of the Utica," said Kirby Walker, Schlumberger's stimulation domain manager for the northeast. "It is not so much the Utica but the Point Pleasant Formation operators are after, which underlies the Utica.

"Whenever you are comparing Utica to Eagle Ford, it really is Point Pleasant that looks a lot like the Eagle Ford, where you have black shales intermingled with organically rich limestone," Walker continued.

"There may be high breakdown pressure in high carbonate formations as far as completions

are concerned. There also may be issues placing sand," he said, "and we have seen that."

As a starting point, most Utica operators are using the same completion methods as in the Marcellus. There is very little sharing of production results among operators, so there also are different ideas of what should work and what does not as far as completions are concerned. Some Utica operators perform more stages with tighter cluster spacing while others perform longer stages completions with fewer clusters, Walker noted.

"We don't have a lot of good public production data to understand which techniques work and which don't," Walker explained, "but you can tell what operators are happy with by what technique they continue using."

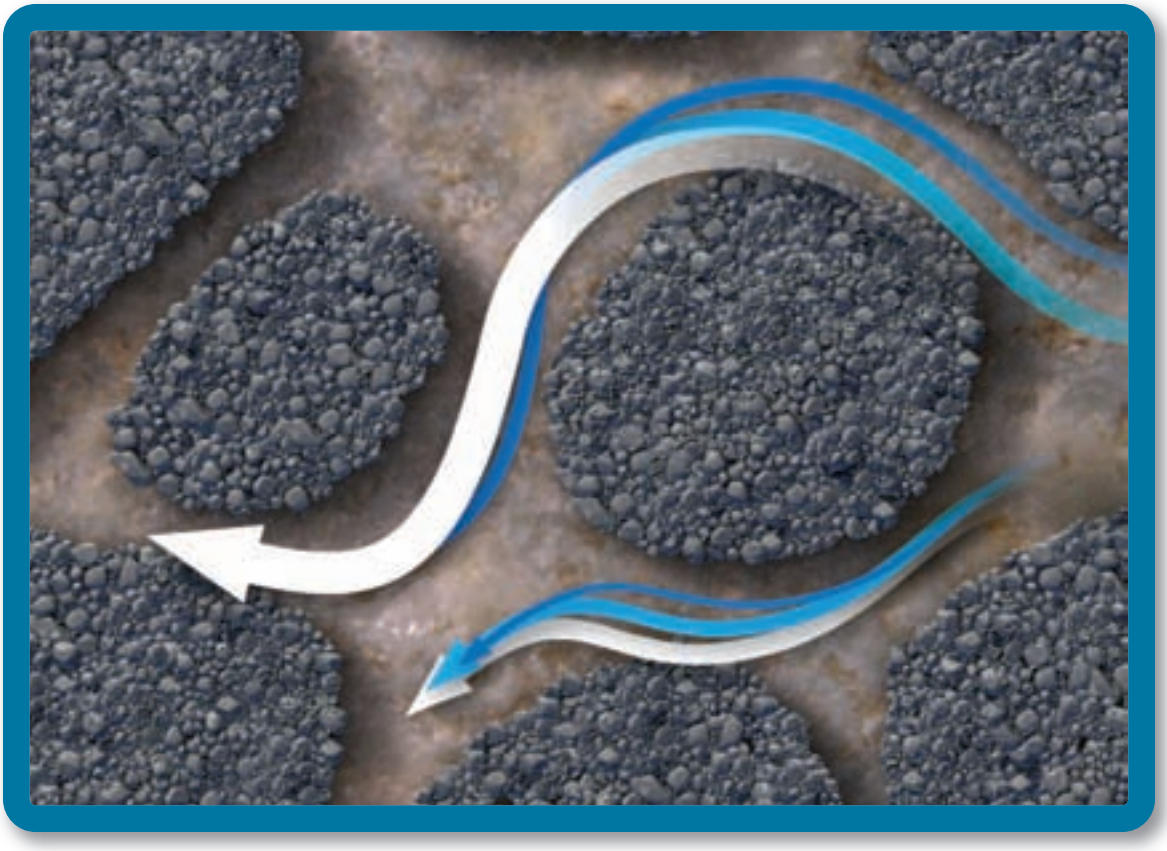
Operators are completing the relatively few Utica wells with the cased-hole PNP method with lateral lengths of 4,500 to 6,500 ft. However, there is talk about 10,000-ft laterals, Walker noted. Coiled tubing to mill out the plugs is one limitation on ultra-long horizontal laterals. Coiled tubing usually is limited to about 6,000 ft into the horizontal.

As for frac fluids, operators predominantly have used slickwater systems in the Marcellus, but they seem to use linear gels and crosslinked systems in the Utica. Extra viscosity in the fluid helps to get the extra frac width necessary to place the proppant, especially with higher breakdown pressures and issues with placing sand noted earlier.

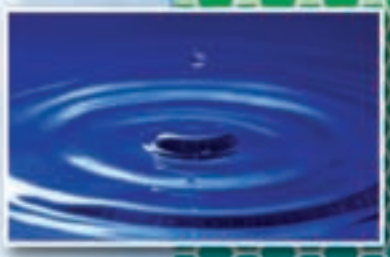
A higher level of carbonate in the Utica compared with a higher level of clay in the Marcellus makes it a harder rock. This, combined with similar to slightly higher closure stresses in the Utica, means that operators may begin placing larger proppant in those wells to avoid the potential crushing of natural sand proppants. Instead of 30/50 or 40/70, Walker said, operators may go up to a 20/40 size proppant provided they can create that the necessary fracture width.

"There also may be a need for intermediate strength proppant, which in other shale basins has more than paid for the increased cost in increased production by keeping the near-well bore open," he said.

Schlumberger has used its HiWAY channel fracturing method in three Utica wells to date. At the



The HiWAY flow-channel hydraulic fracturing technique decouples fracture productivity from proppant permeability and creates flow channels. Instead of flowing through the proppant pack, hydrocarbons flow through channels, increasing conductivity by orders of magnitude. *(Image courtesy of Schlumberger)*

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end of January 2012, these wells had yet to be flowed back, so the company does not have production results. However, Schlumberger does have about 2,300 HiWAY stages in the Eagle Ford and has seen a 20% increase in production. "We increased gas production in one well by 37% and oil production in another well by 32%," Walker said.

In addition to increasing oil and gas production, the frac method reduced the amount of proppant and fluid by as much as 40% less proppant and 24% less fluid in the Eagle Ford. "We are hoping to achieve those results in the Utica," Walker said.

HiWAY flow-channel hydraulic fracturing technique involves mixing fibers with proppant to create channels through the fracture network to enhance conductivity. Rather than leaving fracture flow dependant on proppant pack conductivity, the HiWAY technique creates stable channels for hydrocarbons to flow through, increasing the effective fracture conductivity. According to Schlumberger, in areas in which fracture conductivity is not limiting, the HiWAY service also improves production by increasing the effective area of contact with the reservoir.

The technique involves a unique combination of placement methods, materials engineering, completions techniques, and process control equipment, the company said. Operators ensure the stability of the flow channels by using a proprietary fiber, which maintains the structures from surface to reservoir until the fracture has closed and the *in-situ* stress of the rock takes over.

The productivity of the fracture decouples from the actual permeability of the proppant used. According to Schlumberger, rather than flowing through the proppant pack, hydrocarbons flow through stable channels, meaning infinite fracture conductivity. Traditional losses in proppant pack conductivity from crushing, fines, fluid damage, multiphase flow, and non-Darcy effects are eliminated, ensuring more fluid and polymer recovery, the company said.

"We are finding that HiWAY works in more and more formations," Walker said. "As long as the ratio (Young's modulus divided by the closure stress) is above 300 it is conducive to using HiWAY. Below that level may still be applicable, but after a closer look.

"We were being very conservative early on and now that ratio number is around 280, so it really has been pushed down. As far as the Eagle Ford and Utica, that ratio is down to about 600 to 800, so they are good candidates for its application," Walker said.

Operators have not used the method in Marcellus yet; however, in late January the company was preparing to stimulate a five-well pad where it is pumping two slickwater fracs and three HiWAY stimulations.

## Treating Utica's liquid-rich wells like Eagle Ford wells

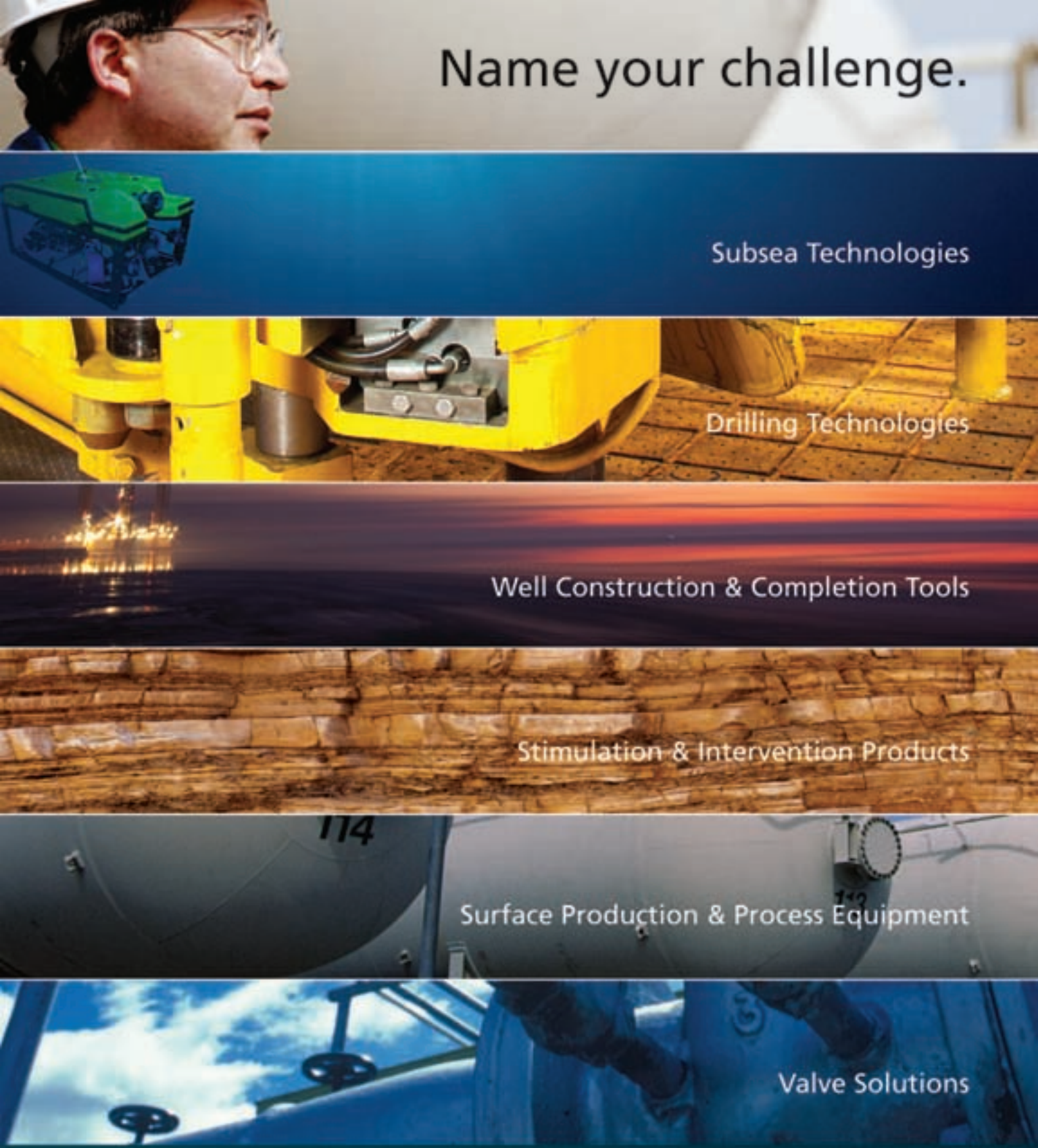
While the Utica Shale underlies the Marcellus by 3,000 to 7,000 ft, depending on the area, operators and geologists equate the Utica Formation as more comparable to the Eagle Ford than the Marcellus in terms of drilling and completion. Rocky Seale, US sales manager for Packers Plus, agrees. "That seems to be the correlation from the standpoint of the rock composition and rock mechanics, with its limestone and quartz content, and how it is going to break and fracture," he said.

"While a lot of people are equating the Utica with the Eagle Ford," he continued, "it is an independent shale play that is shallower than the Eagle Ford, so operators are stepping into the play with expectations that there are going to be some anomalies associated with the Utica."

Packers Plus has completed several Eagle Ford wells. In the Marcellus, the company completed many openhole horizontal wells early in the play, but operators thought the Marcellus needed to be stimulated using cluster perforations to induce multiple fractures and create a complex fracture network. However, Seale noted that philosophy is changing for Marcellus and Eagle Ford wells, and operators are re-evaluating single-point entry fractures rather than cluster configurations.

The company expects to begin operating in the Utica this year and has several openhole jobs scheduled for various operators. From a mechanical standpoint, Packers Plus will begin as simply as possible in the Utica, initially using its StackFRAC method. Utica horizontal well sections generally range about 3,000 to 3,500 ft in length, Seale said, and he recommended beginning with 15 or 16 stages.

"We have a good run history and good per-

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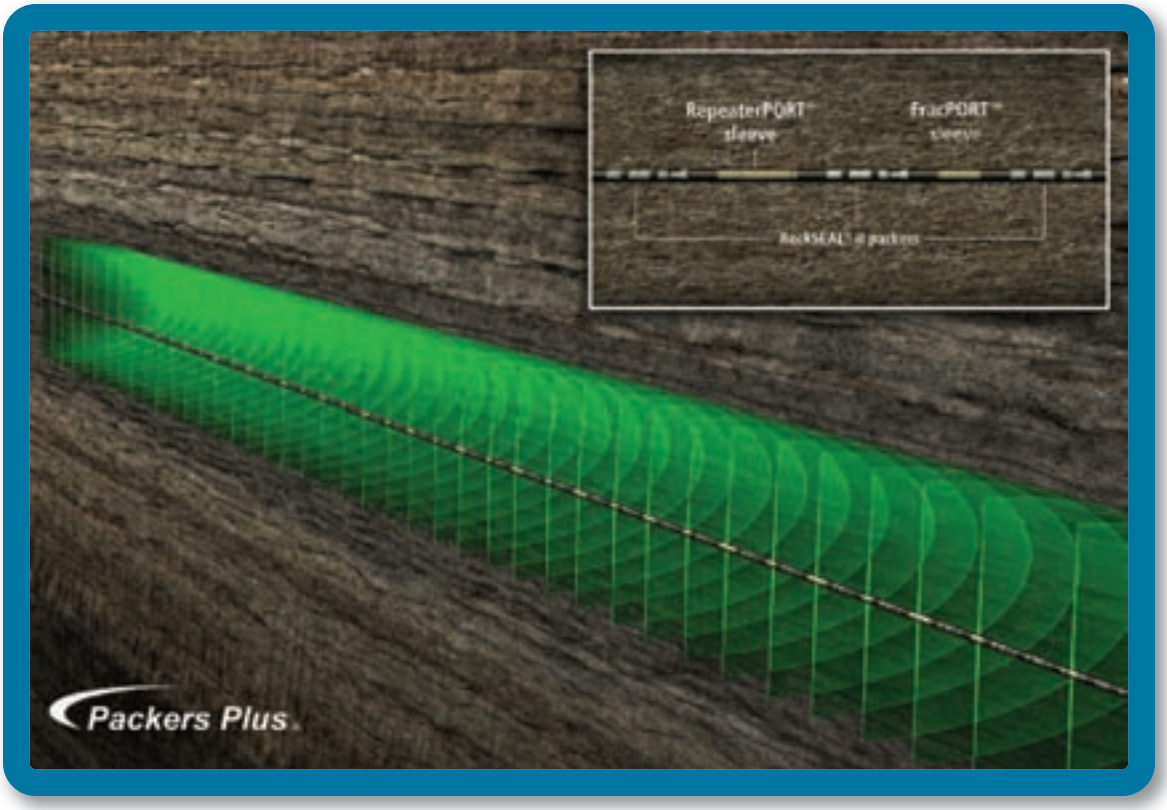


Packers Plus RepeaterPORT sleeve stage multiplier technology allows more than one stage to be opened using the same size ball. This system could be used for future Utica completions. *(Image courtesy of Packers Plus)*

formance data and we can modify the mechanical completion as far as stage spacing and entry points," he said. "The perfect example is the Bakken Shale where we started about four years ago doing six stages and now we are performing as many as 40 stages."

Seale also explained that the company's recently developed RepeaterPORT sleeve would be relevant technology in the Utica as well as the Eagle Ford because it allows more stages but maintains a single-point entry. According to the company, the RepeaterPORT sleeve is a ball-actuated, hydraulically activated flow port that allows for more than one stage to be activated with the same size actuation ball. The company runs it in conjunction with a FracPORT sleeve with the same ball seat size. Each sleeve runs between two RockSEAL II packers to allow specific zones of the well bore to be isolated and selectively fractured, effectively increasing the number of stages available in the company's StackFRAC HD (high density) system.

The company assembles the RepeaterPORT sleeve in the completion string and runs it into the well bore to the planned depth. It then inserts the appropriate ball size in the string and pumps it down onto the seat. The company pressures up the toolstring and activates the sleeve as the ball passes through it. The ball continues down the liner and lands in the FracPORT sleeve. The company further pressures up the toolstring to open the FracPORT sleeve, allowing stimulation fluid to flow into the annulus. It then inserts a second actuation ball of the same size into the string and pumps down the RepeaterPORT sleeve seat. Finally, the company pressures up the toolstring to open the RepeaterPORT sleeve, allowing stimulation fluid to flow into the annulus.

According to Packers Plus, the QuickFRAC system is capable of fracturing 60 stages while pumping only 15 treatments at surface. Using limited entry diversion techniques and the company's proprietary technology, the system allows the operator to fracture several isolated stages at one time through a batch fracturing method. The system is a set of tools capable of simultaneously stimulating multiple stages with a single fracture treatment. For each treatment zone, the system includes a number of QuickPORT sleeves

flanked by RockSEAL II packers, which creates multiple, individually isolated stages within a single treatment zone. An actuation ball available in multiple sizes activates each treatment zone, enabling operators to stimulate several fracturing zones in succession with the biggest ball at the top. The system evenly will distribute the fractures in a select zone of the well bore. The company has tested the system in the Bakken, Horn River, Montney, and other shales.

Packers Plus inserts the appropriate size ball into the string and pumps down onto the seat. The company pressures up the toolstring to activate and open the QuickPORT sleeves to allow stimulation fluid to flow into the annulus. A variety of ball sizes are available, allowing operators to run multiple rounds of fracture treatments in sequence. After the operator completes the stimulation, it can flow back the balls and mill out the system.

Packers Plus developed QuickFRAC for openhole completions, eliminating the need to cement, perforate, and run bridge plugs. No rigs are required for the job. The conventional way of performing multistage fracturing is the cemented liner PNP method, which includes casing and cementing the entire horizontal, which basically cuts off any inflow from the horizontal. The operator must perforate, pump water and sand down the liner, trip in with coiled tubing or wireline to set a bridge plug, and then move up the well bore and repeat the process. This method involves over-displacing proppant, which the company avoids by running continuous pumping operations.

With the QuickFRAC system, the operator drops a ball and activates and opens three stages, for example. Each port has a nozzle restriction designed to allow a specific pumping rate. If an operator wanted to perform a 30-stage job, instead of being on location for several days to pump 30 individual stages, the system can pump 10 stages on the surface while delivering 30 stages downhole by dividing each interval into three specific stages. If each interval requires 20 bbl/min on surface, the operator would pump 60 bbl/min and each of the three intervals in this example would receive 20 bbl/min. According to the company, the operator uses about the same amount of proppant volume and it can reduce the total time to frac the well by two-thirds.

## Preparing water management solutions for the Utica

Water management solutions for any oil and gas operation are crucial to successfully drill and complete wells. Water treatment processes result in access to water needed for the well completion process as well as provide clean, usable water from contaminated flowback and produced water. This saves the operator thousands of dollars per well in addition to reducing the environmental footprint of the drilling operations. Select Energy Services, active in numerous North American shale plays including Haynesville, Eagle Ford, Barnett, Fayetteville, Woodford, Granite Wash, Niobrara, Bakken, and Marcellus, is preparing for the anticipated increase in drilling and production operations in the Utica Shale. Many of the water treatment options in other shale plays are adaptable to Utica.

"We have been acquiring water rights and permits as well as acquiring land to develop sites for our equipment and services," said Jeff Gross, the company's director of water solutions and business development for the northeastern US. "We have sites already permitted and available for us to provide water to our customers, and we also are exploring the re-use of industrial water from a facility in Ohio that could be usable for fracing operations."

Additionally, the company, which operates salt water disposal wells, is in various stages of the permitting process for multiple saltwater disposal wells for Utica operations. Select Energy Services also recently opened a Utica Shale headquarters office in Carrollton, Ohio, that will serve as its operations base for the area. The company expects to employ about 200 people in the area by the end of the year.



Select Energy Services currently has no centralized treatment locations in the Marcellus or Utica. The company relies on trailer-mounted equipment to bring the facilities as close to the well site as possible. The company has centralized water treatment sites in several shale plays, but not in Marcellus nor are any currently planned for Utica. "We either pipe or truck water to the well site," Gross said, "but we try to pipe as much as possible to reduce truck traffic."

The company has invested in numerous technologies to treat flowback and produced water. The level of treatment ranges from filtration of the flowback water, which is then blended with freshwater for fracing, to electro coagulation (EC) with its Water Rescue Technology for removal of iron, turbidity, bacteria, and other dissolved and suspended solids including hardness reduction. The standardized system using EC technology will treat between 1,500 to 20,000 b/d through the EC unit.

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Water Rescue Services, a Select Energy Services partner, treats produced water with its mobile unit during a recent hydraulic fracturing operation. *(Photo courtesy of Select Energy Services)*

If additional treatment is required, the company can use the Protreat advance precipitation technology to remove specific cations and anions and soften the water in addition to removing iron, turbidity, and solids. The process treats flowback and produced water and produces a sodium/potassium chloride brine solution for re-use in fracing operations. The first treatment facility is in Weld County, Colo., servicing the DJ Basin and Niobrara Shale. The companies also are working on a mobile version of the treatment process.

The industry can treat water to the point that it produces distilled water and dry salt, but it has used it sparingly. "We have the ability to apply a distillation/crystallization process, but we haven't seen a lot of need at this time in the Marcellus and at current conditions. We don't anticipate the immediate need for the Utica," Gross said. "However, we know that day is coming when fracing operations wind down and production ramps up, producing highly salty brine.

"It will be very expensive to truck that brine to a disposal well, so we are prepared to provide the evaporation, distillation, and crystallization process where the end product basically is dry salt and fresh distilled water."

Presently Select Energy Services disposes of untreated flowback water in its disposal wells in the region and in other shale plays. However, the company is working on a program to utilize certain treatment technologies to remove water from the flowback and produced water and then dispose the concentrated brine in the wells. "The result," Gross said, "is instead of injecting 1,000 bbl of water in the well, you only inject 400 to 500 bbl, expanding our well capacity because we would be injecting a lower volume of brine.

"We are using that concept in other shale plays and we will be implementing the process in the Utica as the volume increases," Gross said.

Several states have become wary of containing flowback and produced water and even clean water in ground containment pits, Gross noted. One solution the company uses is called a Muscle Wall aboveground containment system. The company recently purchased a 50% stake in Muscle Wall Holdings, which provides the mobile, reusable systems. "We go onsite and set up and pump the water into the containment system, treat it as necessary through our systems, and then store it in another containment system to ultimately transfer the water back to the well site for fracing operations as the operator requires it," Gross explained. ■

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# A Marcellus and Utica Update

## Midstream infrastructure expands as the Utica, Marcellus plays thrive.

**By Skip Simmons**
Contributing Editor

Marcellus gas development has proceeded at full throttle and a number of midstream infrastructure projects have followed. With production from the play averaging 607 Bcf/d between July and December of 2011, the USGS raised its resource base estimates to 84 Tcf. As 2011 came to a close, considerable uncertainty remained in the various states' regulatory arenas, specifically the continuing dialog related to hydraulic fracturing and reporting requirements, concern about earthquakes in eastern Ohio thought to be the result of Marcellus brine injections into a deep disposal well, and final decisions on hydraulic fracturing regulations from New York state regulators that may have caused some operators to cancel their leases and develop elsewhere for now.

The Marcellus and Devonian shale gas plays underlay portions of six northeastern states and cover 95,000 sq miles. The majority of developing and developed Marcellus Shale gas is in northwestern West Virginia and in Pennsylvania with lesser quantities developed to date in New York. The West Virginia and southwestern Pennsylvania developments generally have involved hydrocarbon-rich gas, while gas in other developed areas generally is dry, pipeline-quality gas.

The Utica Shale underlies the Marcellus throughout much of its footprint and extends westward into Michigan, southward into Kentucky and Tennessee, and northward into Ontario and Quebec. Operators initially focused on developing north-central Ohio and eastward along the Ohio/Pennsylvania border. Earlier efforts in upstate New York along the Canadian border and into Quebec proved some what successful but development issues remain there.

In 2011, initial exploratory efforts in Ohio's Utica Shale provided a glimpse as to what some operators believe to be another Eagle Ford-type and potentially Eagle Ford-class shale development opportunity. Utica development is exploratory at this time. Information often is tightly held as leasing continues in some parts of the state and/or joint venture or other commercial arrangements are being negotiated. Initial indications show that Utica may be somewhat of an analog to the Eagle Ford Shale geology with a shallow oil window in west-central Ohio, a narrow wet gas window moving eastward, and a drier gas window near the Ohio, West Virginia, and Pennsylvania borders. Though much too early in the development cycle to identify longer-term midstream infrastructure locations and needs, parties believe, based upon initial exploratory results, that future infrastructure needs will include the ability to manage crude oil, high-grade condensate, wet gas, natural gas liquids, and marketable natural gas. Initial area efforts will be supported as they were in the Marcellus area by truck, rail, and barge operations on the liquids side with wet gas processed partially onsite to remove heavier hydrocarbons and then routed to existing area gas pipelines. Gas blending operations similar to those employed in the Marcellus play will suffice until operators build centralized gas processing and/or other NGL handling facilities, and they realize full NGL value potential.

Hydrocarbon-rich Gas Midstream Infrastructure

| Operator/System | Size/Commercial Capability | In Service |
|---|---|---|
| **Caiman Energy** | | |
| Ft. Beeler gathering, gas plant, fractionators, and NGL pipeline | Processing 0.12 Bcf/d, expanding to 0.32 Bcf/d by early 2011 and to 0.52 Bcf/d by late 2012. NGLs currently are routed by pipeline to Mark West Liberty Houston, PA fractionator. | Partial |
| Moundsville, WV fractionator | 27,500 b/d of fractionation capacity on Ohio River | Partial |
| **Dominion Transmission Inc.** | | |
| Hastings, WV processing plant | 0.18 Bcf/d wet gas processing capability with fractionator capacity of 13,000 b/d. Storage, rail, truck, barge, and pipeline capabilities for NGL's disposition. | Yes |
| Natrium processing plant | 0.2 Bcf/d wet gas gathering capability to Natrium,WV gas processing plant and fractionator. NGL capacity: 36,000 b/d (4Q 2012). | No |
| Natrium expansion | Expand to 0.4 Bcf/d and 59,000 b/d (future) | No |
| Line TL-404 project WV,PA,OH | Gather processable gas from Marcellus developments in WV and Utica developments in OH (from East Ohio Gas). | No |
| Northeast Marcellus Project, PA | 0.2 Bcf/d receipts from Southwest PA to Leidy Hub (2012) | No |
| **EQT Midstream** | | |
| Gathering PA | 0.13 Bcf/d to Equitrans system, Total capacity 0.39 Bcf/d | Yes |
| Gathering WV | 0.085 Bcf/d to Equitrans system | Yes |
| **Keystone Midstream** | 0.04 Bcf/d Sarsen plant | Yes |
| Gathering PA | 0.05 Bcf/d Bluestone plant (2Q 2012) | No |
| **MarkWest Energy Partners** | | |
| Siloam NGL Complex, KY | Receives NGLs from four non-Marcellus regional processing plants. Temporarily, Marcellus' heavier NGLs are trucked there until Houston, PA fractionator is complete. Fractionator has 24,000 b/d capability with storage, truck, rail, and barge disposition for NGLs. | Yes |
| **Mark West Liberty** Majorsville, WV gathering and gas plant | 0.27 Bcf/d wet gas receipts at Majorsville, WV gas plant. Connecting NGL pipeline to Houston, PA fractionator as well as extending NGL pipeline to connect to Caiman Energy's Fort Beeler plant NGL pipeline. | Yes |
| **Mark West Liberty** Houston, PA gathering and gas plant | 0.36 Bcf/d wet gas receipts at Houston, PA gas plant. Current depropanizer at 27,000 b/d with full fractionator at 60,000 b/d. Has rail and truck loading facilities as well as propane pipeline to Enterprise/TEPPCO NGL pipeline. | Yes |
| **Mark West Liberty** Mobley, WV gas plant | Mobley 1: 0.12 Bcf/d gas plant straddling portion of Equitrans pipeline (2Q 2012). | No |
| | Mobley 2: 0.2 Bcf/d gas plant | No |
| | An NGL pipeline will be constructed to connect to the Houston, PA fractionator (3Q 2013.) | No |
| **Nisource Midstream Services** | | |
| Gathering system PA | 0.1 Bcf/d wet gas to Mark West Liberty Majorsville plant. | Yes |
| Gathering system WV | 0.25 Bcf/d wet gas to Mark West Liberty Majorsville plant. | Yes |

*(Tables by Hart Energy)*

## Utica liquids potential

An unknown to the regional development equation is what level of NGL product operators will achieve from the Utica Shale. Assuming operators find similar ethane content in the Utica developments, one would expect that initial Utica developments would return ethane to the gas stream as did Marcellus in its initial development periods or share developing ethane pipeline capacity with Marcellus ethane. Then-existing ethane pipelines may also be expanded. A larger potential problem exists, however, for the heavier NGLs, as those products currently piped, trucked, or railed within the region likely will exceed local market or regional demand, and operators may require alternative infrastructure solutions for those NGLs in future years.

Well ahead of the game and for future consideration by Utica operators, El Paso recently proposed a Utica Gas Header Project that would use a 26-in. Tennessee Gas Pipeline in Ohio converted to provide a hydrocarbon-rich gas service. Initially providing a header for blending and limited processing/refrigeration capability, the facility would evolve over time to provide a long-term processing solution to Utica producers. The project would accommodate up to a maximum of 1.2 Bcf/d of rich gas with potential NGL outlets to existing area NGL pipelines as well as routing ethane to the Mariner West Pipeline, to the ATEX project, and to El Paso's proposed MEPS project.

## Neighboring Marcellus contains hydrocarbon-rich gas

Over the past several years, operators have developed extensive gas-processing and NGL liquids-handling infrastructure in West Virginia and southwestern Pennsylvania. In addition to facilities required for natural gas transportation, operators have developed and continue to develop major new midstream infrastructure to allow natural gas liquids to be removed from the flowing wellhead production and deliver those products to their related markets. This midstream infrastructure includes implementation of wet gas-gathering systems, associated gas-processing plants, fractionation facilities, product storage tanks, and truck and rail loading facilities. Operators aggregate and market those natural gas liquids, valued relative to an expected higher forward crude oil price forecast, above what those same products would have received had they remained in the gas stream and been priced and sold therein. Although not as rich in hydrocarbon content as some other developing shale plays, operators are building gas-processing facilities in the Marcellus region in a number of key locations.

Developments in southwestern Pennsylvania and West Virginia most often consist of rich gas streams. Operators have developed them in association with area gas-processing and natural gas liquids-handling capabilities. Operators have implemented gas-processing plants and/or fractionators as well as made connections to local NGL transportation and distribution capabilities such as truck, rail, and barge.

Ironically, portions of the rich gas streams that operators are developing are higher in ethane content relative to other US shale developments and relative to other US domestic gas sources. This higher-than-average ethane content becomes an increasing concern over time due to proximity to nearby downstream gas consuming markets or regional gas storage facilities. To date, operators have blended ethane with other regional flowing gas to continue to meet transporting pipeline gas-quality specifications. Many regional gas pipeline operators have signaled that ongoing area development will yield actual production volumes flowing from the richer Marcellus sources that will have exceeded regional pipeline blending options and flexibility by 2013 and thereafter. At that point, regional processing and/or treating infrastructure capabilities to remove the excess ethane quantities and evacuate it from the area must be in place.

Some parties have agreed to ethane pipeline solutions and will extract ethane from the gas stream to flow via ethane pipelines to downstream consuming markets. The Mariner West project, a joint venture between Mark West Energy Partners and Sunoco Logistics, is the first ethane pipeline solution. Currently under construction, Mariner West will use a combination of existing/converted Sunoco facili-

Current and Proposed Marcellus Area Major Dry Gas Systems

| Operator, System | Size/Commercial Capability |
|---|---|
| **Anadarko**<br>Grugan gathering | 0.2-0.6 Bcf/d. Dry gas connection to Transco pipeline.<br>Expandable to 1.15 Bcf/d capability. |
| **Boardwalk Field Services (for Southwestern)**<br>Gathering system, PA | Phased-in, 0.275 Bcf/d gathering of dry gas and delivery to Tennessee Gas (2012+). |
| **Chesapeake Midstream Partners**<br>Appalachia Midstream Services | 1.0 Bcf/d dry gas gathering |
| **Chief Oil & Gas**<br>Gas gathering and compression | 0.3 Bcf/d dry gas delivery into Transco |
| **Crestwood Midstream Partners**<br>Tygart Valley gathering WV | 0.2 Bcf/d dry gas delivery to Columbia Gas (2Q 2012) |
| **DCP Midstream/Magnum Hunter**<br>Eureka Hunter Pipeline | 0.2 Bcf/d dry gas to Dominion |
| **DTE Energy**<br>Bluestone gathering system | 0.7 Bcf/d dry gas delivery to Millennium (2Q 2012) |
| **Dominion Transmission Inc.**<br>Northeast Marcellus Project PA | 0.2 Bcf/d receipts from Southwest PA to Leidy Hub (2012) |
| **Laser Northeast Gathering Company, LLC (acquired by Williams Partners, 4Q 2011)**<br>Susquehanna Pipeline | 0.4 Bcf/d gathering and dry gas delivery to Millennium Pipeline |
| **M3 Midstream LLC**<br>Gas gathering system WV, PA | 0.73 Bcf/d gathering and dry gas delivery to Texas Eastern (2012) |
| **National Fuel Midstream**<br>Covington gathering<br>Trout Run gathering | 0.15 Bcf/d gathering. Delivery to Tennessee<br>0.3 Bcf/d gathering. Delivery to Transco |
| **Penn Virginia Resource Partners**<br>Gas gathering system, PA (for Range Resources) | 0.85 Bcf/d dry gas gathering system |
| **Superior Appalachian Pipeline**<br>Bruceton Mills gathering system, WV<br>Snow Shoe Pipeline | 0.22 Bcf/d of dry gas gathering with delivery to Columbia Gas<br>0.75 Bcf/d of dry gas gathering with connection to Texas Eastern and to Dominion |
| **UGI Energy Services**<br>Auburn Gathering system, PA<br>Extension/connection to Transco Pipeline (2Q 2013) | 0.12 Bcf/d dry gas delivered into Tennessee Gas Pipeline<br>0.2 Bcf/d additional dry gas capacity with delivery to Transco |
| **Williams Pipeline Partners**<br>Gas gathering system acquired from Cabot (late 2010)<br>Gathering system expansion<br>Springville gathering | 0.4 Bcf/d dry gas with delivery to Tennessee<br>Will add 0.85 Bcf/d gathering by 2013<br>0.45 Bcf/d dry gas gathering. Delivery to Transco |
| **Williams Partners/Chevron JV**<br>Gas gathering/Laurel Mountain Midstream<br><br>Laurel Mountain Midstream expansion | 0.2 Bcf/d from regional conventional gas wells, adding 0.5 Bcf/d from Marcellus wells<br><br>0.7 Bcf/d with delivery to TX Eastern, expect total capacity to be 0.9 Bcf/d by 2013 |

Interstate Gas-pipeline Proposed Take-away Projects: Marcellus and Utica*

| Type of facility/location | Operator/ Owner | Size/Commercial capability |
|---|---|---|
| Appalachian Gateway project | **Dominion Transmission Inc. (DTI)** | 0.475 Bcf/d gas receipts with delivery to TX Eastern and/or Dominion at Oakford, PA (2012). |
| West Virginia/Southwestern PA | | 0.15 Bcf/d transport gas by DTI from Tennessee 300 line in northern PA to Tennessee 200 line in NY (3Q 2012) |
| Northeast Marcellus Project, PA | | 0.2 Bcf/d. Receipts from Southwest PA to Leidy Hub (2012) |
| Equitrans Marcellus expansion | **Equitrans** | 0.13 Bcf/d and 0.43 Bcf/d dry gas receipts from Mark West Majorsville plant. Total 0.7 Bcf/d. Can be further expanded to 1 Bcf/d (in service) |
| Sunrise project –new compression and pipelines in WV and PA | | (2Q 2012). Provide ability for EQT to manage increasing receipts from both liquids rich and dry gas plays |
| 2-Phase expansion/compression | **Millennium Pipeline** | 0.3 Bcf/d added capacity by 2013 |
| Lamont Compression (2 phases) | **National Fuel Gas Supply Corp.** | 0.09 Bcf/d. Delivery to Tennessee 300 line (in service) |
| Line "N" replacement, expansion, and compression (2 phases) | | 0.16 Bcf/d (in service) and 0.15 Bcf/d (2012). Southwestern PA receipts with delivery to TX Eastern |
| Empire Pipeline's Tioga County extension (operated by National Fuel) | | 0.2 Bcf/d. Delivery to Millennium Pipeline and Tennessee Gas. (in service) |
| Northern Access expansion (for Statoil) to Ellisberg, PA | | 0.32 Bcf/d. Delivery to NFG for transportation to Canadian border (4Q 2012) |
| West to East (W2E) project and Appalachian lateral projects | | 0.485 Bcf/d. Southwestern Pennsylvania receipts with added delivery to Leidy area Hub (2013) |
| Northeast supply diversification project | **Tennessee Gas Pipeline** | 0.25 Bcf/d dry gas receipts on Line 200 (2012) |
| Tennessee Gas – line 300 expansion/replacement PA/NY/NJ | | 0.35 Bcf/d dry gas receipts with delivery to downstream markets and 0.3 Bcf/d upstream delivery to Henry Hub (in service, 11/2011) |
| Northeast Upgrade project | | 0.25 Bcf/d delivery to downstream markets (2012) |
| MPP project | | 0.24 Bcf/d additional expansion of Line 300 to existing delivery points on TGP system (3Q 2013). |
| TIME III/Southwestern PA | **Texas Eastern (TETCO)** | 0.455 Bcf/d delivery to northeast markets via TETCO and Transco. (in service) |
| TEAM 2012 /Southwestern PA | | 0.19 Bcf/d delivery to northeast markets via TETCO |
| Texas Eastern/ Algonquin Gas transmission: NJ/NY project | | 0.8 Bcf/d of new transportation capacity from NJ to Con Edison in NY (4Q 2013) |
| Ohio Pipeline Energy Network* (Utica) | **Texas Eastern (TETCO)** | Add up to 1 Bcf/d of transportation capacity on the Texas Eastern pipeline system in Ohio. American Electric Power (AEP) and Chesapeake Energy Marketing are participants (4Q 2014) |
| Northeast Supply Project | **Transco** | 0.12 Bcf/d (4Q 2012) and 0.22 Bcf/d (4Q 2013) delivery to downstream markets in PA/NJ |
| PennStar Pipeline project (proposed) | **UGI Energy Services/NiSource Gas Transmission & Storage** | 0.5 Bcf/d of future transportation capacity on the Columbia Gas system in PA with interconnects to Transco, Tennessee, Dominion, and Millennium pipelines |

In January 2012, Enterprise Products Partners also announced that it would build a new Marcellus ethane pipeline with a newbuild 595-mile pipeline...

ties and new connecting pipeline facilities to route up to 65,000 b/d of ethane to existing Canadian markets in Sarnia, Ontario. Service is expected by 4Q 2013. Contracts with Nova Chemicals support the Mariner West project. In fact, Marcellus operator Caiman Energy recently announced an arrangement for NOVA Chemicals to purchase up to 15,000 b/d of ethane from Caiman's Fort Beeler gas-processing plant. Later in 2011, NOVA Chemical and Range Resources also signed a contract for Range to provide a long-term supply of ethane to Nova.

In January 2012, Enterprise Products Partners also announced that it would build a new Marcellus ethane pipeline with a newbuild 595-mile pipeline routing southward from southwestern Pennsylvania to Cape Girardeau, Mo., where it would connect with a reversed, existing Enterprise 16-in. pipeline to the Gulf Coast. The so-called ATEX Express Pipeline then would connect to Enterprise's existing Mont Belvieu, Texas, natural gas liquids storage and distribution complex by a 55-mile, 16-in. pipeline facility. Enterprise expects the 125,000 b/d project to be in service by 1Q 2014. Just recently, however, Enterprise announced that requests have exceeded this proposed capacity; negotiations continue as to when or if Enterprise will increase the proposed project size and how that might impact the project timeline.

Regional operators are considering other ethane pipeline project proposals. Some of these proposals would route eastward towards the Philadelphia area, some would route westward towards the Chicago area, and others would also route to the Gulf Coast. Meanwhile, Shell Chemical is evaluating building a major petrochemical complex in the Marcellus region with such a facility becoming a major ethane consumer. The states of West Virginia, Pennsylvania, and Ohio (Utica) are all encouraging Shell or others to locate the multibillion facility in their state. With pipelines proposed to export regional ethane to other markets, a critical path item for these decisions becomes the long-term sustainability and availability of ethane which will remain in the area from not only the Marcellus but from the developing Utica Shale as well.

Pipelines, trucks, rail, and barges have transported other NGL product currently generated in the Marcellus region to local and regional markets. Operators are adding area gas-processing plants, expanding existing plants and fractionators, as well as connecting these facilities to NGL transportation and distribution systems. Adding ethane pipelines should minimize any expected near- to mid-term concerns for downstream pipeline gas-quality issues. With favorable ethane pricing, ethane producers also should realize added overall NGL value.

## Major Marcellus area dry gas-gathering systems

Many of the Marcellus gas-gathering systems in central Pennsylvania and other areas of the play are focused on dry gas development and connecting those facilities to existing regional pipelines. After implementation to support initial development activities, operators are expanding and/or consolidating many of these gathering systems. Operators will continue to develop other gas-gathering systems as regional supply development activity remains steady.

## Marcellus producers push supply further east

After producing, gathering, and treating to pipeline quality where required, the Marcellus operators connect volumes to regional interstate and intrastate pipelines for delivery into the market. Most of the pipelines in the Northeast are sold out from a firm transportation capacity standpoint, both for annual gas transportation service from distant supply areas and from regional storage facilities providing firm

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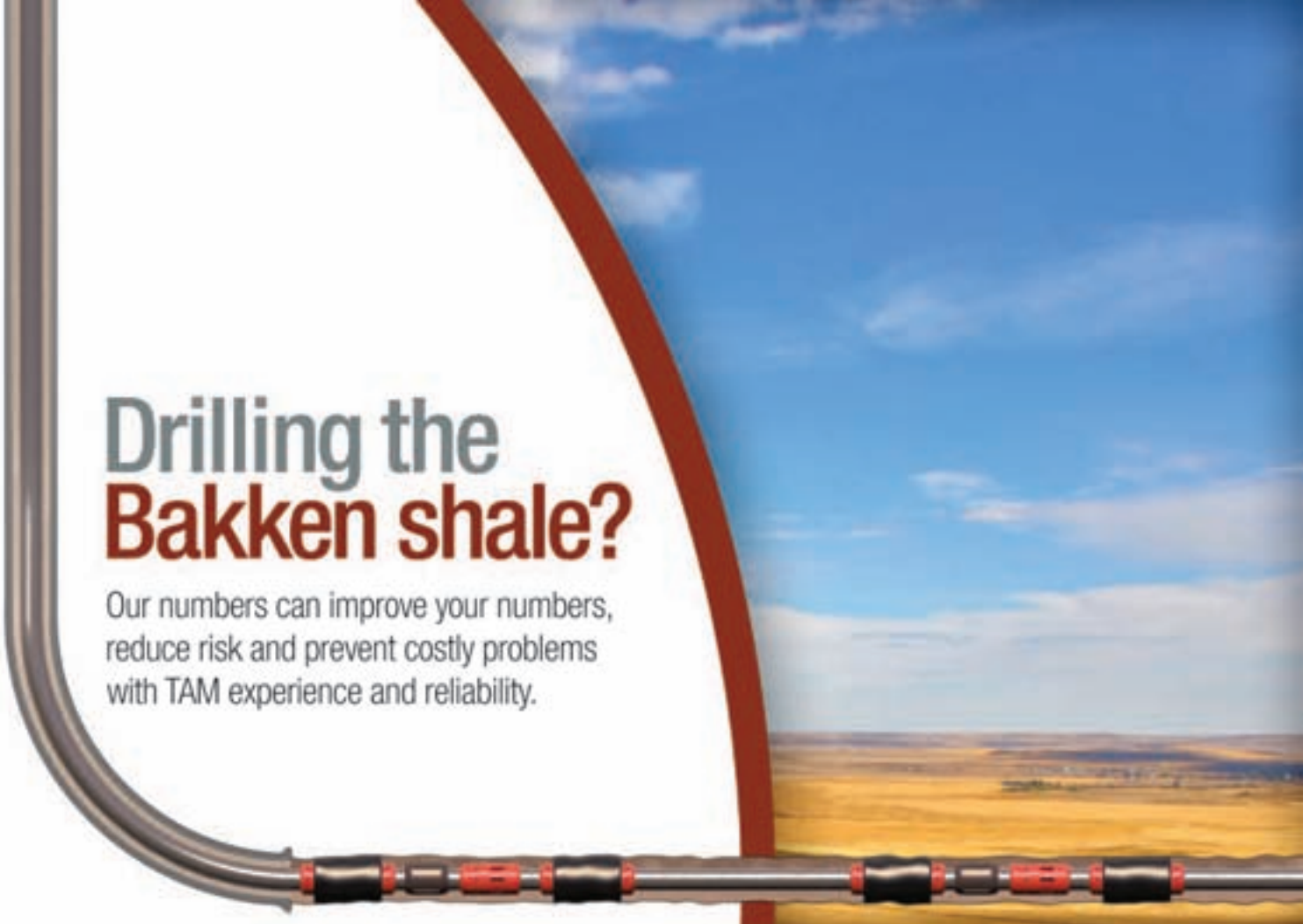

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seasonal withdrawals of gas in the winter months. Historically, downstream market demand for additional flowing supply or storage drives most area pipeline capacity expansions rather than upstream supply availability as the driving force. However, a number of Marcellus producers have elected to push their supplies deeper into the market area, and Utica producers are expected to do likewise when their volumes reach sufficient scale.

Interstate pipeline expansions (see related table) represent a unique combination of firm capacity offerings. Some offerings provide for short-haul expansions that improve the connectivity of Marcellus volumes to points on the regional pipeline grid where firm capacity already may be available to downstream markets or regional gas storage (i.e., a feeder-type role). Other expansions represent construction of incremental firm capacity that provides direct access to downstream markets in the northeastern US. Parties will evaluate numerous other projects for future implementation, with most of them needed from 2013 and beyond. In the interim, the developing Marcellus supplies effectively will compete for access to existing firm pipeline capacity and market share, in many cases backing off gas supplies previously received from distant supply areas.

In spite of the possibility for new hurdles to regional supply development, Marcellus midstream gas and NGL infrastructure development has continued. Even in a lower overall natural gas price environment, most Marcellus producers have stayed the course. Parties remain committed to assuring that these facilities are in place to gather, treat, process, and move the developed resources into the regional markets or export them from the region to markets elsewhere. The Marcellus play continues to be heralded as world-class, and its aggressive midstream infrastructure buildout continues to anchor its competitive position. ■

# The Utica Shale: Competing with the Big Boys

## The Utica is not a liquids-rich utopia, but it will do.

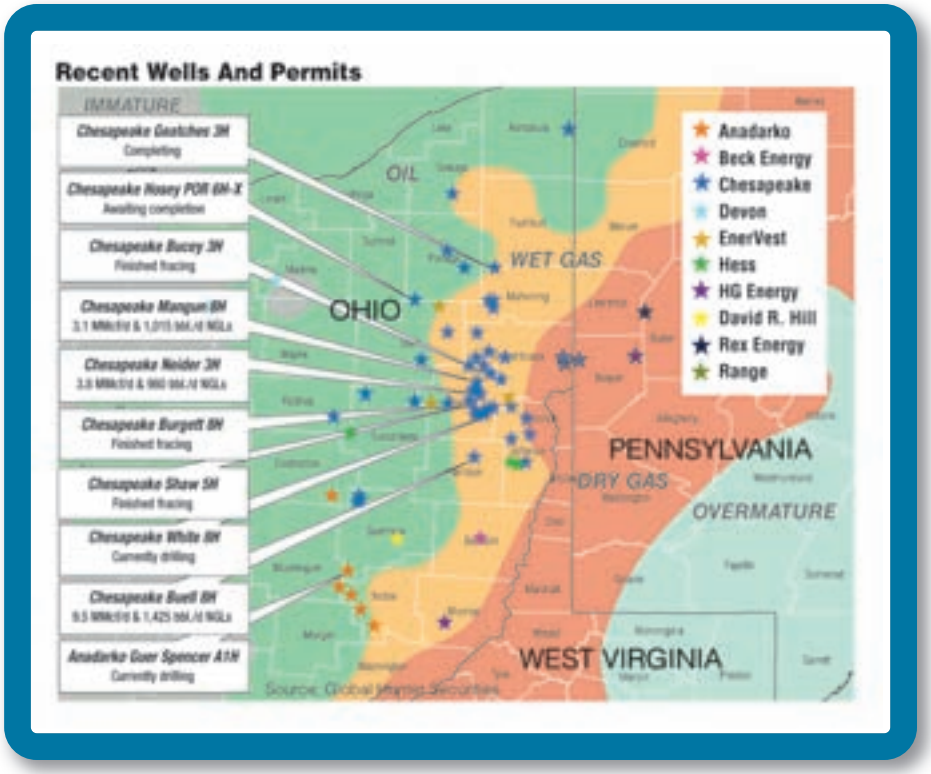
**By Mike Warren**
Executive Director, Research, Hart Energy

The Utica Shale made big news on Jan. 4, 2012, when Total, France's largest E&P company, acquired 619,000 acres from Chesapeake and EnerVest in 10 counties in the eastern Ohio part of the play. The position required Total to pay US $2.32 billion in upfront costs and carry fees, with Chesapeake receiving $2.03 billion and EnerVest $290 million. Total roughly paid $15,000 per acre.

By the end of 2011, operators had drilled 13 wells across the acreage with promising results seen from each well in terms of productivity and liquid content. The JV will ramp up drilling activity significantly with 25 rigs planned to be in operation by year-end 2014.

This was the second deal that Total inked with Chesapeake. In 2010, Total also bought into the dry gas Barnett play in Texas. Total subsequently has taken American technology abroad as the French E&P giant has advanced unconventional gas plays in Algeria, Argentina, Australia, Canada, and Denmark.

With US natural gas prices falling precipitously from $6/MMbtu at the start of 2010 to $2.50/MMbtu in mid-January 2012, many domestic and international E&P companies have turned their attention to the liquids-rich North American plays. How does the Utica stack up to other oilier North American plays and what companies are best positioned in the play?




*(Graphs from The North American Shale Quarterly, courtesy of Rystad Energy and Hart Energy)*

**Play-By-Play Comparison**

| | Depth (ft.) | Thickness (ft.) | Porosity (%) | Permeability (md) | TOC (%) |
|---|---|---|---|---|---|
| Utica (core) | 6,000-8,000 | 80-120 | 6-12 | - | 3+ |
| Utica | 500-14,000 | 50-500 | 3-12 | - | 0.3-4.26 |
| Eagle Ford | 8,000-14,000 | 75-300 | 3-15 | <0.0001-0.003 | 0.6-7 |
| Monterey | 3,500-16,000 | 500-3,500 | 5-30 | <0.0001-2 | 0.1-12 |
| Bakken | 7,000-11,000 | 20-100 | 3-12 | 0.05-0.5 | 2-18 |
| Marcellus | 2,500-8,500 | 25-250 | 1.5-12 | 0.0002-0.02 | 2-14 |
| Barnett | 6,500-9,000 | 100-700 | 3-7 | 0.01-0.1 | 2-7 |
| Haynesville | 10,500-12,700 | 150-350 | 8-12 | 0.0001-1 | ~4 |

*(Source: Global Hunter Securities)*

## Geology and history

The Utica Shale play is a geological system of Ordovician age underlying multiple states in the Northeast. In the Appalachian Basin, it is present in Pennsylvania, Ohio, West Virginia, and New York, always a few thousand feet below the more well-known Marcellus Shale. Partially, it also underlies Kentucky, Maryland, Tennessee, Virginia, Michigan, and Indiana (the last two in the Michigan Basin) in the US, and Ontario and Quebec in Canada. The Utica Formation corresponds to a black shale source rock rich in organic content. In western Ohio, the Utica system is associated with the group of Utica and Point Pleasant formations, while moving from Ohio to West Virginia and extending all the way to eastern Pennsylvania; it's also sometimes referred to as Antes shale.

Recent Utica activity focuses on east Ohio, where the Utica becomes shallower and the Marcellus Shale play ends. In Ohio, the Utica Shale shows three distinct windows: oil, wet gas, and dry gas, moving from west to east, as in the Eagle Ford Shale. The oil window includes several dozen Ohio counties, which could correspond to a vast oil resource. However, because the formation is too shallow, we expect the commercial viability will be related to operator ability to extract the oil using horizontal drilling and hydraulic fracturing techniques.

The Utica Shale has a long history. The first oil found in Ohio was in Noble County at 475 ft in 1814, and the first commercial production was from the Macksburg Sand in Washington County in 1884. Ohio was the No. 1 producer in the US from 1895 to 1903. According to the Ohio Oil and Gas Association, peak production occurred in 1896 at 24 MMbbl, or 66,000 b/d – with most of the oil coming from the Lima-Trenton Field in northwestern Ohio.

## Amassing acreage positions

If we fast-forward to the age of horizontal drilling and hydraulic fracturing, the first part of the Utica to receive attention was Range Resources, which made an announcement in September 2009 when it spud its Lloyd Zahn Unit 1H that tested 4.4MMcf/d. Shortly thereafter, EV Energy and EverVest acquired Ohio and northwest Pennsylvania producing assets from EXCO.

By mid-year 2010, Royal Dutch Shell acquired East Resources assets for $4.7 billion, which also included acreage positions in the Utica. Chevron acquired Atlas Energy in November 2010 for $3.2 billion with significant acreage in Ohio. ExxonMobil and Anadarko also claimed that they had entered the play. By November 2010, Chesapeake acquired huge acreage positions from Anschutz Exploration Corporation at approximately $1,200 to $1,500 per acre.

In February 2011, Gulfport Energy and Windsor Energy acquired acreage positions for roughly $2,300 per acre. By August of that year, Rex Energy acquired positions in Ohio for about $3,600 per acre. Prices went significantly higher by September with the entry of Hess's JV with

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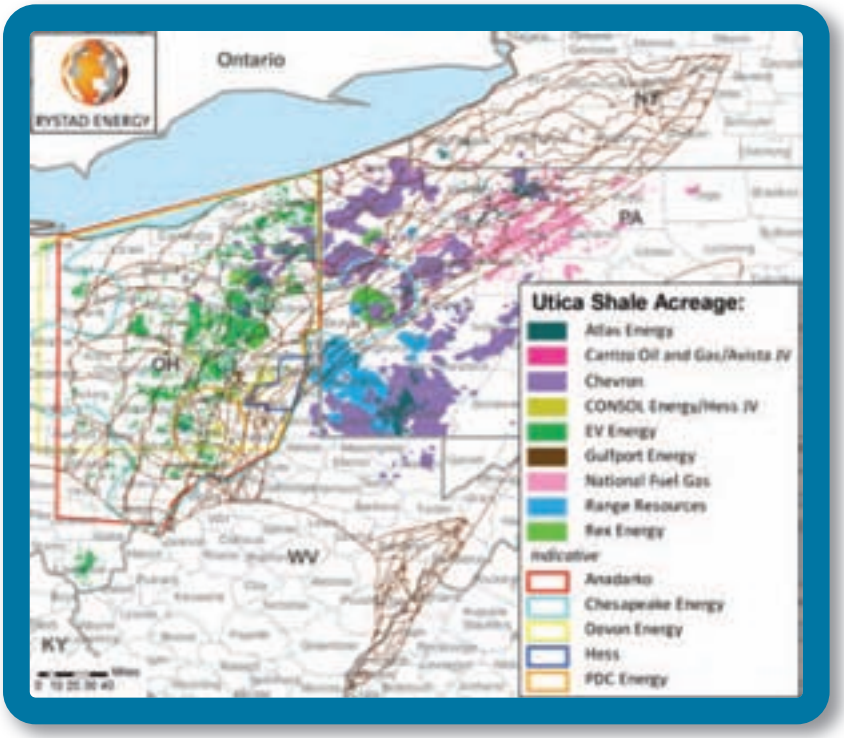


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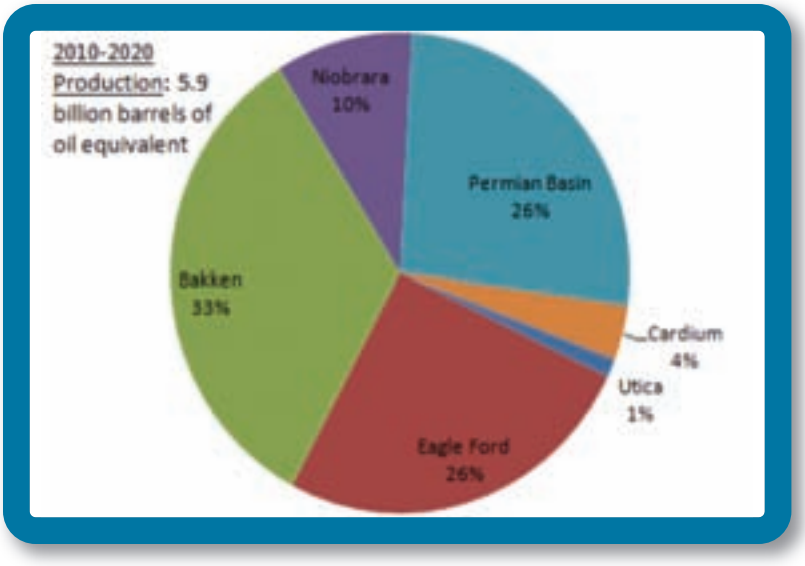



North American oil and condensate production from six shale oil/tight oil plays

CONSOL Energy valued at $5,930 per acre and its acquisition of Marquette with Utica acreage costs rising to $8,824 per acre.

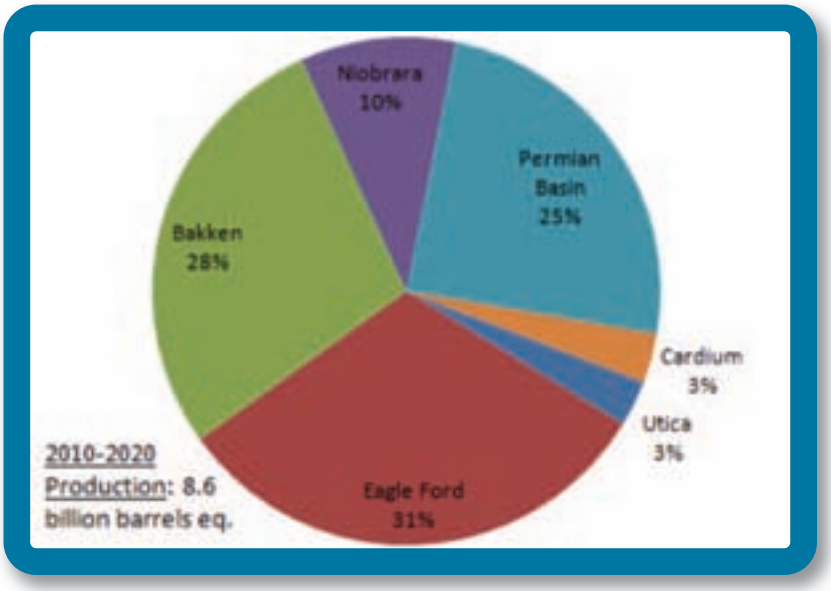
## Point Pleasant: the sweet spot

Undoubtedly, the sweet spot for the Ohio Utica is the Point Pleasure Formation that runs diagonally through the eastern side of the state from northeast to southwest and butts up against the wet gas window, which is near the western border of Pennsylvania. According to Jackie Reed, Reed Geochemical Consulting, "The Utica does have organic content in it, but it is modest when compared with the Point Pleasant. We would guesstimate about a third of the resource is in the Utica, and two-thirds are in the Point Pleasant."

Given the concentrate of resources in the Point Pleasant Formation, leasing activity and well permitting are concentrated there. Core counties are Carroll, Columbiana, Jefferson, Harrison, Belmont, East Tuscarawas, and East Guernsey. Counties north of the core area are Mahoning, Portage, Trumbull, and Ashtabula. The wet gas northern core also extends into two Pennsylvania counties: Mercer and Crawford. Muskingum, Noble, Monroe, Morgan, and Washington Counties lie south of the core.

While operators have drilled in the Utica from Quebec to Cheboygan County in Michigan and several counties in Pennsylvania, all eyes were on Chesapeake's reported results from Harrison and Carroll Counties because these wells were in the liquids-rich part of the play. In Harrison County #8H Buell peaked at 9.5 Mcf/d of gas and 1,425 boe/d of natural gas liquids. In Carroll County, #8H Mangun peaked at 3.1 Mcf/d of gas and 1,015 boe/d of natural gas liquids. The #3H Neider well, also in Carroll County, peaked at 3.8 Mcf/d and 980 boe/d of natural gas liquids. Chesapeake still is evaluating its prospective oil acreage positions.

While several companies have commented that the Utica is similar to the Eagle Ford given its three distinct windows, the comparison should end there. The Eagle Ford had a robust gas infrastructure ready to quickly service wet gas from the play, while the Utica has minimal natural gas infrastructure and is in the early development phase. Moreover, the Marcellus should receive the lion's share of infrastructure investment in the short term, which means that the Utica will share pipelines and processing stations with the Marcellus. This could inhibit the play's short-term development.




North American total hydrocarbon production from six shale oil/ tight oil plays

The good news for the Utica is that the play is closely held by a handful of players that either have deep pockets or have lined up joint ventures that should ensure a flow of funds to develop the play. Coupled with its liquid-rich potential with gas prices hovering below $3/MMbtu and oil prices flirting with $100/bbl, the Utica should receive its share of infrastructure outlays.

## What is the Utica's potential?

While the Utica may have as much as 2 Bboe in the state of Ohio, our analysis suggests that production will pick up more gradually than what Hart Energy envisions in the Eagle Ford. In our North American Shale Quarterly forecast, we see that the Utica only will account for 1% of North American shale oil/tight oil/condensate production from 2010 to 2020. The Bakken, Eagle Ford, and Permian Basin will produce 85% of North America's oil and condensate from tight oil and shale oil formations.

Where the Utica adds hydrocarbon value is in their natural gas liquids potential. Looking at only the five biggest oily plays covered in the North American Shale Quarterly, the Utica should produce roughly 7% of the North American total. Coupled with the Marcellus NGL and dry gas production, the Ohio/Pennsylvania region will have the largest production of NGLs east of the Mississippi.

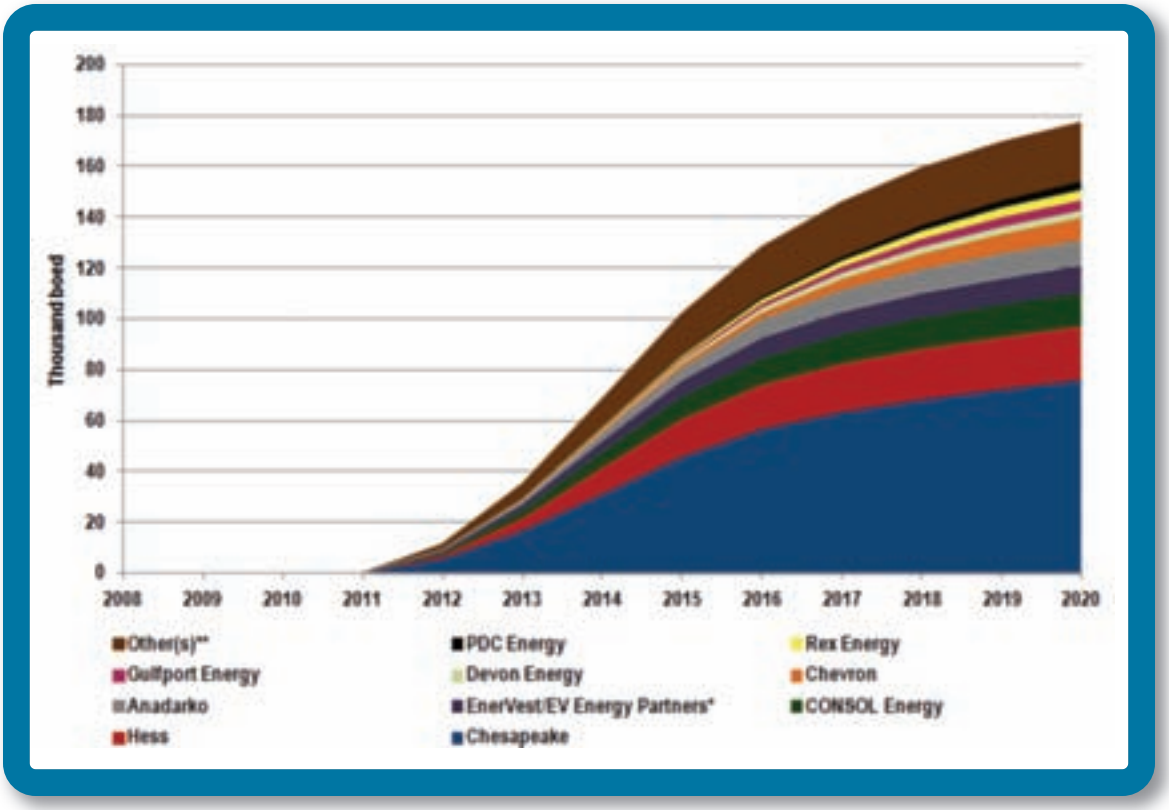
Looking at total hydrocarbon production from 2010 to 2020, we expect the Utica to produce on par with Canada's biggest liquids-rich play – the Cardium. The Cardium and Utica should combine to produce 6% of hydrocarbon production from the oiler North American plays. Given the forecast for North American natural gas prices, company announcements – such as Chesapeake's pullback in the Marcellus, and EIA's significant downgrade in Marcellus natural gas production – Hart Energy sees more and more concentration of investment and rig counts in the oiler plays.

While the Utica is not a utopia for companies looking to deploy assets into liquid rich plays – like the Eagle Ford or the Niobrara – it does offer some cover from very low natural gas prices and higher margins than dry gas plays.

## How do Utica players stack up?

Chesapeake and EnerVest/EV Partners obviously have made the biggest moves in Ohio when it comes to the Utica Basin with the Total JV. CONSOL Energy also signed a key joint venture with HESS. Devon recently did a deal with SINOPEC that will include some acreage positions in the Ohio Utica as well. Chevron had purchased Atlas Energy, which also had acreage positions in the Ohio Utica as had Royal Dutch Shell with the purchase of East Resources. Given that several of the major integrated oil companies have staked claims to the Ohio

Utica Shale (Ohio) production




Utica, the level of deep pockets might be unprecedented in a play at this level of its maturity.

That said, we see Chesapeake as one of the first and biggest producer throughout our forecast period. Hess will be a distant second with CONSOL a more distant third. EnerVest/EV Partners, Anadarko, and Chevron should round out the top six producers in the state of Ohio. Devon, Gulfport Energy, Rex Energy, and PDC Energy should complete the top 10.

Given the massive spread between oil and gas prices, the amount of acreage in the wet gas and oil windows in the Ohio part of the Utica should be most coveted by E&P companies. Our analysis suggests that Chesapeake has 59% of non-dry-gas acreage positions leased in the Ohio part of the Utica. Hence, Total's rather high cost of entry – $15,000 per acre – may be an excellent price to acquire future oil production and learn how to produce liquids in a shale play.

Anadarko and CONSOL have the second and third largest leased positions in the liquids-rich part of the Utica (Ohio). Chevron and Devon should round out the top five. The North American Shale Quarterly has not identified acreage positions of all companies, however, and as more permitting and drilling occur our analysis might change.

Finally, let's take a look at breakeven prices factoring in a 10% nominal discount rate with oil prices averaging $90 real over the 10-year forecast period. Our analysis suggests that in the JV, wet gas part of the play, Chesapeake's breakeven price would be in the mid-$30s. The same can be said concerning Gulfport Energy and Rex Energy's positions, albeit the size of their acreage is miniscule in comparison with Chesapeake's. The rest of the players in the Ohio Utica, including Chesapeake's oil/condensate window, should see breakeven prices in the mid-$40s. Breakeven prices do not take into account lease acreage costs or transportation.

While the Utica might not have the amount of liquids production to rival the Eagle Ford, Permian Basin, or the Bakken, breakeven prices in an oily play are competitive with the big three North American liquids-rich plays. North American liquids-rich plays in large volumes are running, hence this is the main reason why many E&P companies are quickly taking positions in Ohio. ■

# Additional Information on the Utica Shale

For more details on the Utica Shale, consult the selected sources below.

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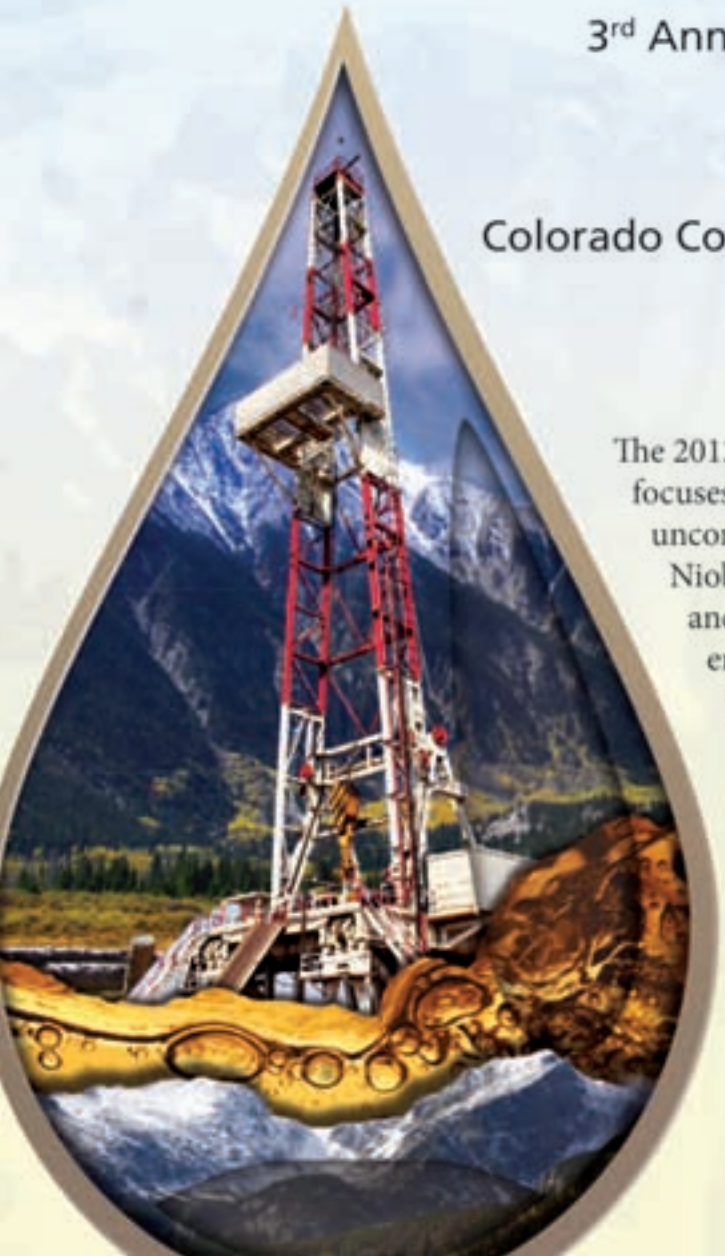

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