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INDUSTRY SPOTLIGHT

Unconventional Oil & Gas

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A Discussion with Shawn Reynolds, Senior Energy Analyst, Van Eck Hard Assets Investment Team

Shawn Reynolds is a co-Portfolio Manager for Van Eck's actively managed hard assets equity funds. With over 25 years of experience working as both an exploration geologist and an analyst covering global energy companies, he is a renowned thought leader in the energy space. He has been quoted in myriad trade publications and has authored several technical geology articles published in periodicals such as the American Association of Petroleum Geologists.

Why all the buzz about unconventional oil and gas?

What has evolved over the past several years is a combination of technologies that has unlocked oil and gas reservoirs and has led to a substantial increase in recoverable reserves. Today, we are seeing this capacity unlocked by new and very effective technologies.

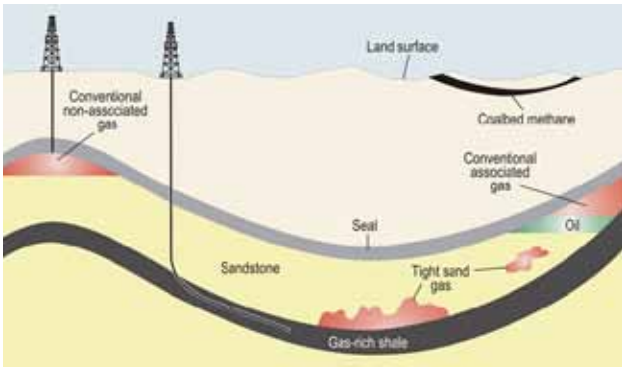
These technologies are allowing us to go back to conventional reservoirs that have essentially been squeezed, if you will, of their organic supply. These reservoirs were previously known to have hydrocarbons in them but there was no way to access this capacity with conventional methods. The advancement of these technologies has allowed this subset of energy companies to unlock this capacity and essentially may enable them to go back and re-tap source rock everywhere. That's what is really exciting about unconventional energy.

What is "fracking" and how is it being utilized by unconventional oil and gas companies?

Hydraulic fracturing or "fracking" can be described as the act of pumping fluid and sand down a well at high pressure. The pressure causes the surrounding rock to fracture. When the pressure is relieved, a thin layer of sand props open the fractured rock, acting as a conduit to allow natural gas or oil to flow to the well so that it can be recovered.

It's important to understand that the actual physical engineering act of fracking happens at virtually every conventional well in the United States and has for decades. Fracking is not new or unique.

Also, horizontal drilling in and of itself has been around for 50+ years – and by "horizontal drilling," I mean the act of drilling horizontally to 500 feet or 1,000 feet. Extended reach horizontal drilling, however, is being taken out to 2,000 feet, 5,000 feet, even as far as 10,000 feet. This has opened up the contact to traditional reservoirs much more than if they were drilled vertically.



Source: U.S. Energy Information Administration and U.S.G.S.
For illustrative purposes only.

Hydraulic fracturing and extended reach horizontal drilling are the two technologies that are being utilized together to produce these dramatic results. New capability is resulting from applying these fracking techniques – which have been around for a long time – to a horizontal spread of 10,000 feet. The technology of this is spectacular.

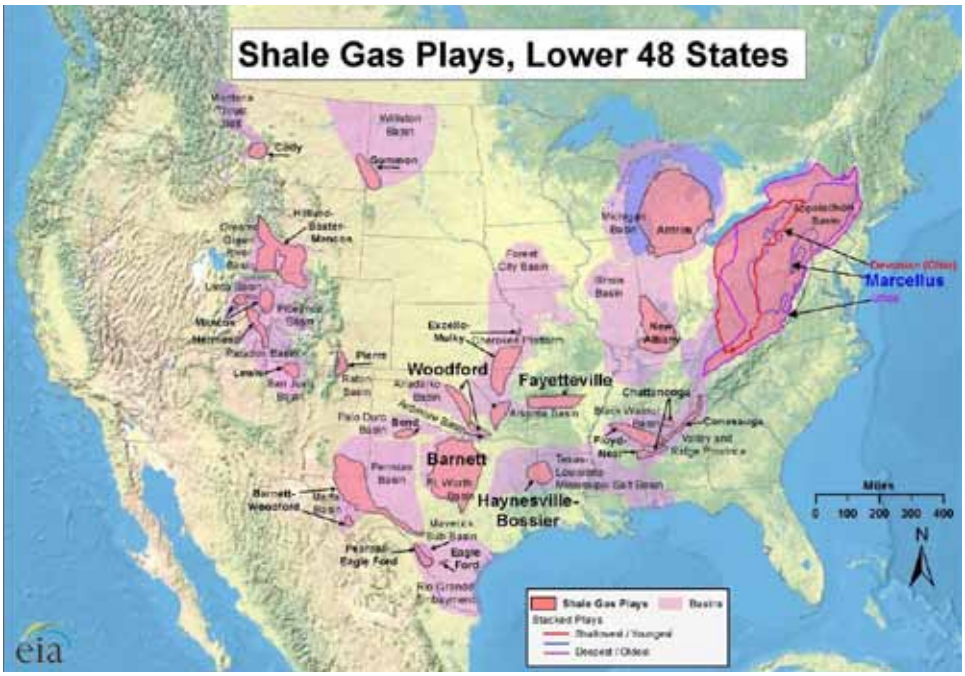
What are some other technologies utilized by these companies?

Coalbed methane is another technology that is effective and makes economic sense. These same technologies (hydraulic fracturing and horizontal drilling) are used, but the drilling occurs in coal seams in order to release the natural gas. It's interesting to note that because coal absorbs a lot of water, sometimes coal seams produce only water for years before natural gas begins to be released.

What's referred to as oil sands is much different because there is no fracturing. There are two ways to get to oil sands. One is mining and the other is a combination of horizontal drilling and steam injection. As of January 31, some of the top holdings in Market Vectors Unconventional Oil & Gas Index (MVFRAKTR) are involved in oil sands, including top holdings Canadian Natural Resources, Devon Energy, and Encana Corporation.

Unconventional drilling technologies have led to excess capacity of natural gas in the United States. How much further can the unconventional energy story unfold?

We went through a phase from about 2004 to 2009 where the unconventional story was all about gas. Ten years ago, we were short natural gas and prices rose to upwards of $15. The techniques I just described resulted in a tremendous increase in resource capacity; it was hugely successful from an energy supply and energy independence point of view. Now, these same technologies are being tested on oil source rock. From an equity investment point of view, this is what energy managers are watching – the oil side of the story. I think a good indication of the potential is what's happening at the Bakken Reserve in North Dakota, which is increasingly being viewed as a major oil resource in the United States. This has sparked a tremendous amount of interest in the vast amount of source rock in Texas; currently, there is what I would call a modern day boom in the Permian Basin in west Texas. Of course, there is no way to predict the future outcome, but I believe there is exciting potential there.



Source: Energy Information Administration based on data from various published studies. Updated: March 10, 2010
For illustrative purposes only. Current data may differ from data quoted.

What are the effects of low natural gas prices on unconventional energy companies?

Fund managers and shareholders tend to look at reserves and net asset values. For example, Cabot Oil & Gas (which currently does 95 percent of its business in natural gas) was still the No. 1-performing stock in the S&P 500 last year. The stock outperformed even with natural gas prices falling from over $4 to under $3. This was based primarily on production and reserves. So, it's my view that even with low commodity prices, we may potentially still see strong stock price appreciation. Through these advanced technologies, huge amounts of economic resources are being uncovered. With unconventional resource plays, the resource is already there; I would say that the geological risk is nil. These techniques are essentially turning exploration companies into manufacturing businesses. There are potential efficiency gains from not moving rigs around in search of the resources: the crew gets better, the geographical knowledge gets better, and the technical knowledge specific to that reservoir gets refined.

Will the economics of low commodity prices cut off the technical progress of the industry? What are the effects on company operations?

Because natural gas prices are so low, pure natural gas drilling is clearly receding. For "dry gas producers" (i.e., those companies that only produce natural gas), the economics makes producing very tough. Currently, in North America, much more drilling is focused on oil or natural gas liquids (NGLs). Examples of NGLs are butane, propane, and ethane. With the NGLs comes associated natural gas, so there is still natural gas production going on from these companies where the economics makes sense as a whole. It is my view that even as little as 30 percent of NGLs in the total production would make the drilling profitable for these companies because those commodities are currently priced much higher.

How do you assess the risks associated with environmental concerns leading to a slowdown, if not a halt to, unconventional technologies?

To be clear, the environmental concerns we hear about today are really only in regards to massively extended horizontal drilling combined with fracking – really taking the technology out to the limits of the engineering.

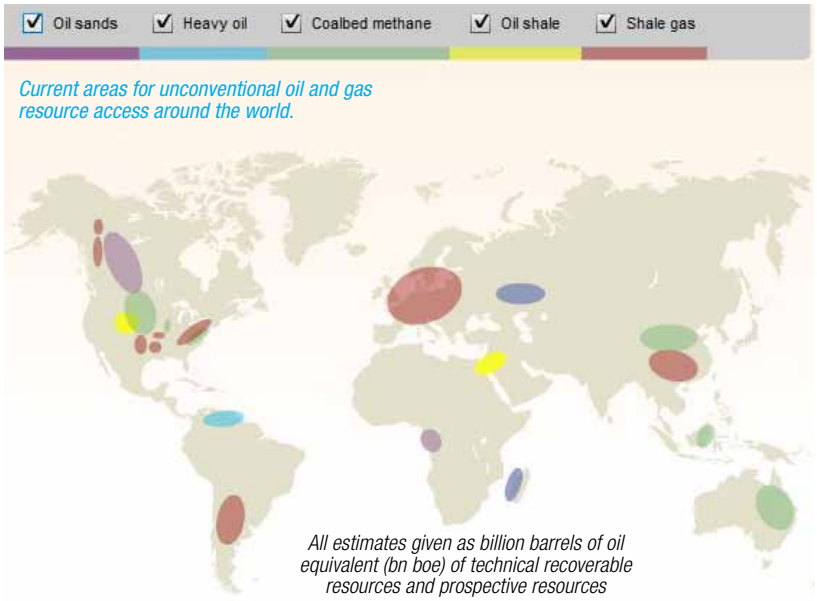
From my perspective, which is a deep knowledge of geology and of the techniques used to drill the geology, the physical act of fracking does not hold a lot of environmental risk. As I've stated earlier, fracking in and of itself is not new or unique. Again, it's technology that is being used – and has been used for decades – in every well in the country. So when we hear reports that they are banning fracking in New York, it's not entirely

accurate. They are not talking about banning fracking altogether. What they are referring to is fracking in deeply extended horizontal wells. Fracking permits are being issued today and are being utilized today. And, yes, this less extreme form of fracking is considered part of the unconventional space, if you will. You simply cannot drill a well in this country without fracking. I believe that if fracking were to be banned altogether, we'd be looking at $200 oil and $20 natural gas.

What may be a more valid concern with regards to unconventional oil and gas drilling techniques, however, is the handling and treatment of water, as well as the access to that water. Those are the big issues that may be a huge focus for these firms going forward. There certainly may be new regulations that are developed and, as a result, there may be some hurdles along the way for these firms. However, there may actually be some opportunities that unfold as well. Companies that deal with water recycling, for example, may come into play as a result of new regulations.

Are these unconventional drilling technologies used in countries outside of North America?

Countries around the globe are really just starting to look at these technologies. China, for example, has been drilling coalbed methane, but they had not been drilling shale until very recently. Unconventional shale drilling is a rapidly developing theme in China right now. We're also seeing these same trends in Argentina and Poland. Coal seam gas has being drilled in Australia for many years, and they too are now starting off on the shale side. India has also shown some interest, though they have not really acted yet. The unconventional oil and gas theme is really just starting to develop internationally. Some of the big issues for these companies will be access to water, especially for countries like China, Argentina, and Australia.



Source: Lambert Energy Advisory
For illustrative purposes only. Current data may differ from data quoted.

What catalysts may help to buoy unconventional energy companies further?

Any demand-driven push would likely be a huge boon for these companies. For example, a government mandate for the use of natural gas-powered vehicles would potentially lead to sustained price strength for natural gas. I'm not suggesting such a mandate will happen, but it's an interesting way to look at it. It's not such a far-fetched concept given that President Obama focused on natural gas in his State of the Union speech in January. Compressed natural gas-powered vehicles are used all over the world. In fact, over half the automobiles in New Zealand run on compressed natural gas. The infrastructure needed to be put in place for the electric car is on the order of a trillion dollars. In contrast, the infrastructure for compressed natural gas-run automobiles is basically in place.

A Glossary of Terms*:

Conventional Resources – Gas or oil trapped in porous rock formations such as sandstone. It is often difficult to find, but once discovered, typically the easiest to produce through standard methods, including hydraulic fracturing, which has been used for the last 60 years.

Unconventional Resources – Advancement in a combination of technologies – horizontal drilling and multistage hydraulic fracturing – have made shale and other unconventional gas supplies commercially viable. The majority of supply growth in today's recoverable gas resources can be attributed to unconventional reservoirs. These same technological breakthroughs are now being applied to oil reservoirs.

Shale gas/oil – Natural gas/oil tightly locked in fine-grained sedimentary reservoir rock requiring advanced technologies to drill and fracture the gas/oil-bearing zones.

Coalbed methane (CBM)/coal seam gas (CSG) – A form of natural gas that has been absorbed into the solid matrix of coal and, subsequently, extracted from coal beds.

Tight sands/oil sands – Low permeability sandstone reservoirs that produce primarily dry natural gas (tight sands) or crude bitumen, a heavy, viscous form of crude oil (oil sands). Oil sands are found primarily in Canada and Venezuela. Bitumen is extracted and processed using two methods: mining and in situ technology (injecting steam).

Horizontal drilling – The act of drilling wherein the borehole penetrates a reservoir in a manner parallel to the formation. The process of intersecting the reservoir horizontally allows for much greater contact with the reservoir.

Hydraulic fracturing – The act of pumping fluid and sand down a well at high pressure, causing the surrounding rock to fracture. A thin layer of sand props open the cracks acting as a conduit to allow the natural gas/oil to flow from low permeability formations. Hydraulic fracturing has been used in conventional energy production for over 60 years. Recent innovations in multistage hydraulic fracturing have helped to unlock unconventional reservoirs.

**Source: Canadian Association of Petroleum Producers; American Association of Petroleum Geologists.*

IMPORTANT DISCLOSURE

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