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How Horizontal Drilling And Fracking Have Reshaped The U.S. Energy Landscape

Primary Credit Analysts:

Marc D Bromberg, New York (1) 212-438-5488; marc_bromberg@standardandpoors.com

Stephen Scovotti, New York (1) 212-438-5882; stephen_scovotti@standardandpoors.com

Alan M Levin, CFA, New York (1) 212-438-7214; alan_levin@standardandpoors.com

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How Horizontal Drilling And Fracking Have Reshaped The U.S. Energy Landscape

Hydraulic fracturing, commonly referred to as fracking, and horizontal drilling technology have helped transform the U.S. energy industry in recent years. By combining the two, exploration and production (E&P) companies have greatly increased their access to previously untapped oil and natural gas reserves, which has led to a significant boost in output.

The result of this pairing has been a significant rise in energy production—a trend that we believe will continue to grow. Today, the U.S. is sitting on an oversupply of natural gas, largely because we currently lack the infrastructure needed to export it. In terms of oil production, fracking and horizontal drilling have become so material that some economists believe the U.S. will be able to slowly cut back—and possibly one day stop—importing oil from abroad.

Overview

- While they're not new technologies, fracking and horizontal drilling have significantly reshaped the U.S. energy industry in recent years.
- By using these techniques, E&P companies have dramatically increased their ability to tap previously uneconomic oil and natural gas reserves.
- The resulting energy production in the U.S. has led to an overabundance of natural gas, which we currently have no way to export, and prospects for reducing our long-term dependence on oil imports.
- We believe fracking and horizontal drilling will continue to boom, particularly in the U.S., but they will be accompanied by increased regulatory oversight regarding environmental and health concerns.

While fracking and horizontal drilling have been a boon in terms of energy production, the chemicals used in fracking do pose some environmental risks. As such, the rapid ascent of its usage has garnered some noteworthy opposition alongside its legions of supporters, which range from energy companies, equipment suppliers, and municipalities where energy production creates jobs and stimulates the economy. We believe the usage of these technologies will continue, particularly in the U.S., but it will be accompanied by further regulatory oversight regarding environmental and health concerns.

Fracking involves the injection of millions of gallons of water, sand, and chemicals at extremely high pressure into wells drilled many thousands of feet below the earth's surface. Horizontal drilling is the process of drilling a well parallel to the oil zone, as opposed to drilling a well vertical to the oil zone. Horizontal drilling requires considerably more fracking fluid than vertical drilling—upwards of 20 times as much, according to some E&P issuers. While fracking technology has been around since the 1940s, it didn't become a true game changer until about a decade ago, when E&P companies began to drill horizontal, or directional, wells to access significantly more of each formation's "hydrocarbon window" than they could with traditional vertical wells. Fracking also increased rock permeability, which allows more of the hydrocarbons trapped in the rock to flow to the opening, or bore, of a drilled well.

Horizontal drilling and fracking dramatically broadened U.S. gas and oil exploration by enabling operators to extract

from shale plays and tight gas formations that were previously too costly to produce hydrocarbons economically. The term "play" typically refers to a geographic area that has been targeted for exploration due to favorable geoseismic survey results, well logs, or production results from a new well in the area. Shale plays are unconventional resource plays that are characterized by very tight rock with insufficient permeability. This lack of permeability prevents hydrocarbons from flowing to the wellbore in traditional vertical drilling scenarios. We believe the development of shale plays is reshaping the energy landscape. The Energy Information Administration (EIA) has estimated that shale gas represents 44% of resources for the lower 48 U.S. states and that shale gas will account for 46% of U.S. natural gas production by 2035.

While horizontal drilling and fracking have been a boon with respect to energy production, they have contributed to an oversupply of natural gas, further widening the price spread between oil and gas. The use of horizontal drilling and fracking for oil extraction has also created a noticeable price difference between two key oil benchmarks: West Texas Intermediate (WTI) and Brent crude.

The Beginning Of The Boom

When horizontal drilling became more widespread several years ago, E&P companies initially targeted dry gas fields including the Haynesville in Louisiana and the Barnett in Texas. Dry gas fields typically produce raw natural gas that contains minimal liquid hydrocarbons. More recently, companies have set their sights on oil-weighted plays, such as the Bakken in North Dakota and the Eagle Ford in South Texas. By combining fracking with horizontal drilling, operators can produce significantly more than what they could from just a single vertical well.

The pressure from fracking creates fractures in the underground formations, and the sand or ceramic (i.e., proppant) holds the fissures in the rock open, enabling natural gas and oil to flow more freely into the wellbore and ultimately to the surface.

The Interstate Oil and Gas Compact Commission (a forum for government representatives to focus on oil and natural gas issues) has reported that more than nine out of every 10 gas and crude oil wells (both horizontal and vertical wells) use fracking, which has helped it garner more attention and interest than ever before—it has also very quickly transformed the domestic energy balance.

Not everyone is a fan of these technologies, especially fracking, and the subject has elicited more than its fair share of criticism from environmental groups that argue that it could be contaminating groundwater, contributing to air pollution, and depleting water supplies.

Horizontal wells, along with fracking, have contributed a far greater supply of hydrocarbons than many energy analysts previously forecast. In fact, the yield has been so substantial on the oil side that some now believe the U.S. could become energy self-reliant. According to Lipow Oil Associates, an oil and gas consulting firm, domestic crude output could reach 7 million barrels a day within three years (approximately one-third of current U.S. consumption). This would be the highest level of production in 20 years and would be a 17% increase from the current production of nearly 6 million barrels per day.

Regarding gas, horizontal drilling in conjunction with fracking has unearthed tremendous supply gains as well—a level that analysts at IHS Global Insight (a research firm that specializes in forecasting and data analysis) reported in 2009 would supply the U.S. for more than 100 years. The U.S. primarily has an oversupply of gas because it doesn't have sufficient capacity to transport it outside of North America. The only way to transport the gas is to convert it to liquefied natural gas (LNG), and the necessary infrastructure to do this is many years away. Our forecast is that there will be more than enough supply to meet any demand growth in the U.S. for the foreseeable future. The increase in supply is affecting gas prices, which recently touched their lowest level in a decade. According to IHS Global Insight, approximately 70% of U.S. natural gas production comes from hydraulically fractured wells.

The Widening Gap Between Oil And Natural Gas Prices

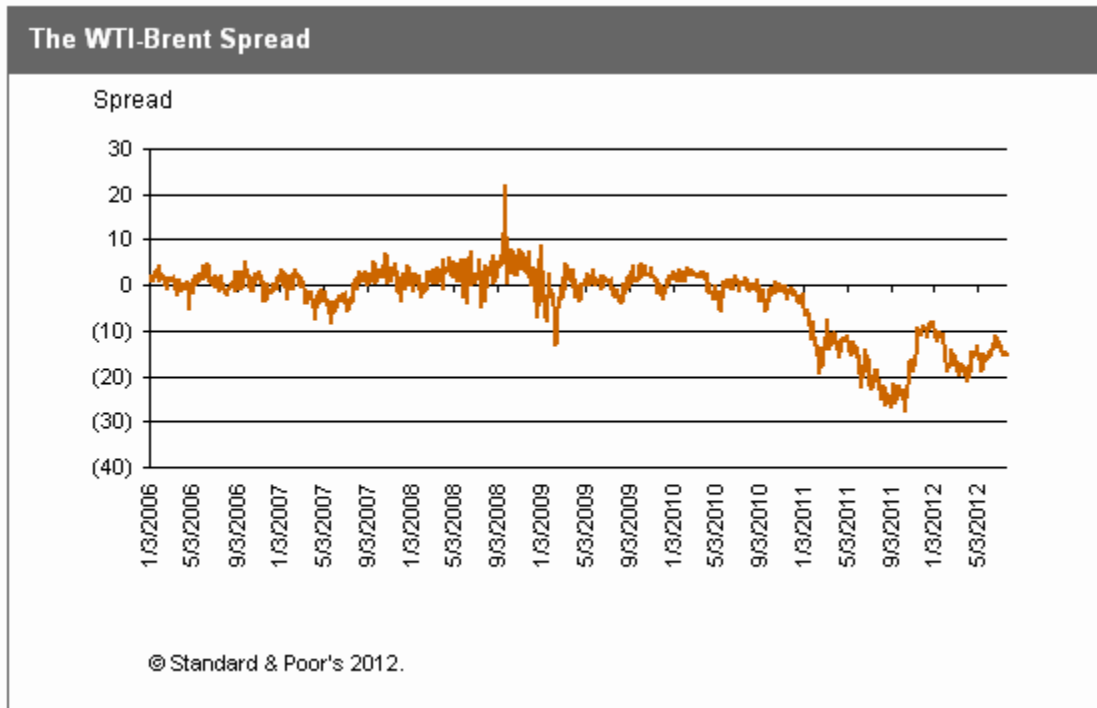
Along with limited natural gas export capacity, horizontal drilling and fracking have dramatically shifted the price difference between oil and natural gas. Historically, oil and natural gas prices have moved somewhat in tandem to generate ratios between 6 to 1 and 10 to 1 (using WTI as the benchmark for oil and the Henry Hub as the benchmark for natural gas). Based solely on an energy-equivalent basis, we think the oil to natural gas price ratio should be approximately 6 to 1. However, the ratio began to widen in 2009—in sync with the increased usage of these technologies. Today, the ratio is approximately 30 to 1.

Due to the increased production of natural gas from shale plays, coupled with insufficient infrastructure to transport natural gas outside of the U.S., the oil to natural gas price ratio remains very high by historical standards. Shipping natural gas abroad is difficult and requires very costly infrastructure. As a result, natural gas use tends to be regional, making it less susceptible to global supply and demand forces than oil. The lack of export capacity in the U.S. for natural gas means the output of the increased gas production is likely to stay within North America, at least for the next few years, which will likely uphold a wide divergence between oil and gas prices.

How Horizontal Drilling And Hydraulic Fracturing Affects The WTI–Brent Spread

Prior to 2011, prices for WTI and Brent crude, the two main bellwether crude oil types, traded in tandem. WTI is the primary benchmark for U.S. oil prices and the underlying delivery point for NYMEX futures contracts in Cushing, Okla., a major trading hub for crude oil. Brent is a North Sea composite blend that typically serves as a global benchmark. Historically, WTI traded at a slight premium to Brent because it's less sulfurous and less dense, making it easier to refine (see chart 1). Since early 2011, however, Brent has traded at a premium, reaching as high as about \$27 last year. As of Sept. 10, 2012, Brent was trading at a \$18 premium to WTI.

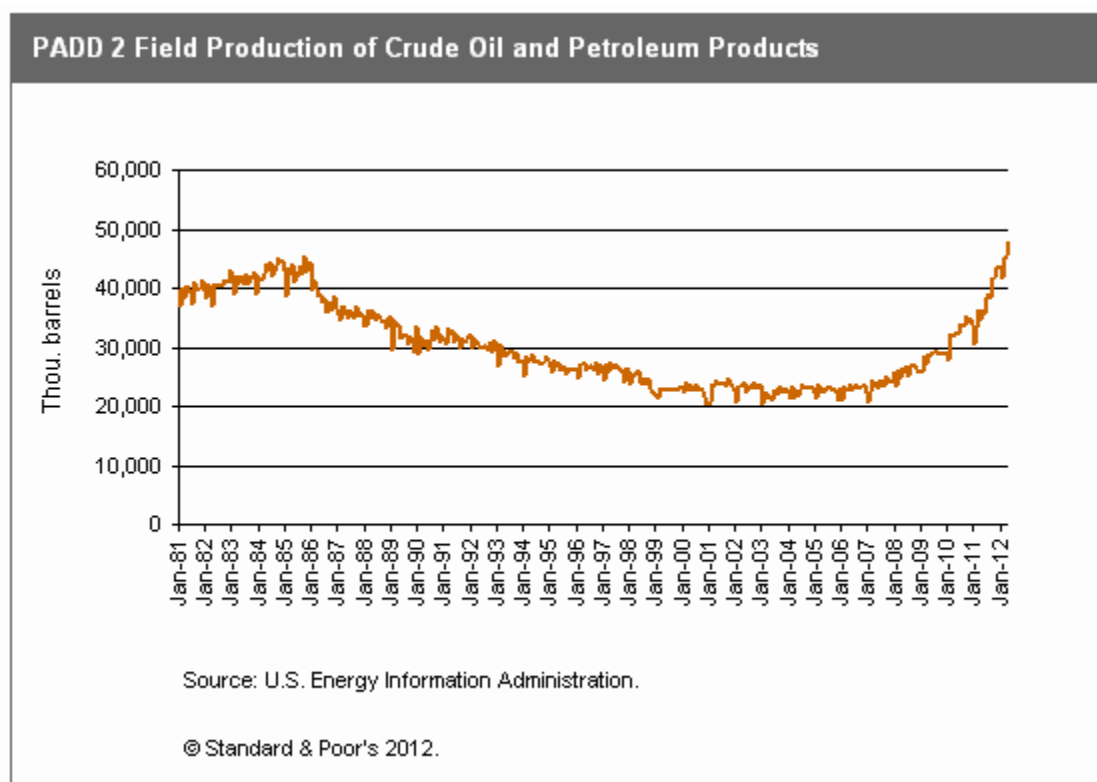
Chart 1



The differential between WTI and Brent is attributable to a significant supply of crude oil in Cushing due to ramped-up production from the Bakken oil shale in North Dakota and the Canadian oil sands. Developers only recently ramped up production in the Canadian oil sands because they previously didn't consider it to be as cost effective. However, high global oil prices have made extraction from the Canadian oil sands profitable.

The Bakken oil shale, first surveyed in the 1990s, could be one of the largest oil discoveries in the U.S. As a result, oil production from the PADD 2 region (the EIA's designation for the Midwest markets, including the Bakken in North Dakota) has rapidly increased over the past two years, recently averaging approximately 33 million barrels (MMBbl) per month, or 1.1 MMBbl per day (see chart 2).

Chart 2



Until additional pipeline capacity is available to bring more crude from the PADD 2 region to the Gulf Coast, we expect WTI to continue trading at a discount to Brent. Moreover, we expect operators will continue increasing production because horizontal drilling and hydraulic fracturing makes extraction in the Bakken shale more economical. This will contribute to the glut of supply in Cushing. Production in the Bakken basin, which represents the vast majority of production in the PADD 2 region, was 594,000 barrels of oil equivalent per day (boepd) in June 2012. We believe that production in the Bakken could exceed 1 million boepd by 2015.

Standard & Poor's believes that the large WTI-Brent spread is unlikely to trend significantly higher than \$20 per barrel over the course of 2012. We believe that at a higher differential, it becomes more attractive to transport oil from the PADD 2 region to other regions via rail and barge. This provides somewhat of an artificial cap, although the availability of rail and barges is limited.

We believe that the WTI-Brent spread will likely remain steady through 2013. It could come down by the end of 2014, however, as the total capacity for moving oil out of a specific area (takeaway capacity) via pipeline comes on line.

The Impact Of Horizontal Drilling And Fracking On The Oil And Gas Industries

Horizontal drilling and fracking are likely to have a profound impact on the operating performance of companies working in the energy sector, particularly oilfield services companies, E&P operators, and refiners. For companies that offer fracking services, we think margins could continue to weaken from very high levels given the overcapacity that

exists in the industry. For E&P operators, this overcapacity will mean lower completion costs and possibly improved profitability. For refiners, horizontal drilling and fracking could keep the WTI-Brent spread steady and benefit well-placed refiners that source WTI crudes.

The oilfield services industry

We believe the energy industry is poised to continue adding drilling capacity over the next six-12 months, and service companies are likely to benefit as rig demand should remain strong in liquids-rich basins. However, due to the overcapacity of pressure pumping equipment, companies that provide these services are likely to see lower pricing. Earlier this year, industry consultant Spears & Associates estimated that capacity of pressure pumping equipment (measured in horsepower) could grow 28% this year. Some providers, however, have more recently told us that growth will likely be more muted.

Schlumberger (A+/Stable/A-1), Halliburton (A/Stable/A-1), and Baker Hughes (A/Stable/A-1) are three of the largest fracking provider, but they benefit from participating in a variety of service activities. Our overall credit outlook for these providers remains favorable, given the diversity of their cash flows. We expect these companies to maintain dominant positions in overall oilfield services.

Comparatively, companies that rely on fracking for a majority of their earnings and cash flows, especially pressure pumping equipment providers, will likely experience much more volatility. We believe smaller providers—those with exposure to just one or two basins—will be particularly vulnerable. These companies have historically worked on jobs that their larger peers overlooked because they tend to be small and of relatively short duration. However, an oversupplied market could cause the larger players to take on smaller jobs as a way to put their underutilized crews to work. This could increasingly challenge smaller companies and put downward pressure on their EBITDA margins.

The E&P industry

For E&P operators, the horizontal drilling and fracking boom is among several drivers of profitability, and therefore, credit performance (the key driver, of course, is hydrocarbon pricing). Completion costs, which include fracking, casing, cementing, and perforating, typically represent up to one-third of the cost of drilling a well, and fracking is the main contributor. Completion costs have declined significantly from the peak of late 2011 because of overcapacity in the market, and we expect costs to continue falling over the next six-12 months as the supply of pressure pumping equipment will likely outpace demand. To date, however, the decline in cost has been on a regional basis.

E&P companies operating in the Eagle Ford shale in Texas have experienced some of the biggest declines, as reported costs have come down as much as a third from July 2011. In an effort to capitalize, operators are moving rigs from nearby gas-weighted Haynesville to the Eagle Ford. Similarly, E&P operators are experimenting with increasingly longer laterals (some operators are reporting wells more than 10,000 feet long.) Meanwhile, fracking activity in the Bakken is also increasing, as players such as Continental Resources, Whiting Petroleum, and Oasis Petroleum are ramping up production.

The refining market

Given the oversupply in Cushing, some geographically well-placed refiners that source WTI, such as HollyFrontier Corp. (BB+/Positive/--) and Western Refining Inc. (B/Stable/--), reportedly are benefitting from lower input costs. These companies, located relatively close to mid-continent basins or to infrastructures that can transport

mid-continent crudes, can move crude oil economically by rail or truck.

The Economic Benefits In The U.S. Of Horizontal Drilling And Fracking

Though still in its early stage, the horizontal drilling and fracking boom is transforming some regional economies. On a larger scale, we think these technologies have the potential to alter the national economy. For example, IHS Global Insight projected in December 2011 that, with a contribution from these technologies, producing natural gas from shale would create 870,000 jobs and add nearly \$120 billion to the U.S. economy over the next four years. IHS Global Insight has also estimated that the federal government could collect up to \$14.5 billion in annual tax payments from shale plays by 2015 (it collected less than \$10 billion in 2010).

At a more regional level, horizontal drilling and fracking are helping transform local economies despite struggles in the broader U.S. economy. The Pennsylvania Department of Labor and Industry said that new hires across the Marcellus basin in 2011 almost doubled the level in 2010. Of the 15 counties in the U.S. with the lowest unemployment rates, 11 are in North Dakota, which is the home of the oil-weighted Williston Basin. Not surprisingly, North Dakota is one of the only states in the U.S. that's currently running a budget surplus, and labor is in such demand that McDonald's is reportedly paying \$15 per hour. Foreign investors are also pumping capital into local economies as well by investing in basins that are reliant on these technologies. For example, investors from South Korea, China, and Norway collectively paid roughly \$4 billion for South Texas drilling rights in the last year.

Because increased investment in hydrocarbon wells typically finds its way to other sectors, horizontal drilling and fracking contributions to local economies extend well beyond the oil fields. For instance, these types of endeavors typically benefit hotels, restaurants and leisure, and retail. They also lead to construction jobs that are tied to pipeline and roadway improvements. These technologies also hold the potential for new revenue sources at the state level—beyond those associated with increased tax collections for job activity. For instance, Ohio Governor John Kasich recently introduced a plan to introduce a hydraulic fracturing tax, which, if adopted, could net up to \$1 billion annually to the state. Other states are also considering a similar fracking tax.

Since the U.S. has for many years been dependent on foreign sources for energy, the use of these technologies has caused some economists to debate whether the U.S. could become energy independent—an idea that would have seemed absurd several years ago. The EIA has indicated that by the end of this decade, nearly half of the crude that the U.S. consumes will be produced in the U.S.

According to IHS Energy Research Associates, U.S. oil production has risen 25% since 2008—which is not coincidentally the same time that the current horizontal drilling and fracking boom began. The U.S. is also using these technologies to make inroads with natural gas. Up until as recently as 2007, the U.S. was an importer of natural gas. Through the widespread use of fracking and directional drilling technology, the U.S. has reduced its reliance on imports. On July 13, 2012, the EIA reported that U.S. imports of natural gas totaled 1.95 trillion cubic feet equivalent (Tcfe)—a 25% decline from 2010 and the lowest level since 1992.

The Environmental Concerns Over Domestic Hydraulic Fracturing

In the U.S., the environmental focus has been on fracking. Fracking tends to be regulated at the state level, given that hydraulic fracturing is exempt from several federal environmental statutes. Over the past several years, some opponents have raised certain environmental issues concerning fracking.

Fracturing fluid contains many different chemicals, some which contain carcinogens. As such, some states require fracking companies to disclose the chemicals they use at their drilling sites to those states' environmental state protection agencies. New York and Pennsylvania have mandated such disclosure. Other states have required companies to disclose the chemicals they use during hydraulic fracturing at the FracFocus Web site. FracFocus is the national hydraulic fracturing registry and is managed by the Ground Water Protection Council (a nonprofit organization whose members include state water regulatory agencies) and the Interstate Oil and Gas Compact Commission.

Fracking creates a significant amount of wastewater. If wastewater finds its way into freshwater aquifers, it could cause health or environmental problems. Keeping fracking wells separate and distinct from other geological formations may mitigate this risk. But some people have claimed that wastewater several thousand feet below a freshwater aquifer could infiltrate the aquifer over a long period of time. In addition, some environmentalists fear that faulty well construction of wellbores or pipelines may create leaks that could permeate freshwater aquifers.

The disposal of wastewater is another issue. Given the presence of chemicals in hydraulic fracturing fluid, the fluid needs to be treated correctly before being disposed of or reused. Some parties are worried that groundwater could be compromised if chemicals or wastewater spills during transport to disposal sites. In addition, there is also a concern that wastewater could infiltrate groundwater at disposal destinations.

The national Environmental Protection Agency (EPA) is currently studying the negative effects that hydraulic fracturing may have on drinking water. The study will examine the full life cycle of water during hydraulic fracturing—from the acquisition of water, to mixing of chemicals with water and the flowback of water, and the ultimate disposal of the water. The EPA has stated that it plans to release a first progress report toward the end of 2012, noting that it plans to release a final draft report for peer review and public comment in 2014.

There are also nonwater-related risks. Hydraulic fracturing may cause methane leaks from natural gas wells, which could contaminate the air surrounding the well. While this could happen with any natural gas well, it is more prevalent in shale gas drilling, which utilizes fracking. Some environmentalists are concerned that higher-than-normal methane in the air may induce health problems. Methane is also a potent greenhouse gas. The EPA is looking into establishing air pollution emission standards for fracking. However, the first national air pollution standards for wells drilled with fracking will not be in place until 2015.

International Horizontal Drilling And Fracking Have Not Boomed

While many consider these technologies as "game changers" in the U.S., they have not been adopted to nearly the

same extent in many international locations—despite the vast potential for shale gas internationally. In fact, some countries have banned hydraulic fracking. The EIA commissioned Advanced Resources International Inc., an external consultant, to examine shale gas resources for 32 countries. Advanced Resources International found the 32 countries to have a total of 5,760 Tcfe of shale gas resources in 2009. To put this into perspective, the U.S. had 862 Tcfe of shale gas resources at the same time (the EIA subsequently revised its estimate for the U.S. down to 542 Tcfe). Since many of the 32 countries are highly dependent on natural gas imports, using horizontal drilling and hydraulic fracturing to develop shale gas resources may provide a means to become more energy independent. Some of the import-reliant countries include Poland (187 Tcfe recoverable shale gas resources), France (180 Tcfe), and South Africa (485 Tcfe). Other countries don't rely as much on imports, but did have significant shale gas resources that might be recoverable via fracking, such as China (1,275 Tcfe).

China recognizes its vast supply of natural gas but didn't complete a shale gas well until 2011, and thus is just starting to utilize horizontal drilling and hydraulic fracturing. The country, however, has entered into strategic relationships with foreign companies that have the specialized skills to help develop its shale gas reserves using these technologies. As it does, it will join Poland, another country that is already using horizontal drilling and fracking techniques to extract natural gas from shale plays. Historically, Poland has relied on Russian imports of natural gas.

While there is interest in horizontal drilling and hydraulic fracturing abroad, some countries are wary of environmental and health concerns of fracking. France banned hydraulic fracturing in 2011 because of environmental concerns, notable because its shale gas reserves tend to be close to populated areas.

Additionally, shale gas drilling is not necessarily as economically viable in international locations as it is in the U.S. In general, it tends to cost more in Europe because reserves are deeper underground and typically harder to extract. In China, certain regions lack sufficient water to support both agriculture and hydraulic fracturing.

Overall, the combination of environmental concerns over fracking and the lower rates of return related to shale gas drilling in certain countries could impede natural gas production that utilizes hydraulic fracturing.

The Future Of Fracking Poses Opportunity And Risks

Horizontal drilling and hydraulic fracturing have transformed the competitive landscape within the oil and gas industry. They have altered the traditional pricing relationship between crude oil and natural gas, at least temporarily affected the WTI and Brent price differential, and unlocked tremendous resources from some basins that were considered uneconomic to drill until recently. However, fracking has been contentious. Fracking has invited criticism from those who label it as an environmental threat and praise from others who claim that it could reduce our reliance on foreign crudes.

If natural gas demand does not catch up to the current supply, the U.S. could remain oversupplied for the next several years. That would have very different implications for oil and gas players. Among fracking suppliers, we believe margins will likely decline through 2013, but we currently think that the slide in itself, coupled with a diversity of service offerings from the largest providers, are not likely to lead to rating changes. On the other hand, we think lower completion costs should boost profitability for many E&P players, assuming the pace of oil and gas prices does not

drift much lower.

We believe the horizontal drilling and fracking phenomenon will continue to grow. We expect this growth, however, will be accompanied by further regulatory oversight of fracking regarding environmental and health concerns. While horizontal drilling and fracking in international locations haven't been as widespread as in the U.S., we foresee international horizontal drilling and fracking expansion to be areas of growth for the industry.

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