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MLPs

OIL & GAS DRILLING TECHNOLOGY LEADS TO EFFICIENCY GAINS

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Jeremy Anagnos, CFA
Senior Global Portfolio Manager

Hinds Howard
Associate Portfolio Manager

EXECUTIVE SUMMARY

U.S. producers are responding to lower oil prices by improving efficiencies and reducing costs. This should lead to more resilient production and a secular shift to lower marginal production costs in the U.S., and continued production growth over the next few years as oil prices recover to the \$65-\$75/bbl range. MLPs should benefit from increased volumes on pipelines and the long-term need for infrastructure investment to support production.

- Oil prices have declined sharply since the middle of last year
- U.S. oil production has continued to grow and is projected to increase in 2015
- Producers are responding to price pressure by decreasing drilling capital plans for 2015, but they are also focused on improving the efficiency of the wells they are drilling
- Increased drilling and completion efficiency, combined with lower services costs, can make development of oil reserves economically attractive even at current prices
- There are some parallels to draw by reviewing the natural gas oversupply situation that the U.S. is still working through, where production efficiencies have helped production grow even with declines in the number of wells drilled

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BASICS OF WELL DEVELOPMENT

To better understand the concept of efficiency, it's important to understand the process for well development. There are three primary stages of developing a well: drilling, completion and production.

DRILLING

A process by which a hole in the ground is drilled and sections of steel pipe (casing) are placed into the hole, secured by cement.

- Facilitated by a drilling rig that can be moved from location to location
- Pad drilling, increasingly common today, involves a single rig drilling multiple (5-10) wells within a few yards of each other

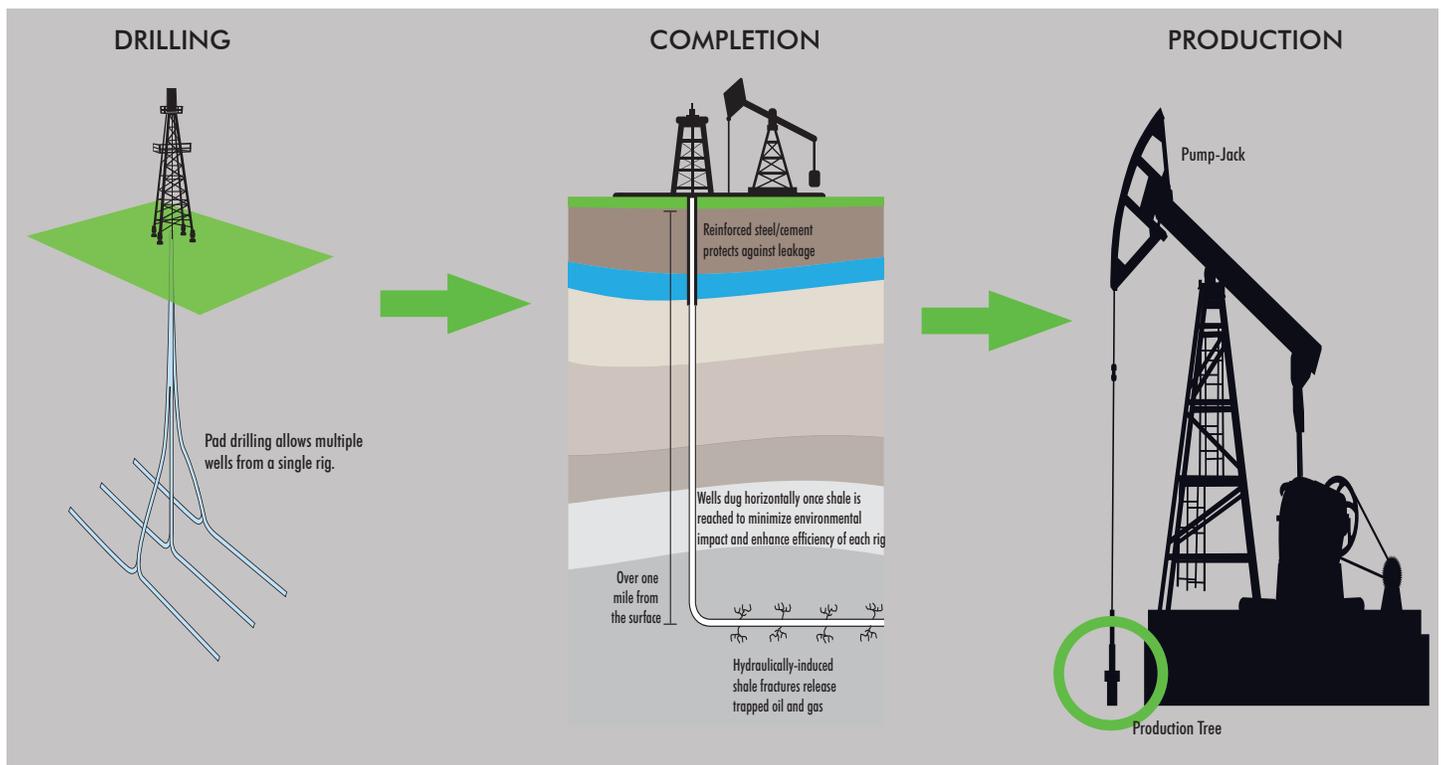
COMPLETION

After drilling and casing, wells are completed by preparing the well for production. Completion involves adding small holes or perforations along the production zone, injecting fracturing fluid (mostly water) and proppant (frac sand) at high pressure into the perforations to expand the surface area from which oil and natural gas can flow into the well.

PRODUCTION

The stage where oil and natural gas are extracted from the well.

- A collection of valves (called a production tree) are attached to the top of the well to regulate pressure, control flows, and allow access to the well
- The production tree outlet valve can be connected to a small pipeline that connects the well either to a pipeline distribution network or to storage tanks for collection by trucks
- If pressure declines, an artificial lift device (pump-jack) can be used to increase well pressure



DRILLING ECONOMICS

Drilling returns depend on the cost to drill and complete a well plus ongoing production costs versus the cash inflow from the sale of oil and natural gas produced from that well. Cash inflows depend on commodity prices and volume of production. The two key variables in the equation (aside from realized oil and natural gas prices) are costs and production volume. Efficiency gains arise from either a reduction in cost or an increase in production.

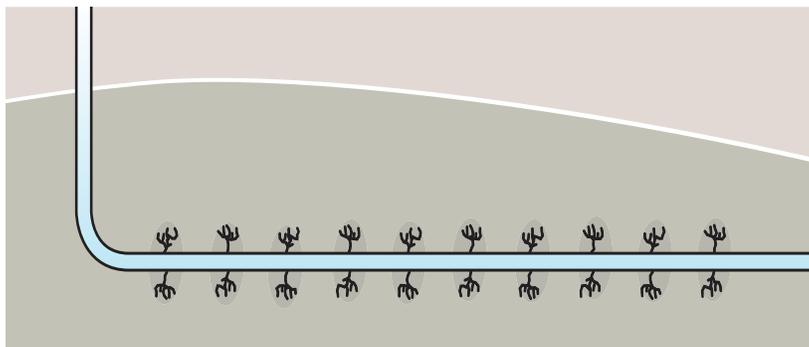
In the simplest of terms, efficiency gains are achieved by producing more oil and gas for less money. This can be achieved in a number of ways:

- Reduced drilling time means less costs per well (rigs are operated on rates per day)
 - Pad drilling helps as there is much less time spent moving the rig from well to well
- Reduced fuel costs to run equipment
- Reduced water costs
 - Procuring water for use in completion can be a major expense
 - Disposal of water produced from the well can be a significant expense
- Increased production from better completion techniques:
 - Optimized proppant mix, including adding more sand
 - Increasing the number of frac stages
 - Longer laterals per well

The diagram below, from a recent investor presentation of producer Devon Energy, highlights the various efficiency and production levers that producers can employ to optimize completions. Optimization is reached through experimentation across various wells. In this simple diagram of Devon's well design in a specific basin, Devon is showing how they are having success with double the frac stages, significantly more sand and longer laterals. At some point in the experimentation process, the costs of adding more sand and more stages outweigh the returns, and just before that point is reached is optimization.

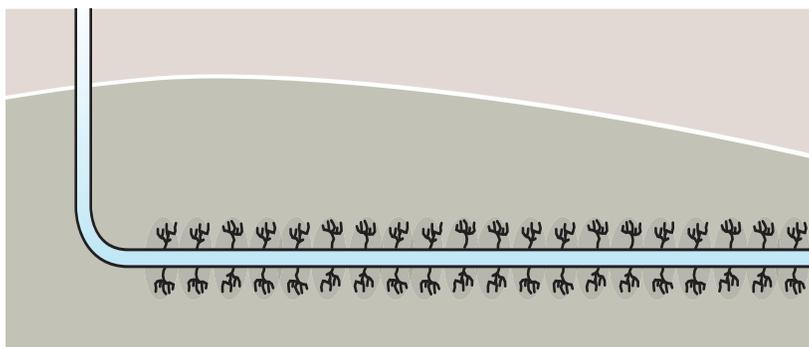
Optimized Completion from More Stages, More Sand

Old Design:



10 Frac Stages
40 Perf Clusters
Sand: 3.5 MM lbs.
Fluid: 130k Bbls.

New Design:

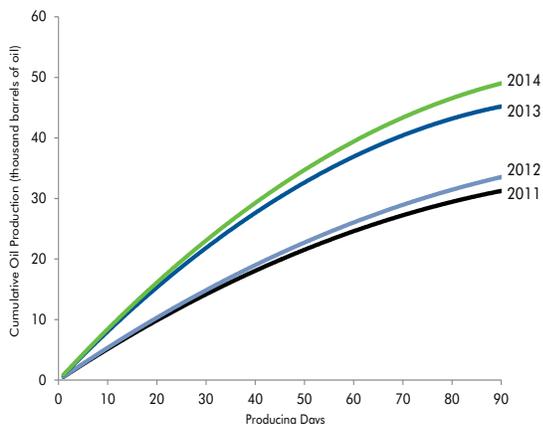


20 Frac Stages
80 Perf Clusters
Sand: 6.0 MM lbs.
Fluid: 140k Bbls.

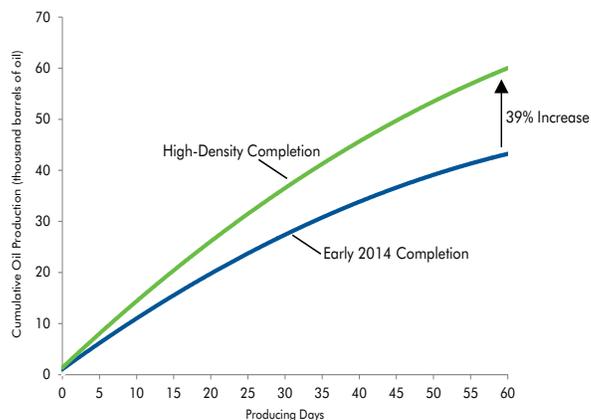
Producers are employing all of the above techniques and are seeing efficiency gains. An example is EOG Resources, which published the charts below, highlighting efficiency gains in the Eagle Ford Shale. EOG is reducing its drilling time per well. EOG has also increased its frac density (by adding more sand), leading to 39% greater production per well.

Efficiency Gains and Higher Density Completions Improving Well Productivity

Average Eagle Ford Cumulative Oil Production



Cumulative Oil Production: Comparable Eagle Ford Wells



Source: EOG Resources as of December 31, 2014.

Producers also make decisions across their acreage. When faced with lower commodity prices, they can react aggressively to adjust their plans by:

- Dropping less productive vertical rigs, opting instead for the horizontal or longer lateral wells
- Shifting rigs from less productive areas to basins with the most productive wells
- Shifting rigs within basins from lower productivity sites to higher productivity sites

As shown in the table below, we are seeing evidence of producers making these shifts, with a greater percentage of oil rigs being shut down in areas outside of the top 3 oil basins (Eagle Ford, Permian and Bakken) and by an acceleration of the reduction of vertical wells active. Without data broken down by county, evidence of shifts within basins is not available, but anecdotally companies are (rationally) reducing rig count starting with the highest cost, least productive wells first.

Drilling Rig Activity Snapshot

	Latest Release Feb. 20, 2015		Peak of Rig Count Sept. 19, 2014		% Change Since Peak
	# of Rigs	% of Total	# of Rigs	% of Total	
Total Rigs	1,310		1,931		(32%)
Oil Focused	1,019	78%	1,601	83%	(36%)
Natural Gas Focused	289	22%	330	17%	(12%)
Rig Type					
Horizontal	979	75%	1,341	69%	(27%)
Vertical	203	15%	378	20%	(46%)
Directional	128	10%	212	11%	(40%)
Oil Rigs by Basin					
Top 3 Oil Basins	622	61%	755	47%	(18%)
Other Basins	397	39%	846	53%	(53%)

Source: Baker Hughes as of 02/20/2015.

Efficiency gains, coupled with reductions in oilfield services costs as a result of lower oil prices, dramatically reduces breakeven prices producers can achieve. Efficiency gains tend to be larger in newer basins, as there is generally a period of experimentation as producers seek to optimize the completion mix. We expect efficiency gains to continue, driving overall cost per well down over the next few years.

NATURAL GAS COROLLARY

We've already seen this story play out with U.S. natural gas production. In the years leading up to the Global Financial Crisis, natural gas priced at Henry Hub (main U.S. benchmark) generally traded in the \$6-8/mmbtu range or higher in extreme periods. As the shale revolution took hold, production growth overwhelmed demand. Gas prices dropped below \$2/mmbtu for a period of time and have generally remained in the \$2-4/mmbtu range ever since.

Producers responded to this sharp price decline by reducing gas focused drilling rigs in higher cost basins. As gas prices declined 77% in the 14 month period through August 2009, the gas rig count declined 54%. Since that period, gas focused drilling rigs have fallen by another 59%.

Despite 1,300+ gas rigs being dropped since the 2008 peak, U.S. natural gas production has increased by 30% from December 2008 levels. While an increase in associated gas from growing oil production played a role, the main driver of increased production has drilling efficiencies that lower costs and extract more natural gas per well.

For instance, new well production per rig in the Marcellus and Utica, two prolific gas producing shale plays, has increased by 842% and 1600%, respectively, since 2008. These productivity gains helped the breakeven price for drilling natural gas wells in the Marcellus shale region decline by more than 50% since 2008, from around \$4/mmbtu to below \$2/mmbtu, according to analysts.

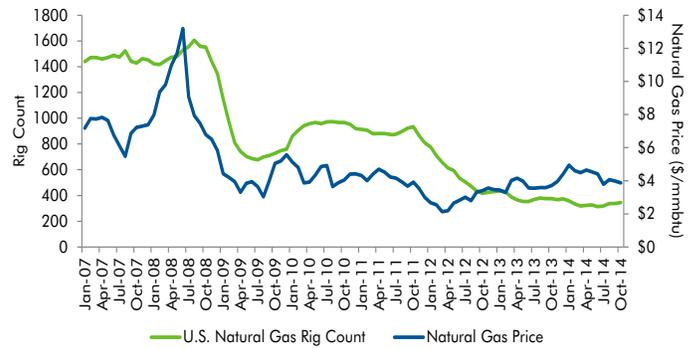
During that time period of lower natural gas prices, there has been an acceleration of capital investment into natural gas infrastructure to support the growth in production. More production creates the need for more gathering & processing capacity. Lower regional gas prices are indicative of bottlenecks in the natural gas value chain, which create opportunities for pipeline development projects to add capacity for that excess of production to reach market.

IMPLICATIONS FOR MIDSTREAM MLPs

We do not expect oil production to grow as dramatically as natural gas has through its price decline, because natural gas production did benefit from associated gas produced from oil-focused wells. However, we do expect oil production growth to continue in the face of sustained oil prices in the \$65-\$75/barrel range as a result of technological improvements leading to efficiency gains.

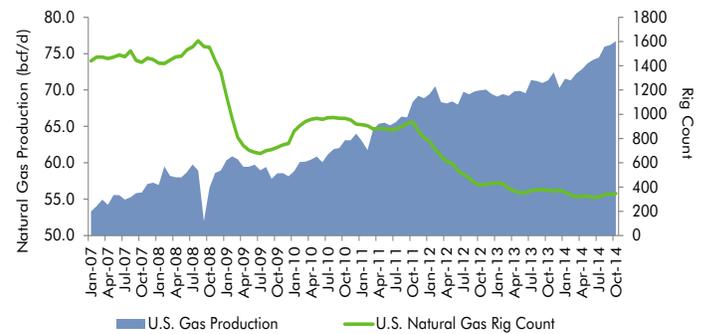
Production growth and demand growth for oil, natural gas and NGLs requires additional pipeline, processing and storage infrastructure. MLPs will develop the majority of the necessary infrastructure to support production growth and to alleviate bottlenecks within the oil and NGL value chain. MLPs are capital intensive businesses that grow by investing capital into attractive capital projects or acquisitions. Additional opportunities to invest capital translate into cash flow and distribution growth for MLPs.

Rig Count Followed Natural Gas Prices



Source: Baker Hughes and EIA as of October 31, 2014.

Production Increases Despite Falling Rig Count



Source: Baker Hughes and EIA as of October 31, 2014.



Source: Energy Transfer Partners

CONCLUSION

A combination of supply and demand response is necessary to bring oil prices into balance. Lower prices will drive demand for oil over time. U.S. producers are responding on the supply side by reducing drilling plans. But the supply response may be somewhat muted by efficiency gains and cost reductions that allow production growth to sustain itself for longer than it otherwise would have. The combination of demand growth from what appears to be sustainable lower prices and supply push from gains in efficiency should help oil production to remain resilient even at these lower prices.

Certain MLPs are poised to thrive in an environment where production growth and low prices continue for longer than most expect. MLPs should benefit from continued capital investment opportunities, export infrastructure capital investment opportunities from increased demand, and increased volume on existing infrastructure as the demand response plays out.

In this volatile commodity price environment, active management of sub-sector allocation and stock selection investment decisions within the MLP sector have never been more critical to portfolio performance. CBRE Clarion is well positioned for such an environment with the requisite experience, resources, knowledge base and long-term MLP investment track record.

AMERICAS

Philadelphia

Global Headquarters

201 King of Prussia Road
Suite 600
Radnor, PA 19087
Phone +1 610 995 2500

EUROPE

London

3rd Floor, One New Change
London, EC4M 9AF
United Kingdom
Phone +44 207 809 9000

ASIA PACIFIC

Hong Kong

3501, Two Exchange Square
8 Connaught Place
Central, Hong Kong
Phone +852 2846 3002

Tokyo

Kasumigaseki Common Gate West Tower 33F
3-2-1 Kasumigaseki, Chiyoda-ku
Tokyo, 100-0013 Japan
Phone +81 3 5251 8050

Sydney

363 George Street
Level 26
Sydney NSW 2000
Australia
Phone +61 2 9333 3333



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