Impact of Shale/Unconventional Production On the Long-Term U.S. Natural Gas Price Outlook

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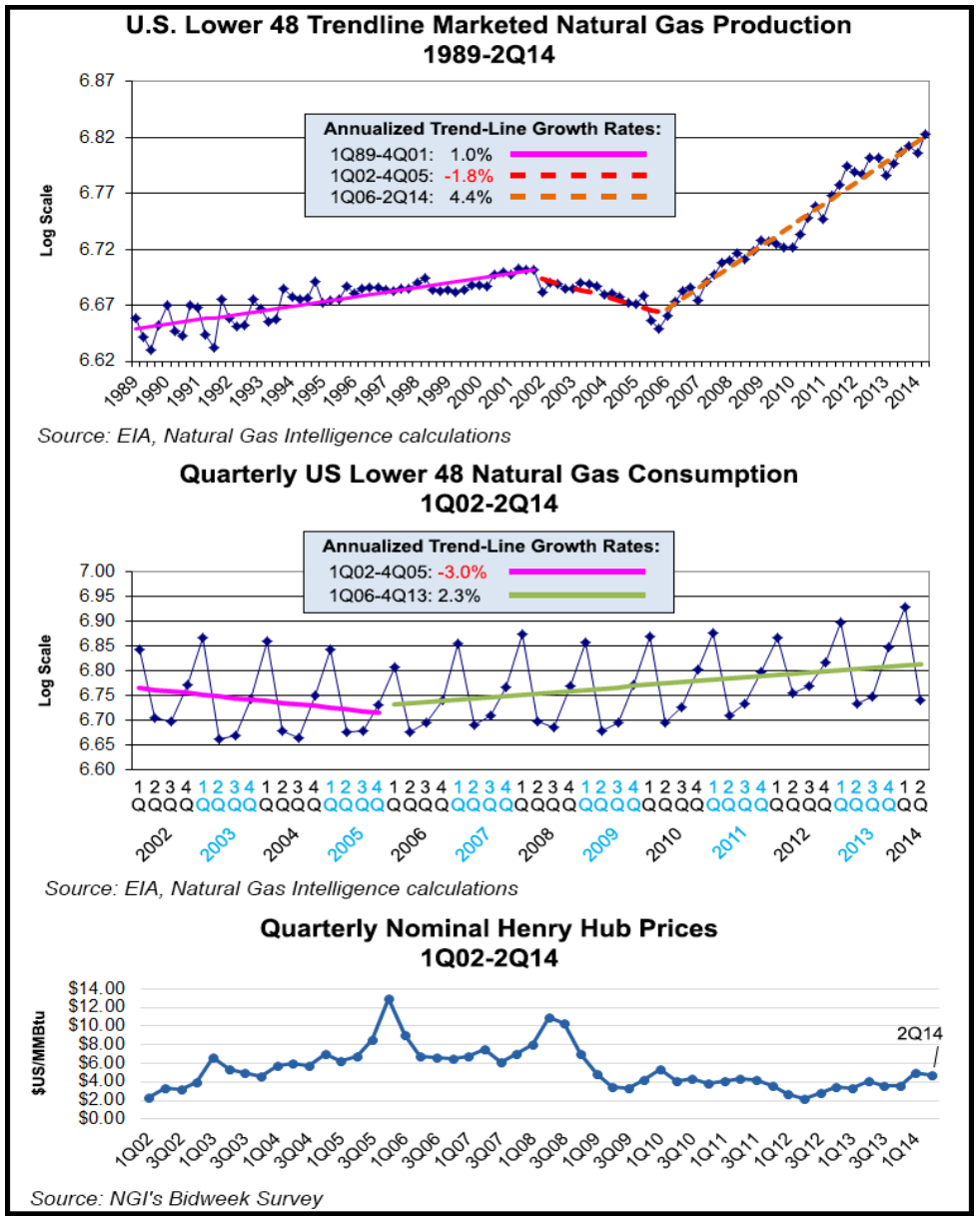
U.S. Nat Gas Production Has Outpaced Consumption Since 2006



- U.S. L48 natural gas production has grown at an annualized trend-line growth rate of 4.4% per year since 1Q06.
- Meanwhile, domestic nat gas consumption has only grown by 2.3% per year over that same time period.
- Production growing at ~2x the rate of consumption growth has had a predictable downward impact on prices.

BUT WILL THIS CONTINUE??

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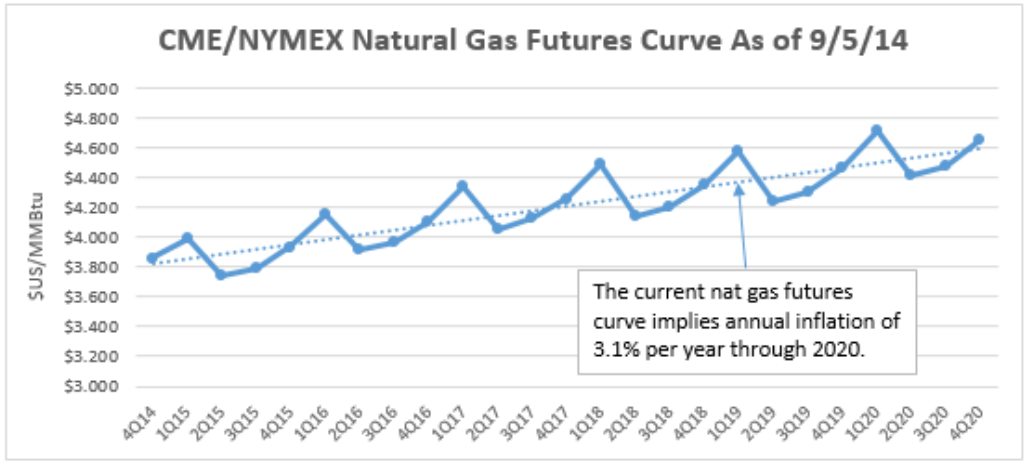
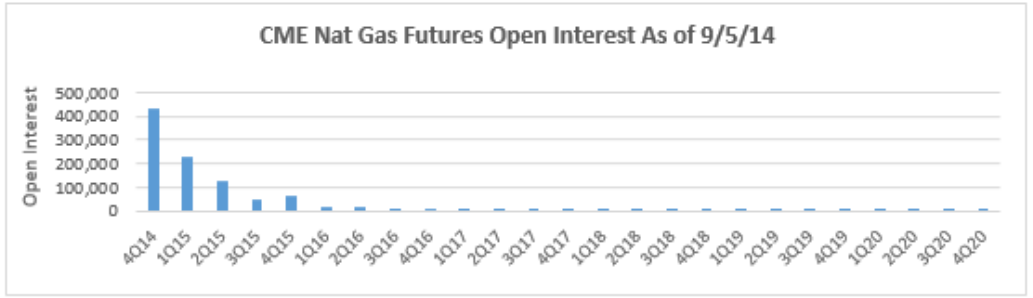
Current Wall Street & Market Outlook

- Wall Street sell-side research consensus estimates for future natural gas prices are typically higher than the CME futures curve at any particular time.
- Natural gas futures open interest is largely concentrated through the end of 2015.
- The CME/NYMEX gas futures curve is pricing in higher inflation than that for the overall market, meaning the real gas curve slopes upward.
- However, our bias is that real U.S. natural gas prices will be flat to down through 2020.





Consensus Wall Street Nat Gas Spot Market Estimates vs NYMEX Futures Curve As of 9/5/14

Qtr/Yr	Wall Street Consensus	NYMEX	Difference	% Diff
4Q14	$4.500	$3.860	$0.640	16.6%
1Q15	$4.500	$3.987	$0.513	12.9%
2Q15	$4.400	$3.745	$0.655	17.5%
2015	$4.480	$3.865	$0.615	15.9%
2016	$4.700	$4.036	$0.665	16.5%
2017	$4.530	$4.196	$0.334	8.0%
2018	$4.560	$4.296	$0.264	6.2%

Source: Bloomberg, CME Group

Inflation Embedded in Treasury Yield Curves As of 9/5/14

Term	Treasury Yield	TIPS Yield	Estimated Inflation
1 Yr	0.10%	-1.31%	1.41%
2 Yr	0.52%	-1.21%	1.73%
3 Yr	0.99%	-0.88%	1.87%
5 Yr	1.69%	-0.32%	2.01%
7 Yr	2.14%	0.04%	2.10%

Source: U.S. Department of the Treasury, Natural Gas Intelligence calculations

Nat gas futures traders are pricing in 3.1% annual inflation through 2020, while the market is forecasting U.S. inflation to be more like 2.0%/yr. over that time period.

We’re Going To Take Two Approaches to Looking At Future U.S. Natural Gas Prices

1. Supply/Demand Approach

2. Unit Cost Approach

“Consensus” Non-Investment Bank U.S. Nat Gas Production & Consumption Forecasts

U.S Production Through 2020
2.5%-3.5%/yr.

- Estimate below the 4.4% annual growth rate over the last 8+ years.
- Much of this growth comes from the Marcellus/Utica Shale & associated gas.
- Main risks are any rules that limit hydraulic fracturing, and if unconventional core areas, or sweet spots, prove to be less lucrative than currently assumed.

U.S Consumption Through 2020
2.0%-3.5%/yr.

- Higher than the trend of 2.3% per year growth since 2006.
- Assumes industrial demand grows faster than it has in recent years.
- Demand for power generation is a wildcard.
- U.S. is currently a net importer of natural gas, but LNG exports are coming. How will that affect the supply/demand balance?

Quick Back-of-the Envelope Consumption Outlook (Ignoring LNG Exports For the Moment)

Sector	% 1998 U.S. Consumption	% 2013 U.S. Consumption	1998-2013 Annual Trend-Line Growth Rate	Assumed Future Annual Trend-Line Growth Rate Thru 2020	Column C x Column E
Residential & Commercial	33%	**32%**	0.0%	**0.0%**	0.0%
Industrial	37%	**29%**	-1.1%	**2.5%**	0.7%
Electric Power	21%	**31%**	4.1%	**3.5%**	1.1%
Other	8%	**8%**	1.4%	**4.0%**	0.3%
TOTAL	***100%***	***100%***	***0.8%***	*Weighted Average =*	***2.1%***

Totals may not add because of rounding

- This is NOT a forecast per se, but rather an exercise to show what U.S. consumption growth would be if the individual sectors grow at expected future rates.
- So far, this is below the 2.5%-3.5% range of production estimates.

U.S. LNG Exports Increase Long-Term Demand

- Some U.S. LNG export capacity comes on line in late 2015/2016, with the majority in 2018/2019.
- We believe LNG exports could increase demand for U.S. natural gas by ~10 Bcf/d by 2020, including nat gas consumed to convert dry gas to LNG.
- Assuming a 2.1% annual growth for traditional non-LNG export factors, and including 10 Bcf/d of LNG exports, that leads to CAGR of 4.0%/yr. through 2020, greater than the "consensus" production estimate range of 2.5%-3.5% through the end of this decade.

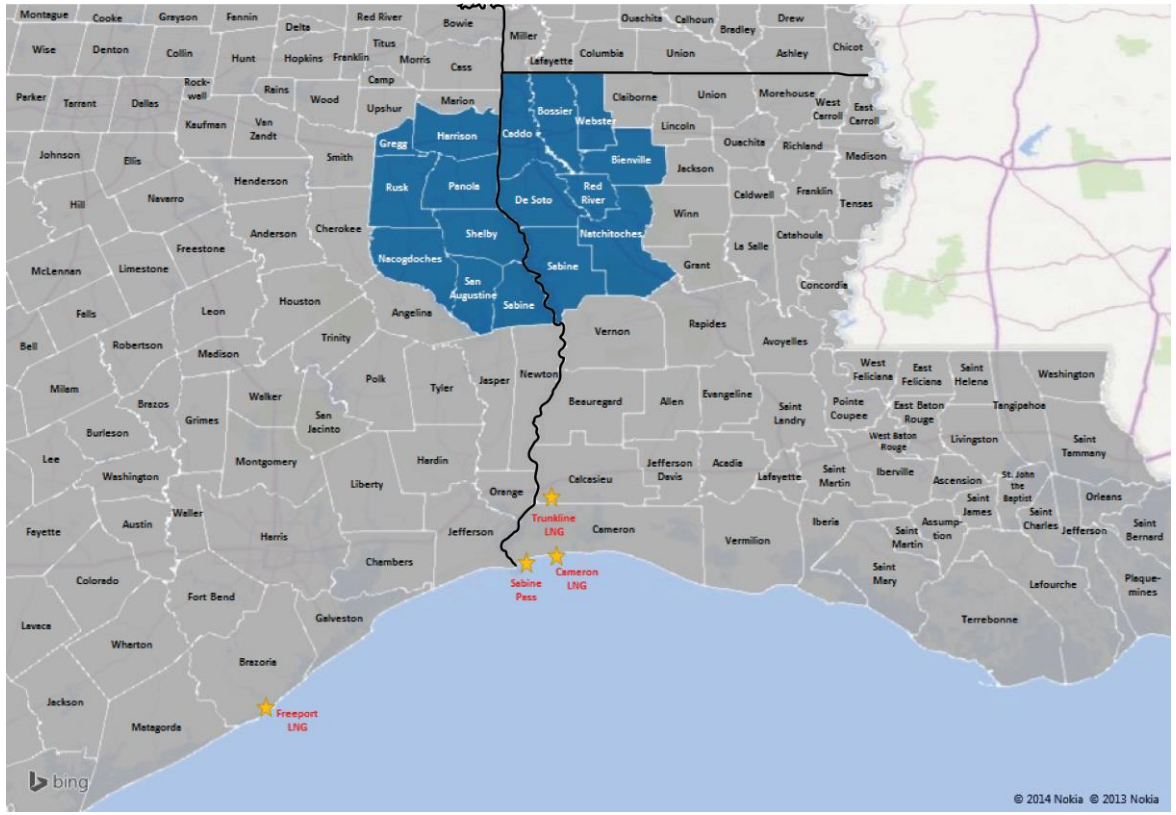
Cumulative Annual Growth Rate Calculation

2013 Consumption	71.3 Bcf/d
Annual Growth (Ex LNG) through 2020	2.1%
2020 Consumption (71.3*(1.021^6.25)) =	81.2 Bcf/d
Add: 10 Bcf/d in LNG Exports	91.2 Bcf/d
CAGR through 2020 ((91/2/71.3)^(1/6.25))-1	4.0%

But can the U.S. meet this incremental net export demand with increased production?

Yeah, It Can

- We believe the Haynesville Shale in particular can step up production
  - Located in North Louisiana and East Texas, close to proposed GOM export facilities
  - Current production 6 Bcf/d, but peaked at close to 11 Bcf/d.
  - Anywhere from 35,000 – 50,000 wells left to be drilled there
  - Lots of takeaway capacity
  - Dry gas, so it doesn't have to be processed
  - BG Group a big player here (50/50 production JV with EXCO Resources, and holds LNG export capacity at Sabine Pass & Lake Charles)
- Production in the Fayetteville Shale, Rockies, and increased associated gas from the Permian, Bakken & Eagle Ford Shales could help, too
- Pipeline reversals will allow more Appalachia production to travel to the Gulf Coast



The unknowns are how much U.S. sourced LNG gets priced off Brent crude oil, and what the mere threat of being able to export LNG to higher priced foreign markets will do to domestic prices. Regardless, expect U.S. LNG exports to increase domestic price volatility.

Other Things To Monitor/Consider That Could Impact Long-Term U.S. Natural Gas Supply/Demand

- Will Congress repeal favorable oil & gas tax treatment?
  - Intangible drilling credits
  - MLPs (Canada got rid of Canroys, but doubt it will happen in the U.S.)
- Could Obama get more aggressive after mid-term elections?
  - Statistics "guru" Nate Silver gives Republicans a 60% chance of taking the Senate
- Might the U.S. ever achieve a comprehensive energy policy that favors the use of natural gas?
  - Could impact the development of NGVs, among other things

Unit Cost Approach: The U.S. Natural Gas Industry Is Highly Competitive, & That Has Major Ramifications On Long-Term Domestic Nat Gas Prices

Estimated 2013 U.S. Natural Gas Production Market Share By Volume

Producer	Est. 2013 Mkt Share
ExxonMobil	6.9%
Chesapeake Energy	5.4%
Anadarko Petroleum	4.8%
Devon Energy	3.5%
ConocoPhillips	3.4%
Southwestern Energy	3.2%
BP	3.1%
BHP Billiton	2.4%
Total 8-Firm Concentration Ratio	***32.7%***
Maximum Herfindahl-Hirshman Index (HHI)	847

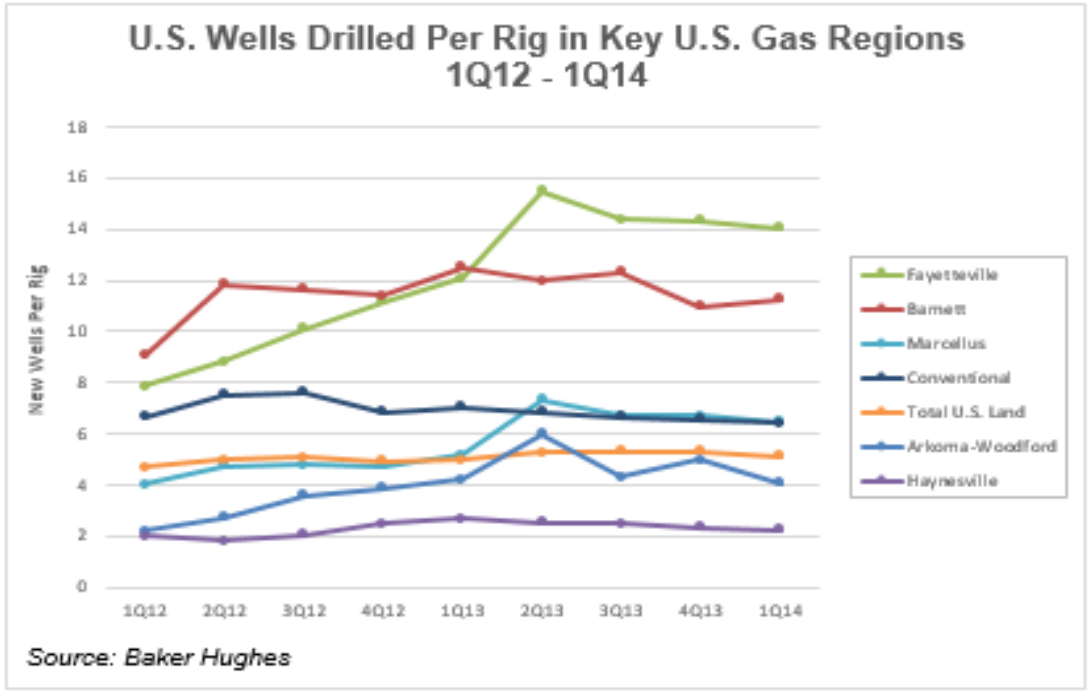
Note: We believe U.S. antitrust officials consider industries that have an 8-firm concentration ratio of less than 50%, and a Herfindhal-Hirshman Index of less than 1500, to be unconcentrated. Note that the 847 Maximum HHI index we calculated assumes that private companies comprised 25.5% of total U.S. nat gas consumption in 2011, and that all those private companies were assumed to be one single company. In reality, the actual HHI score for the U.S. natural gas industry is ***far*** less than 847.

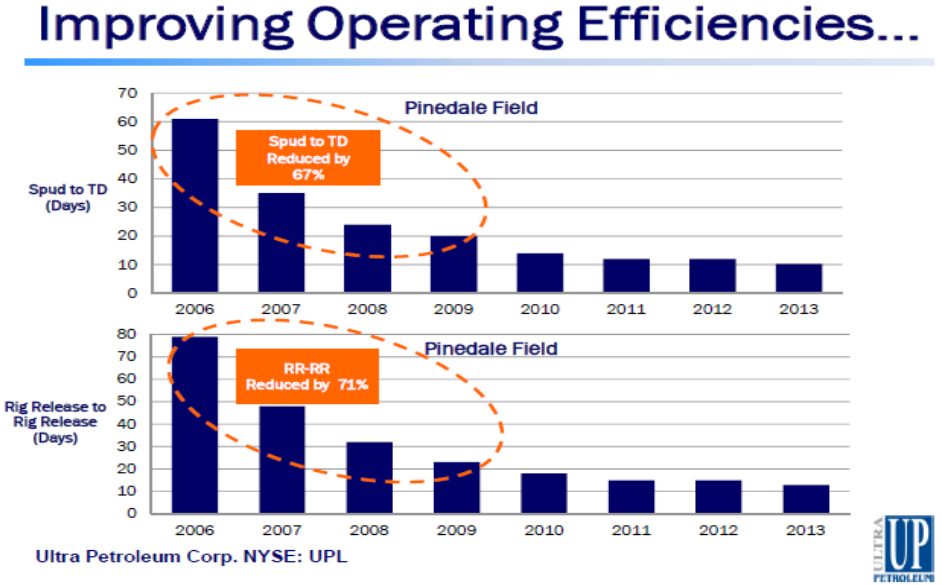
Source: EIA, Company documents, Natural Gas Intelligence calculations

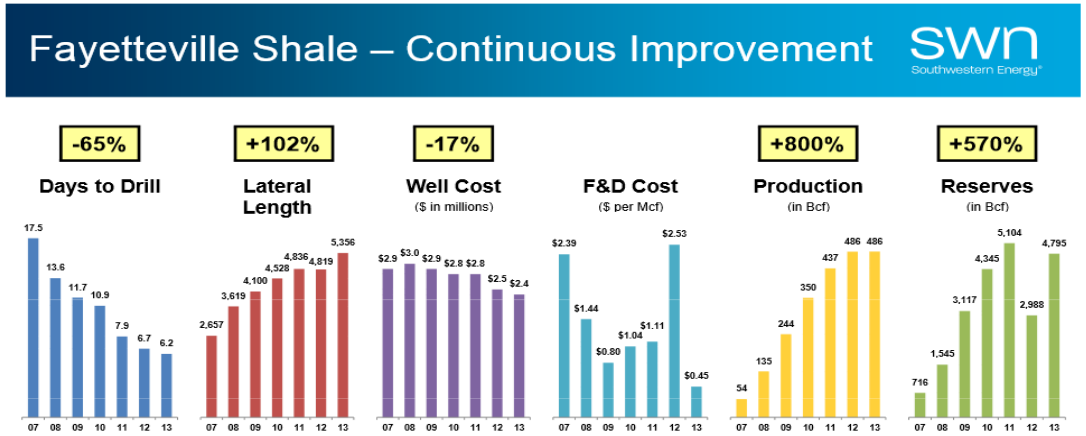
- There are ~7000 oil & gas producers in the U.S.
- In perfectly (highly) competitive markets, which are defined as highly fragmented where producers are price takers, the profit maximizing point is that where price = marginal cost.
- In the long-run, all costs are variable, and are therefore included in the basket of marginal costs.
- Theoretically speaking, unit costs should be a major driver of long-term prices in perfectly competitive markets.

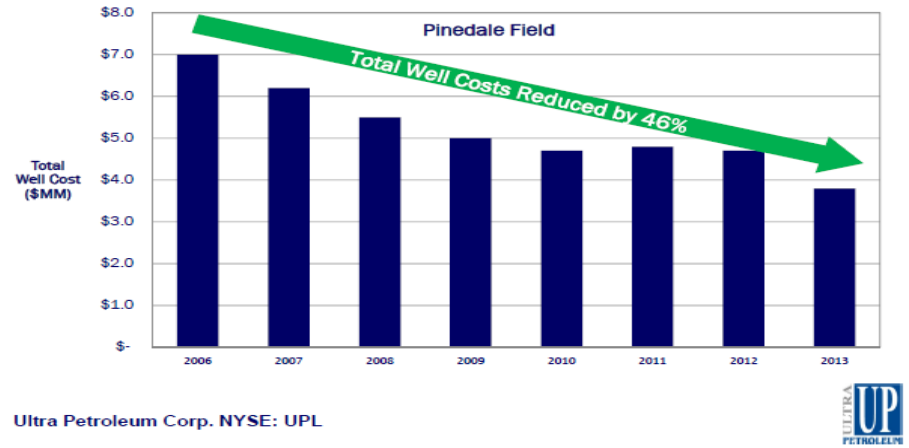
In reality, no markets are truly perfectly competitive. However, we believe the U.S. natural gas industry is extremely competitive, so unit costs should have a defining role on U.S. natural gas prices. Said differently, if unit costs decline, producers, who are price takers, can accept a lower price and still earn an acceptable return on invested capital.

U.S. Unconventional Plays Have Had a Dramatic Impact on Natural Gas Unit Production Costs

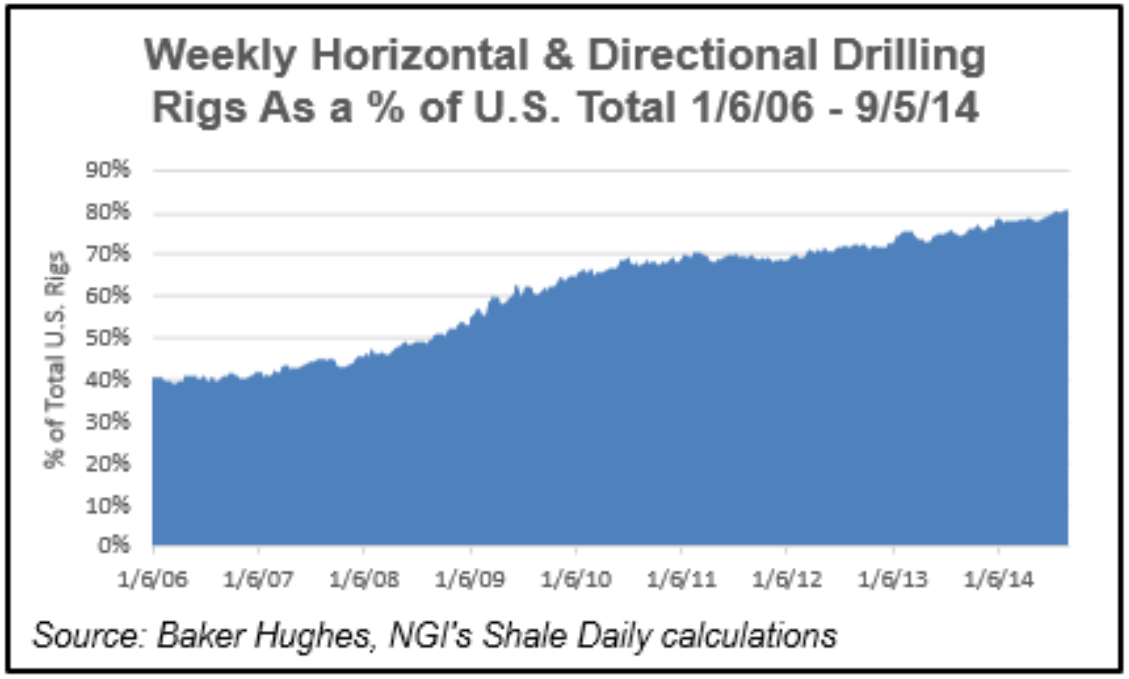








Much of The Cost Improvements To Date Have Been From Horizontal & Directional Drilling

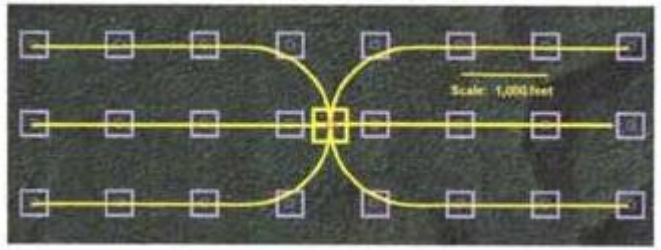


- As a former colleague likes to say, “horizontal wells on average cost 3x as much as vertical wells, but yield 5x as much production.”
- However, as both Baker Hughes & Halliburton stated in 1Q14, the industry has probably already realized the “low lying fruit” in terms of cost efficiencies.

Other Key Contributors to Lower Unit Costs in Recent Years

- Pad drilling (a.k.a. “manufacturing” or “development” mode)
  - Can drill multiple wells off the same wellbore
  - % of wells drilled on pads was 20% in 2010, 50% in 2013, and projected to be 70% in 2018. according to Nabors Industries’ March 2014 IR Presentation
- Longer laterals
  - These cost more, but reach more of the pay zone
- More efficient and “walkable” rigs
  - Many older rigs simply cannot handle all shale plays
  - Walkable/skiddable rigs reduce downtime
- Advanced completion techniques
  - Plug & perf, sliding sleeve, zipper fracs, HiWay Frac, etc.
  - Increased number of fracking stages
- Better fracking “recipes”
  - Using the right completion fluid and type/amount of proppant (sand)
- General learning curve impacts
  - Things typically improve with experience
  - Companies are sharing information to develop unconventional plays more economically

Example of a 6 Well Pad



Source: Range Resources

What Will Drive Future Unit Cost Improvements?

- Continued progress on the previously mentioned factors
- Favorable production mix changes
  - Growing unconventional production means lower cost gas will crowd out higher cost production.
- Development of stacked plays
  - Can reach multiple pay zones from the same wellbore, and achieve synergies with shared land costs.
  - Should increase production as well.
  - Prime targets are the Permian, Eagle Ford Shale, and Appalachia.
- Recompletion of existing horizontal wells
  - Starting to take hold in the Haynesville
- Yet to be discovered technology advancements
  - Oil service companies understand that the next wave of efficiency improvements are likely to be driven by technology, and they are devoting R&D dollars to find the next big thing.
- Improved recovery factors
  - Typical recovery factors: shale 5%-30% tight sands 30%-50% conventional 50%-95%
  - More production for the same cost will obviously lower unit costs.
  - Would also increase production.

Key Takeaway: Unit costs should continue to decline over time, albeit at a slower pace. That will put downward pressure on natural gas prices, everything else being equal. We also believe these developments should allow U.S. natural gas production to continue to grow.

Summary/Quick Conclusions

- Lots of things can happen between today and “the long-run,” but based on what we see today, and what we reasonably expect will happen, our bias for U.S. real long-term natural gas prices is to the downside through 2020.
- We believe U.S. supply has a greater chance to outpace U.S. demand increases going forward. Even if they match each other, lower unit costs should still move real gas prices lower, everything else being equal.
- U.S. LNG exports are a wildcard on prices. Production should be able to keep pace with demand, but just the threat of being able to export to higher priced foreign markets *may* cause U.S. real natural gas prices to inch higher after 2020, everything else being equal.
- LNG exports from the U.S. will likely increase domestic gas price volatility.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