

# **Valuing Oil & Gas Reserves (Part I)**

## **Impact and History of Oil & Gas Prices**

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February 2018

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# Introduction

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## Commodity Prices Impact Reserve Value

To understand generally how oil & gas reserves are valued, you need to know a bit about the history of the U.S. oil & gas industry and the impact prices of the commodities have played on reserve values.

- Volatile Oil Price Environment – from a high of nearly \$150/barrel in 2008 to a low of \$26/barrel in 2015-2016.
- Volatile Natural Gas Environment - over \$13 MBTU in December of 2005 and down to \$2.81 in December 2017.
- Shale Revolution - There has been a revolution in the industry starting with the first successful shale drilling in the Barnett Basin, west of Ft. Worth, Texas.

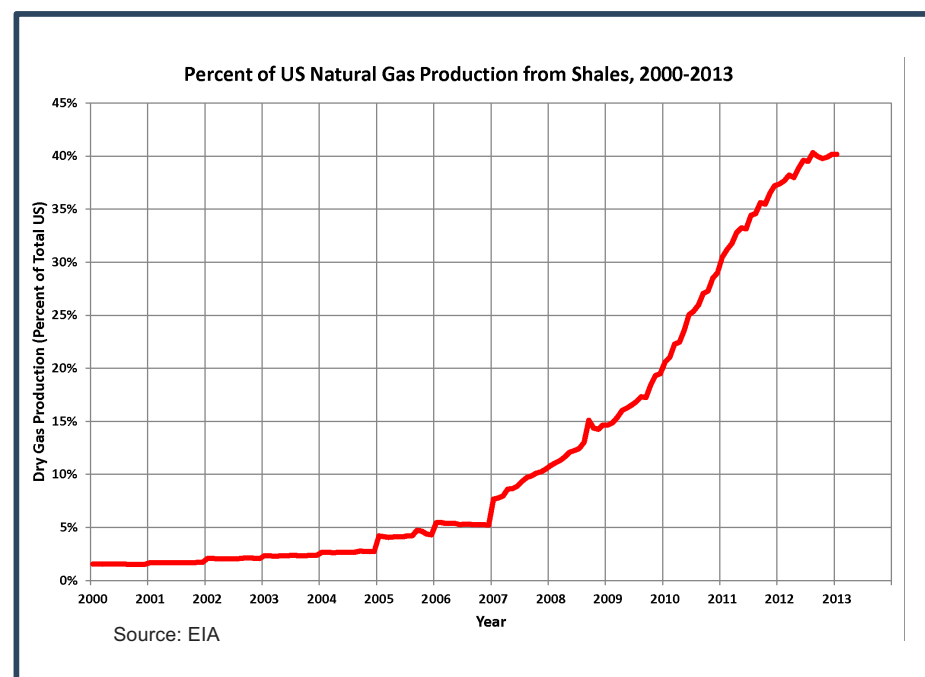
# Perspective on Natural Gas Production

## Plenty of Natural Gas

The number of unconventional natural gas wells in the US rose from 18,485 in 2004 to 25,145 in 2007 and is expected to continue increasing until about 2040. This expectation is shown in the chart on the right which indicates dry gas production from shale was approximately 2.5% in 2004 exploded to become 40% of all dry gas production.

The economic success of shale gas in the United States since 2000 has led to rapid development of shale gas in Canada, and, more recently, has spurred interest in shale gas possibilities in Europe, Asia, and Australia. It has been postulated that there may be a 100-year supply of natural gas in the United States, but only 11 years of gas supply is in the form of proved reserves.

“Shale Gas in the United States,” *Wikipedia*



# Perspective on Oil Production

## Domestic Oil Production Impacting Global Oil Prices

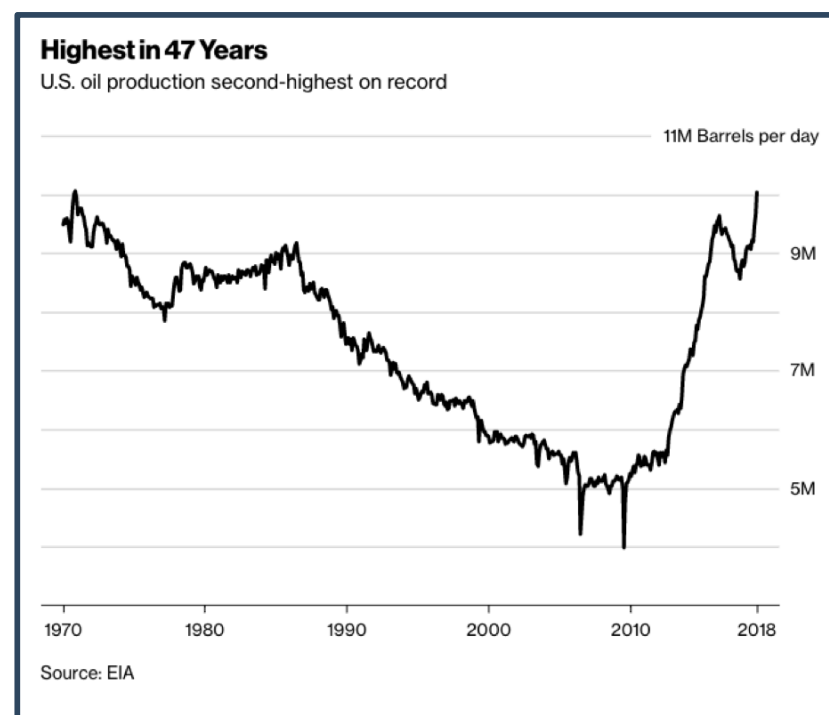
The news also comes after the Organization of Petroleum Exporting Countries decided last year to extend an agreement with several non-OPEC members to curb output in response to a global supply glut fed in part by shale. That agreement was finally showing signs of working, with prices emerging from a three-year downturn. After falling near \$26 a barrel in 2016, the global benchmark oil price climbed above \$70 a barrel in January, and the US price is following suit. Yet, increasing output from the US may threaten rising prices.

Exxon Mobil Corp. is spending billions to triple output by 2025 from the Permian, where its costs are as low as \$15 a barrel.

Production from Texas, which also included the Eagle Ford play, contributed 3.89 million barrels a day to the November figure, the most of any state. Output from the Gulf of Mexico surged and North Dakota, where most of the Bakken shale lies, pumped the most since August 2015.

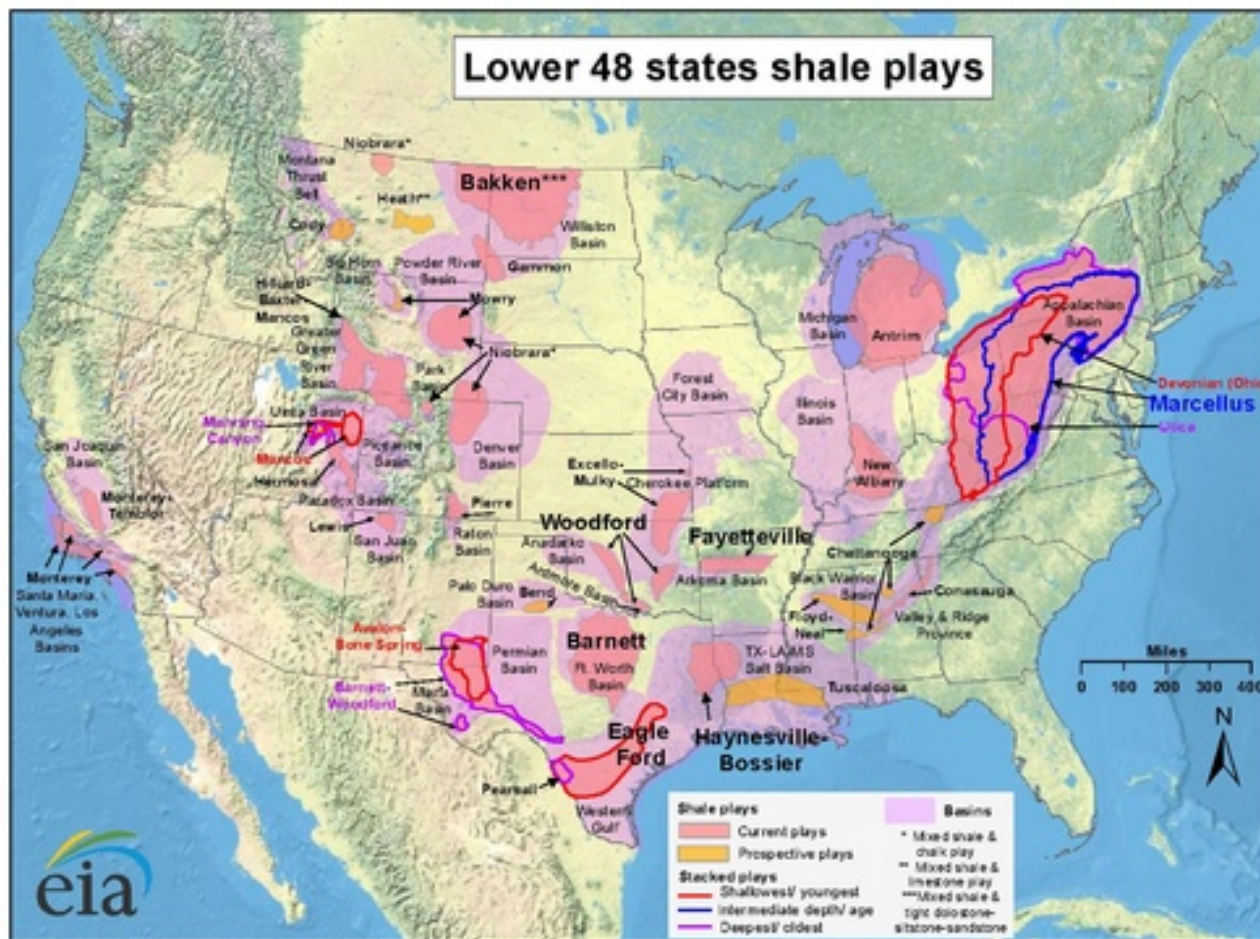
– Jessica Summers

“Shale Sends US Oil Output Past Historic 10 Million-Barrel Mark,”  
*Bloomberg*



# Lower 48 States – Shale Plays

Shale, Shale, Shale



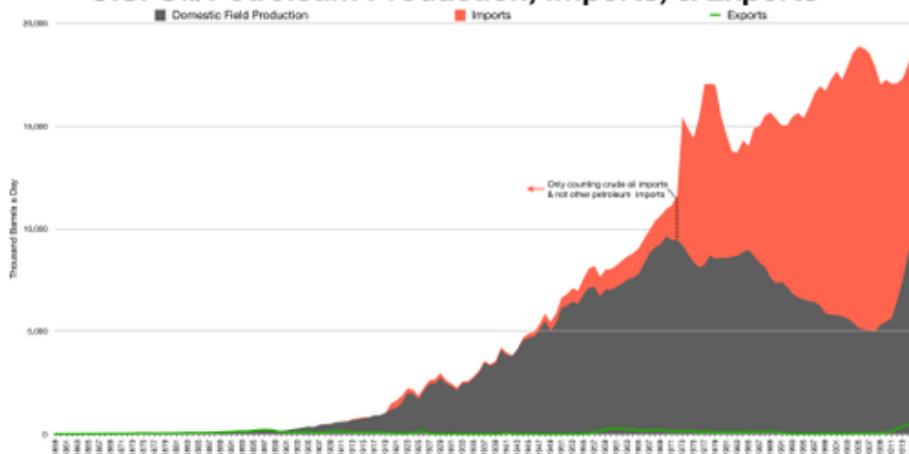
Source: Energy Information Administration based on data from various published studies. Updated: May 9, 2011

# Lower 48 States – Shale Plays

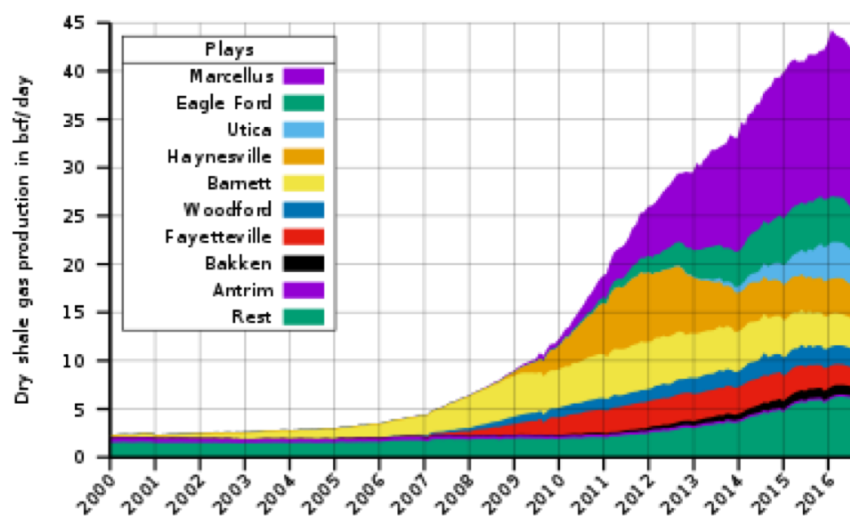
## Shale, Shale, Shale

*Increases in shale production along with changes in federal laws are allowing for increased exports of oil.*

**U.S. Oil/Petroleum Production, Imports, & Exports**



**Shale Gas Production by Geologic Formation**



*Spurred on by oil exploration, the increase in natural gas production has significantly shifted the pricing landscape for natural gas.*

# Shale Background

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## Technology Multiplied Production of Oil and Natural Gas

Some oil pioneers figured out how to economically obtain oil and natural gas from shale deposits. Instead of vertical-only drilling, they drilled to the shale deposits which might be 200-400+ feet thick. For example, drillers would go 5,000 feet down and then drill horizontally through the shale for up to a mile, with multiple fracks of the drill pipe along the way to allow the oil or gas to flow to the surface. Pumping sand and chemicals were added under very high pressure into the fractures of the shale to open up and increase the flow of the oil or gas.

Soon multiple basins were identified and horizontal wells drilled into the shale creating a tremendous amount of a new oil and gas supply in America.

The Marcellus and Utica basins in West Virginia and Pennsylvania have flooded the Eastern flowing pipeline to the point of over-capacity and caused the prices to plummet in the Marcellus basin to the point that drilling is no longer economically feasible. (For additional perspective, see “Natural Gas Pipeline Projects Lead to Smaller Price Discounts in Appalachia Region,” *EIA*.)

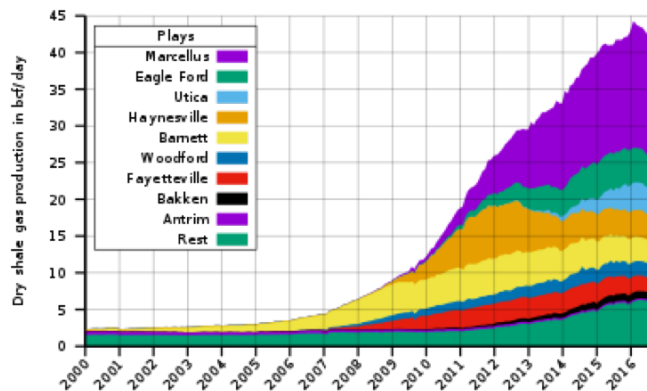
# Historical Pricing

## The Fall of Natural Gas

Let's look at commodity prices in the last 10 years.

At one point in 2008, I was sure that natural gas would never drop below \$5.00 MCF. I was very wrong. Look at the chart to the right. Natural gas dropped to under \$2.00 MCF. Compare this chart to the natural gas production chart shown below (and earlier) and note the significant increase in production during 2008-2010 is a contributing factor.

### Shale Gas Production by Geologic Formation



### Natural Gas Prices – 2008-2018



Source: [macro trends.net](http://macro trends.net)



# Historical Pricing

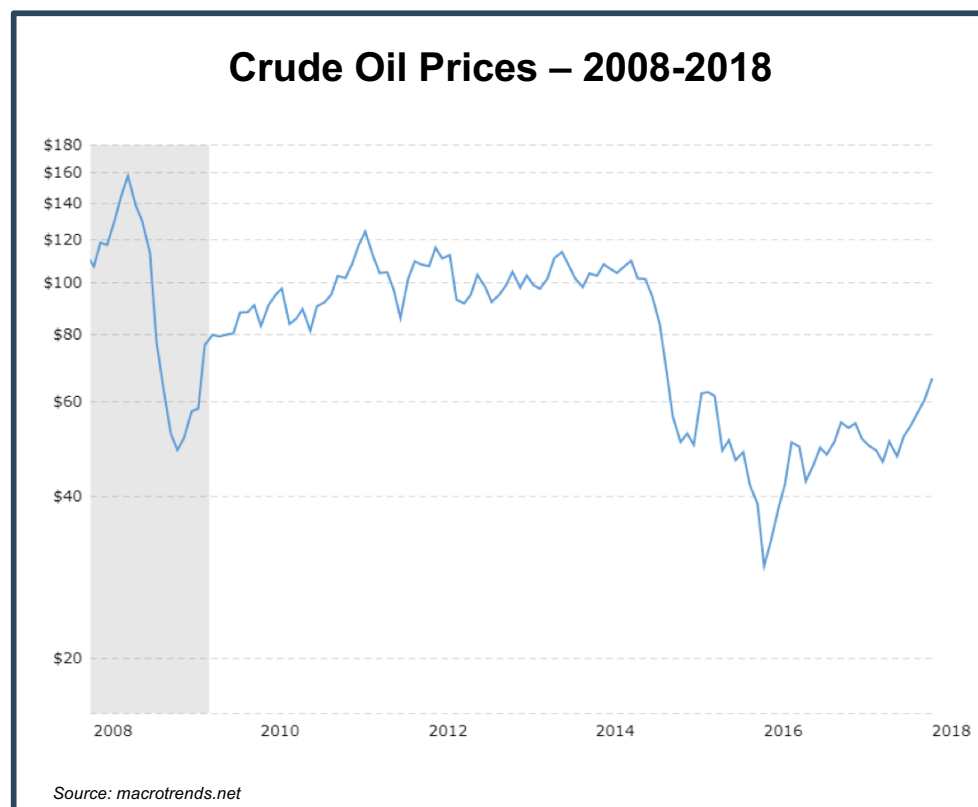
## Higher Crude Oil Production = Lower Prices

Oil is on quite the roller coaster. Currently, oil has bounced back to \$65 to \$70 a barrel. As we discussed earlier, many think it will rise in 2018.

Currently, it is predicted that the U.S. will out-produce Saudi Arabia in 2018 with over 10M barrels a day while still importing 7M barrels a day.

U.S. production has roughly doubled since 2008.

Saudi Arabia is reportedly considering buying a U.S. shale driller to learn the secrets of the drilling technology.



# Drilling & Reserve Summary

## Well Costs Depend on the Basin

As you can see, prices are very volatile, and the cost to drill has fluctuated with the supply and demand.

It also varies, of course, by depth and complexity. The deepest is in the Utica where vertical depths are 10,000 feet and more which is quite different than the Marcellus where the vertical depth is close to 5,000 feet.

After the shale is penetrated, the technicians turn the drill bit from vertical to horizontal and drill through the shale for up to 2 miles. (See Bakken chart on following page).

### Cost to Drill Horizontal Wells by Basin

<b>Bakken</b>	6 to 10 M
<b>Marcellus</b>	4 M+
<b>Utica</b>	8 to 10 M+
<b>Eagle Ford</b>	5 to 7 M
<b>Permian</b>	5 to 7 M

# Bakken Drill Length Averages

Size of the Wells Are Growing as Is Production (2008 v 2013)

## Bakken Drilling Averages

	2008	2013
Well Lateral Length*	5,000 ft	10,000 ft
Well Total Depth (TD)*	16,000 ft	21,000 ft
Avg. Oil Production per Well	77 bpd	130 bpd
Drilling Time per Well	32 days	18 days

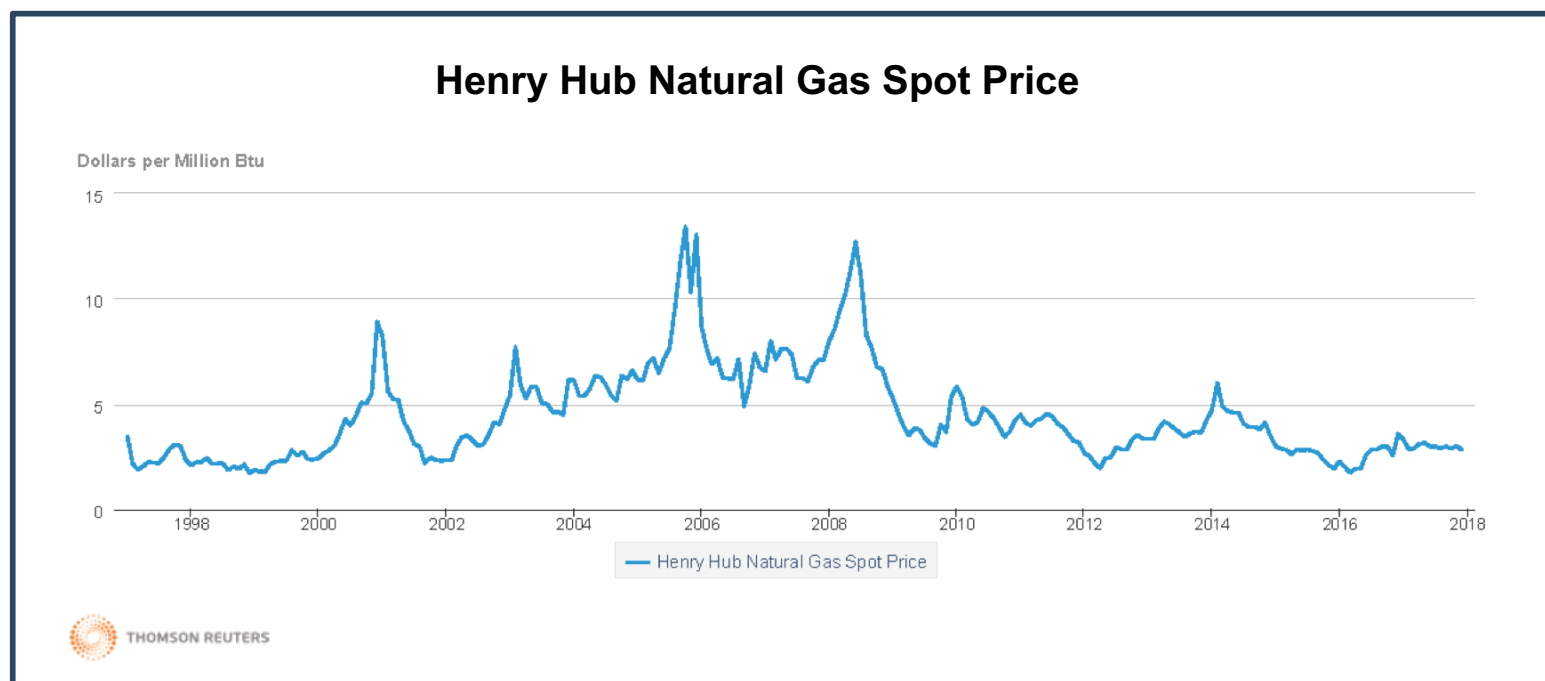
\*As experienced by DTC Energy Group drilling supervisors

\*\*Source: North Dakota Department of Mineral Resources

# Long Term Henry Hub Natural Gas Spot Price

## Higher Supply of Natural Gas, Lower Prices

Natural gas hit a high of \$13.42 MBTU in October 2005. The next highest was \$12.69 MBTU in June 2008. By September 2009, natural gas dropped to \$2.78 MBTU. In March 2012, natural gas was \$2.15 MBTU. In April 2016, \$1.95 MBTU. However, natural gas is now about \$2.80 MBTU.



# Natural Gas Summary

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## The Natural Gas Miracle Is a Problem

We are exporting more natural gas than ever, both through LNG plants along the coast and through pipelines to Mexico.

The U.S. Energy Information Administration projects that exports to Mexico will increase by 25% in 2018, from 1.1 to 1.8 mmcf.

**Current economics indicate that it is cheaper to buy natural gas than to produce it – how can this be and how long can it stay this way?**

From a high of \$12.69 MBTU to less than \$3.00 MBTU recently, it is projected to stay that way for years.

# Effect on Deal Prices

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## Valuations Are Tricky

### What Has This Meant to Deal Prices?

In all but a few key basins, like the Permian, the price of gas reserves has plummeted. In 2015, a client bought gas-only assets in the Marcellus at an auction for \$20M cash. The same assets were purchased by a knowledgeable player two years earlier for about \$55M.

We did an allocation of the purchase price and had to figure out the value of the parts without the help of usable comps.

Components include: three drilled but uncompleted wells, a pipeline gathering system, and rights to about 20,000 acres. Typically, the undrilled acreage with little or no production history in the area can be valued one of two ways:

1. DCF with a haircut from the value level of proved producing acreage. As we will discuss, these haircuts can be as high as 100% in today's market.
2. Transaction prices for purchases of similar acreage.

The challenge was that the transactions were two or so years old and the market had cratered since then as exhibited by the purchase for about 1/3 of earlier prices.

### So How to Value the Assets?

We identified, with the client, that it would take a net \$4.00/mcf received to make the \$4M/well drilling costs economical. We projected the net price they would likely receive based on NYMEX projected futures. The surprising result for me was that it was projected to nine years.

Based on the WACC, we discounted the current transactions for the PV and the WACC for nine years and came up with \$530/acre – previous transactions were over \$2,000/acre. We added the other parts and the estimated values fit.

# Oil & Gas Industry Services

Mercer Capital provides business valuation and financial advisory services to companies in the energy industry.

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- Exploration & Production
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## Mercer Capital's Energy Group



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