

Natural Gas Update

Presentation to:
SARL Conference

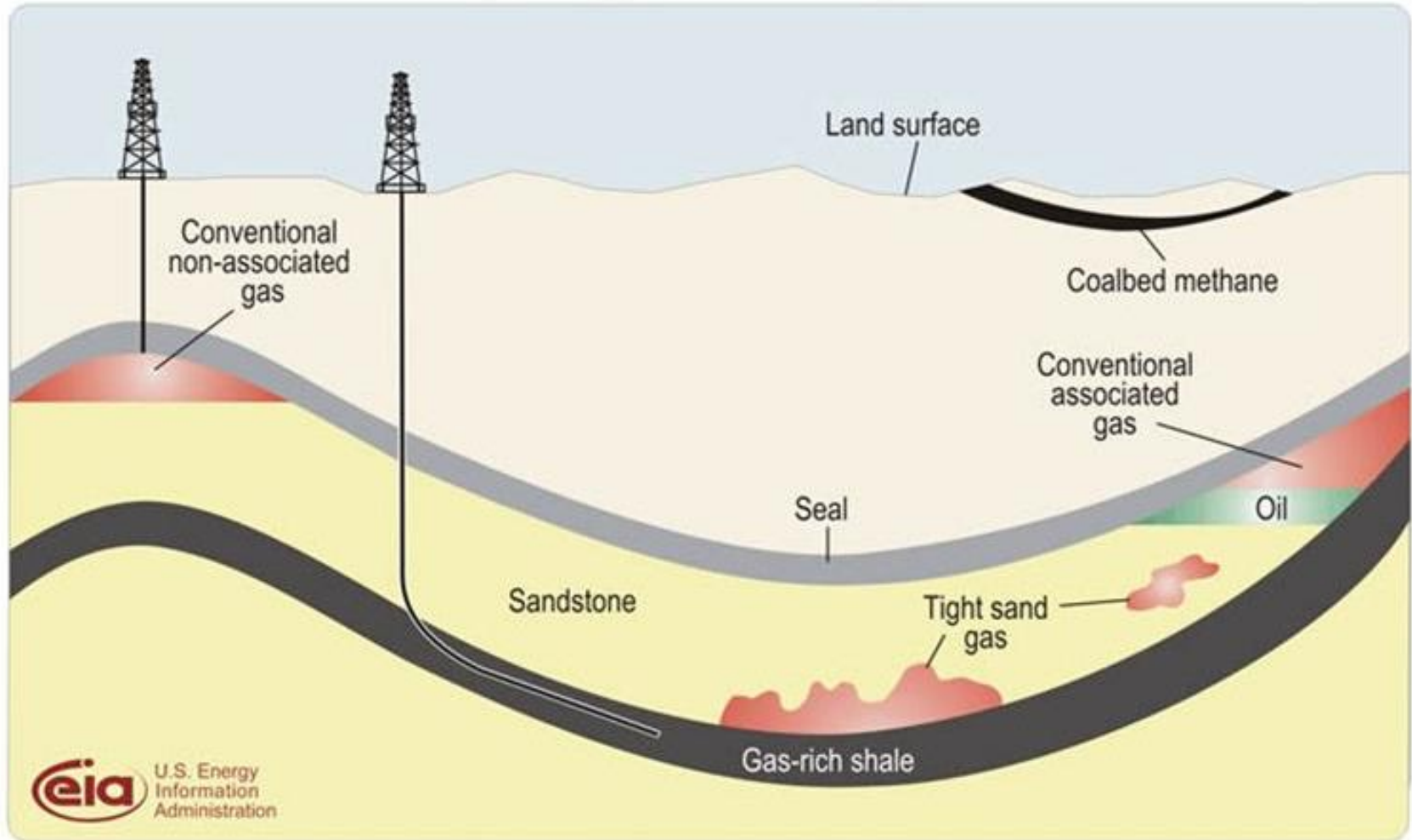
By:
John Harpole



January 6, 2018

It is not a scarce resource anymore

Schematic geology of natural gas resources

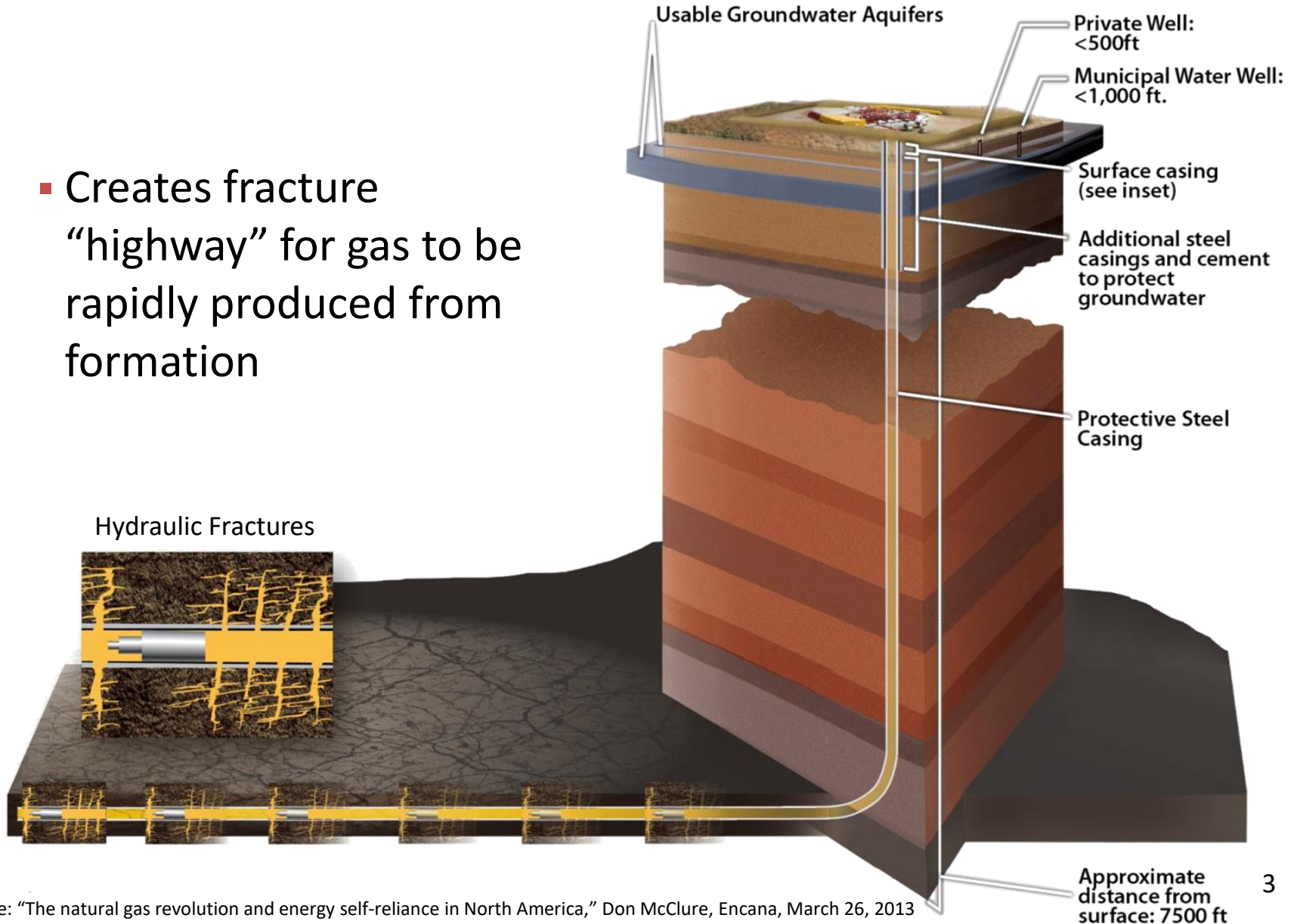


Source: US Energy Information Administration

Hydraulic Fracturing

Pumping fluid under high pressure to fracture formation

- Creates fracture “highway” for gas to be rapidly produced from formation



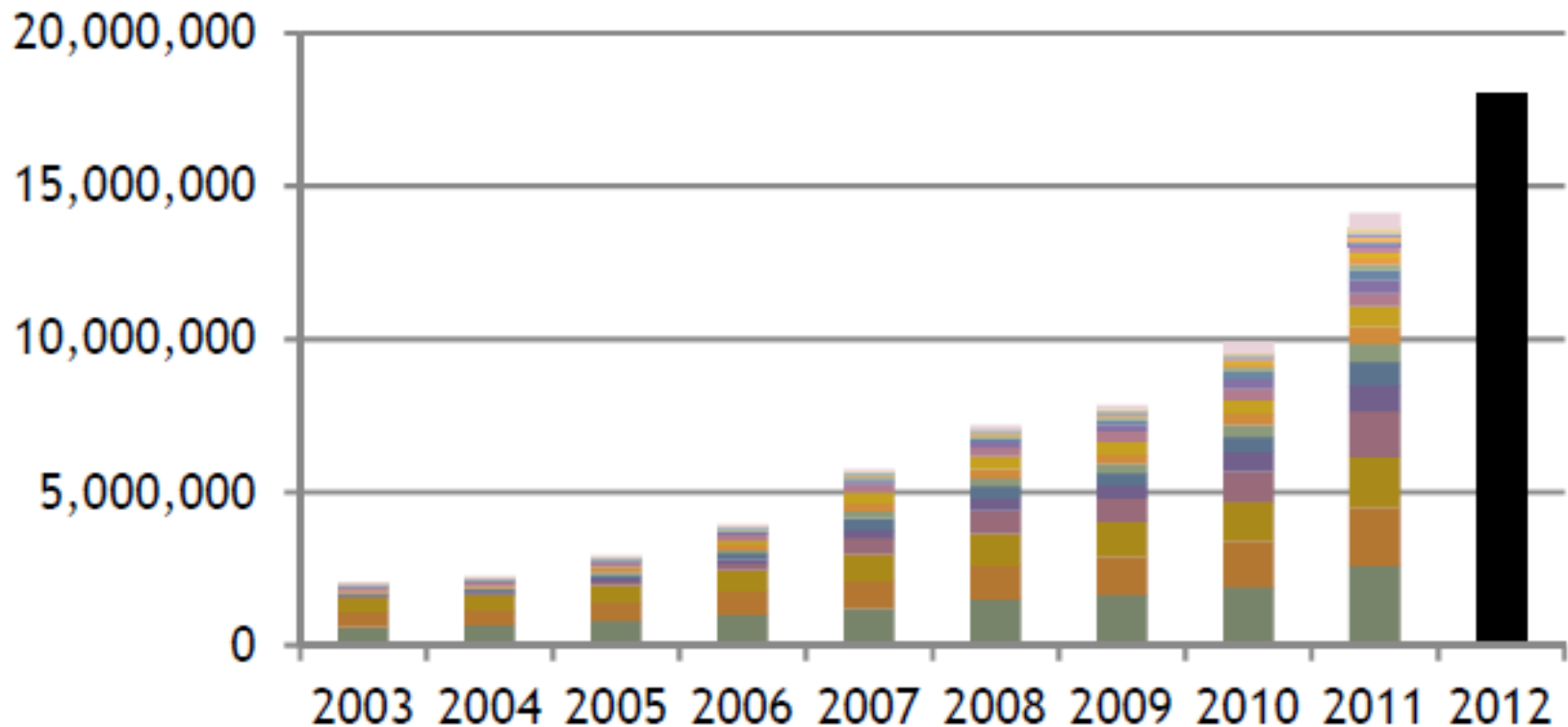
North American shale plays (as of May 2011)



Source: U.S. Energy Information Administration based on data from various published studies. Canada and Mexico plays from ARI.
 Updated: May 9, 2011

Fracturing Application Exploded

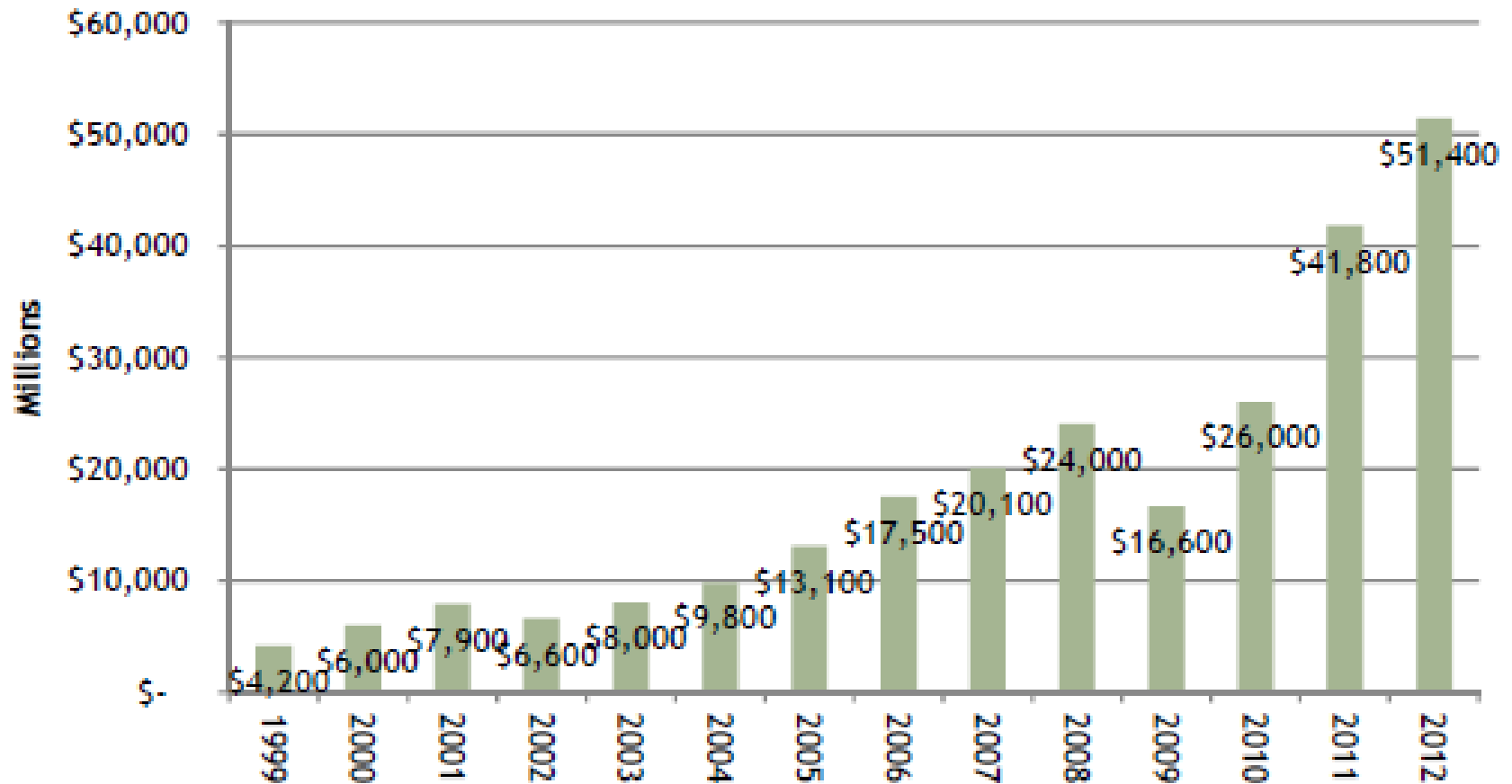
North American Frac Horsepower



Source: Chris Wright, Liberty Resources Tuesday Lunch Club Presentation, 3/5/13

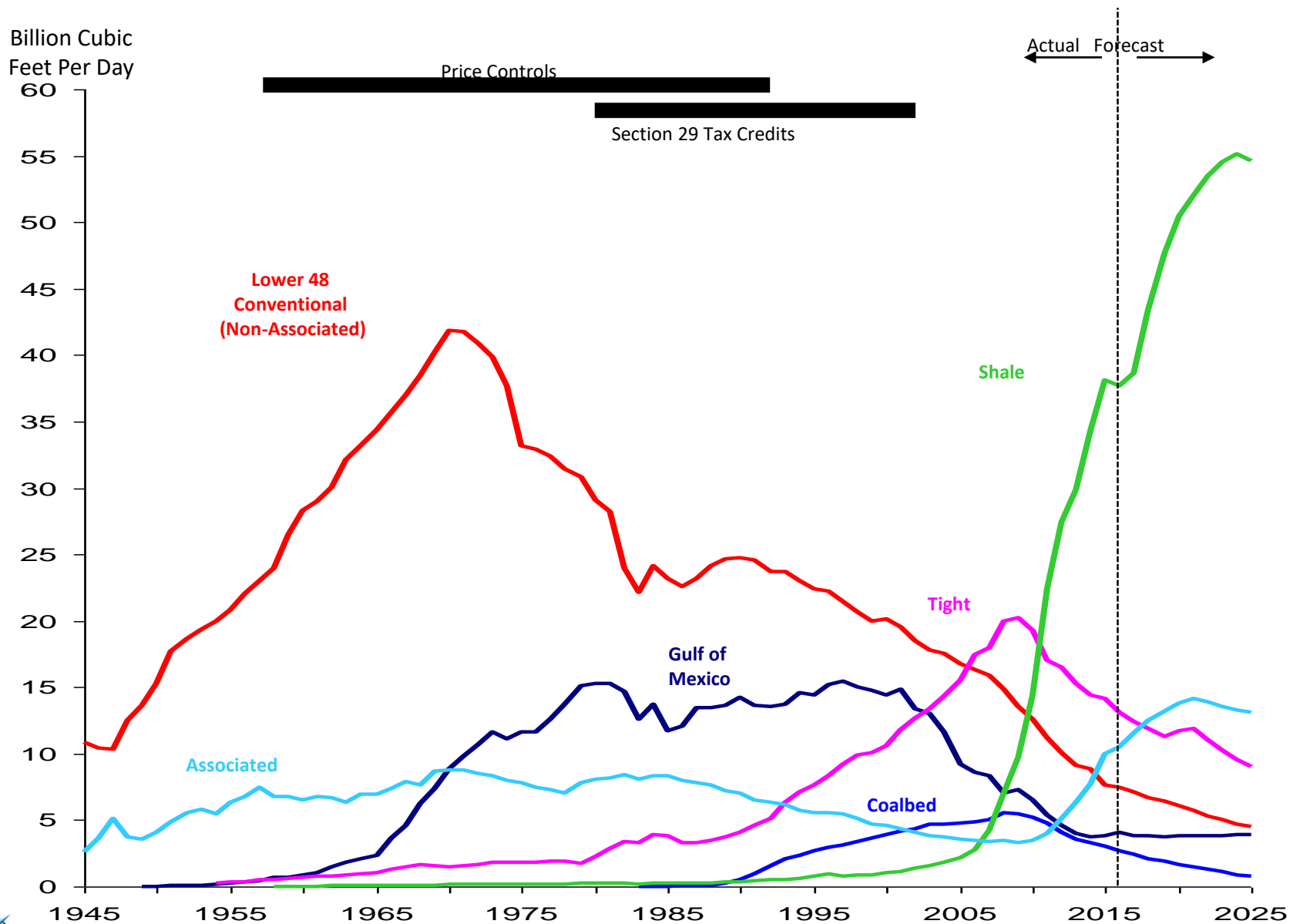
10-fold growth in 10 years

Pressure Pumping Services



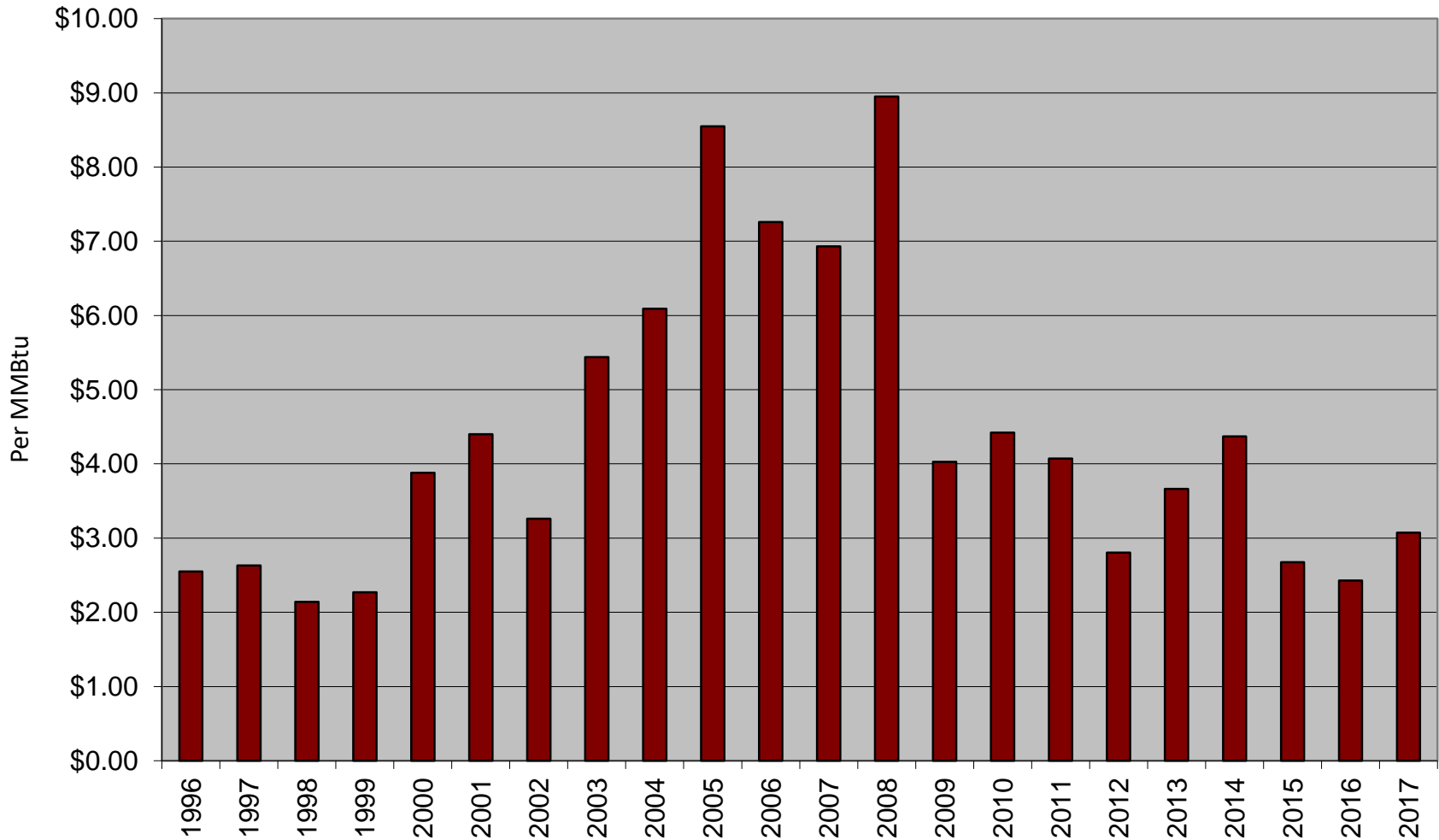
Source: Chris Wright, Liberty Resources Tuesday Lunch Club Presentation, 3/5/13

FIGURE 3
UNITED STATES NATURAL GAS PRODUCTION

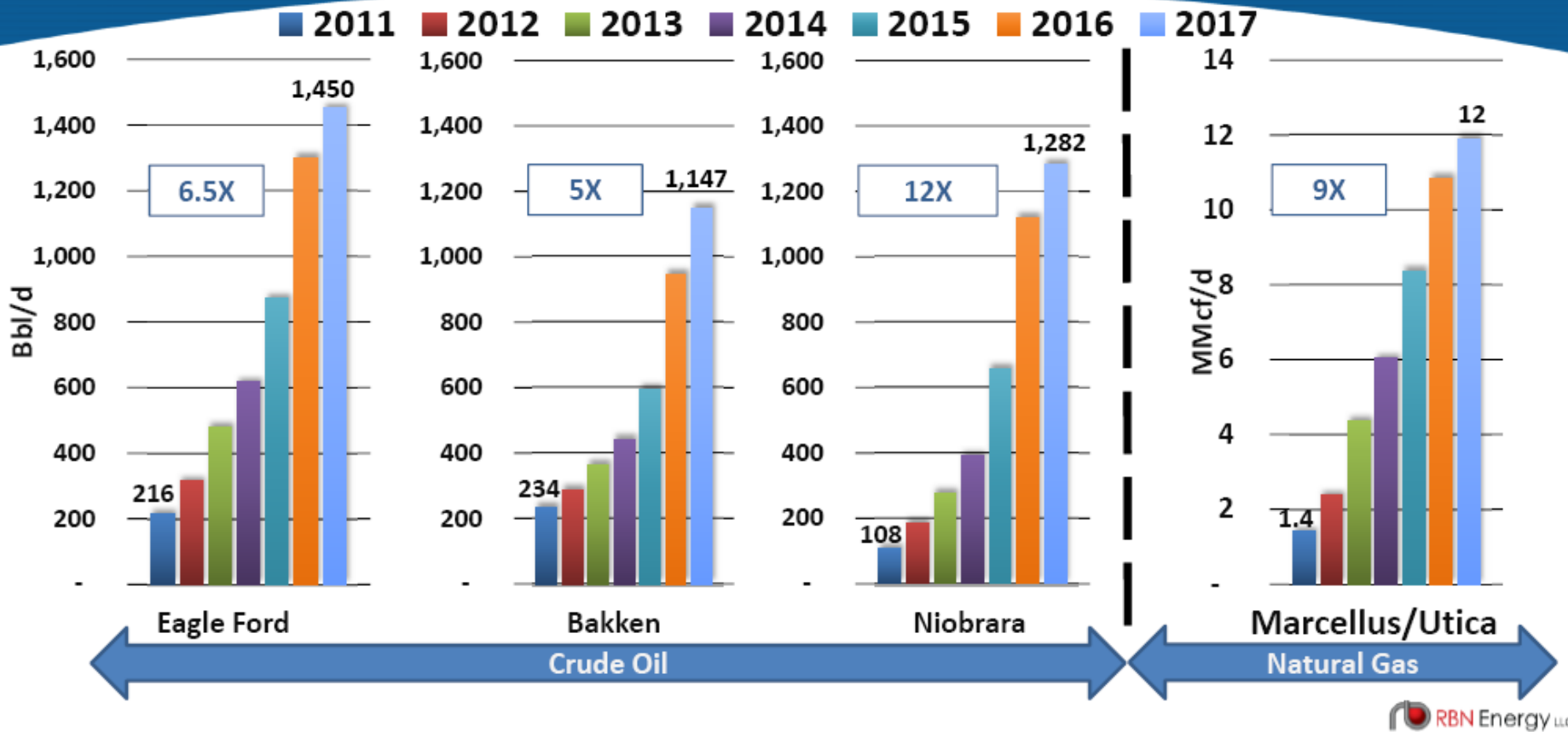


Despite a price drop

Historical Henry Hub Index Prices (1996-Current)



Oil and Gas Production Added Per Rig

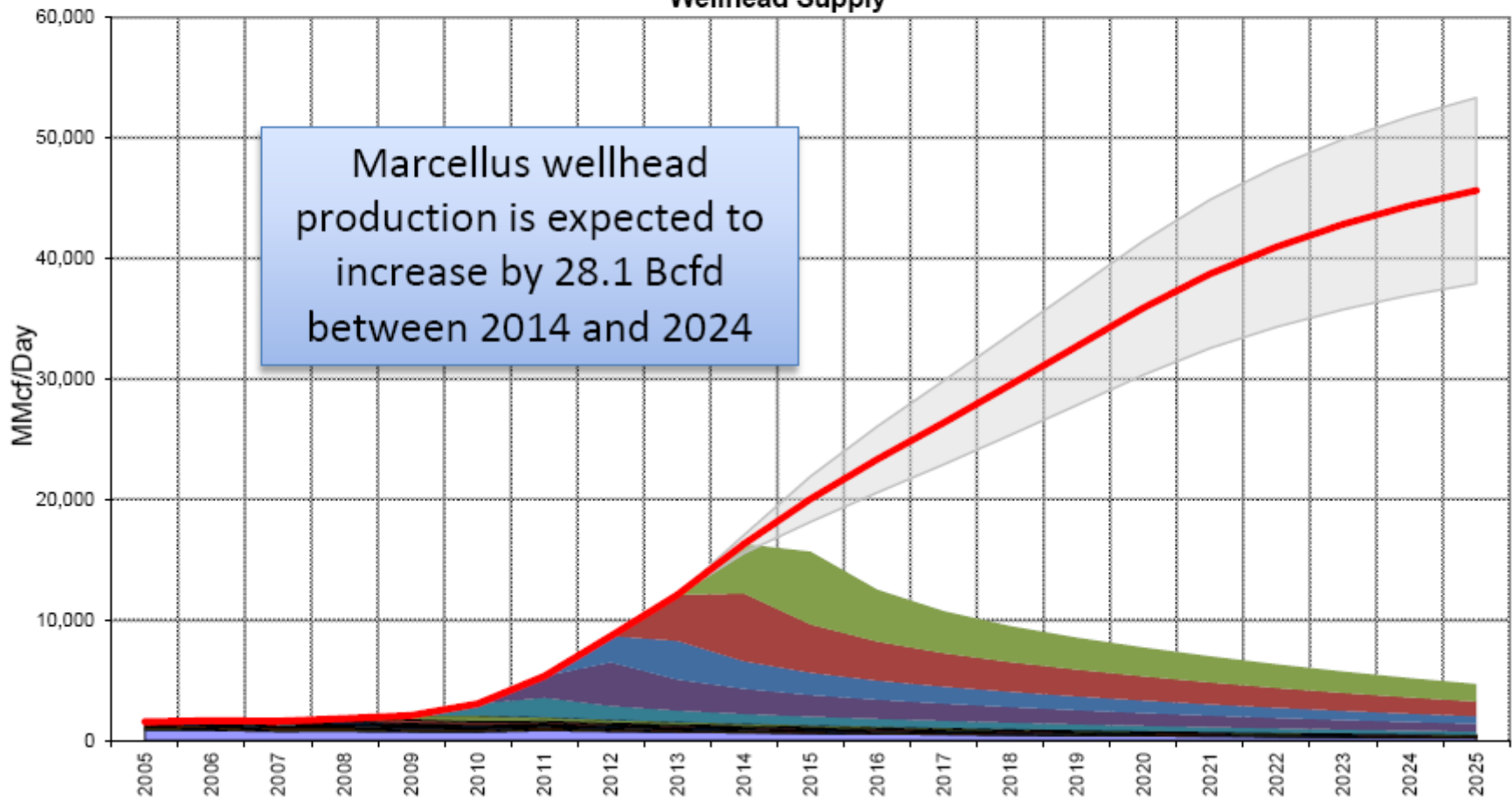


Source: *Midstream to Markets: Oil Markets: Out of the Woods?*, RBN Energy, The Energy Summit, August 23, 2017

Marcellus

Marcellus/Utica Area

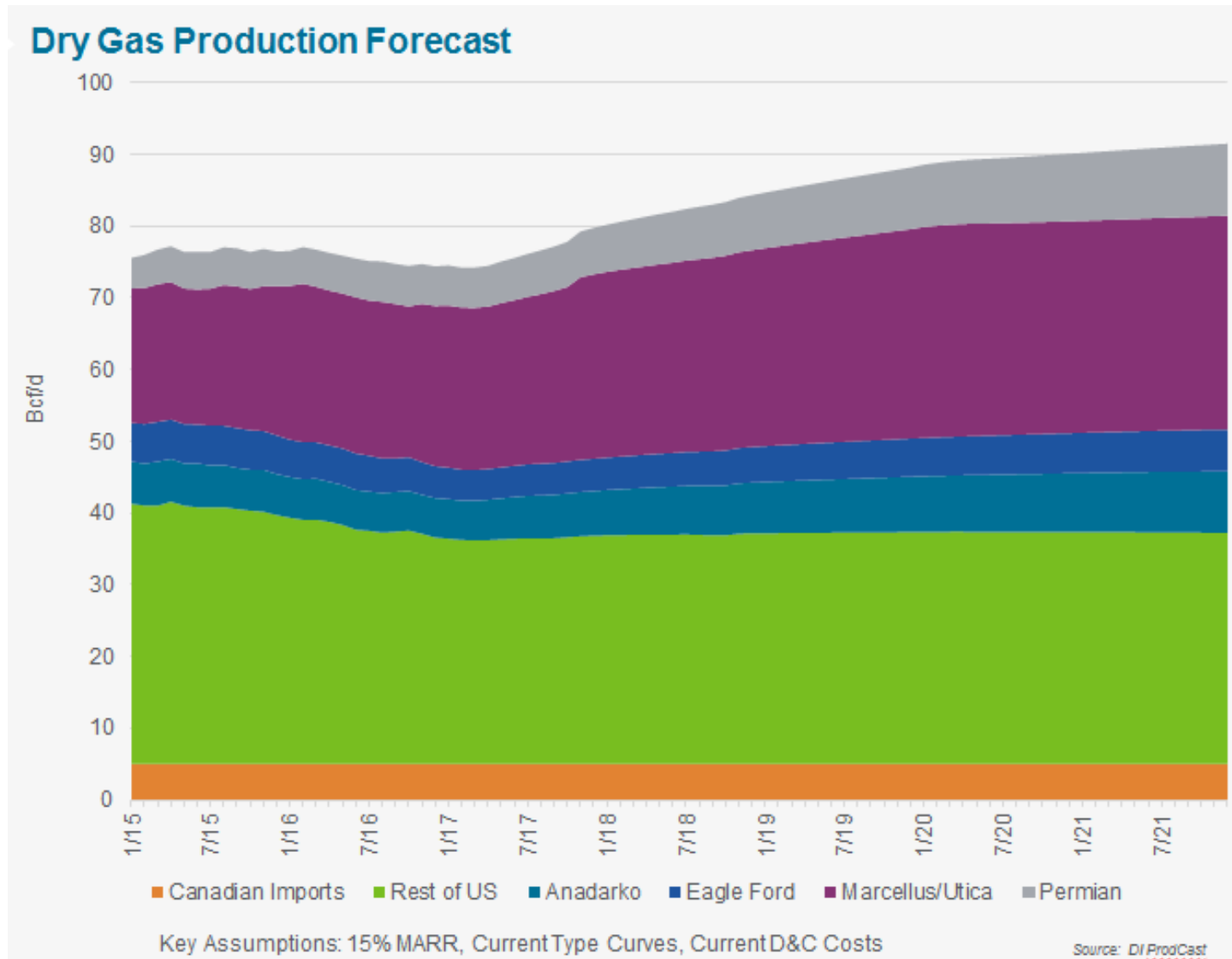
Wellhead Supply



1990-2013: Wellhead total data from DI Desktop

2014-2025: Kinder Morgan forecast

Dry Gas Production 5-Year Outlook



Source: *The New Normal(ization): Market Intelligence: FundamentalEdge Outlook*, Bernadette Johnson, August 2017

The Crystal Ball Price Forecast

YEAR	WTI (\$/Bbl)	HH (\$/MMBtu)
2017	\$52	\$3.25
2018	\$52	\$3.15
2019	\$60	\$3.00
2020+	\$60	\$2.85

Source: *The New Normal(ization): Market Intelligence: FundamentalEdge Outlook*, Bernadette Johnson, August 2017

Conclusions: Natural Gas

- US natural gas supply **is growing again**. Dry gas production in June 2017 was **1.1 Bcf/d higher** than December levels. June 2017 also marked the first month of production above 2016 levels. **However, year-to-date production remains below 2016 levels.** DI expects the largest gains in production during 4Q2017 as pipeline takeaway capacity becomes available. This will allow a year-on-year growth of 0.5 Bcf/d.

Conclusions: Natural Gas (cont'd)

- Pipeline flows across the country **have already changed dramatically** as a result of the Marcellus/Utica growth.
 - A **de-bottlenecking in the Northeast** should finally occur in 4Q2017. Expect Northeast basis to tighten starting this winter
 - **Bottlenecks in the Permian and Anadarko are emerging**. In the Permian, gas needs to move East in order to reach growing LNG demand while in the Anadarko, the constraints are intra-basin and to interstate pipelines.
- Over the next 5 years, **significant natural gas production growth is expected in the Permian, Anadarko and Marcellus/Utica**. Significant demand growth is also expected, led by LNG exports.

Associated Gas: Commodities Tied Together at Drillbit

This graph shows the interrelatedness of the commodities and the impact of the price of crude oil on the production of natural gas regardless of the price of natural gas.

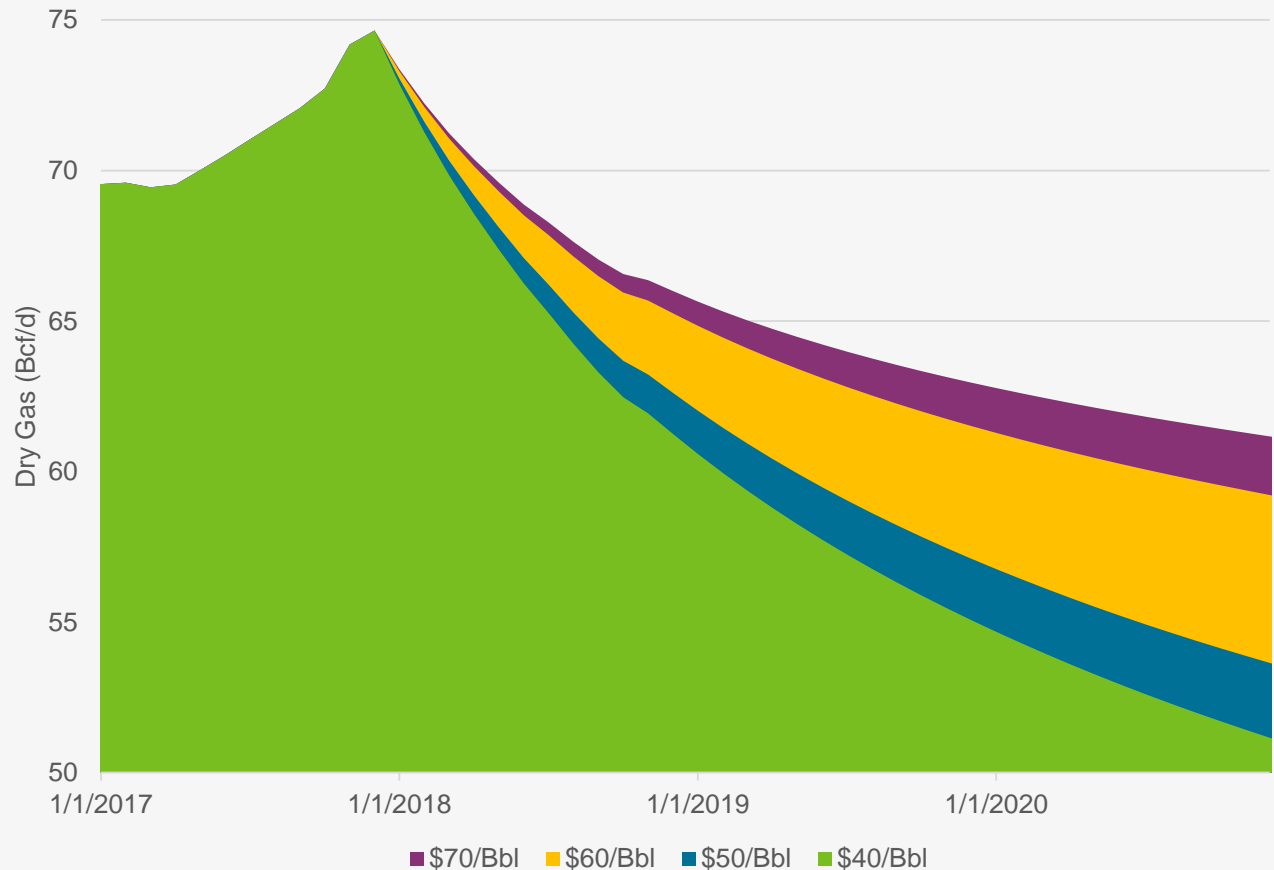
This chart illustrates the decline rates of natural gas production in a scenario where there is no value associated with natural gas production. Hence, the production wedges between \$40-\$70/Bbl represent those additional gas production volumes from crude oil directed drilling programs only. Said another way, this chart demonstrates the associated gas production from purely crude oil economics driven drilling.

By the end of 2020, a WTI price of \$70/Bbl vs. a WTI price of \$45/Bbl would lead to an ~5 Bcf/d higher natural gas production level, regardless of natural gas prices.

A lot of areas come into the money between \$50-\$60/Bbl, which means that there is a lot of associated gas that comes online at the \$60/Bbl WTI mark. This is the reason for the declining price forecast for natural gas prices when paired with an increasing crude oil price profile.

It is prudent to note that a higher gas price or NGL prices will lead to increased production of all commodities all else held equal as well. No commodity should be forecasted in a silo.

Associated Gas: Commodities Tied Together at Drillbit



Source: DI ProdCast

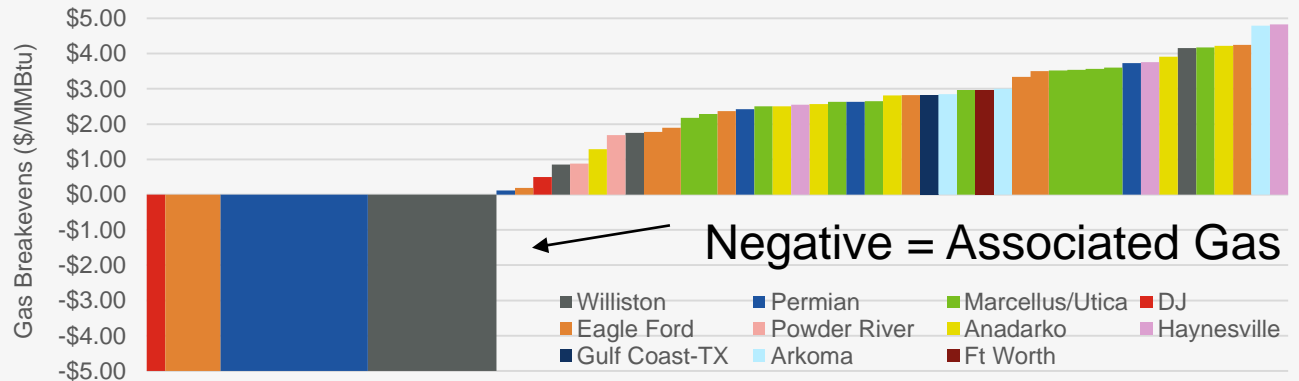
Henry Hub Breakevens Sensitivity to Oil Prices

These charts show natural gas breakeven prices assuming a crude oil price of \$52 and \$62 per BBL. An oil price is necessary for the breakeven calculation since wells produce a combination of gas and oil. The amount of each varies by area.

At \$52 WTI, there are 19 areas (basin/field/tier) with gas breakevens below \$0/MMBtu. Many of these are in the Permian (blue in chart), where companies mainly drill for oil and not gas. At \$62 WTI, this number increases to 31 areas that will have a breakeven gas below \$0/MMBtu meaning wells will be drilled, independently of the price of gas. This is the associated gas production discussed in the previous slide.

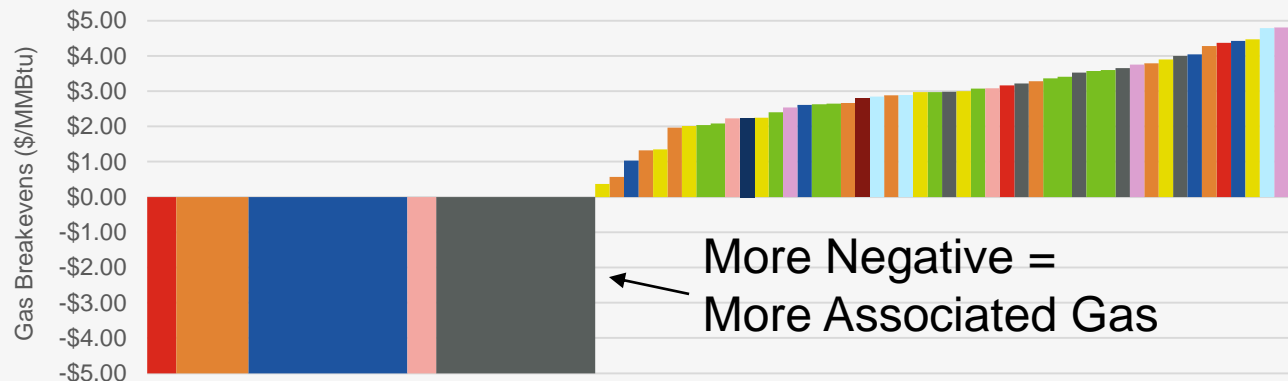
In addition to the Permian, the Marcellus and Utica areas (in green) are very low in the breakeven stack and this is why significant gas production growth will originate from these basins.

Henry Hub Breakevens at \$52 WTI



Assumes 20% MARR

Henry Hub Breakevens at \$60 WTI



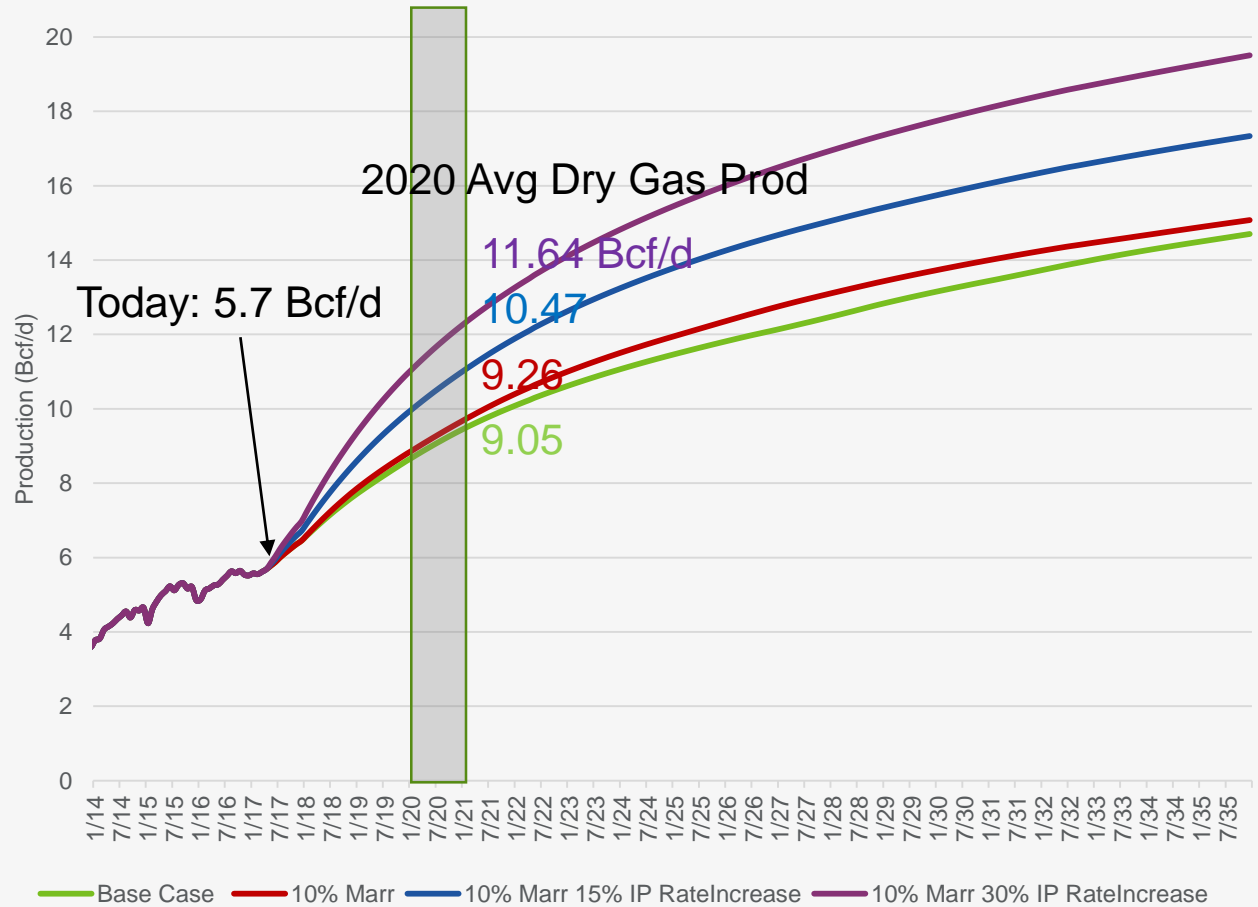
Key Assumptions: 20% MARR, Current Type Curves, Current D&C Costs

Source: DI ProdCast

US Production: Very Sensitive to MARR & Well Efficiencies (Permian Gas Example)

Production is very sensitive to MARR and continued drilling efficiencies – Example Permian

Permian Dry Gas Under Various MARRs and Efficiencies (At DI Price Forecast)



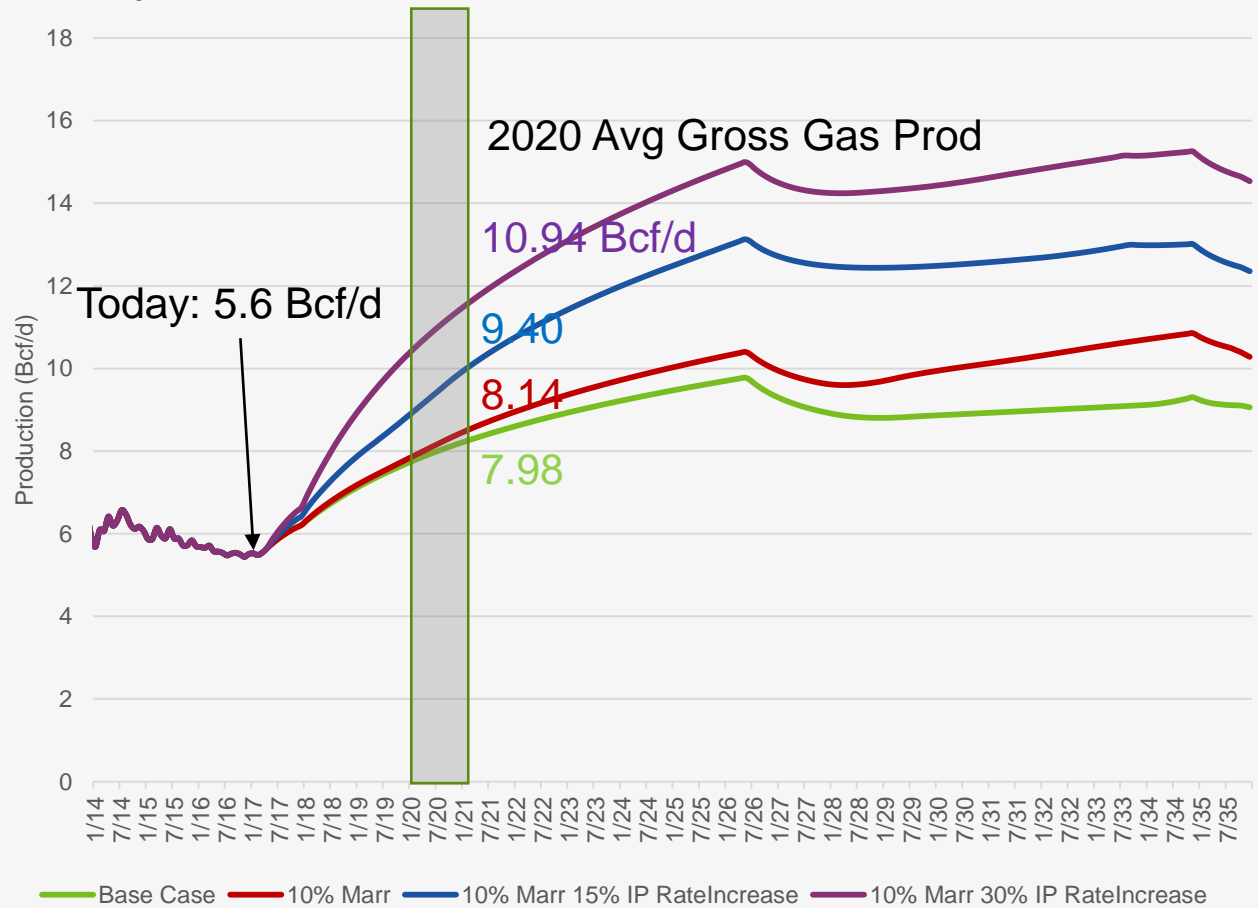
Base Case Assumptions: 15% MARR, Current Type Curves, Current D&C Costs

Source: DI ProCast

US Production: Very Sensitive to MARR & Well Efficiencies (Anadarko Gas Example)

Production is very sensitive to MARR and continued drilling efficiencies – Example Anadarko

Anadarko Dry Gas Under Various MARRs and Efficiencies (At DI Price Forecast)



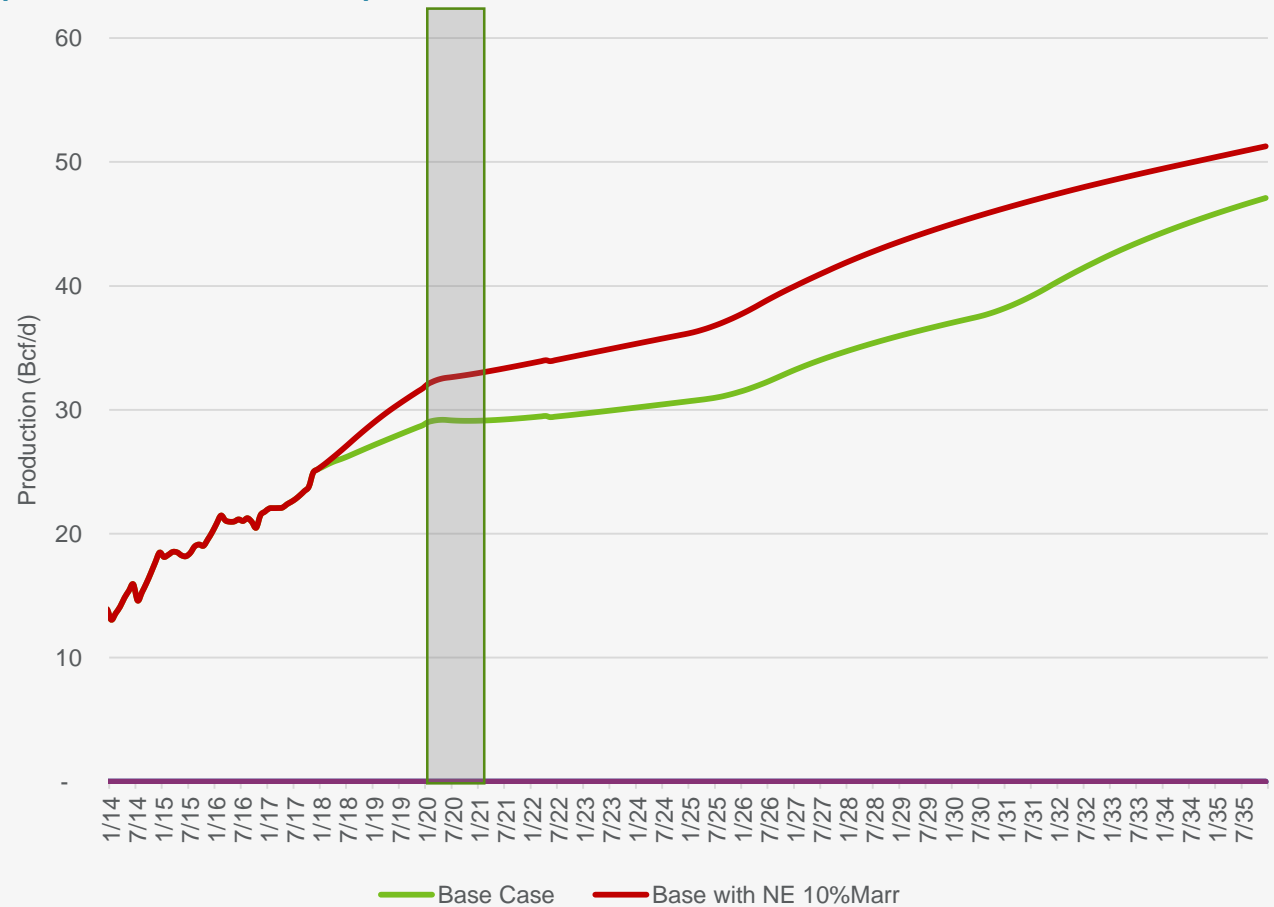
Source: DI ProCast

Base Case
Assumptions: 15%
MARR, Current Type
Curves, Current D&C
Costs

US Production: Very Sensitive to MARR & Well Efficiencies (Marcellus/Utica MARR Sensitivity)

Production is very sensitive to MARR and continued drilling efficiencies – Example Anadarko

Marcellus/Utica Dry Gas Under Various MARRs and Efficiencies (At DI Price Forecast)



Base Case
Assumptions: 15%
MARR, Current Type
Curves, Current D&C
Costs

Source: DI ProCast

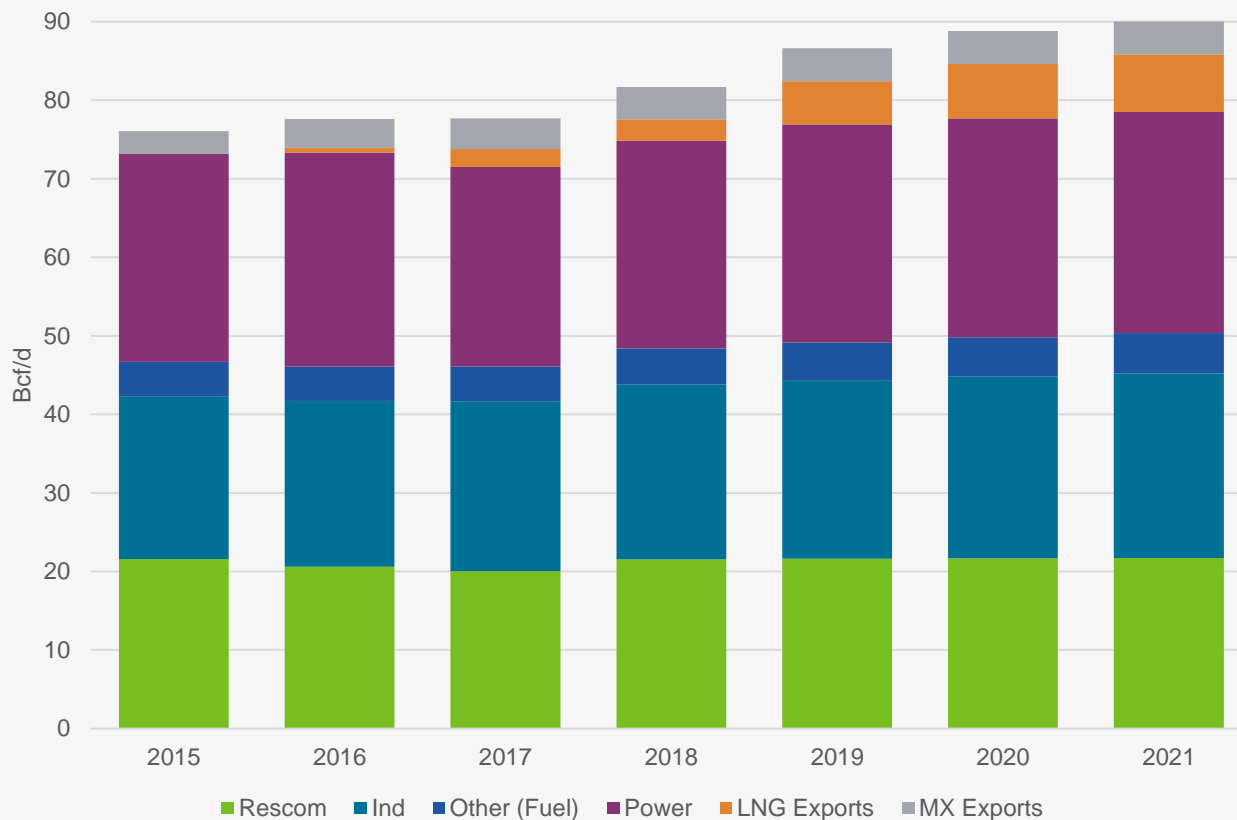
Total Demand: 5-Year Outlook

Demand for natural gas is expected to grow significantly in the US over the next 5 years.

LNG exports leads demand growth, while power demand and Mexican exports will also contribute sizeable increases.

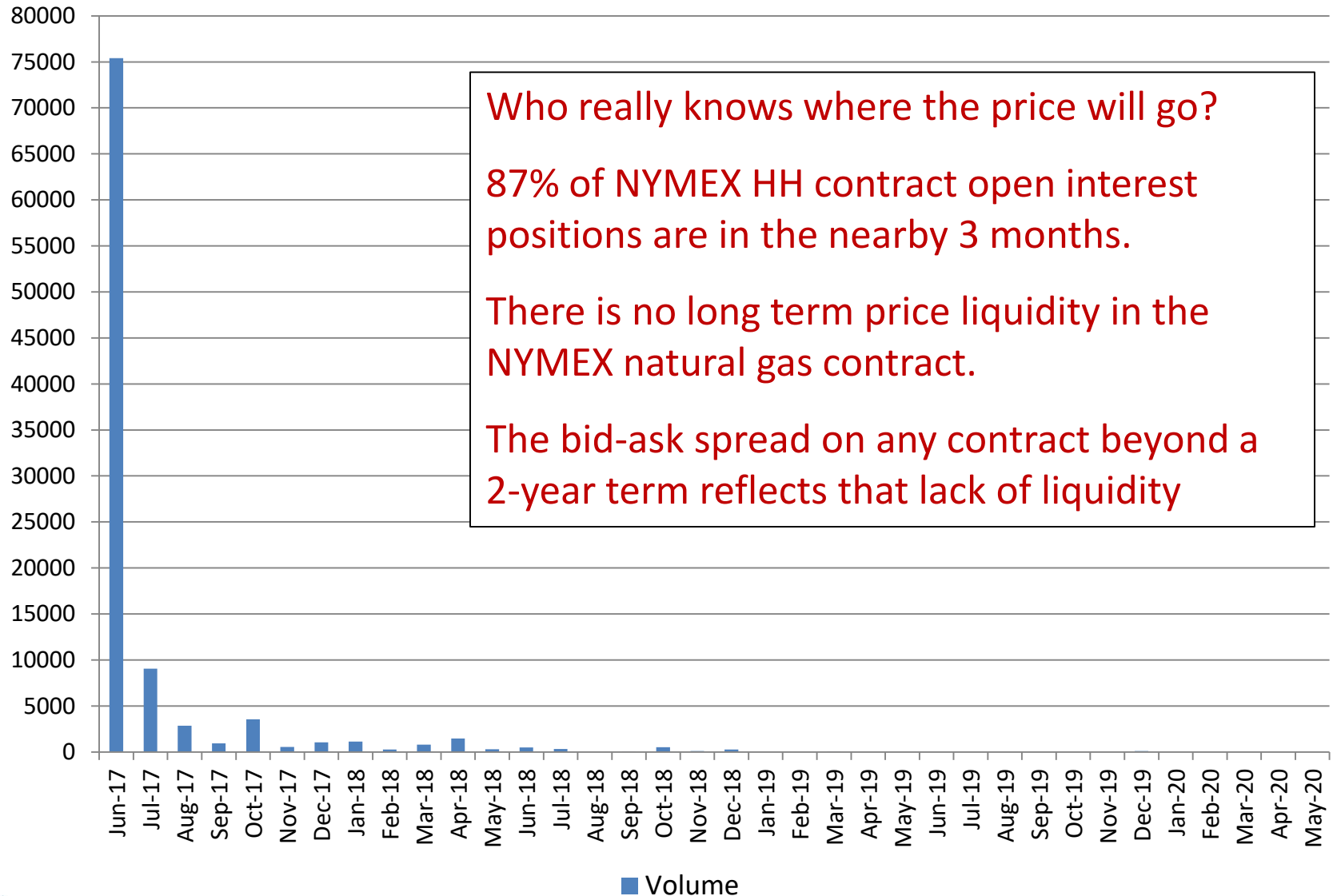
Total demand is expected to increase by almost 9 Bcf/d in 2021 over 2016.

US Demand by Sector



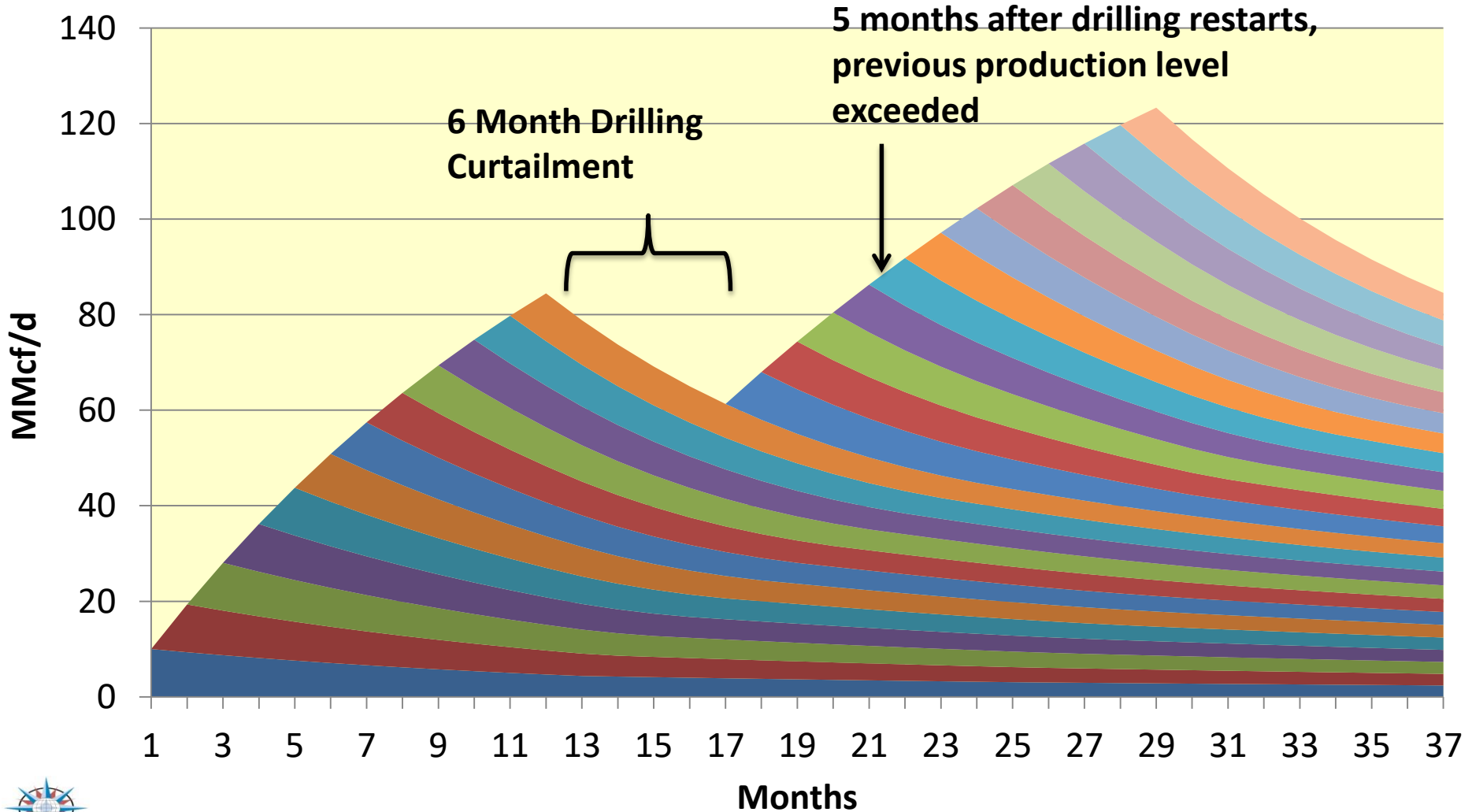
Source: EIA, SNL, NOAA Weather

NYMEX Henry Hub Gas Futures Contract Open Interest Position



The "Ferrari" Affect Substantially Reduces The Likelihood Of Price Spikes

One Rig In the Haynesville



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