The U.S. Shale Revolution:

Natural Gas - It's Not a Scarce Resource Anymore

Presentation to:

CREA Energy Innovations Summit

By:

John Harpole

Mercator Energy

October 30, 2017

Circa 2007

Let’s discuss your cost of natural gas.

U.S expected to import 35% of its natural gas needs by 2020

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Circa 2007

Russia's Energy Muscle

- Energy Used Over 55 times Against Former Soviet Nations Since 1990

Source: *Europe Doubles Down on Russian Gas to Feed its Energy Appetite,* by Andrew Haney, Ricardo Bracho, Nick Wolfe and Max Faith

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Energy Security?

- By the year 2020, Gazprom will supply nearly 70% of the European Union’s natural gas.
- Would you pursue a conflict with a country that you depend on for the majority of your energy needs?

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Gazprom's Current Near-Monopoly Supply Position

% of Supply from Gazprom/Russia	
Slovakia	100%
Macedonia	100%
Finland	99%
Bulgaria	97%
Serbia & Montenegro	87%
Lithuania*	84%
Hungary	80%
Czech Republic	79%
Greece	76%

*Remember

Source: "Domestic Consumption" EIA International Energy Annual, 2007; "Exports 2006 and 2007" Gazexport as cited by Energy Intelligence, March 2008

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Gazprom's Current Near-Monopoly Supply Position

(cont'd)

% of Supply from Gazprom/Russia	
Austria	74%
Slovenia	64%
Poland	62%
Turkey	60%
Germany	40%
Croatia	37%
Italy	30%
Romania	28%
France	25%

Source: "Domestic Consumption" EIA International Energy Annual, 2007; "Exports 2006 and 2007" Gazexport as cited by Energy Intelligence, March 2008

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10/21/2008 in Tehran, Iran
Russia, Iran and Qatar form natural gas cartel

Qatar's Deputy Premier and Minister of Energy and Industry, Abdullah bin Hamad Al-Attiya

Iranian Oil Minister, Gholam Hossein Nozari

Alexei Miller, Chief of Russia's state gas monopoly - Gazprom

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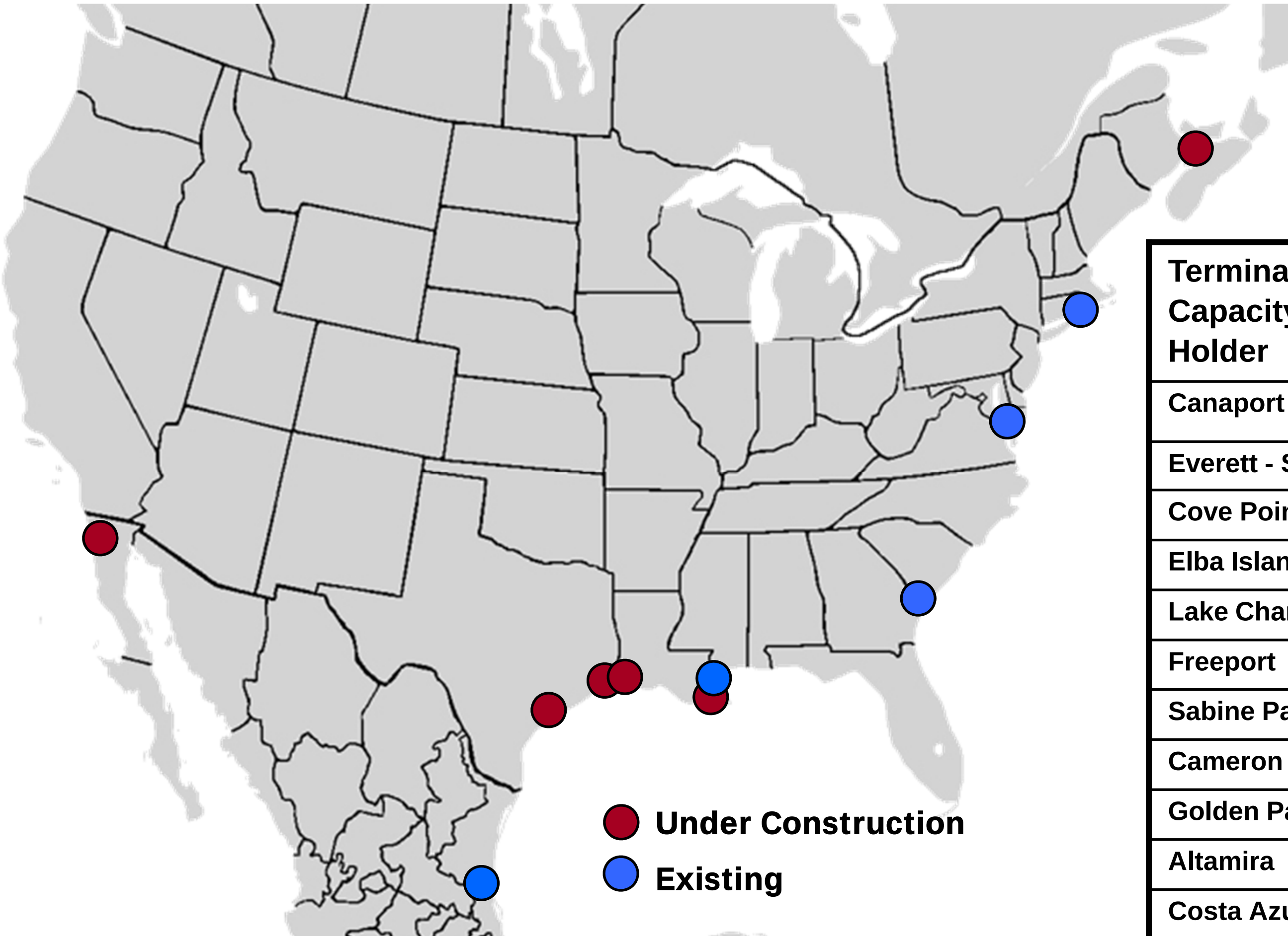
Global LNG Available to Supplement U.S. Supplies As Needed, November 2007



Terminal Capacity Holder	Baseload Sendout (MMCF/D)(1)
Canaport	1,000
Everett - Suez	700
Cove Point	1,800
Elba Island	800
Lake Charles	1,800
Freeport	1,500
Sabine Pass	4,000
Cameron	1,500
Golden Pass	2,000
Altamira	700
Costa Azul	1,000
Total	16,800

U.S. regasification capacity is on track for a four fold increase to over 16 bcf/day of capacity

Source: Chenier Energy, Inc. November, 2007 presentation
(1) Capacity estimated as of 2010

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U.S. Shale Gas Development Could be Slowed by LNG Imports

- "Importing LNG to the U.S. would be economical at an average gas price as low as \$3.50/MMBtu."
- "Whereas shale gas requires an average gas price of at least \$6.50/MMBtu to be economical."

Source: Scott Thetford, VP of Pace Global Energy Services, LLC

Wrong!

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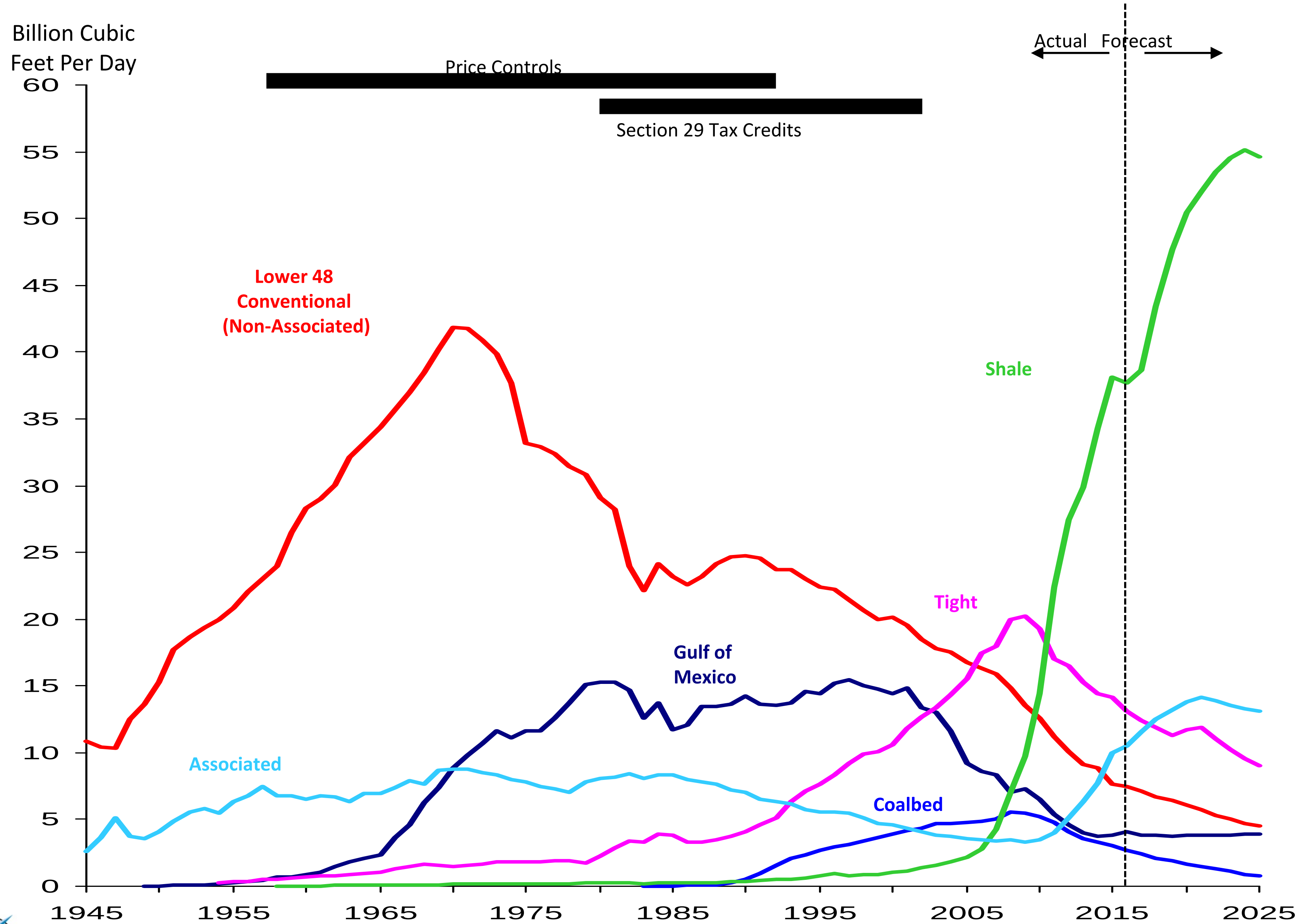
… and then the U.S. Shale Revolution happened… and the world will never be the same again.

FIGURE 3

UNITED STATES NATURAL GAS PRODUCTION



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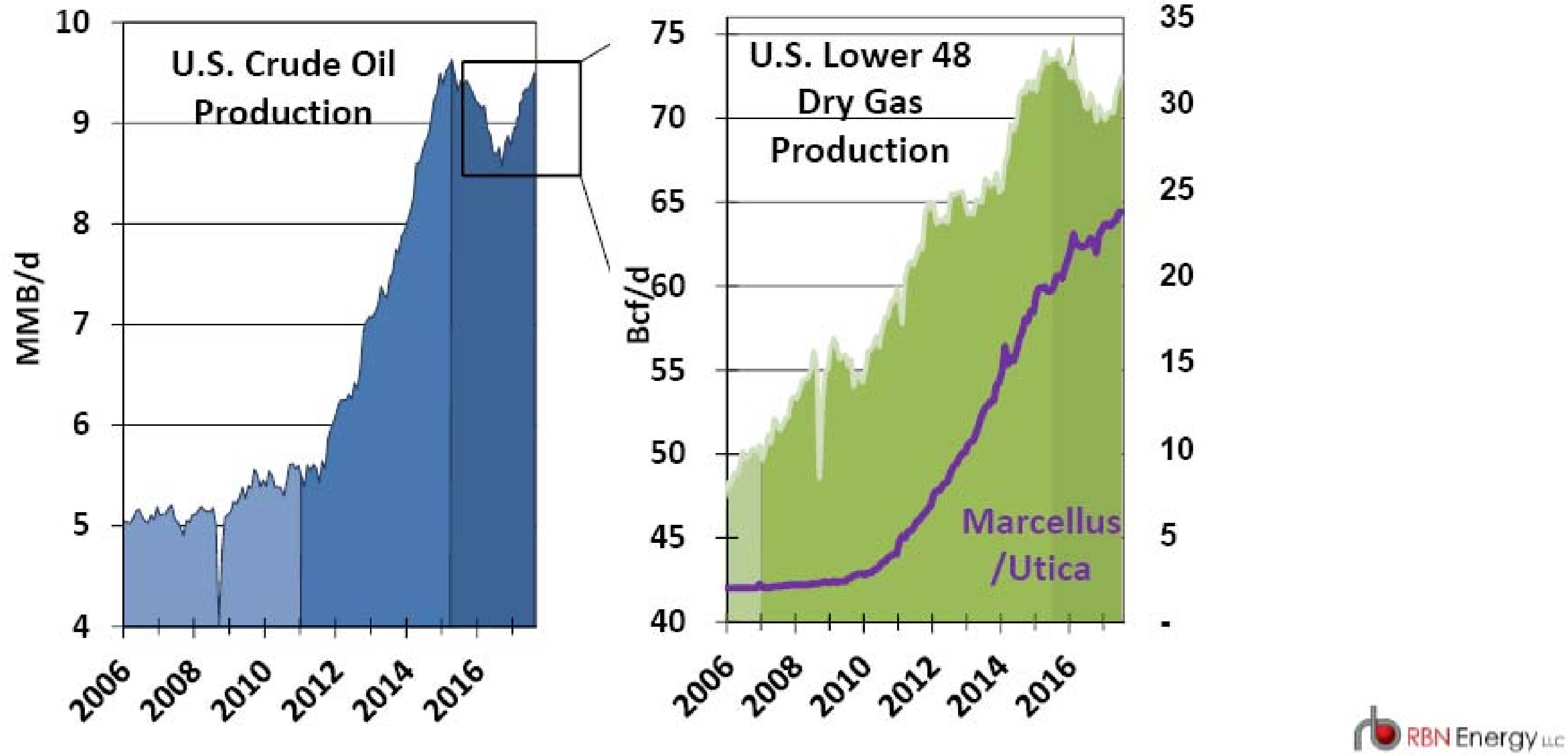
Source: *The Outlook for Oil and Gas,* Henry Groppe, Groppe, Long & Littell, May 2017

Production of Crude Oil and Natural Gas



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

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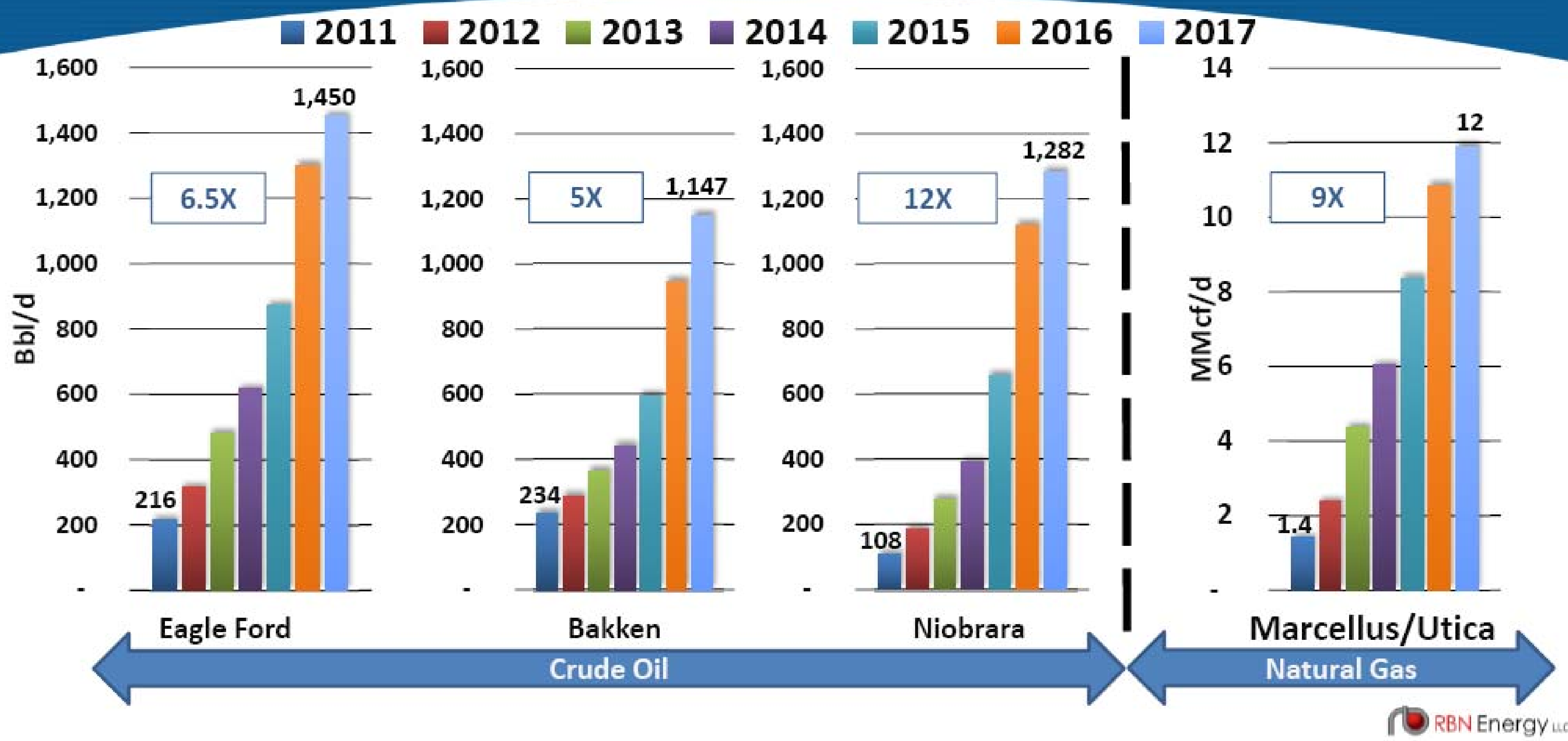
Oil and Gas Production Added Per Rig



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

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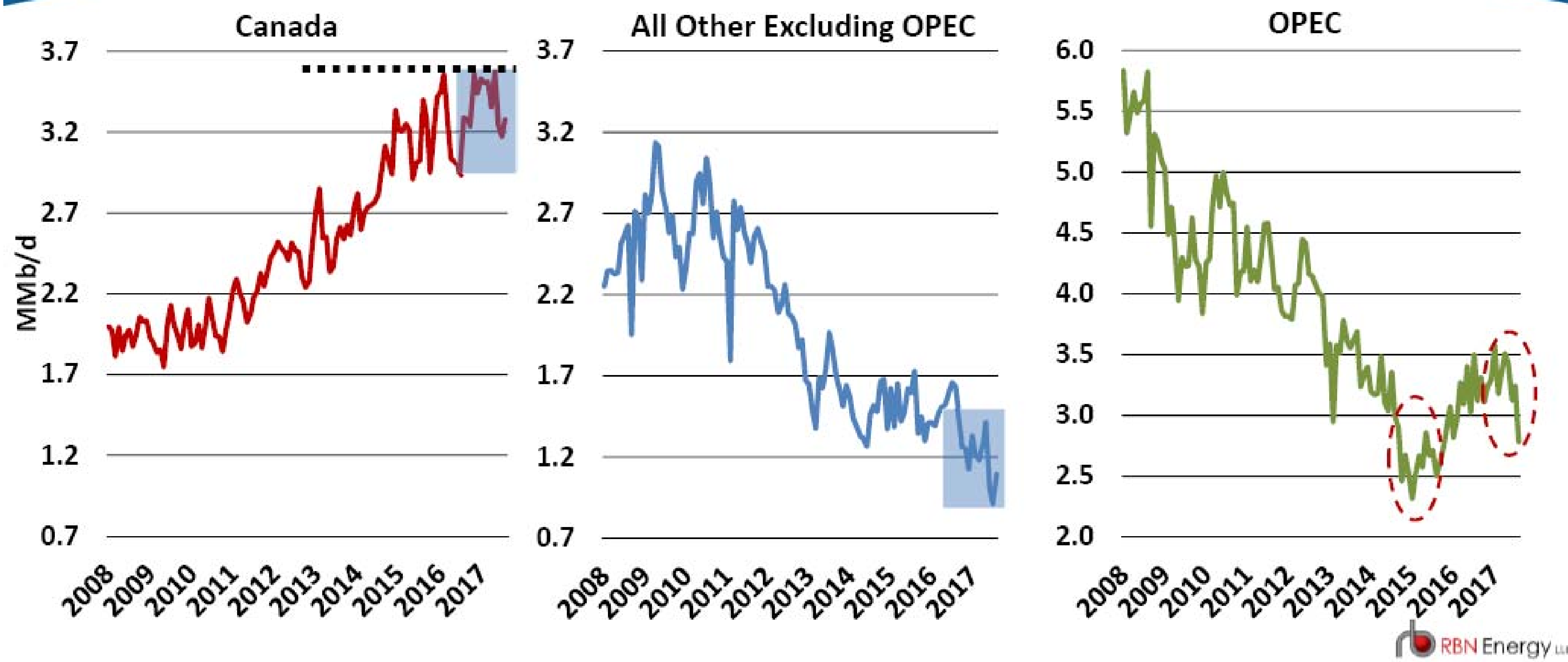
U.S. Crude Oil Imports



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

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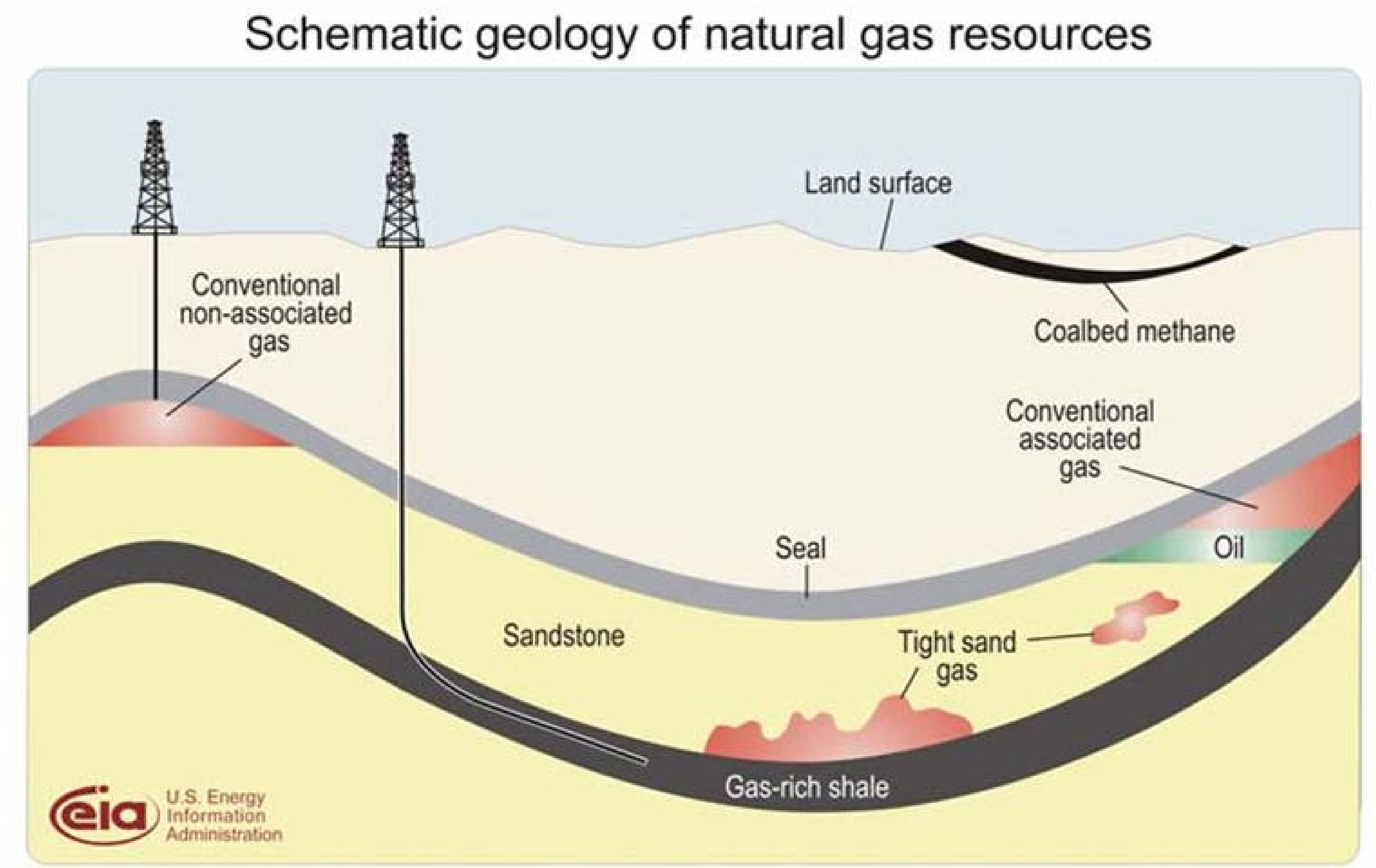
It is not a scarce resource anymore



Source: US Energy Information Administration

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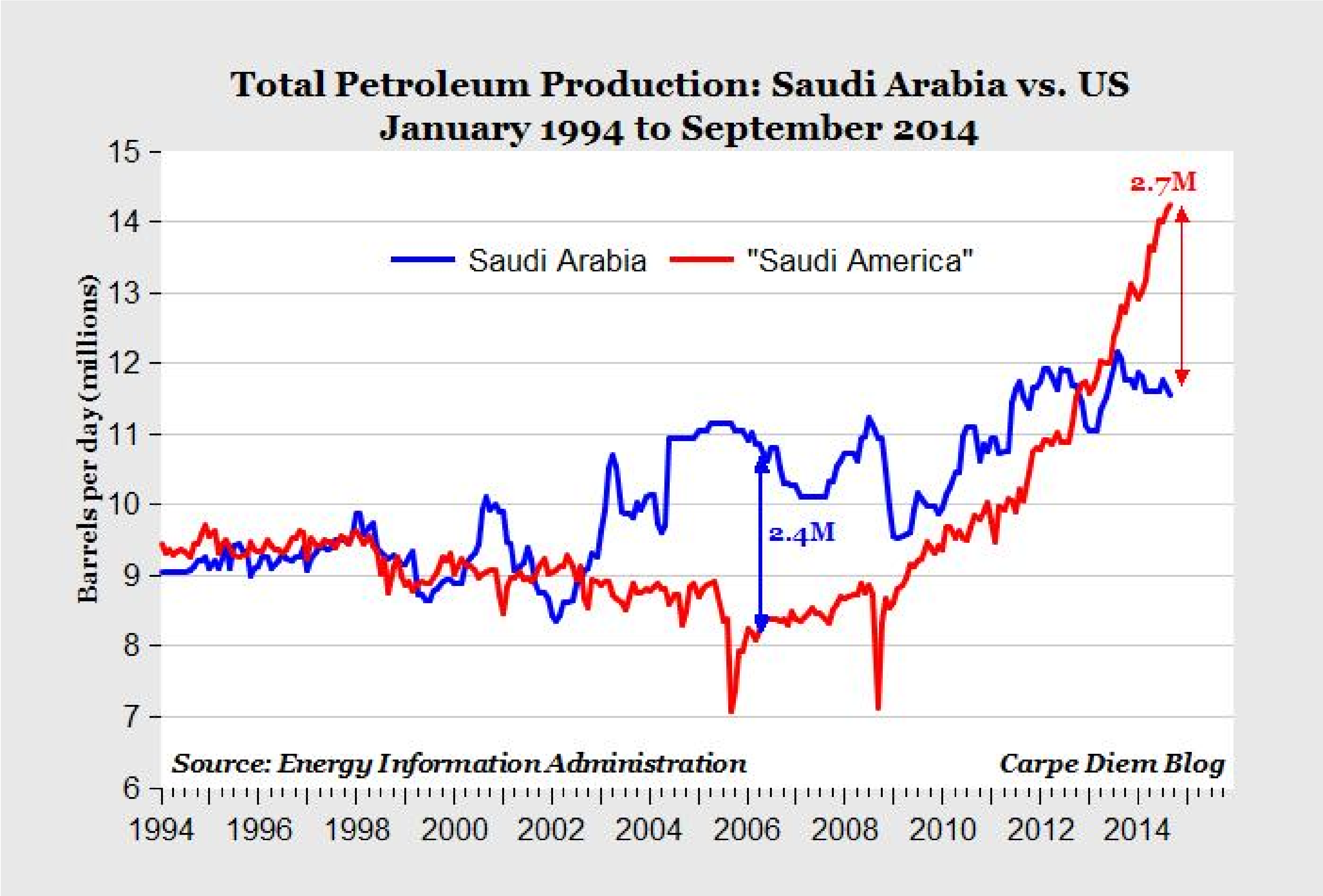
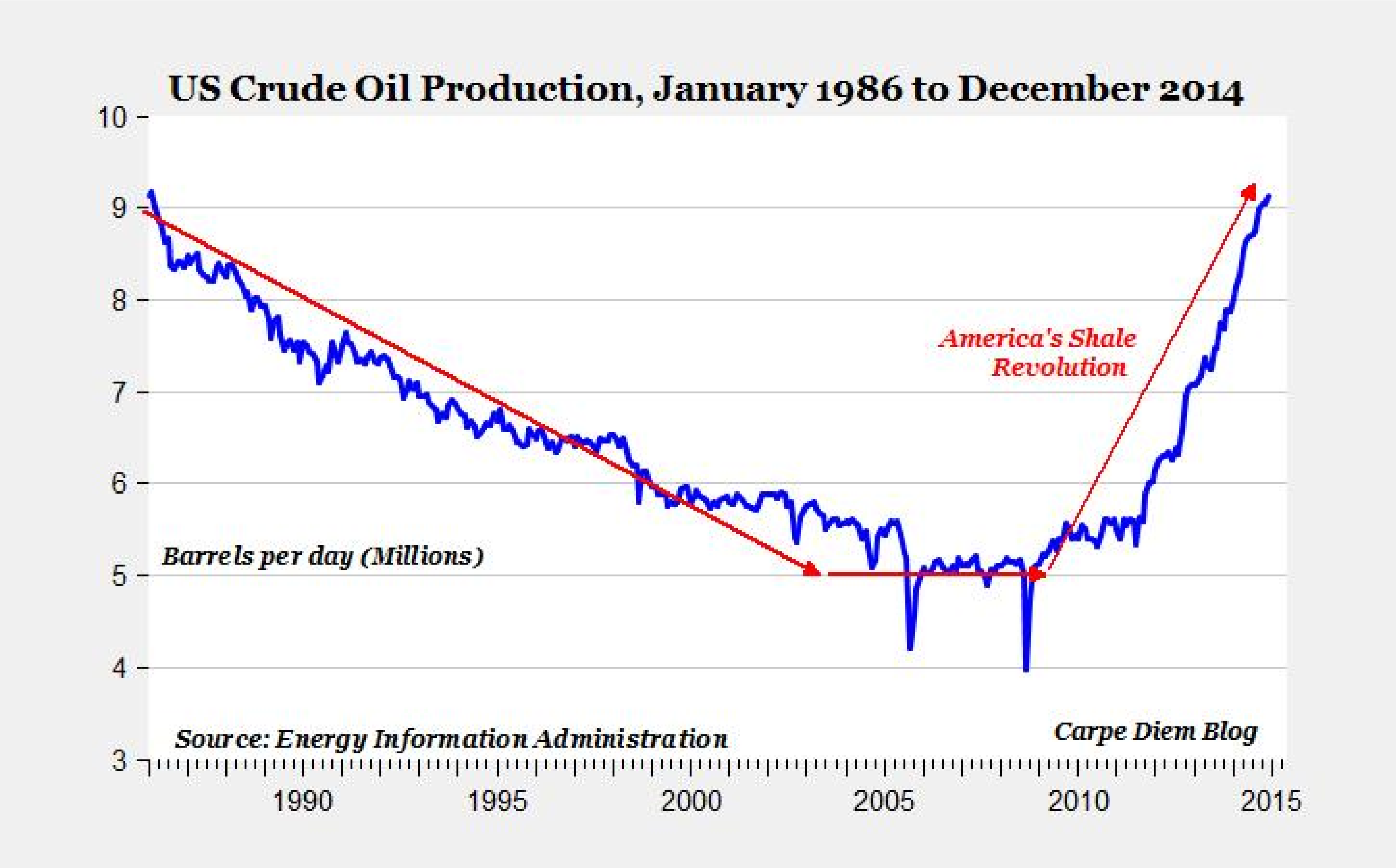


Source: *My top ten energy charts of the year for 2014,* Mark J. Perry, American Enterprise Institute, January 5, 2015



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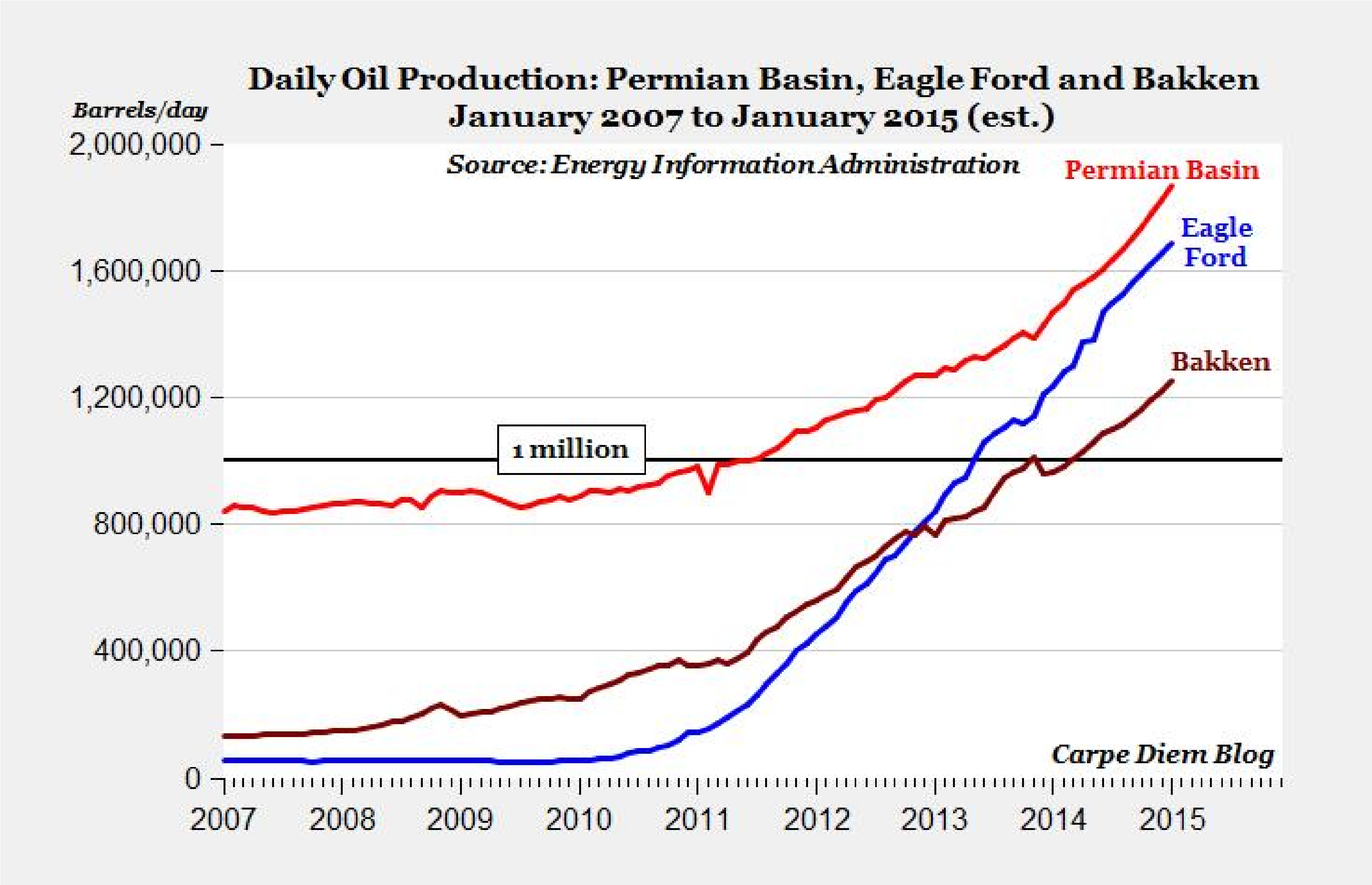

Source: *My top ten energy charts of the year for 2014,* Mark J. Perry, American Enterprise Institute, January 5, 2015

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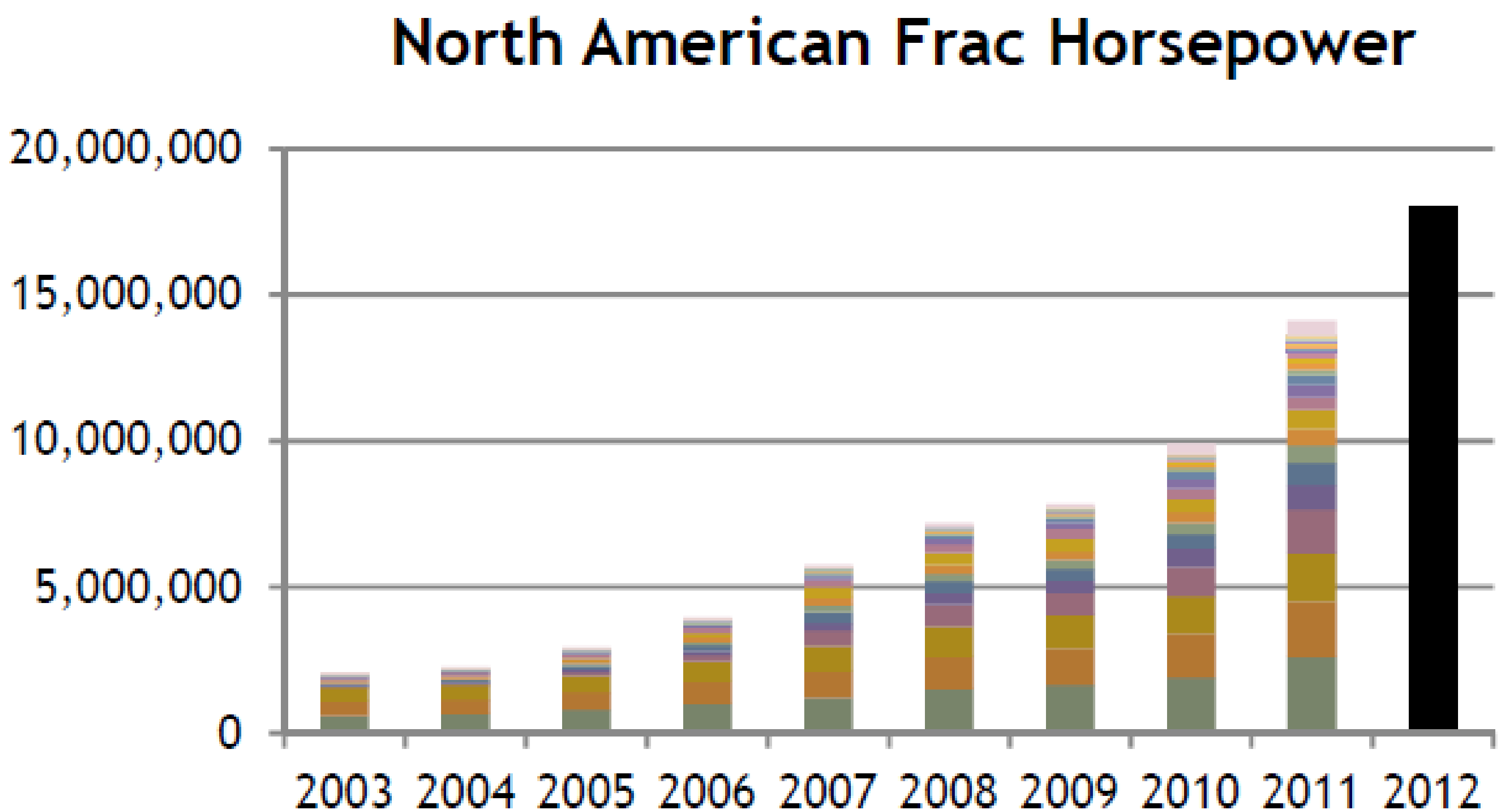
Fracturing Application Exploded



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

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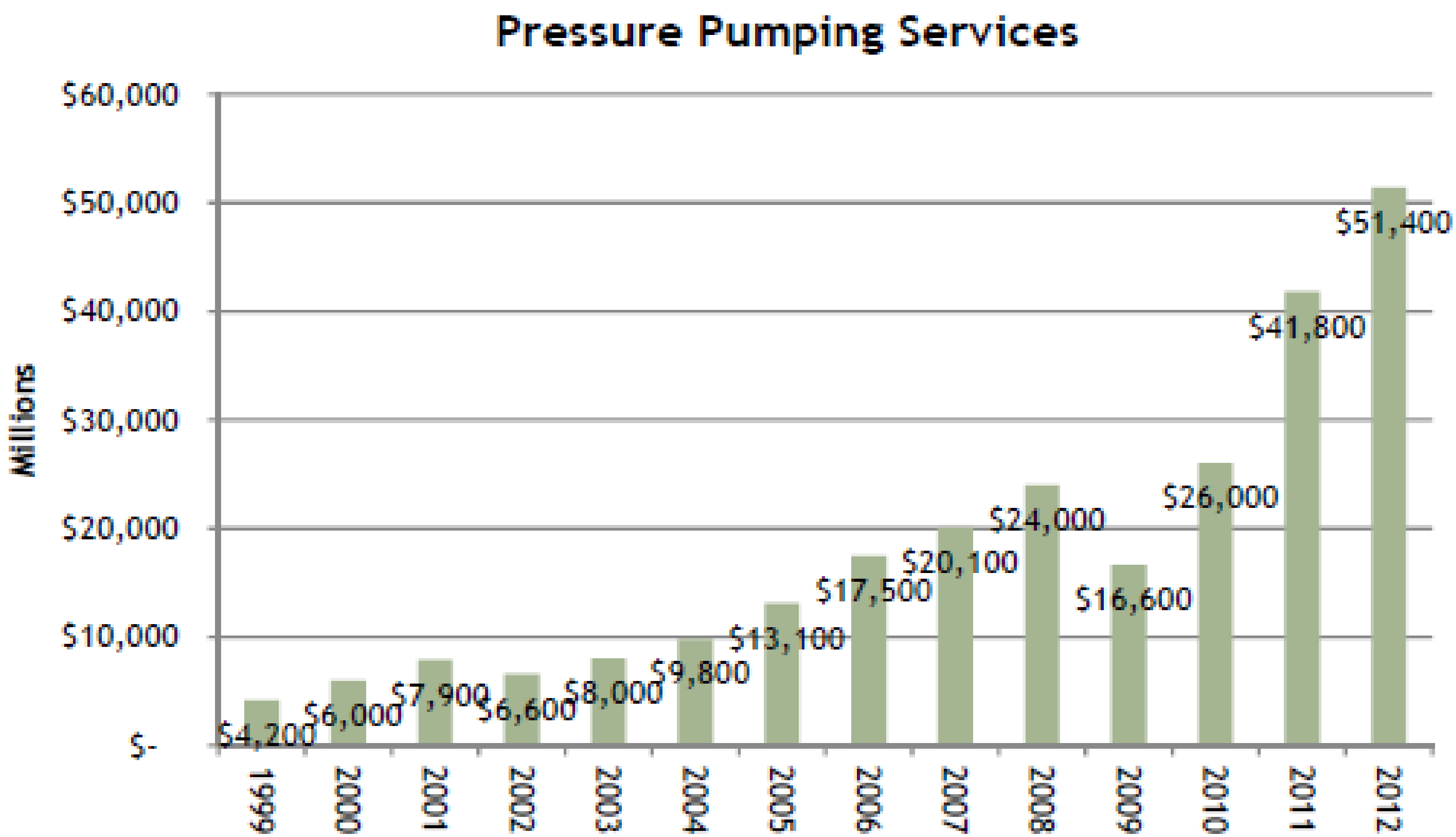
10-fold growth in 10 years



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

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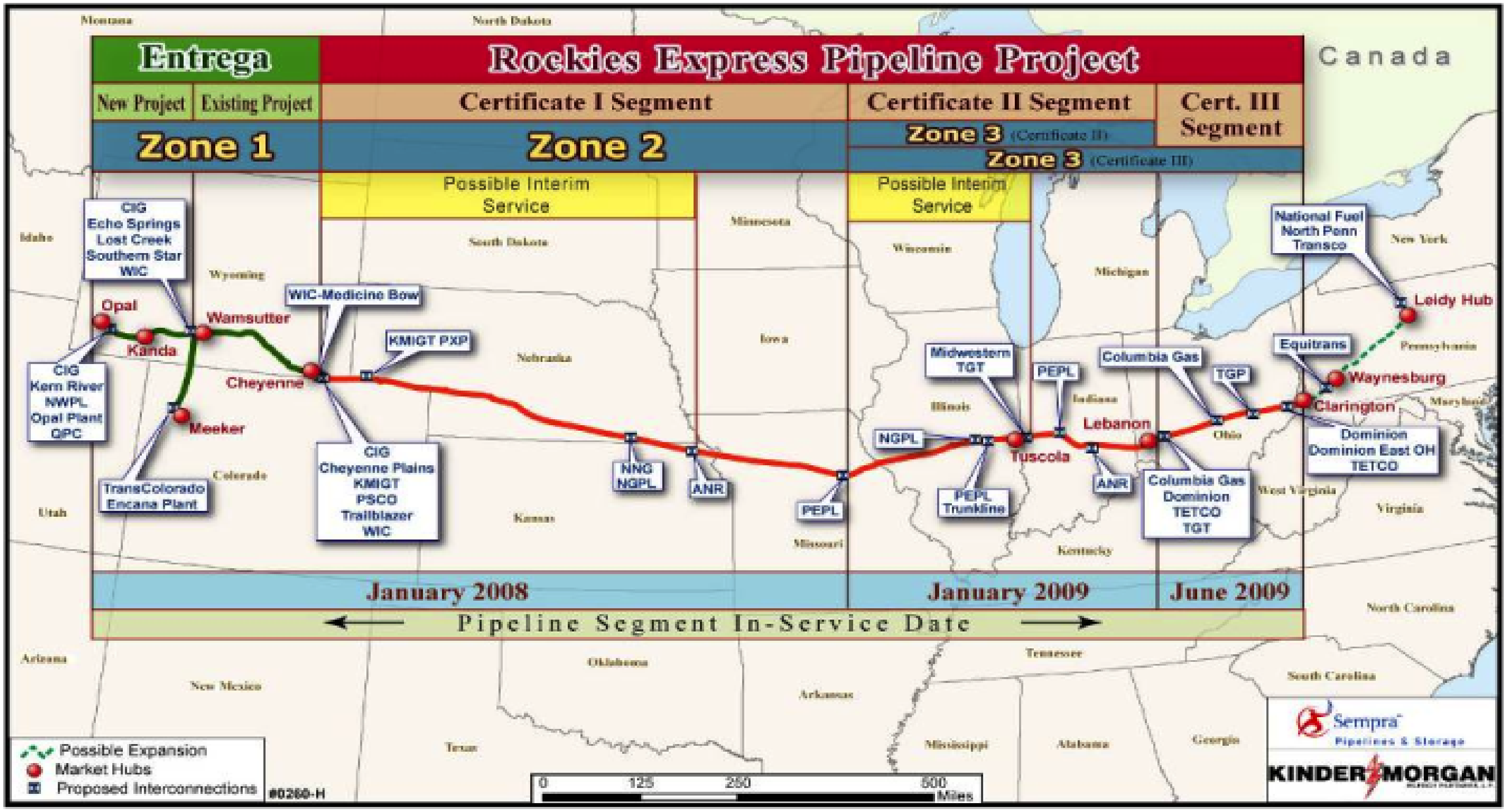
The Reversal



- Prediction 2007: 4 BCF/d of anticipated demand in Northeast U.S.
- Reality 2017: 12 BCF/d of new supply

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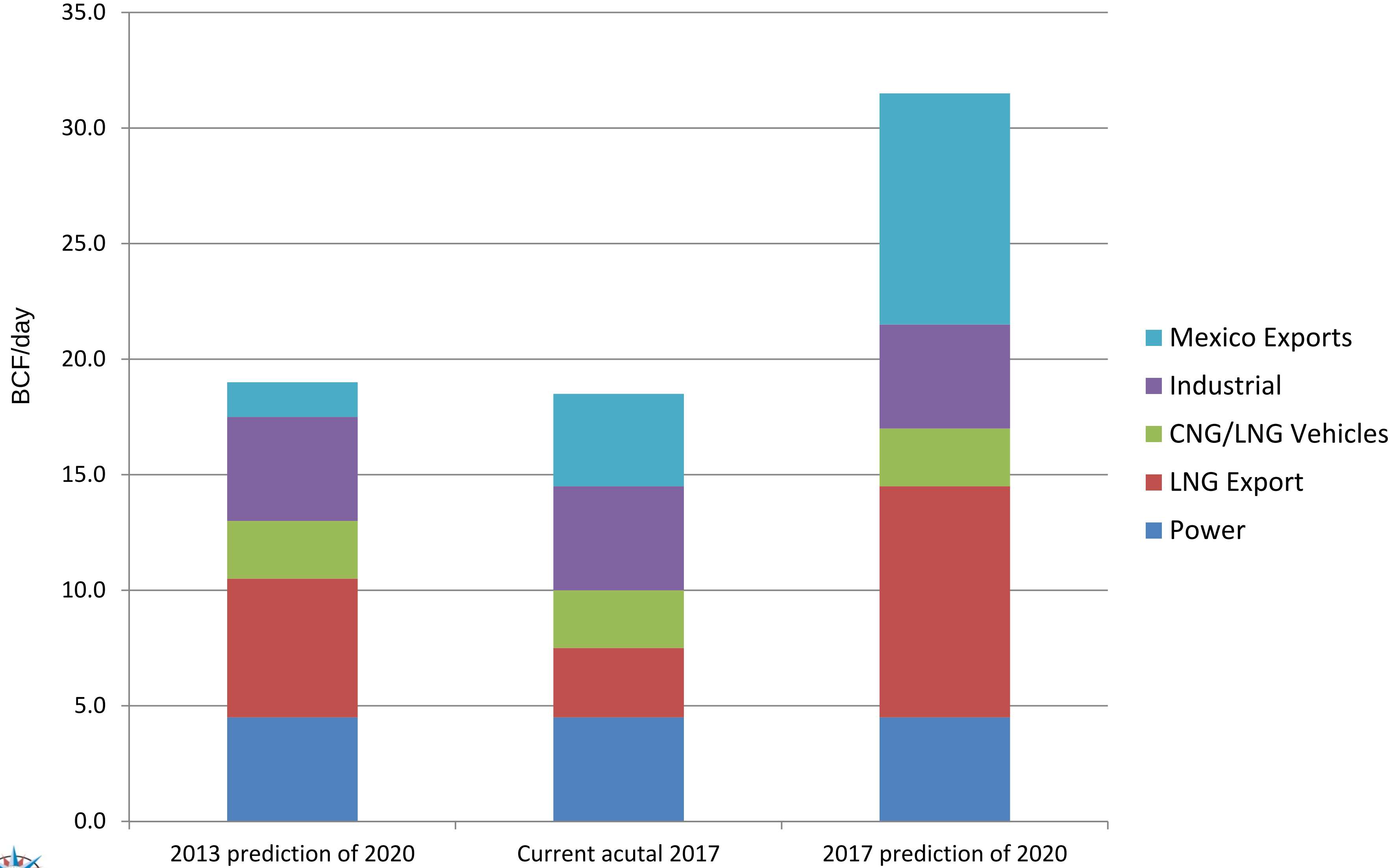
North American Natural Gas
Demand Ranges by Selected Sector



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Two Significant Growth Areas for Demand

- U.S. LNG Exports
- Pipeline exports to Mexico

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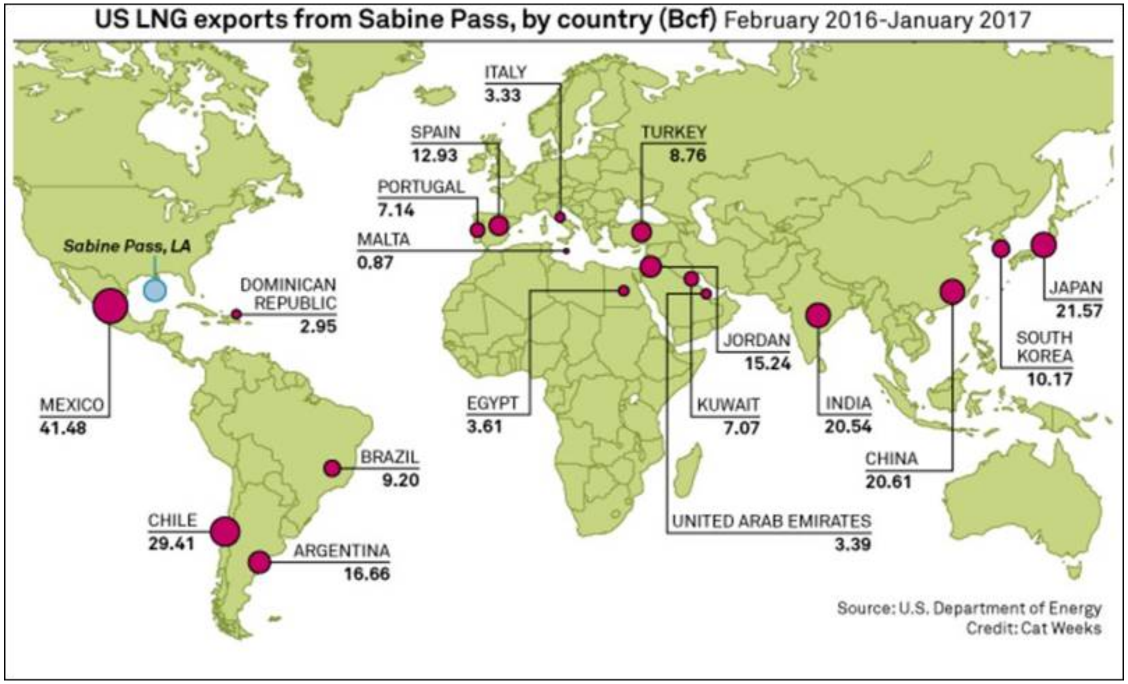
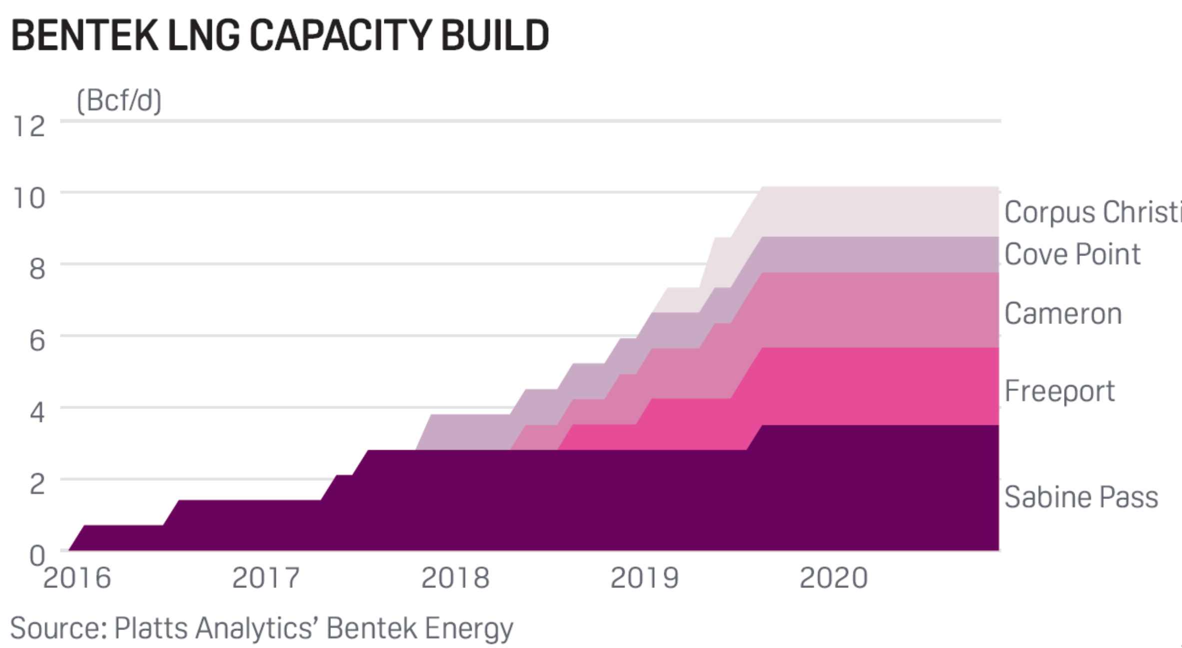


Cheniere Energy exports 100th LNG cargo



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Source: *LNG buyers pushing US exporters to be flexible*, Harry Weber, Grant Gunter, Gas Daily, S&P Global Platts Publication, February 10, 2017

Lithuania

Becomes first ex-Soviet state to buy US natural gas

- “Lithuania became the first former Soviet state to import a shipment of US natural gas on Monday, at a time when Washington has promised to help weaken Europe’s reliance on gas supplies from Russia.”
- “The liquefied natural gas cargo aboard the Clean Ocean tanker is highly symbolic, as Lithuania looks to cement ties and backing from Washington following Moscow’s annexation of Crimea in 2014.”

Source*:* Financial Times, David Sheppard, Energy Markets Editor, August 21, 2017

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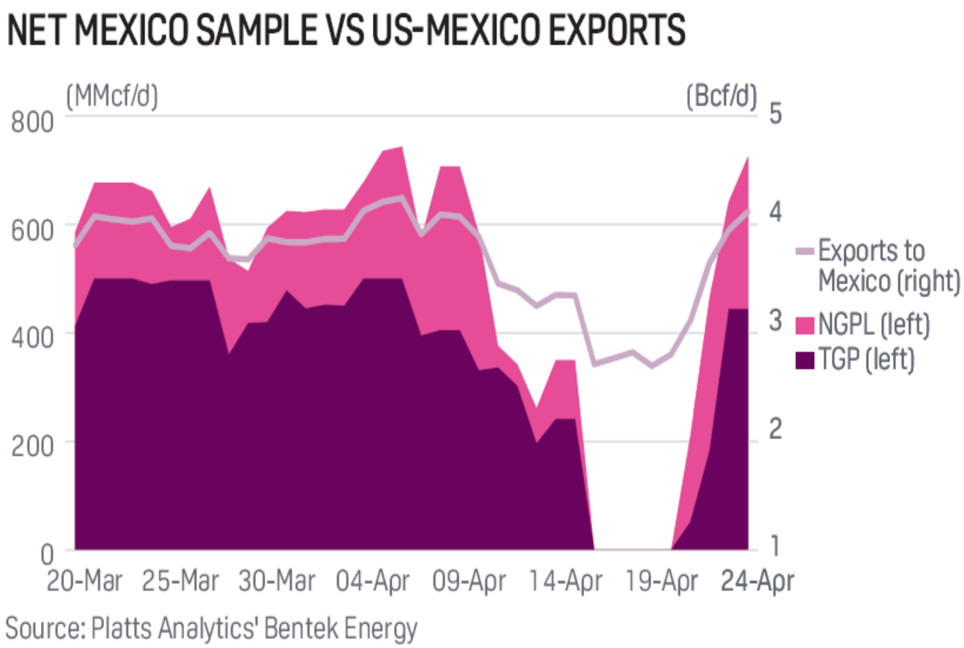
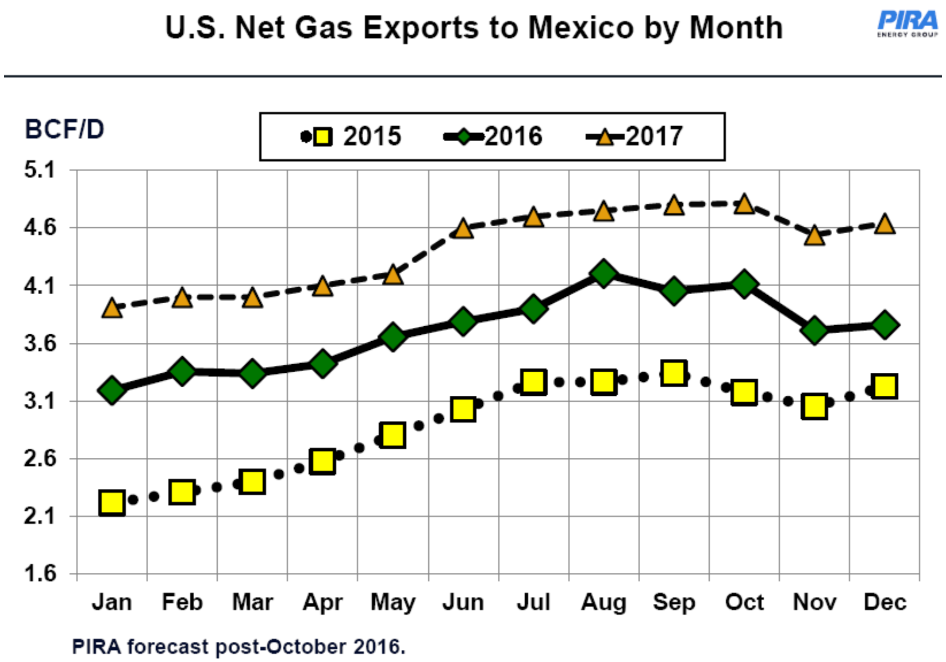
Rockies Access to Asia

Source: Veresen Corporate Presentation, November 2014

South to the Border





Sources: *US-Mexico exports hit pre-maintenance levels,* J. Robinson and Thad Walker, S&P Global Platts Gas Daily, April 25, 2017
North American Gas Forecast Monthly, PIRA, January 30, 2017

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The Future?

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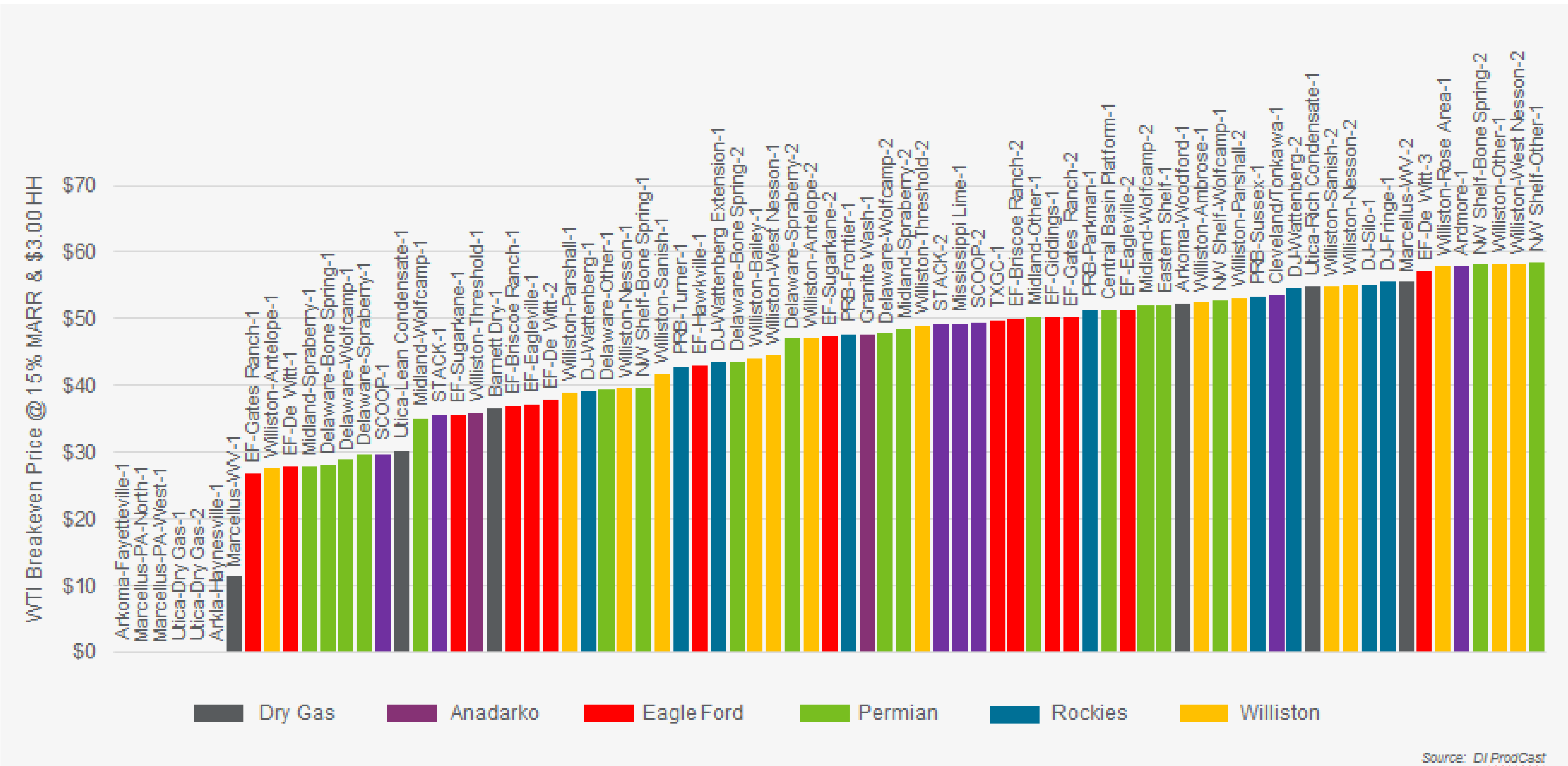
US Production: Economics Support Increased Activity



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

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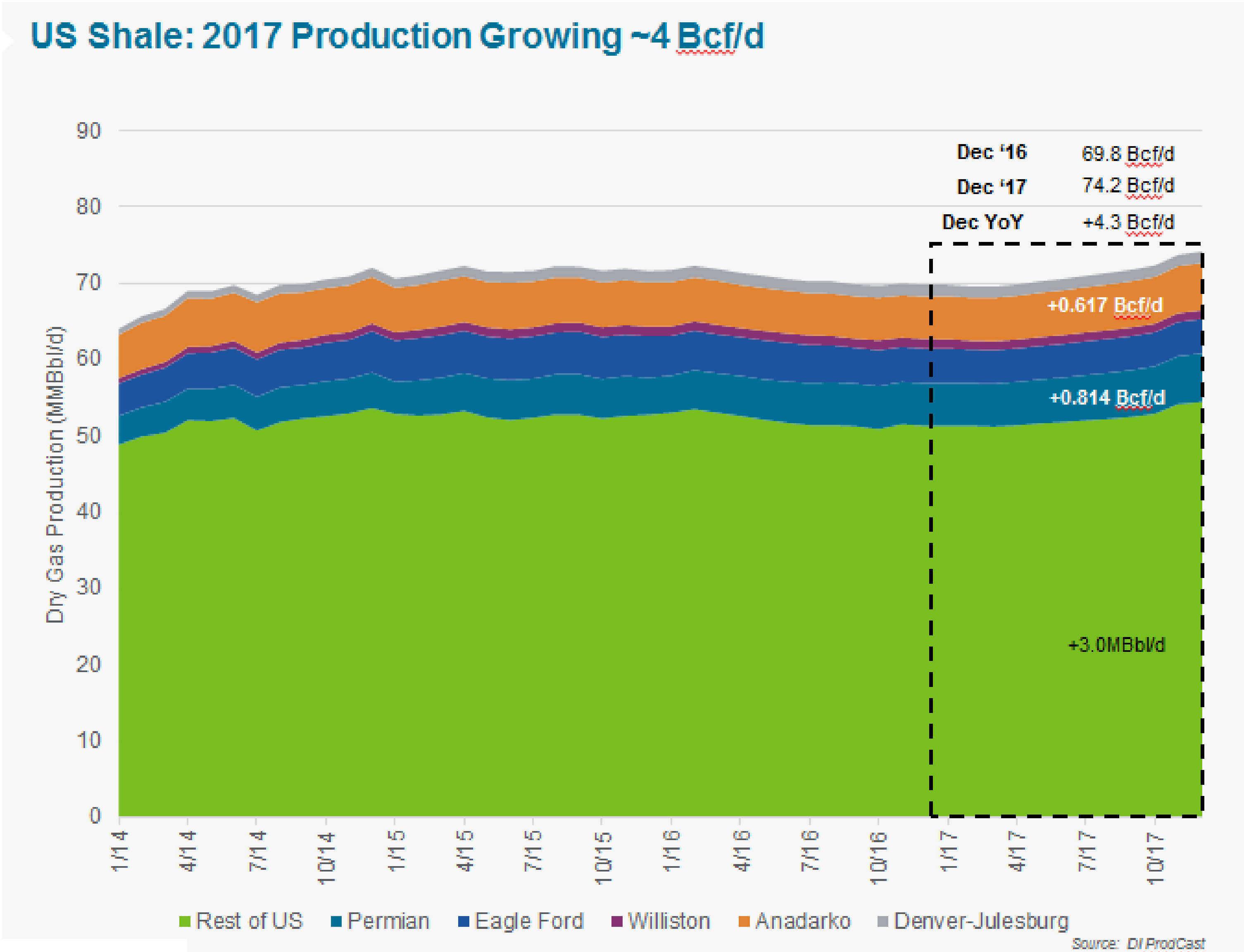
Short Term Production Outlook



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

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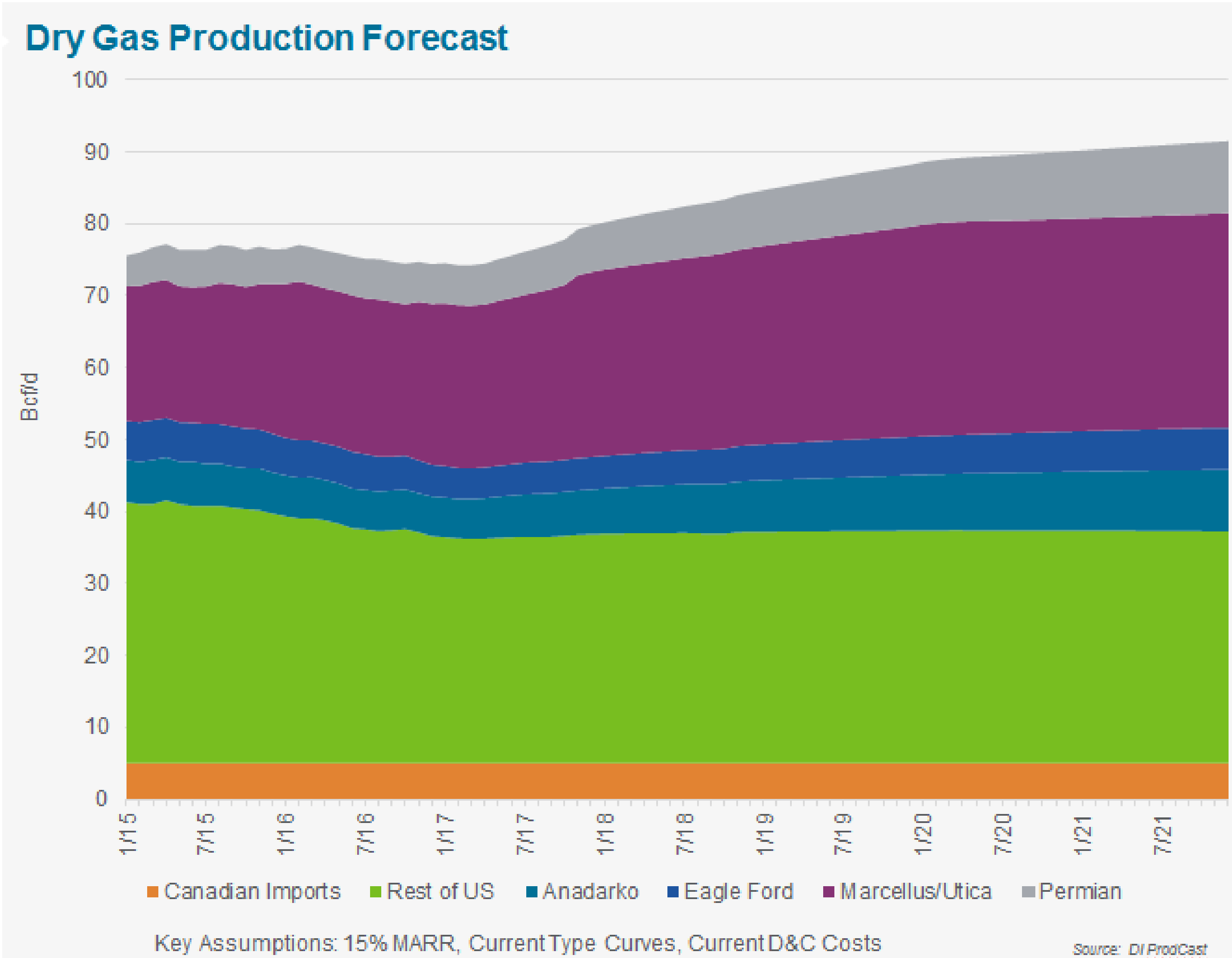
Dry Gas Production 5-Year Outlook



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

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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 is **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.

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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.

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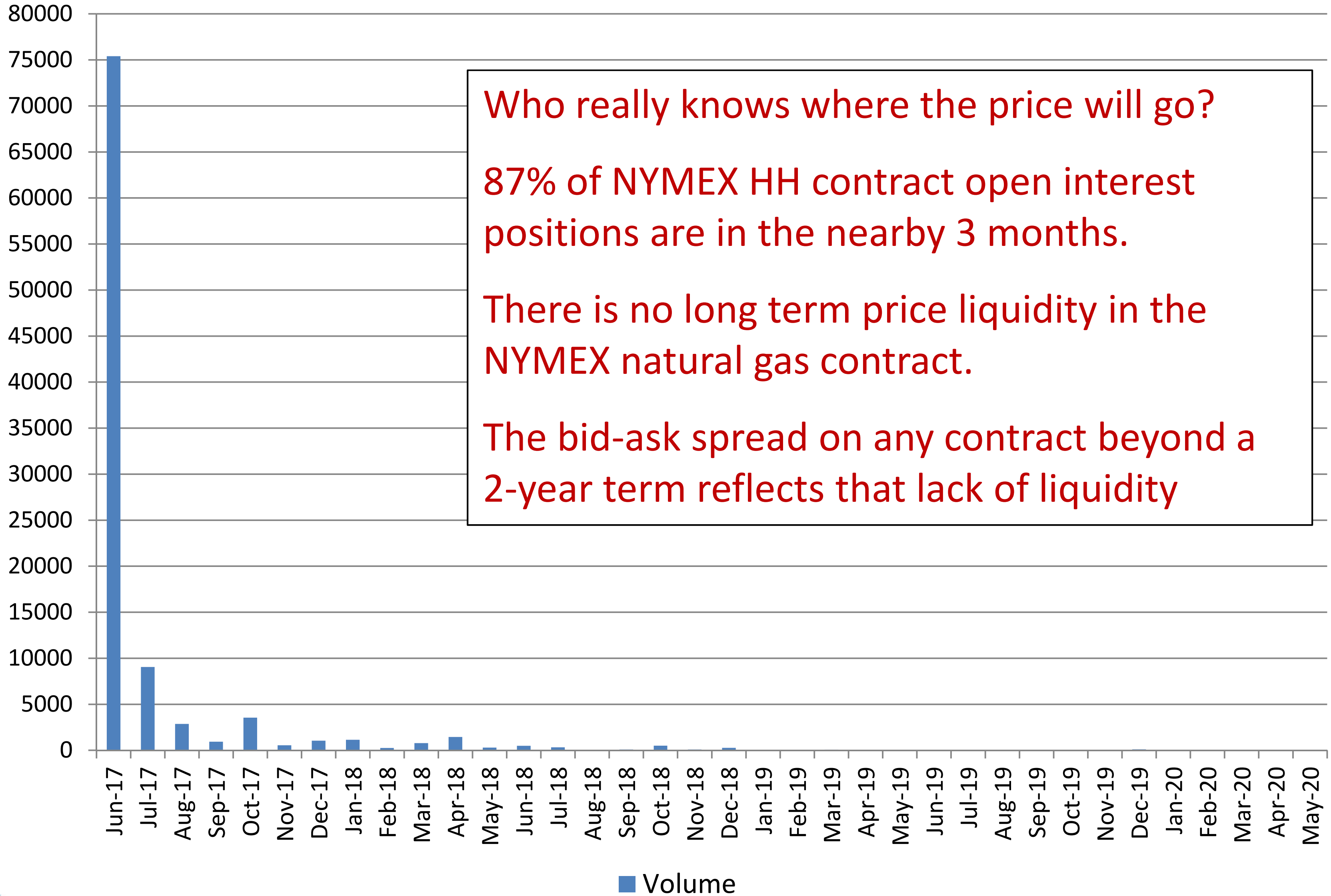
NYMEX Henry Hub Gas Futures Contract Open Interest Position

Who really knows where the price will go?

87% of NYMEX HH contract open interest positions are in the nearby 3 months.

There is no long term price liquidity in the NYMEX natural gas contract.

The bid-ask spread on any contract beyond a 2-year term reflects that lack of liquidity



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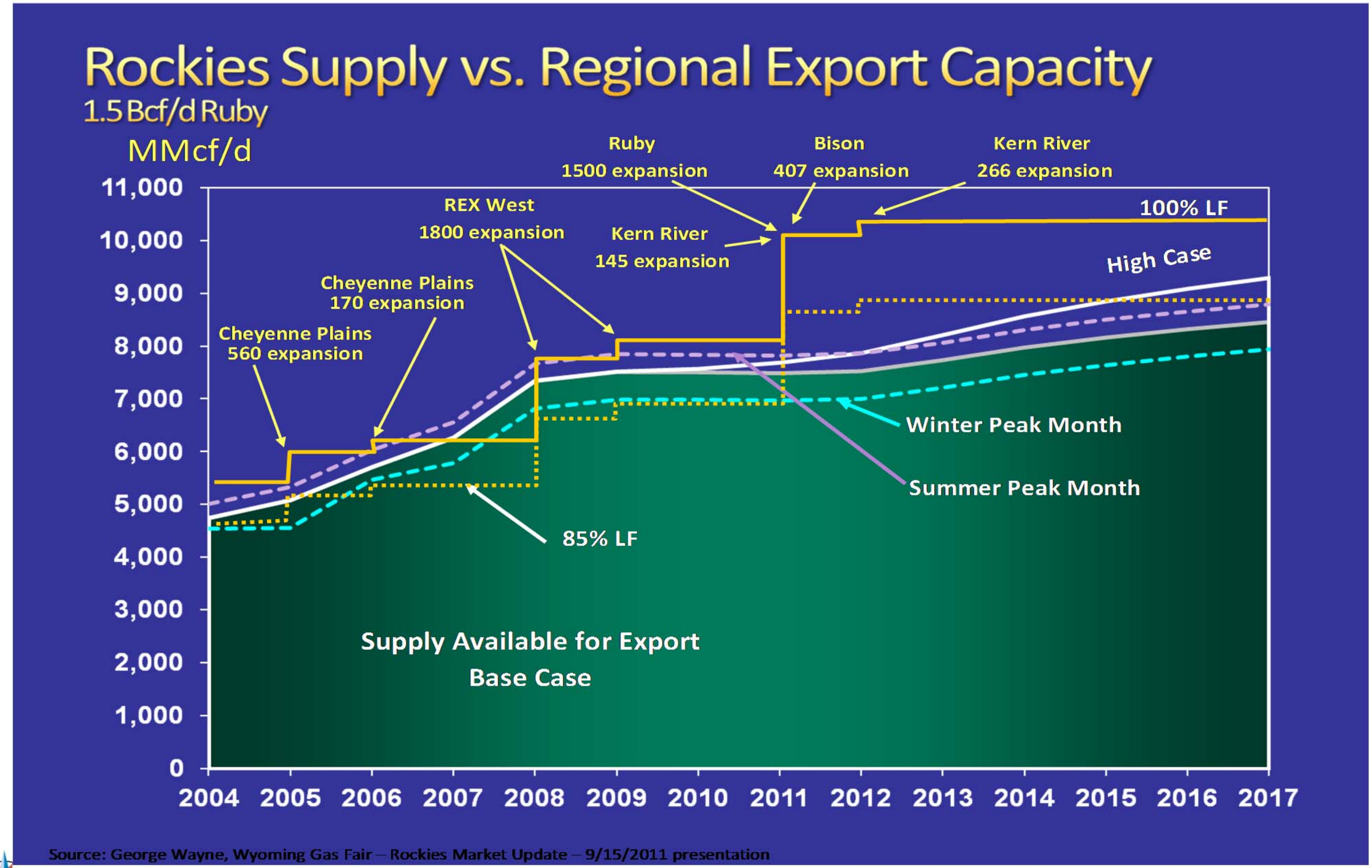
Source: *NYMEX Henry Hub Gas Futures Contract, May 1,* S&P Platts Gas Daily, May 2, 2017

Rockies Supply vs. Regional Export Capacity



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Source: George Wayne, Colorado Interstate Gas