

# The End of Scarcity?

## Measuring the Impact of the Oil Price Collapse on North American Natural Gas Markets

### **Presentation to:**

NAIFA Annual Day on the Hill  
Denver, CO

By:

John Harpole



March 2, 2016











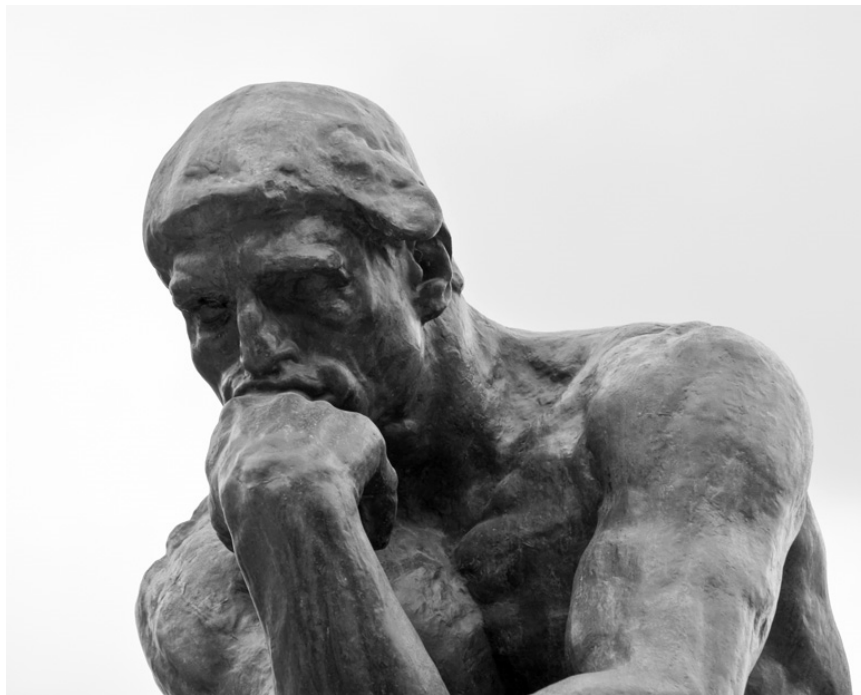






# The Big Question

- What issues will have the greatest impact on North American natural gas prices in the next 5 years?





# The Big Four Issues to Watch

1. Global Oil Price Recovery
2. Marcellus and Utica Shale Production
3. Industrial Demand
4. U.S. LNG Exports

# The Big Four Issues to Watch

## 1. Global Oil Price Recovery

# What Happened? A Global Perspective

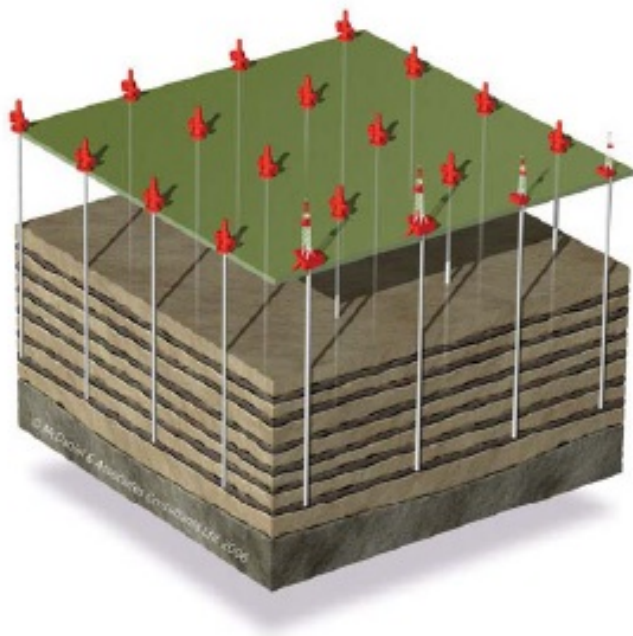
- US oil supply rose
- Unexpected large supply growth out of Iraq
- Surging oil supply from Saudi Arabia
- Possible removal of EU sanctions on Iran

# What Happened? A U.S. Perspective

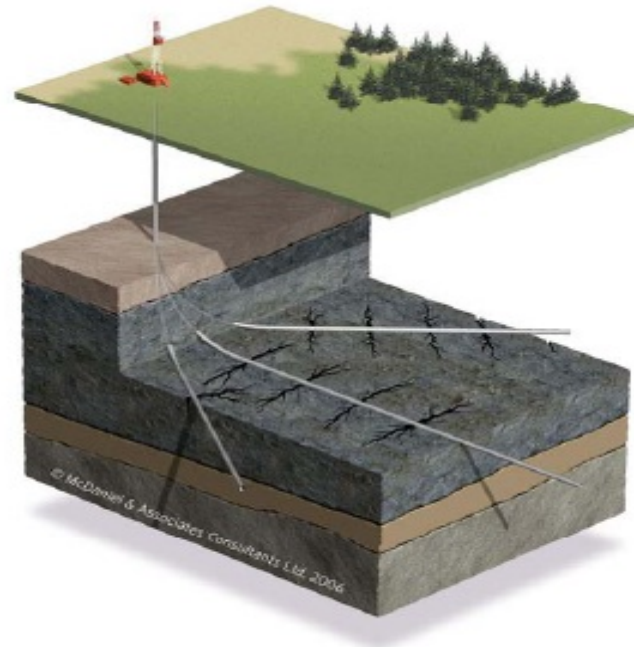
- Thanks to hydraulic fracturing, horizontal drilling and private property ownership of minerals, the world should no longer live under the threat of energy insecurity.
- Energy once scarce, is now super-abundant and that reality will continue to change the world as transportation issues are remedied.



# Horizontal Drilling



Traditional Wells



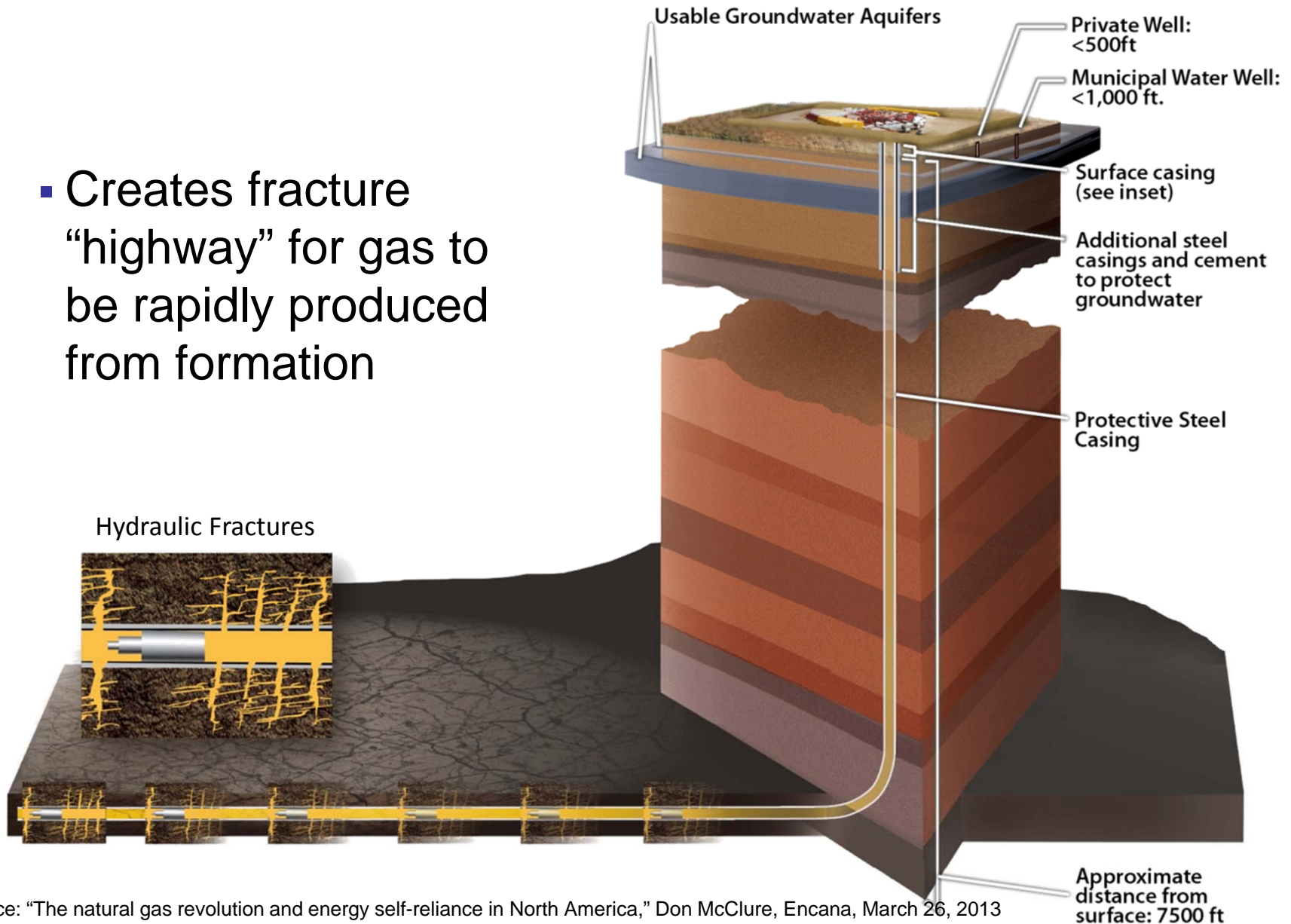
Horizontal Drilling

Source: "The natural gas revolution and energy self-reliance in North America," Don McClure, Encana, March 26, 2013

# Hydraulic Fracturing

Pumping fluid under high pressure to fracture formation

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



Source: “The natural gas revolution and energy self-reliance in North America,” Don McClure, Encana, March 26, 2013

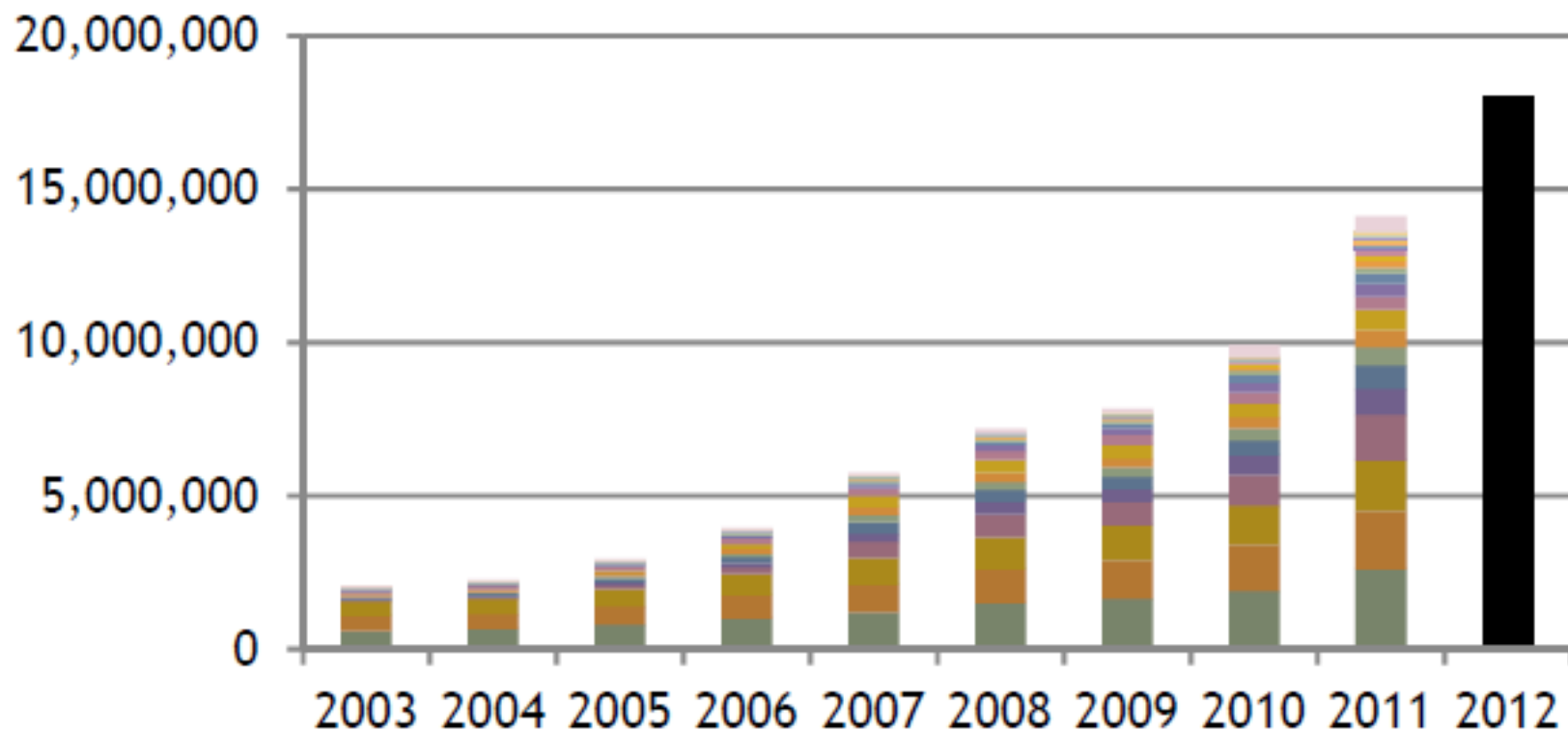




Source: U.S. Energy Information Administration based on data from various published studies. Canada and Mexico plays from ARI.  
 Updated: May 9, 2011

# Fracturing Application Exploded

## North American Frac Horsepower

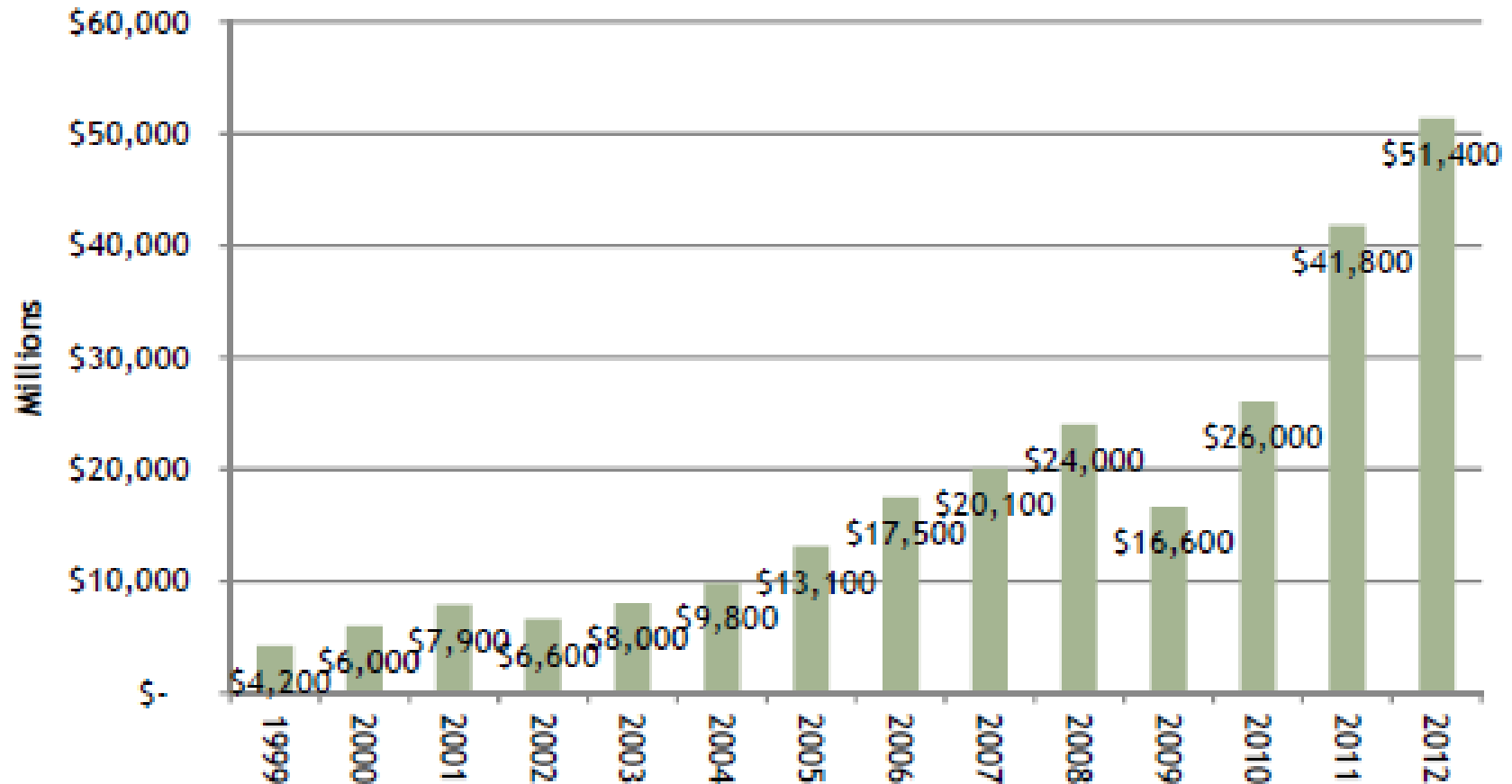


Source: Chris Wright, Liberty Resources Tuesday Lunch Club Presentation, 3/5/13



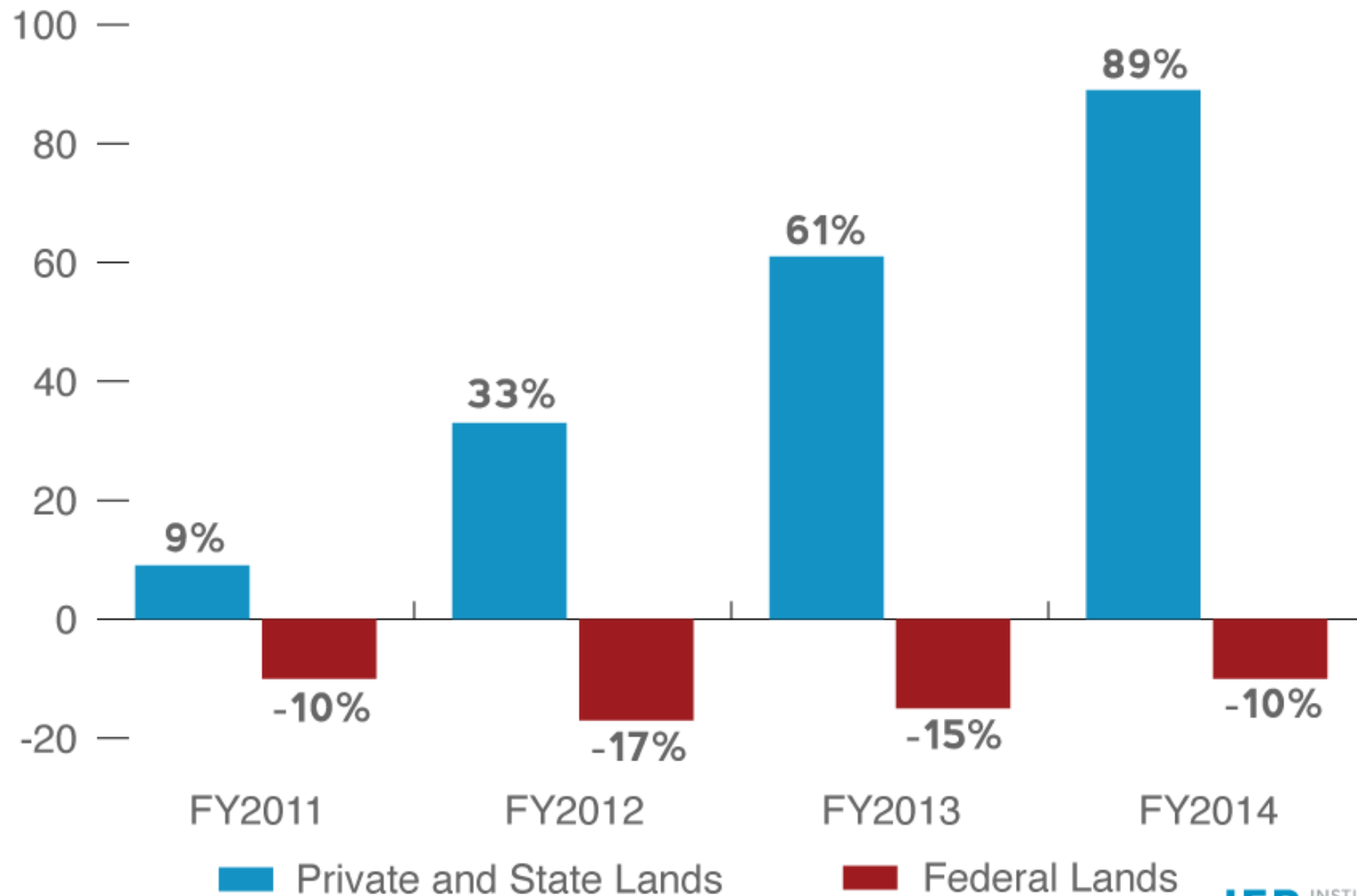
# 10-fold growth in 10 years

## Pressure Pumping Services



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

## OIL PRODUCTION ON FEDERAL VS. PRIVATE AND STATE LANDS PERCENT CHANGE FROM FY2010



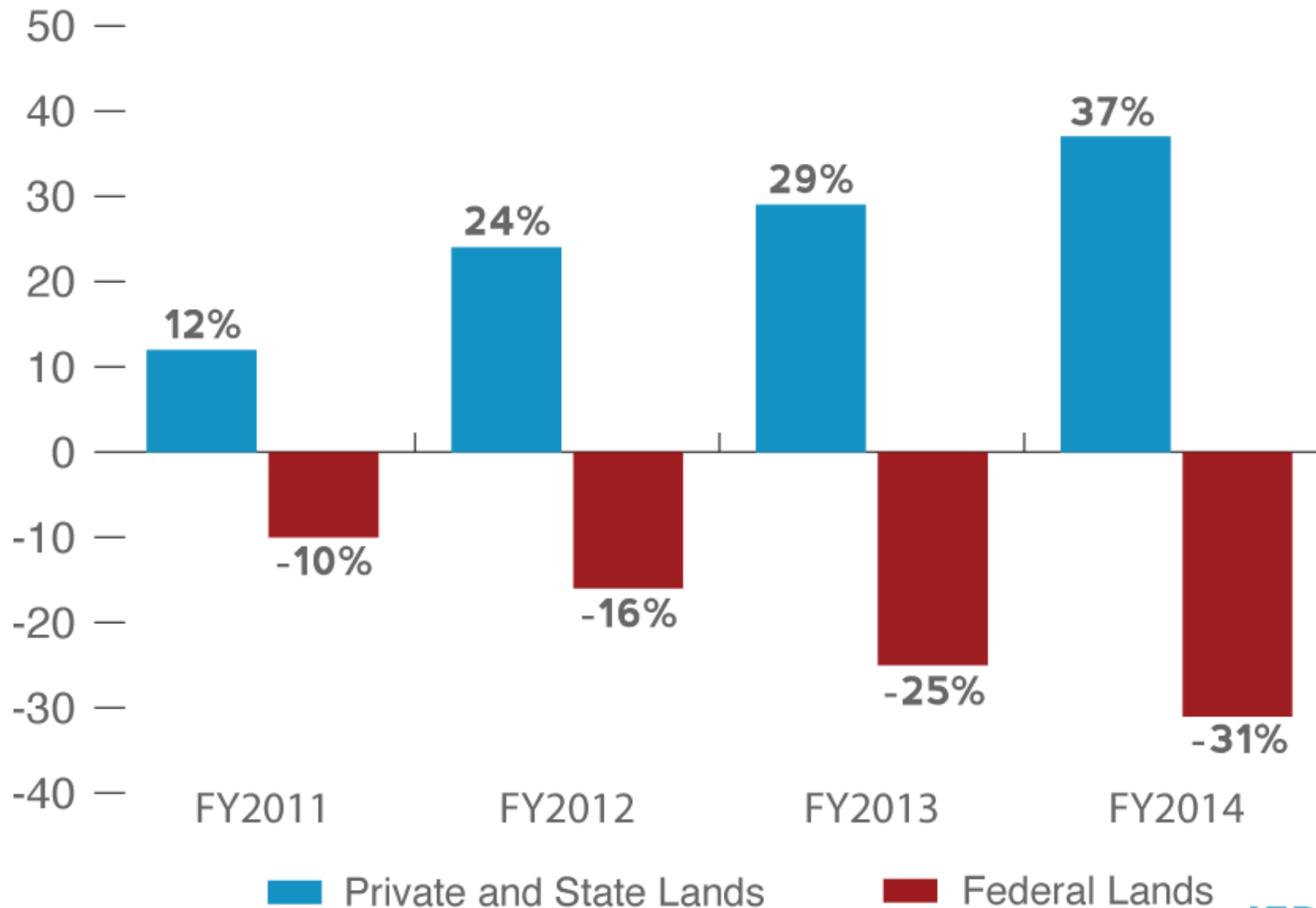
**IER** INSTITUTE FOR ENERGY RESEARCH



Mercator Energy

Source: "Oil and Natural Gas Booms on Private and State Lands," Institute for Energy Research, April 14, 2015

## NATURAL GAS PRODUCTION ON FEDERAL VS. PRIVATE AND STATE LANDS, PERCENT CHANGE FROM FY2010



**IER** INSTITUTE FOR ENERGY RESEARCH



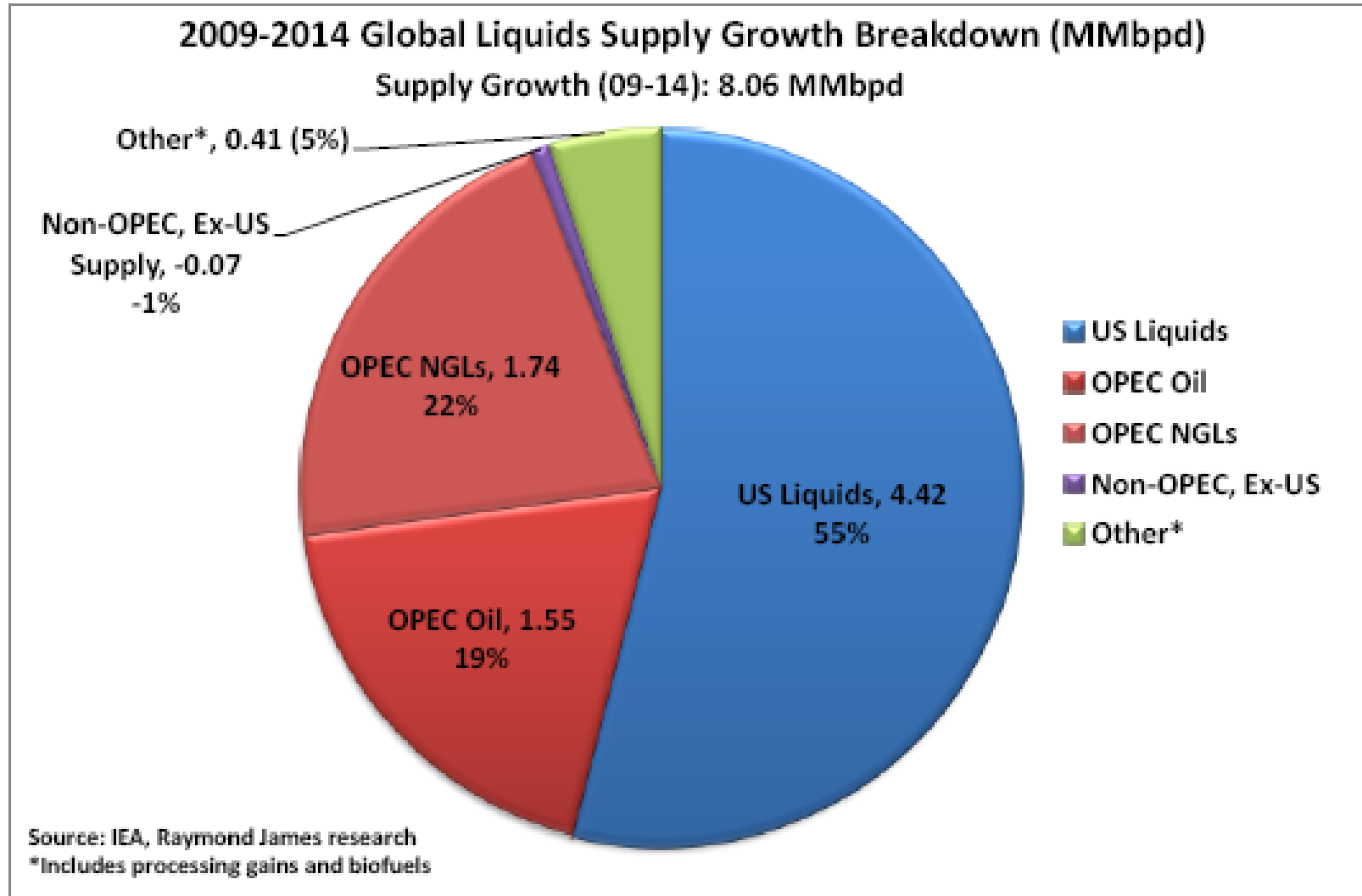
# Saudi Arabia to Erect a 600 Mile “Great Wall” to Fend off ISIS



# Saudi Arabia Builds Giant Yemen Border Fence – 1,100 miles



# The House of Saud's Motivation





# Is it a production war or demand destruction or both?

- On November 27, 2014 at an OPEC meeting in Vienna, the Saudis said,

“Yakfee!”

or

“Enough!”

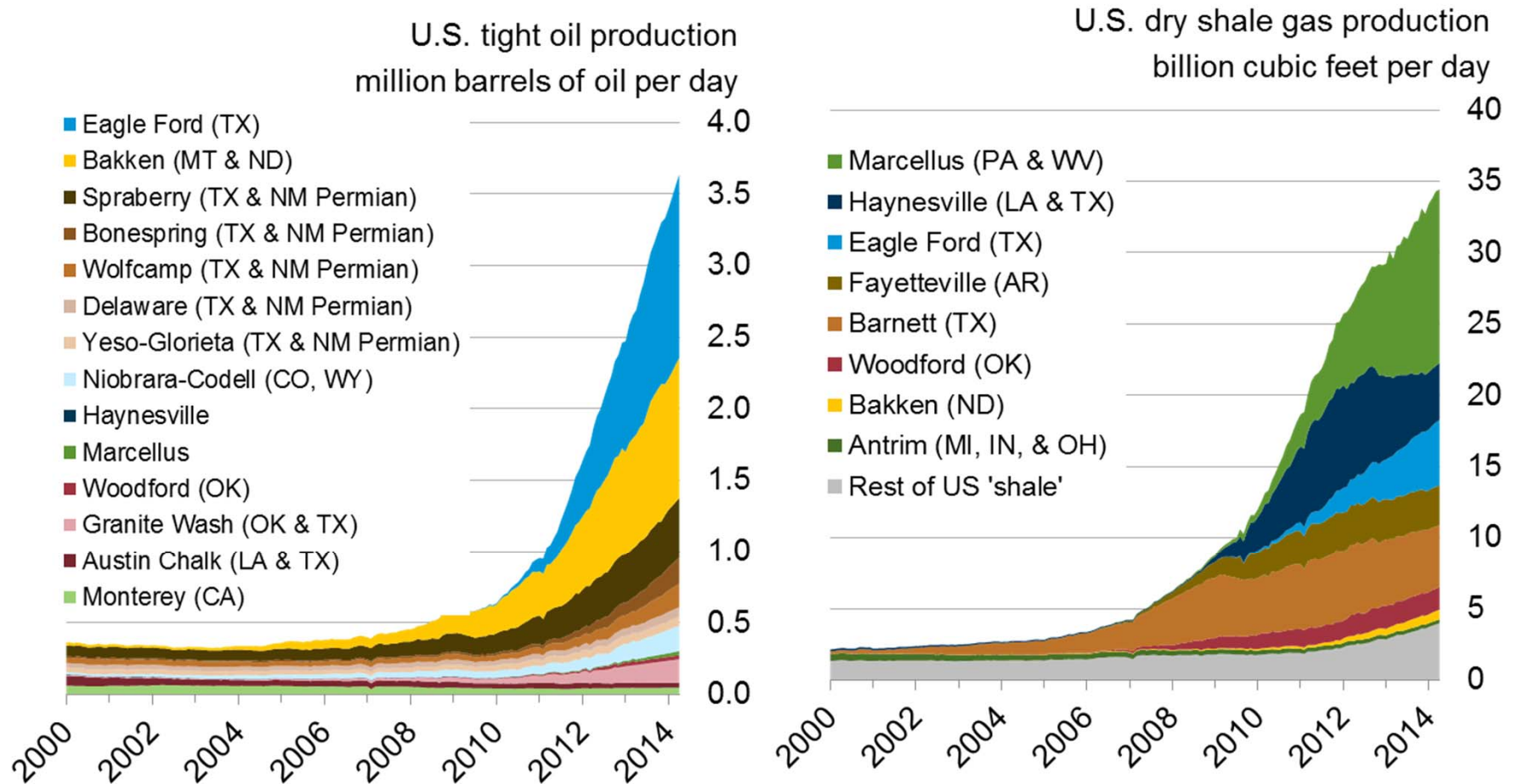
- They resisted calls from OPEC members Iran, Iraq and Venezuela to reduce the production target of 30 million barrels per day.

# Major Takeaways

- Crude oil prices are depressed due to the current global oversupply.
- The crude oil oversupply will take between 1 to 2 years to correct, unless a major structural event takes supply out (OPEC, etc.)
- Marginally economic areas across the U.S. will be negatively impacted. Geography and crude quality can tip the sales either way.
- Natural gas drilling that was dependent on the value of natural gas liquids has been negatively affected
- North American LNG exports could also be affected.
- Is this the end of energy scarcity?



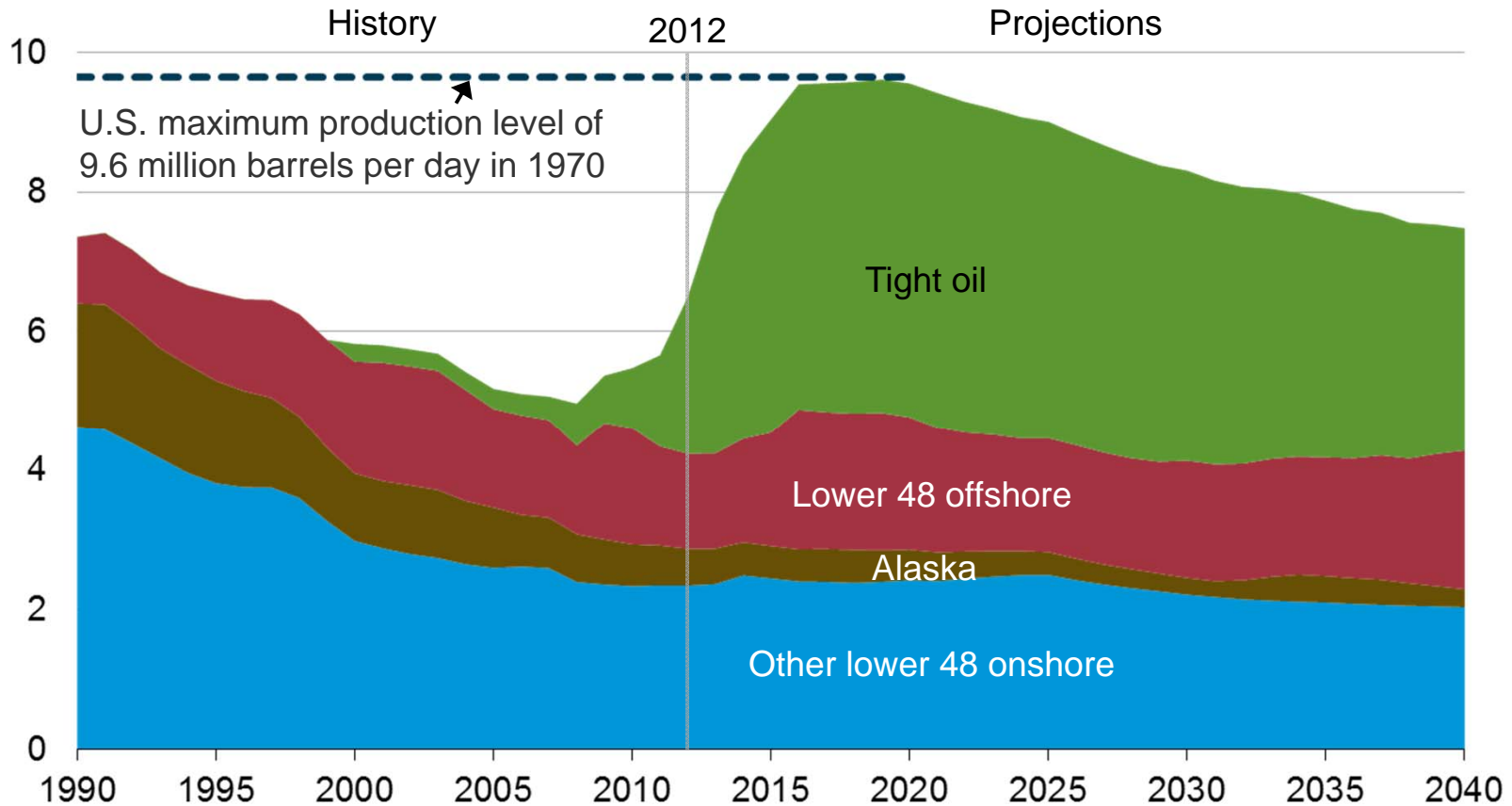
# The U.S. has experienced a rapid increase in natural gas and oil production from shale and other tight resources



Sources: EIA derived from state administrative data collected by DrillingInfo Inc. Data are through April 2014 and represent EIA's official tight oil & shale gas estimates, but are not survey data. State abbreviations indicate primary state(s).

# Growing tight oil and offshore crude oil production drive U.S. output close to historical high

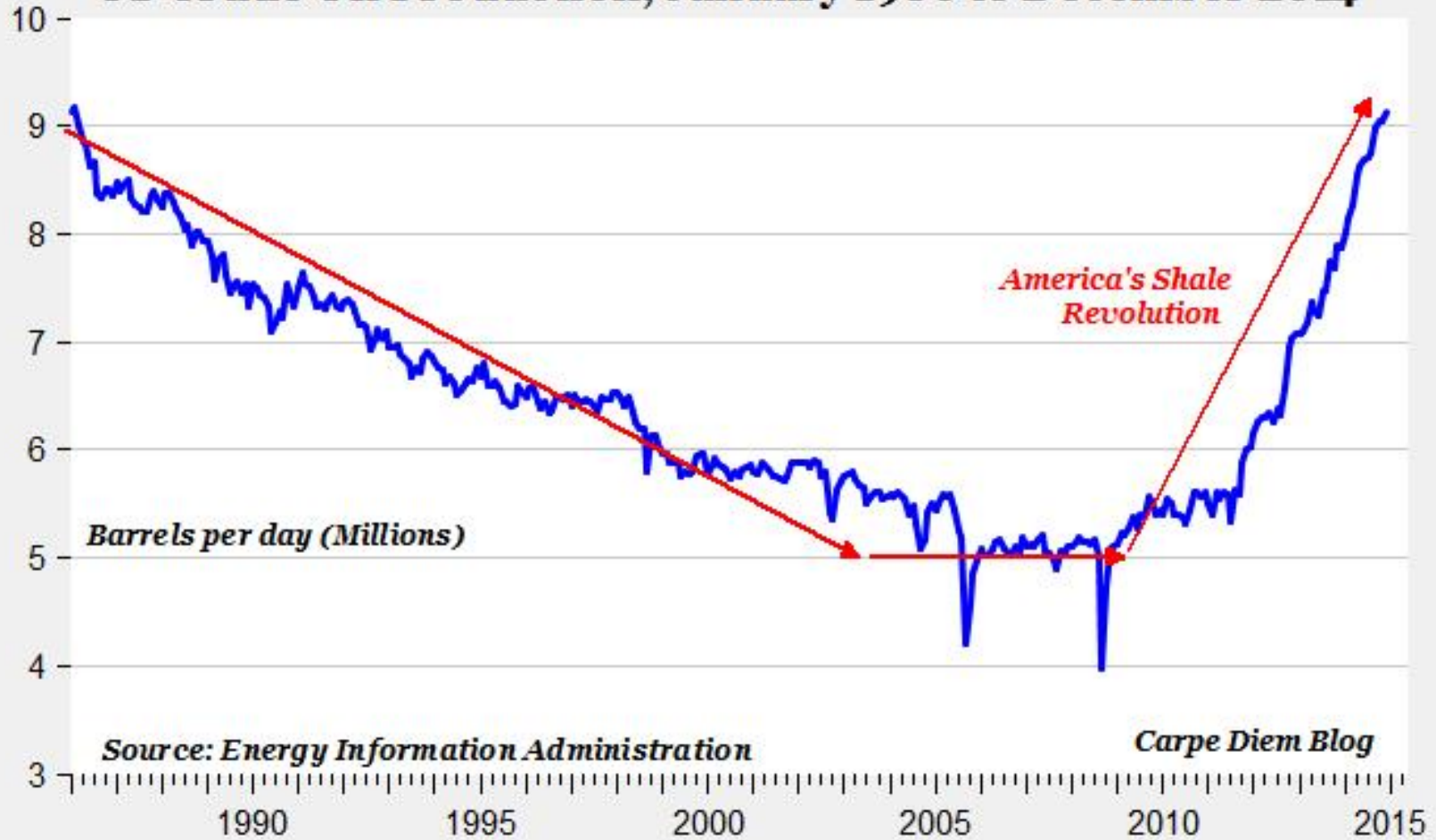
U.S. crude oil production  
million barrels per day



Source: EIA, Annual Energy Outlook 2014 Reference case

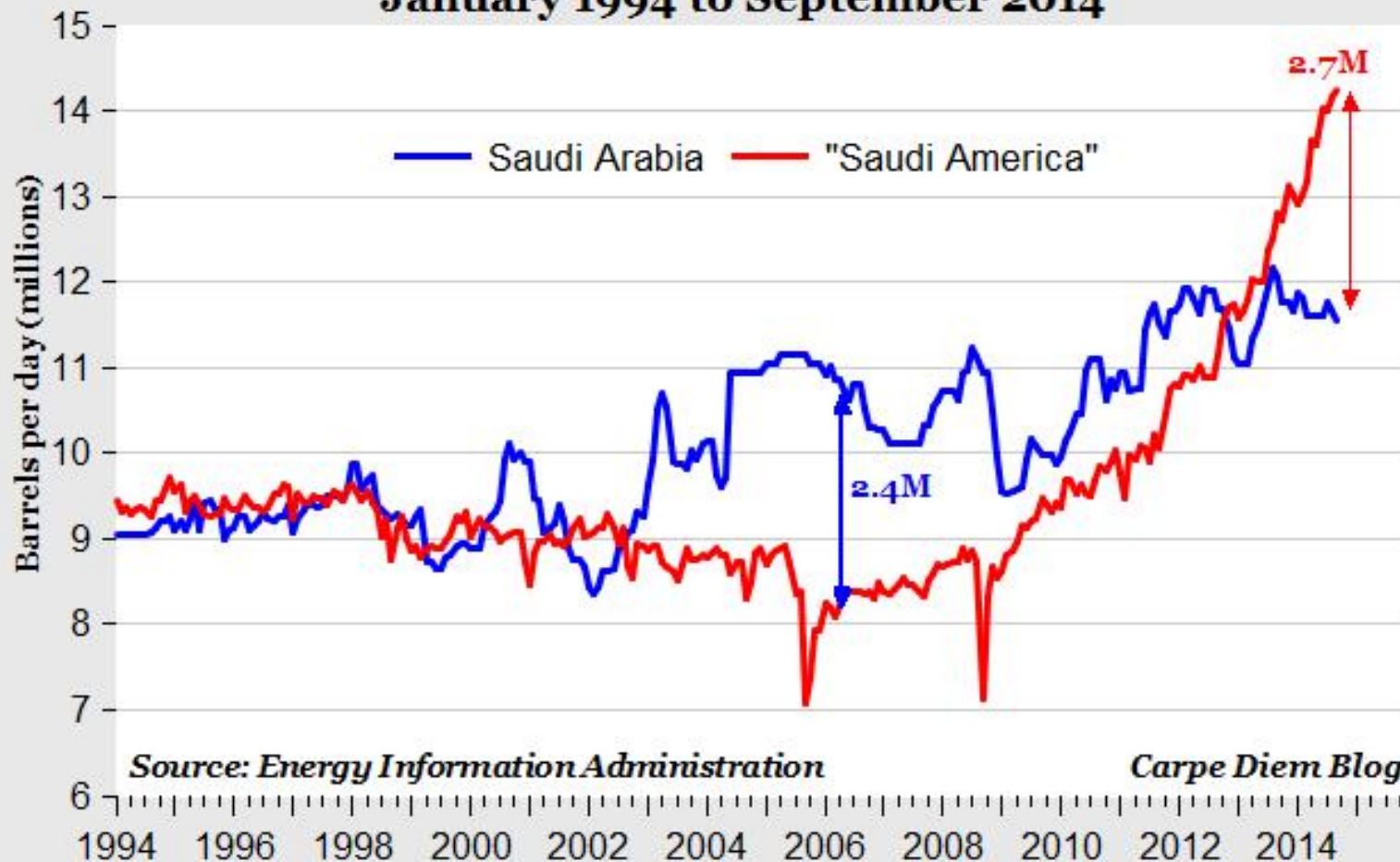
Source: U.S. oil and natural gas outlook, Adam Sieminski, EIA Administrator, Presentation to IAEE International Conference, June 16, 2014

# US Crude Oil Production, January 1986 to December 2014



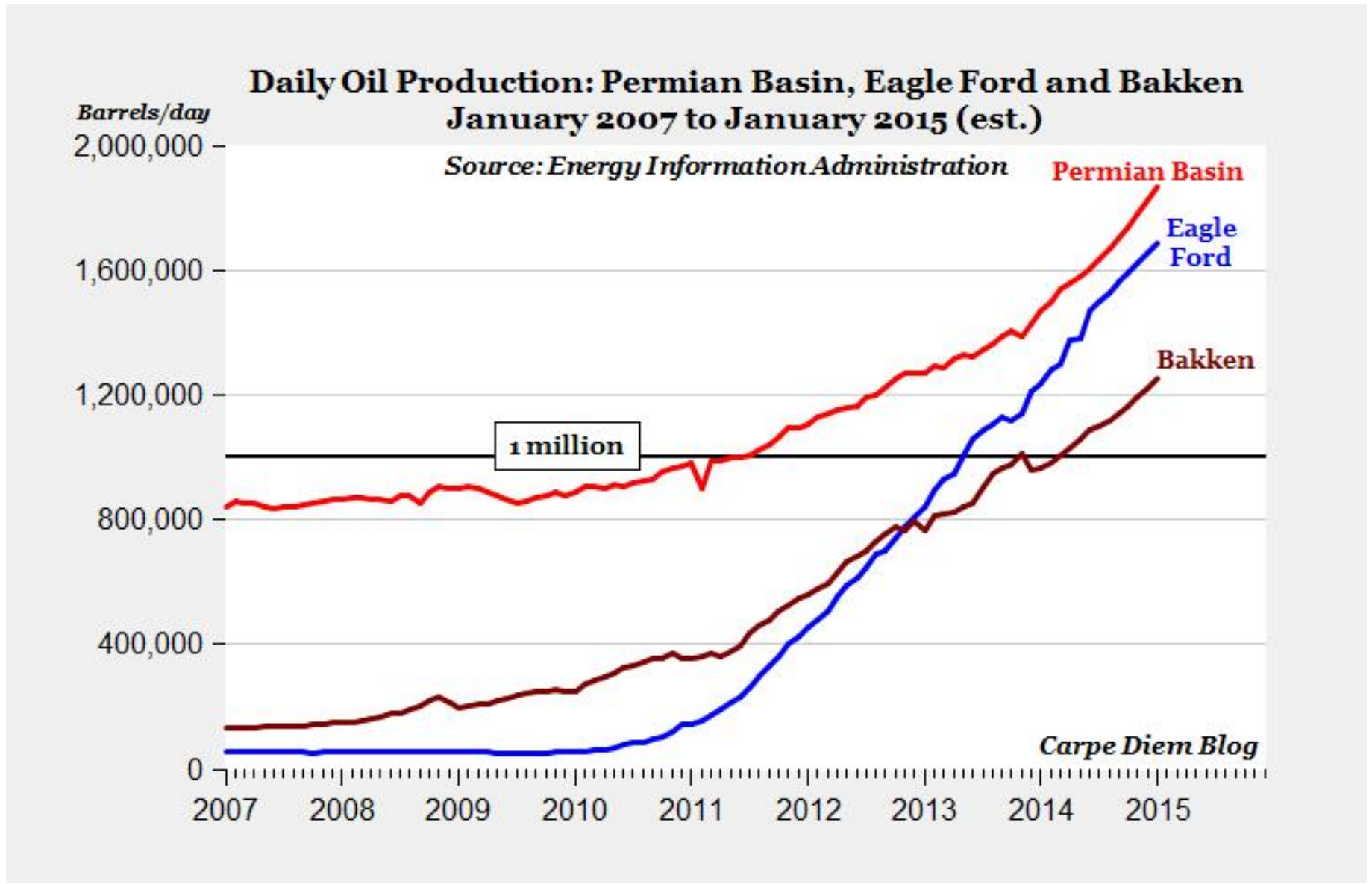
Source: My top ten energy charts of the year for 2014, Mark J. Perry, American Enterprise Institute, January 5, 2015

## Total Petroleum Production: Saudi Arabia vs. US January 1994 to September 2014



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

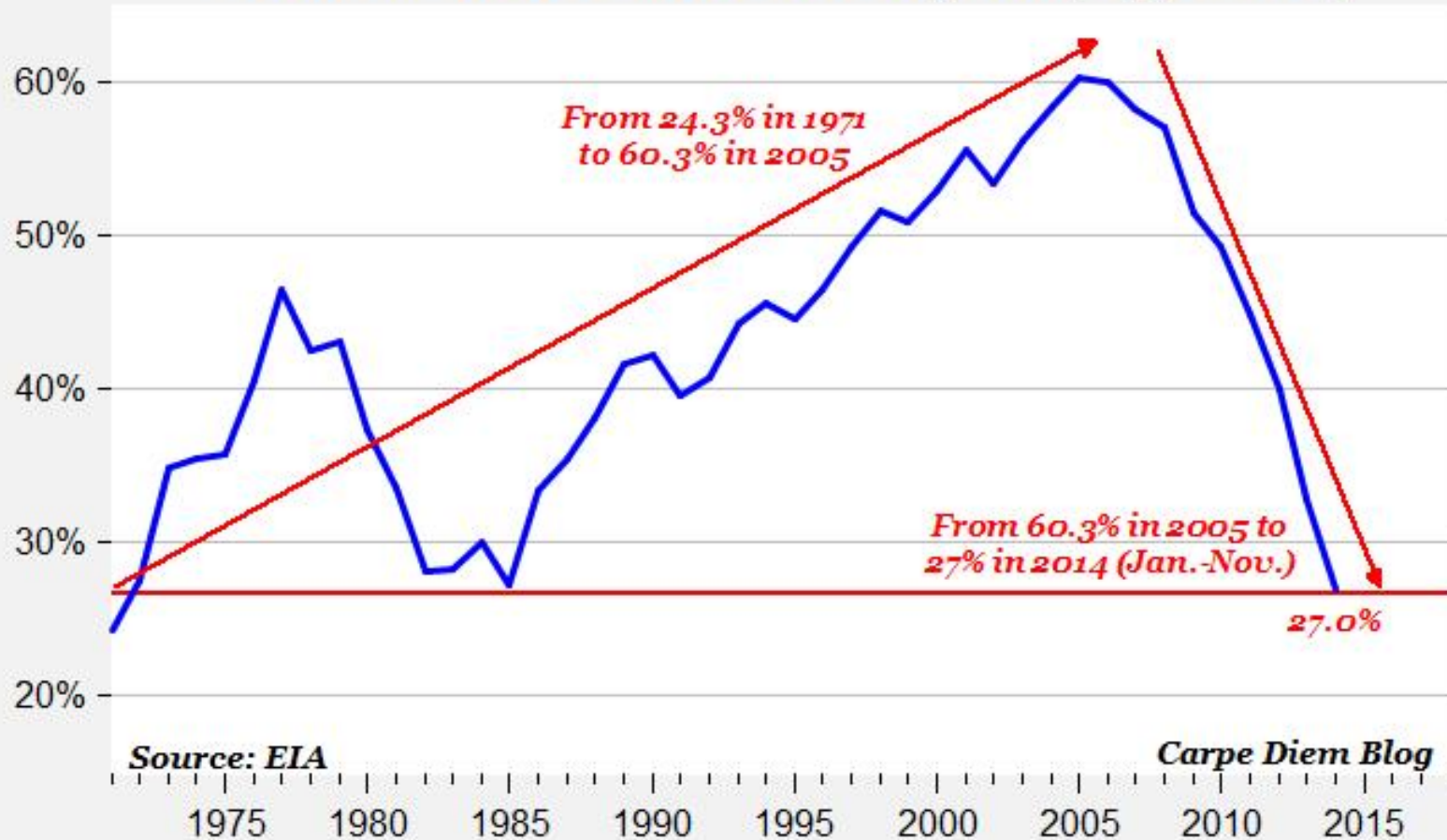




Source: My top ten energy charts of the year for 2014, Mark J. Perry, American Enterprise Institute, January 5, 2015



## America's Net Petroleum Imports, 1971-2014



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

# What is the Motivation for Saudi Arabia?

- Is this a shot across our bow?
- Are we victims of our own success?
- Who is the real target of their price war?

# OPEC's Strategy? 11/28/14 Quote













**“In 2016, when OPEC *completes this objective of cleaning up the American marginal market*, the oil price will start growing again,”** said Fedun, who’s made a fortune of more than \$4 billion in the oil business, according to data compiled by Bloomberg. **“*The shale boom is on a par with the dot-com boom. The strong players will remain, the weak ones will vanish.*”**

- Leonid Fedun, VP and Board Member at OAO Lukoil (LKOD)



Source: *OPEC Policy Ensures U.S. Shale Crash, Russian Tycoon Says*, Asst Natl Dir Melony B. DeFord, Tea Party Command Center, November 28, 2014

# OPEC Member States

Country	Region	Joined OPEC <sup>[1]</sup>	Population (July 2008) <sup>[2]</sup>	Area (km <sup>2</sup> ) <sup>[3]</sup>
 Algeria	Africa	1969	33,779,668	2,381,740
 Angola	Africa	2007	12,531,357	1,246,700
 Ecuador	South America	2007 <sup>[A 1]</sup>	13,927,650	283,560
 Iran	Middle East	1960 <sup>[A 2]</sup>	75,875,224	1,648,000
 Iraq	Middle East	1960 <sup>[A 2]</sup>	28,221,180	437,072
 Kuwait	Middle East	1960 <sup>[A 2]</sup>	2,596,799	17,820
 Libya	Africa	1962	6,173,579	1,759,540
 Nigeria	Africa	1971	146,255,300	923,768
 Qatar	Middle East	1961	824,789	11,437
 Saudi Arabia	Middle East	1960 <sup>[A 2]</sup>	28,146,656	2,149,690
 United Arab Emirates	Middle East	1967	4,621,399	83,600
 Venezuela	South America	1960 <sup>[A 2]</sup>	26,414,816	912,050
<b>Total</b>			<b>369,368,429</b>	<b>11,854,977 km<sup>2</sup></b>



# It's About Geopolitical Power & Market Share for the Saudis



# A Game of Chicken?

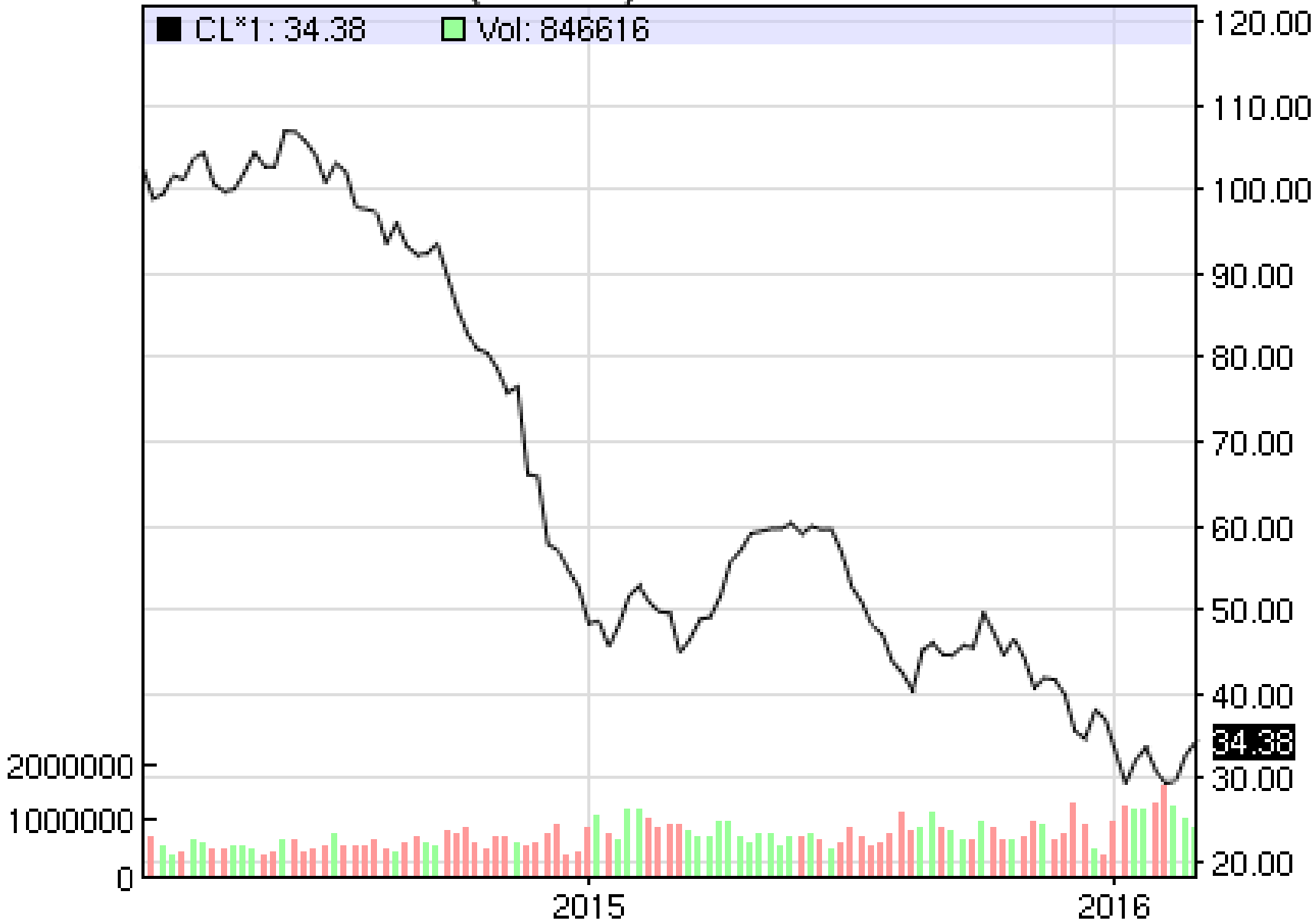
Nation	Oil price per barrel required to break even or balance budget
<b>US producers</b>	<b>\$38-\$77</b>
Qatar	\$58
Kuwait	\$59
UAE	\$90
<b>Saudi Arabia</b>	<b>\$92</b>
Angola	\$94
<b>Russia</b>	<b>\$101</b>
Iraq	\$116
Venezuela	\$117
Algeria	\$119
Ecuador	\$122
Nigeria	\$124
<b>Iran</b>	<b>\$136</b>

According to data compiled by Bloomberg, *“prices have dropped below the level needed by at least 9 OPEC member states to balance their budgets.”*

Source: Reuters, *The Saudi Arabian Oil Conspiracy and What it Might Mean for Your Portfolio*, The Motley Fool, Adam Galas, January 18, 2015

*Survival of fittest as oil tumbles below \$65*, Bloomberg News, December 1, 2014

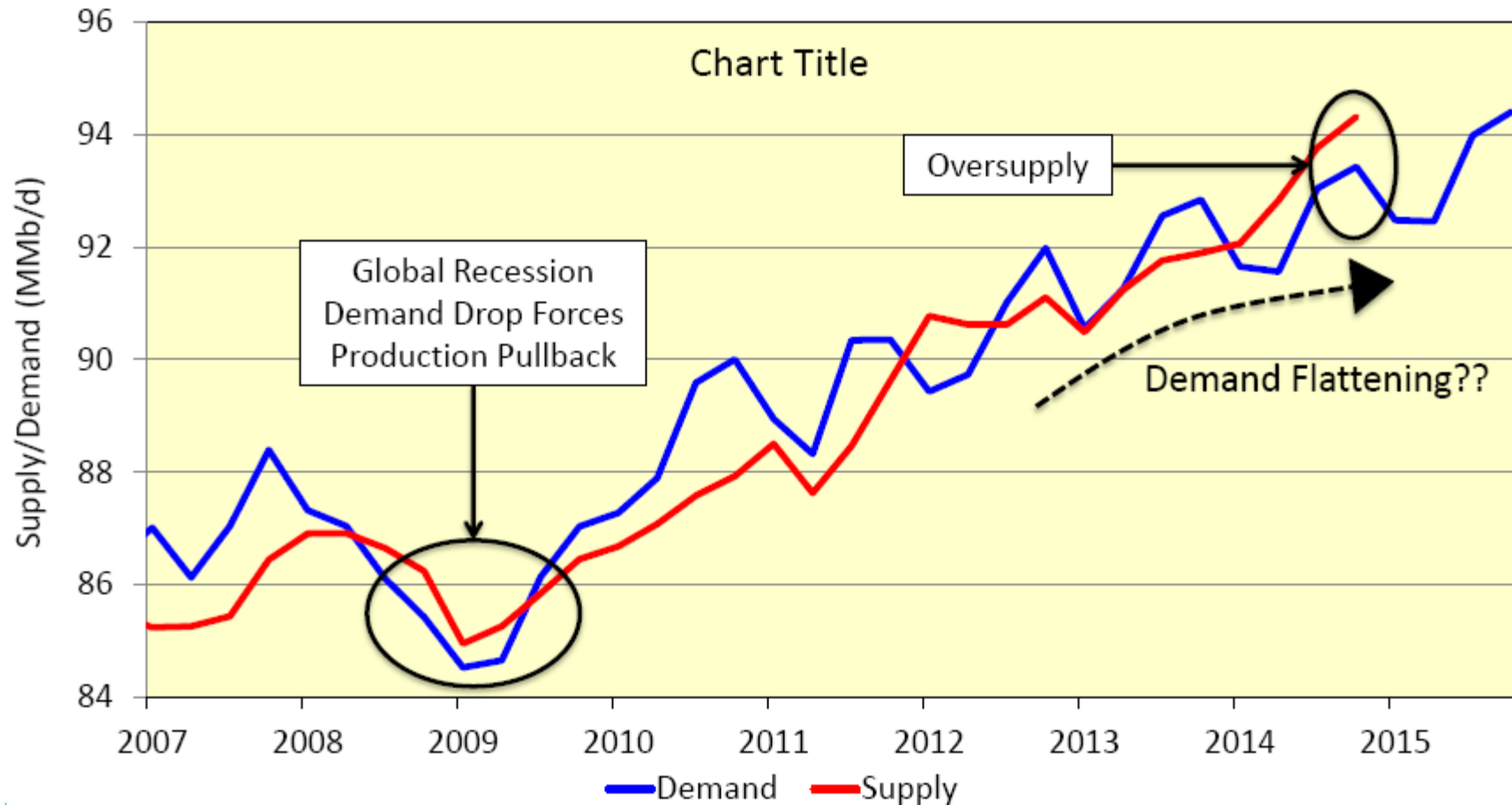
# CLJ14 - Crude Oil WTI (NYMEX)



# Global Supply/Demand Balance

## Lower Prices A Function of Global Oversupply

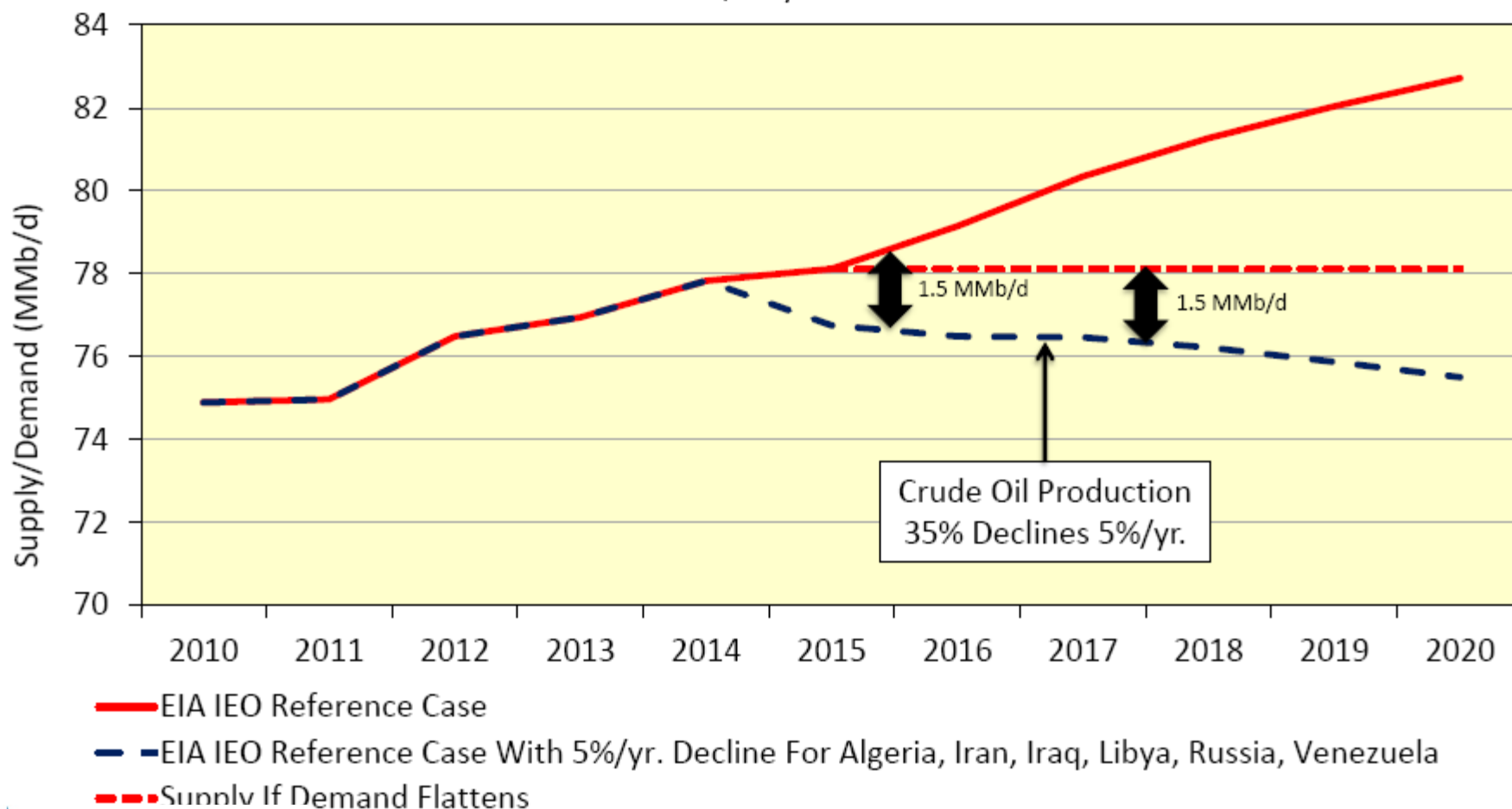
Supply is nearly 1.5 MMb/d over demand. Supply has been higher than demand briefly in the past without price drops (inventory build), however the current oversupply is at a time where demand is also at its peak.



Sources: *The Outlook for U.S. Crude: Implications for Colorado*, Bernadette Johnson, Ponderosa Advisors  
 IEA Global Supply/Demand Crude NGLs, Non-Conventional Oils

# Global Crude Oil Over-Supply 'Pain Period' Will Last 1 to 3 Years

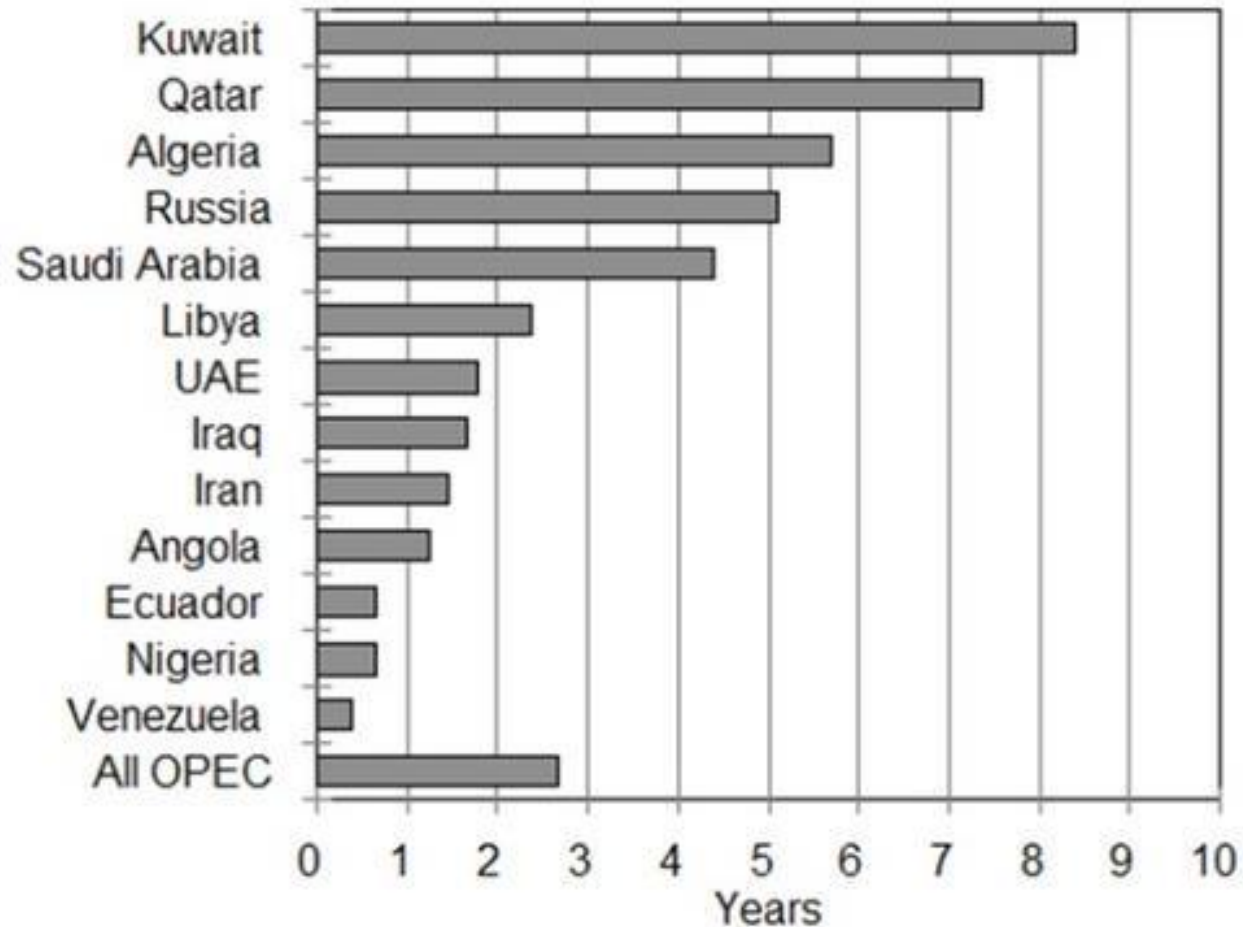
If lower prices force natural declines in high cost producing countries, global production could fall by 1.5 MMb/d by 2016.





# Survival of the Fittest?

DURATION OF FOREIGN RESERVES @ \$50/BBL DEFICIT



Saudis have staying power; \$750 billion in foreign country reserves



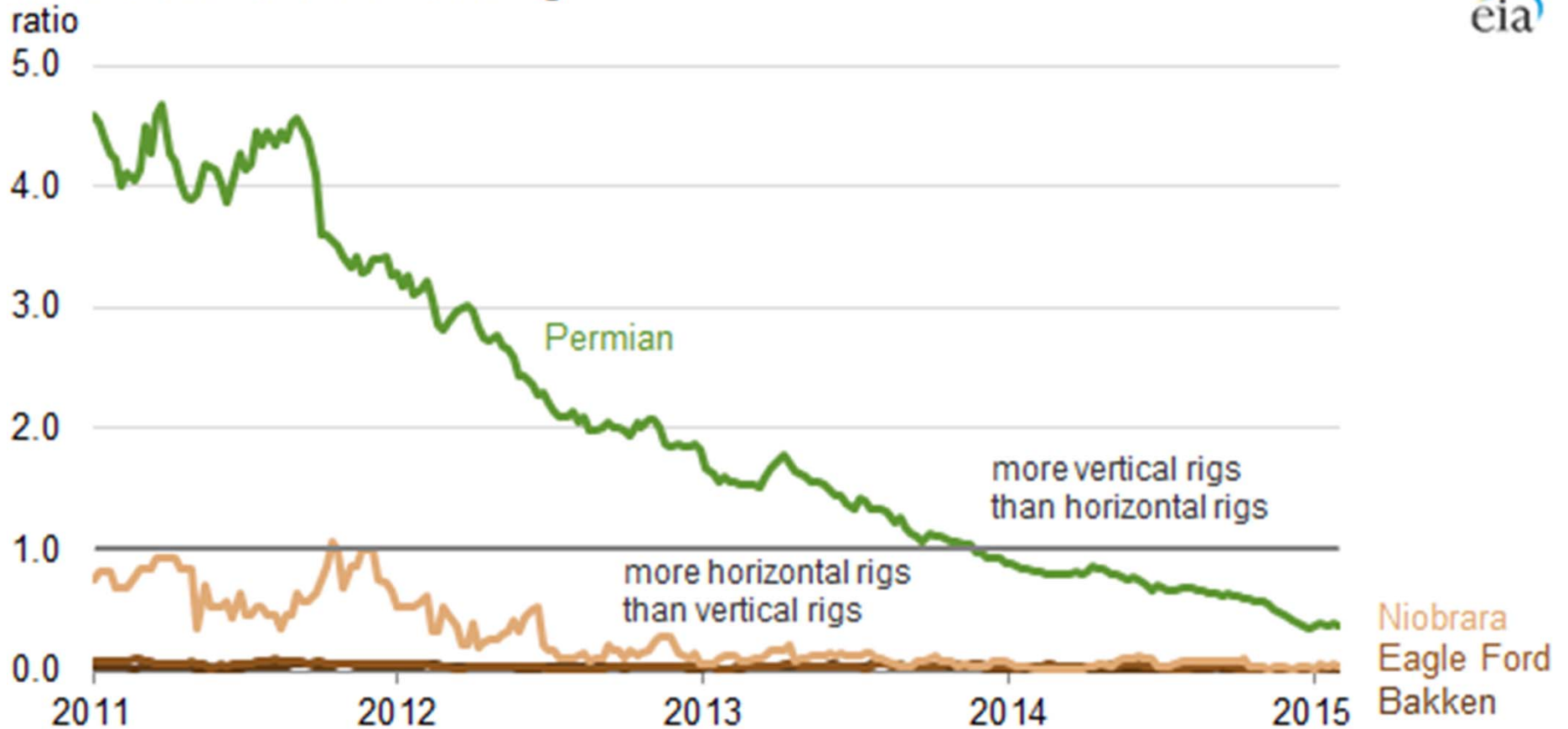
Source: Oilprice.com, *The Saudi Arabian Oil Conspiracy and What it Might Mean for Your Portfolio*, The Motley Fool, Adam Galas, January 18, 2015

# Impact of Lower Prices in U.S.

Despite a rig count drop...

# Ratio of vertical to horizontal rigs

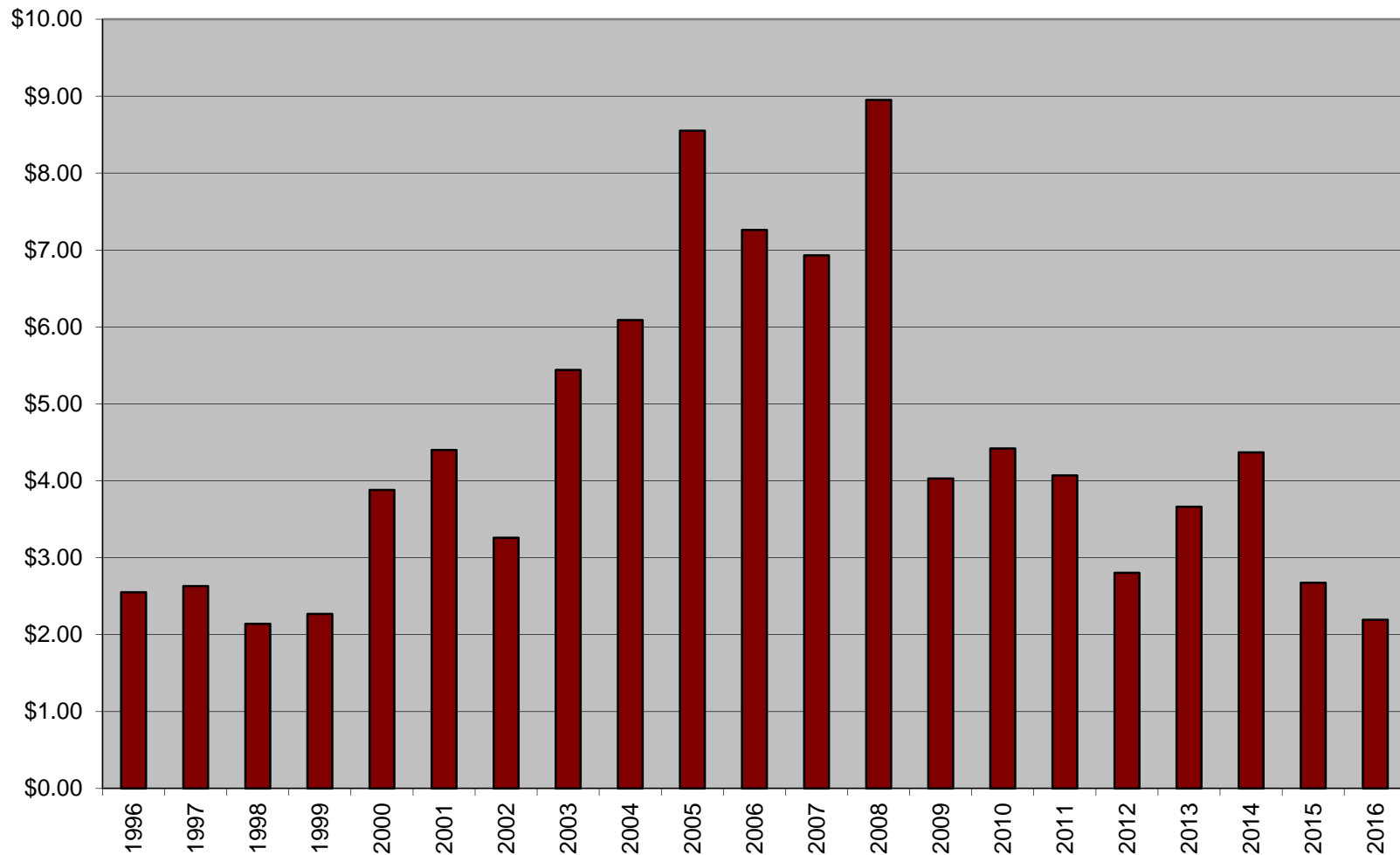
Ratio of vertical to horizontal rigs



Source: *Falling rig counts drive projected near-term oil production decline in 3 key U.S. regions*, March 17, 2016

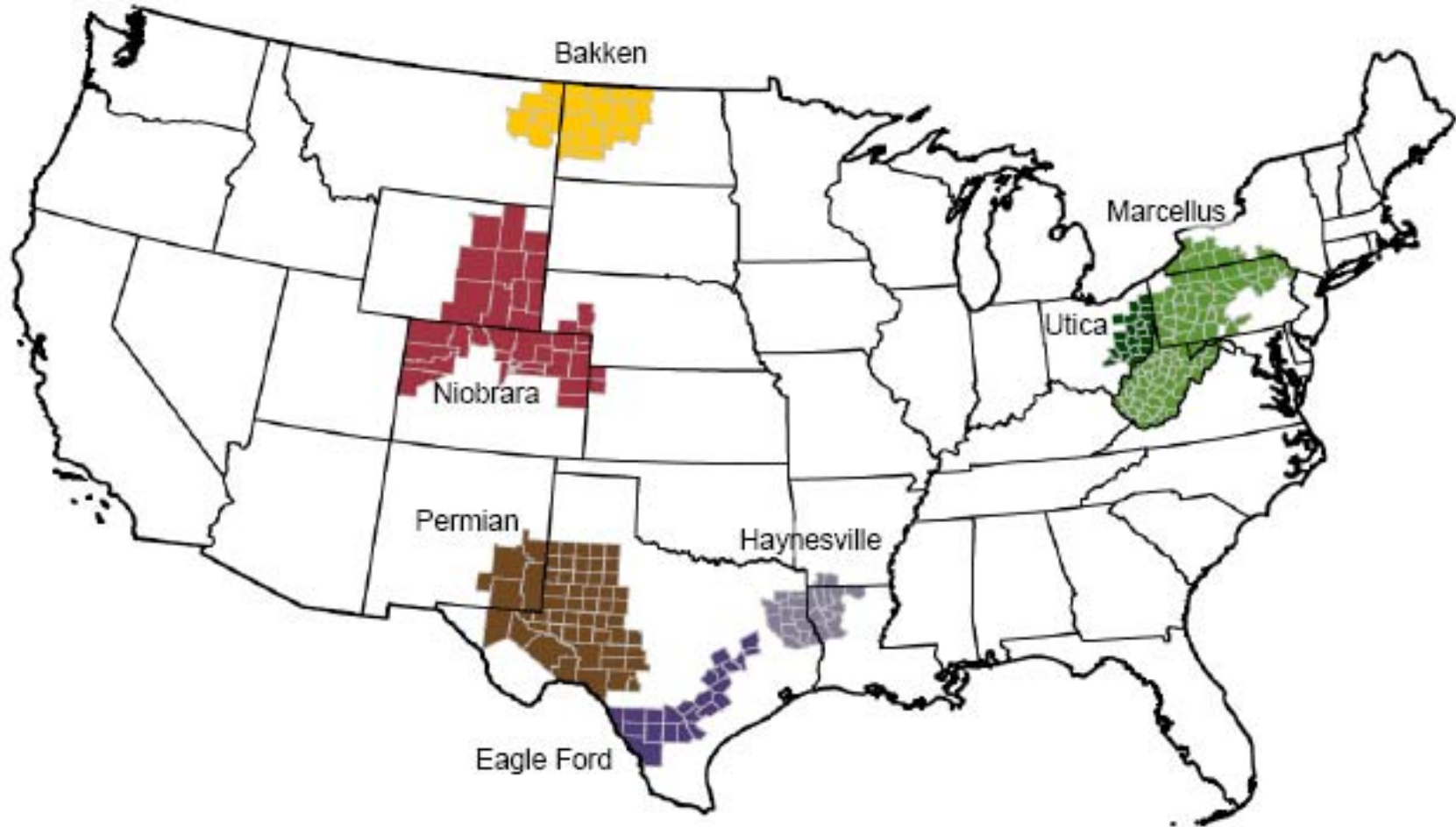
# Despite a price drop

Historical NYMEX Henry Hub Index Prices (1996-Current)



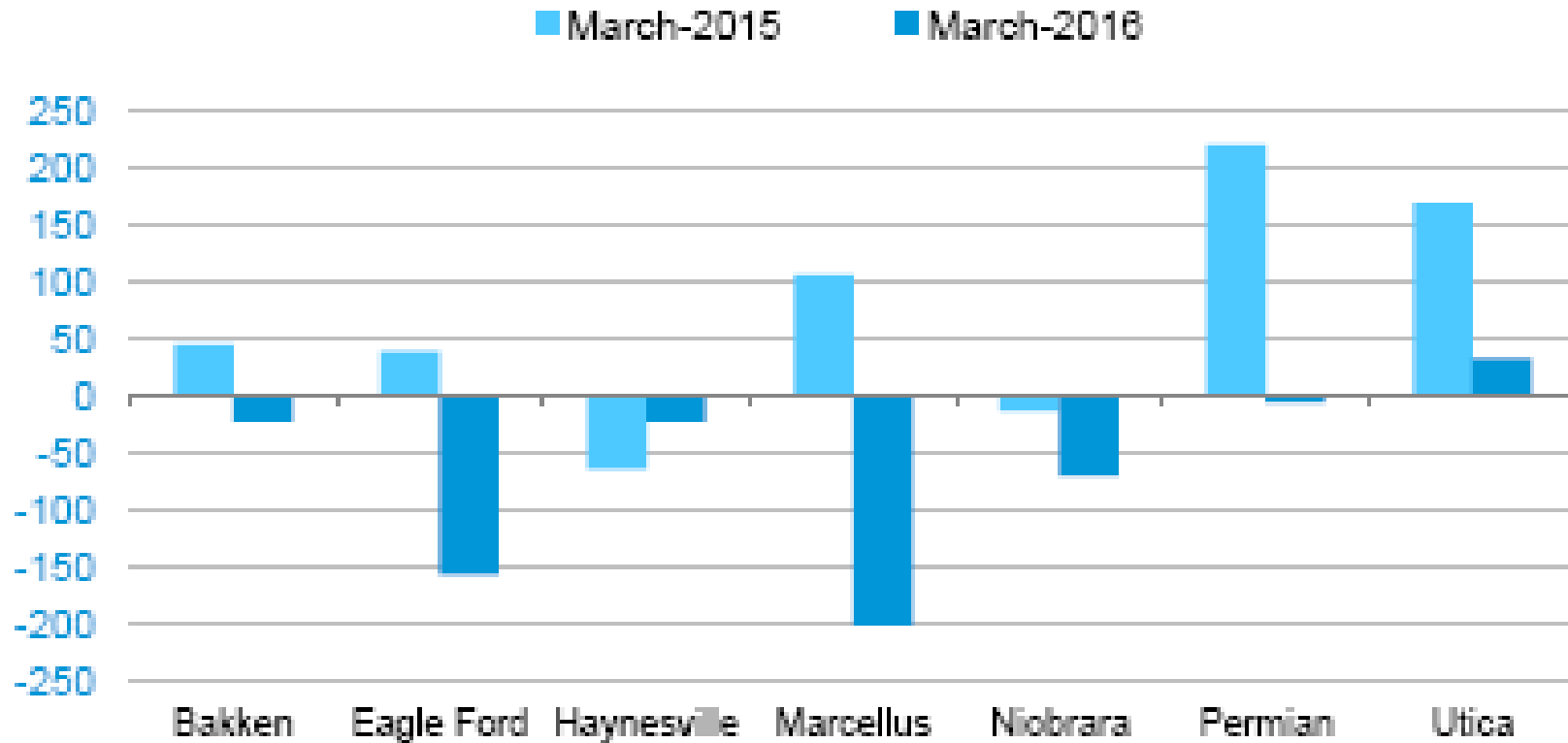
Source: NYMEX – Average last 3 days of close as reported in Platts Gas Daily Report, A McGraw Hill Publication

The seven regions shown below account for 92% of domestic oil production growth and all domestic natural gas production growth during 2011-14.



## Indicated monthly change in gas production (Mar vs. Feb)

million cubic feet/day

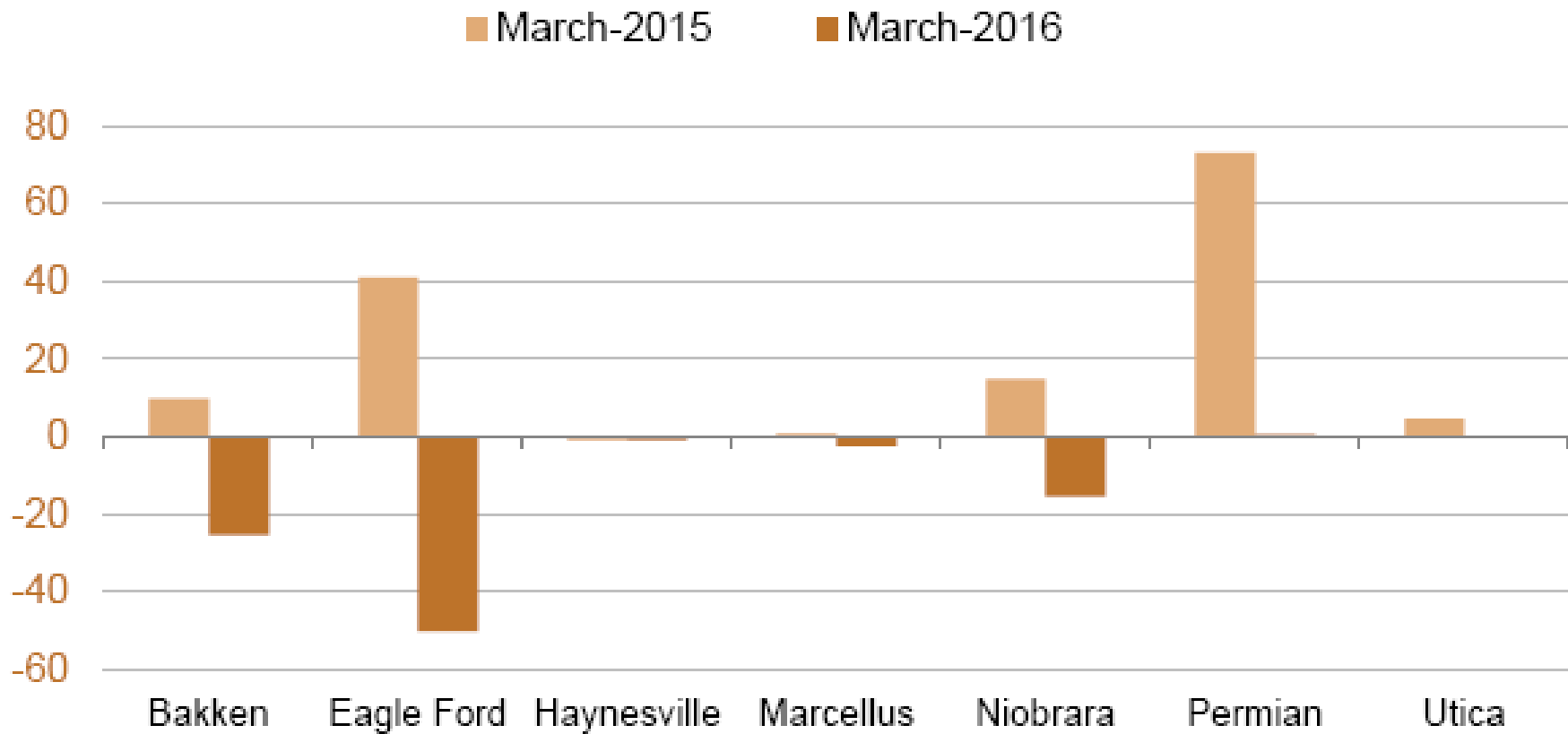


Source: Drilling Productivity Report, EIA U.S. Energy Information Administration, February 2016



## Indicated monthly change in oil production (Mar vs. Feb)

thousand barrels/day

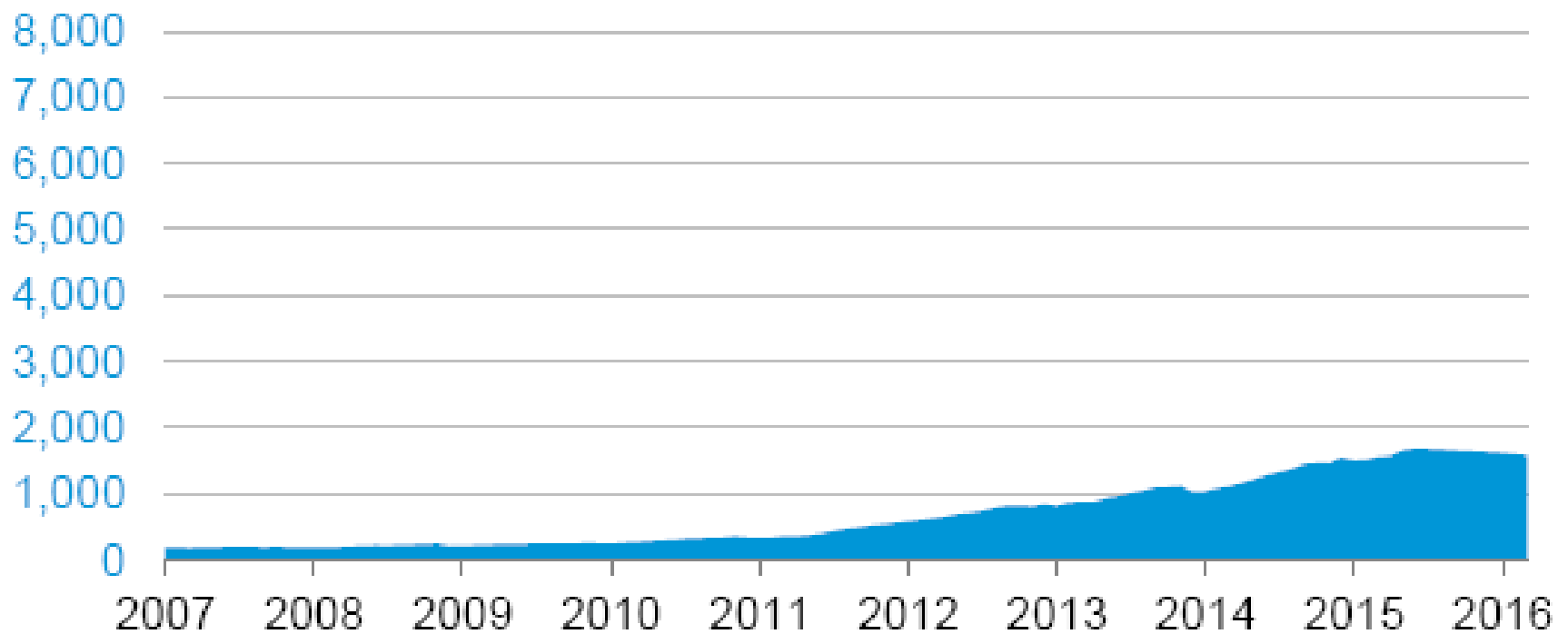


Source: Drilling Productivity Report, EIA U.S. Energy Information Administration, February 2016

# Bakken Region Natural gas production

million cubic feet/day

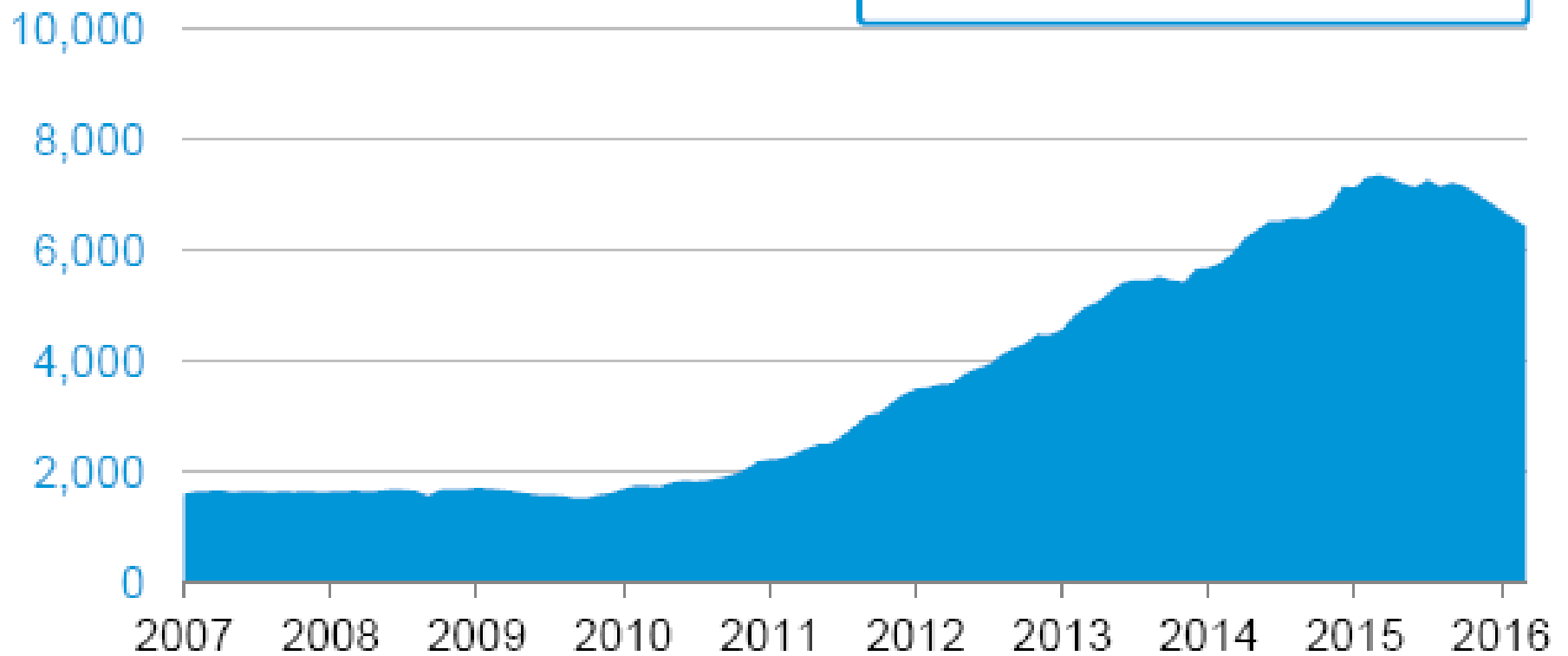
**Gas -24**  
million cubic feet/day  
month over month



Source: Drilling Productivity Report, EIA U.S. Energy Information Administration, February 2016

## Eagle Ford Region Natural gas production

million cubic feet/day

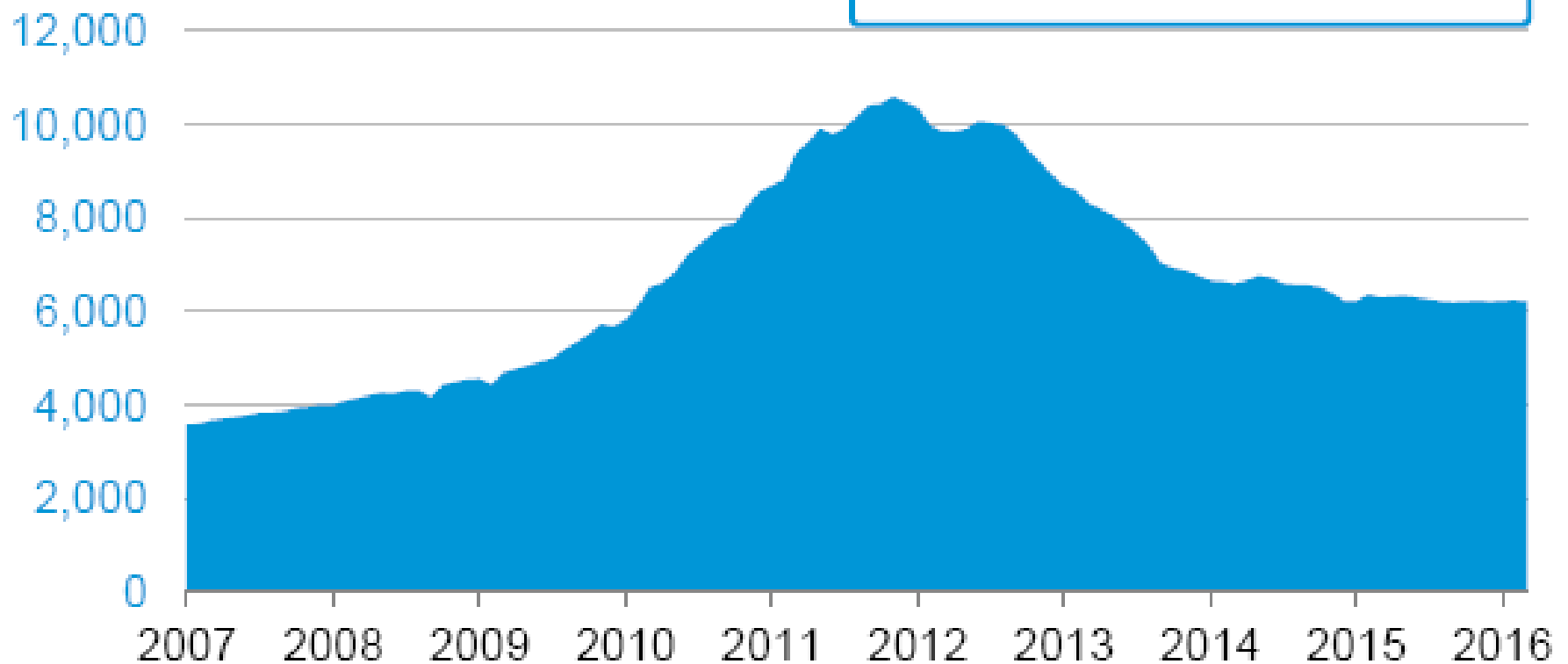


Source: Drilling Productivity Report, EIA U.S. Energy Information Administration, February 2016

# Haynesville Region Natural gas production

million cubic feet/day

**Gas -23**  
million cubic feet/day  
month over month

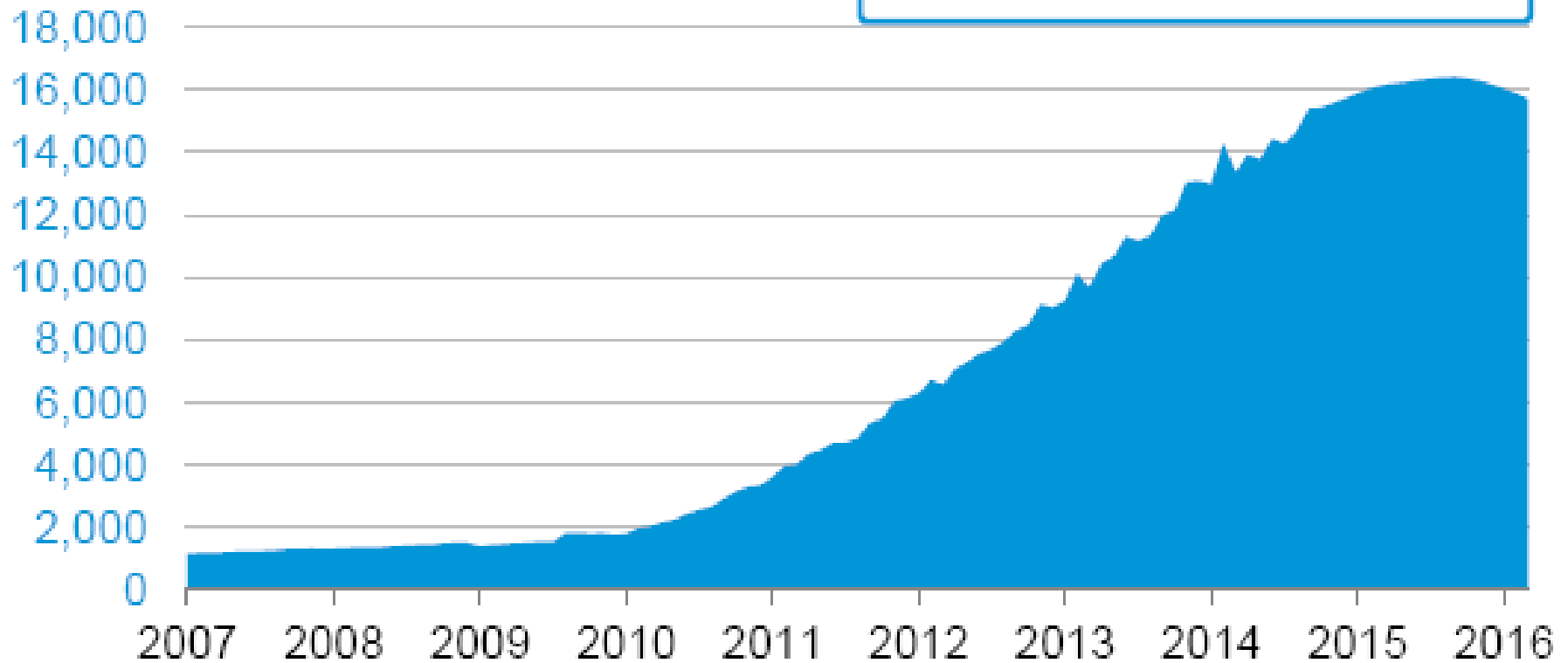


Source: Drilling Productivity Report, EIA U.S. Energy Information Administration, February 2016

# Marcellus Region Natural gas production

million cubic feet/day

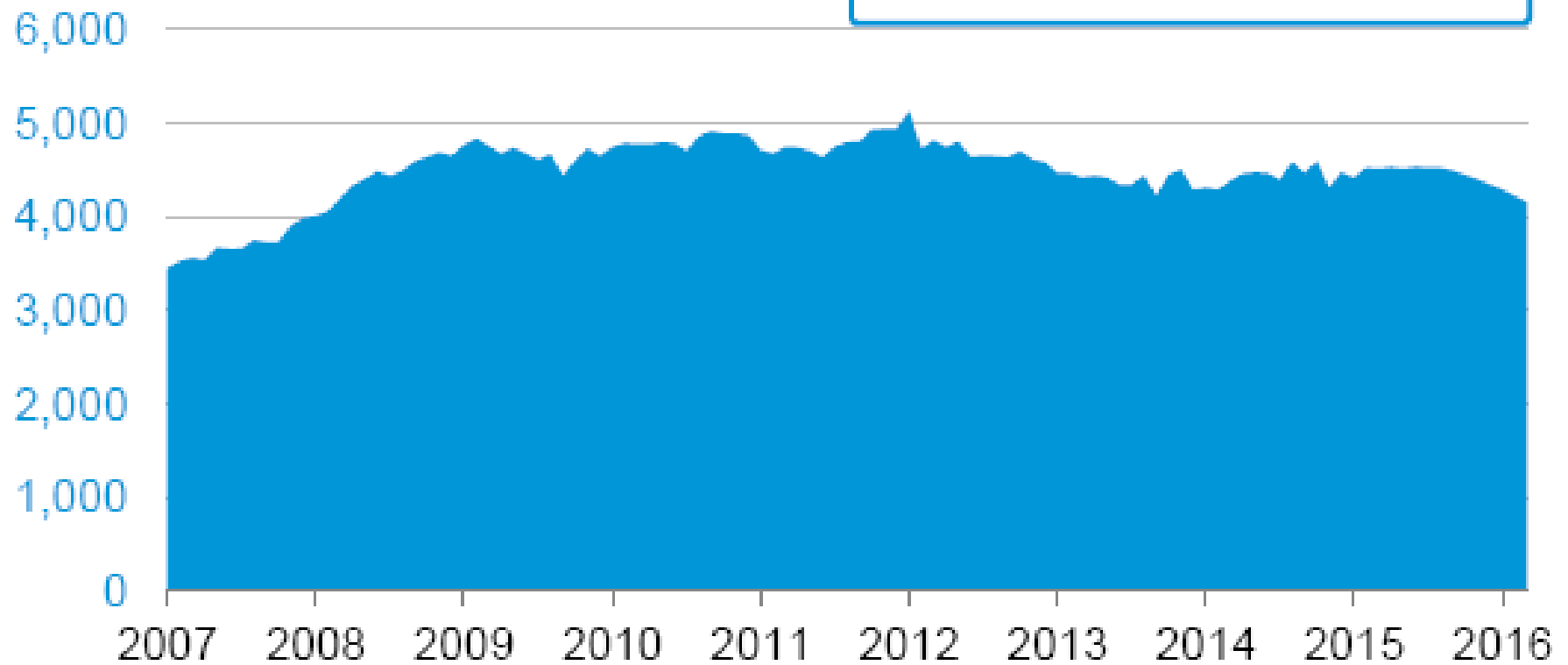
**Gas -202**  
million cubic feet/day  
month over month



Source: Drilling Productivity Report, EIA U.S. Energy Information Administration, February 2016

## Niobrara Region Natural gas production

million cubic feet/day



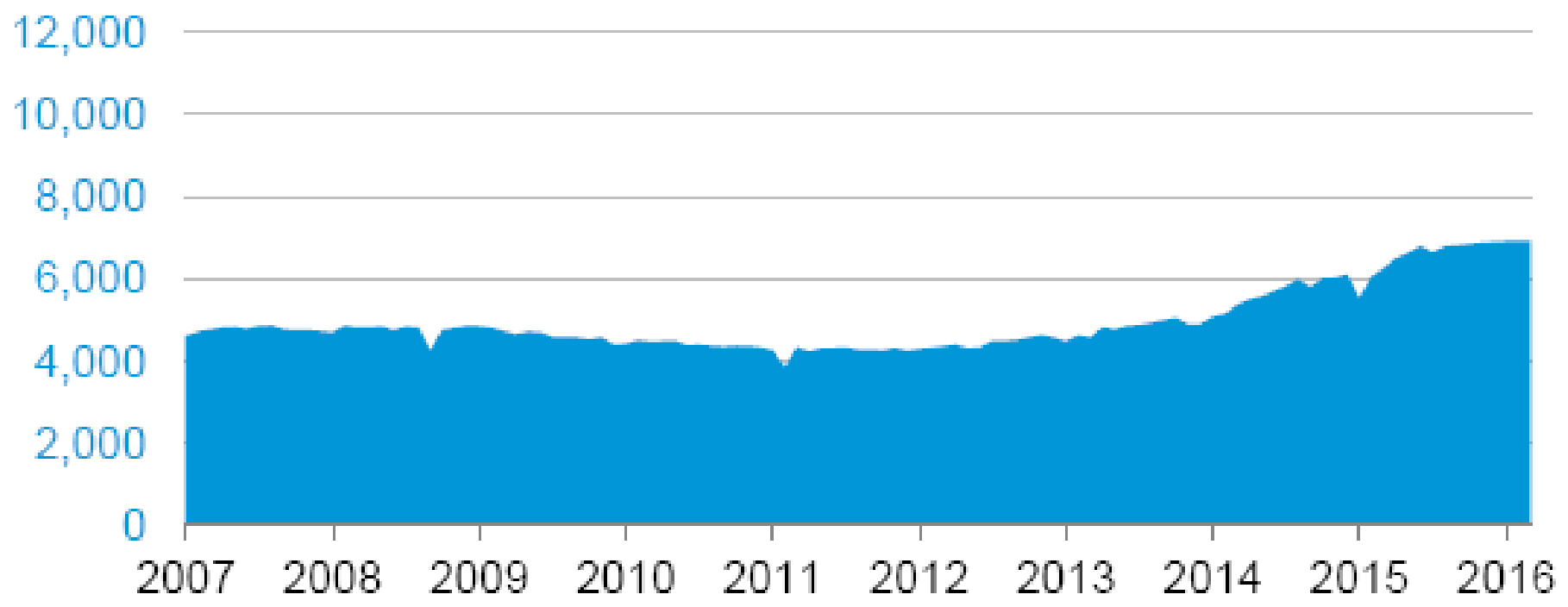
Source: Drilling Productivity Report, EIA U.S. Energy Information Administration, February 2016



# Permian Region Natural gas production

million cubic feet/day

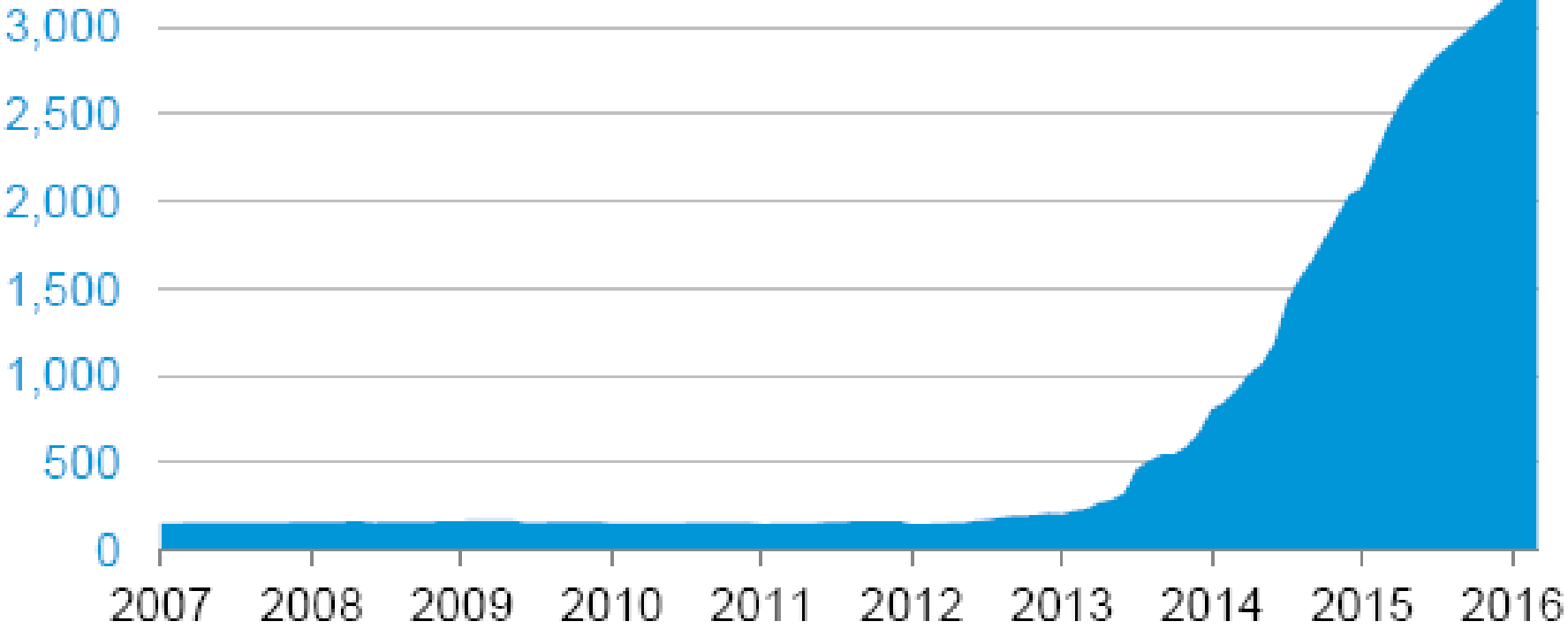
**Gas -6**  
million cubic feet/day  
month over month



Source: Drilling Productivity Report, EIA U.S. Energy Information Administration, February 2016

Utica Region  
**Natural gas production**  
million cubic feet/day

**Gas +32**   
million cubic feet/day  
month over month



Source: Drilling Productivity Report, EIA U.S. Energy Information Administration, February 2016

# Is There Hope?

- Despite headwinds production volumes were tenacious for 18 months
- Volumes are starting to rollover.
- They have held in there but now they are down nearly half a BCF per day in the top 7 producing basins.

Let's talk about demand...

# China Gambles

- From 2005 – June 2013, \$430.4 billion invested world wide “with energy as the focus”
- Those investments were predicated on the scarcity of energy.
- It was the wrong bet.



# China Sleeps?

That miscalculation may impact the hoped for growth in oil demand that the world expected China/Asia to realize over the next 5 years





# China

- Without significant demand in China, it is doubtful that world oil prices will strengthen in the near term (2015-2020)
- Combined with an aging population, China's GDP growth will slow
- That will obviously affect world/U.S. oil prices and natural gas liquid values



# Four Grandparents, Two Parents, One child. 4-2-1



Source: "The Age Curve: How to Profit from the Coming Demographic Storm," Kenneth W. Gronbach, October 2015

# China Abandons One-Child Policy

Will future historians consider the elimination of the “one-child-only” policy in China as the end of the Malthusian inspired “era of perceived scarcity”?



\*Medium variant of U.N. projections. Note: Projections don't account for the change in China's one-child policy  
 sources: U.S. Census Bureau's International Database (population); United Nations (working age); Chinese official media; WHO (male/female ratio) THE WALL STREET JOURNAL.



# Storing it Away

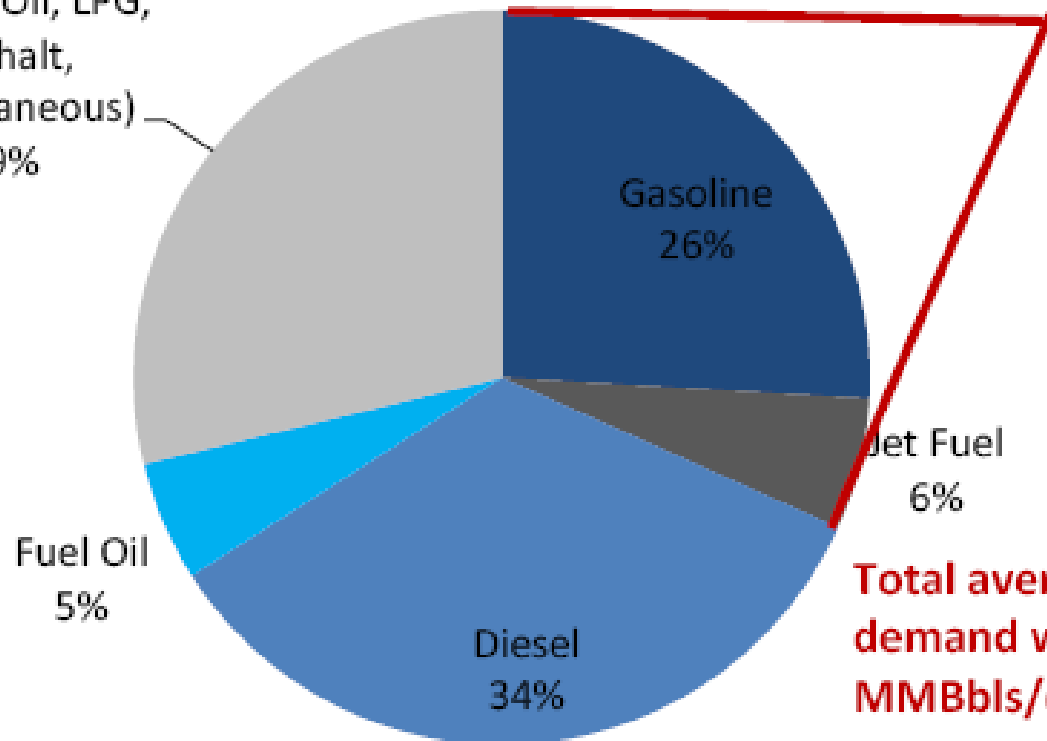
- For the first 11 months of 2015, we calculate that China purchased approximately 430 MBbls/d of oil that was either stored in commercial or SPR inventories
- Continued filling of their SPR could add approximately 200,000 barrels/day of additional demand
- Continued gasoline demand growth and SPR storage builds will hold up 2016 Chinese demand



Source: *Chinese Demand Outlook; Consumer Class Shifts Growth to Gasoline from Diesel*, Raymond James, February 29, 2016

## 2015 Chinese Oil Demand Breakdown

Other (Naphtha,  
Heating Oil, LPG,  
Asphalt,  
Miscellaneous)  
29%

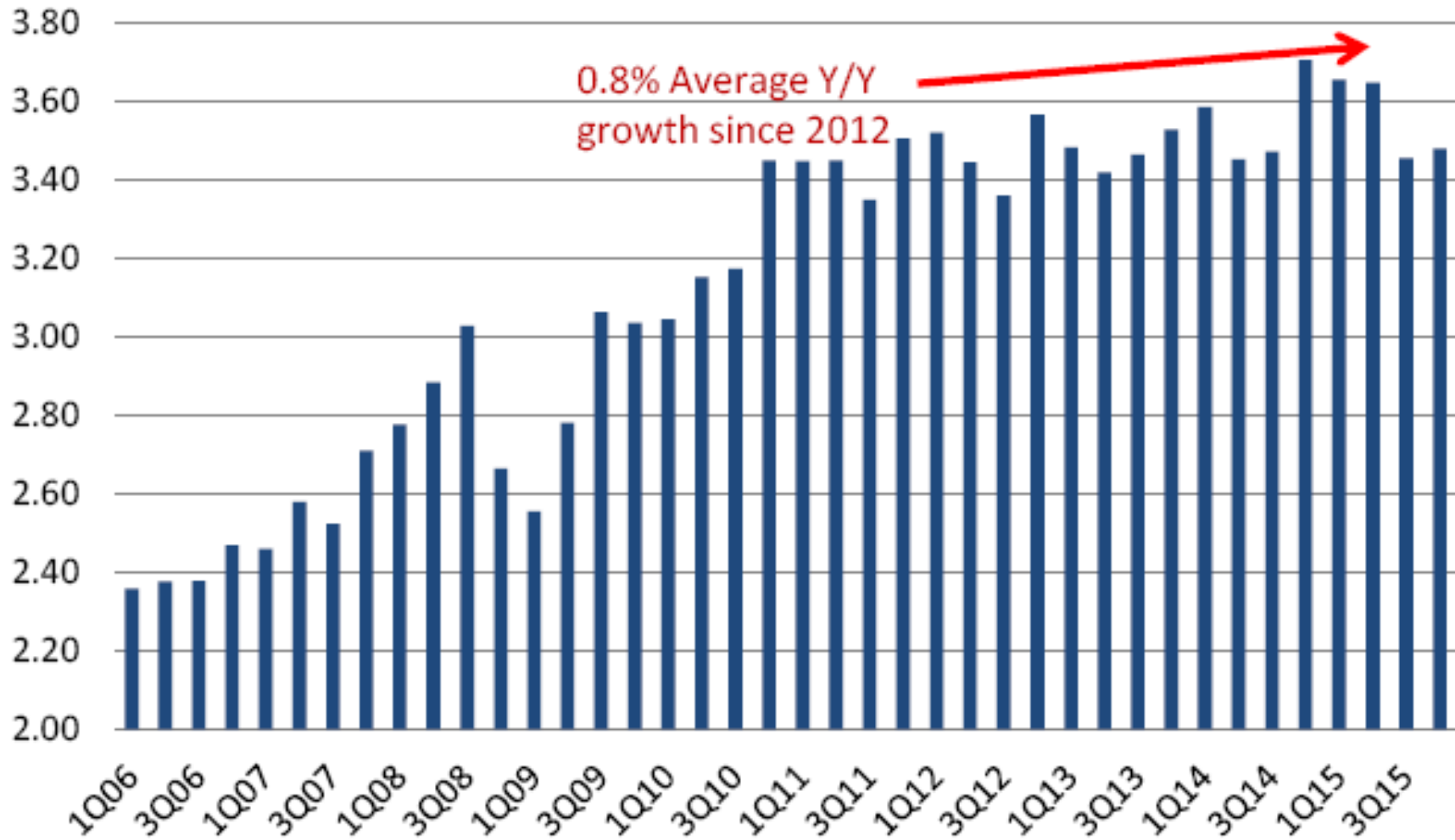


Source: Bloomberg, IEA, National Bureau of Statistics of China, Raymond James



Source: Chinese Demand Outlook; Consumer Class Shifts Growth to Gasoline from Diesel, Raymond James, February 29, 2016

## Quarterly Chinese Diesel Demand (MMBpd)

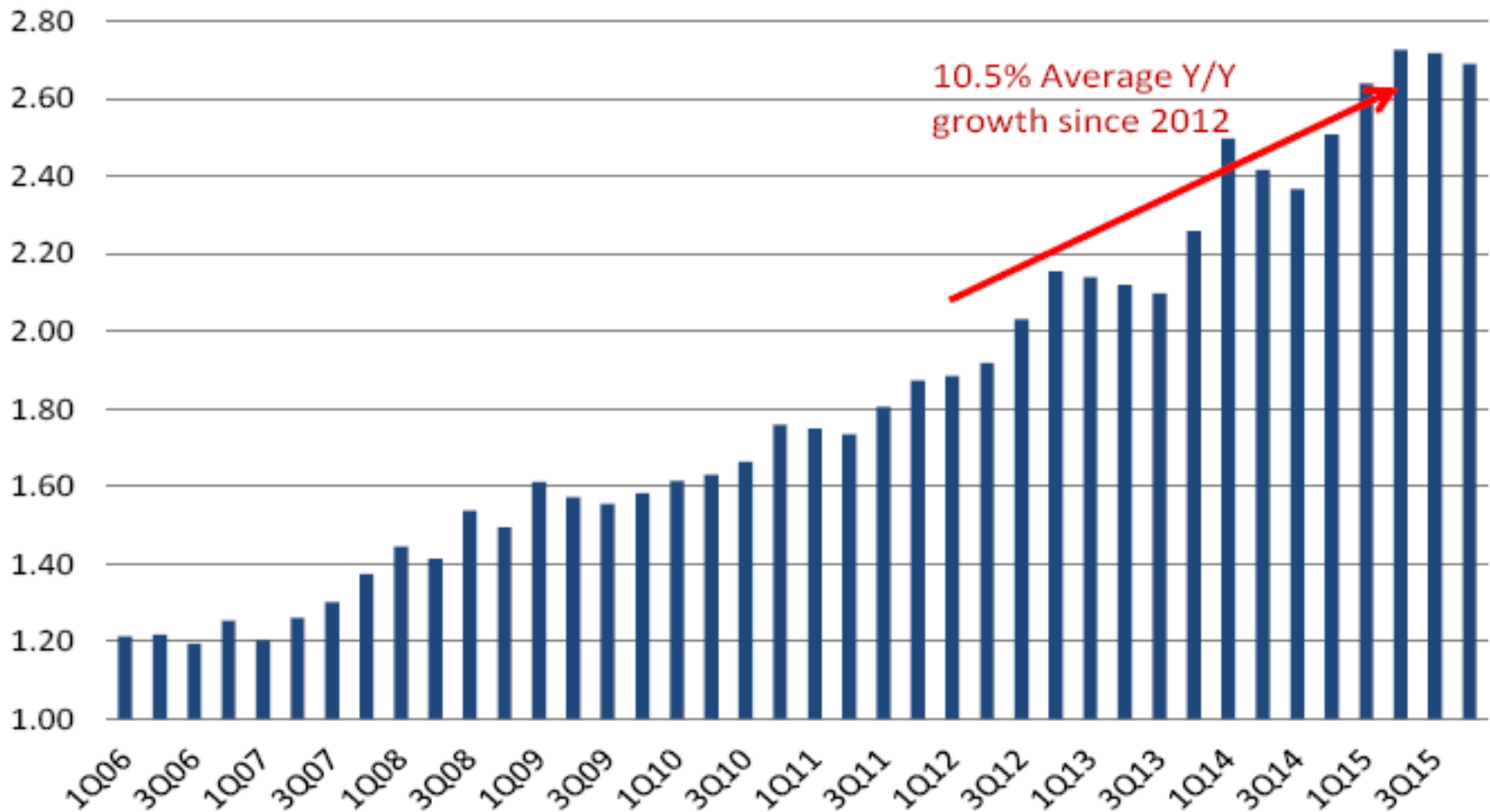


Source: Bloomberg, National Bureau of Statistics of China, Raymond James

Source: Chinese Demand Outlook; Consumer Class Shifts Growth to Gasoline from Diesel, Raymond James, February 29, 2016



## Quarterly Chinese Gasoline Demand (Million Bpd)



Source: Bloomberg, National Bureau of Statistics of China, Raymond James

Source: Chinese Demand Outlook; Consumer Class Shifts Growth to Gasoline from Diesel, Raymond James, February 29, 2016

# The Lesson for China, Free Markets?

“Consider for a moment that any one person can only know a fraction of what is going on around him. Much of what that person believes will be false rather than true...”

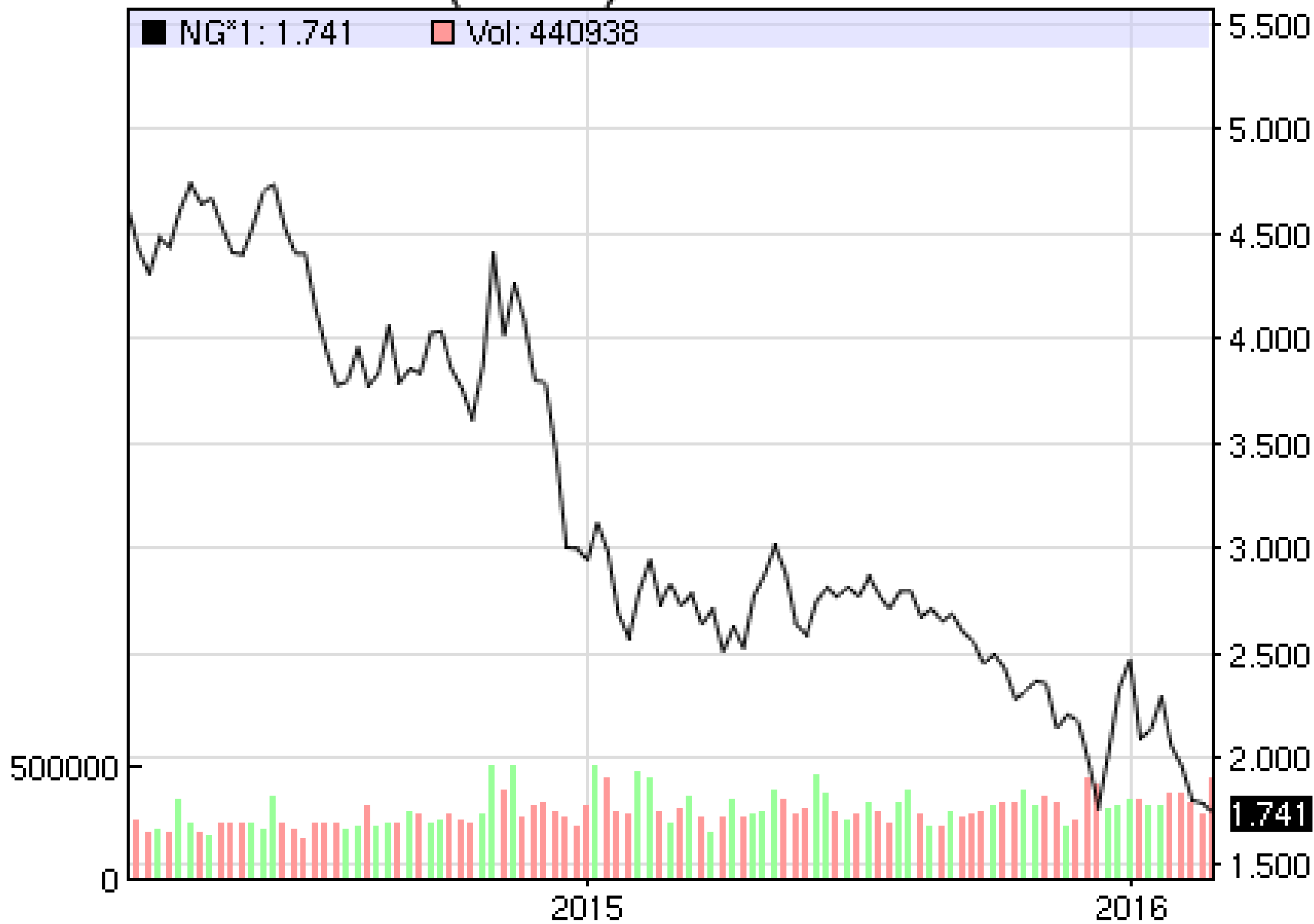
- F.A. Hayek in his “The Constitution of Liberty”

# Free Markets

“It is because every individual knows so little and, in particular, because we rarely know which of us knows best that we trust the independent and competitive efforts of many to induce the emergence of what we shall want when we see it.”

- F.A. Hayek in his “The Constitution of Liberty”

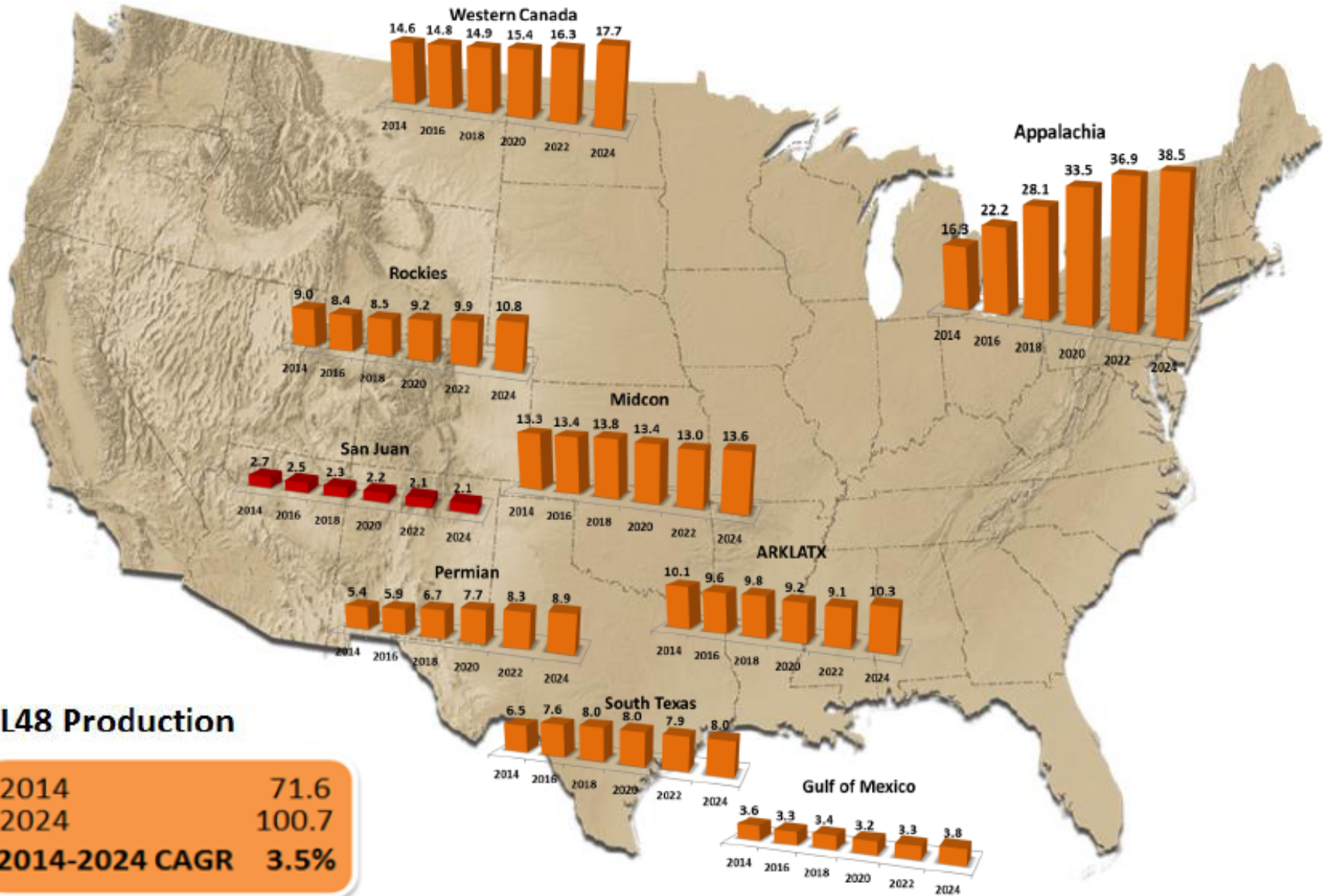
# NGJ14 - Natural Gas (NYMEX)



Source: Nasdaq.com, End of day Commodity Futures Price Quotes for Natural Gas (NYMEX)

Mercator Energy

# Supply



## L48 Production

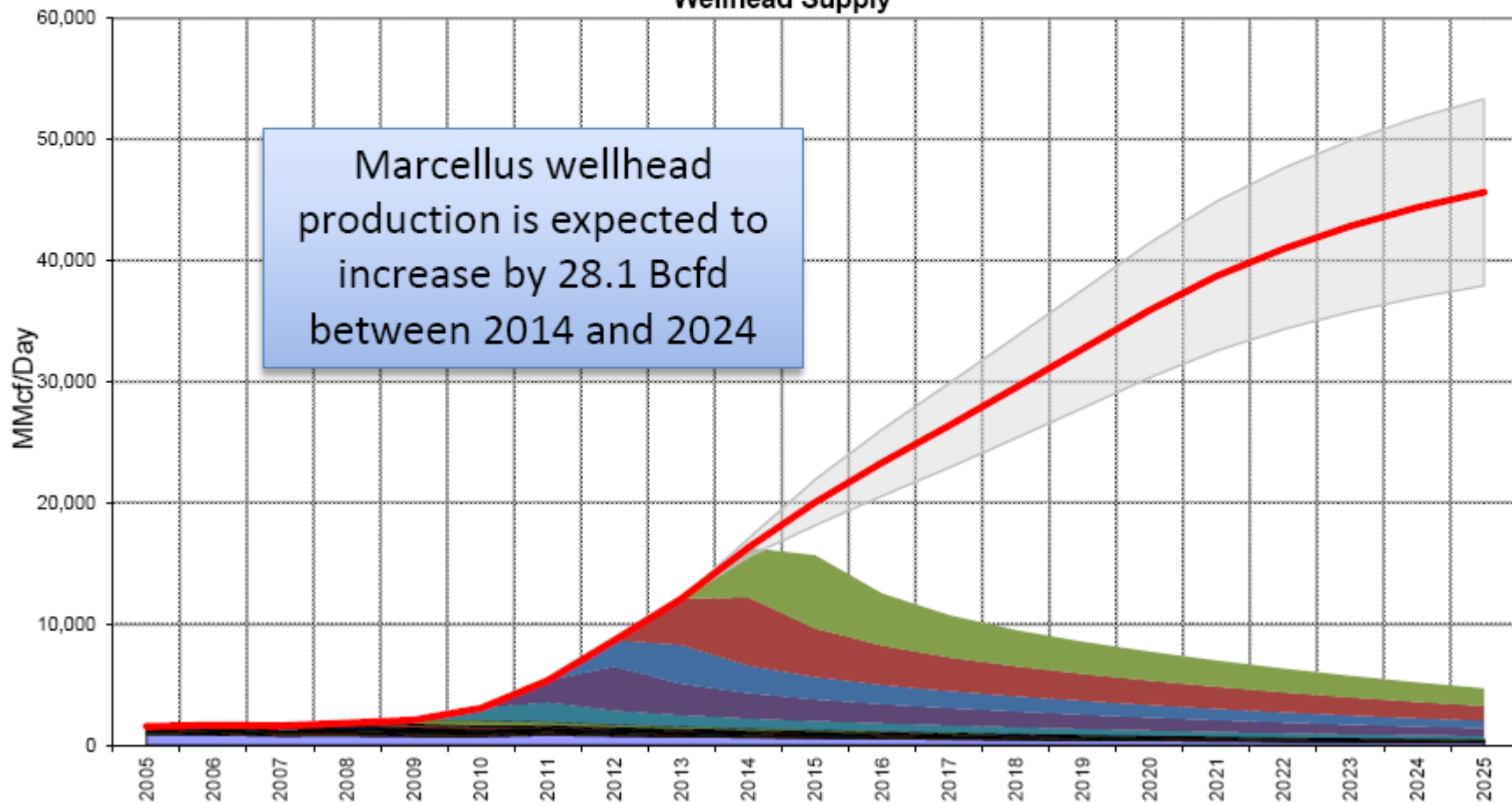
2014	71.6
2024	100.7
2014-2024 CAGR	3.5%

# The Big Four Issues to Watch

## 2. Marcellus and Utica Shale Production

# Marcellus

## Marcellus/Utica Area Wellhead Supply

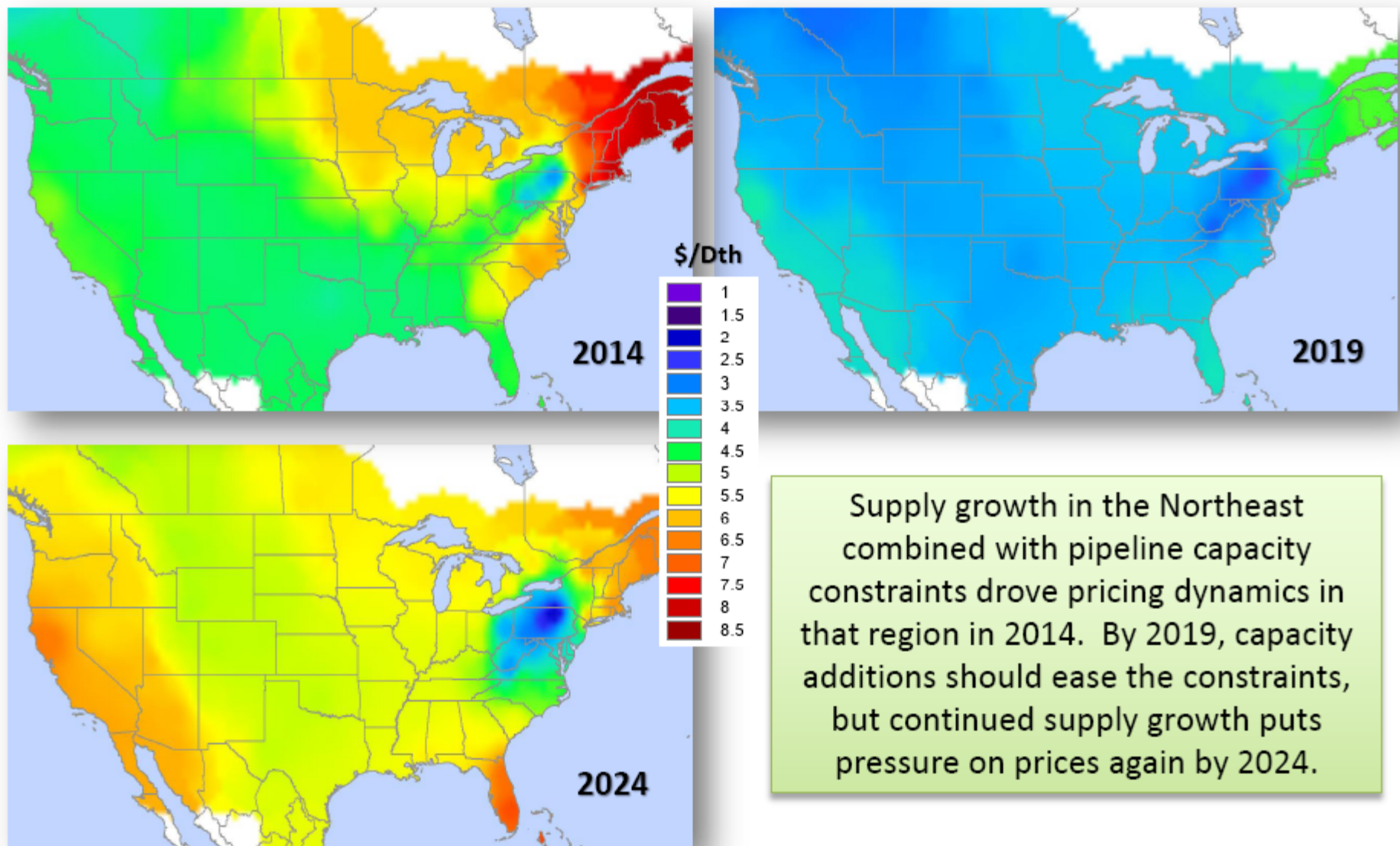


1990-2013: Wellhead total data from DI Desktop  
2014-2025: Kinder Morgan forecast



# North American Price Expectations

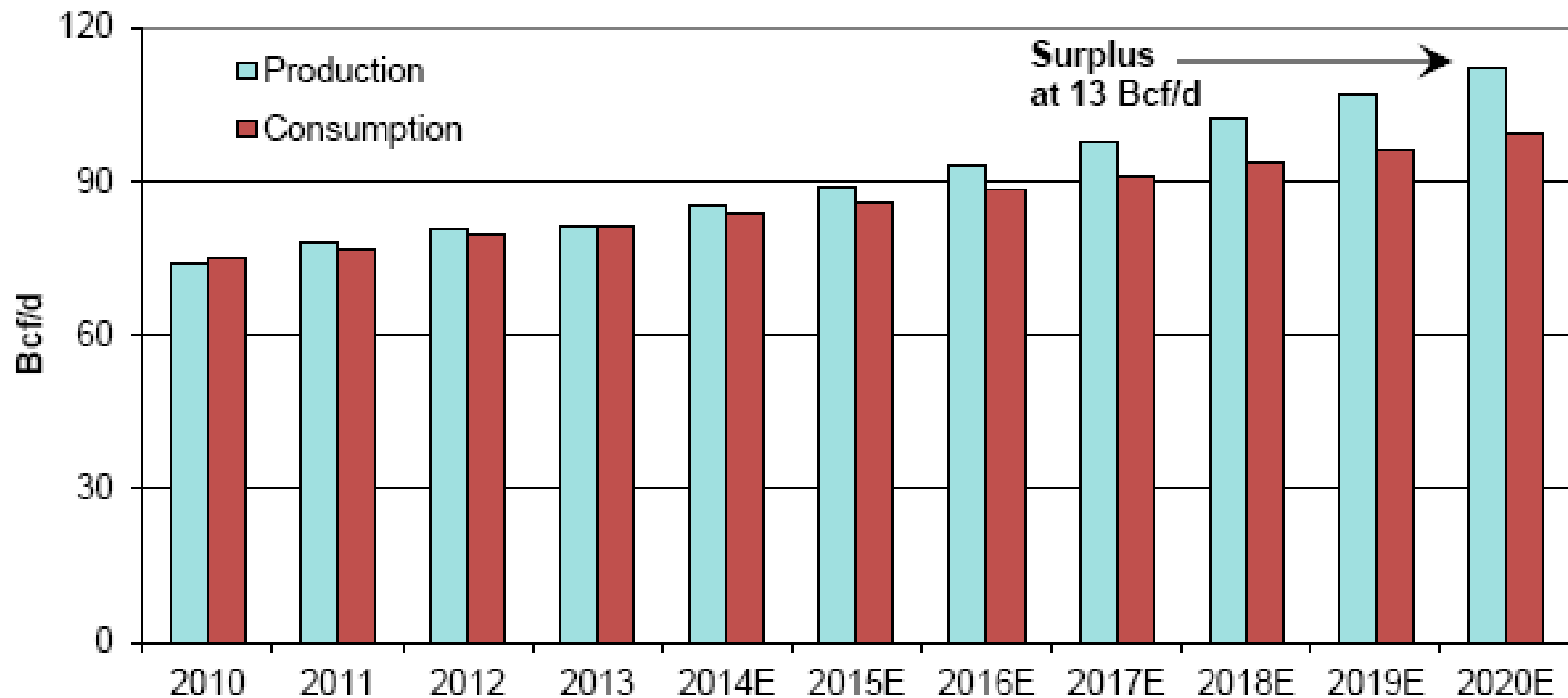
## Supply and Pipeline Constraint Impacts



Supply growth in the Northeast combined with pipeline capacity constraints drove pricing dynamics in that region in 2014. By 2019, capacity additions should ease the constraints, but continued supply growth puts pressure on prices again by 2024.

Source: ICF International, KM analysis

# U.S. and Canada: Natural Gas Production vs. Consumption



Source: BP Statistical Review, Raymond James research

# The Big Four Issues to Watch

## 3. Industrial Demand

## *Additional 20,950+ MMlbs/yr. Ethylene Capacity Planned or Under Construction*

<b>Company</b>	<b>Location</b>	<b>Date</b>	<b>MMlbs/yr.</b>
Westlake	Lake Charles	March 2016	250
LyondellBasell	Corpus Christi	June 2016	800
Aither	Charleston	January 2017	600
ChevronPhillips	Cedar Bayou	January 2017	3,300
Dow	Freeport	January 2017	3,300
ExxonMobil	Baytown	January 2017	3,300
OxyChem/Mexichem	Ingleside	January 2017	1,200
Sasol	Lake Charles	January 2017	3,300
LyondellBasell	Channelview	January 2017	550
Indorama	Lake Charles	December 2017	850
Formosa	Point Comfort	January 2018	3,500

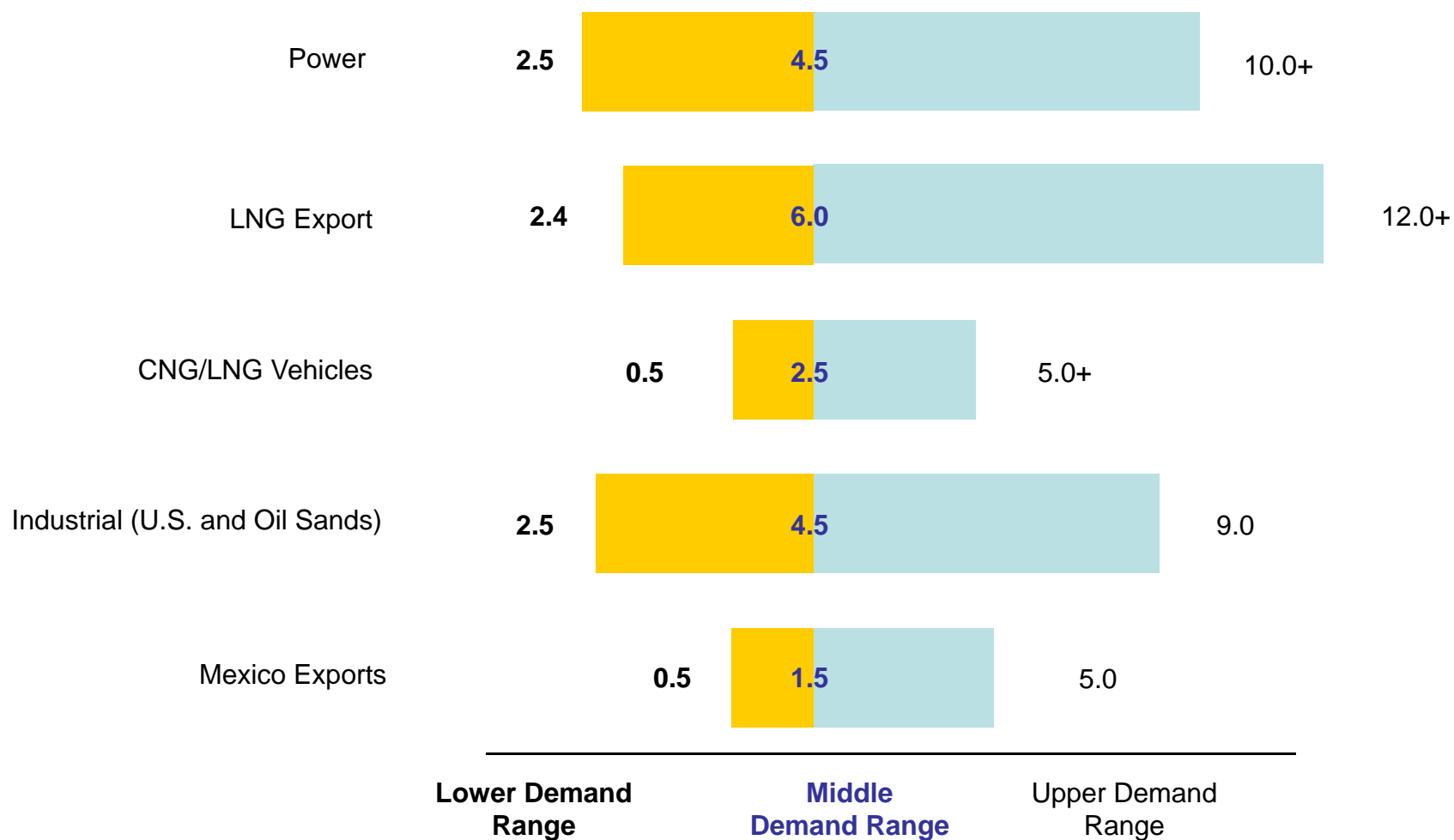
Source: Ponderosa Energy

# The Big Four Issues to Watch

## 4. U.S. LNG Exports

# North American Natural Gas Demand Ranges by Selected Sector

Significant demand growth is possible in the LNG, transportation/HHP and power sectors through 2020 in Bcf per day.



# First LNG Cargo out of Louisiana





# US LNG Export Projects Under Construction

US LNG Projects Under Construction					
Projects	Uncontracted Capacity (bcf/d)	Contracted Capacity (bcf/d)	Nameplate Capacity (bcf/d)	Percent Contracted	Online Date
Sabine Pass T1-4	0.3	2.1	2.4	89%	Feb-16 – Sept 17
Cameron LNG T1-3	0.0	1.7	1.7	100%	Early/Mid/Late -18
Freeport LNG T1-3	0.1	1.7	1.8	97%	Sept-18 – Aug-19
Cove Point T1	0.1	0.7	0.8	92%	Dec-17
Corpus Christi T1-2	0.2	1.0	1.2	86%	Jun-19, Apr-20
Sabine Pass T5	0.1	0.5	0.6	83%	19-Jan
Total	0.7	7.8	8.4	92%	NA

# US LNG Export Projects Under Construction

- Nameplate US export capacity to total 8.4 bcf/d by YE 2020 with just over 8bcf/d exportable 2020.
- >90% or 7.8bcf/d of the capacity is contracted.
  - What does this mean? The off-takers pay ~\$3/MMBtu for any contracted LNG volumes they defer/cancel. Buyers could then buy LNG on the spot market for ~\$7.00/MMBtu or all in cost of ~\$10.00/MMBtu (including the cancellation fee).
  - All in US LNG landed in Asia likely runs \$7.50-\$9.50 depending on US gas price and transports costs.
- There are 5 major US LNG export projects under construction (assumes Sabine Pass is one project).
- There are another >4bcf/d of LNG export projects that are ~fully contracted, which we would consider close to FID (e.g. Lake Charles, Golden Pass).

# LNG Export Economics...and its effects

- US LNG to Asia: \$2.00 Henry Hub + \$3 liquefaction charge + \$2.25 shipping = \$7.25/MMBtu
- US LNG to Europe: \$2.00 + \$3 liquefaction charge + \$1 shipping = \$6.00/MMBtu
- The liquefaction charge is how Cheniere earns a return on capital for the contracted portions of its facilities, but the actual liquefaction cost is much cheaper than \$3/MMBtu. We estimate the actual cost to liquefy the gas is ~\$0.50.
- Thus, at today's pricing and transport costs, a facility owner could ship US gas to Europe for a variable cost of ~\$4/MMBtu, sell it for ~\$6/MMBtu and net \$2/MMBtu in gross profit.

# World LNG Estimated October 2014 Landed Prices



# World LNG Estimated January 2016 Landed Prices (\$U.S./MMBtu) - update



Source: Waterborne Energy, Inc. Data in \$US/MMBtu, updated February 2016

Note: Includes information and Data supplied by IHS Global Inc. and its affiliates ("IHS")



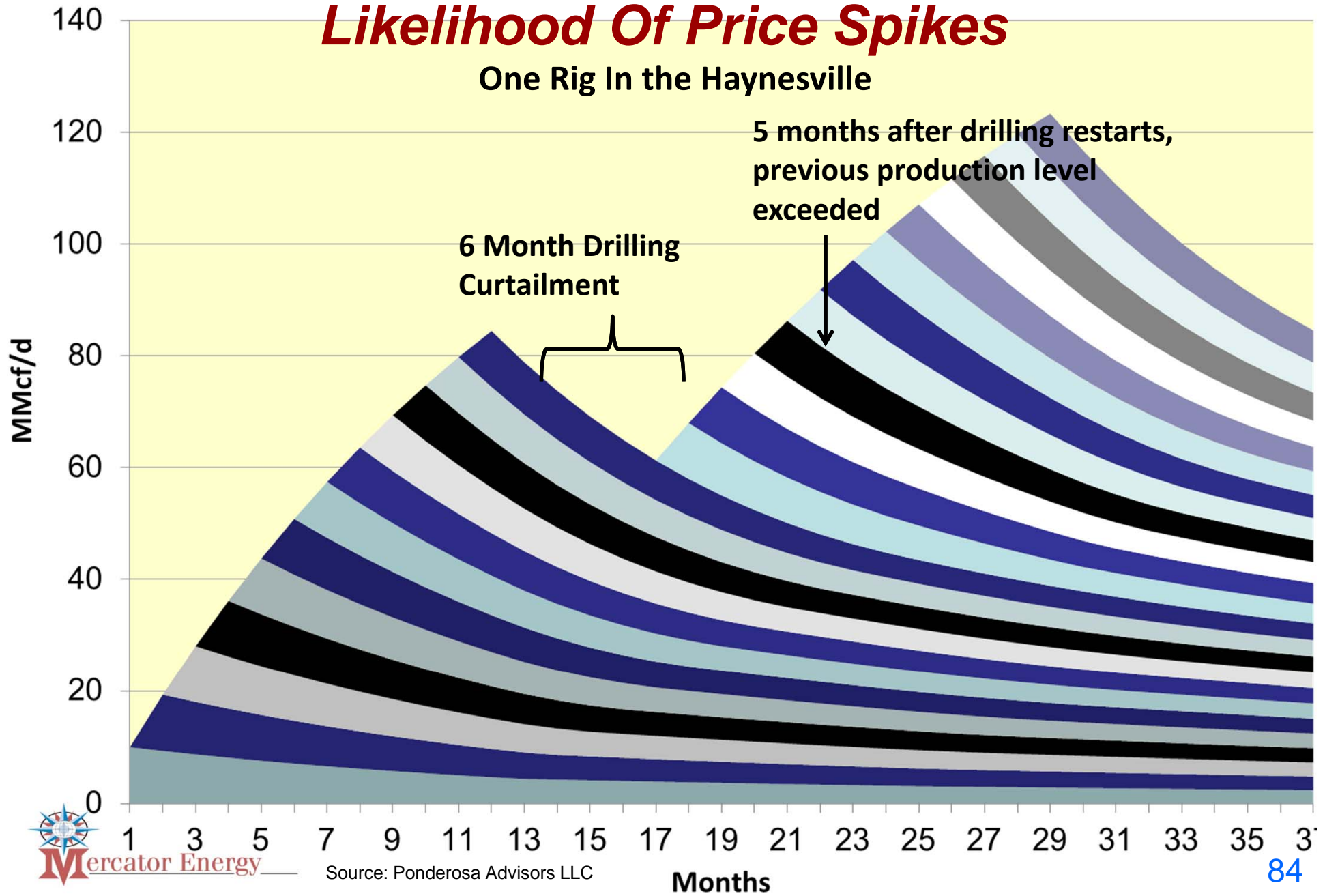
# It's a buyers market

“The 7-8 BCF of U.S. LNG exports that is expected by 2020 is equal to 20% of the total world LNG import market of 32.1 BCF.”



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

## One Rig In the Haynesville





# Impact on Colorado

Producer	October 1, 2014	February 26, 2016	Change
Whiting Petroleum Corporation	\$73.85	\$4.01	\$69.84 ↓
SM Energy Company	\$75.72	\$9.04	\$66.68 ↓
Pioneer Natural Resources Co.	\$189.82	\$123.37	\$66.45 ↓
Anadarko Petroleum Corporation	\$99.26	\$38.02	\$61.24 ↓
Noble Energy	\$66.79	\$29.50	\$37.29 ↓
Antero Resources	\$54.03	\$22.85	\$31.18 ↓
EOG Resources, Inc.	\$96.85	\$67.50	\$29.35 ↓
Linn Energy	\$29.58	\$0.44	\$29.14 ↓
WPX Energy, Inc.	\$23.32	\$4.26	\$19.06 ↓
Encana Corporation	\$21.38	\$4.29	\$17.09 ↓

# Impact on Colorado

MLP	October 1, 2014	February 26, 2016	Change
Energy Transfer Partners LP	\$64.53	\$26.67	\$37.86 ↓
DCP Midstream Partners LP	\$53.91	\$19.41	\$34.50 ↓
Kinder Morgan, Inc.	\$38.20	\$17.76	\$20.44 ↓
Enterprise Products Partners LP	\$39.62	\$23.37	\$16.25 ↓
Tallgrass Energy Partners, LP	\$43.68	\$33.46	\$10.22 ↓

# Impact on Colorado

Company	Numbers of Jobs, Locations	Date of Announcement
WPX Energy Inc.	142, Denver	March 2, 2015
Noble Energy Inc.	80 in Denver, 20 in Greeley	April 7, 2015
Linn Energy	52, Denver	April 15, 2015
Pioneer Natural Resources	102 in Trinidad, 75 in Denver	May 5, 2015
Bayou Well Services	250, Weld County	May 15, 2015
Newfield Exploration Co.	91, Denver	May 28, 2015
Baker Hughes Inc.	124, Adams County	August 12, 2015
Baker Hughes Inc.	17, Adams County	September 30, 2015
Bonanza Creek Energy	“15 percent” of its staff	“late September” 2015
Fidelity Exploration & Production Co.	About 75 in Denver	November 4, 2015
Noble Energy Inc.	45 in Denver, 25 in Greeley	November 11, 2015
Bill Barrett Corp.	“Less than 20 percent” of staff	February 24, 2016

The solution to low oil prices is low oil prices.

According to Raymond James, 2016 WTI will average \$50, rising to \$75 in 2017, settling at \$70.

# Conclusions

- Energy companies face sustained pain – “The next few months may be as bad as they were in the 1980’s.” – Tom Petrie
- World oil prices (Brent) will be range-bound for at least 2 more years in the \$35-\$45 per barrel.
- China (Asian) demand will not rebound – expect slow GDP growth in Asia
- Watch for dry natural gas production in the U.S. to decline in the 4<sup>th</sup> quarter 2016. A new ceiling target of \$3.50 per MMBtu could become the new “norm” for the next 3 years.

# Citations for Report

All of the information utilized for this report is a compilation of information pulled from the following data sources:

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Kinder Morgan

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