

# Measuring the Impact of the Oil Price Collapse on the U.S. Shale Revolution

A Global to Regional Analysis

**Presentation to:**

Vital for Colorado Board of Directors  
Denver, CO

By:

John Harpole

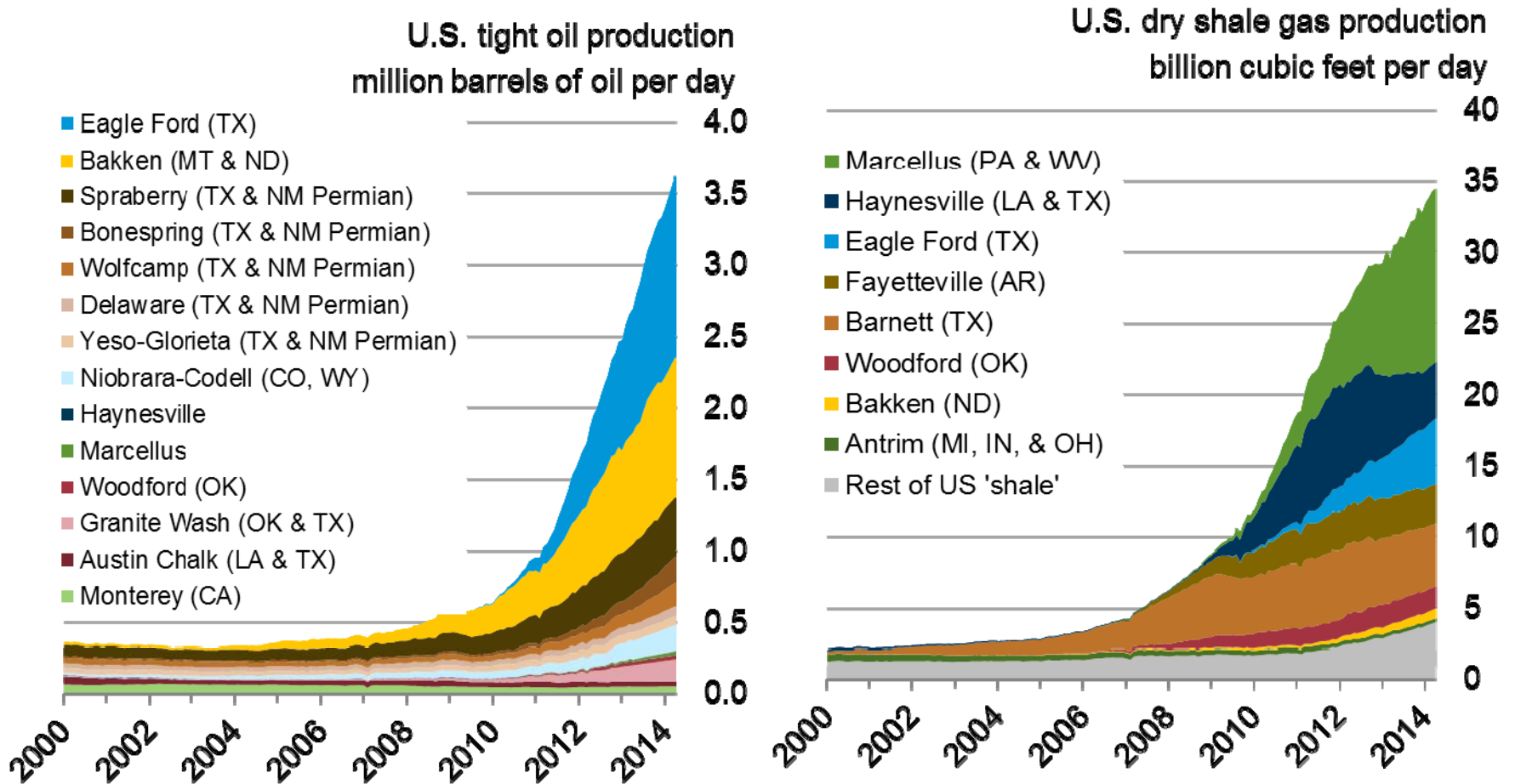


February 18, 2015

# U.S. Crude Oil Imports



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



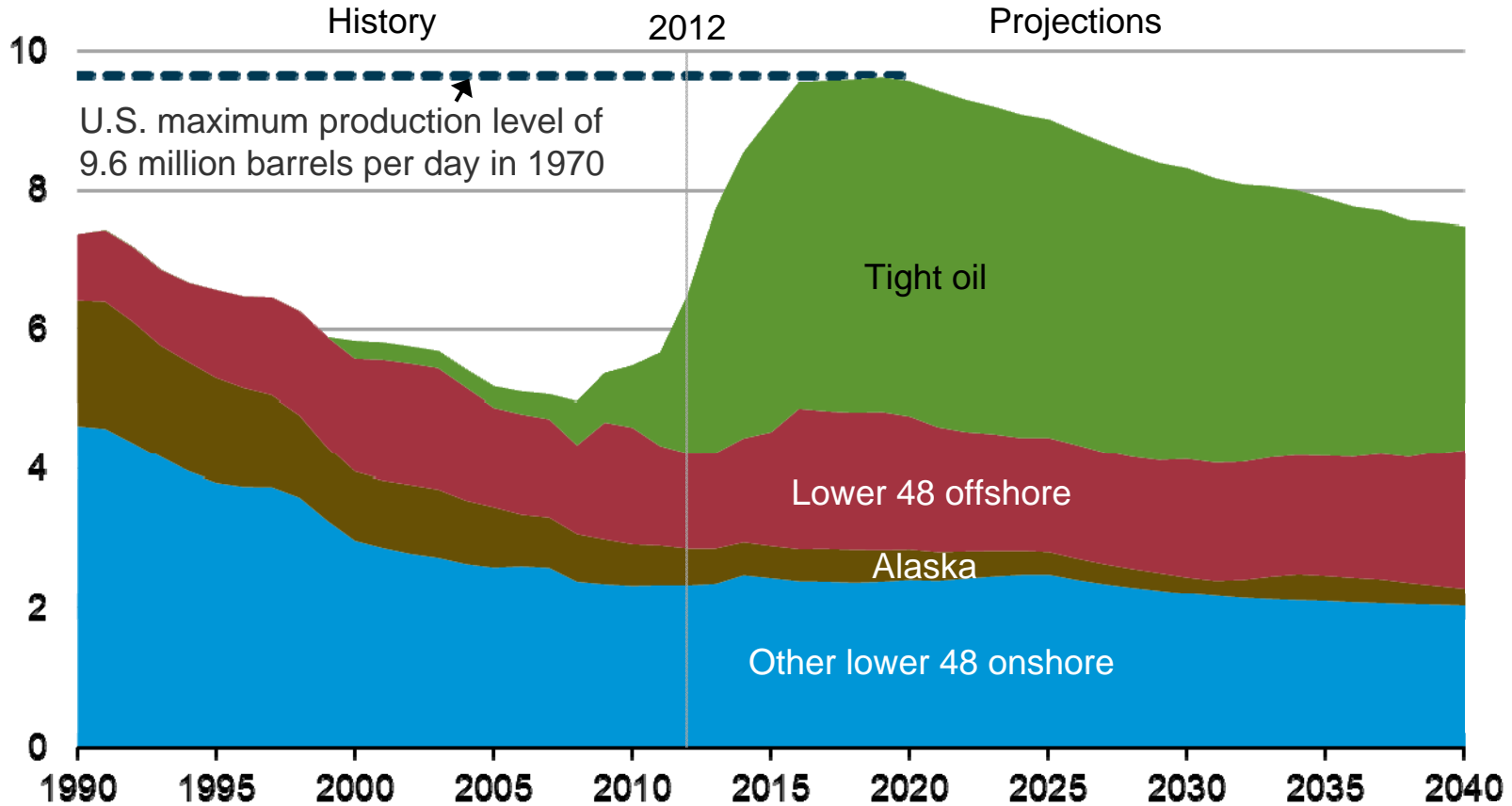
Sources: EIA derived from state administrative data collected by DrillingInfo Inc. Data are through April 2014 and represent EIA's official tight oil & shale gas estimates, but are not survey data. State abbreviations indicate primary state(s).



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

# 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

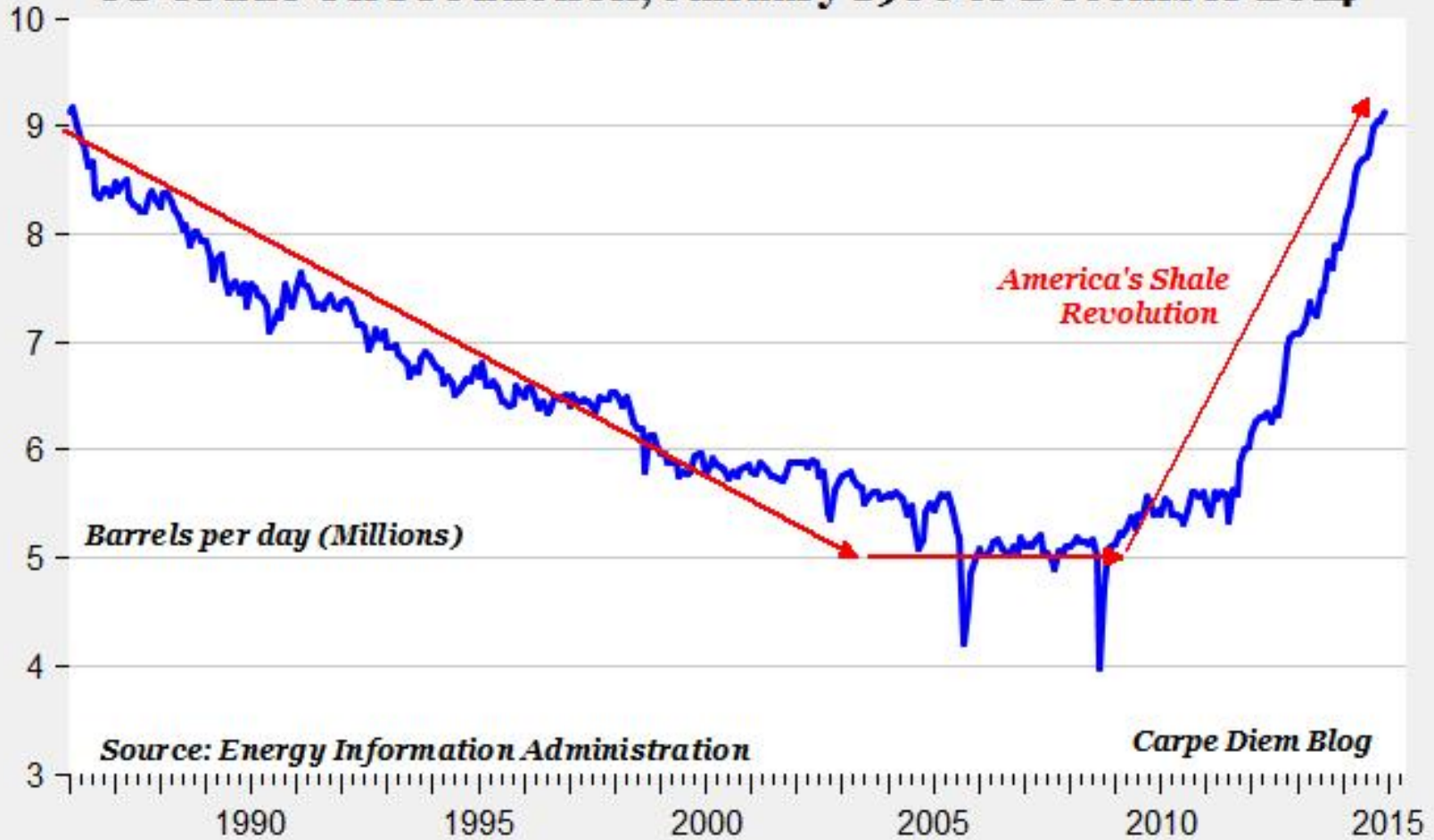


Source: EIA, Annual Energy Outlook 2014 Reference case

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

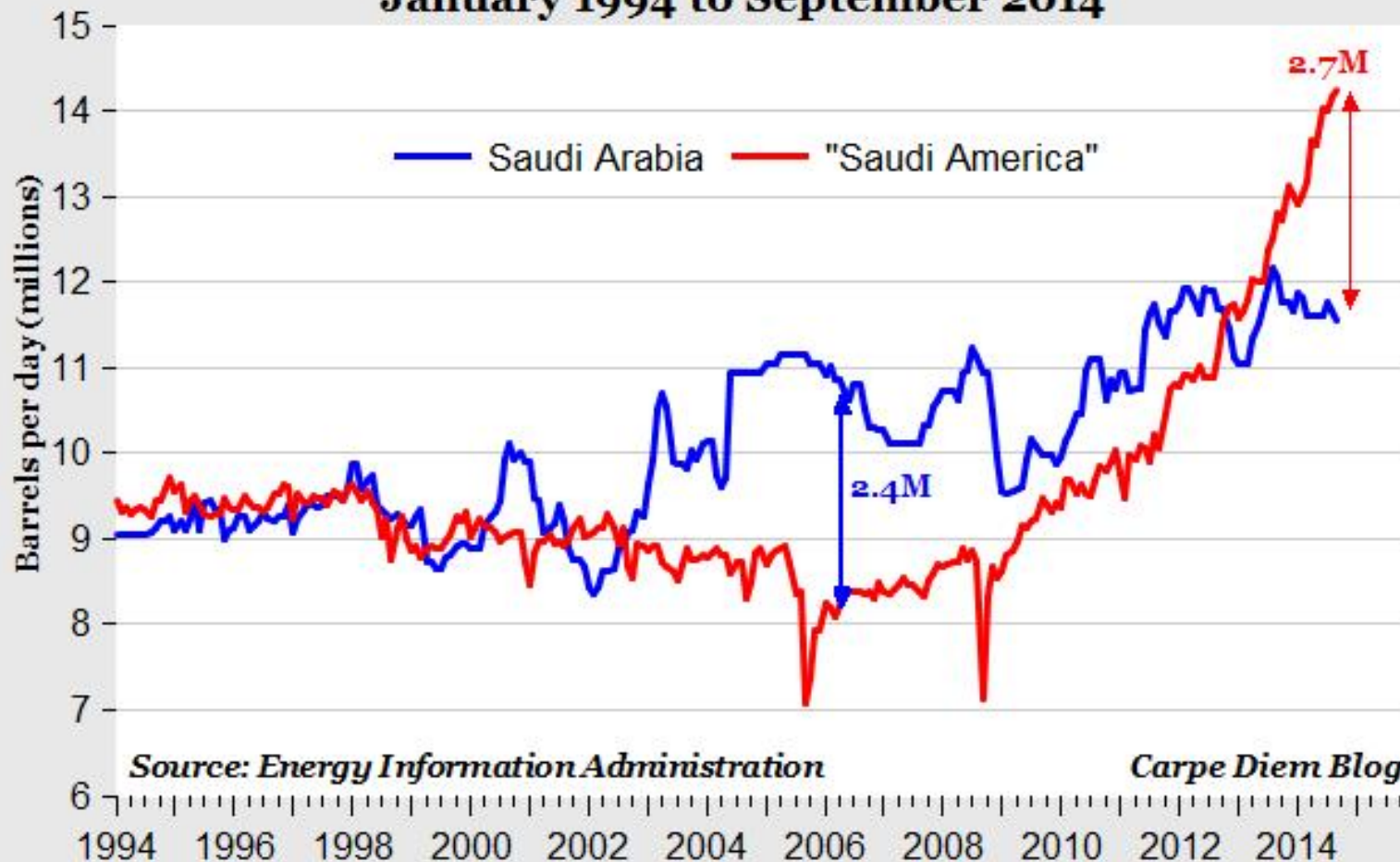


# US Crude Oil Production, January 1986 to December 2014



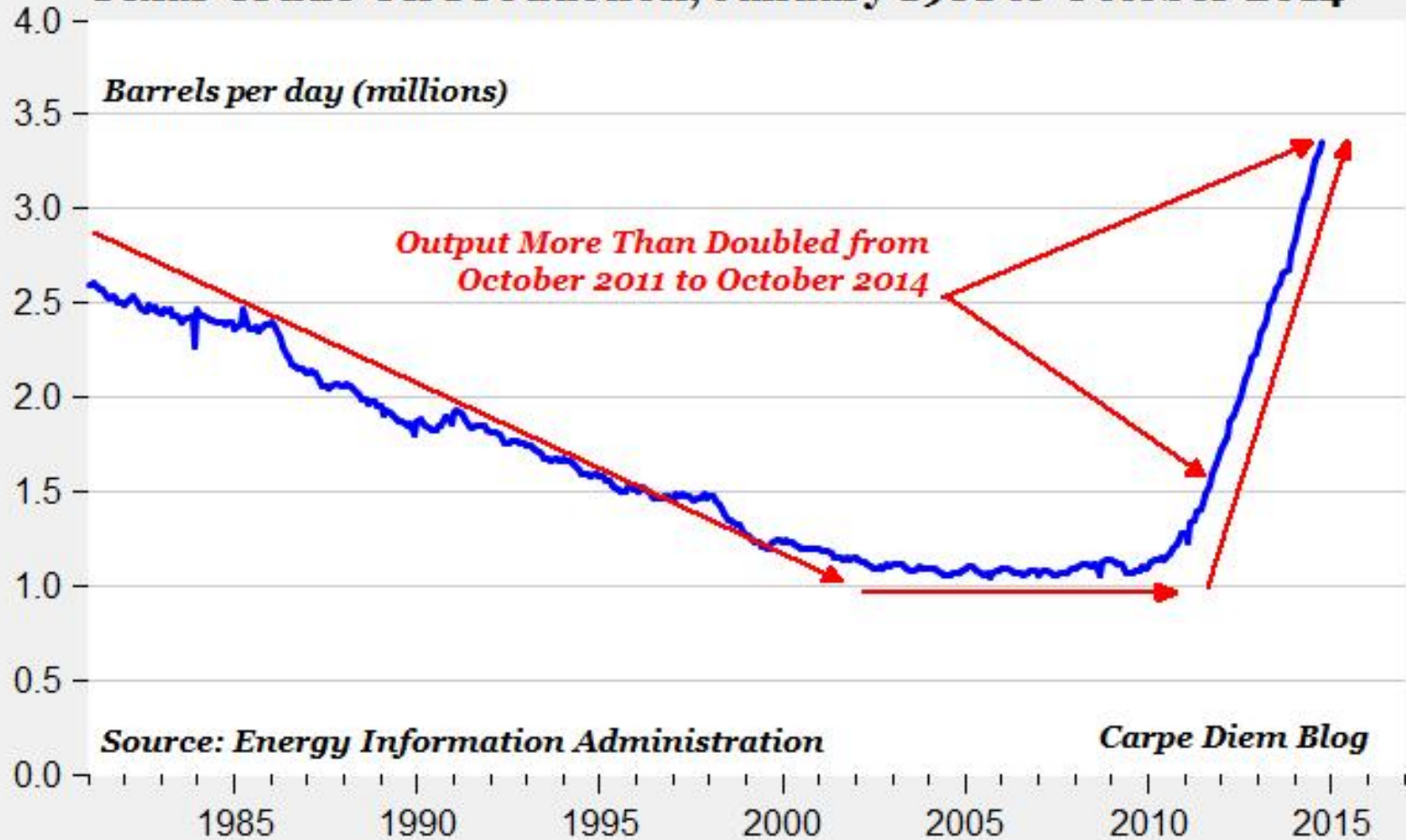
Source: My top ten energy charts of the year for 2014, Mark J. Perry, American Enterprise Institute, January 5, 2015

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

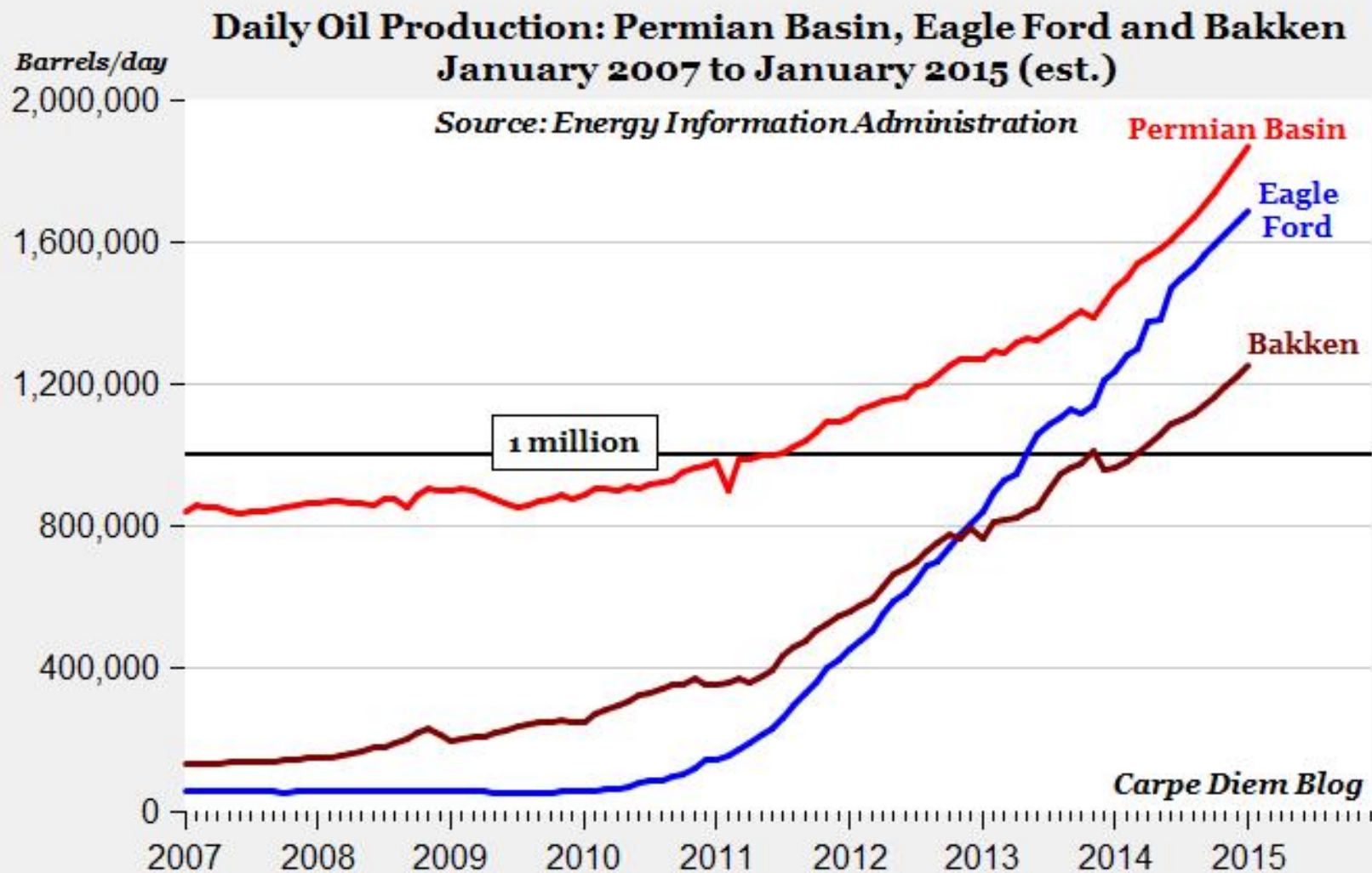


Source: My top ten energy charts of the year for 2014, Mark J. Perry, American Enterprise Institute, January 5, 2015

# Texas Crude Oil Production, January 1981 to October 2014



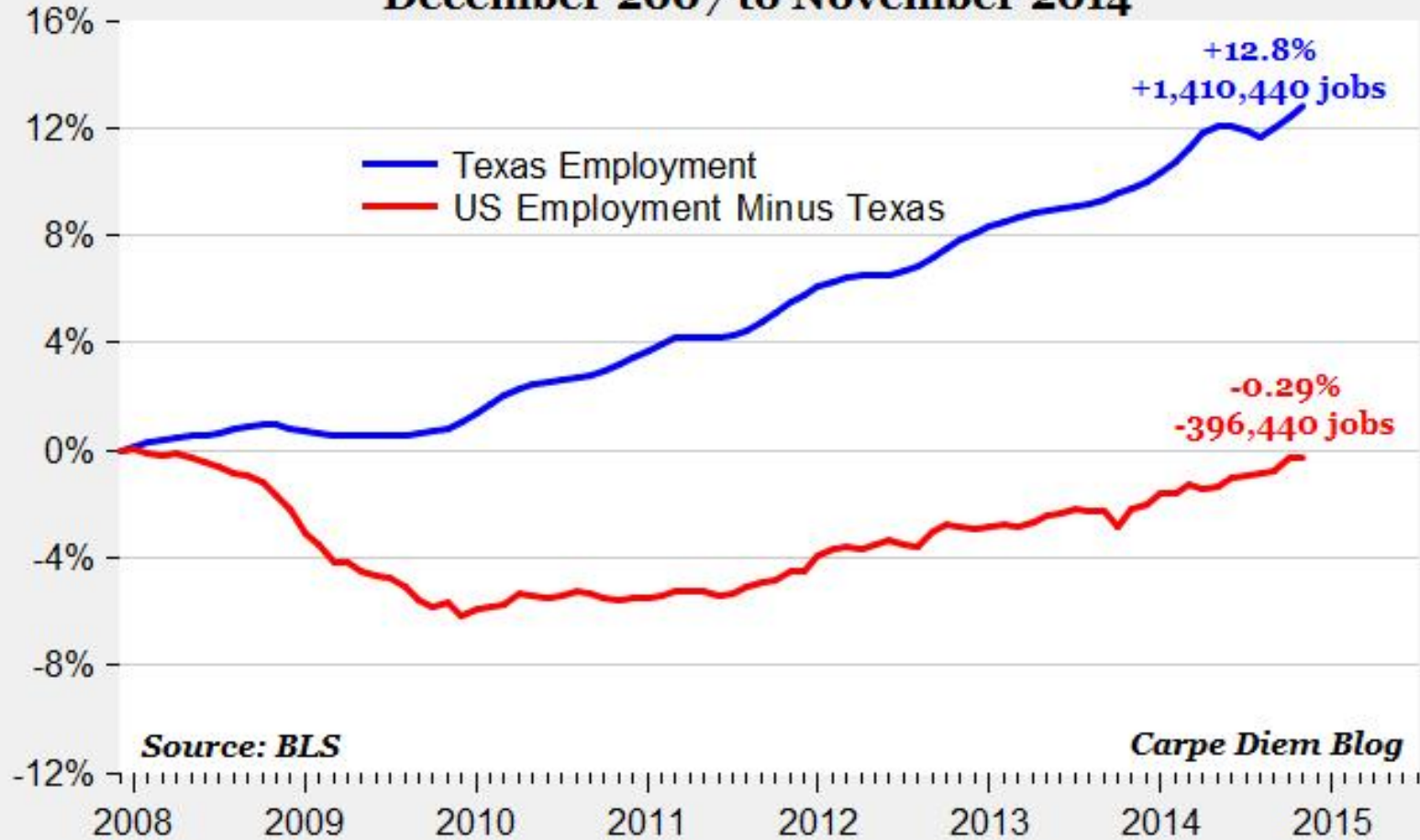
Source: My top ten energy charts of the year for 2014, Mark J. Perry, American Enterprise Institute, January 5, 2015



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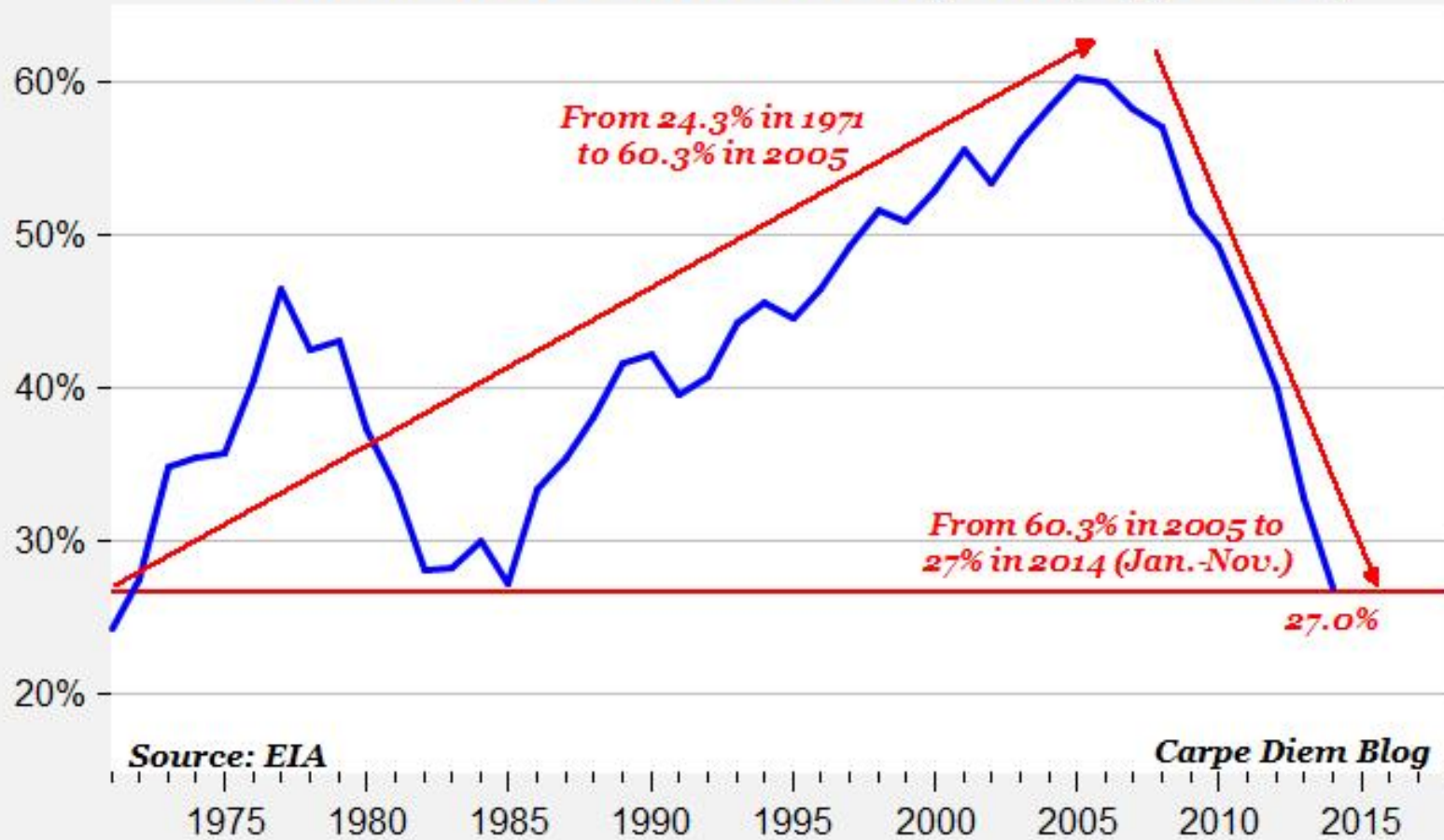


## Percent Change in Employment: Texas vs. US Minus Texas December 2007 to November 2014



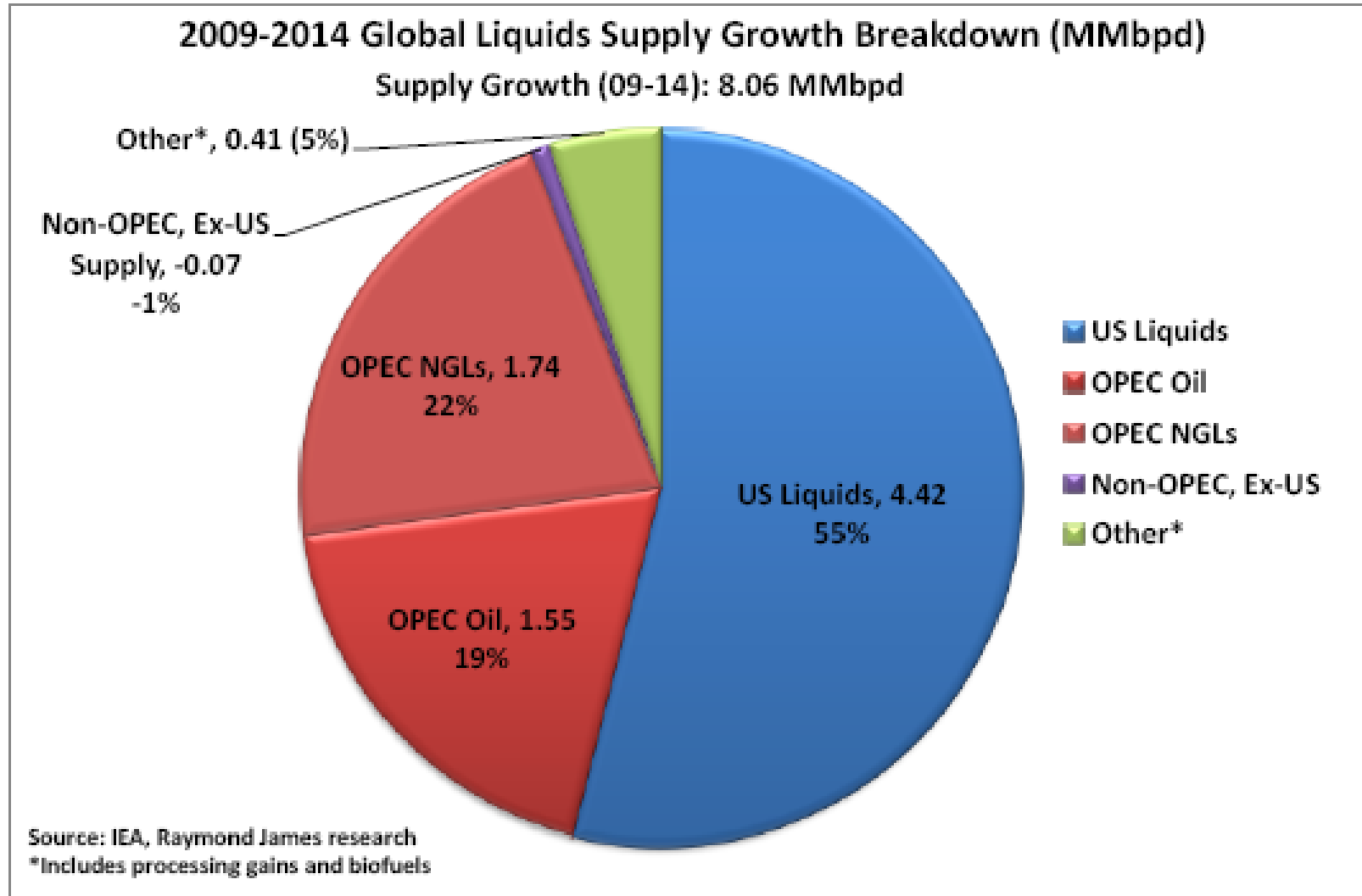
Source: My top ten energy charts of the year for 2014, Mark J. Perry, American Enterprise Institute, January 5, 2015

## 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

# The House of Saud's Motivation



# The Production War is on!

- 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.



Source:

**M**ercator Energy



# The U.S. Oil Story

- Saudi Arabia's shot across the bow
- Are we victims of our own success?

# OPEC's Strategy?

“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

# Prince Alwaleed bin Talal

Saudi Prince: \$100-a-barrel oil 'never' again



Saudi Crown Prince  
Abdullah bin Abdul Aziz

Saudi Foreign Minister  
Prince Saud al-Faisal (C)

Saudi billionaire Prince  
Alwaleed bin Talal



Source: *The Fabulous Life of Prince Alwaleed Bin Talal Alsaud*, Forbes and Maria Bartiromo for USA Today, January 11, 2015

# Oil at \$65 Until Mid-2015: Kuwait Official

“The reason, according to Iranian Oil Minister, Bijan Namdar Zanganeh, was to keep prices low enough and long enough to threaten the U.S. shale oil industry and restore OPEC’s market share in America. Shale extraction requires expensive methods such as fracking and horizontal drilling, and many observers say it isn’t profitable if the price of oil drops below \$65 per barrel.”















Source: Real Money, The Street Ratings, By: Oilprice.com, December 11, 2014

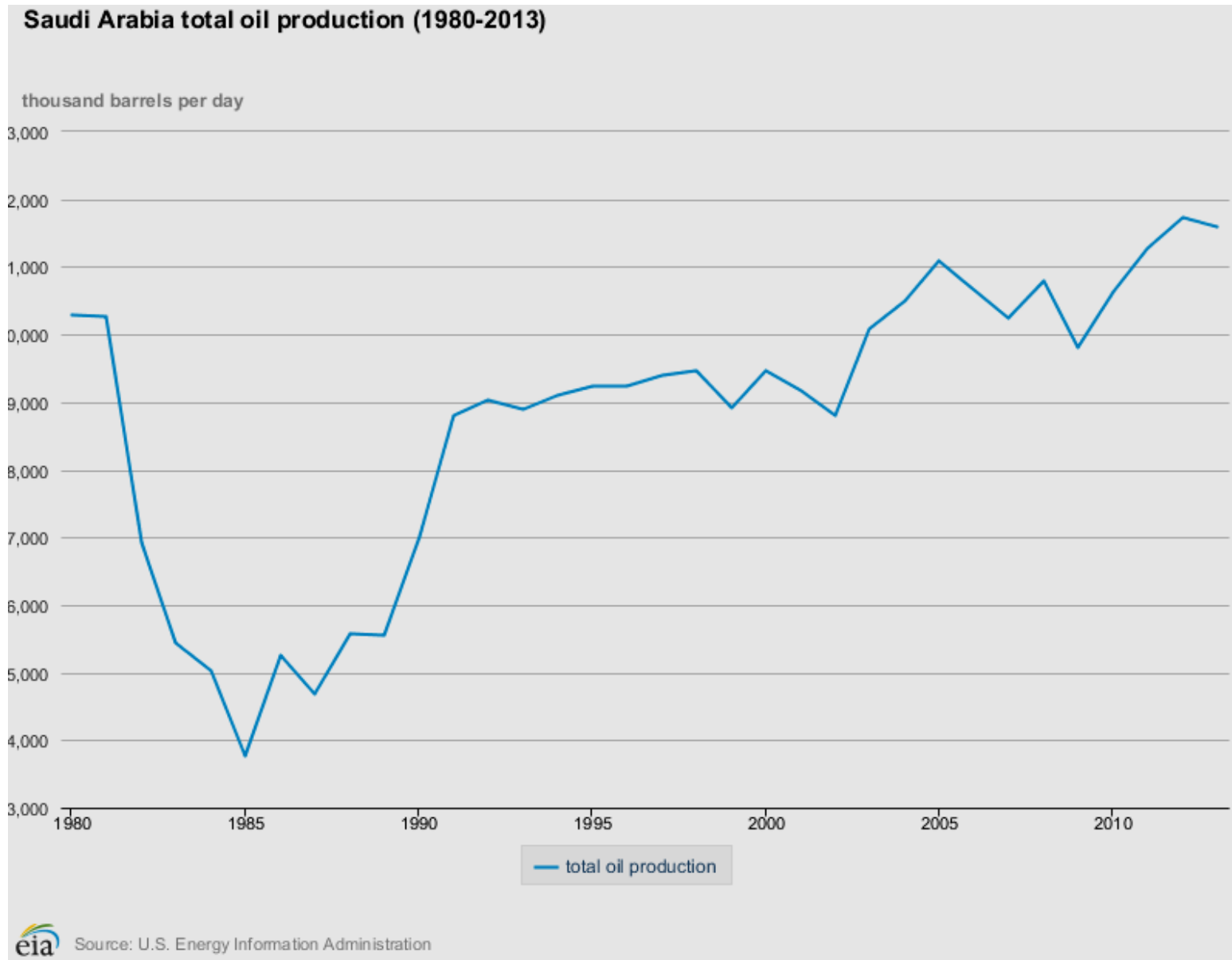
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# OPEC Member States

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





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



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



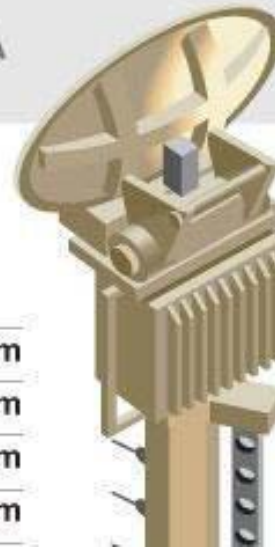
# Days Before Vienna



**SPEXER 2000 radar**  
*Also known as TRGS Sec*

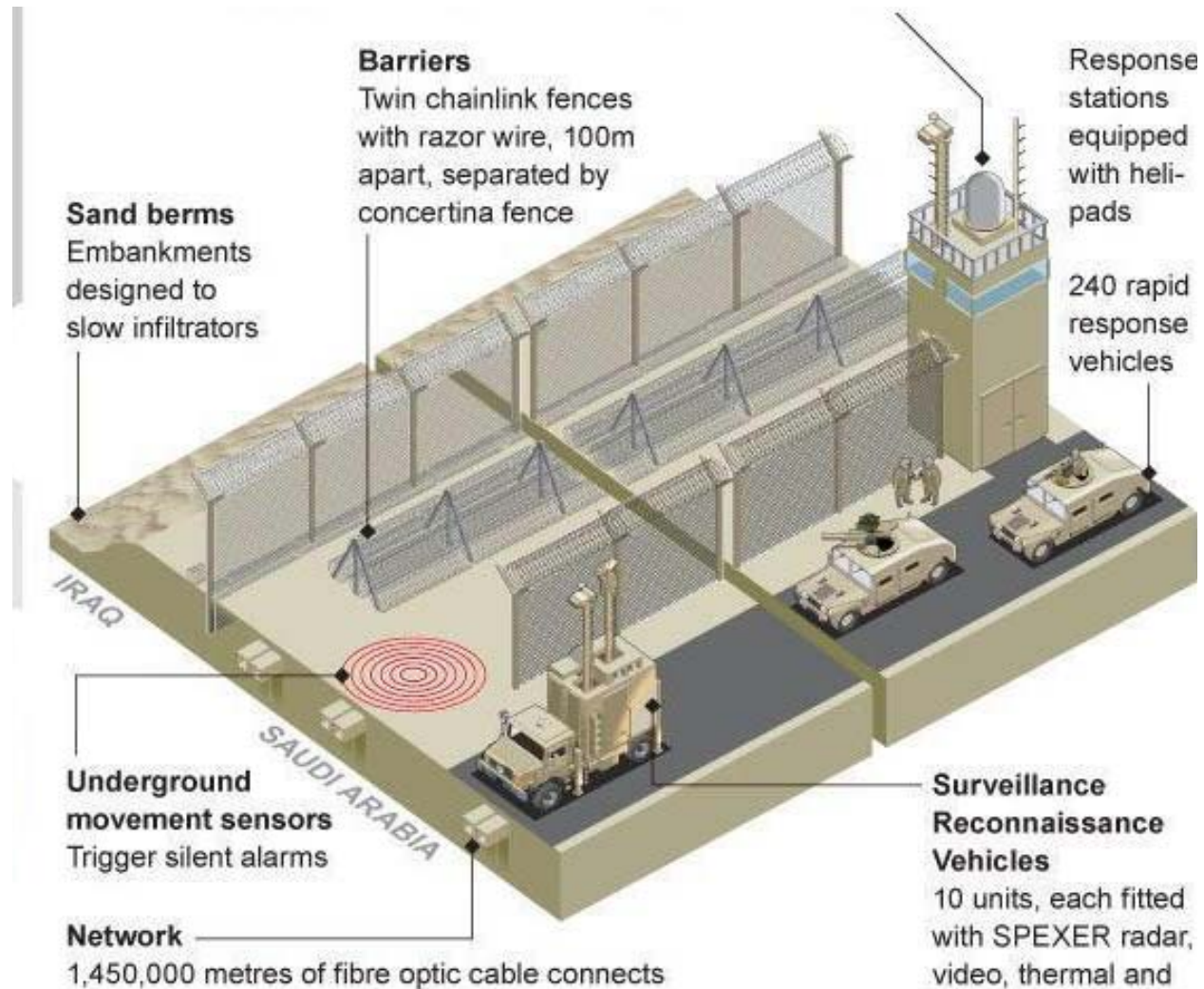
**DETECTION RANGES**

Pedestrian (slow moving)	<b>18km</b>
Light vehicle	<b>22km</b>
Truck	<b>36km</b>
Light aircraft	<b>27km</b>



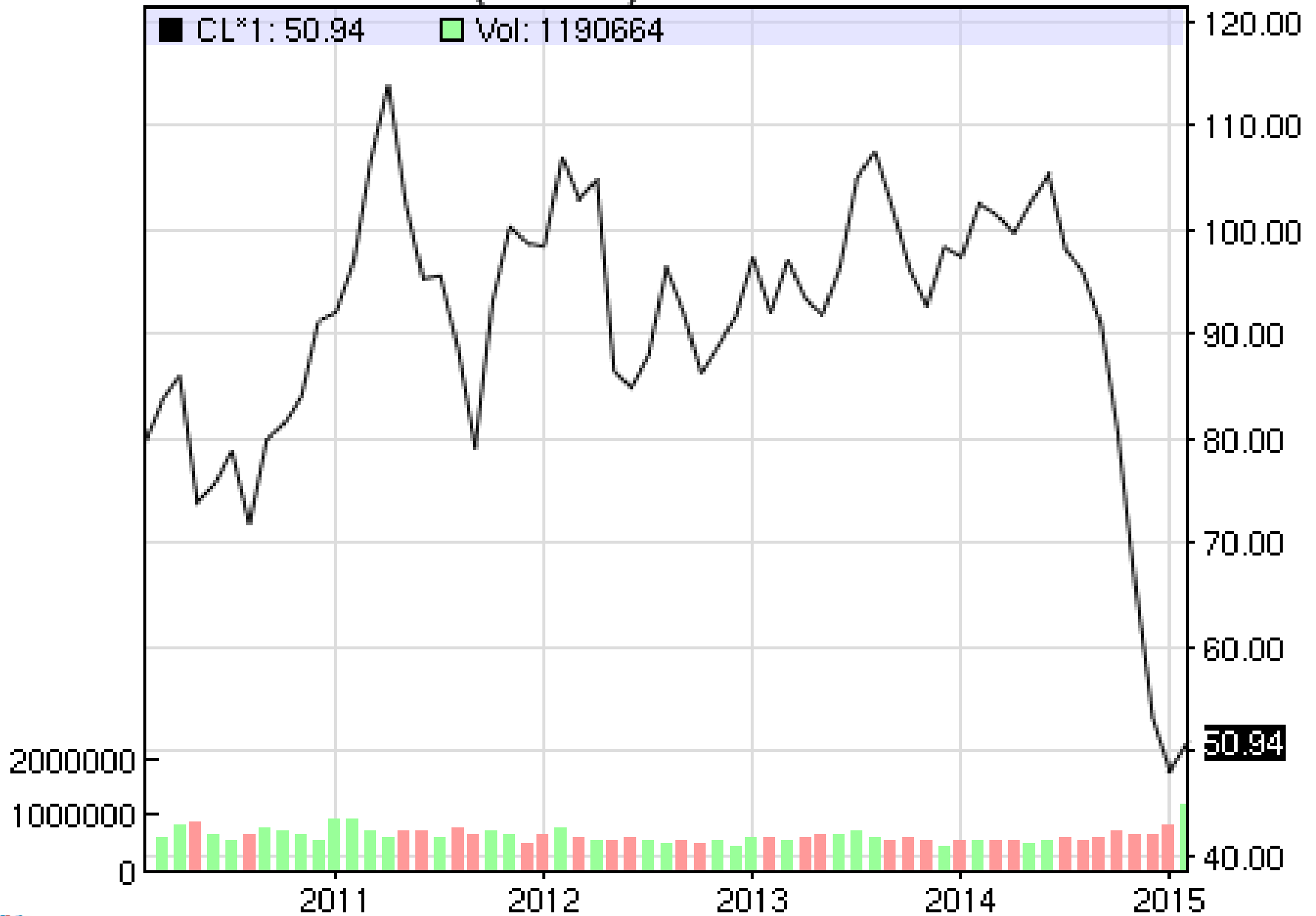


# Fortress Saudi Arabia

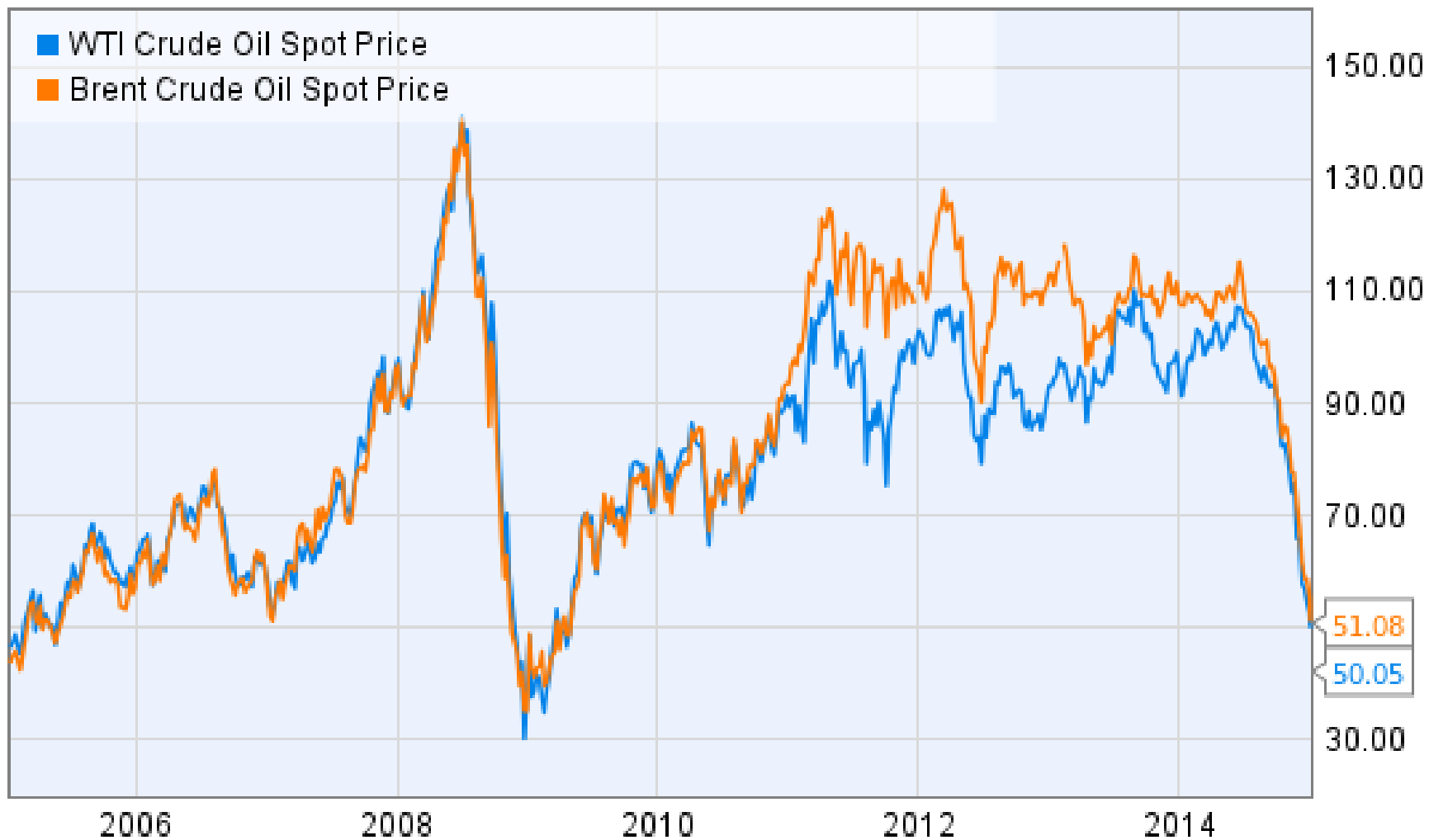




# CLH10 - Crude Oil WTI (NYMEX)



Source: Nasdaq.com, End of day Commodity Futures Price Quotes for Crude Oil WTI (NYMEX)



The Motley Fool

Jan 13 2015, 11:02AM EST. Powered by **YCHARTS**

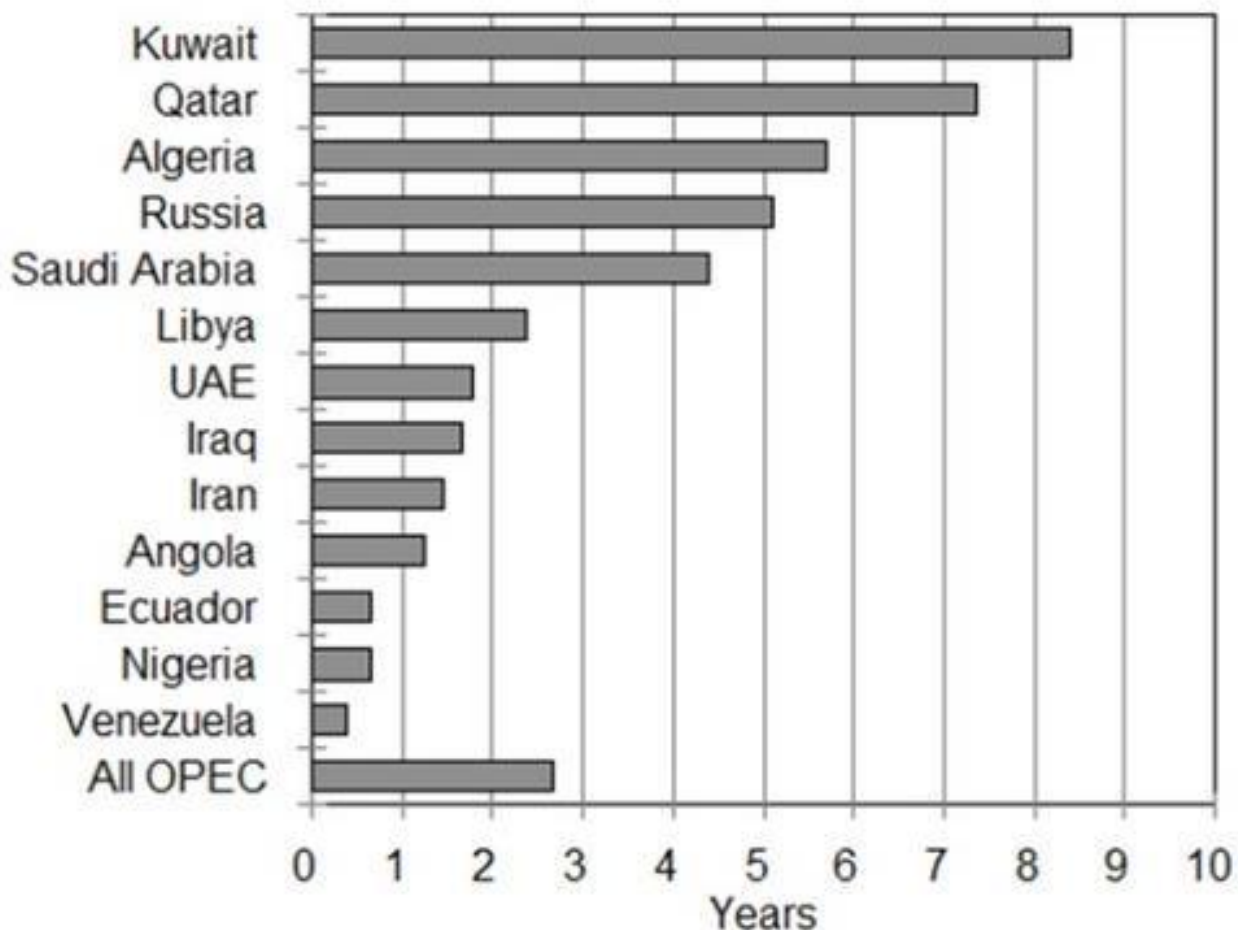


Source: WTI Crude Oil Spot Price data by YCharts, *The Saudi Arabian Oil Conspiracy and What it Might Mean for Your Portfolio*, The Motley Fool, Adam Galas, January 18, 2015

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# 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

# Iran Wary of Oil 'Shock Therapy' as OPEC Vies for Market

Iran relies on oil sales for 60% of its foreign revenue.



President of Iran Hassan Rouhani



Source: Golnar Motevalli, Bloomberg, December 1, 2014

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# OPEC: Iran blames falling oil price on ‘political plot’

Will their response be 1) war-like resistance or 2) the pursuit of a nuclear settlement?



Iran Oil Minister Bijan Namdar Zanganeh

“High prices are a disadvantage to OPEC’s market share,” he said. “If you want to increase your share, you have to reduce prices, but you can’t do it through ‘shock therapy’ over the course of three months if you want to change everything.”

Source: Andrew Critchlow, Commodities Editor, [Telegraph.co.uk/newsbysector](http://Telegraph.co.uk/newsbysector)

*Iran Wary of Oil ‘Shock Therapy’ as OPEC Vies for Market*, Golnar Motevalli, Bloomberg, December 1, 2014



Do you know his name? President of what country?

Nicolas Maduro – waiting for a coup?



- Owes China \$50 Billion
- Has only \$20 Billion in Reserves
- 8-hour lines for food at grocery stores

# Gary Kasparov and Putin

## How popular is Putin?



# Repercussions for the U.S. Energy Story



# NGH15 - Natural Gas (NYMEX)

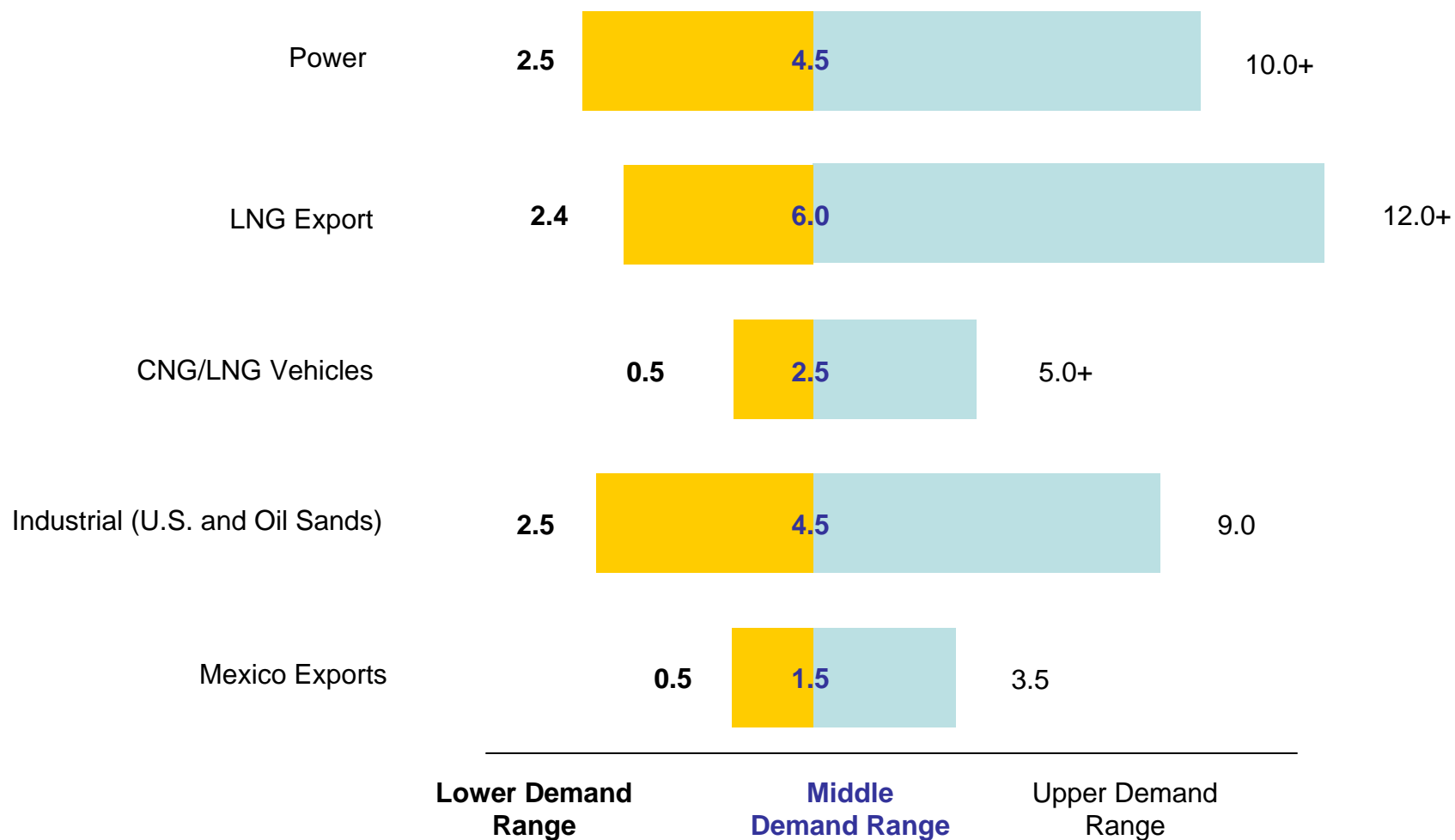


Source: Nasdaq.com, End of day Commodity Futures Price Quotes for Natural Gas (NYMEX)

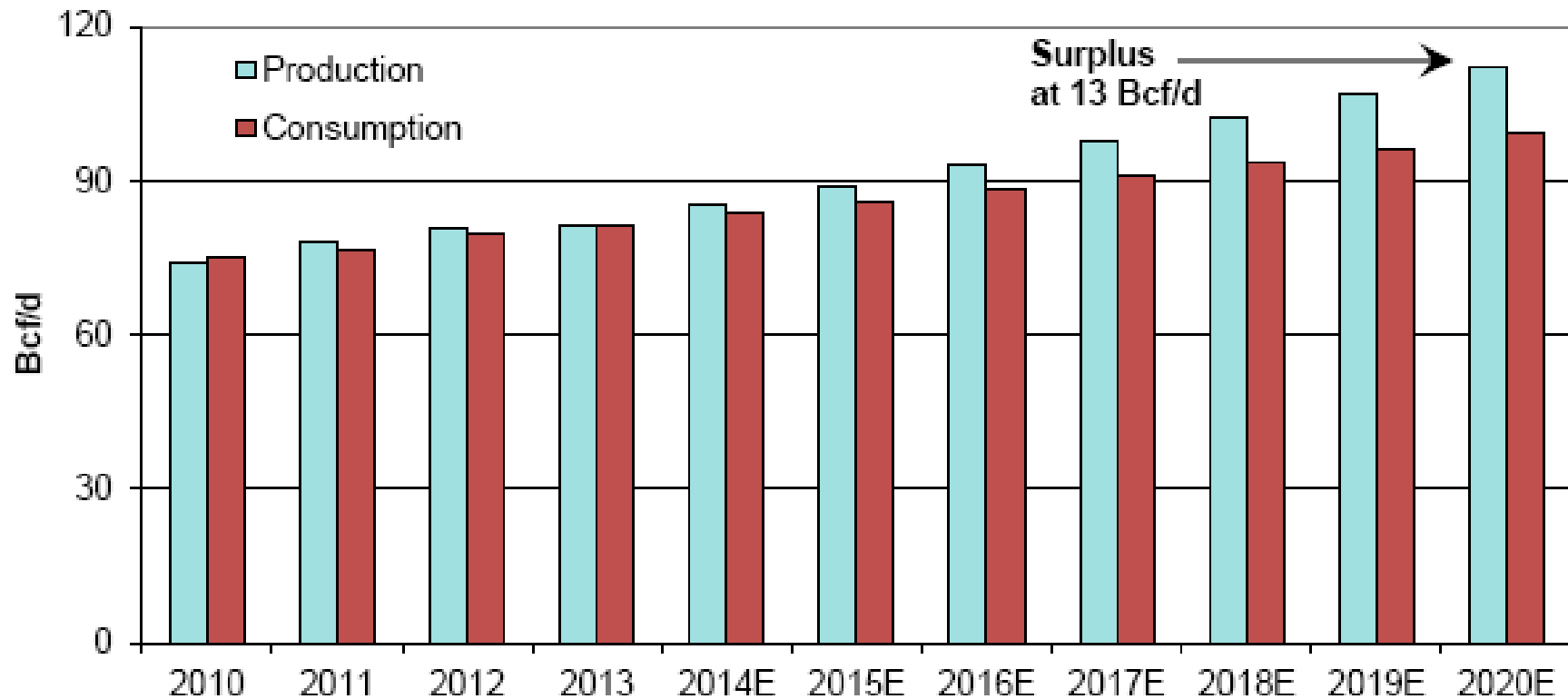
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# North American Natural Gas Demand Ranges by Selected Sector

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



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



Source: BP Statistical Review, Raymond James research



# January 2015 World LNG Prices (\$U.S./MMBtu)

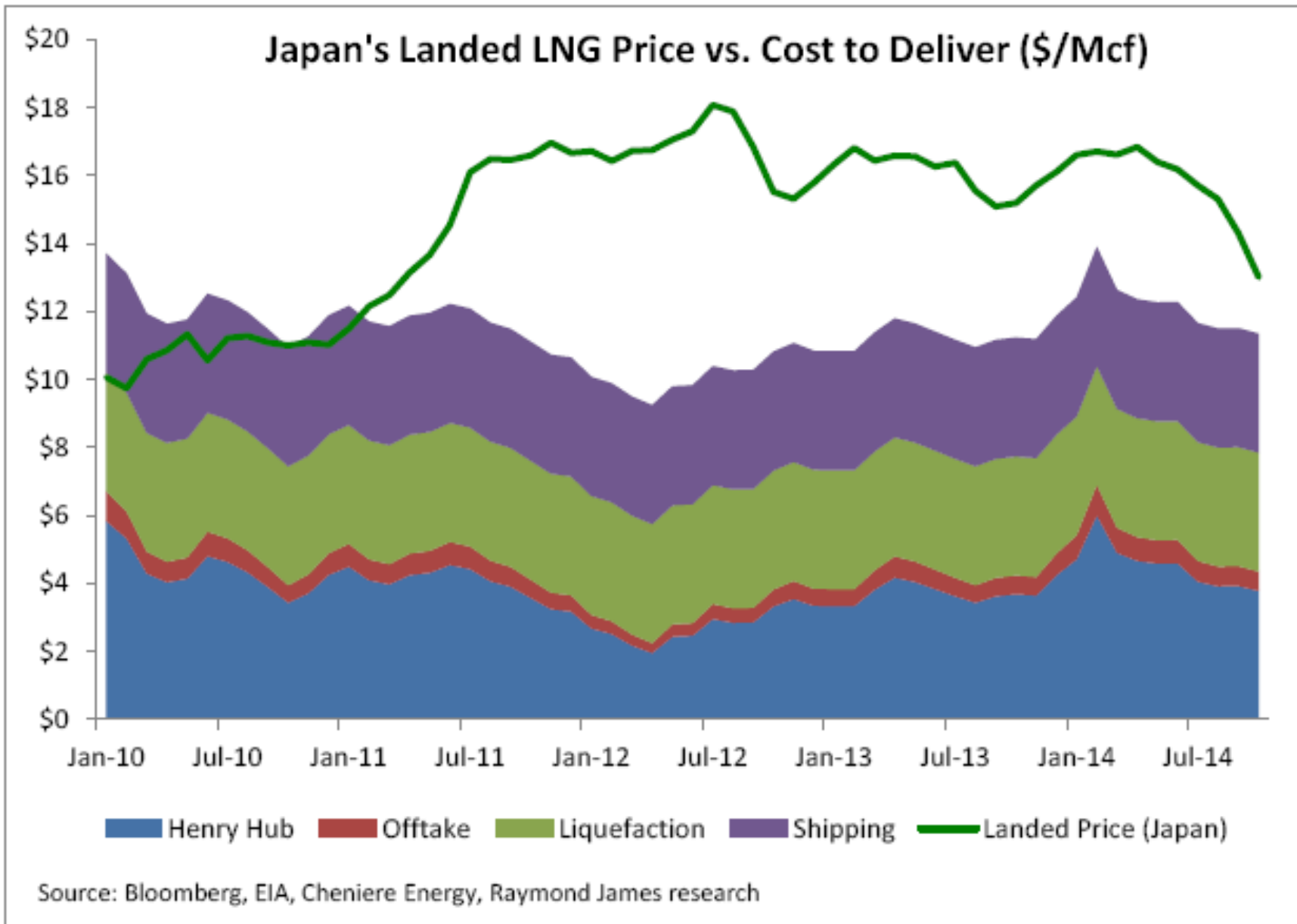


Source: Waterborne Energy, Inc. Data in \$US/MMBtu

# The LNG Delivery Chain



Source: King & Spalding Energy Newsletter, August 2014



# Is the U.S. LNG Price Arbitrage/Advantage Over?

## The Japanese Crude Cocktail Story

### The Oil Derivative LNG Contract

- LNG prices in Pacific Basin (ie – Japan, South Korea, China) are closely tied to crude oil prices
- On a Btu equivalent
  - Crude oil at \$100 per barrel translates to a JCC price of \$14.85 for LNG delivered to Asia (Japan, South Korea, China) (Rule of Thumb LNG Asia - 14.85% of Brent Crude)
- The oil price decline has eliminated the U.S. LNG export advantage

# Is the U.S. LNG Price Arbitrage/Advantage Over?

- U.S. LNG prices delivered to Asia can't compete at \$50 oil = \$7.42 per MMBtu

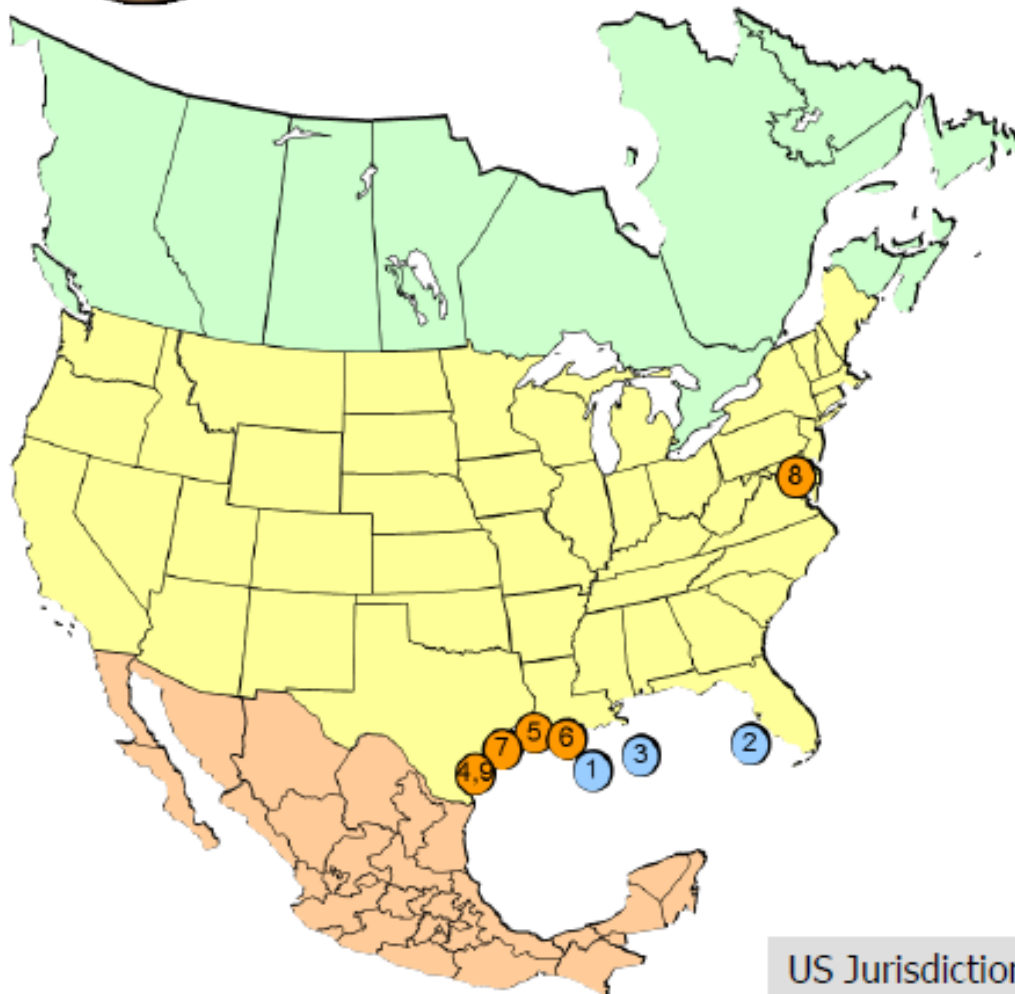
\$4.00/MMBtu	3 year Henry Hub price forecast
\$1.00/MMBtu	ppl cost of transport to LNG facility
\$2.00/MMBtu	liquefaction cost
\$2.00/MMBtu	shipping cost
<hr/>	
\$9.00 MMBtu	Delivered cost to Asia

- U.S. needs \$60-65 crude oil price to breakeven



# North American LNG Import /Export Terminals

## *Approved*



### Import Terminal

#### APPROVED - NOT UNDER CONSTRUCTION

##### U.S. - MARAD/Coast Guard

1. **Gulf of Mexico:** 1.0 Bcfd (Main Pass McMoRan Exp.)
2. **Offshore Florida:** 1.2 Bcfd (Hoëgh LNG - Port Dolphin Energy)
3. **Gulf of Mexico:** 1.4 Bcfd (TORP Technology-Bienville LNG)
4. **Corpus Christi, TX:** 0.4 Bcfd (Cheniere - Corpus Christi LNG) (CP12-507)

### Export Terminal

#### APPROVED - UNDER CONSTRUCTION

##### U.S. - FERC

5. **Sabine, LA:** 2.76 Bcfd (Cheniere/Sabine Pass LNG) (CP11-72 & CP14-12)
6. **Hackberry, LA:** 1.7 Bcfd (Sempra - Cameron LNG) (CP13-25)
7. **Freeport, TX:** 1.8 Bcfd (Freeport LNG Dev/Freeport LNG Expansion/FLNG Liquefaction) (CP12-509)
8. **Cove Point, MD:** 0.82 Bcfd (Dominion - Cove Point LNG) (CP13-113)

#### APPROVED - NOT UNDER CONSTRUCTION

##### U.S. - FERC

9. **Corpus Christi, TX:** 2.14 Bcfd (Cheniere - Corpus Christi LNG) (CP12-507)

#### US Jurisdiction

- FERC
- MARAD/USCG

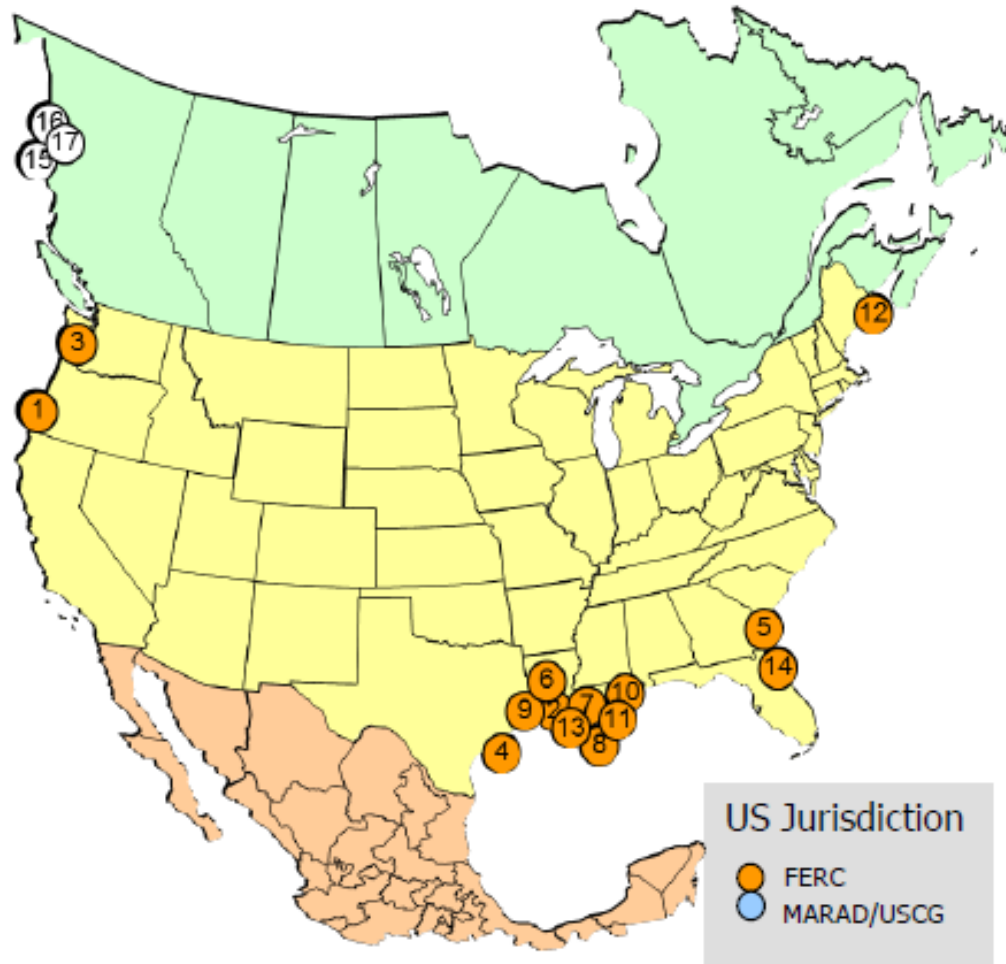
As of January 6, 2015

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# North American LNG Export Terminals *Proposed*



## Export Terminal PROPOSED TO FERC

1. Coos Bay, OR: 0.9 Bcfd (Jordan Cove Energy Project) (CP13-483)
2. Lake Charles, LA: 2.2 Bcfd (Southern Union - Trunkline LNG) (CP14-120)
3. Astoria, OR: 1.25 Bcfd (Oregon LNG) (CP09-6)
4. Lavaca Bay, TX: 1.38 Bcfd (Excelerate Liquefaction) (CP14-71 & 72)
5. Elba Island, GA: 0.35 Bcfd (Southern LNG Company) (CP14-103)
6. Sabine Pass, LA: 1.40 Bcfd (Sabine Pass Liquefaction) (CP13-552)
7. Lake Charles, LA: 1.07 Bcfd (Magnolia LNG) (CP14-347)
8. Plaquemines Parish, LA: 1.07 Bcfd (CE FLNG) (PF13-11)
9. Sabine Pass, TX: 2.1 Bcfd (ExxonMobil – Golden Pass) (CP14-517)
10. Pascagoula, MS: 1.5 Bcfd (Gulf LNG Liquefaction) (PF13-4)
11. Plaquemines Parish, LA: 0.30 Bcfd (Louisiana LNG) (PF14-17)
12. Robbinston, ME: 0.45 Bcfd (Kestrel Energy - Downeast LNG) (PF14-19)
13. Cameron Parish, LA: 1.34 Bcfd (Venture Global) (PF15-2)
14. Jacksonville, FL: 0.075 Bcfd (Eagle LNG Partners) (PF15-7)

## PROPOSED CANADIAN SITES IDENTIFIED BY PROJECT SPONSORS

15. Kitimat, BC: 1.28 Bcfd (Apache Canada Ltd.)
16. Douglas Island, BC: 0.23 Bcfd (BC LNG Export Cooperative)
17. Kitimat, BC: 3.23 Bcfd (LNG Canada)

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# North American LNG Export Terminals *Potential*

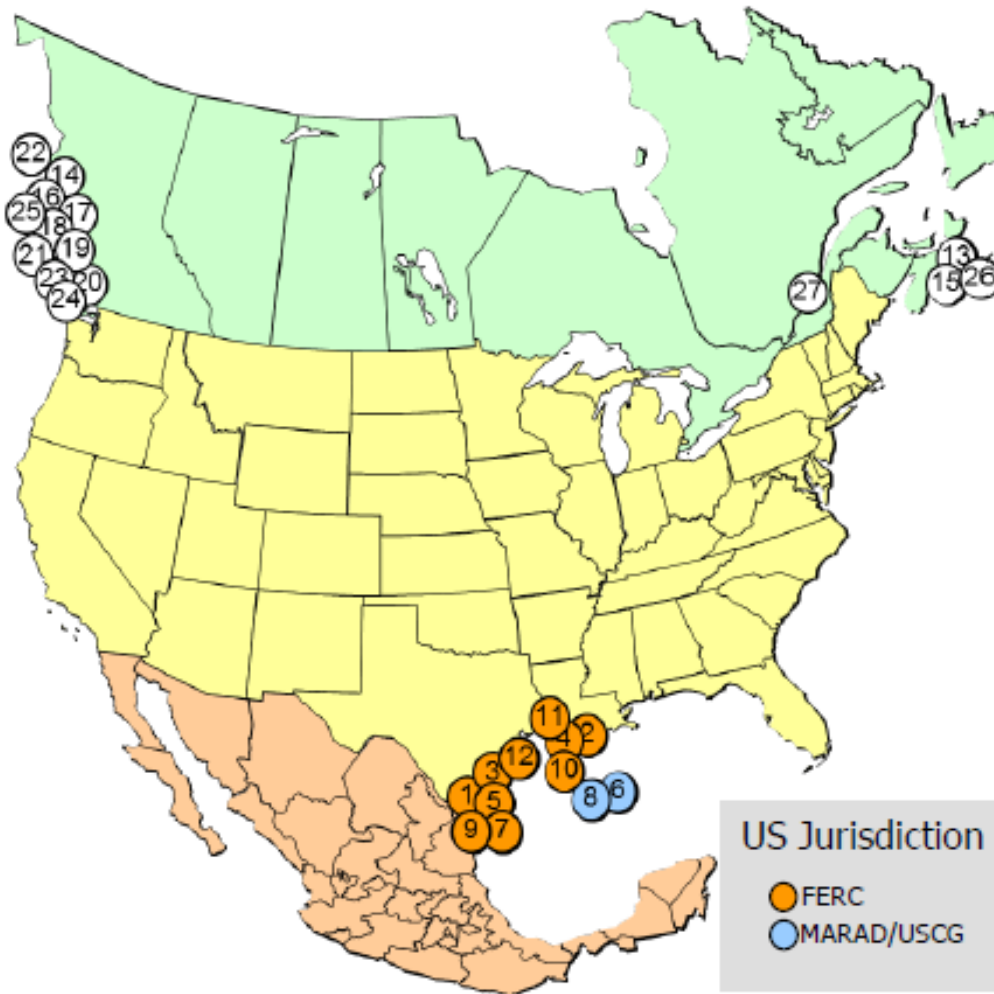
## Export Terminal

### POTENTIAL U.S. SITES IDENTIFIED BY PROJECT SPONSORS

1. Brownsville, TX: 2.8 Bcfd (Gulf Coast LNG Export)
2. Cameron Parish, LA: 0.16 Bcfd (Waller LNG Services)
3. Ingleside, TX: 1.09 Bcfd (Pangea LNG (North America))
4. Cameron Parish, LA: 0.20 Bcfd (Gasfin Development)
5. Brownsville, TX: 3.2 Bcfd (Eos LNG & Barca LNG)
6. Gulf of Mexico: 3.22 Bcfd (Main Pass - Freeport-McMoRan)
7. Brownsville, TX: 0.94 Bcfd (Annova LNG)
8. Gulf of Mexico: 1.8 Bcfd (Delfin LNG)
9. Brownsville, TX: 0.27 Bcfd (Texas LNG)
10. Cameron Parish, LA: 1.60 Bcfd (SCT&E LNG)
11. Port Arthur, TX: 0.2 Bcfd (WesPac/Gulfgate Terminal)
12. Galveston, TX: 0.77 Bcfd (Next Decade)

### POTENTIAL CANADIAN SITES IDENTIFIED BY PROJECT SPONSORS

13. Goldboro, NS: 1.4 Bcfd (Pieridae Energy Canada)
14. Prince Rupert Island, BC: 2.91 Bcfd (BG Group)
15. Melford, NS: 1.8 Bcfd (H-Energy)
16. Prince Rupert Island, BC: 2.74 Bcfd (Pacific Northwest LNG)
17. Prince Rupert Island, BC: 4.0 Bcfd (ExxonMobil - Imperial)
18. Squamish, BC: 0.29 Bcfd (Woodfibre LNG Export)
19. Kitimat/Prince Rupert, BC: 0.32 Bcfd (Triton LNG)
20. Prince Rupert, BC: 3.12 Bcfd (Aurora LNG)
21. Kitsault, BC: 2.7 Bcfd (Kitsault Energy)
22. Stewart, BC: 4.1 Bcfd (Canada Stewart Energy Group)
23. Delta, BC: 0.4 Bcfd (WesPac Midstream Vancouver)
24. Vancouver Island, BC: 0.11 Bcfd (Steelhead LNG)
25. Prince Rupert Island, BC: 3.2 Bcfd (Orca LNG)
26. Port Hawkesbury, NS: 0.5 Bcfd (Bear Head LNG)
27. Saguenay, Quebec: 1.6 Bcfd (GNL Quebec)



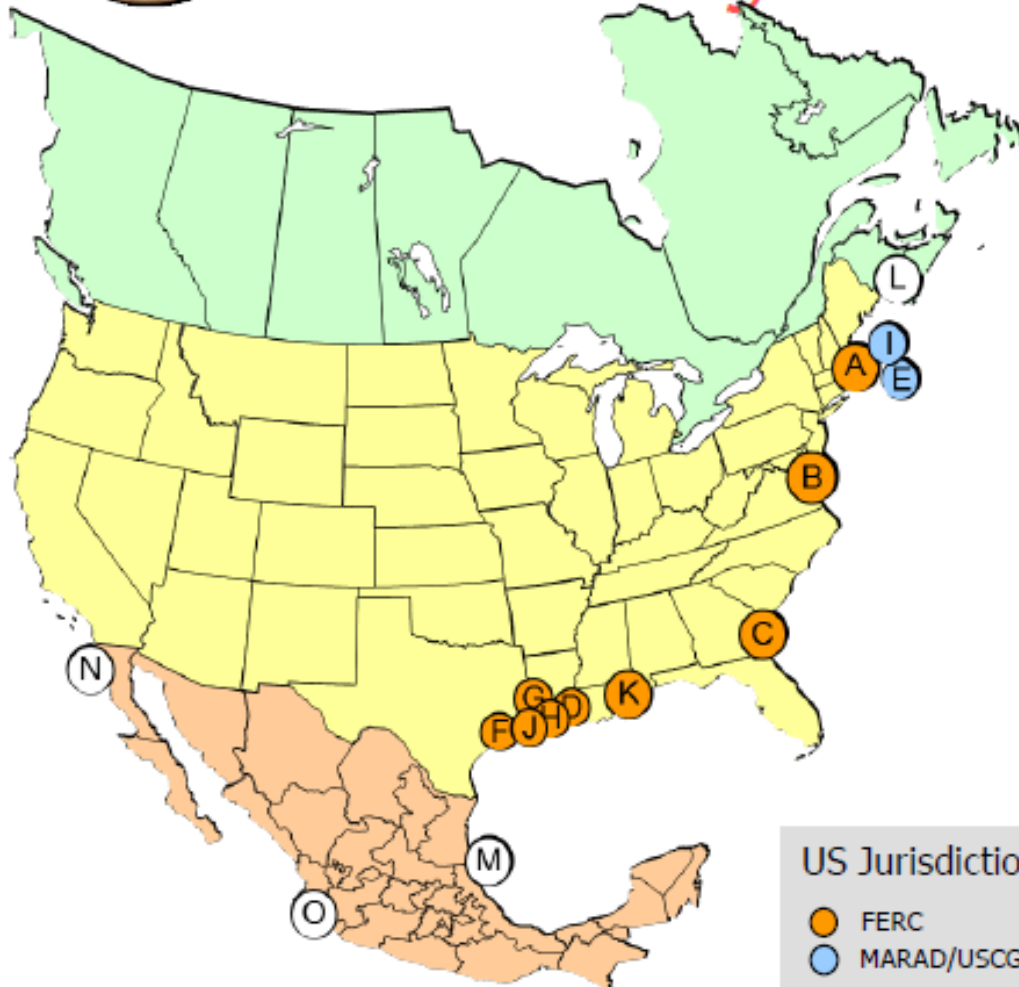
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# North American LNG Import/Export Term

*Existing*



## U.S.

- A. Everett, MA : 1.035 Bcfd (GDF SUEZ - DOMAC)
- B. Cove Point, MD : 1.8 Bcfd (Dominion - Cove Point LNG)
- C. Elba Island, GA : 1.6 Bcfd (El Paso - Southern LNG)
- D. Lake Charles, LA : 2.1 Bcfd (Southern Union - Trunkline LNG)
- E. Offshore Boston: 0.8 Bcfd, (Excelerate Energy - Northeast Gateway)
- F. Freeport, TX: 1.5 Bcfd, (Cheniere/Freeport LNG Dev.)★
- G. Sabine, LA: 4.0 Bcfd (Cheniere/Sabine Pass LNG)★
- H. Hackberry, LA: 1.8 Bcfd (Sempra - Cameron LNG)★
- I. Offshore Boston, MA : 0.4 Bcfd (GDF SUEZ - Neptune LNG)
- J. Sabine Pass, TX: 2.0 Bcfd (ExxonMobil - Golden Pass) (Phase I & II)
- K. Pascagoula, MS: 1.5 Bcfd (El Paso/Crest/Sonangol - Gulf LNG Energy LLC)

## Canada

- L. Saint John, NB: 1.0 Bcfd, (Repsol/Fort Reliance - Canaport LNG)

## Mexico

- M. Altamira, Tamulipas: 0.7 Bcfd, (Shell/Total/Mitsui - Altamira LNG)
- N. Baja California, MX: 1.0 Bcfd, (Sempra - Energia Costa Azul)
- O. Manzanillo, MX: 0.5 Bcfd (KMS GNL de Manzanillo)

As of January 6, 2015

Note: There is an existing import terminal in Peñuelas, PR. It does not appear on this map since it can not serve or affect deliveries in the Lower 48 U.S. states.

★ Authorized to re-export delivered LNG

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# “First Four” LNG Projects Still Moving Forward

- Sabine Pass LNG (Louisiana)
  - Four 4.5 mtpa trains (currently under construction) will be able to liquefy a total of 2.2 Bcf/d
  - Trains 1 & 2 expected to come online in late 2015 or early 2016
  - Trains 3 & 4 expected to come online 2016-17
  - Off-takers: BG Group, GAIL (India), Gas Natural Fenosa and Korea Gas (together have agreed to take 16 mtpa)
- Cameron LNG (Louisiana)
  - Joint venture of Sempra Energy, GDF Suez, Mitsui & Co. and Mitsubishi Corp.
  - Three 4 mtpa trains (currently under construction) will be able to liquefy 1.7 Bcf/d
  - All trains are expected to be fully operational in 2019
  - Off-takers: GDF Suez, Mitsui and Mitsubishi



Source: *Is That All There Is? Will an LNG Surplus and Cheap Oil Cap LNG Exports?* Rusty Brazier, RBN Energy, January 26, 2015



# “First Four” LNG Projects Still Moving Forward

- Freeport LNG (Texas)
  - Two 4.6 mtpa trains (currently under construction) will be able to liquefy 1.4 Bcf/d
  - Trains 1 & 2 expected to be online in 2018
  - FID and construction start up on third train expected soon
  - Off-takers: Osaka Gas, Chubu Electric, BP Energy, Toshiba Corp. and SK E&S LNG have committed to take all 3 trains’ total capacity
- Cove Point (Maryland)
  - One 5.75 mtpa train expected to liquefy up to 770 MMcf/d
  - Expected to be online late 2017
  - Off-takers: Sumitomo Corp. and GAIL (India) have each contracted for 2.3 mtpa of liquefaction capacity



Source: *Is That All There Is? Will an LNG Surplus and Cheap Oil Cap LNG Exports?* Rusty Brazier, RBN Energy, January 26, 2015



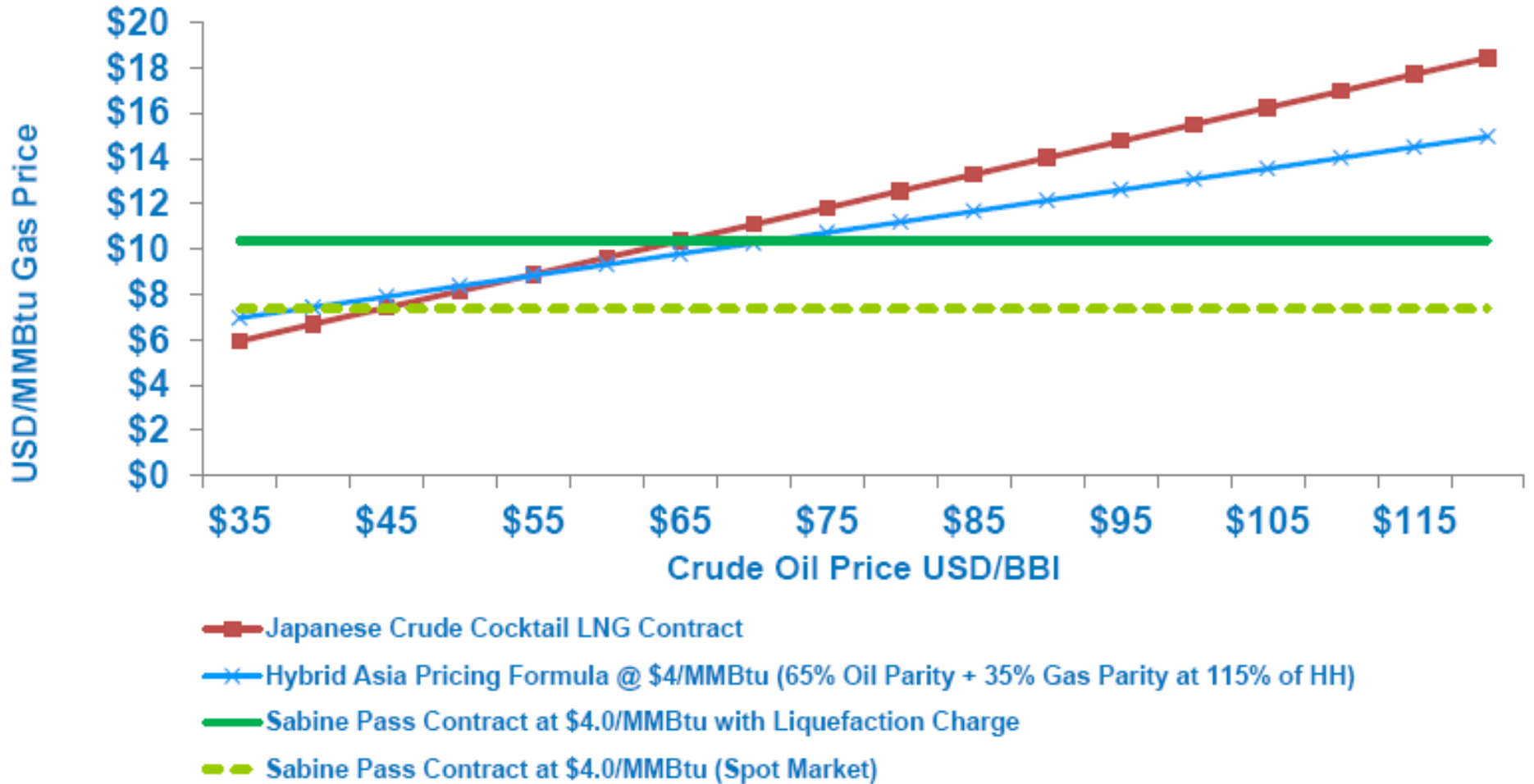
## “First Four” Share Three Important Characteristics

1. They are being constructed at existing LNG import terminals with strong pipeline connections
  - Reduces project costs
2. They hold long-term sale and purchase agreements (SPAs) for all or nearly all of their liquefaction and export capacity and the SPAs are take-or-pay
  - Makes projects financeable
3. They got in before the current energy market upheaval forced LNG buyers, investments and lenders to re-examine FIDs



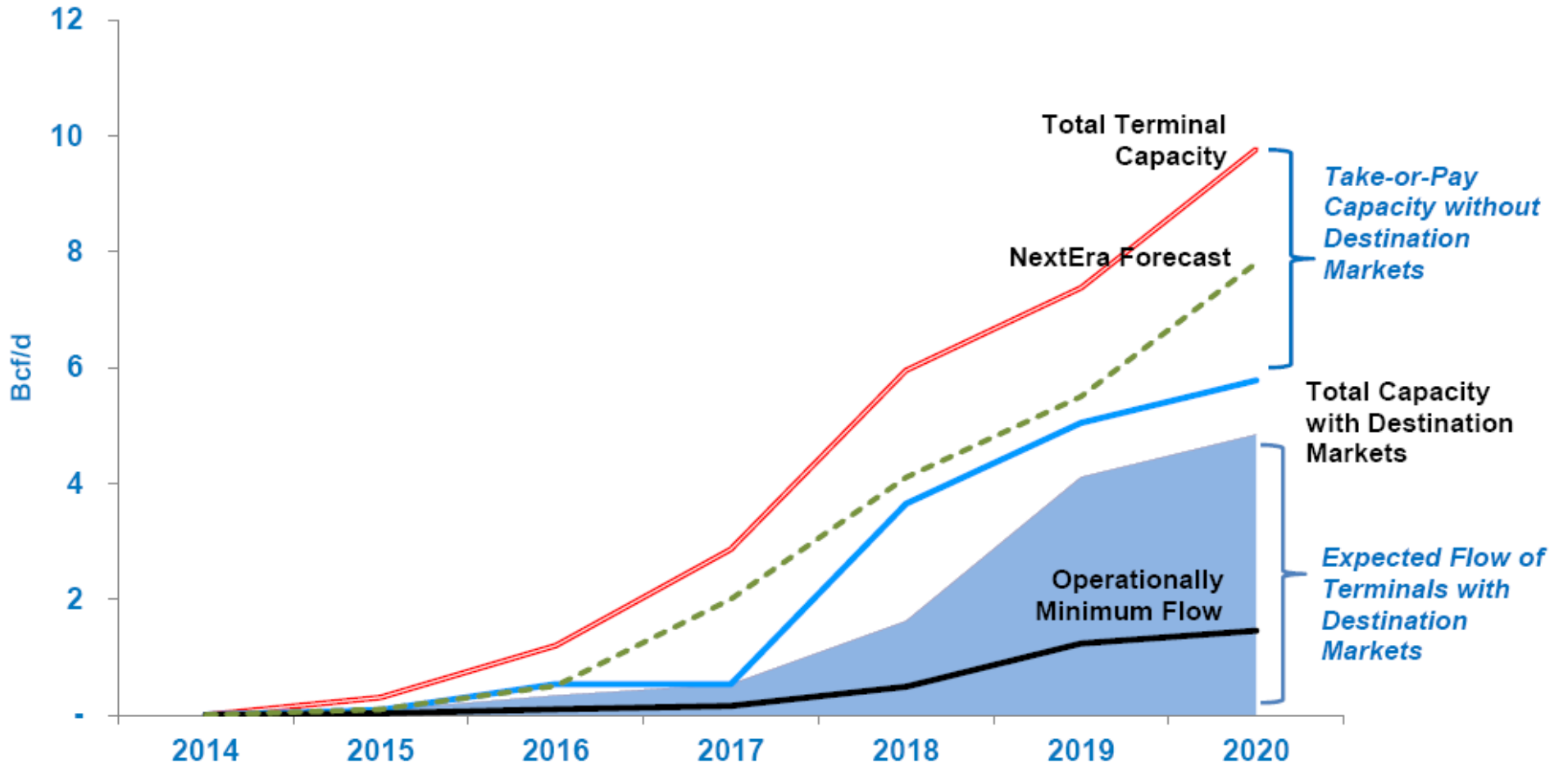
Source: *Is That All There Is? Will an LNG Surplus and Cheap Oil Cap LNG Exports?* Rusty Brazier, RBN Energy, January 26, 2015

## LNG Contract Cost Comparison versus Asia Contract Gas



Source: *Low Tide, Can U.S. LNG Hold on?*, NextEra Energy Newsletter, January 21, 2015

### Lower 48 LNG Export Forecast Range



Source: *Low Tide, Can U.S. LNG Hold on?*, NextEra Energy Newsletter, January 21, 2015

# Export License Volumes for Canadian LNG Projects

Project	Total (Tcf)	Annual (Tcf)	Daily (Bcf)
Aurora LNG	30.50	1.14	3.00
BC LNG <sup>1</sup>	1.69	0.08	0.23
Goldboro LNG <sup>2</sup>	7.30	0.51	1.40
Jordan Cove LNG <sup>3</sup>	15.63	0.63	1.55
Kitsault LNG	24.00	0.90	2.60
KM LNG <sup>1</sup>	9.36	0.47	1.28
LNG Canada <sup>1</sup>	32.90	1.18	3.20
Oregon LNG <sup>3</sup>	13.25	0.47	1.30
Pacific NorthWest LNG <sup>1</sup>	24.50	1.00	2.70
Prince Rupert LNG <sup>1</sup>	29.60	1.06	2.90
Stewart LNG	35.70	1.50	4.00
Triton LNG <sup>1</sup>	2.88	0.12	0.32
WCC LNG <sup>1</sup>	38.90	1.46	3.90
Woodfibre LNG <sup>1</sup>	2.62	0.11	0.29
<b>TOTALS</b>	<b>238.33</b>	<b>9.48</b>	<b>25.67</b>

<sup>1</sup>Canadian gas export license granted

<sup>2</sup>Nova Scotia terminal site

<sup>3</sup>Oregon terminal site

# What Basins are Competitive in This Price Environment?



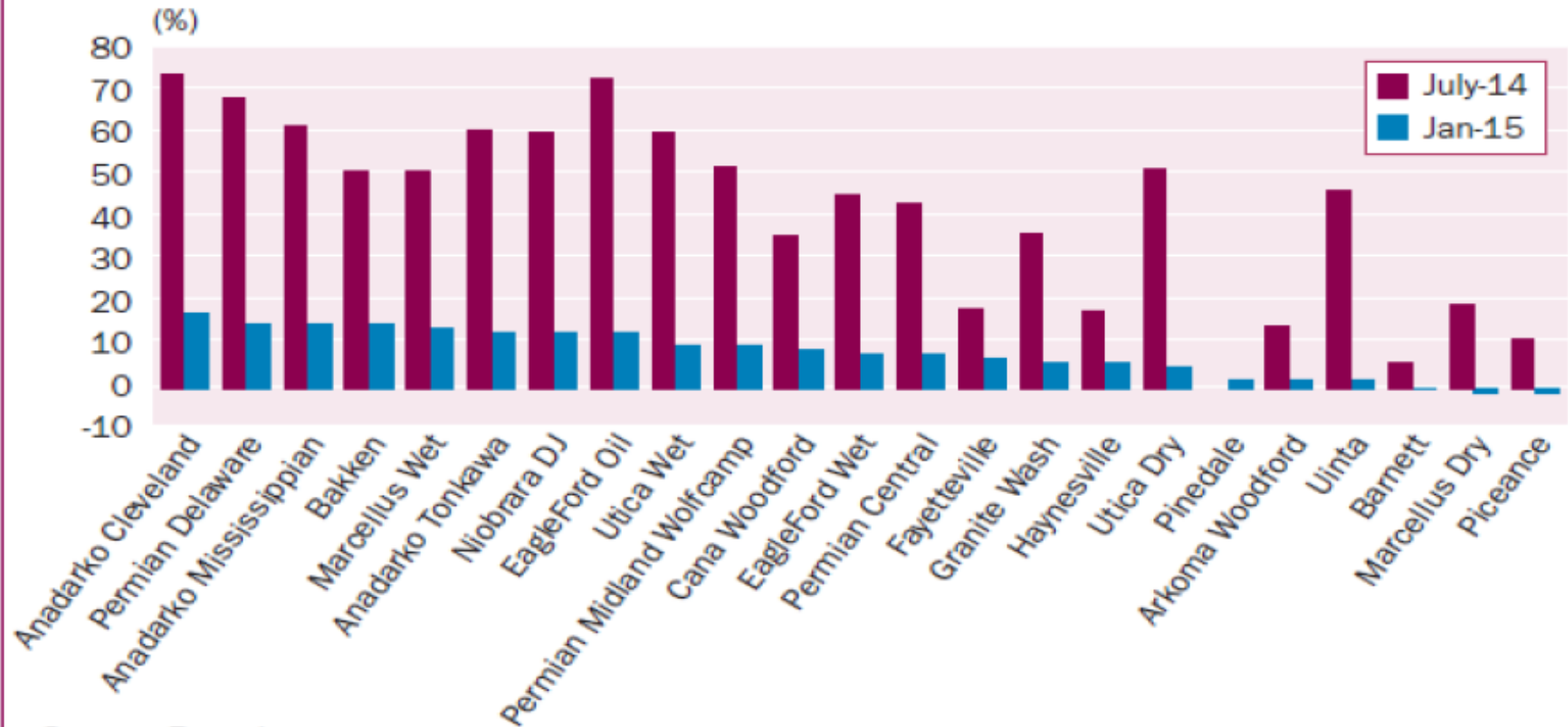
# North American shale plays (as of May 2011)



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



## Internal Rates of Return per Well by Basin/Play (January 2015 versus July 2014)

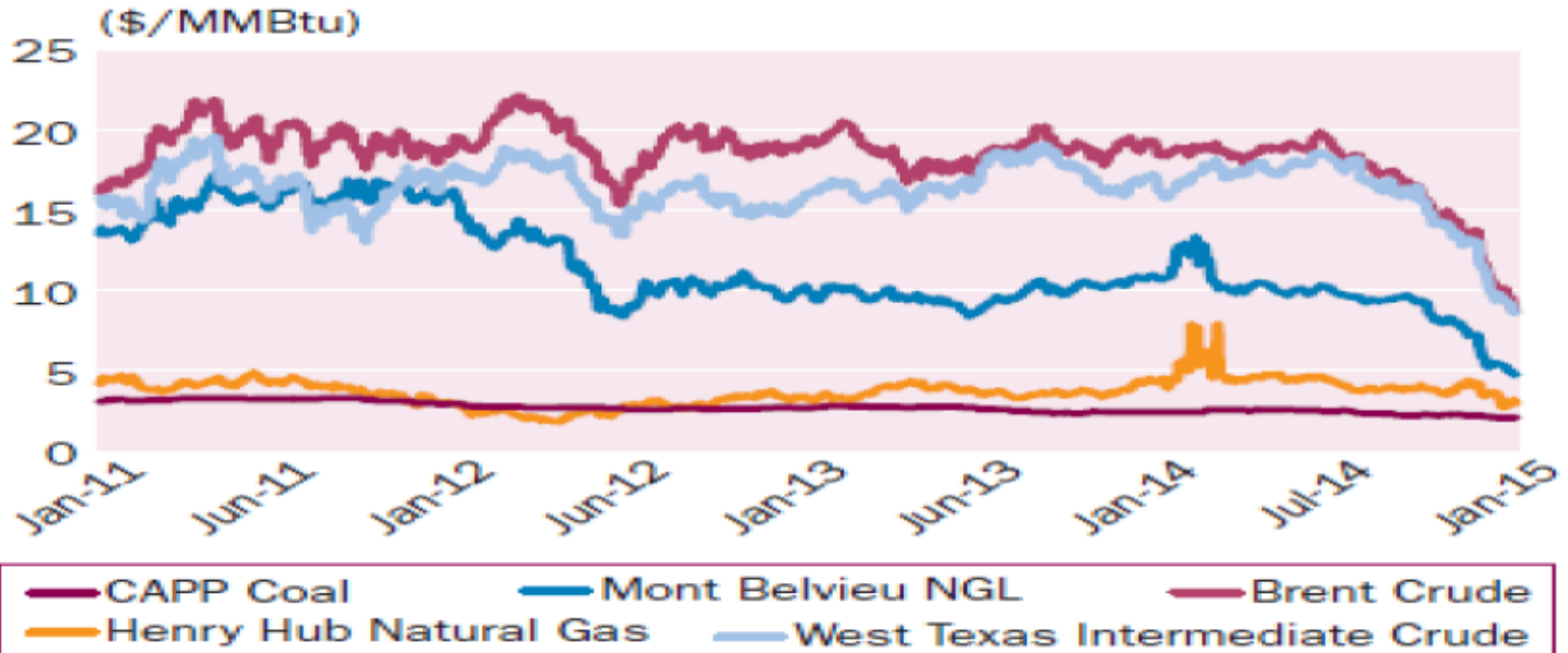


Source: Bentek



Source: *Shale economics challenged as prices plummet*, Arjun Sreekumar, Platts Gas Daily Volume 32 / Issue 7 / Monday, January 12, 2015

## Energy Commodity Price Comparison

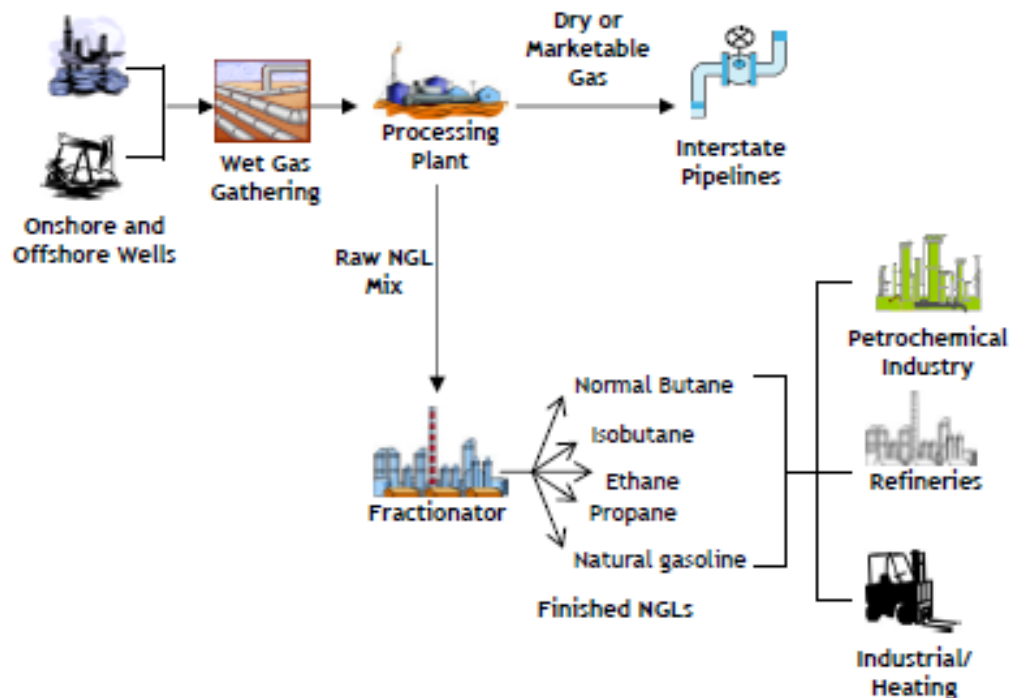


Source: Bentek



Source: *Shale economics challenged as prices plummet*, Arjun Sreekumar, Platts Gas Daily Volume 32 / Issue 7 / Monday, January 12, 2015

## Midstream Overview

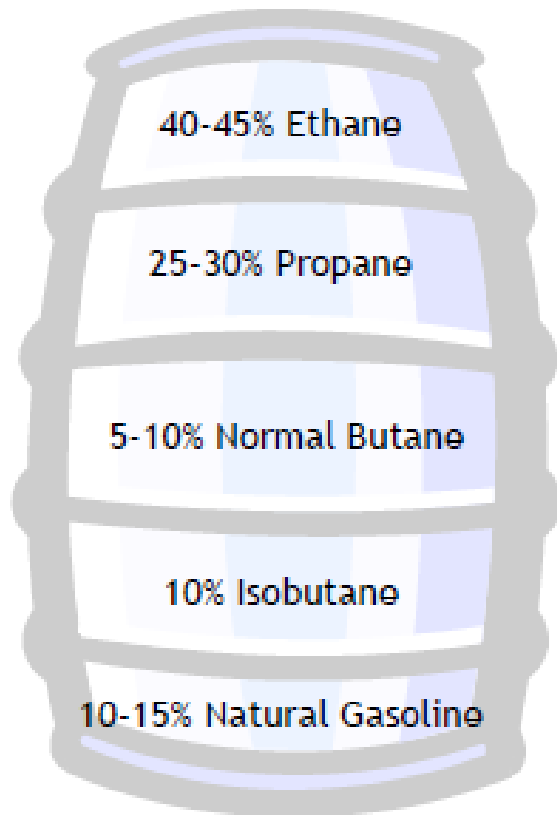


- Frequently overlooked, the midstream industry is a critical link to turn raw natural gas into usable products.
- Natural gas is comprised of two parts - a light gas component and a heavier liquids component. The light gas consists of methane, while the liquids consist of ethane, propane, n-butane, iso-butane and natural gasoline. These natural gas liquids (NGLs) are used in the petrochemical industry, as refinery blend-stock, in home heating, and in many other common applications.
- Most wellhead gas does not meet the quality standards required by interstate pipelines, so it must be processed, removing contaminants and the heavier components (propane+).
- After the NGLs and contaminants are removed, what's left is marketable gas (or dry gas), consisting of methane with some ethane. That gas is then ready to be delivered to interstate gas pipelines.
- The raw NGLs are then sent to large fractionators to break the stream into usable components (ethane, propane, etc.).

Source: *Midstream Update & Primer*, Tudor Pickering Holt & Co., November 2008

# NGL Removal is Non-Discretionary

The typical NGL “barrel” looks like this:



- We stress: propanes and heavier components (propanes+), make up ~60% of the NGL stream, and have to come out of the wet gas produced from the wellhead. Pipeline specs mandate it.
- Ethane is “discretionary,” meaning producers/processors can opt to keep it in the stream or remove it, depending on economics.
- Keeping ethane in the steam is called “ethane rejection” (we know, it is the opposite of what is intuitive, but think of it from the processors’ standpoint). The amount of Btus is always the same - it’s just the state of matter that’s different.

Ethane rejection = more gas, fewer NGLs

Normal processing = less gas, more NGLs

Source: *Midstream Update & Primer*, Tudor Pickering Holt & Co., November 2008

# What Drives Midstream Economics?

	<u>Contract Structure</u>	<u>Commodity Sensitive?</u>
Gathering	Fee	N
Processing	Fee	N
	Keep Whole	Y
	Percent of Proceeds	Y
Raw NGL Pipelines	Fee	N
Finished NGL Pipelines	Fee	N
Fractionation	Fee	N
Storage	Fee	N
Marketing	Fee	N

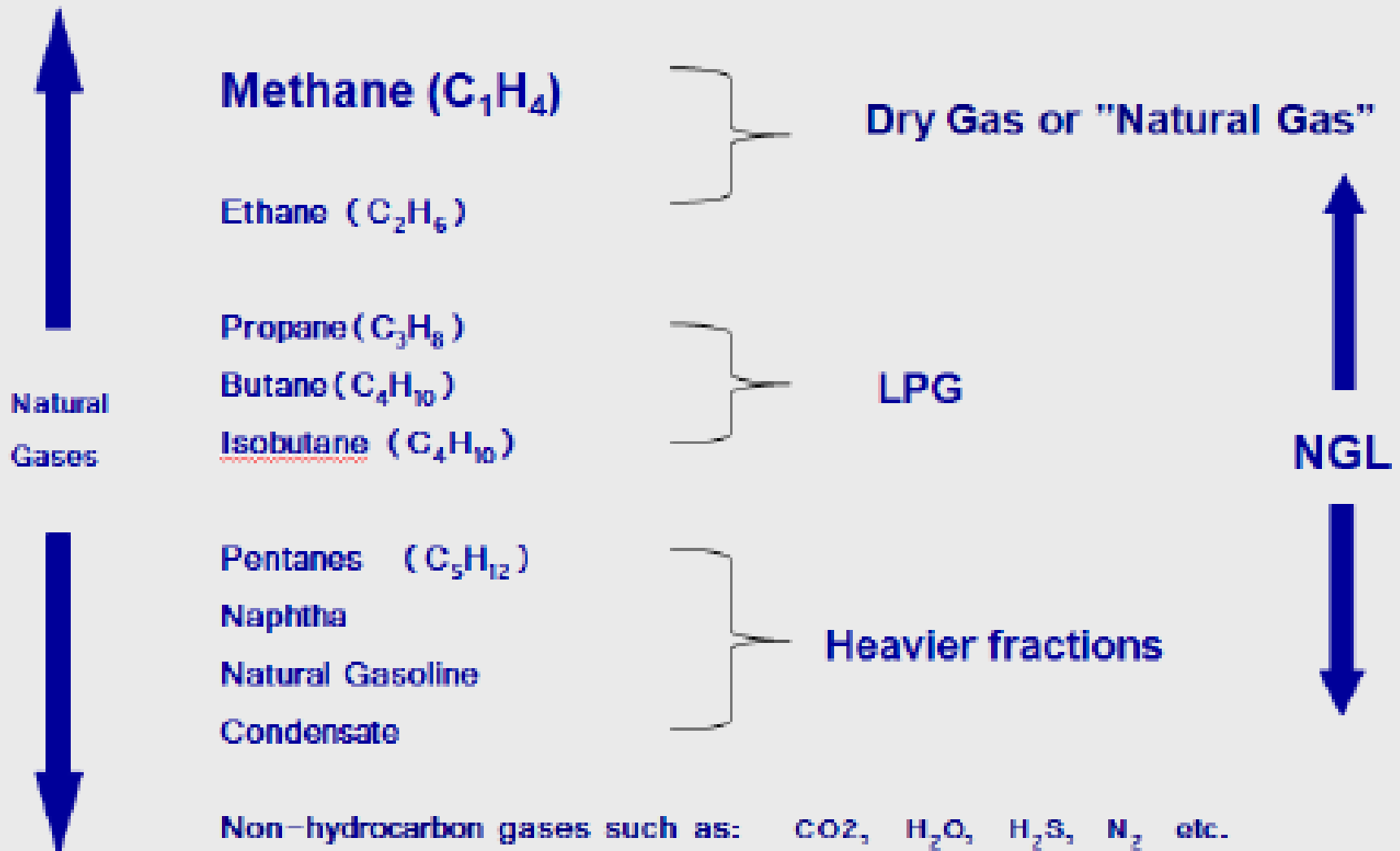
- There are lots of ways to make money through the midstream value chain. While most are fee-based, processing is usually commodity sensitive.
- Since processing involves converting MMBtus from a gaseous form to a combo of liquids and gas, non fee-based processing economics are dictated by the spread between the price of gas and the price of NGLs (the “frac spread”).

Low gas prices/High NGL prices =  
Favorable processing economics  
(Btus worth more taken out of gas stream)

High gas prices/Low NGL prices =  
Unfavorable processing economics  
(Btus worth more in gaseous form)

Source: *Midstream Update & Primer*, Tudor Pickering Holt & Co., November 2008

Definition of dry gas, NGL, LPG and non-hydrocarbon gases

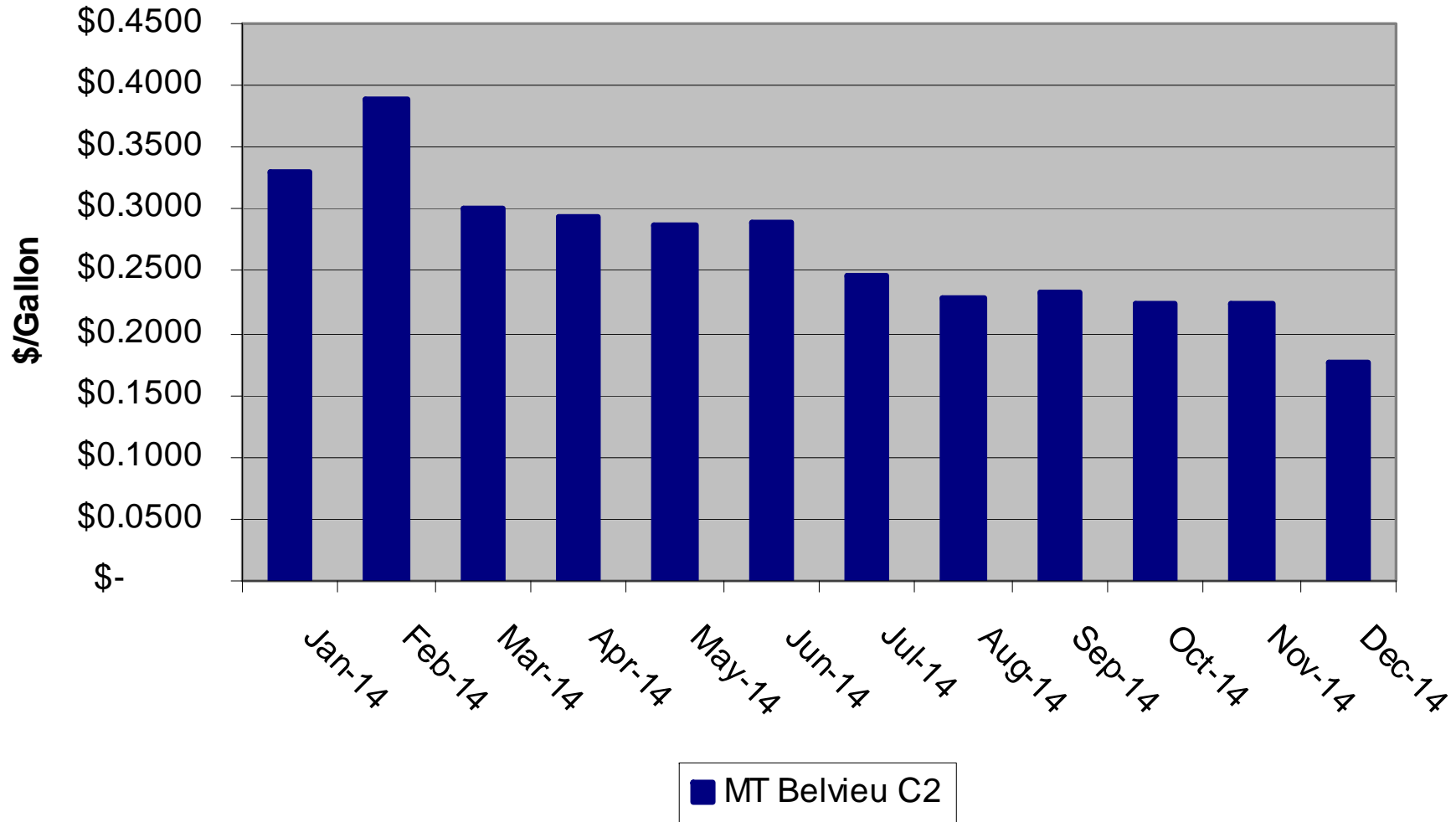


Source: *Natural Gas Liquids – Supply Outlook 2008-2015*

Mercator Energy



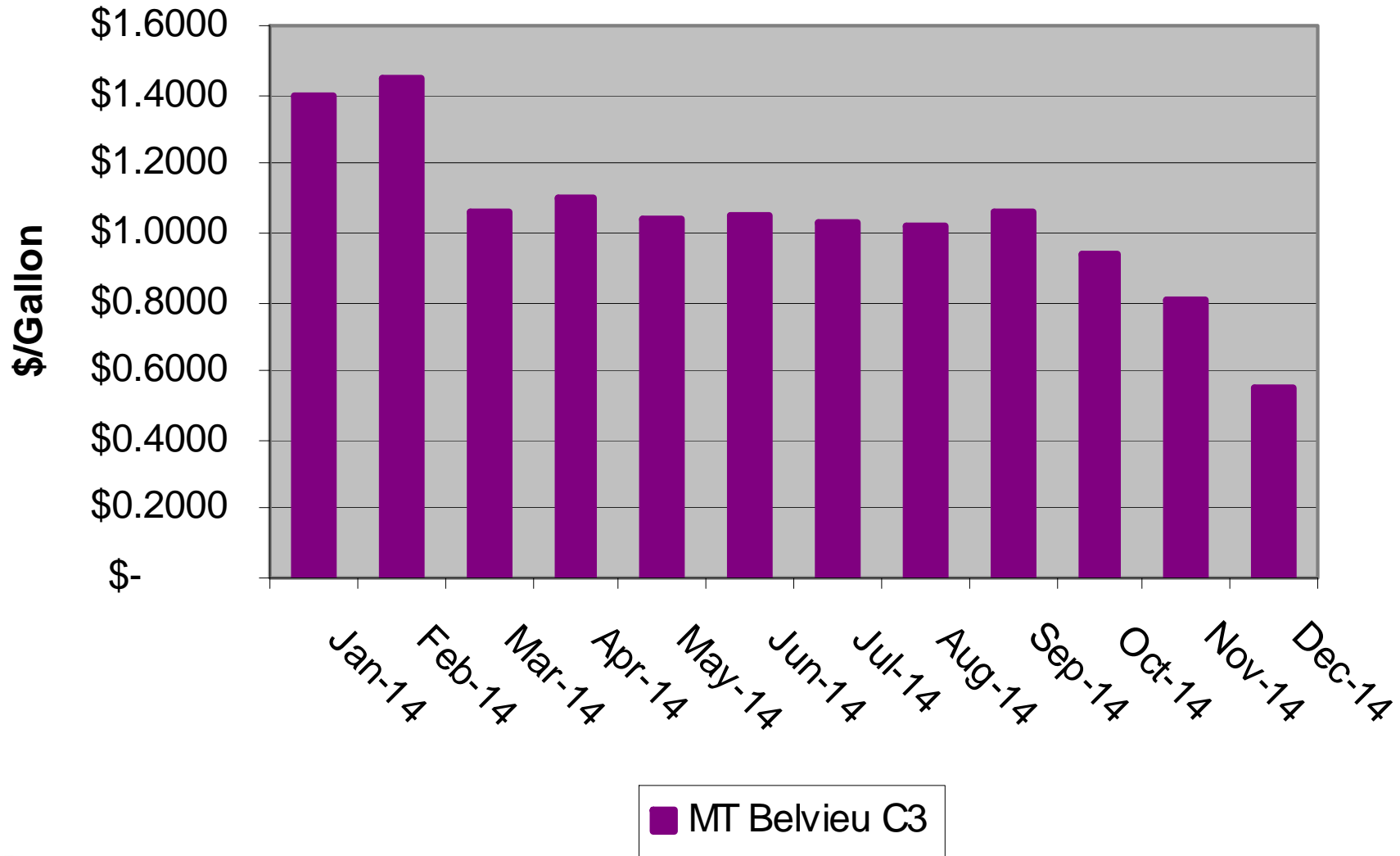
# 2014 Ethane Prices



Source: 2014 Mont Belvieu NGL prices

**Mercator Energy**

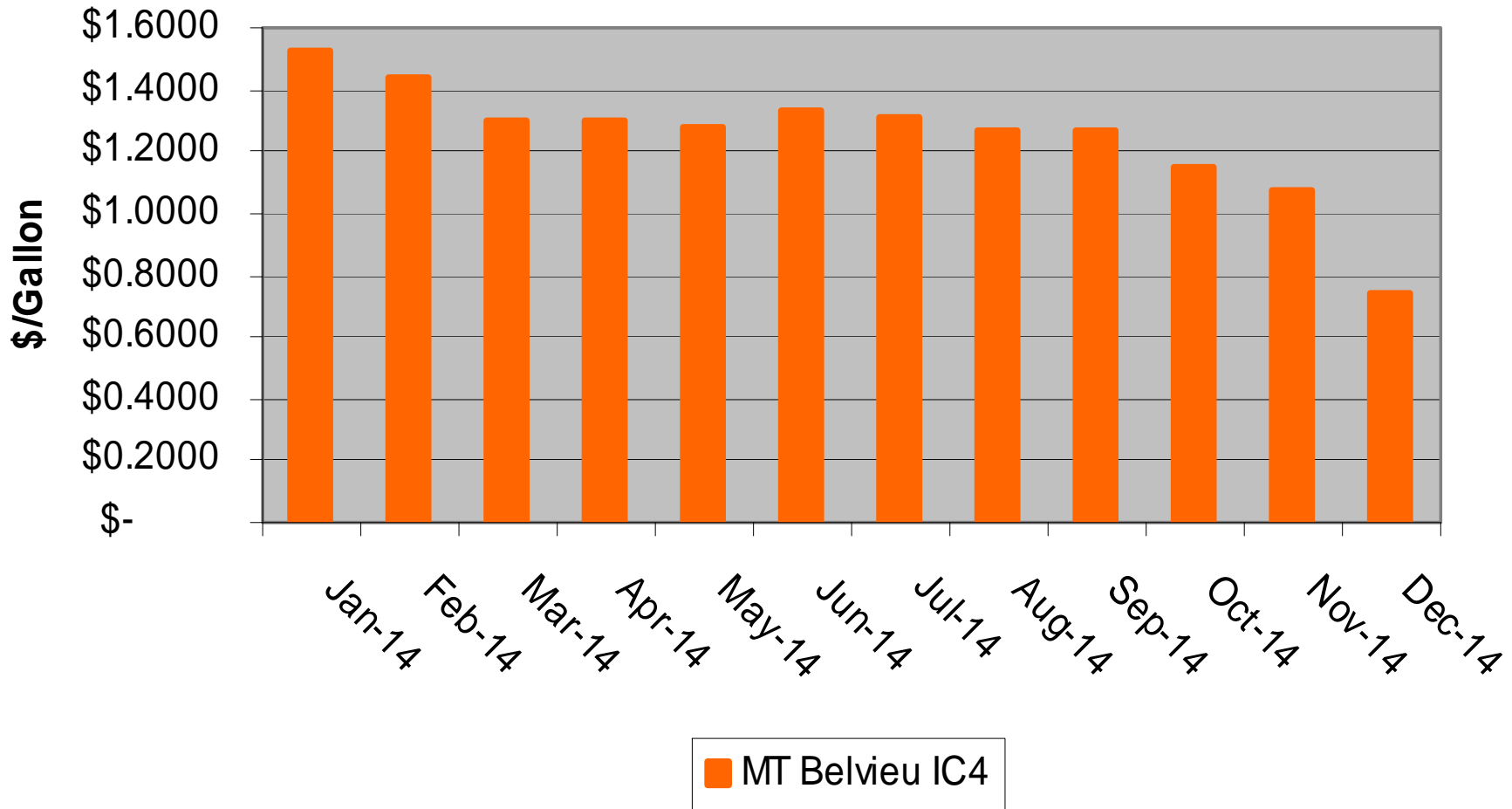
# 2014 Propane Prices



Source: 2014 Mont Belvieu NGL prices



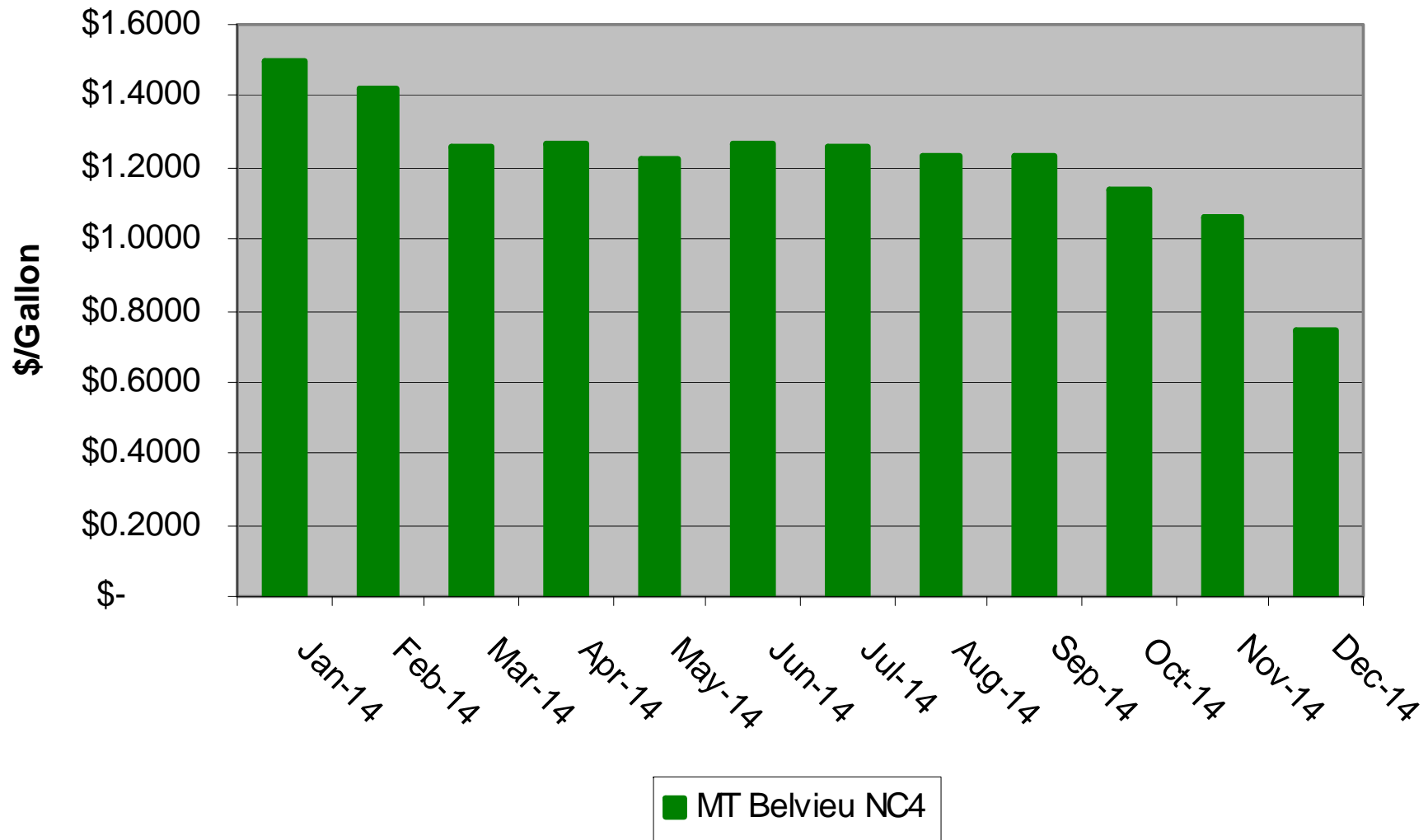
# 2014 Isobutane Prices



Source: 2014 Mont Belvieu NGL prices

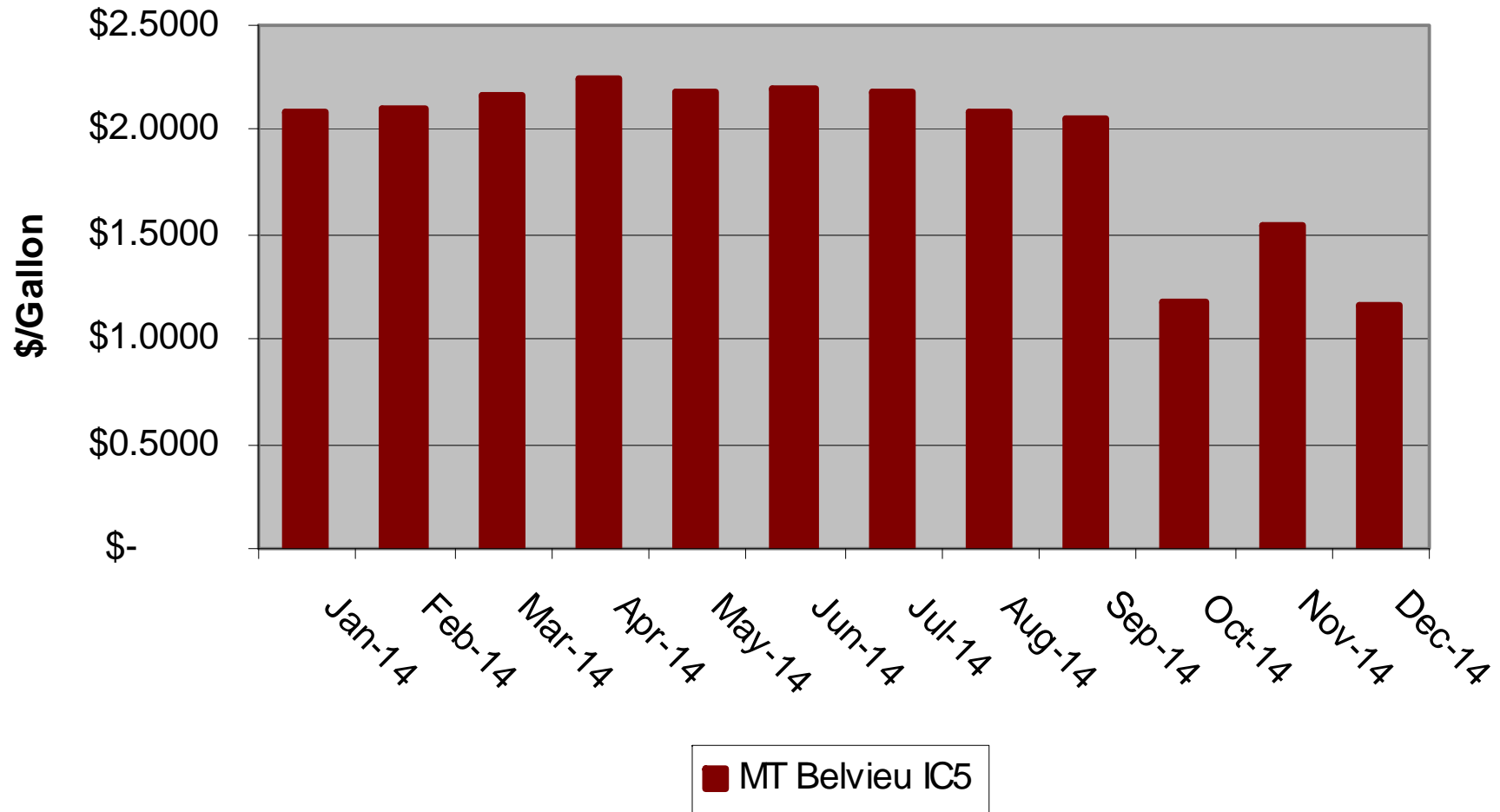
Mercator Energy

# 2014 Butane Prices



Source: 2014 Mont Belvieu NGL prices

# 2014 Iso-pentane Prices

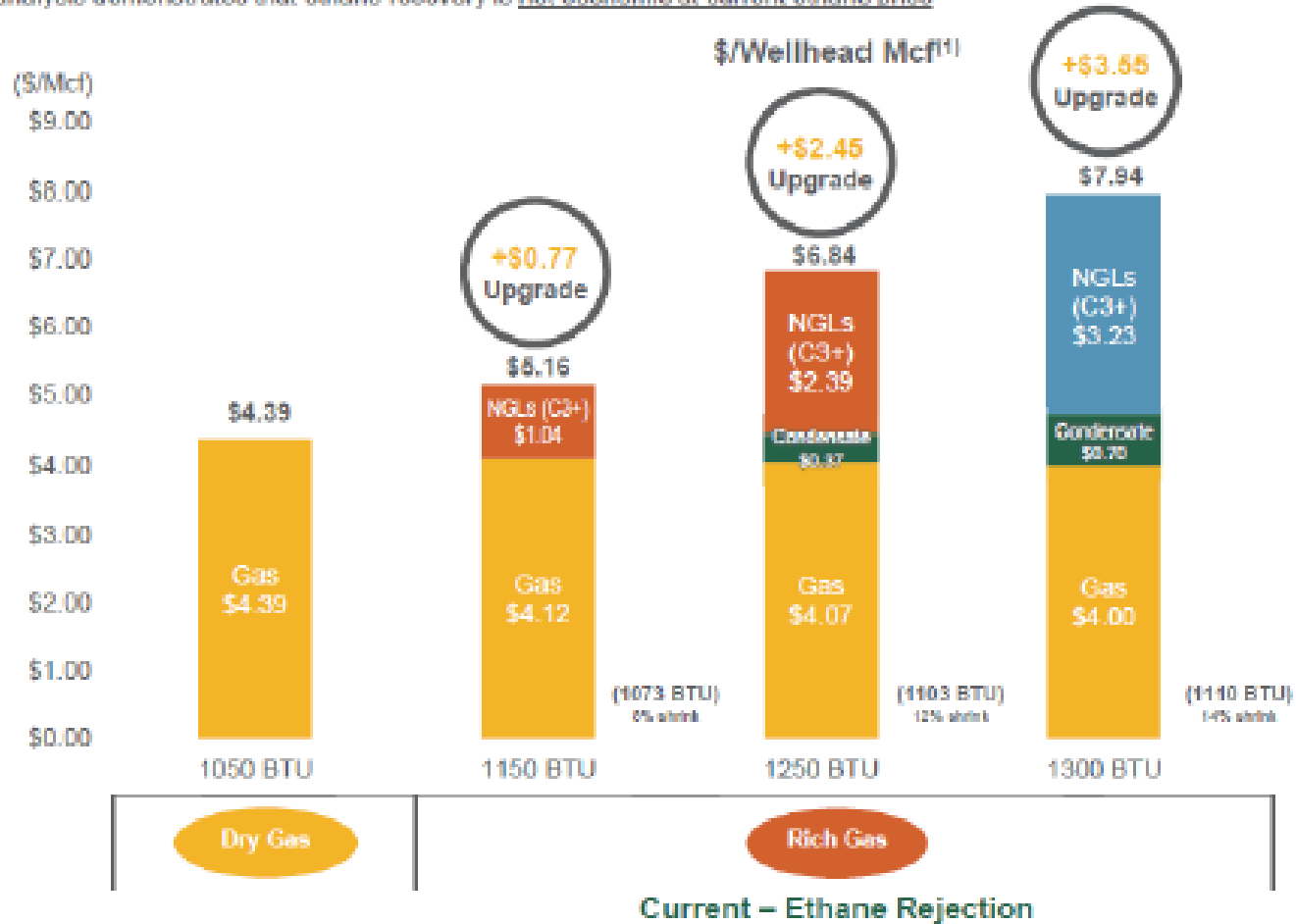


Source: 2014 Mont Belvieu NGL prices

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# Economics Driven by Liquid Content

- Marcellus Shale rich gas and highly-rich gas acreage provides a significant advantage in well economics – assuming \$4.25/MMBtu NYMEX, \$90.00/Bbl WTI and current spot NGL pricing correlation
- Upgrade analysis demonstrates that ethane recovery is not economic at current ethane price



Source: Kentucky Natural Gas & NGL Pricing, Mark Jergens, Midwest Energy Logistics



# Will Plunging Oil Prices Kill This High-Yield Retirement Investment?



Source: The Motley Fool, Adam Galas, December 11, 2014

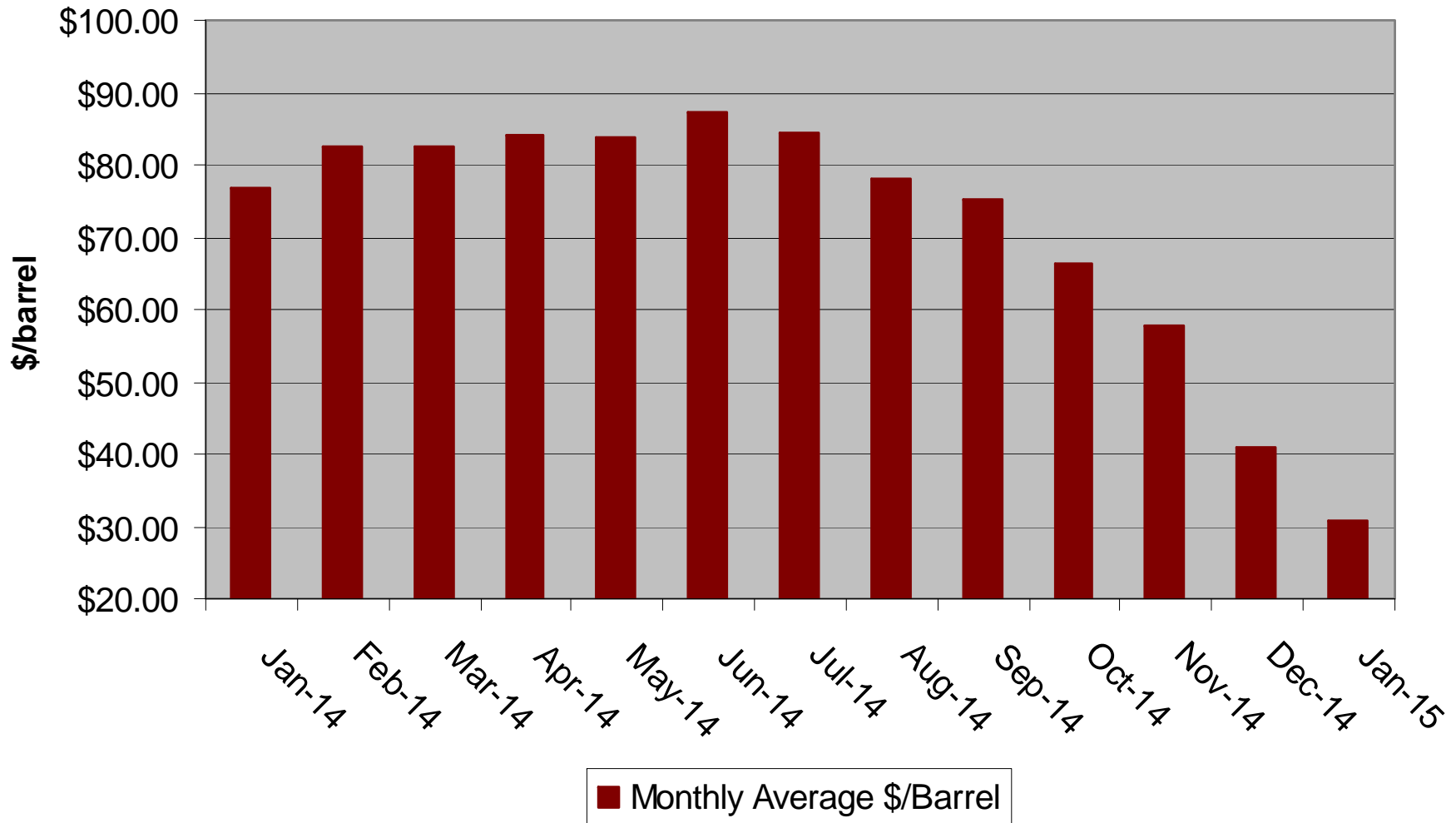
# Wyoming Crude Oil Pricing Comparison

	August 1, 2014 (price per barrel)	February 9, 2015 (price per barrel)
Asphalt Sour	\$68.50	\$29.00
General Sour	\$69.50	\$30.00
Heavy Sour	\$74.34	\$34.80
Medium Sour	\$75.59	\$36.05
Southwest	\$85.88	\$42.86
Sweet (Other)	\$82.88	\$40.86



Source: Shell Energy Connect, Shell Trading (US) Company posted prices

# Uinta Basin Black Wax



\* Daily price for January 16, 2015

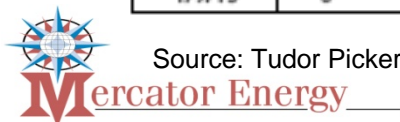
Source: Chevron Crude Oil Marketing, Chevron Posting

# Uinta Basin Rig Count

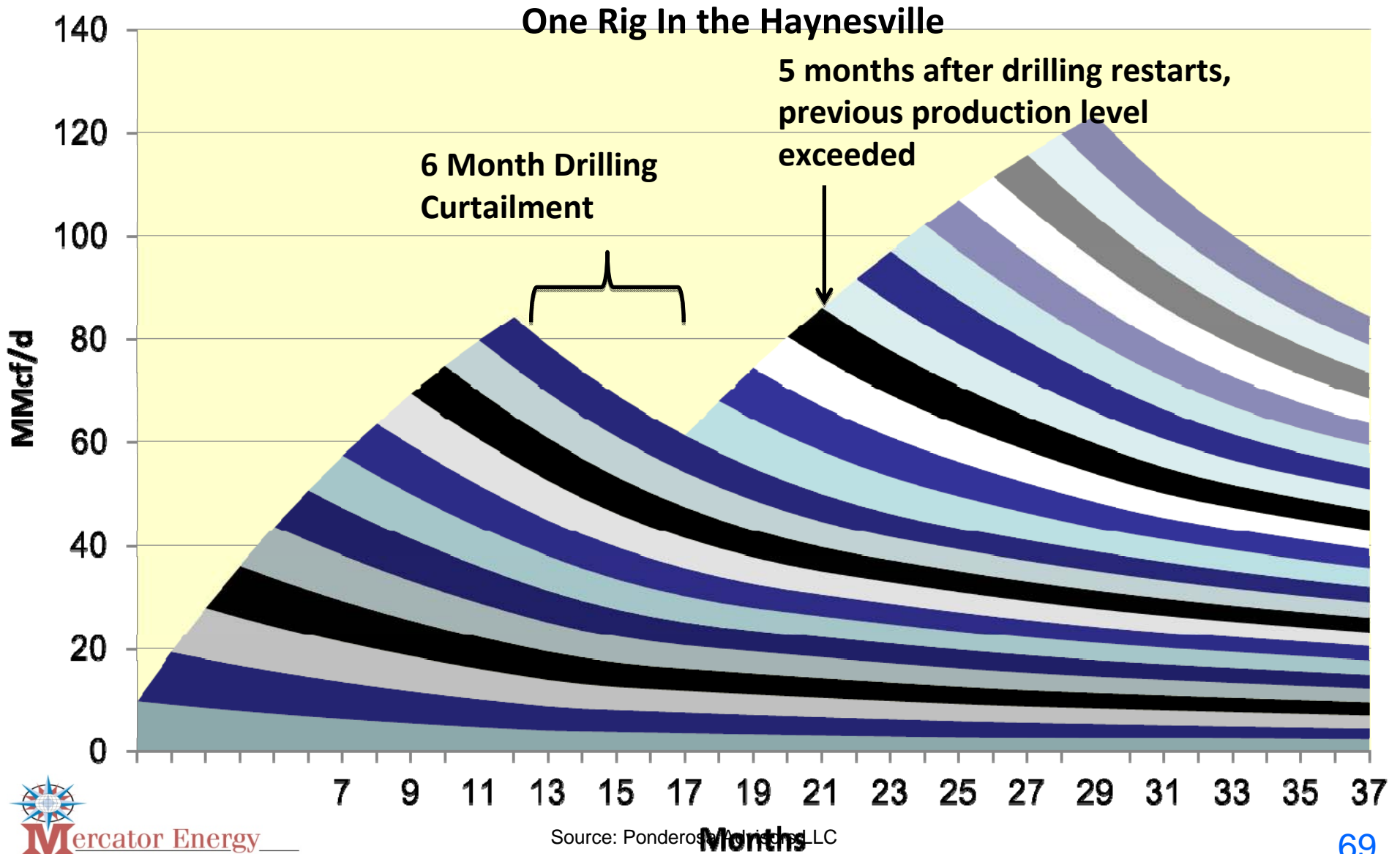
Lost 1/3 of rigs in the last 2 months – average 28 to 20

Date	APC	BBG	BRY	COP	DPTR	EPE	EOG	LINE	MDU	MPX	QEP	UPL	Others	Total Uinta Basin
Q1'08	8	3	0	1	2	0	8	1	0	4	7	0	10	43
Q2'08	7	2	0	1	3	0	9	2	1	6	6	0	13	50
Q3'08	7	4	0	1	2	0	8	1	0	7	7	0	17	56
Q4'08	7	4	0	2	1	0	7	0	0	7	4	0	17	49
Q1'09	5	1	0	1	0	0	6	0	1	4	0	0	7	25
Q2'09	4	2	0	1	0	0	3	0	0	3	0	0	3	16
Q3'09	4	0	0	1	0	0	2	0	0	3	0	0	5	15
Q4'09	5	1	0	1	0	0	0	0	1	4	1	0	5	17
Q1'10	5	2	0	1	0	0	2	1	0	4	1	0	8	24
Q2'10	7	2	0	1	0	0	2	2	0	5	1	0	7	27
Q3'10	9	3	0	1	0	0	2	1	0	4	2	0	6	27
Q4'10	9	4	0	1	0	0	1	1	0	5	2	0	6	28
Q1'11	7	5	0	1	0	0	1	1	0	6	1	0	6	27
Q2'11	7	6	0	1	0	0	1	1	0	6	0	0	6	28
Q3'11	7	6	0	1	0	0	1	2	0	6	0	0	7	29
Q4'11	8	4	0	1	0	0	1	2	0	5	1	0	6	28
Q1'12	8	4	0	1	0	0	1	2	1	9	2	0	7	35
Q2'12	9	4	0	1	0	0	1	3	1	10	3	0	6	38
Q3'12	6	5	0	1	0	0	0	4	1	10	3	0	8	38
Q4'12	4	4	0	1	0	2	0	3	1	7	4	0	6	32
Q1'13	4	6	0	1	0	2	0	3	1	8	3	0	4	31
Q2'13	4	5	0	1	0	3	0	2	1	10	2	0	7	35
Q3'13	4	3	0	1	0	2	0	2	1	10	2	0	6	31
Q4'13	5	1	0	1	0	4	0	3	1	10	1	0	5	31
Q1'14	5	2	0	1	0	4	0	3	2	9	1	0	3	28
Q2'14	4	2	0	1	0	3	0	3	2	7	1	1	5	30
Q3'14	1	2	0	0	0	3	0	3	1	5	1	1	7	25
Q4'14	1	3	0	1	0	3	0	1	1	8	1	1	8	27
Q1'15	1	2	0	1	0	4	0	1	0	6	1	1	4	20
4 Wks Ago	1	2	0	0	0	3	0	1	0	7	1	0	7	22
Prior Wk	1	2	0	1	0	4	0	0	0	6	1	1	4	20
1/9/15	0	2	0	1	0	4	0	1	0	6	1	1	4	20

Source: Tudor Pickering Holt & Co.



# The “Ferrari” Affect Substantially Reduces The Likelihood Of Price Spikes



# Winners

- Consumer growth; consumer spending
- U.S. nitrogen fertilizer industry
- Steel producers
- Refiners
- Chemical producers
- Aluminum smelters
- Natural gas fired electric generators
- Promoters of an increase in the Federal/State gasoline tax

# Losers

- U.S. Energy Security
- State and local governments in oil & gas producing states
- Oil & gas E&P's
- Oil & gas employment
- Oil & gas service companies
- LNG exporters
- MLP's
- Retirement funds
- Renewable energy sector – cheap energy will destroy the “Green Revolution”
- Russia, Iran, Venezuela



# Conclusions

- Crude and NGL prices won't recover for at least 2 years
- U.S. crude, NGL & natural gas production won't decline as quickly as OPEC expects
- U.S. producers will allocate capital to their highest IRR projects
- Low NGL prices create a problem for MLP's
- U.S. "short cycle" drilling (dependent on near term quarter cash flow) will result in U.S. drillers feeling most of the pain
- The "recovery time" will exceed any hedge terms
- The supply response will eventually materialize but it will take longer than expected

# Citations for Report

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

Energy Information Administration (EIA)  
Bentek Energy, Jack Weixel  
Ponderosa Advisors LLC  
Office of Energy Projects  
Bloomberg  
U.S. Department of Energy  
Raymond James and Associates, Inc.  
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Platts Inside FERC Gas Market Report, A McGraw Hill Publication  
American Enterprise Institute  
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LNG World News  
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King & Spalding  
Midwest Energy Logistics, LLC  
National Energy Board  
NERA Economic Consulting  
LNG Business Review  
Colorado Interstate Gas, George Wayne  
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