Outlook for Crude Oil and Natural Gas Prices

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Today's Headlines

- U.S. Geological Survey Finds More Untapped Oil in Part of Permian Basin
  - 10 years ago, in just one part of that sprawling oilfield, the U.S.G.S. identified 530 million barrels of oil that drillers could get their hands on.
  - Now, that number just for the Spraberry Formation is up to 4.2 billion barrels.

U.S. Shale Is Immune To An Oil Price Crash In 2017

- Since OPEC announced the production cut deal at the end of November, industry analysts have been warning that rising production from producers outside the deal—U.S. shale in particular—is effectively capping the oil price gains from that agreement.
- According to the EIA data, Lower 48 states' field production of crude oil has been growing each week since early December, right after OPEC said it would curb supply to try to balance the market and lift the price of oil.
- Despite the worries that cost inflation may slow down production growth, Rystad believes that completion activity is poised to surge for the rest of this year. At WTI price of US$50 per barrel, Lower 48 output is seen to be growing by an additional 390,000 bpd between May 2017 and December 2017.
- Even at $40 U.S. oil from shale will still grow says Rystad. At $30 production would only drop by 500,000 BPD.

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More headlines from today

- U.S. Shale Oil Production to Rise to 122,000 Barrels Per Day in June
- Oil drops on rising US crude inventory, defies expected supply cut extension
- The drillers of West Texas are ready to undermine any OPEC, Russia deal to boost oil prices

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U.S. SHALE ENERGY REVOLUTION

A Paradigm Shift

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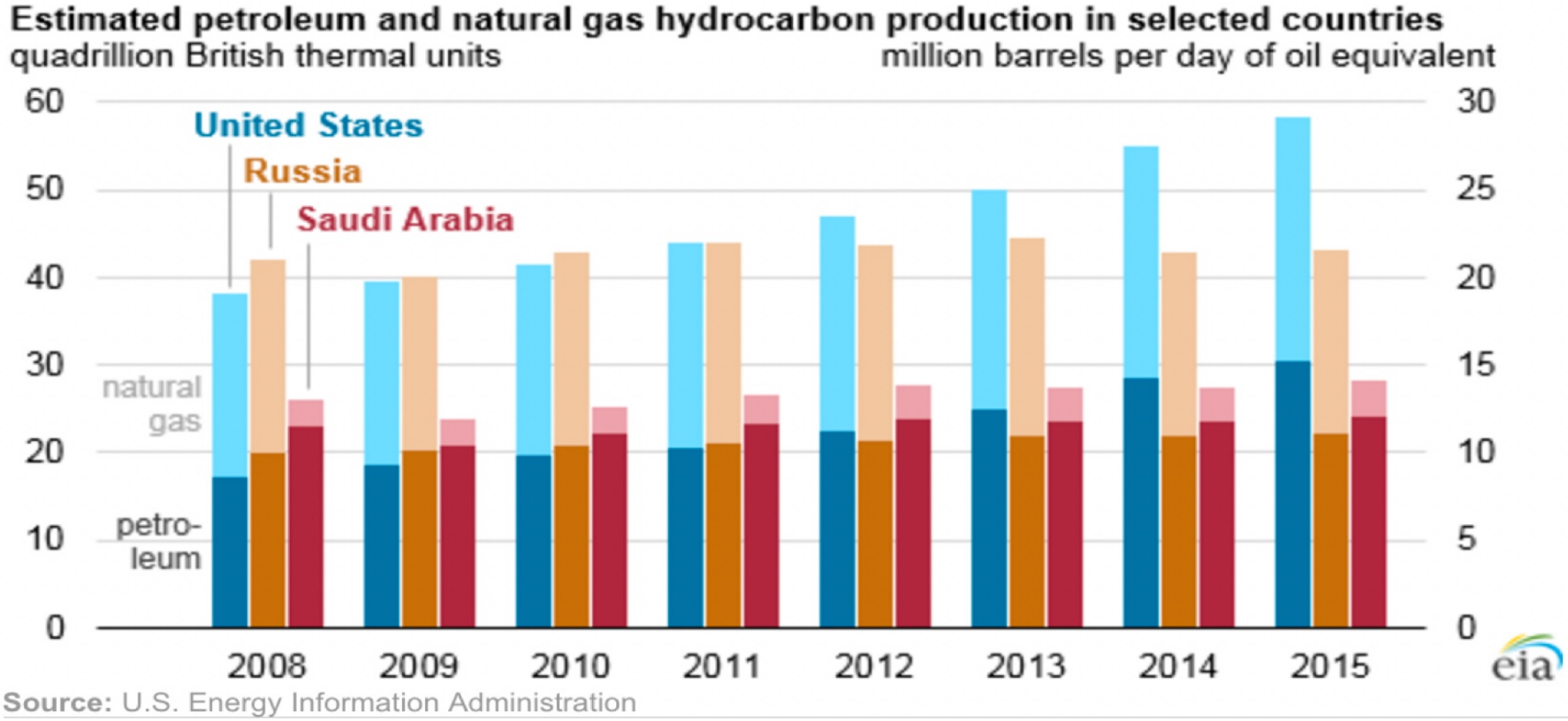
U.S. is the largest producer of petroleum and natural gas in the world



Source: U.S. Energy Information Administration

Note: Petroleum production includes several different types of liquid fuels, including crude oil and lease condensate, tight oil, extra-heavy oil, and bitumen.

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Latest EIA Data

- The EIA's April Short-Term Energy Outlook report estimates that US crude oil production will average 9,220,000 bpd in 2017, which is 0.1% higher than the previous estimates.
- EIA also estimates that U. S. production will average 9,900,000 bpd in 2018, which is 1.8% higher than the previous estimates.
- US production will likely hit a 48-year high in 2018.
- US production increases are due to:
  - technological advances that are leading to a rise in U.S. drilling activity even at lower crude oil prices
  - higher higher crude oil prices in 2017compared to 2016
  - Implementation of President Trump's proposed energy policies

May 11 OPEC Report

- The OPEC report estimates that crude oil production from non-OPEC nations will increase by 950,000 barrels per day during 2017.
- This is a huge increase from last month's estimate of a non-OPEC rise of 580,000 during the year.

OPEC Report

- The report singles out U. S. shale producers as the main culprit for the lingering over-supply situation.
- U.S. oil production has risen by 800,000 barrels of oil per day since last October.
- U. S. added more than 250 drilling rigs and implemented higher drilling budgets for 2017.

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OPEC Report

- The report urges all non-OPEC nations to limit their own production: "*A large part of the excess supply overhang contained in floating storage has been reduced and the improvement in the world economy should help support oil demand. However,* ***continued rebalancing in the oil market by year-end will require the collective efforts of all oil producers to increase market stability****, not only for the benefit of the individual countries, but also for the general prosperity of the world economy.*"

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OPEC Does Not Understand Our Free Market System

- If OPEC is to continue to balance global supply and demand it will have to agree to even deeper cuts from its members who have already lost market share to U.S. producers who the report cites as the main culprits for the over-supply situation.
- Why do U.S. producers over-supply the market? Because of the free and competitive market. Every time oil prices tick up, U.S. producers use the futures market to hedge the price of future production and then increase drilling and production.
- Because of the shale revolution and the robust free energy market in the U.S., **2015 marked the year when the energy world changed from one of scarcity to abundance for hydrocarbons.**

The shale revolution has finally upended the predictions that the U. S. is running out of oil and gas--perhaps

1905- “The available supply of gasoline, as is well know, is quite limited, and it behooves farseeing men oil the motorcar industry to look for likely substitutes”- December 13, 1905 article in “The Horseless Age”

1920- “Our domestic production is not likely to exceed 450 million barrels annually. If by some chance we were able to actually do this, we would exhaust the remaining estimated 7 billion barrels left in the ground in 18 years.- David White, Chief Geologist, United States Geological Survey

1956- “Domestic production will peak between 1965 and 1970, and globally by 1995”- M. King Hubbert, 1956 American Petroleum Institute Annual Meeting, San Antonio, TX

1977- “The oil and natural gas that we rely on for 75 percent of our energy are simply running out. World oil production can probably keep going up for another 6 or 8 years. But sometime in the 1980’s, it can’t go up any more. Demand will overtake production. We have no choice about that.” Jimmy Carter, Energy Address to the Nation, April 18, 1977

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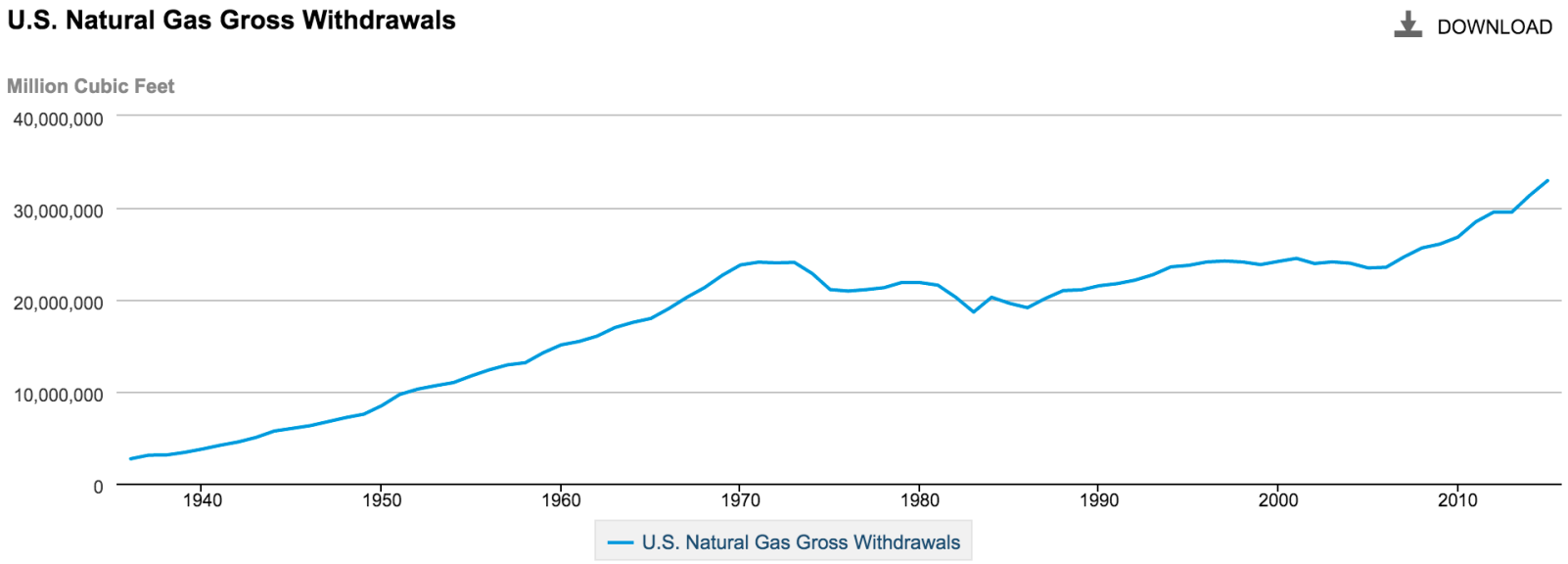
Natural Gas Production



eia Source: U.S. Energy Information Administration

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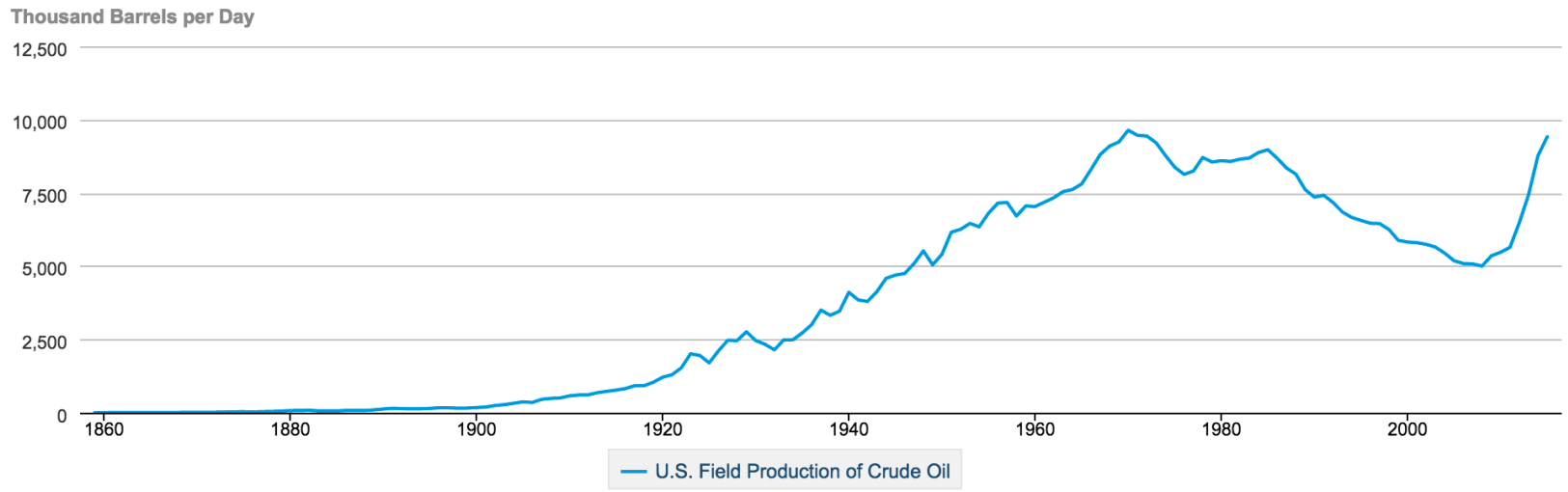
U.S. Crude Oil Production



eia Source: U.S. Energy Information Administration

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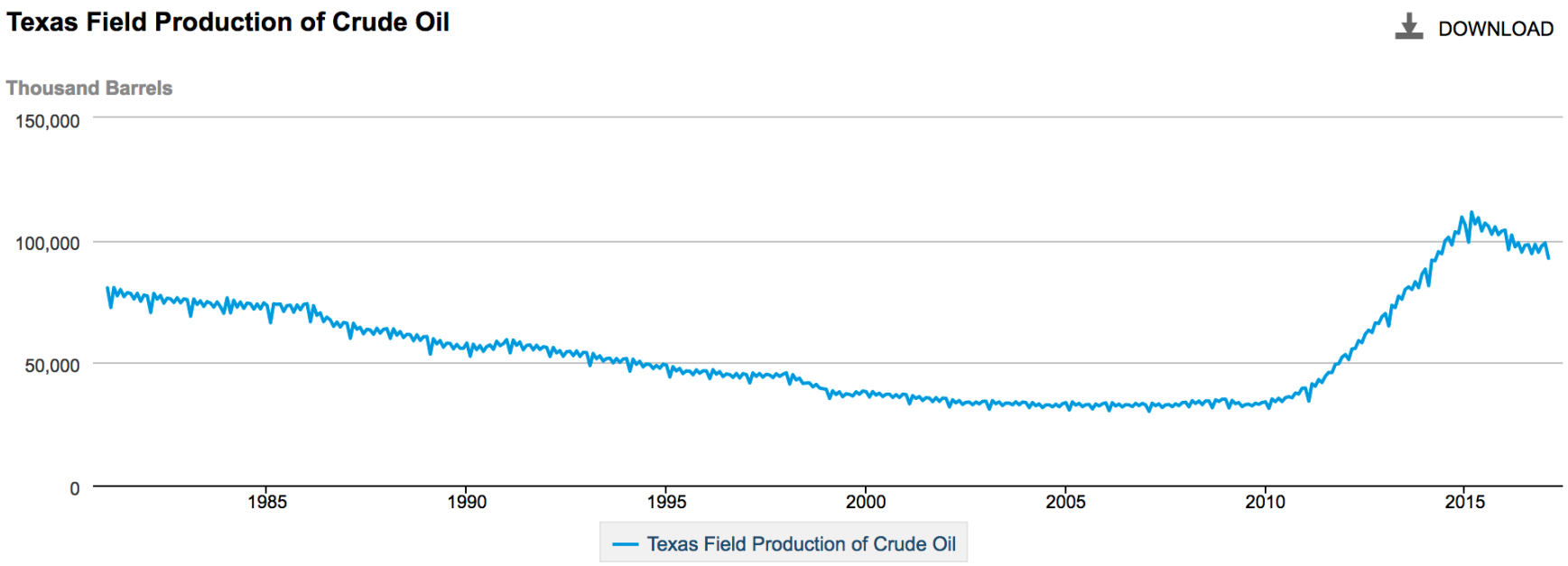
Texas Production of Crude Oil



eia Source: U.S. Energy Information Administration

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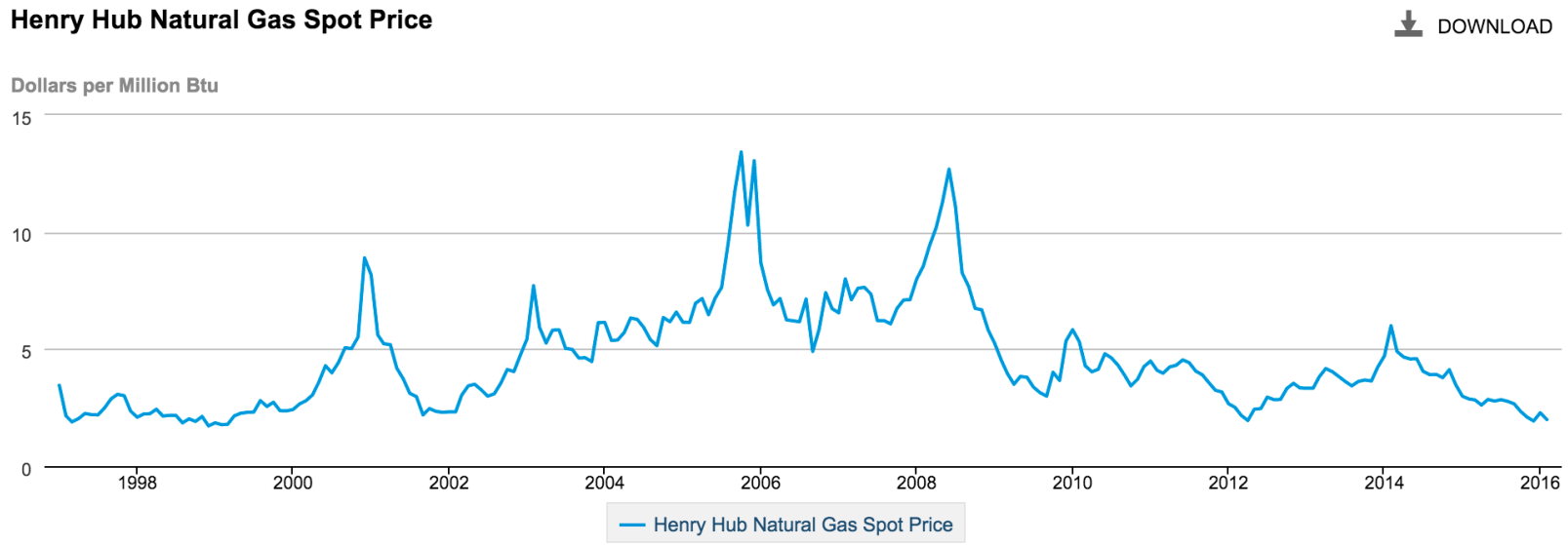
Natural Gas Prices



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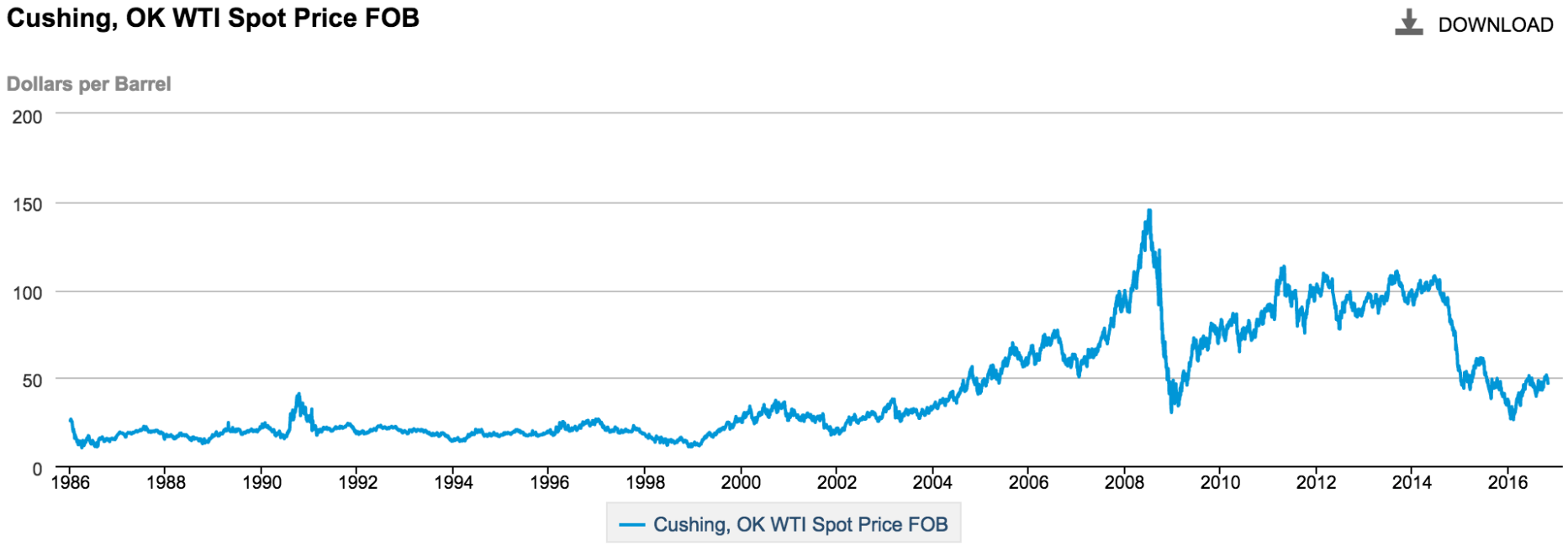
WTI Spot Price, Cushing



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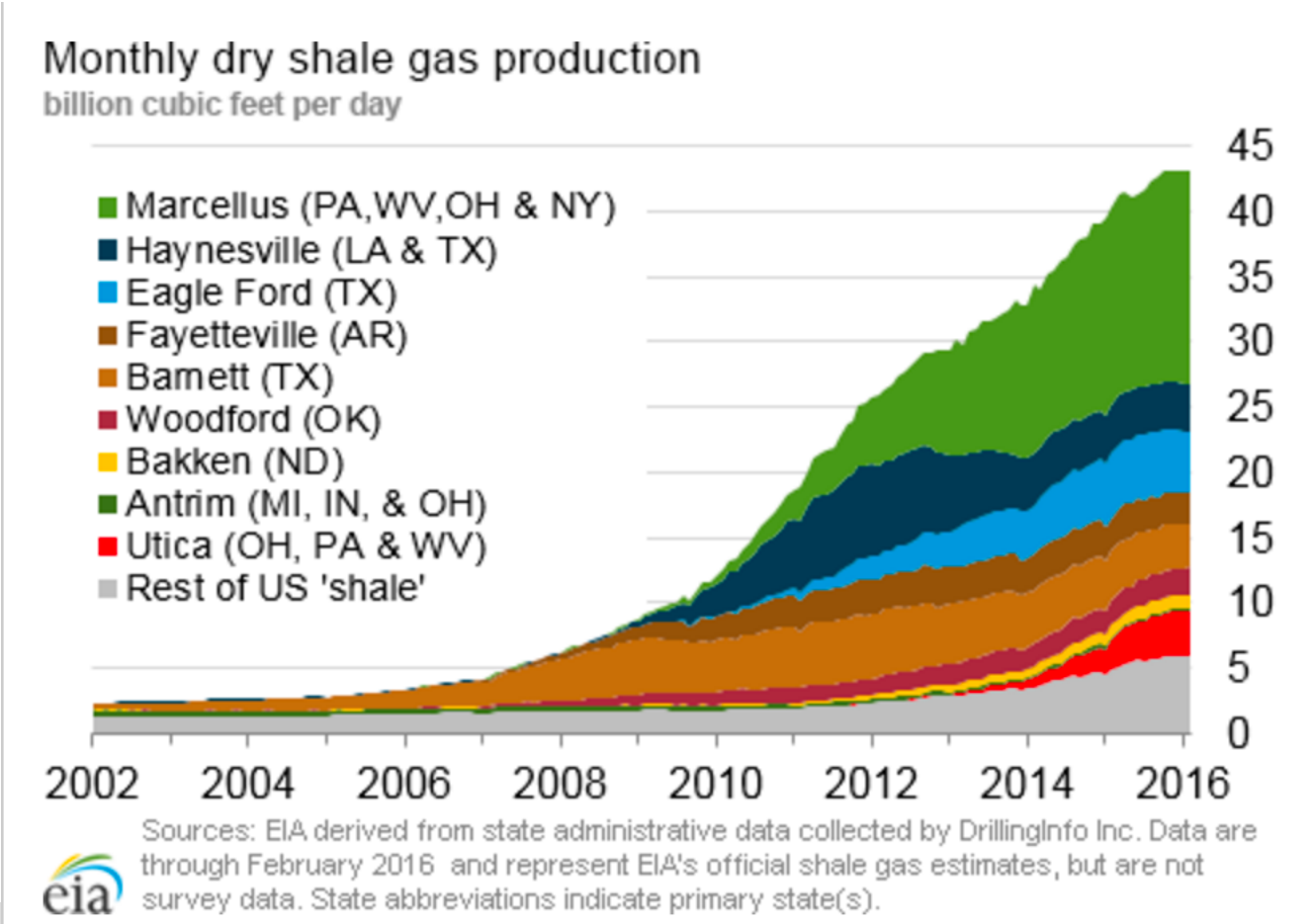
Over half of U.S. Natural Gas Natural is produced from Shales



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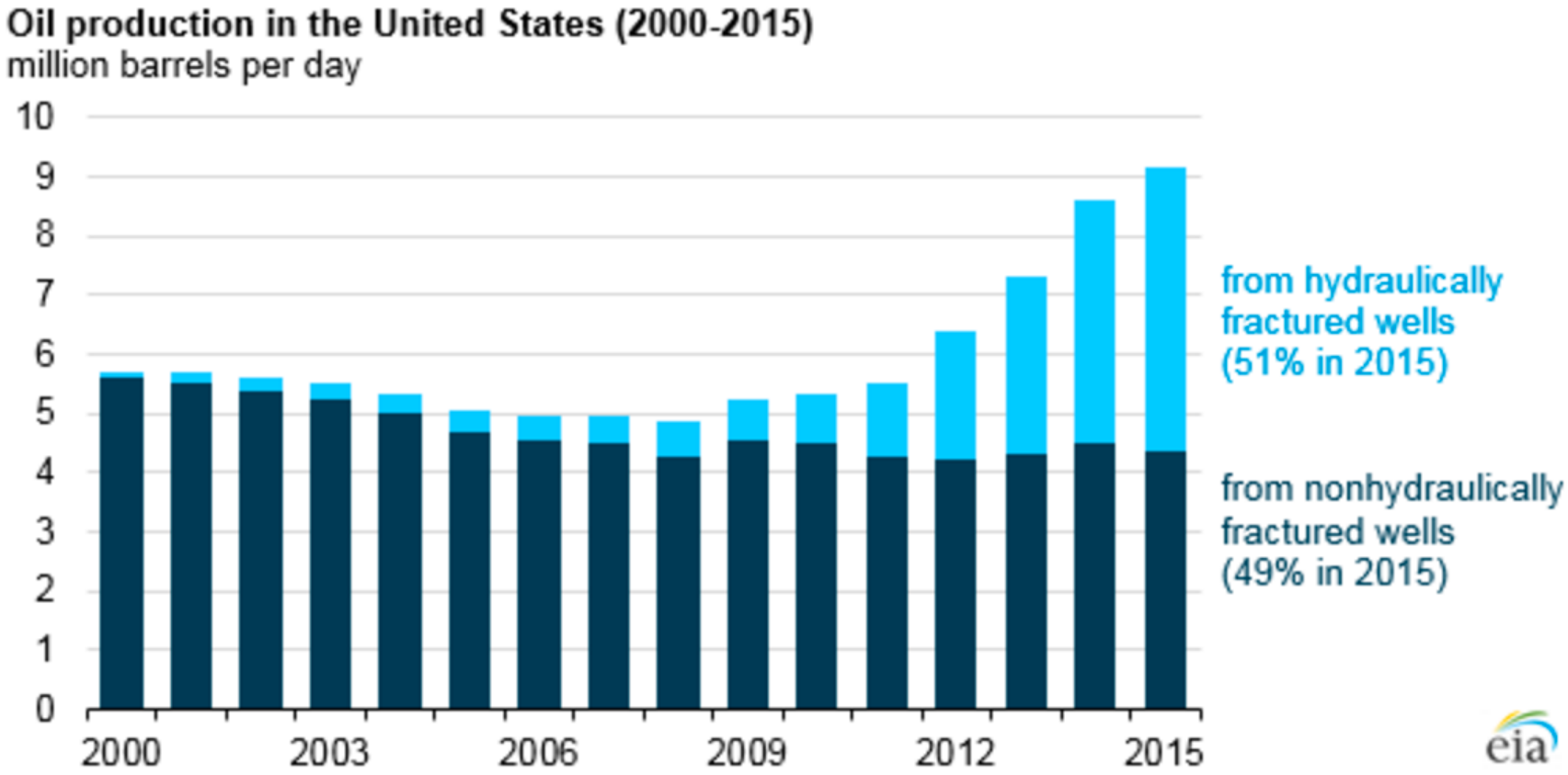
Over Half of U.S. Oil Production is from Hydraulic Fracturing



Source: U.S. Energy Information Administration, IHS Global Insight, and DrillingInfo

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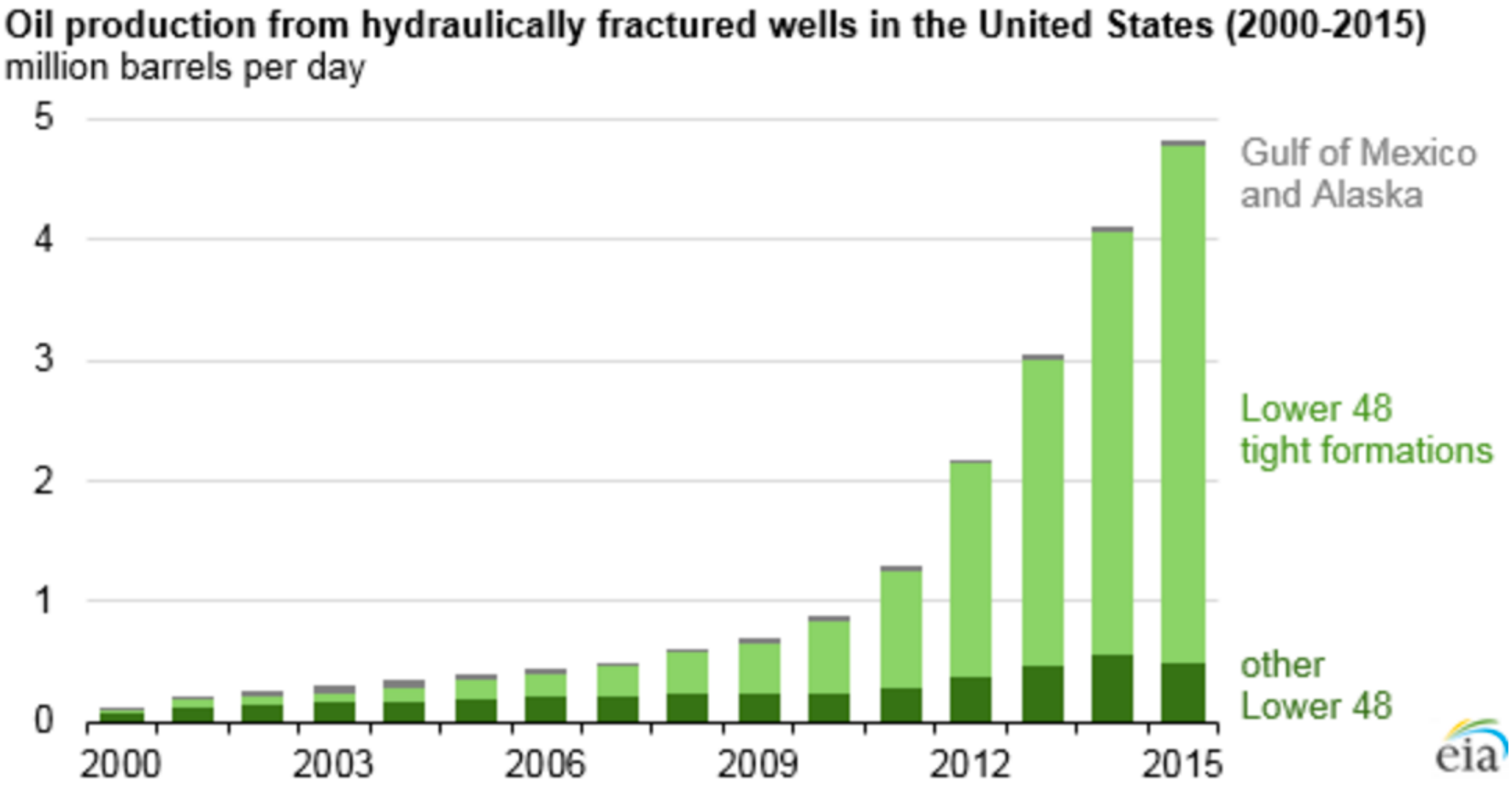
Hydraulically Fractured Wells



Source: U.S. Energy Information Administration, IHS Global Insight, and DrillingInfo

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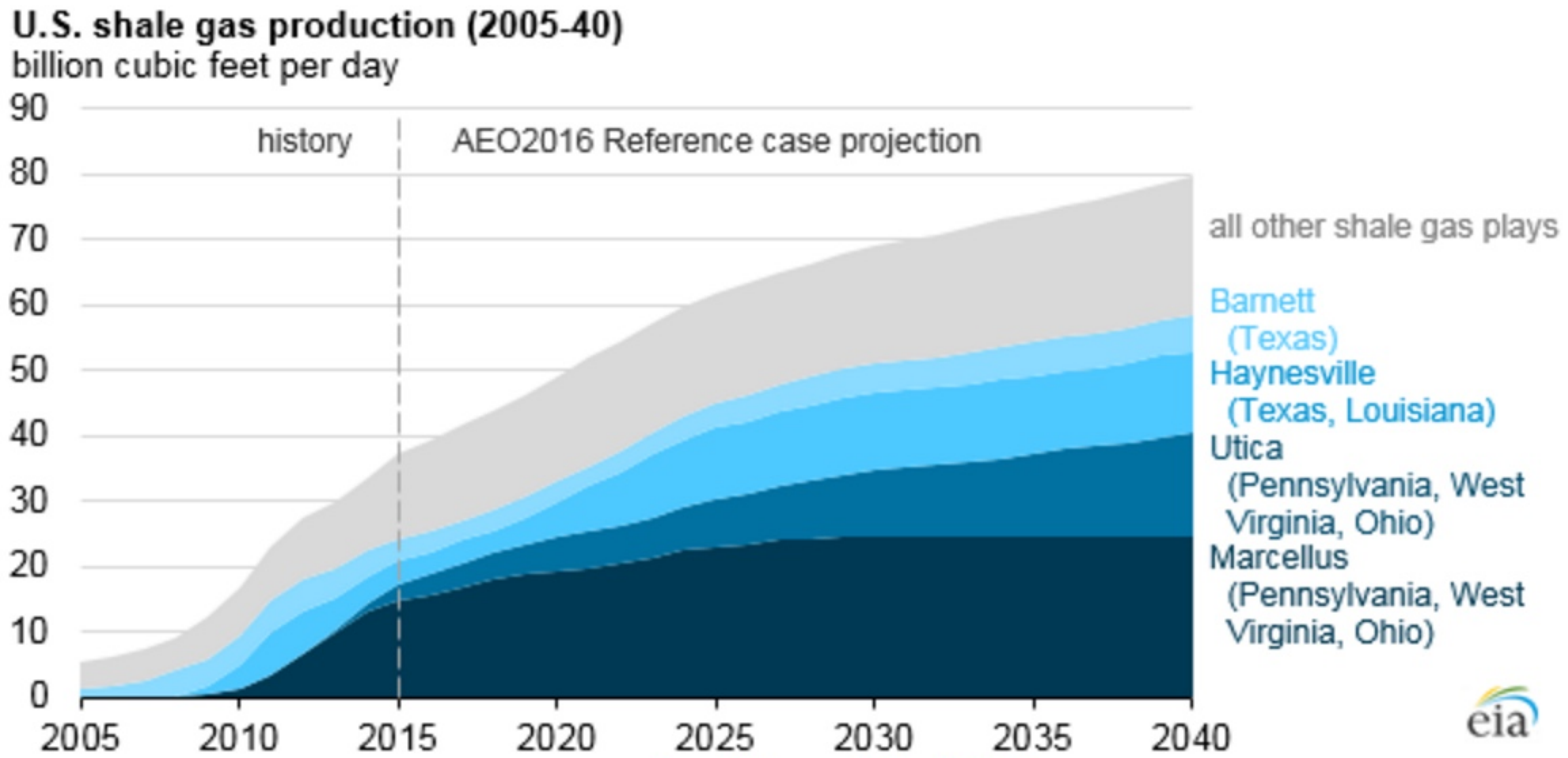
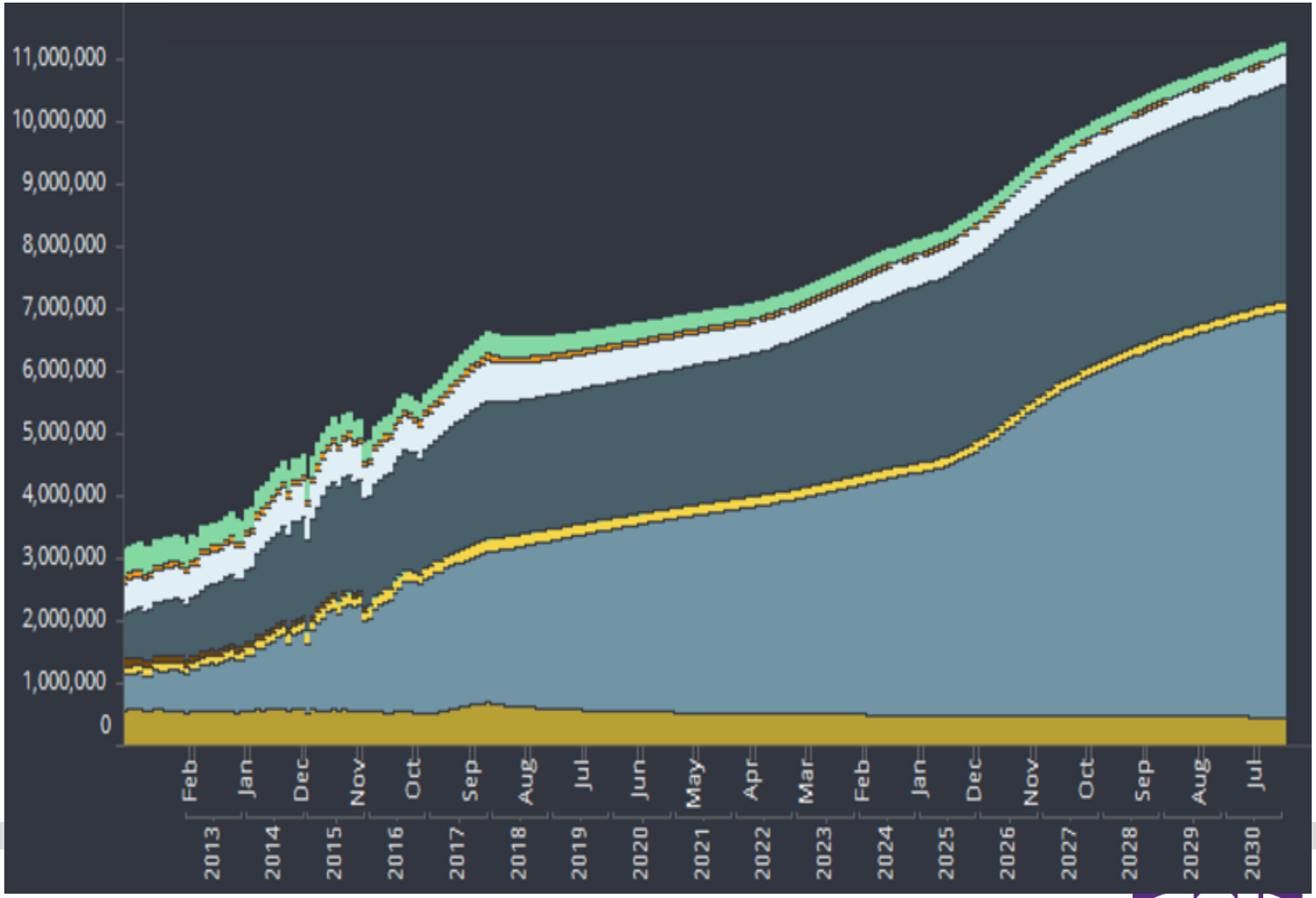
Outlook for Natural Gas Prices



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2016*

Permian Dry Gas Production Forecast (mcf/d)
$0 Gas with Forward Curve Oil



Gas still grows from 6Bcf/d in 2017 to 7Bcf/d by 2021

Source: Drilling Info

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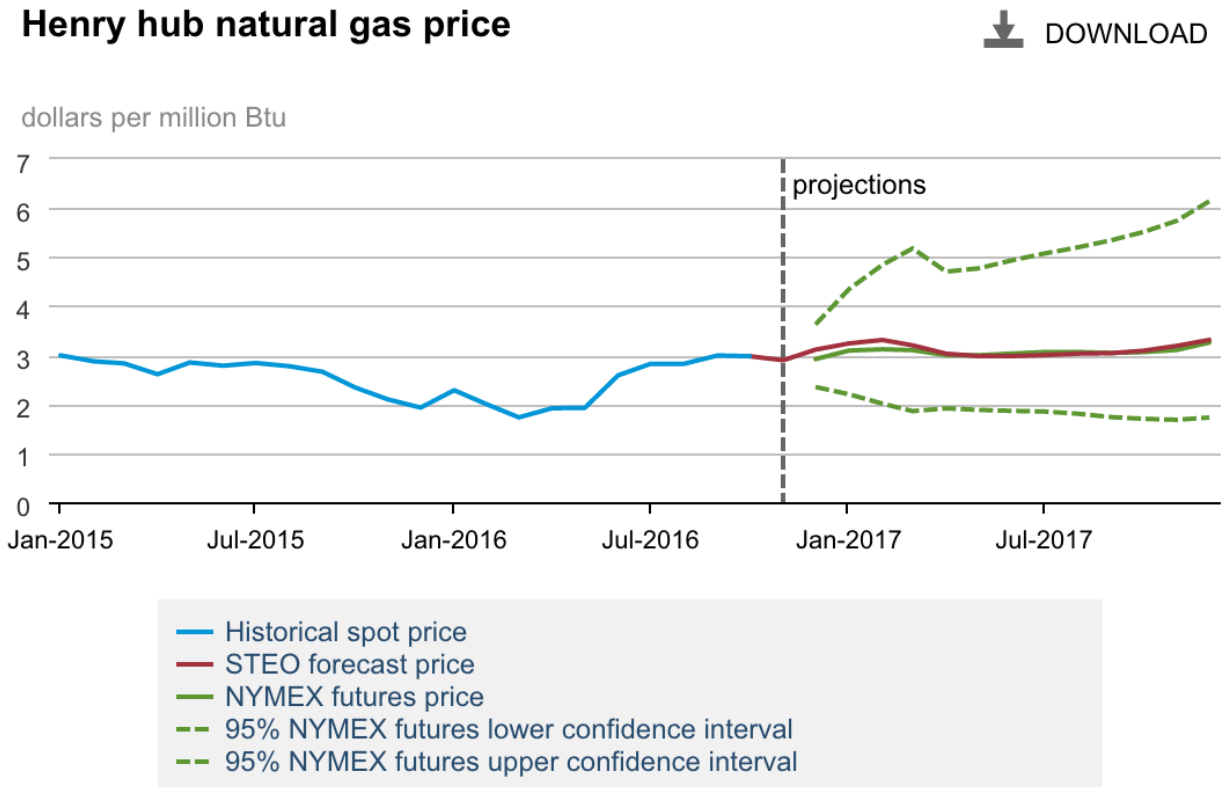
EIA Forecast of Natural Gas Prices



eia Source: Short-Term Energy Outlook, November 2016

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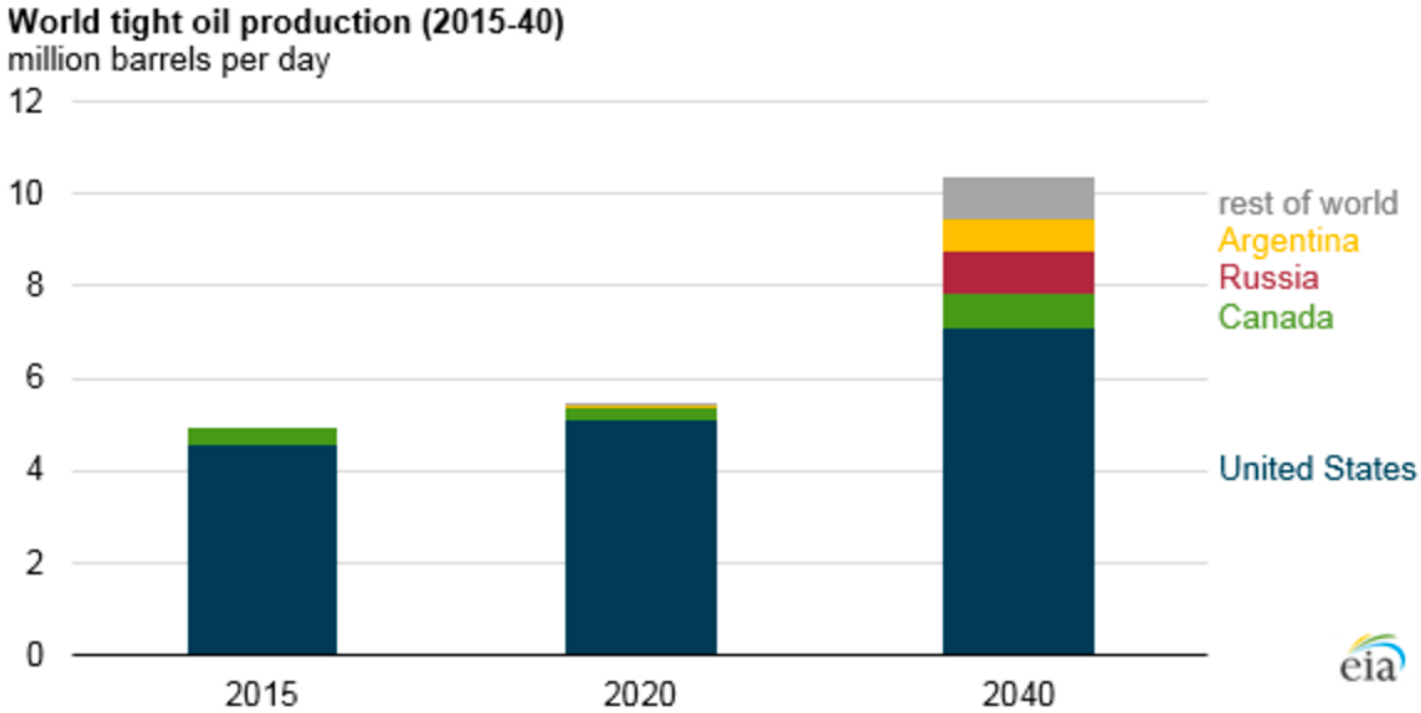
Outlook for natural gas prices

- Flat, mainly due to associated gas production, to trending upward due to
- Exports of LNG which has the potential to push up U. S. natural gas slightly.
- The positive impact of LNG exports was emphasized last week with the announcement of an agreement that allows China to enter into long-term agreements for U.S. LNG

Outlook for Crude Oil Prices

World tight oil production to more than double from 2015 to 2040



Source: U.S. Energy Information Administration, *International Energy Outlook 2016* and *Annual Energy Outlook 2016*

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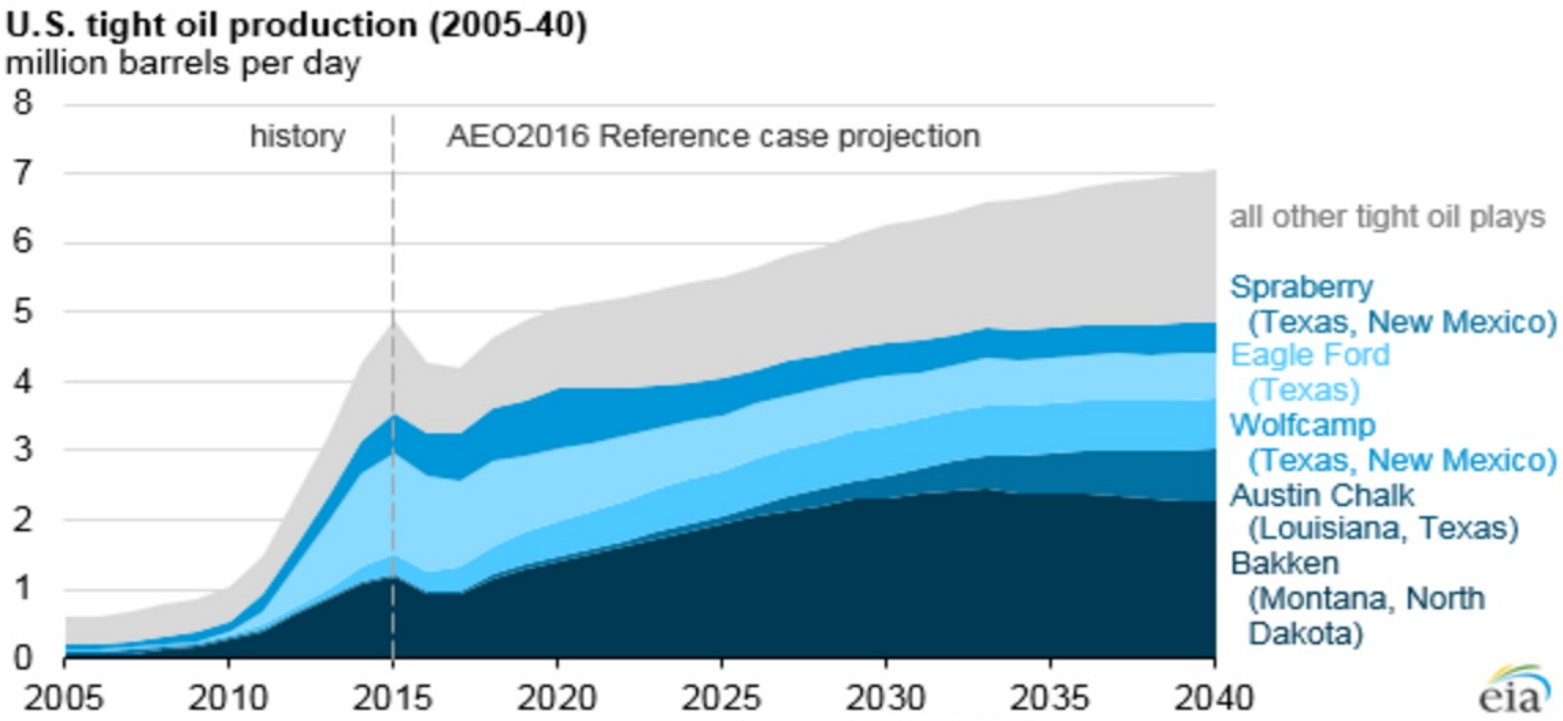
Future U.S. tight oil and shale gas production depends on resources, technology, markets



Source: U.S. Energy Information Administration, *Annual Energy Outlook 2016*

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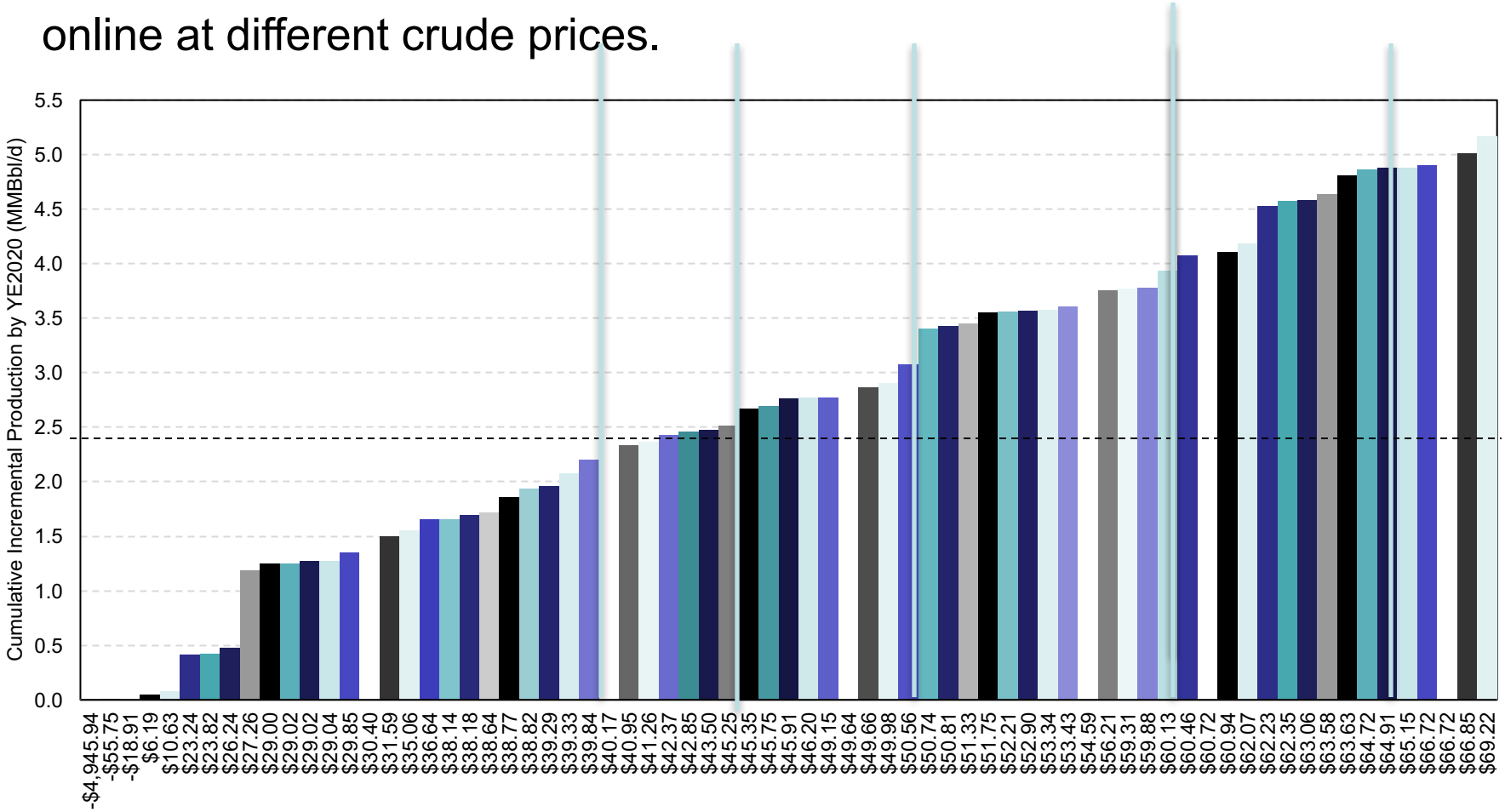
Tracking 200+ Break evens Across the Country: Necessary to Understand Production Potential

- Chart shows how much cumulative incremental production could come online at different crude prices.



Natural Decline from 9/2016-YE2020: 2,179,646 Bbl/d

drillinginfo
better, faster decisions

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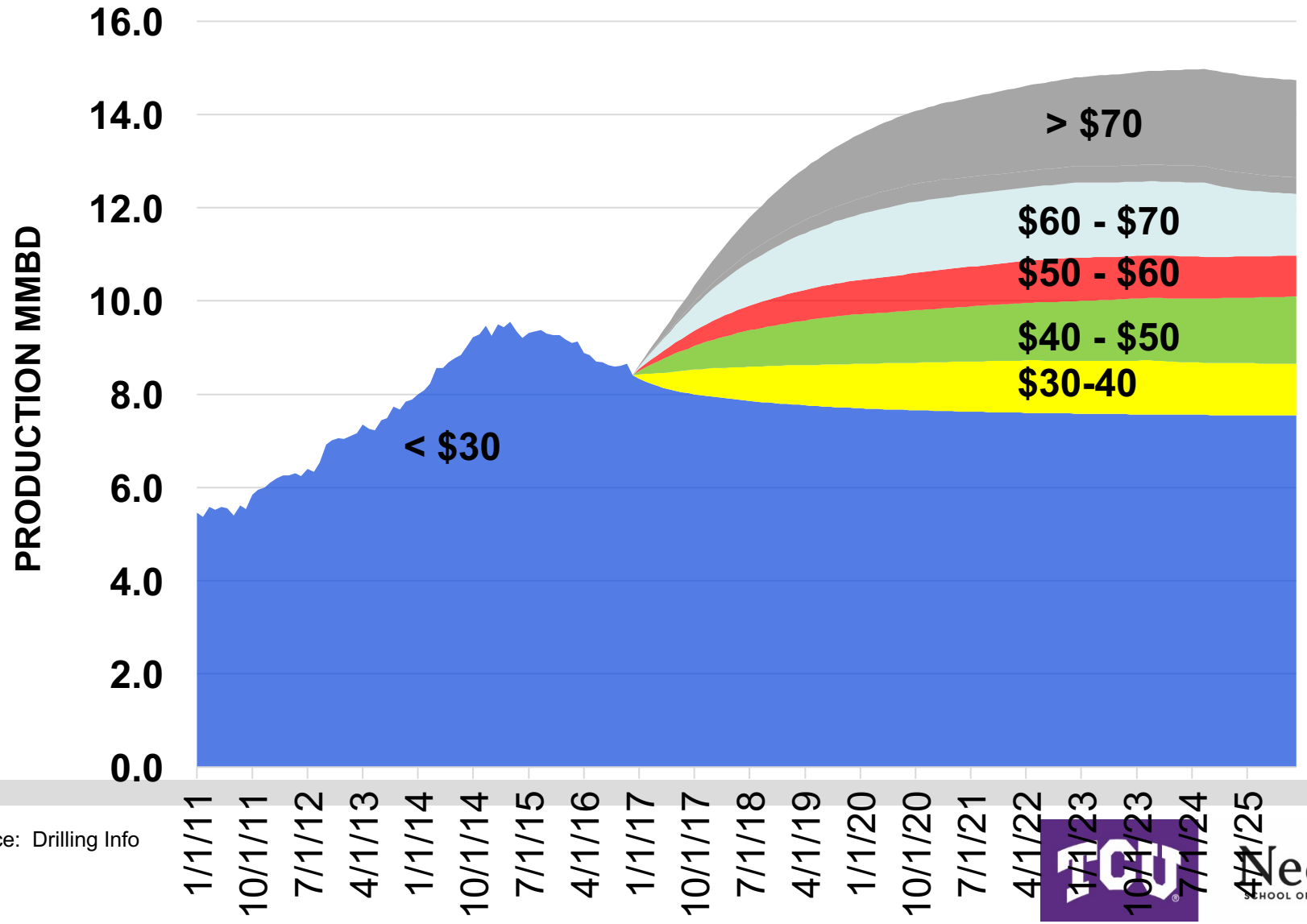
US Crude Production Increases When WTI Futures Above $45

(Assumes $3.50 N. Gas, and NO operational improvement from today)



Source: Drilling Info

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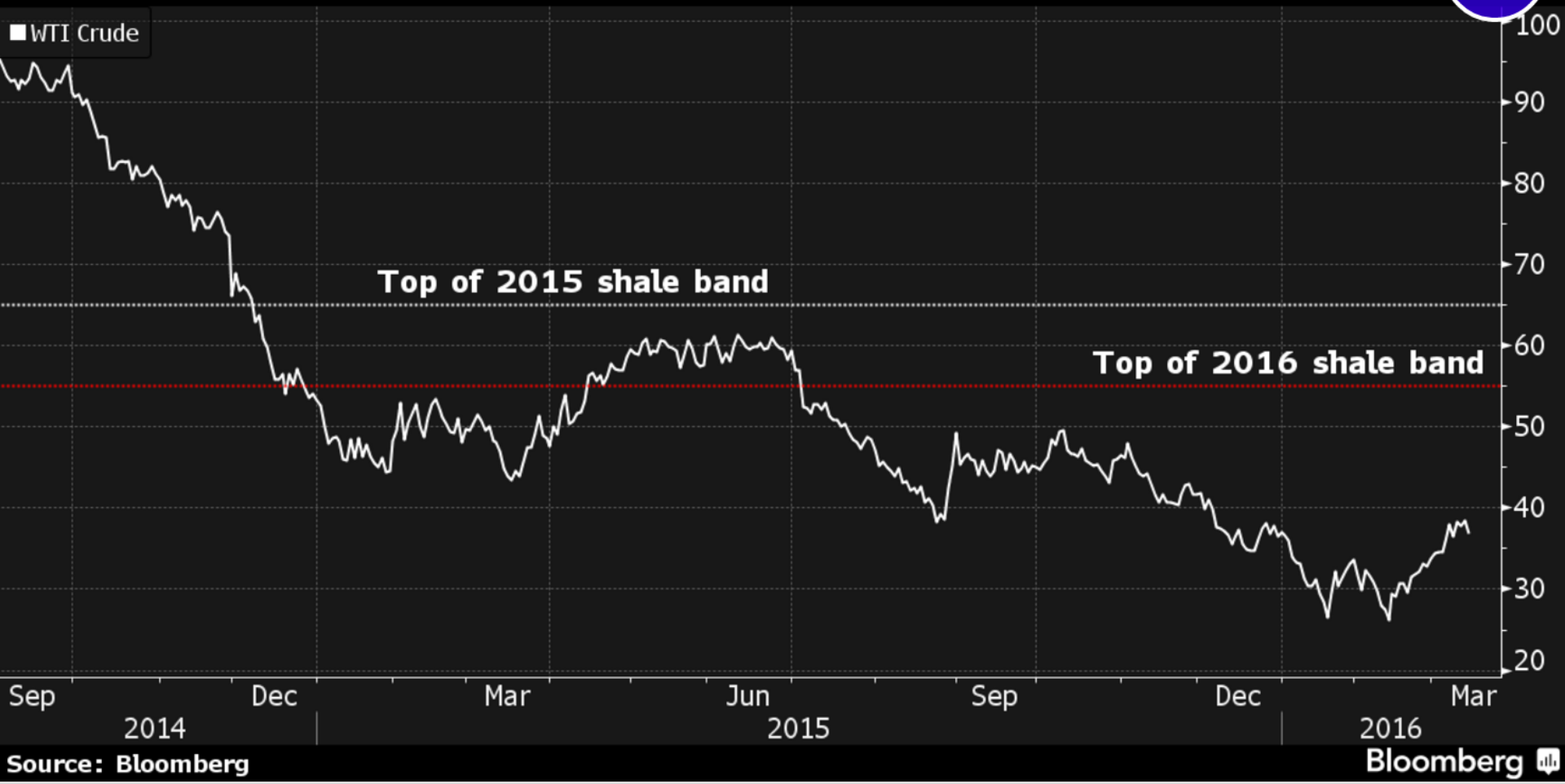
Top of the Oil Market?

Recovery faltered at $60 in 2015; ceiling may be lower this year



Source: Bloomberg

Bloomberg

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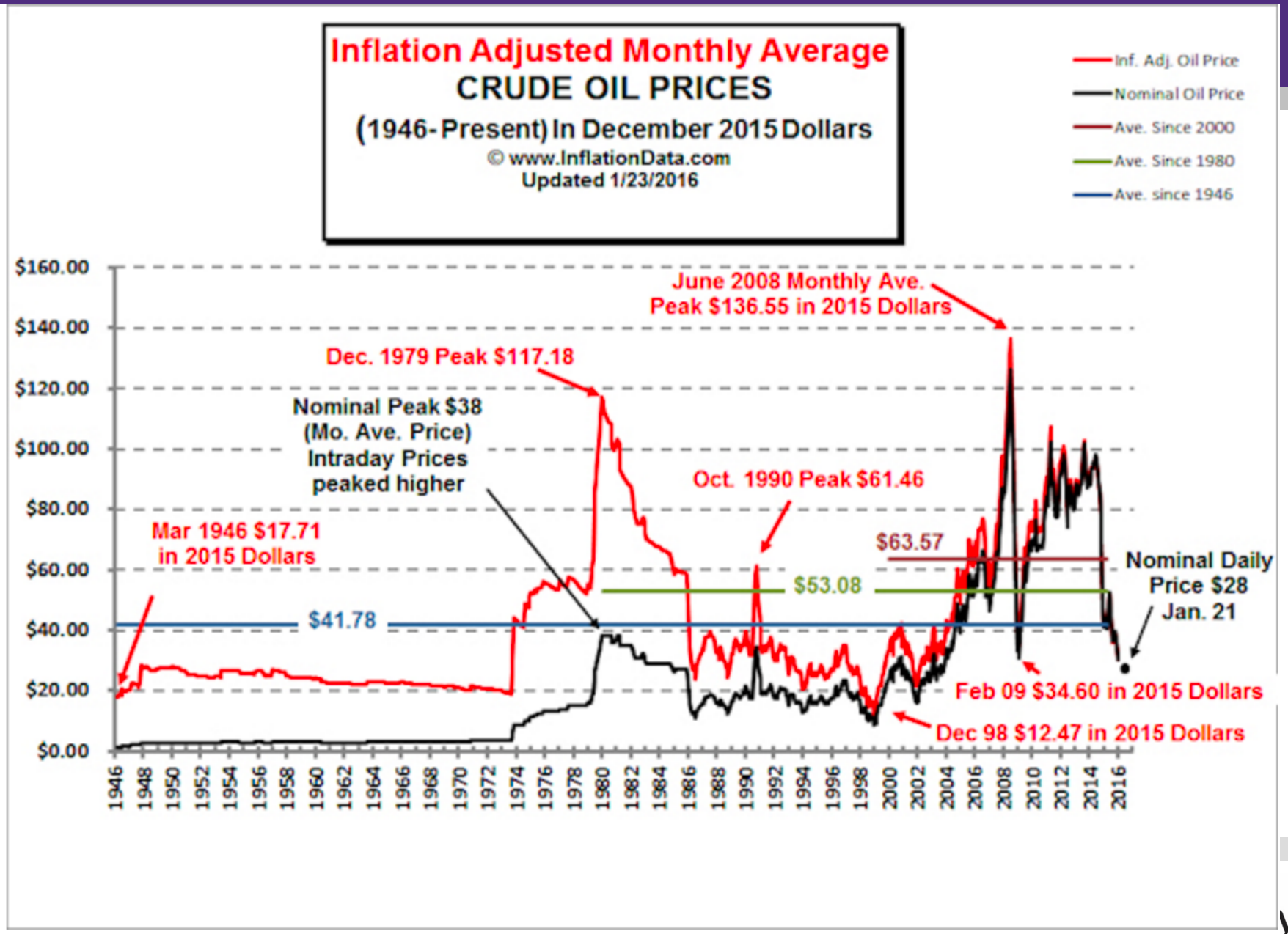
Inflation Adjusted Monthly Average
CRUDE OIL PRICES
(1946- Present) In December 2015 Dollars
© www.InflationData.com
Updated 1/23/2016
Inf. Adj. Oil Price
Nominal Oil Price
Ave. Since 2000
Ave. Since 1980
Ave. since 1946
June 2008 Monthly Ave.
Peak $136.55 in 2015 Dollars
Dec. 1979 Peak $117.18
Nominal Peak $38
(Mo. Ave. Price)
Intraday Prices
peaked higher
Oct. 1990 Peak $61.46
Mar 1946 $17.71
in 2015 Dollars
$63.57
$53.08
$41.78
Nominal Daily
Price $28
Jan. 21
Feb 09 $34.60 in 2015 Dollars
Dec 98 $12.47 in 2015 Dollars
$160.00
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Wall of Supply at $55/bbl due to DUCs

Drilled but uncompleted wells (DUC)
wells

Region	March 2017	April 2017	change
Bakken	809	821	12
Eagle Ford	1,283	1,315	32
Haynesville	176	193	17
Marcellus	664	666	2
Niobrara	644	648	4
Permian	1,869	1,995	126
Utica	89	83	(6)
Total	5,534	5,721	187

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Drilling costs have fallen

Basin	Cost in 2014	Cost in 2015
Bakken	$7.1m	$5.9m
Eagle Ford	$6.6m	$6.5m
Marcellus	$6.6m	$6.1m
Midland Basin	$7.7m	$7.2m
Delaware Basin	$6.6m	$5.2m

Source: EIA “Trends in Oil and Natural Gas Upstream Costs” based on a study by IHS Global, March 2016.

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Finding and Producing Costs are Falling

- Apache Alpine High: early economics indicate gas production breaks even near $2.50/Mcf and oil breaks even at $55/bbl.
- EOG says it can make money at $40
- Wood Mackinzie says costs in the Delaware Basin are below $40

Finding and producing costs will continue to decline as a result of the development of new technologies, the strategic capture of economies of scale, and the refinement of internal processes and big data.

U.S. tight oil is the marginal production

- U. S. oil producers have become the world's marginal producers.
- Marginal producers produce the extra barrels of oil when oil prices make it profitable.
- As in all markets, the market price of crude oil is set by the marginal producers, in this case tight oil producers in the U. S.
- U.S. producers, not OPEC, now set the world price for crude oil.

Crude Oil Price Outlook

- In 2015, we moved from a world of scarcity to a world of abundance of hydrocarbons thanks to the shale revolution.
- World wide demand for crude oil is growing at 1 to 2 million bpd annually.
- Therefore crude oil prices are likely to stay in the range of $40 to $60 per barrel, and likely in the tighter range of $45 to $55 per barrel, for the foreseeable future until demand starts to exert upward pressure on prices.

The Shale Energy Revolution

- The shale energy revolution has permanently increased the resource base of the United States and decreased the cost of energy thereby increasing the productive capacity of the United States.
- If onerous regulations on the oil and gas industry are reduced, there is no reason why the U.S. cannot be the world's largest producer of oil and natural gas.
- U.S. innovation and productivity increases will continue to improve the profitability of oil and gas companies even at these prices.

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THANK YOU!

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