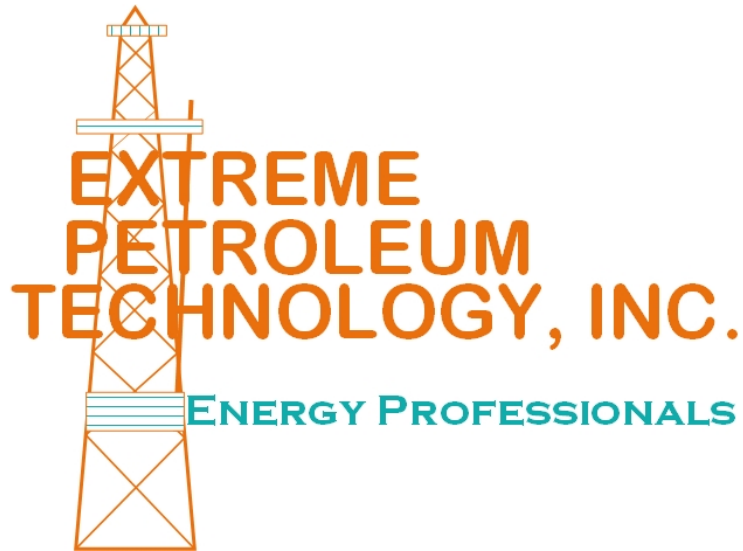


Enhanced Oil Recovery Institute

present

Understanding Oil Price Trends



Leo A Giangiacomo, PE

April 25, 2018

PROPERTY EVALUATION AND ECONOMICS
RESERVES ESTIMATES AND REPORTS
WELL AND COMPLETION DESIGN
RESERVOIR AND EOR STUDIES
EXPERT WITNESS TESTIMONY
STRATEGIC PLANNING
LAND AND LEASE
FINANCE

Ask and it will be given to you; seek and you will find;
knock and the door will be opened to you.

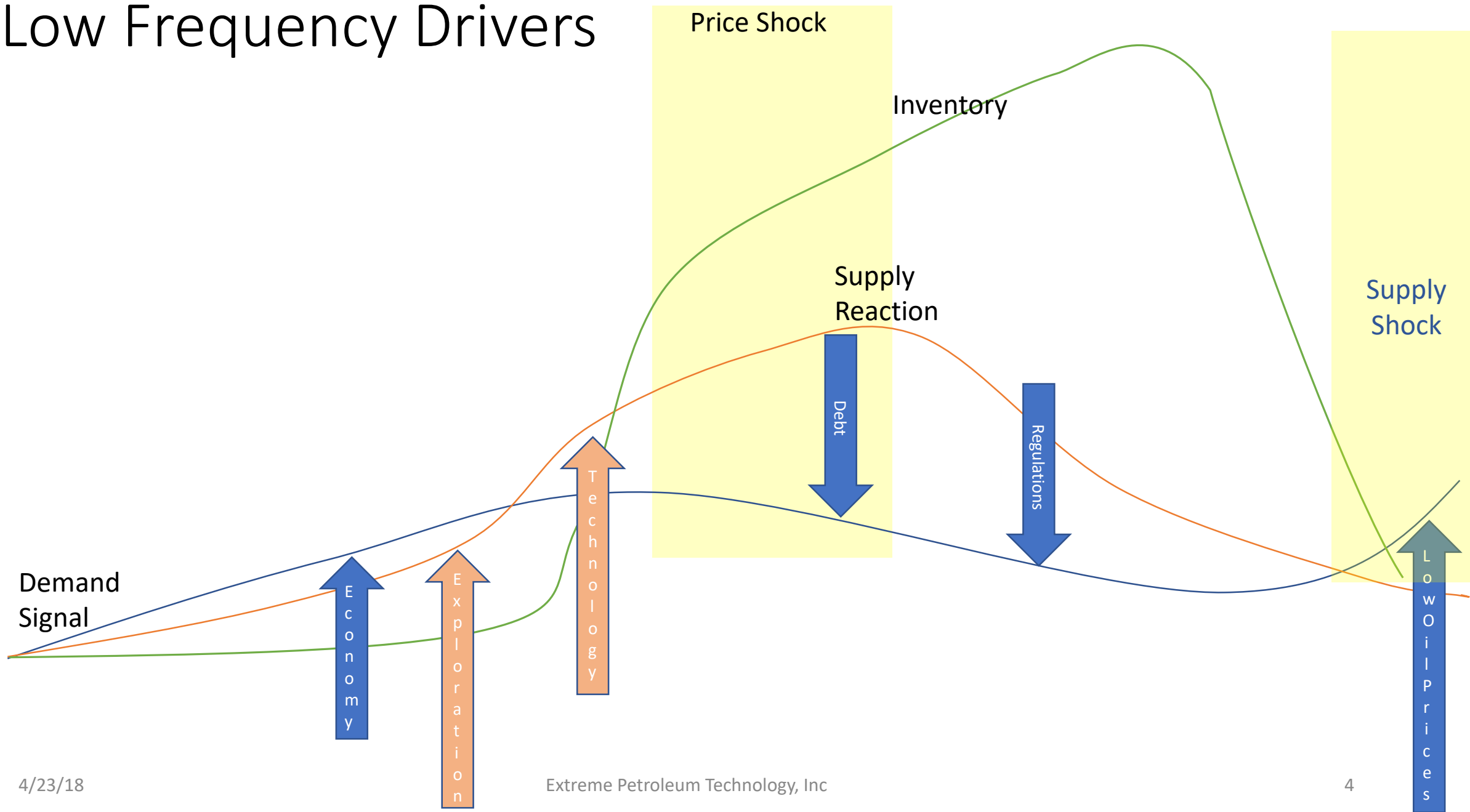
Matthew 7:7

Presentation Outline

- Mechanics
 - Demand
 - Supply
 - Inventory
- Energetics
 - Economy
 - Geopolitics
 - Capital
 - Technology
 - Environment
 - Regulations
- Trajectory
 - Short Term Price Trend
 - Long Term Price Trend



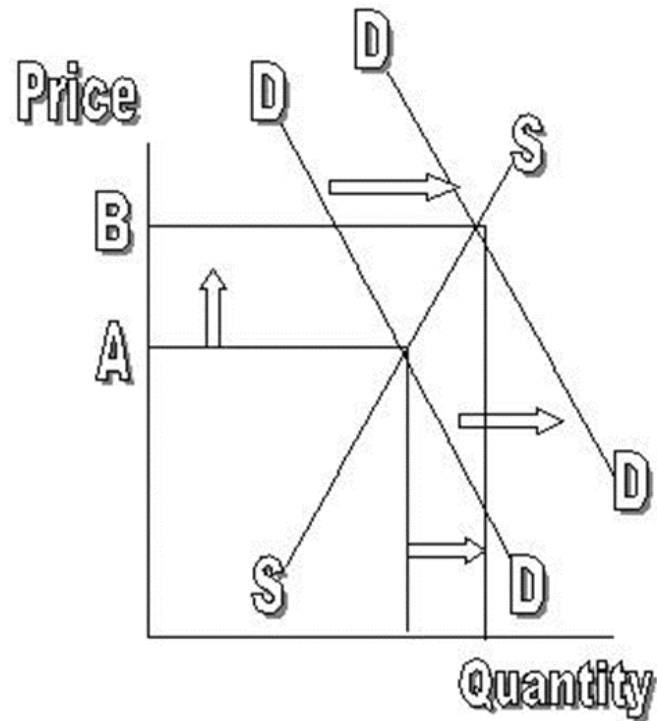
Low Frequency Drivers



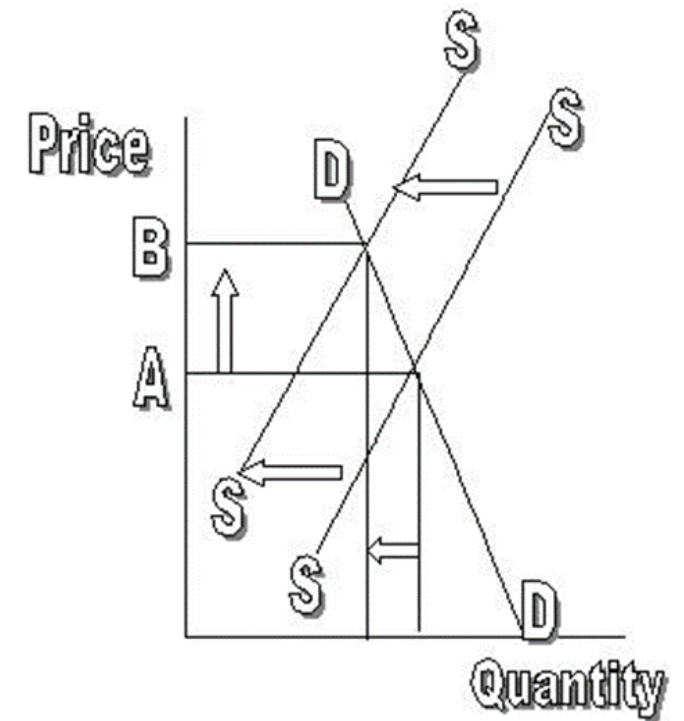
Mechanics

Demand, Supply, Markets and Pricing

Increase in Demand



Decrease in Supply

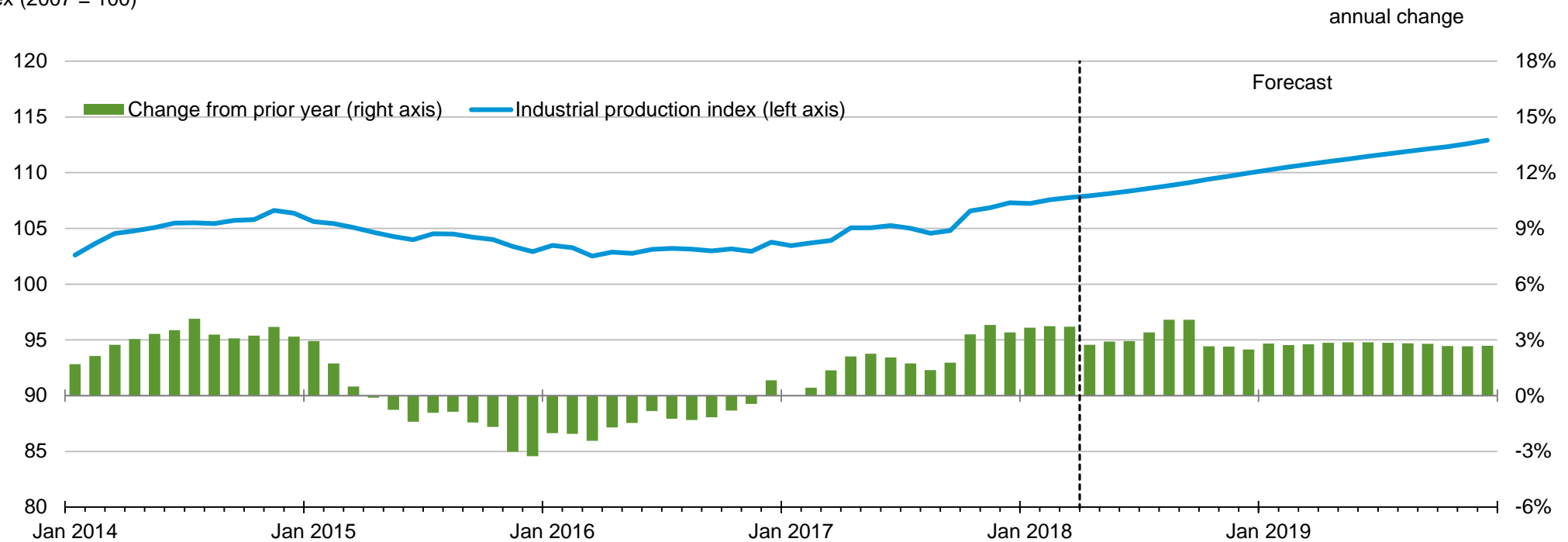


Mechanics Point #1

Market Demand Underpins the Entire Industry

US Industrial Demand

U.S. total industrial production index
index (2007 = 100)



Source: Short-Term Energy Outlook, April 2018.

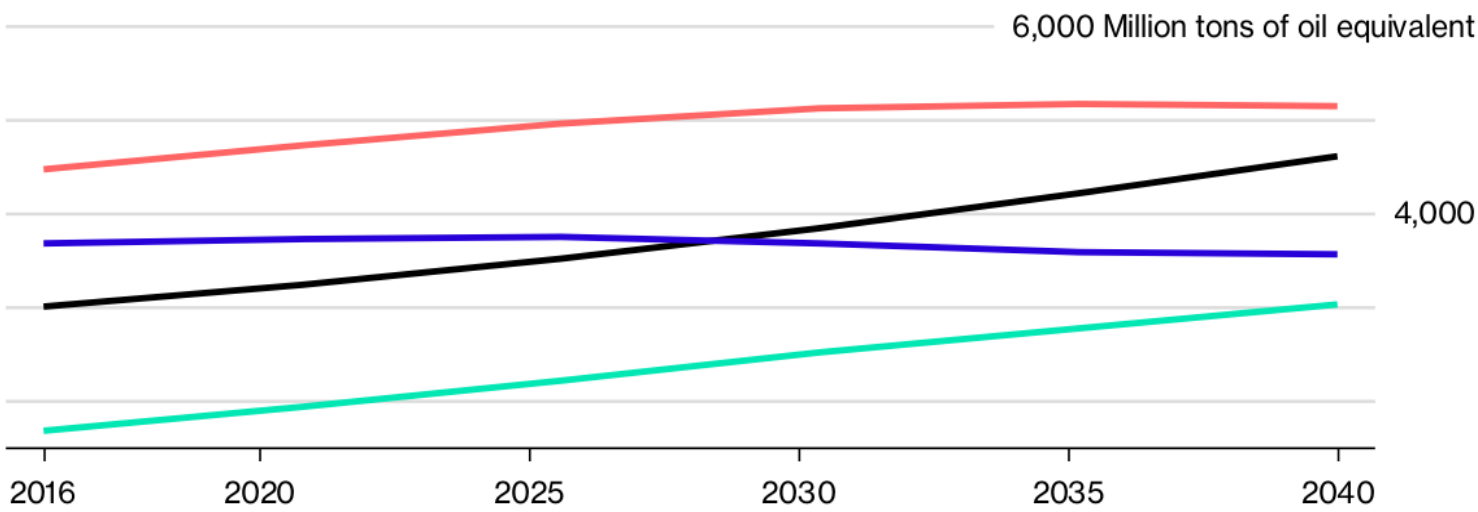
After years of stagnation, we are now seeing 3% growth in the US Industrial Sector

Demand Growth of Energy Types

No Peak for Gas

Primary demand for natural gas to rise as oil, coal wane

■ Natural Gas ■ Oil ■ Coal ■ Renewables



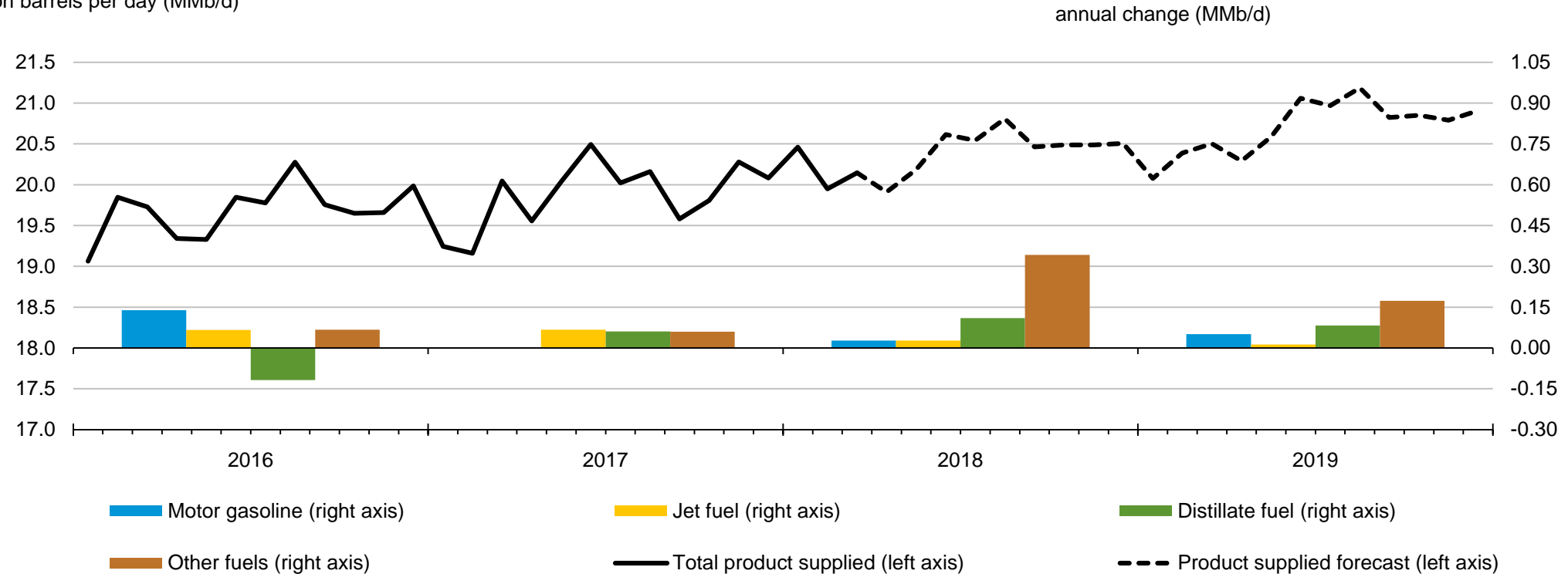
Source: Gas Exporting Countries Forum's "Global Gas Outlook 2017"

Bloomberg

Oil growth (red) to continue and level out after 2030 (no Peak)
Natural gas growth remains strong

US Liquid Fuels Demand

U.S. liquid fuels product supplied
million barrels per day (MMb/d)

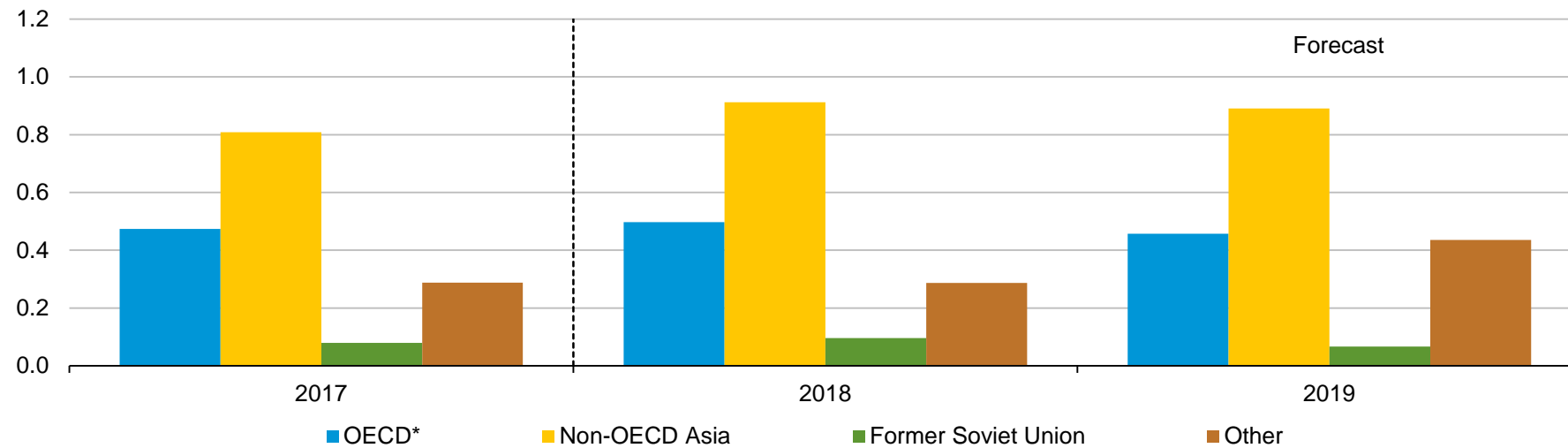


Source: Short-Term Energy Outlook, April 2018.

Liquid fuel demand will continue to increase
Motor gasoline will make up less of the mix

Demand Growth

World liquid fuels consumption growth
million barrels per day



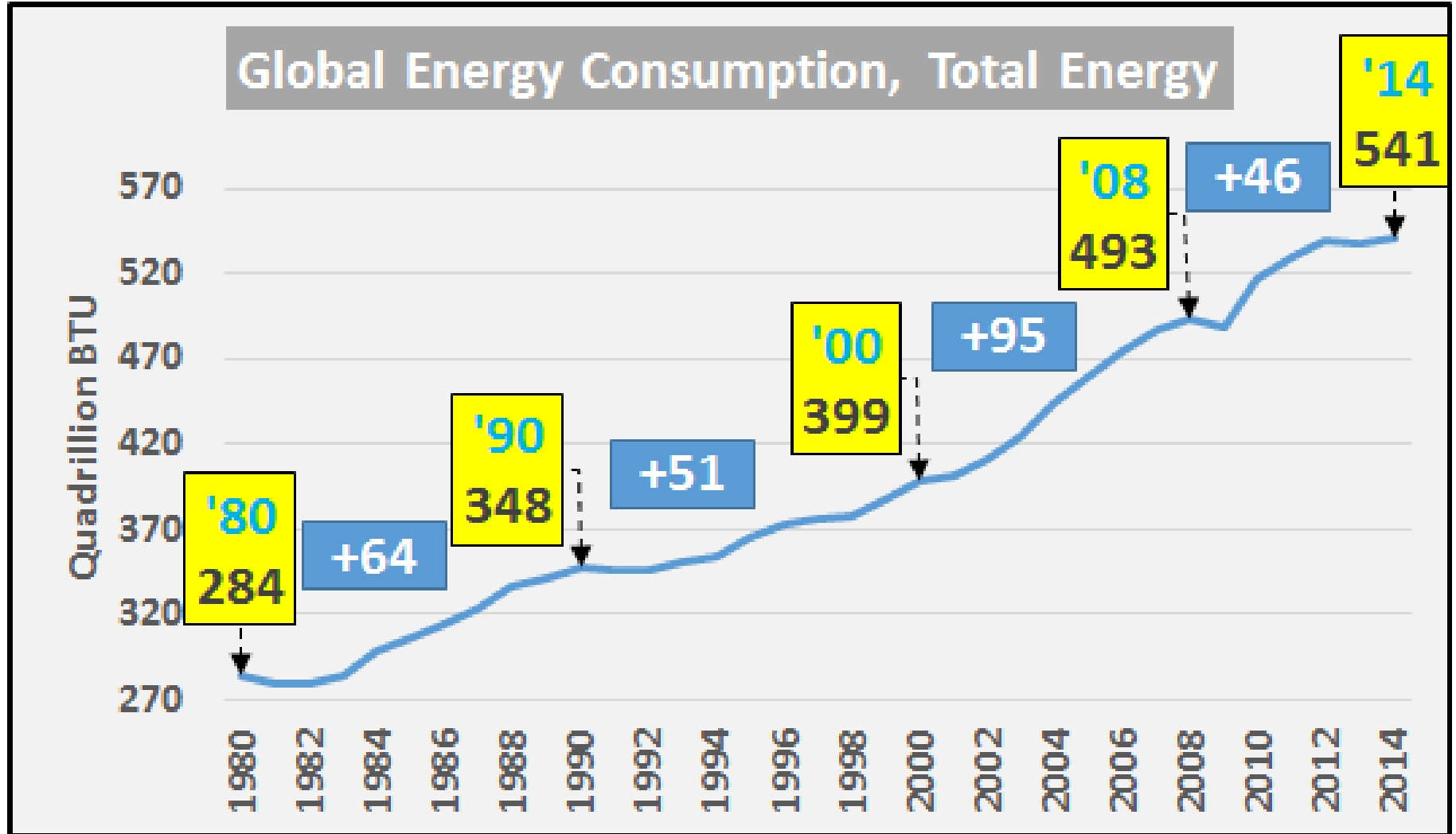
* Countries belonging to the Organization for Economic Cooperation and Development

Source: Short-Term Energy Outlook, April 2018.

Growth is projected to be in Asia
Presume other to be Latin America

The Elephant in the Room

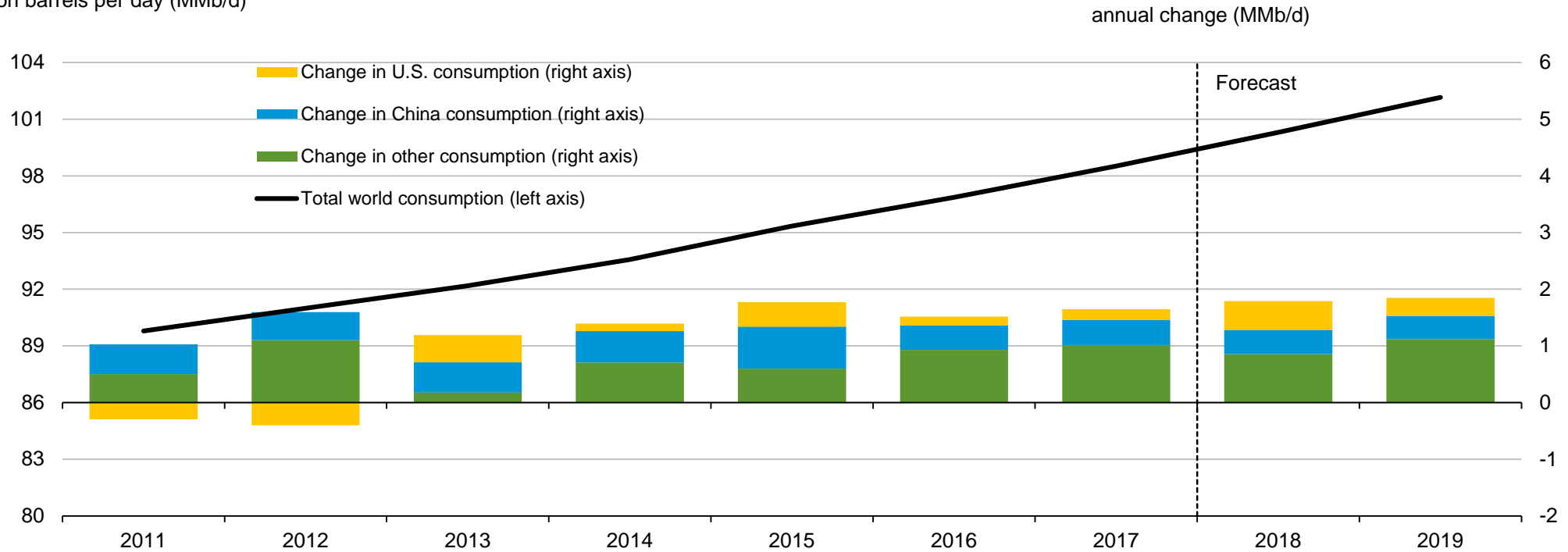
- China demand for oil expected to continue growing
- Natural gas replacing coal



<https://economics.blogspot.com/2017/02/global-economic-growth-is-presently-all.html>

World Demand

World liquid fuels consumption
million barrels per day (MMb/d)



Source: Short-Term Energy Outlook, April 2018.

World demand is forecast to continue growing
US consumption is projected to grow at faster rate

Mechanics Point #2

Supply Reacts to Demand (Slowly)

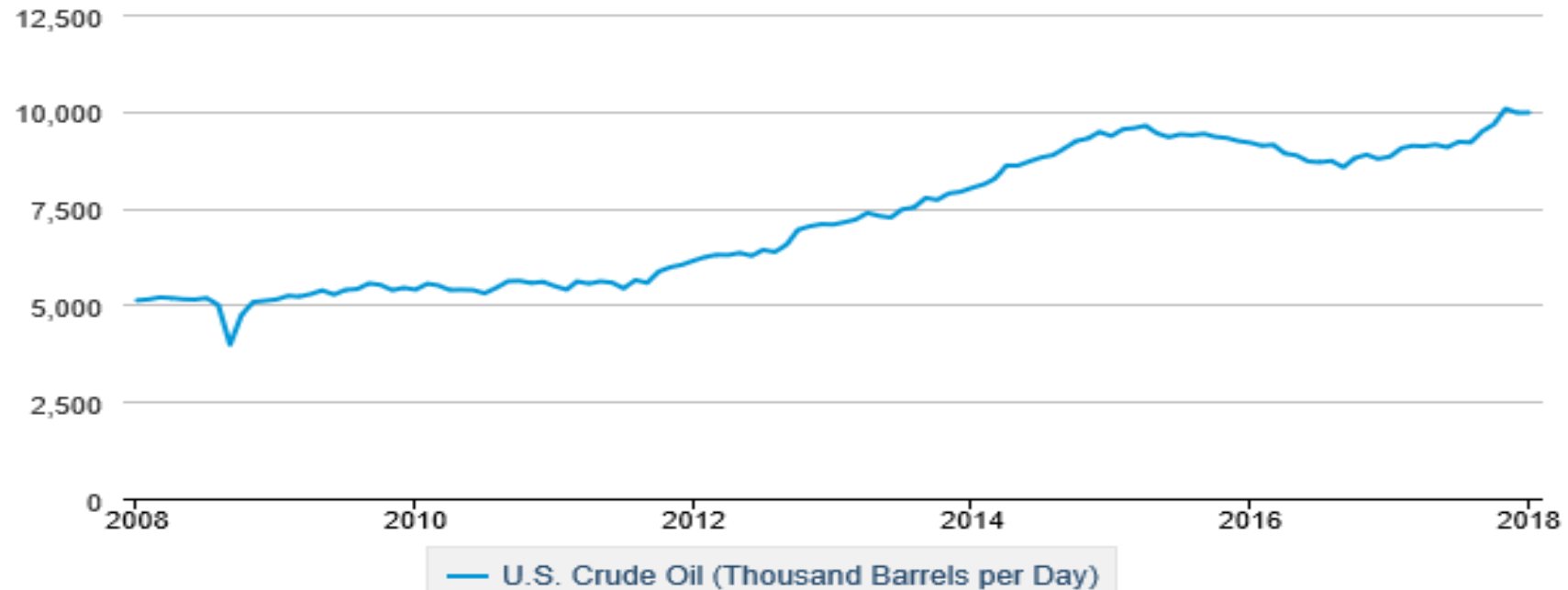
- Exploration cycle time about 10 years from Project ID, through Capitalization, Permitting, Commissioning, Infrastructure to Market
- Cause of Boom and Bust cycle

US Crude Oil Production

U.S. crude oil production



thousand barrels per day



Source: U.S. Energy Information Administration

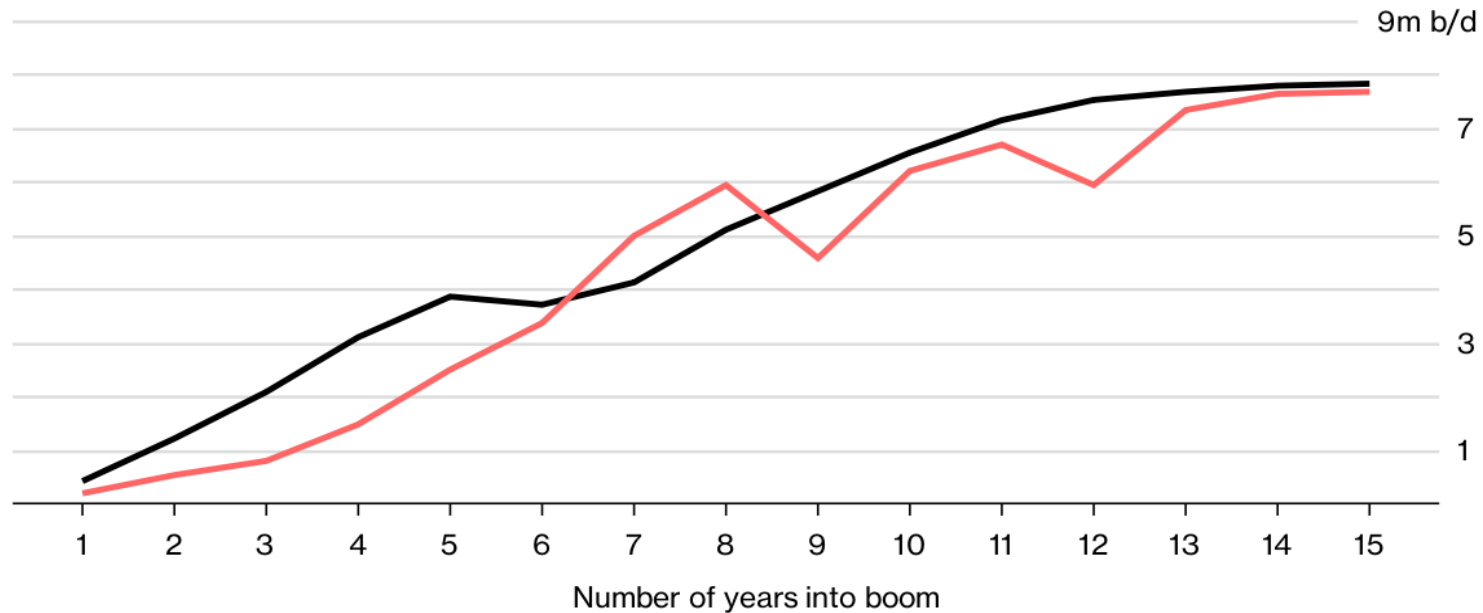
- US Crude oil production has been increasing as unconventional activity and technology improves
- Note effect of price drop in 2015

The US Unconventional Supply in Perspective

Historic Surge

The rise of U.S. shale oil is set to match the boom in Saudi production from 1966 to 1981

■ U.S. ■ Saudi Arabia



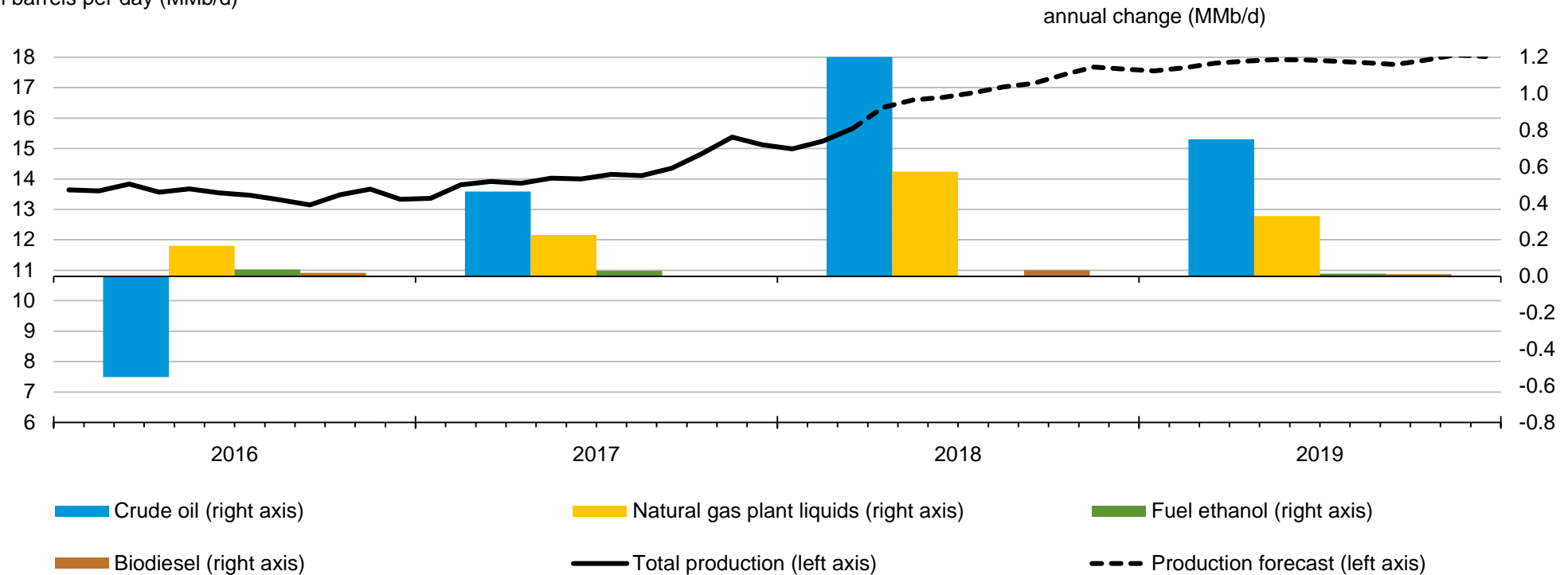
Source: International Energy Agency

Bloomberg

- The US Unconventional boom is paralleled by the Saudi Arabian production boom of the late 1960's and 1970's
- Boom was powered by excessive capital availability from QE programs, coinciding with a revolution in technology (horizontal wells and multistage hydraulic fracturing) accessing tight reservoirs

Supply

U.S. crude oil and liquid fuels production
million barrels per day (MMb/d)

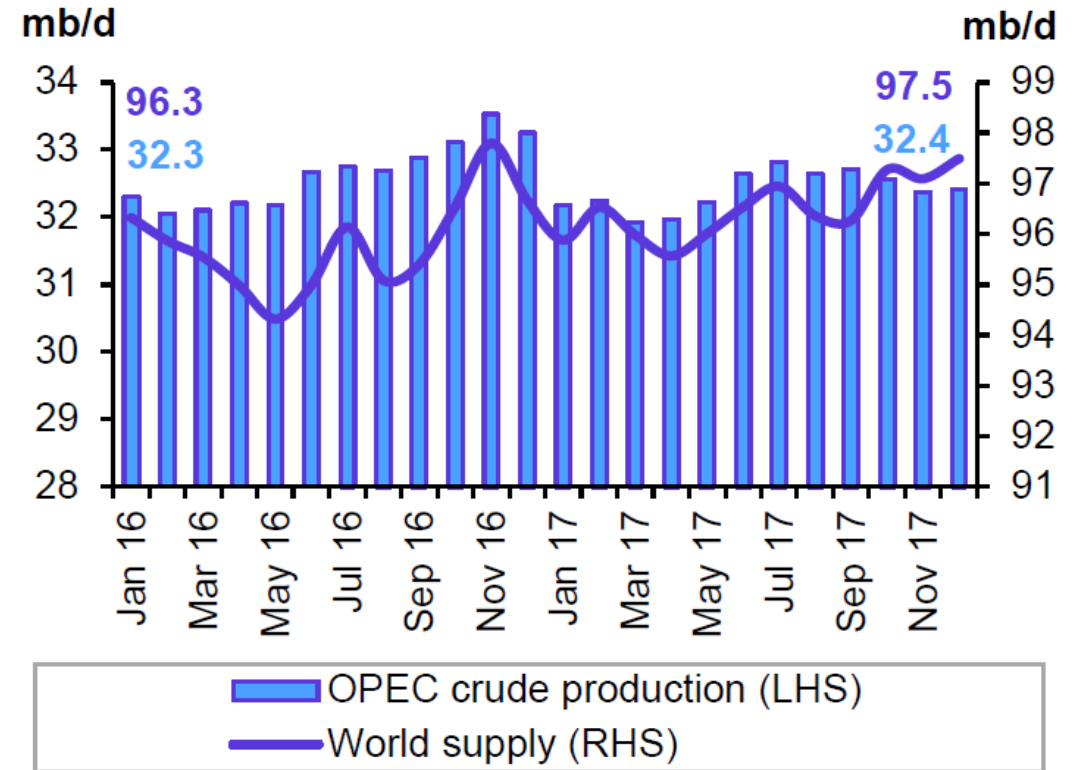


Source: Short-Term Energy Outlook, April 2018.

- Chart includes NGL's, ethanol, and biodiesel
- Large growth rates seen in both oil and natural gas liquids

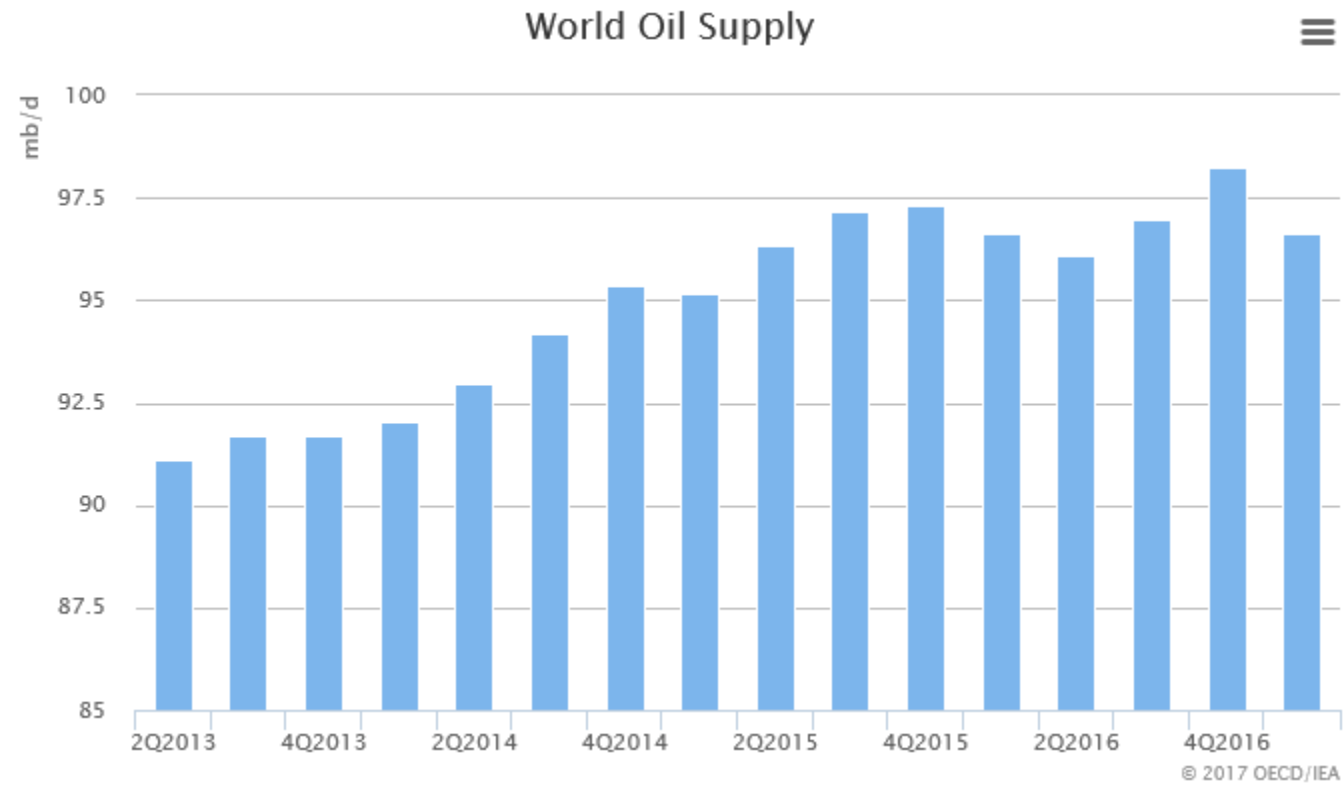
OPEC and World Crude Supply

- In 2016, OPEC tried to increase production and force US shale out of business
- OPEC has reduced market share during 2017
- Even further reductions are evident in 2018



Source: OPEC Secretariat.

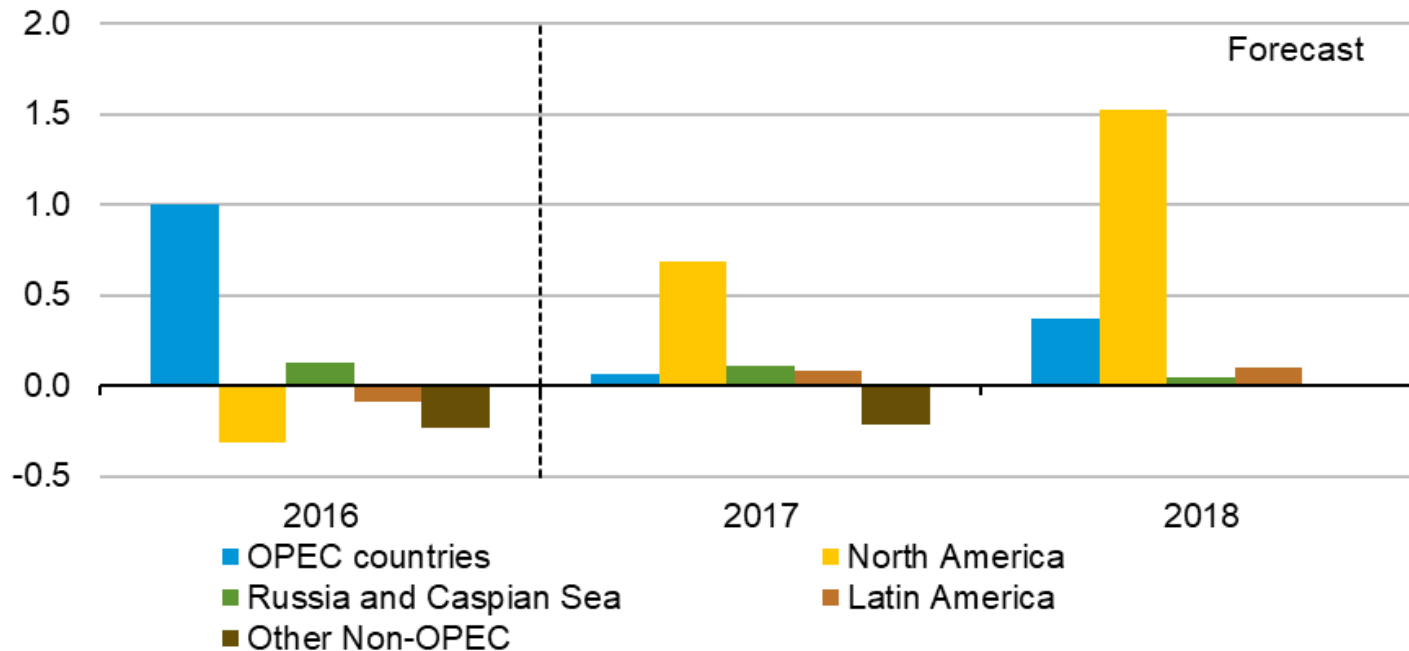
World Supply



- Supply has leveled off since 2015
- This has helped reduce excessive inventory

Supply Growth

World crude oil and liquid fuels production growth
million barrels per day



Source: Short-Term Energy Outlook, December 2017.

- More evidence of how OPEC tried to drive shale out of the market and then backed off.

Mechanics Point #2A

Demand Can Also React to Supply (Feedback)

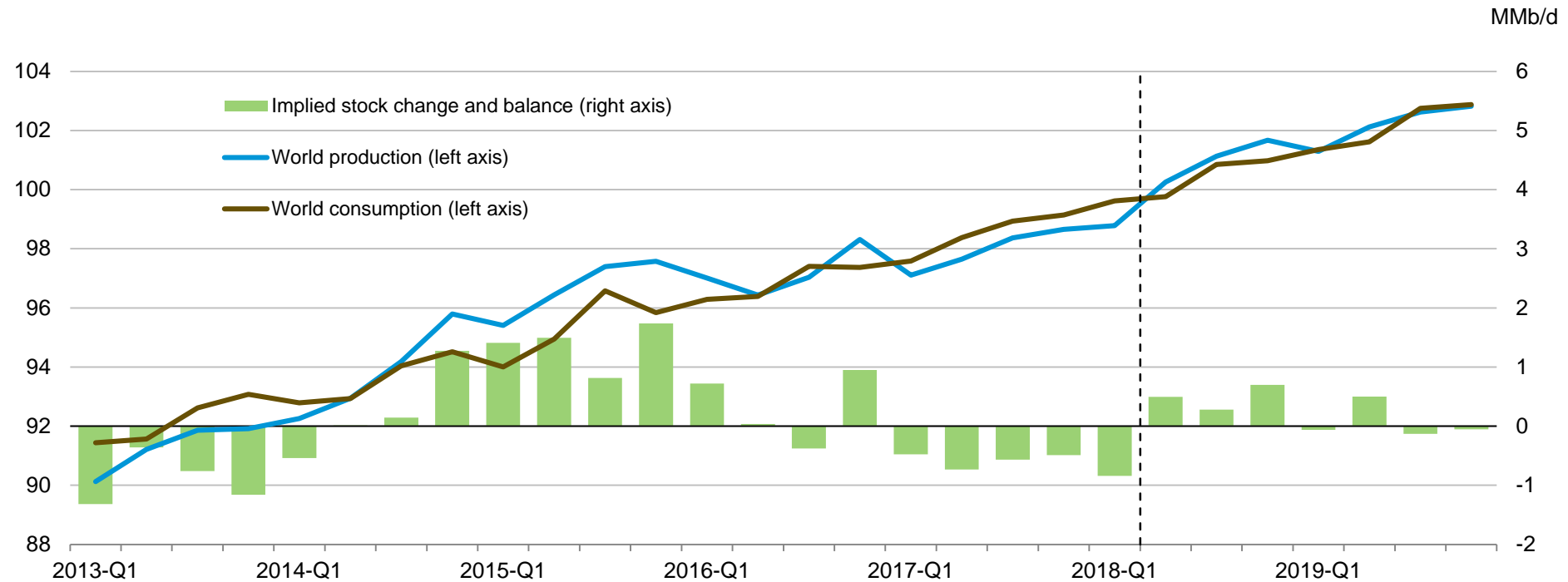
The best cure for low oil prices is low oil prices

Mechanics Point #3

Demand and Supply Must Balance to maintain Market Stability

Demand and Supply Balance

World liquid fuels production and consumption balance
million barrels per day (MMb/d)



Source: Short-Term Energy Outlook, April 2018.

- It should be intuitive that supply must meet demand for a healthy market
- But they never do
- Price is the mechanism that should send the demand signal to supply
- But supply is always retarded and poorly coordinated

Consumption and non-OPEC Supply Growth

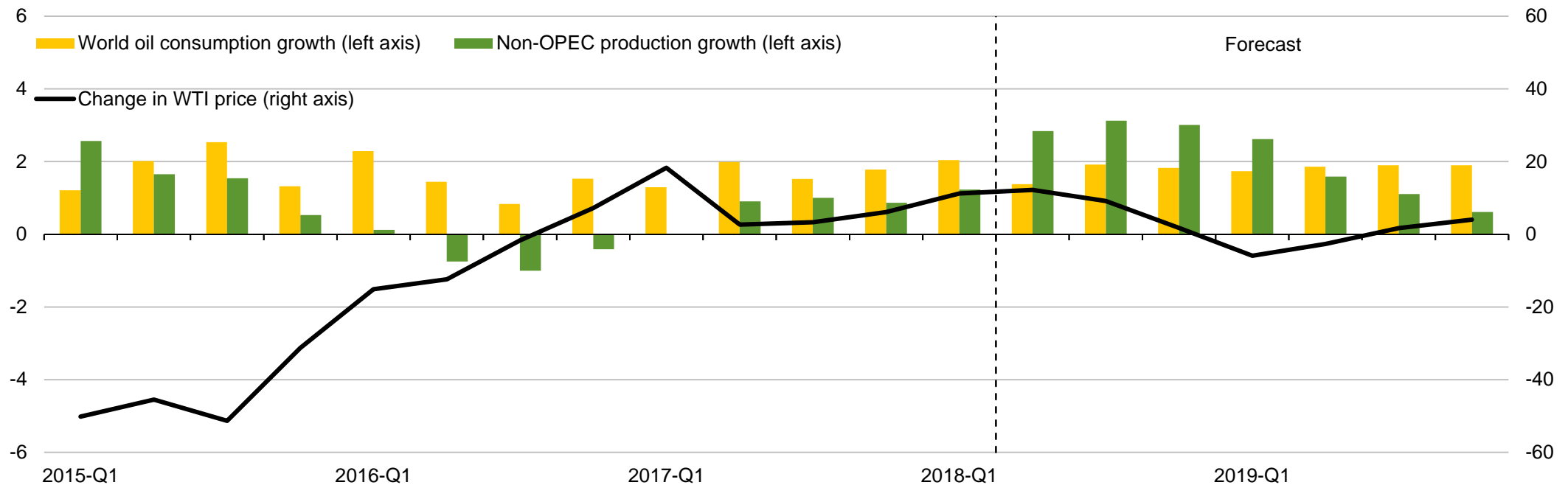
Up until now, we have not introduced the subject of oil prices....

World consumption and non-OPEC production growth

million barrels per day



dollars per barrel

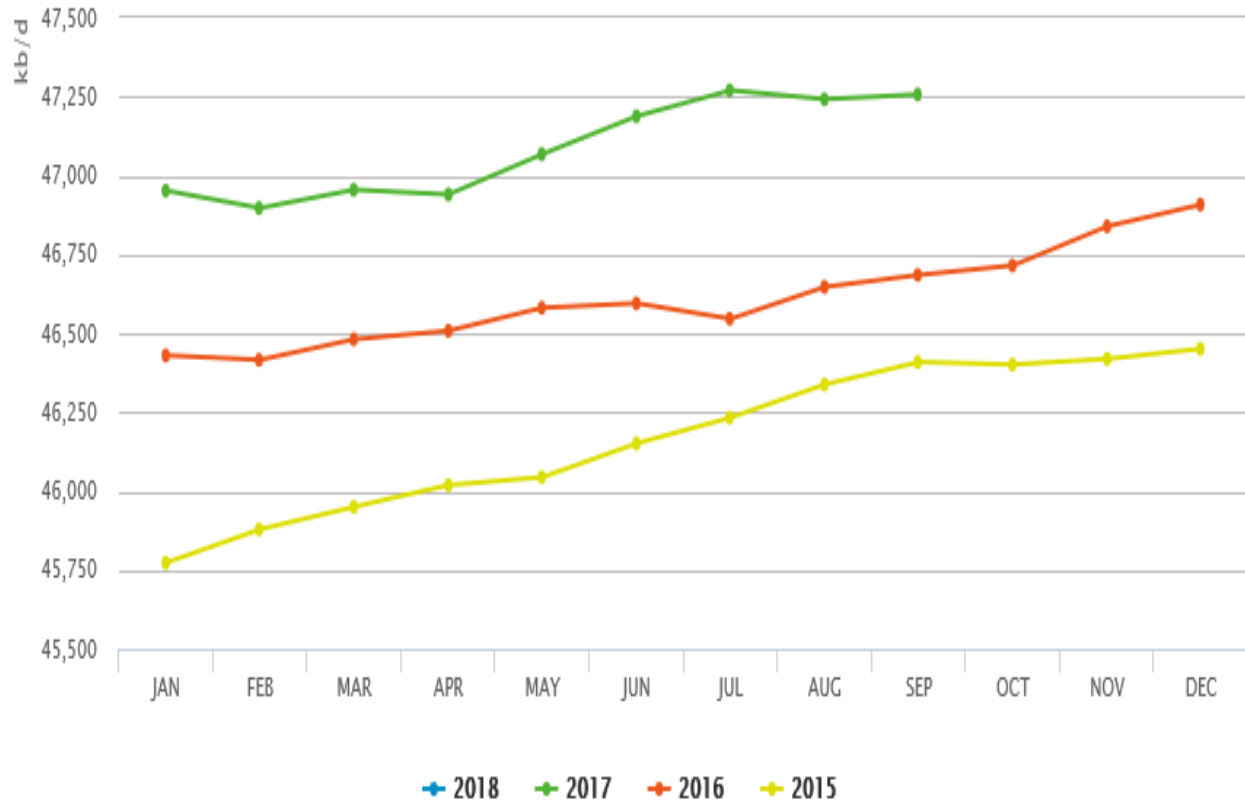


Source: Short-Term Energy Outlook, April 2018.

- Here we see world supply growth rates (yellow bars) juxtaposed to the Non-OPEC production growth (green bars)
- It is a very poor matchup that causes wide swings in oil price (black line)

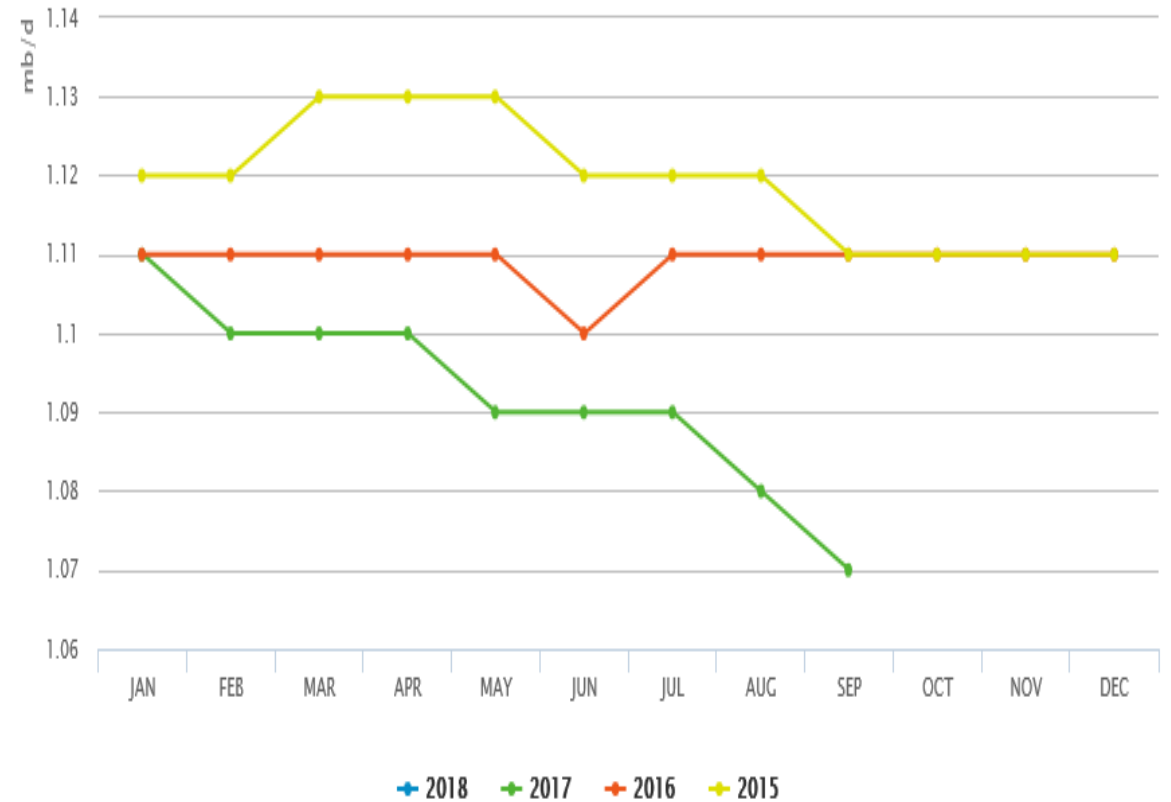
Demand and Supply Trend Comparisons

Demand - 12 Month moving average



© 2018 OECD/IEA

Supply - 12 Month moving average



© 2018 OECD/IEA

❖ Set up for the next price shock

<https://www.iea.org/oilmarketreport/omrpublic/charts/>

Mechanics Point #4

Inventory: The Slush Fund for Demand and Supply

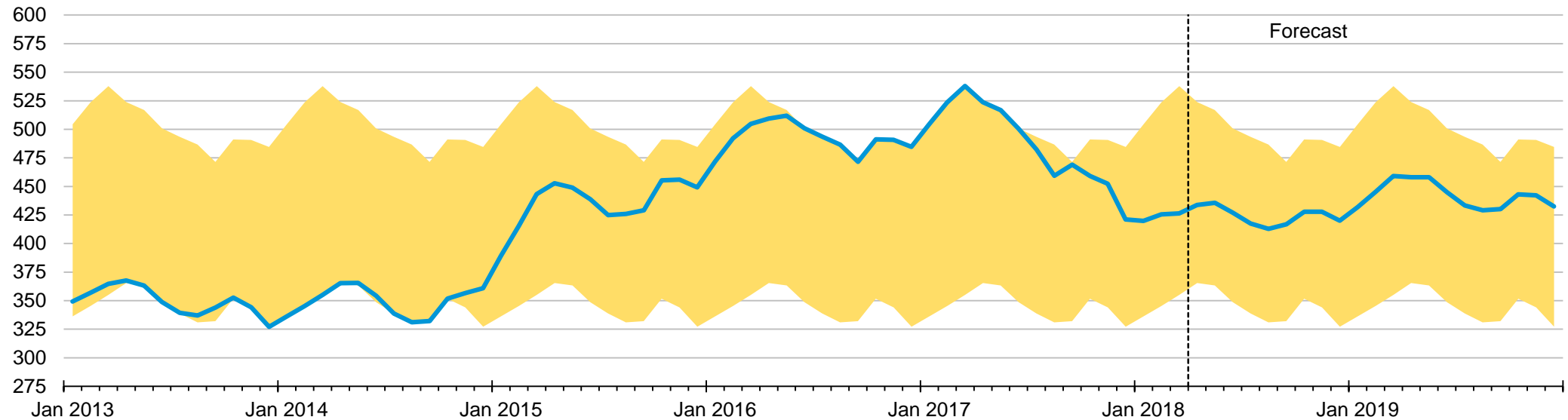
Inventories



- Oil does not move directly from supply to demand, it must pass through inventory
- Inventory is commonly reported by the EIA and refers to US commercial stocks (no other inventories publically tracked)
- Wall Street Analysts commonly mistake US inventories for global inventory (no such thing)
- US has expanded inventory capacity (tanks at Cushing) to absorb excess supply
- Temporary supply interruptions frequently cause inventory drawdowns that are misinterpreted as market strengthening (Fort McMurray fires).
- Inventory is a way to gauge how well balanced supply and demand actually are
- If inventory builds, supply is outrunning demand, if it drops demand is outstripping supply
- Prices react to the change in inventory as a signal to the producers to speed up or slow down
- The problem is that price signals come every second that the market is open
- Supply takes years to bring to market, and thus cannot possibly react, much like a freight train trying to stop quickly

US Inventory

U.S. commercial crude oil stocks
million barrels



Note: Colored band around storage levels represents the range between the minimum and maximum from Jan. 2013 - Dec. 2017.

Source: Short-Term Energy Outlook, April 2018.

- The only reliable inventory number is the US Commercial Crude Stock number published by EIA
- Currently, we are high compared to long term averages, so high that we have changed the five year average
- 2017 has seen a decrease in inventory due to OPEC production cuts

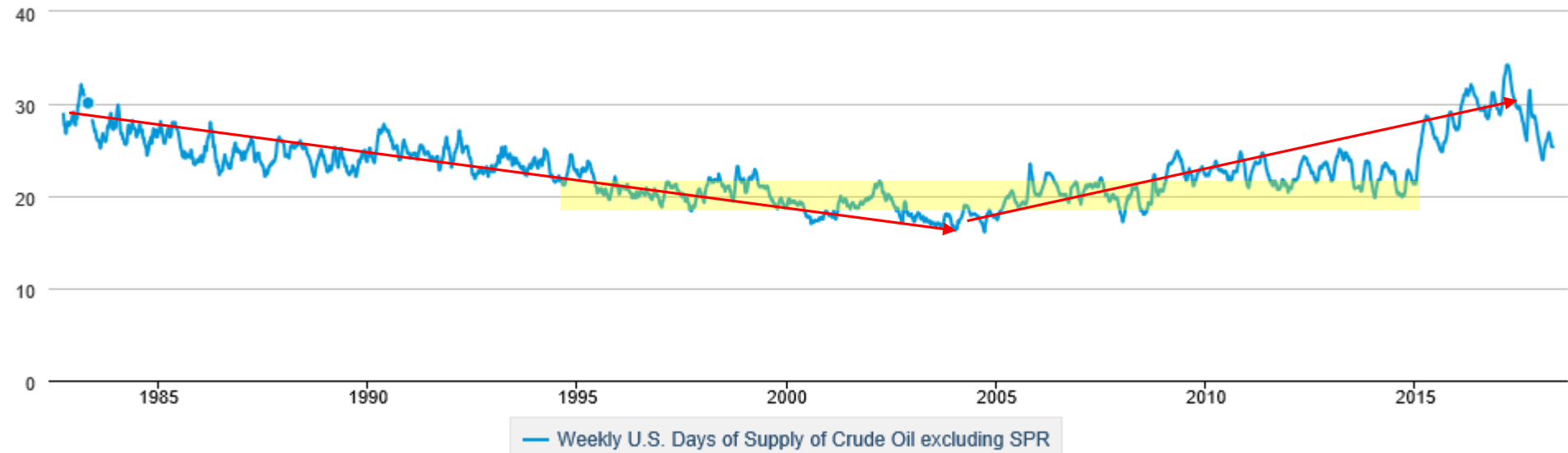
US Crude Inventory

- Normal level about 20 days
- Quickly approaching normal
- Estimate mid 2018

Weekly U.S. Days of Supply of Crude Oil excluding SPR

↓ DOWNLOAD

Number of Days

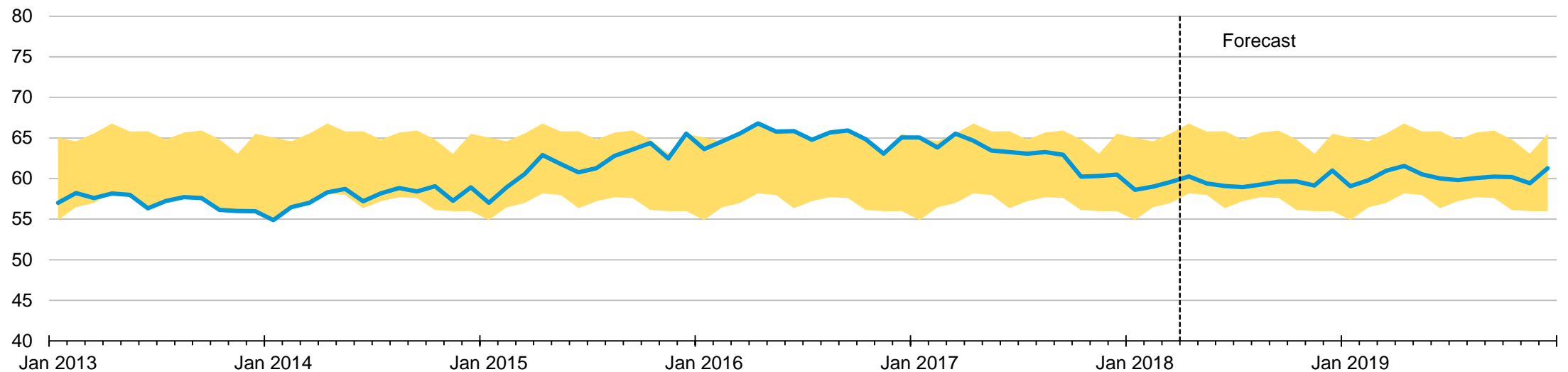


eia Source: U.S. Energy Information Administration

- Looking at the inventory in terms of days of supply is more realistic, accounting for consumption rates
- Disruption in 2015 caused oil price to drop from \$100 to \$30

OECD Commercial Inventories

OECD commercial stocks of crude oil and other liquids
days of supply



Note: Colored band around days of supply of crude oil and other liquids stocks represents the range between the minimum and maximum from Jan. 2013 - Dec. 2017.

Source: Short-Term Energy Outlook, April 2018.

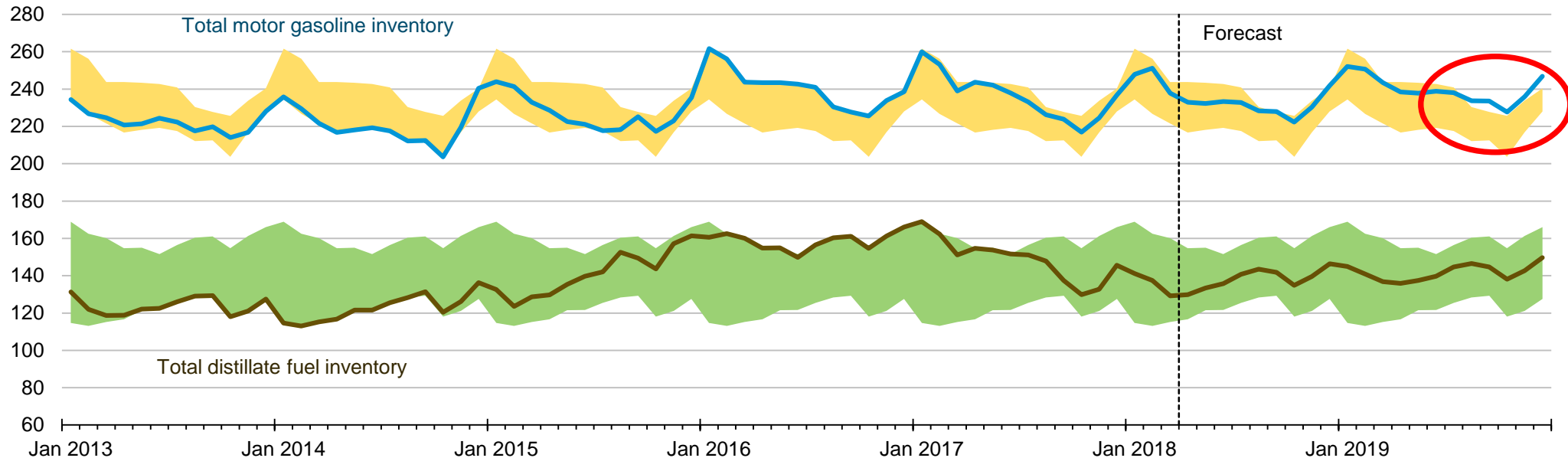
- OECD inventories are more political and not as reliable
- Still shows same trends as US, with reduction in 2017 to nearly average
- Projections show unfavorable builds in inventories over next year or two

Alternative Inventories

- Refined fuels
 - Motor gasoline
 - Diesel and distillates
- Spare production capacity
 - Restrained production (OPEC production cuts, geopolitical problems)
 - Pipeline capacity limits (Permian, Tar Sands)
 - Flaring capacity limits (Bakken, Permian, Powder River)
 - Drilled but Uncompleted Wells (DUC's)
- Tankers

US Refined Product Inventories

U.S. gasoline and distillate inventories
million barrels



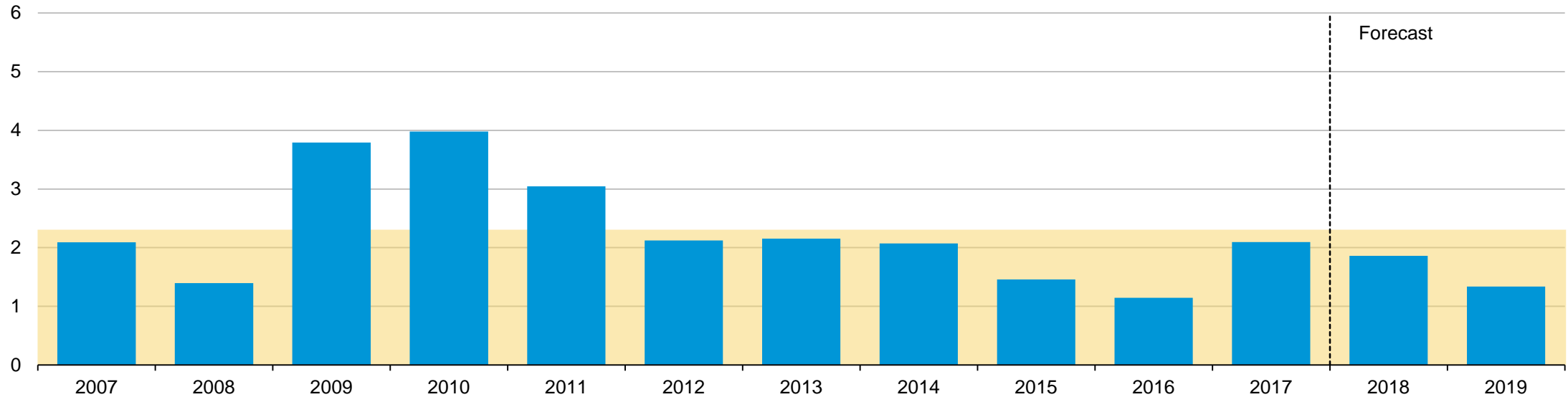
Note: Colored bands around storage levels represent the range between the minimum and

Source: Short-Term Energy Outlook, April 2018.

- Note trend in rising gasoline inventories and drop in distillate inventories
- Caused by lighter oil being produced in unconventional plays, and heavy oil being squeezed out of market from Venezuela and Canadian pipeline capacity

OPEC Surplus Crude Production Capacity

OPEC surplus crude oil production capacity
million barrels per day



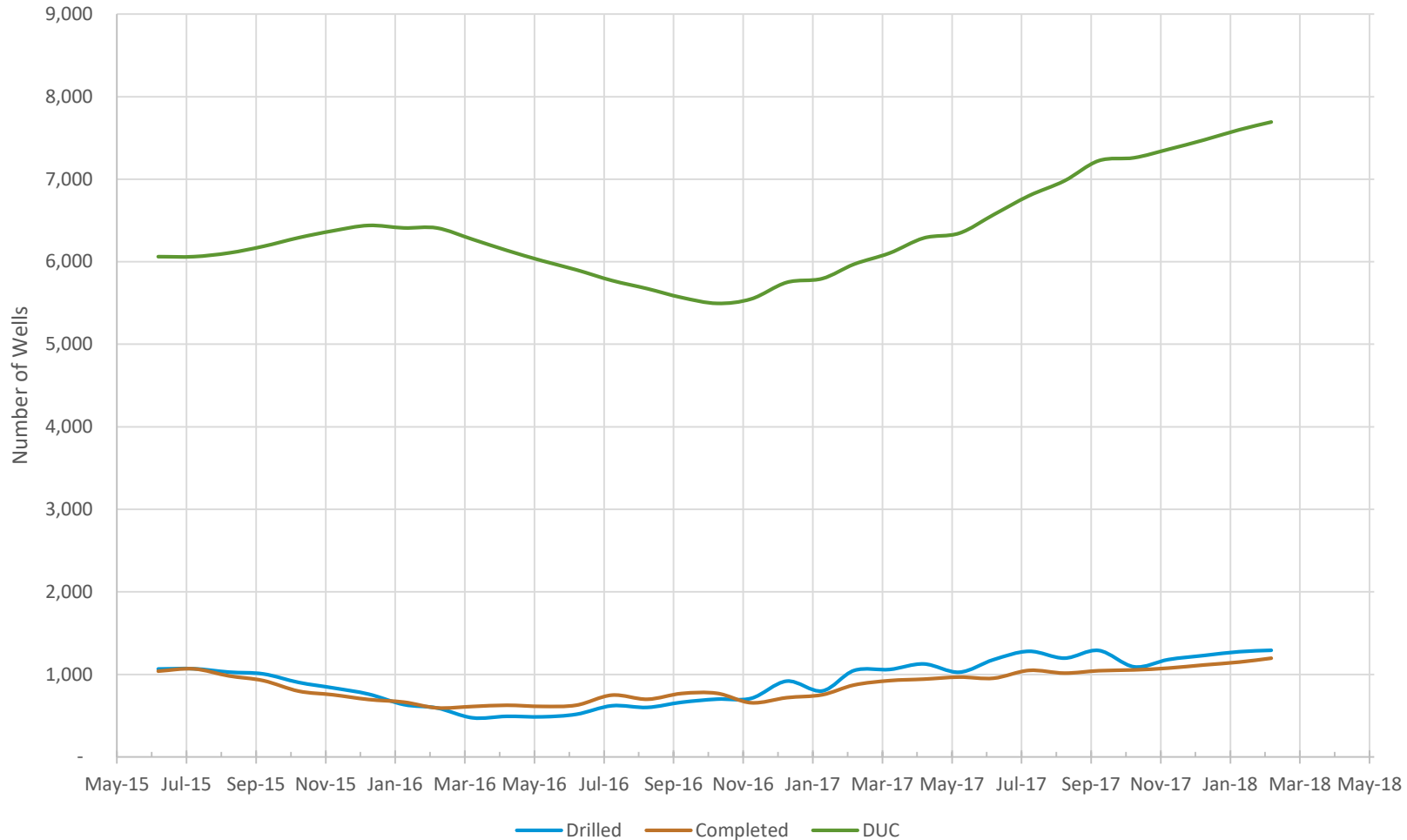
Note: Shaded area represents 2007-2017 average (2.3 million barrels per day).

Source: Short-Term Energy Outlook, April 2018.

- OPEC is facing the decline curve like the rest of us, but they have had little exploration success to replace reserves
- Consequently their production capacity is facing downward pressure.
- They rely on EOR and shale potential
- Voluntary production cuts may not be so voluntary

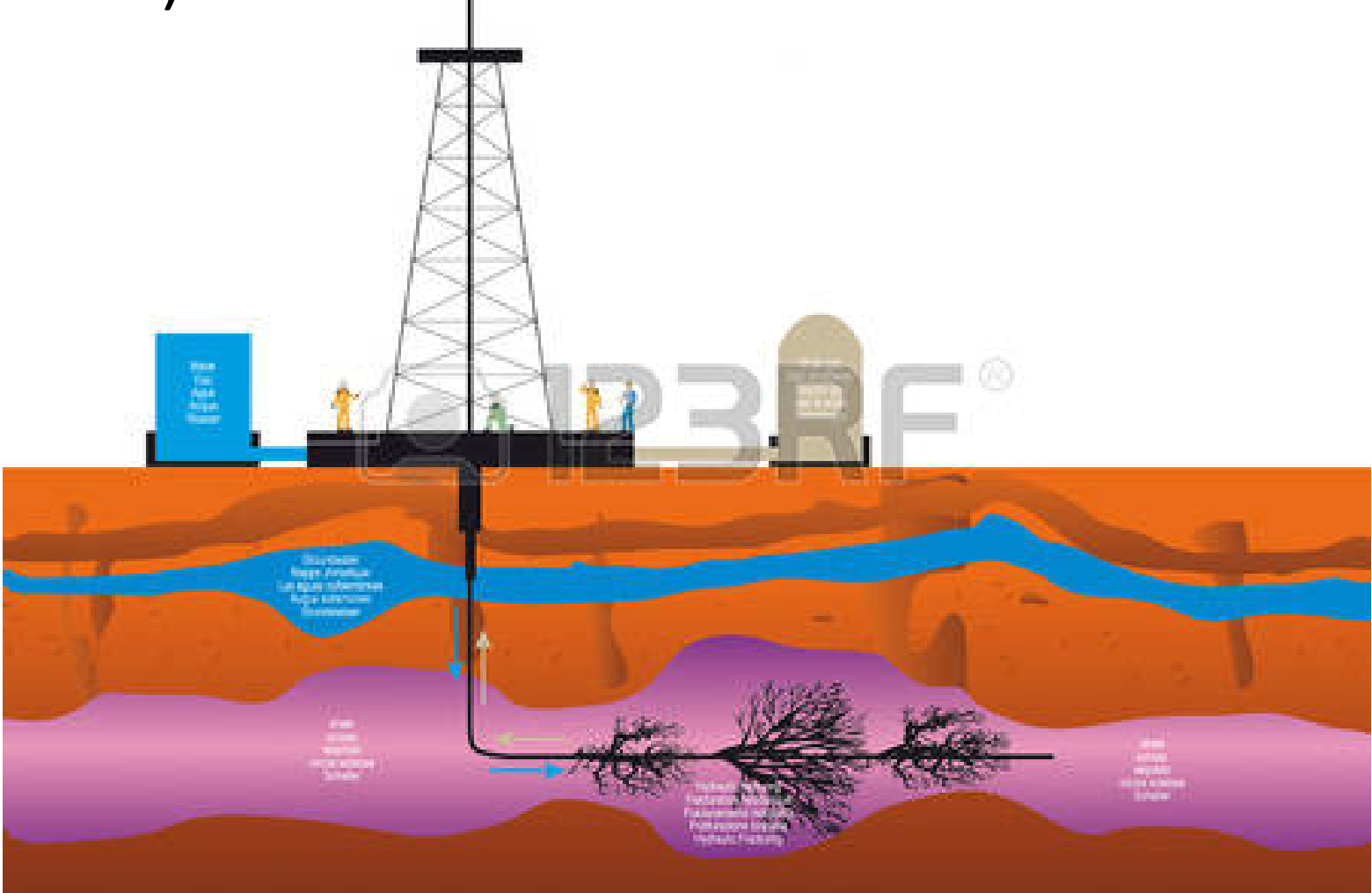
Drilled but Uncompleted Wells (DUC's)

US Unconventional Drilled Uncompleted Wells



- The US has spare production capacity of sorts in a rising inventory of wells that have been drilled but not completed
- Drilling is increasingly becoming a more trivial part of well development than completion and infrastructure
- Assume
 - Average well can make 650 BOPD for Year 1
 - All could be put on production in one year
- $650 \times 7692 = 4,999,800$ BOPD
- That is approximately 71% of the entire current unconventional production

The (Next) Shale Revolution



<https://www.bloomberg.com/news/videos/2017-11-10/the-next-shale-revolution-video>

Market Energetics

Secondary Market Drivers beyond demand, supply, and inventories

Environment

Geopolitics

Capital Markets

Analysts

Economic Growth



Technology

Fiscal Policy

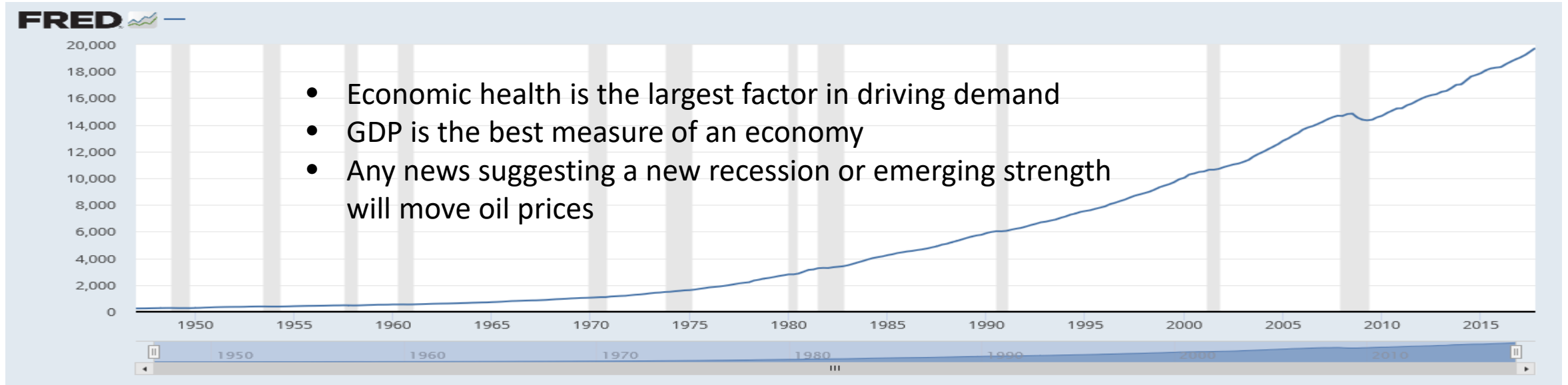
Currency Exchange Rates

Debt

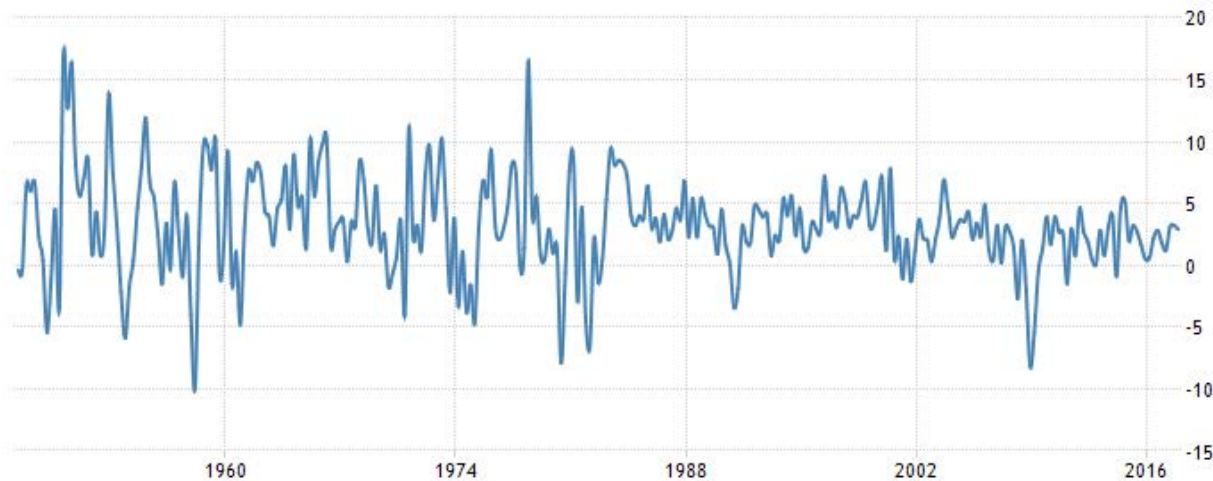
Energetics Point #1

Economic Growth drives Demand and is measured by Gross Domestic Product

US Gross Domestic Product



US GDP GROWTH RATE



SOURCE: TRADINGECONOMICS.COM | U.S. BUREAU OF ECONOMIC ANALYSIS

SOURCE: TRADINGECONOMICS.COM | U.S. BUREAU OF ECONOMIC ANALYSIS

World GDP



World GDP appears to be levelling out, maybe poised for further growth

Data.worldbank.org Darker colors are higher growth rates

Energetics Point #2

Geopolitics are a Wild Card

Stability of Geopolitical Instability



No tanks! Senators want bipartisan check to Saudi arms sale

A bipartisan group of Senators is moving to block the \$1.15 billion sale of US tanks to Saudi Arabia, citing concerns over human rights and the civil war in Yemen. Riyadh has requested new tanks to modernize its arsenal and replace battle-damaged ones.

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Geopolitics

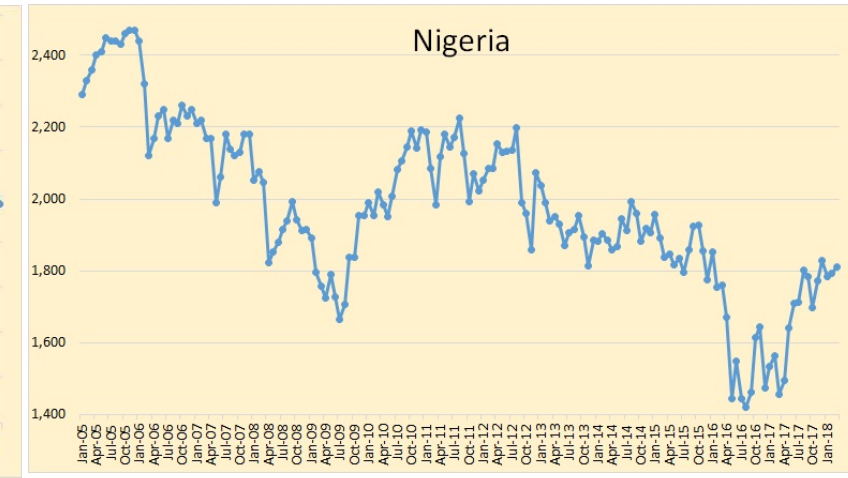
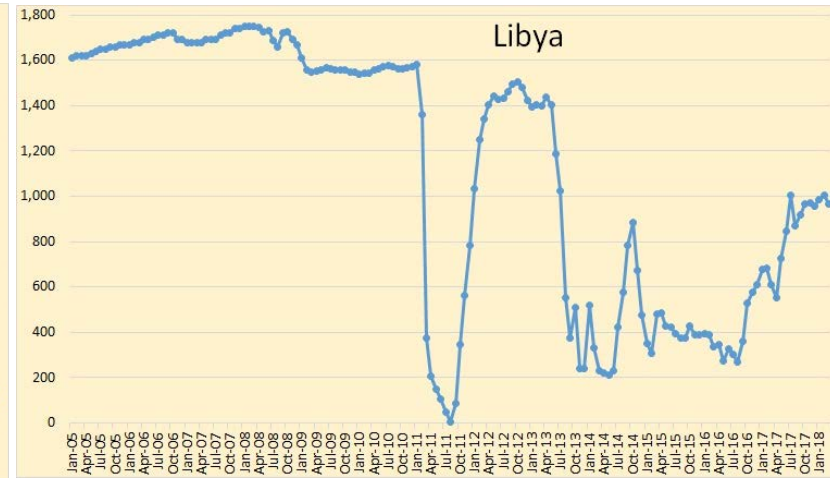
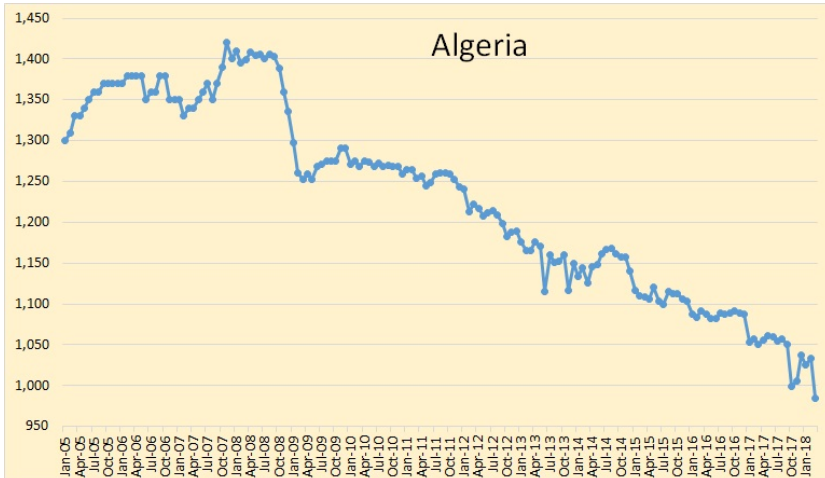
- Hotspots

- Middle East
- China
- Russia
- Iran
- Venezuela
- Nigeria
- Libya
- North Korea

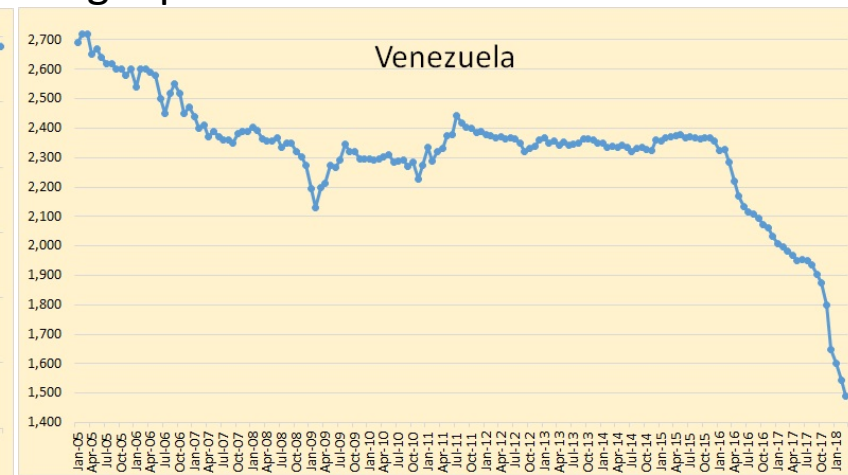
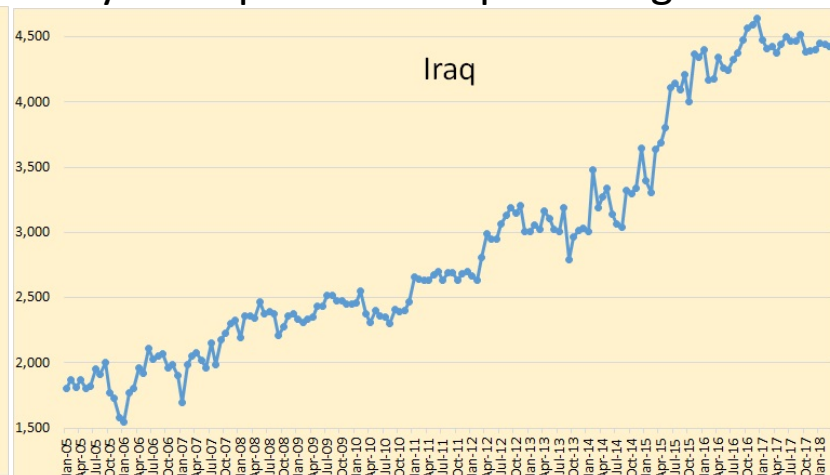
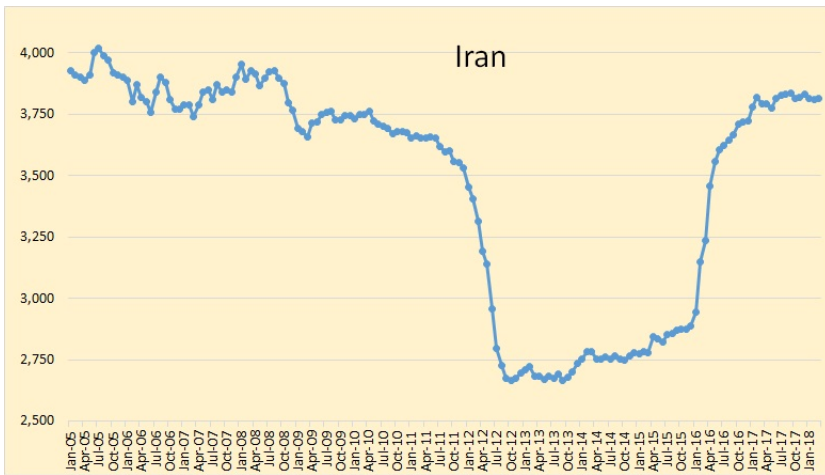
- Issues

- Supply disruption
 - Terrorism
- Petrostates
 - Power Struggles
 - Corruption
- Religion
 - Islam
 - Shiite
 - Sunni
 - Judaism
 - Christianity

OPEC Production History for Select Countries



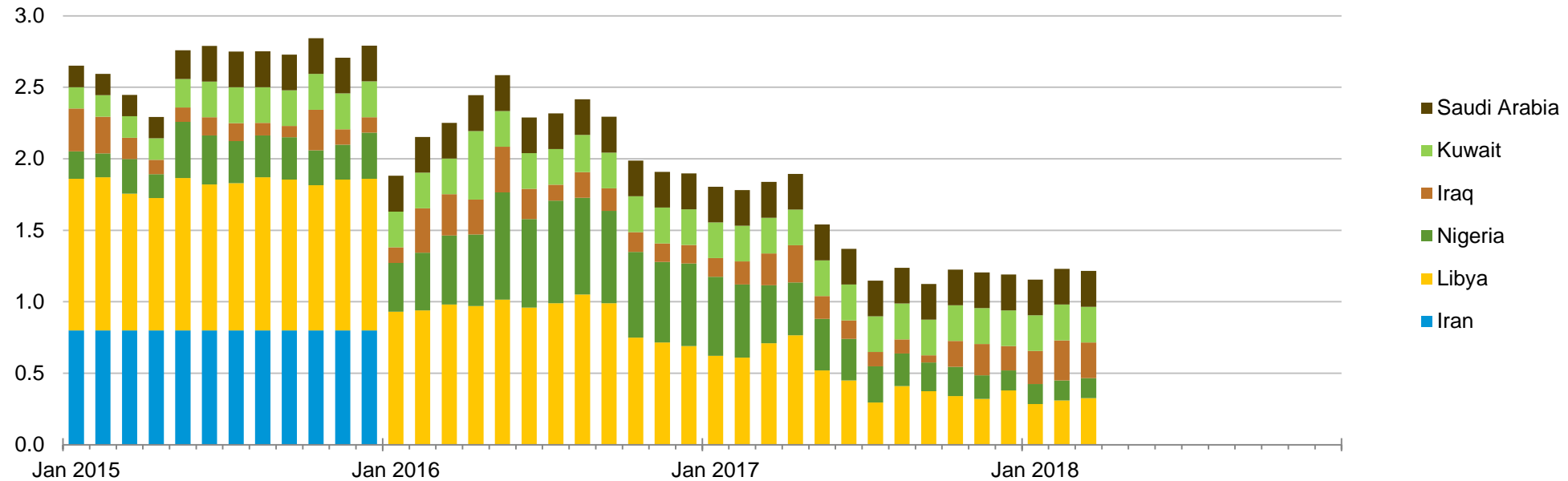
Certain OPEC countries are very susceptible to output changes based on geopolitical factors



<http://peakoilbarrel.com/opec-crude-oil-production-charts/>

Unplanned Outages in OPEC Countries

Estimated historical unplanned OPEC
crude oil production outages
million barrels per day

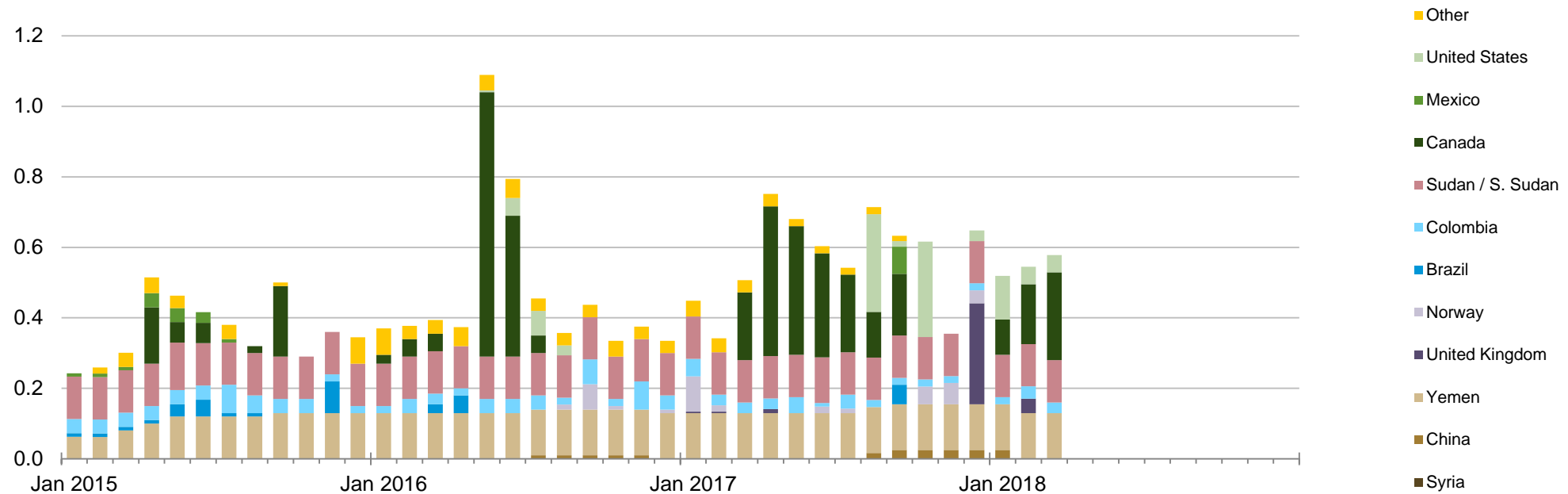


Source: Short-Term Energy Outlook, April 2018.

- Unplanned outages have actually been decreasing, but don't expect that trend long-term.
- Crude production is a rich source of money for corrupt organizations.
- They try to acquire the source, milk them, and prevent rivals from acquiring them.

Unplanned Outages in non-OPEC Countries

Estimated historical unplanned non-OPEC liquid fuels production outages
million barrels per day



Source: Short-Term Energy Outlook, April 2018.

- Non-OPEC outages are about half OPEC outages
- Yemen and Sudan are in civil war
- Canada due to Fort MacMurray Fires, Pipeline leaks

If you put the federal government in charge of the Sahara Desert, in five years there'd be a shortage of sand.

Milton Friedman

Energetics Point #3

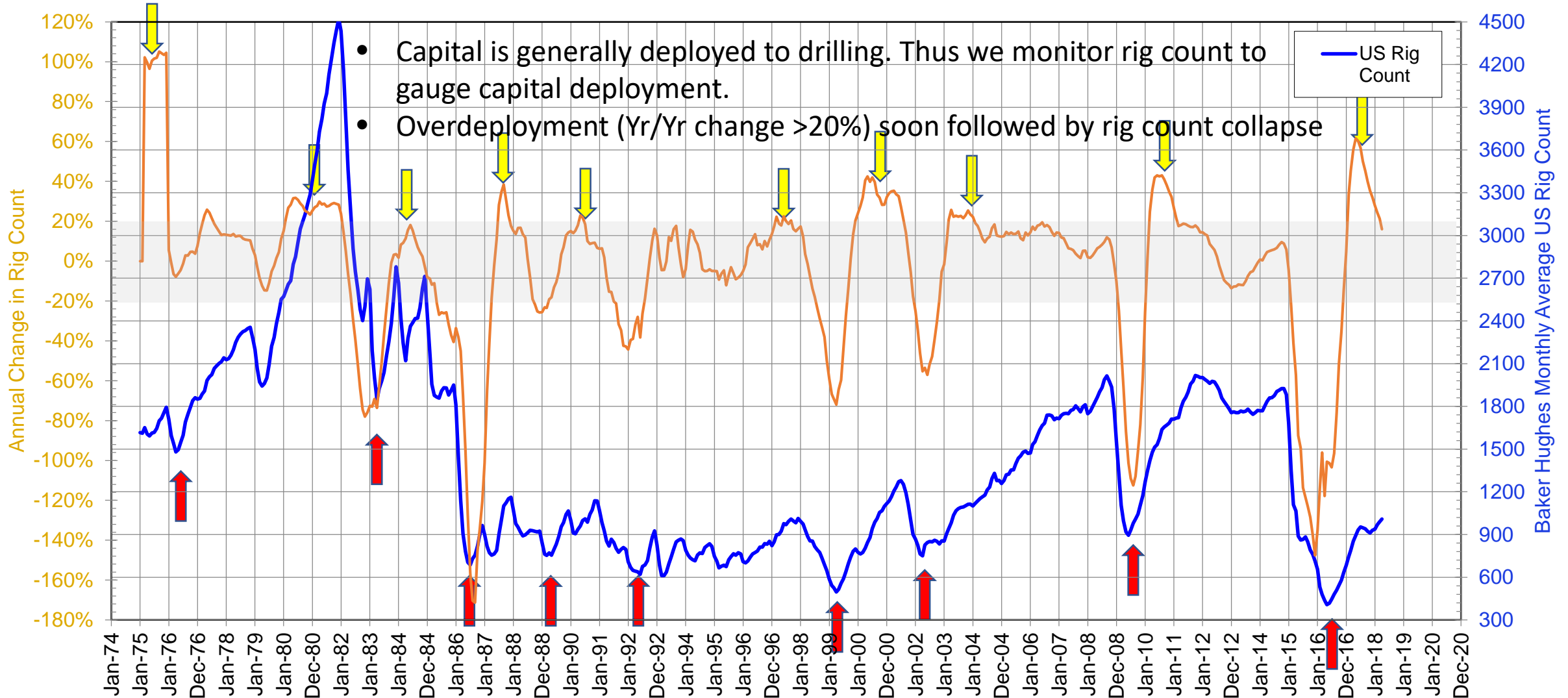
It takes a lot of Capital to provide Supply, and sources are changing dramatically

Capital

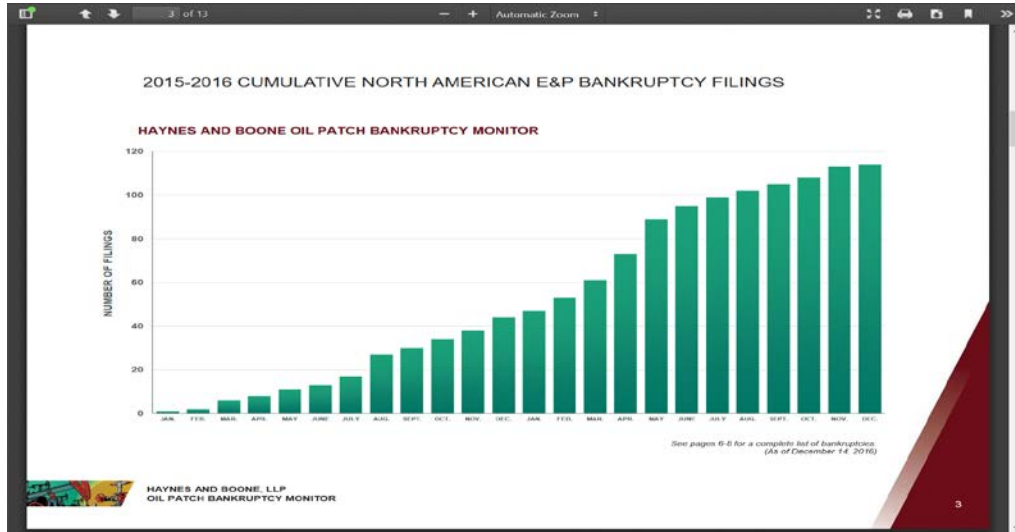
- There has traditionally been a long lead time between the deployment of capital and oil making it to market, exacerbating price swings
- Traditionally capital was provided through major oil companies equity offering for conventional projects
- Some capital was provided by debt financing, especially for smaller companies
- Recently capital has come into the industry through private equity companies, who accessed the Quantitative Easing (QE) money
- US unconventional requires significantly higher capitalization and has relied primarily on PE funding
- US unconventional has significantly shortened the time from investment to cash flow, hence it has drawn most of the capital investment over the past three years
- Investors expect high initial cash flow (High IP) and quick payout (hyperbolic decline) with a high return on capital. They tend to underestimate the risk.
- Without the stamina of PE companies, the US Unconventional industry would not have survived the downturn, and succumbed to OPEC and Russian pressure

Capital is Primarily Applied through Drilling Rigs

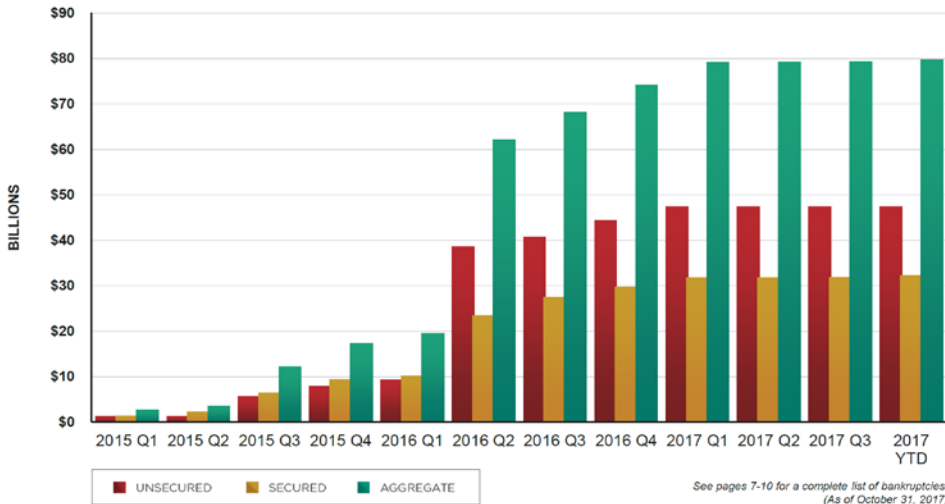
Baker Hughes US Rig Count



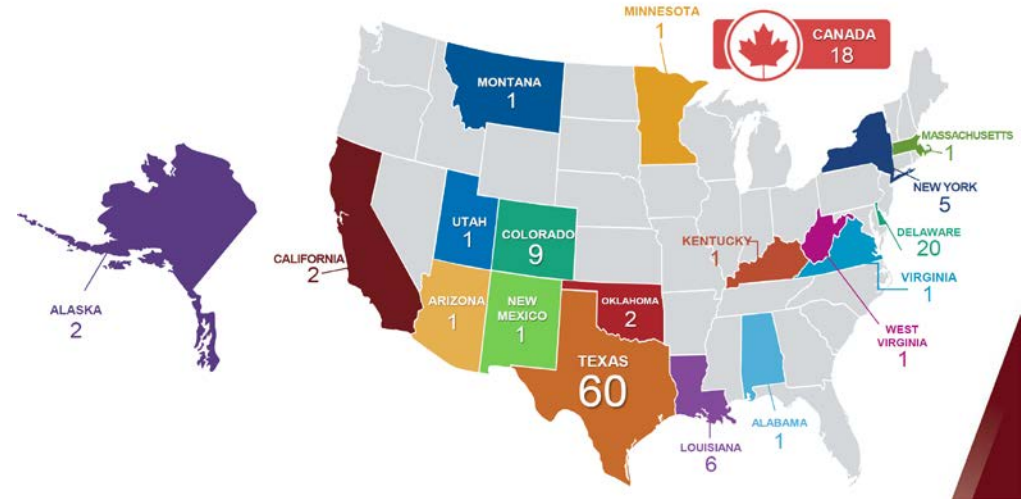
North American E&P Bankruptcies



2015 through 2017



4/23/18



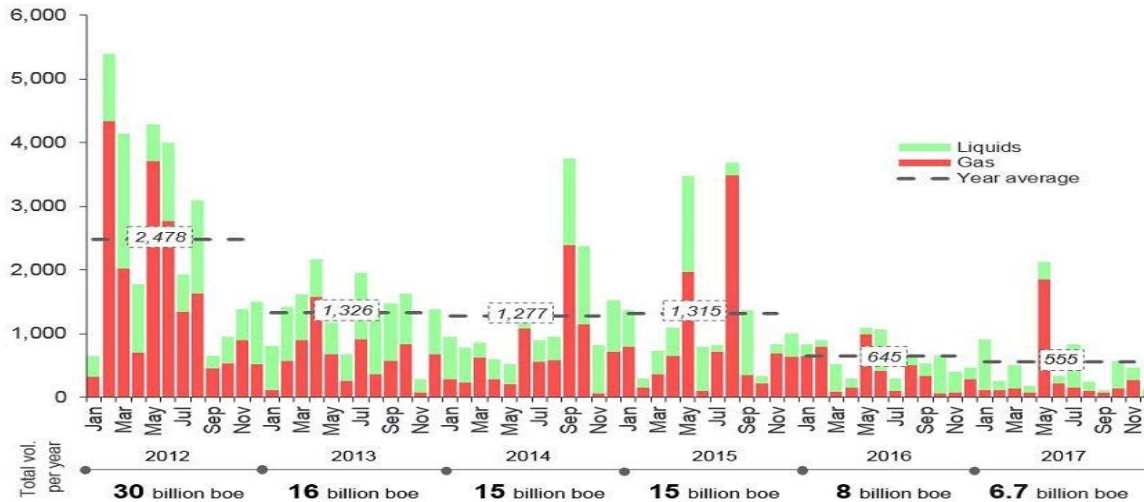
FILING DATE	COURT	CASE NUMBER	DEBTOR	SECURED	UNSECURED	TOTAL
115 1/4/2017	D. Del.	17-10015	BONANZA CREEK ENERGY, INC.*	\$ 191,700,000	\$ 947,941,000	\$ 1,139,641,000
116 1/8/2017	N.D. Tex.	17-40120	ARABELLA EXPLORATION, LLC	\$ 23,523,904	\$ 4,777,516	\$ 28,301,420
117 1/16/2017	S.D. Tex.	17-30262	MEMORIAL PRODUCTION PARTNERS LP*	\$ 457,400,000	\$ 1,595,815,000	\$ 2,053,215,000
118 1/31/2017	S.D. Tex.	17-80033	OTEX RESOURCES LLC	\$ 336,704	\$ 1,363,738	\$ 1,700,442
119 2/1/2017	S.D. Tex.	17-30560	VANGUARD NATURAL RESOURCES, LLC	\$ 1,330,069,779	\$ 443,686,587	\$ 1,773,756,366
120 3/14/2017	D. Colo.	17-12011	BEARCAT ENERGY LLC	\$ 3,411,285	\$ 5,996,500	\$ 9,407,785
121 3/23/2017	E.D. Cal.	17-11028	PACE DIVERSIFIED CORPORATION	\$ 2,730,725	\$ 960,694	\$ 3,691,419
122 4/17/2017	D. Del.	17-10828	VENOCO, LLC	\$ -	\$ 4,144,837	\$ 4,144,837
123 4/21/2017	D. Del.	17-10866	ADAMS RESOURCES EXPLORATION CORPORATION	\$ -	\$ 484,499	\$ 484,499
124 6/2/2017	W.D. La.	17-50705	ROOSTER ENERGY, LLC	\$ 51,659,931	\$ 213,000	\$ 51,872,931
125 6/8/2017	S.D. Tex.	17-33626	DEEP OPERATING, LLC	\$ 385,611	\$ 1,069,242	\$ 1,454,853
126 6/21/2017	N.D. Tex.	17-32420	OMEGA ALPHA RESOURCES LLC	\$ 27,781	\$ 140,164	\$ 167,945
127 6/28/2017	E.D. Tex.	17-20116	KMK OIL & GAS, INC.	\$ 292	\$ 10,033	\$ 10,325
128 6/29/2017	D. Colo.	17-16046	KING'S PEAK ENERGY, LLC	\$ 9,000,000	\$ 14,455,992	\$ 23,455,992
129 8/11/2017	D. Colo.	17-17465	BADLANDS ENERGY, INC.	\$ 33,401,225	\$ 13,012,593	\$ 46,413,818
130 9/5/2017	S.D.W. Va.	17-20459	HARD ROCK EXPLORATION, INC.	\$ 13,852,733	\$ 27,012,878	\$ 40,865,611
131 10/2/2017	D.N.M.	17-12521	HOLCOMB OIL & GAS, INC.	\$ 905,671	\$ 380,978	\$ 1,286,649
132 10/4/2017	N.D. Tex.	17-44107	EXCHANGE AVENUE PRODUCTION CO.*	\$ -	\$ 591,116	\$ 591,116
133 10/10/2017	W.D. La.	17-20948	WILLIAM B. LAWTON COMPANY, LLC*	\$ -	\$ 166,000	\$ 166,000
134 10/16/2017	S.D. Tex.	17-35835	CASTEX ENERGY PARTNERS, L.P.*	\$ 400,000,000	\$ 4,638,454	\$ 404,638,454
2017 YTD				\$ 2,518,405,641	\$ 3,066,860,821	\$ 5,585,266,462
TOTAL 2015-2017				\$ 32,285,863,991	\$ 47,478,640,991	\$ 79,764,504,982

Extreme Petroleum Technology, Inc

Capital Spending Deficit



Global conventional discoveries** [Million boe]



Source: Rystad Energy UCube and Rystad Energy research and analysis

- Spending was cut dramatically from 2015 through 2017
- Spending levels \$600 billion per year in 2014. 2015 was \$400 billion, down a quarter trillion.
- 2015 was \$300 billion, down a third of a trillion.
- 2016 down \$300 billion, down a third of a trillion. Now down a trillion, just on the companies surveyed
- 2017 down \$250 billion. Right there we are lacking 1.25 trillion in upstream investment.
- Cuts totaled between \$1 and \$2 trillion
- Mostly outside the US in conventional
- Global discoveries in 2017 about 6.7 Billion BOE, lowest since 1940's
- Only US shale is offsetting global declines in production
- US shale has very steep decline rates, increasing average global decline rate and requiring increasing discoveries to offset
- Likely to set up future price shock



<http://www.pipeline101.com/why-do-we-need-pipelines/crude-oil-pipelines>

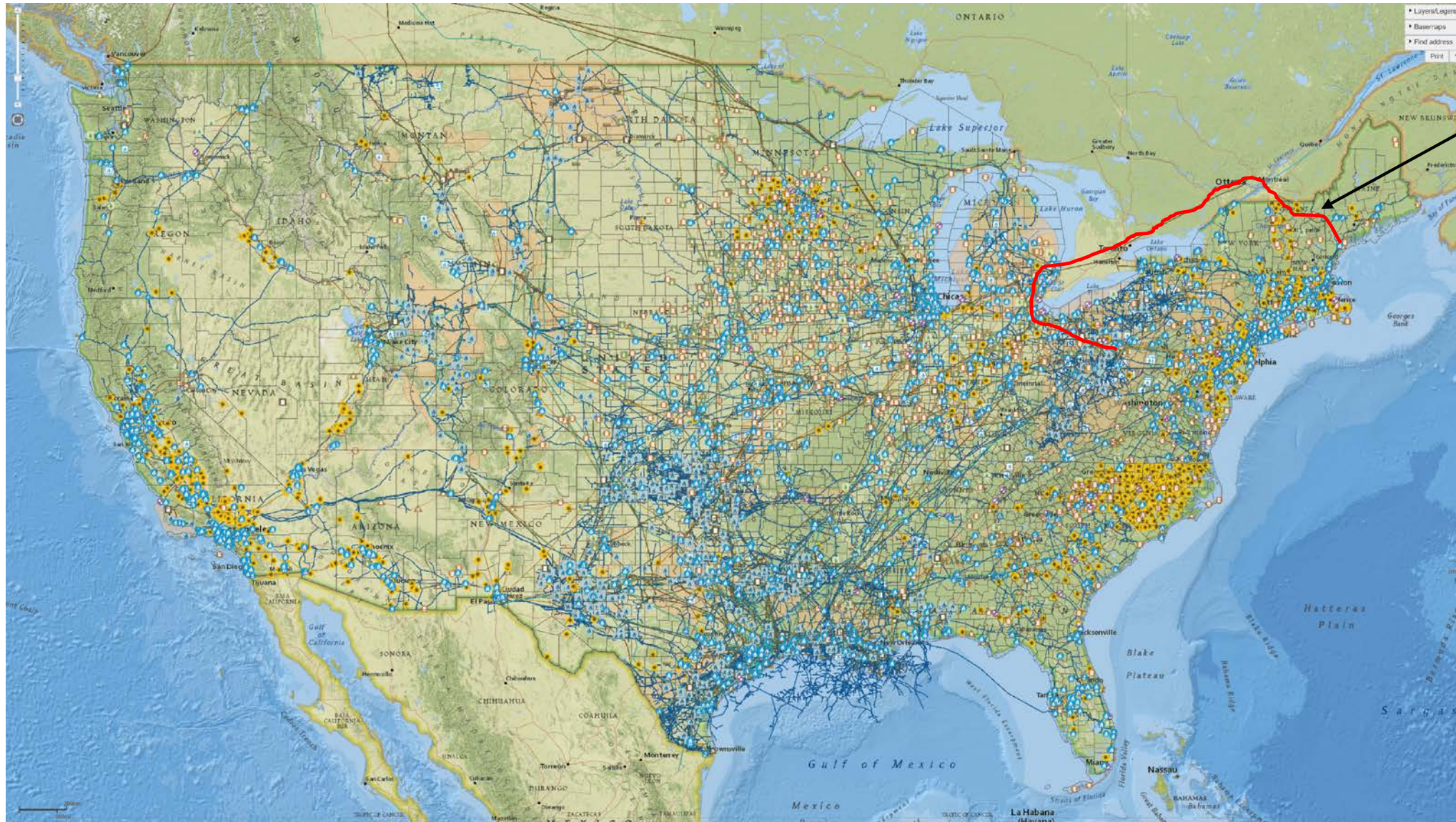
Energetics Point #5

Infrastructure is necessary to get production to market

Market Accessibility

- Unconventional development drills a lot of wells very quickly in a relatively small area.
 - Power is usually not sufficient for artificial lift, compression
 - Pipelines take-away is usually insufficient, and permits are challenged
- Oil Pipelines are at capacity and rates are high
- Gas pipelines can limit oil production due to flaring restrictions
- Need for refining capacity closer to oil production
- Need for NGL processing and marketing is critical for light oils
- New York denies access to any pipelines to connect the Utica/Marcellus gas to the New England market

Oil and Gas Transportation Network



Gas line from Marcellus to Vermont, New Hampshire, Maine through Canada

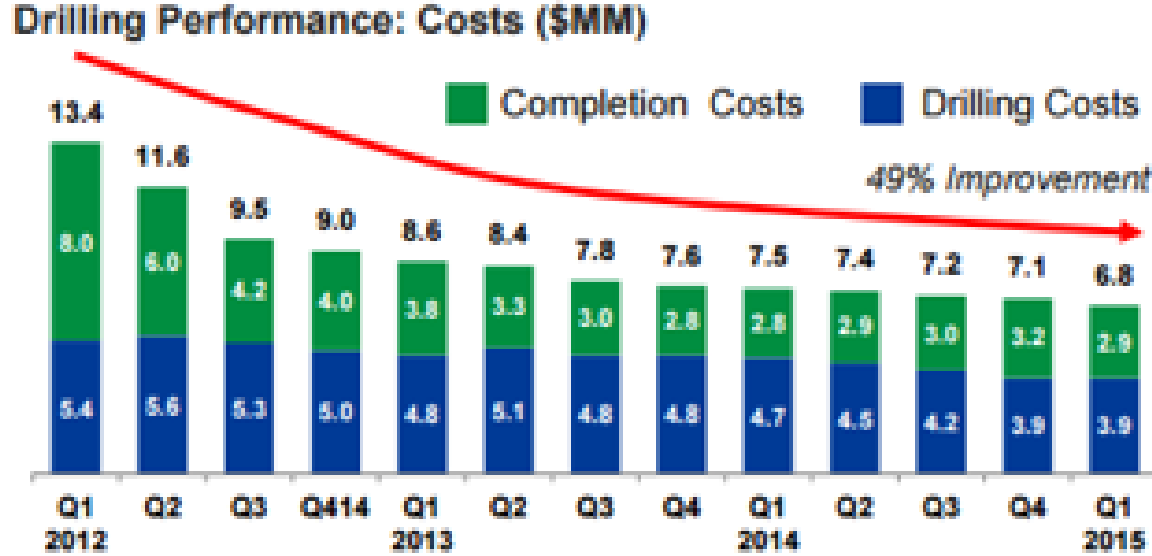
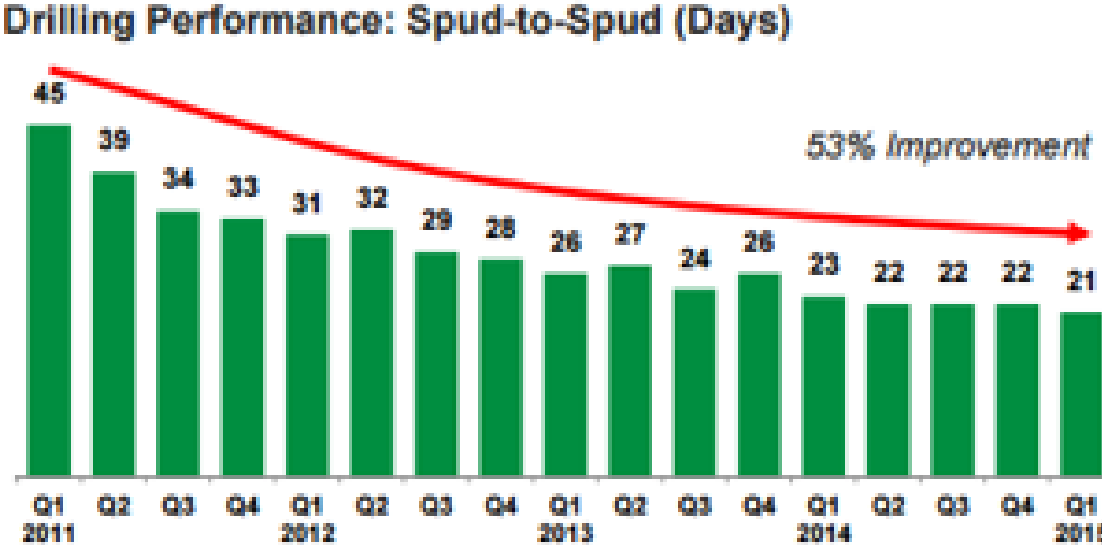
Energetics Point #6

Technology has played a disruptive role in bringing new supply to market

Technology

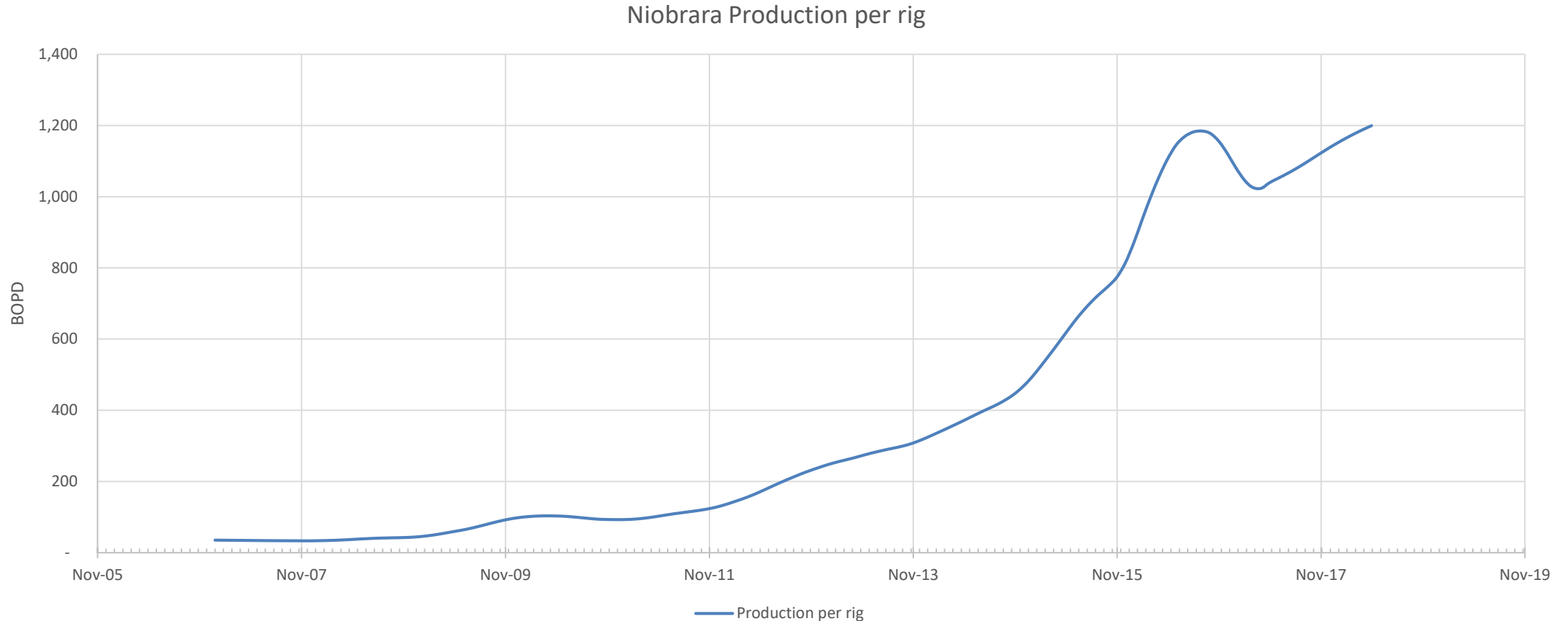
- Unconventional Technology is exploding
 - Exploration
 - Drilling
 - Hydraulic Fracturing
 - Rock Mechanics
 - Data Analytics
 - Petrophysics
 - Logistics
- Water Source and Disposal

Drilling Time and Cost Performance



Hess Corporation data

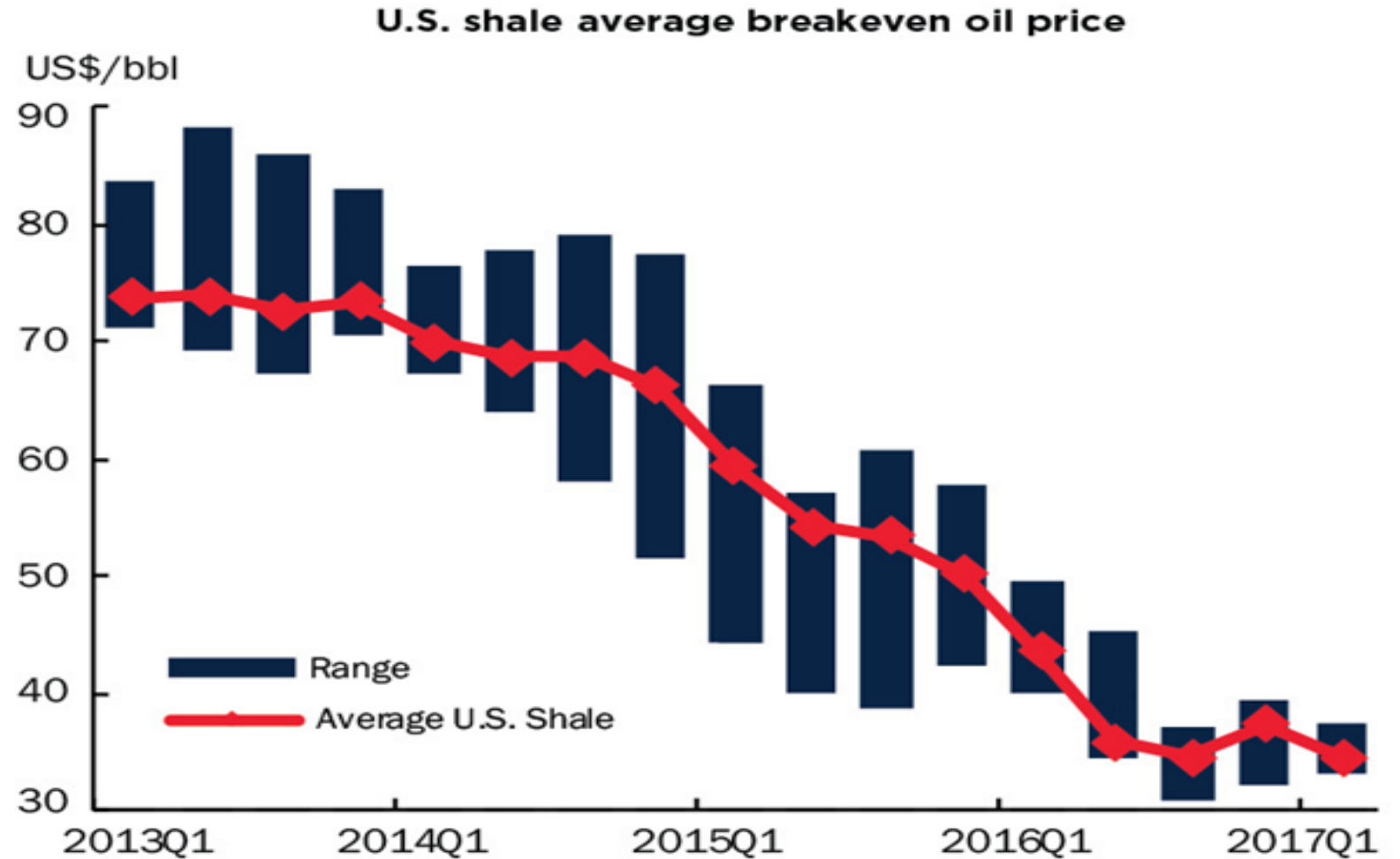
Drilling Productivity



The top Basins, Bakken, Niobrara, Permian have experienced increases in production per rig,
The Eagle Ford had a decline, likely due to maturity

Technology Driving Shale Efficiency

The effect of technology has been to increase efficiency and reduce breakeven prices from \$75 to \$35 in 4 years



SOURCE: RYSTAD ENERGY NASWELLCUBE PREMIUM.

Notes: Breakeven price is based on wellhead costs and does not include test activity, where well was shut-down after completion. Last observation is 2017Q1.

Energetics Point #7

Environmental Protection and Enviropolitics are an increasing concern



<https://www.cnn.com/2016/09/03/us/oklahoma-earthquake/index.html>

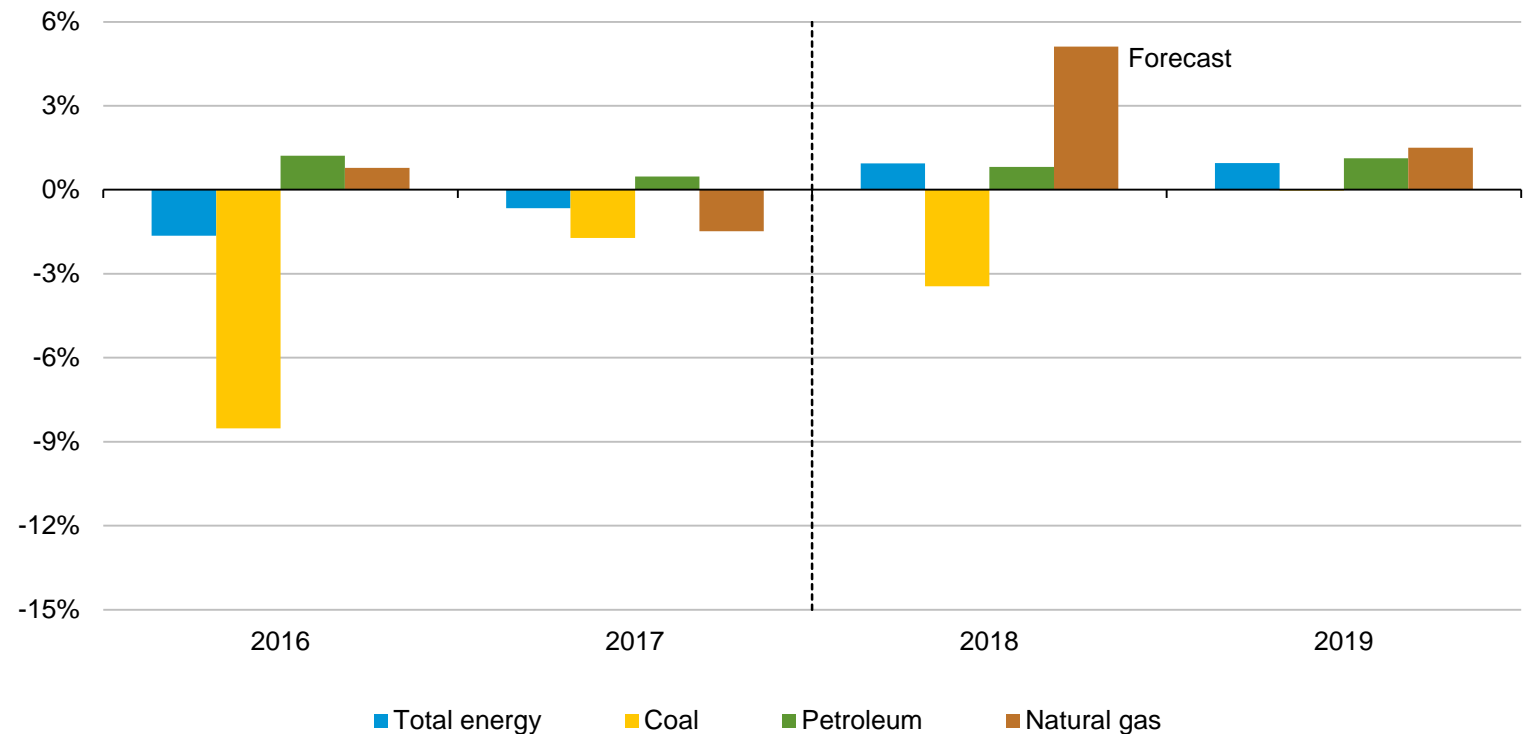
Environment

- Increasing concern over greenhouse gasses, global warming
- Earthquakes due to water disposal
- Regulatory changes
- Special Interest Group Legal Challenges
- Hydraulic Fracturing Opposition

US Energy Related CO₂ Emissions

- Coal-related carbon dioxide emissions are dropping
- Natural gas emissions are increasing as it replaces coal, but at a much lower magnitude
- Petroleum slowly dropping

U.S. energy-related carbon dioxide emissions
annual growth

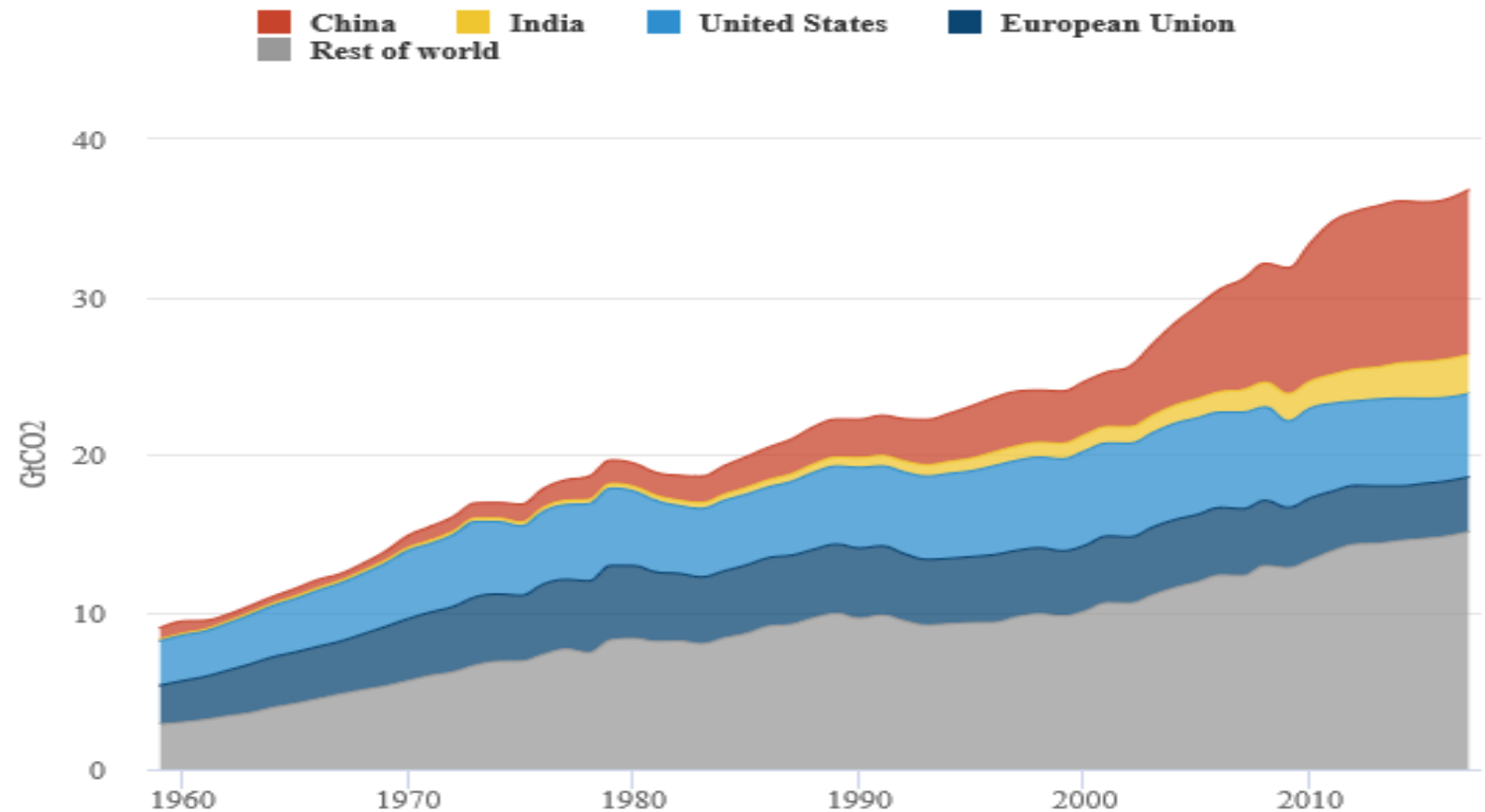


Source: Short-Term Energy Outlook, April 2018.

World CO₂ Emissions

Annual CO₂ emissions from fossil fuels by country, 1959-2017

- CO₂ emissions are more of a China and the rest of the world problem
- The US and EU have actually shrunk back to 1970 levels
- Emissions grew 3% per year from 2000 to 2013, but only 0.4% from 2013 to 2016



<https://skepticalscience.com/co2-rise-2-percent-2017.html>

Regulations

- Lifting of crude oil export ban
- Delay of flaring and venting rules on public lands
- Hydraulic Fracturing
 - Vacation of BLM hydraulic fracturing oversight
 - Local bans on frac operations
 - Russian funding of popular opposition
- Opening lands to leasing
 - ANWR
 - OCS
- FERC Commission appointed to remove backlog of pipeline applications
- Nullify Obama executive orders
- Will the next administration reverse course?

The Stone Age did not end because we ran out of stones.

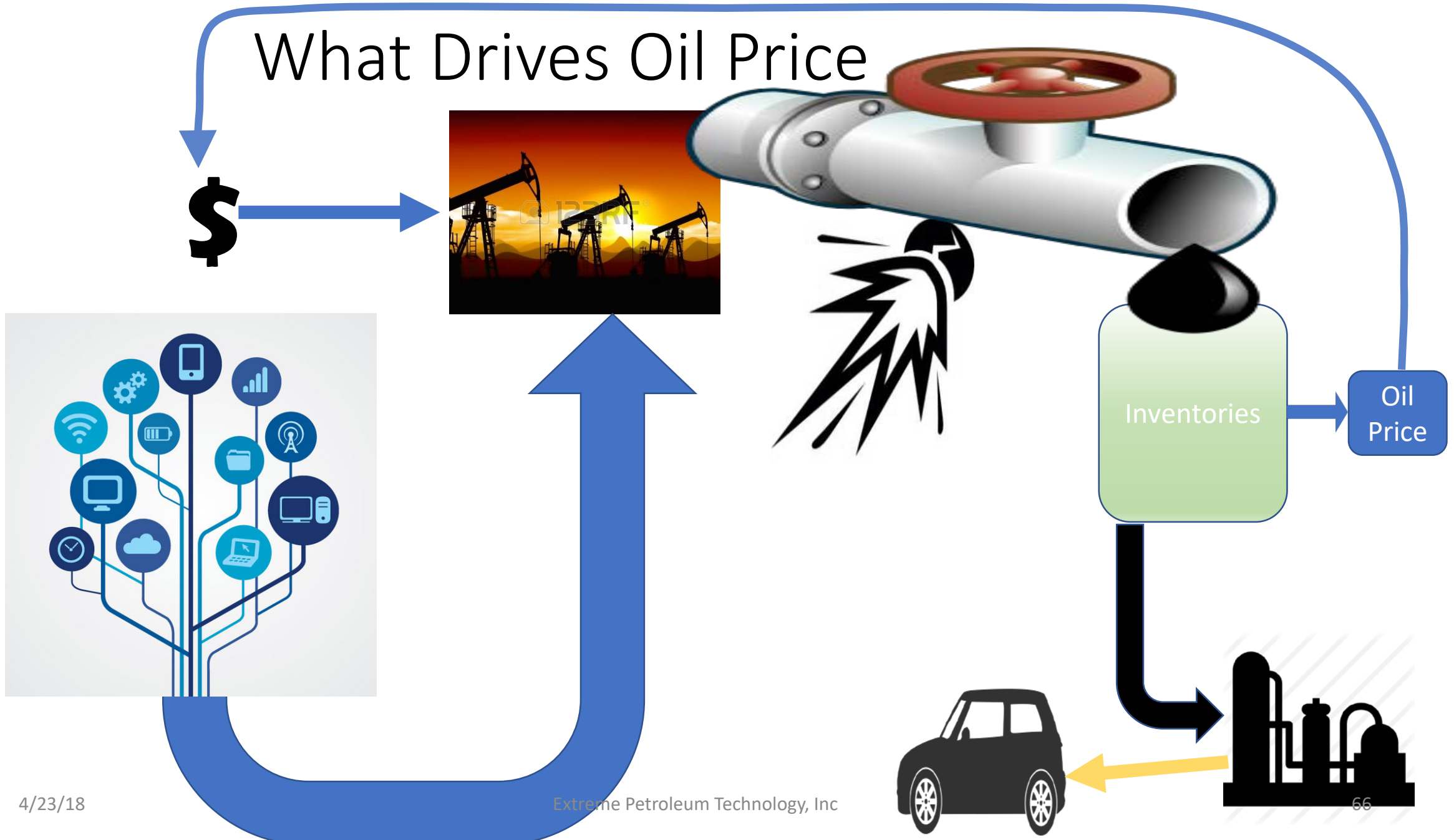
Zaki Yamani (Saudi Oil Minister during 1973 crisis while trying to argue for lower prices to discourage alternative energy)

Trajectory

Where are prices going?

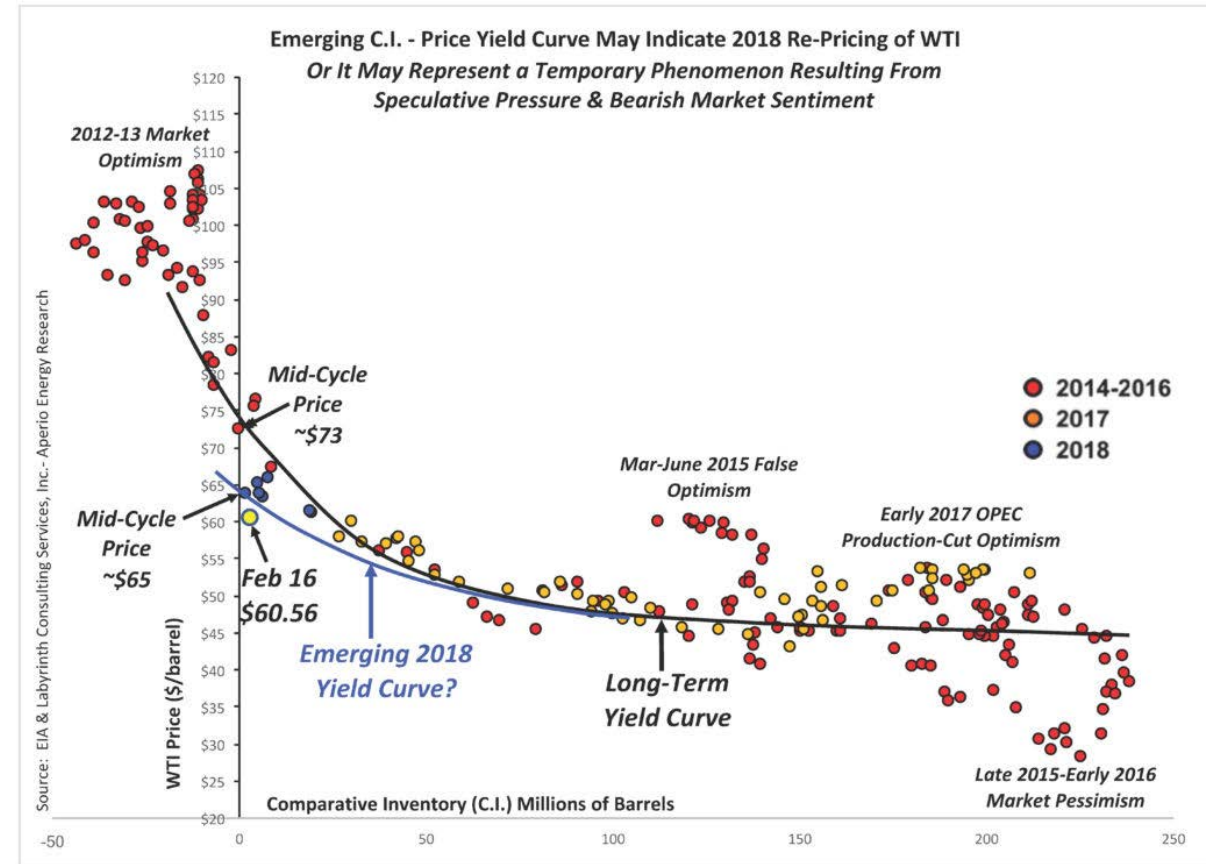


What Drives Oil Price



Trajectory

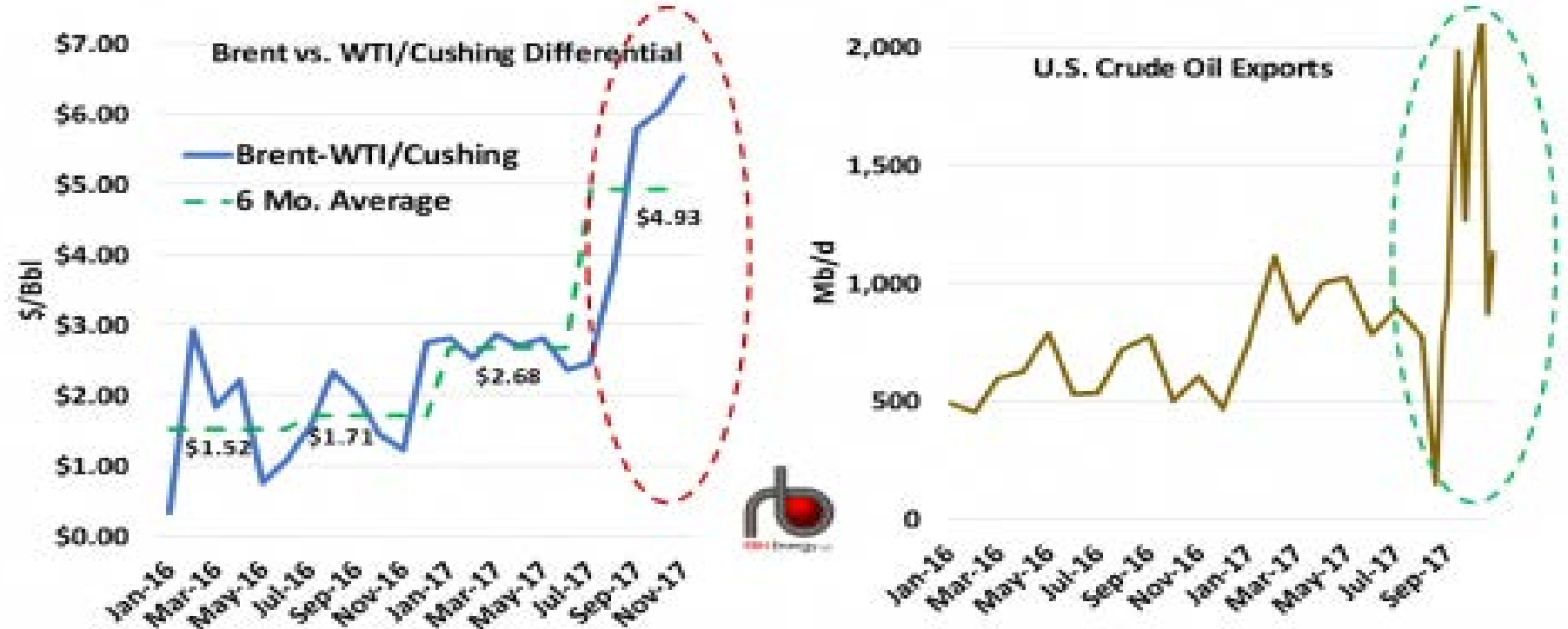
Short Term (2-3 years) Oil Price Trends



Important Factors for Short Term Oil Prices

1. Demand Growth in US, China
2. US Shale production growth/Capital discipline
3. OPEC Production Cuts
4. OPEC's exit strategy
5. Inventories
6. Unexpected outages
7. Outbreak of war

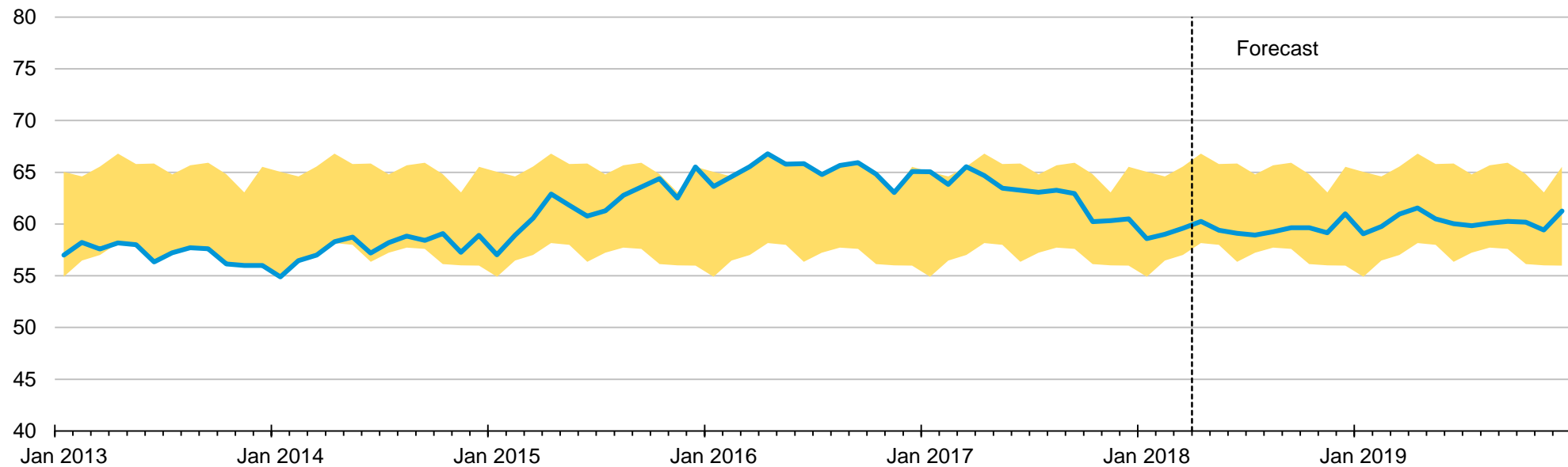
Differentials Effect on US Exports



- Exports tie US prices (WTI) into the world market.
- Unconventional oil is very light as is acceptable to only a few refiners, so it is discounted to Brent
- US refineries spent the last decade gearing up for heavy Canadian crude and can't take Light Unconventional Oil
- Refiners will start to adapt to using unconventional crude and the differential will come down

OECD Commercial Inventories

OECD commercial stocks of crude oil and other liquids
days of supply



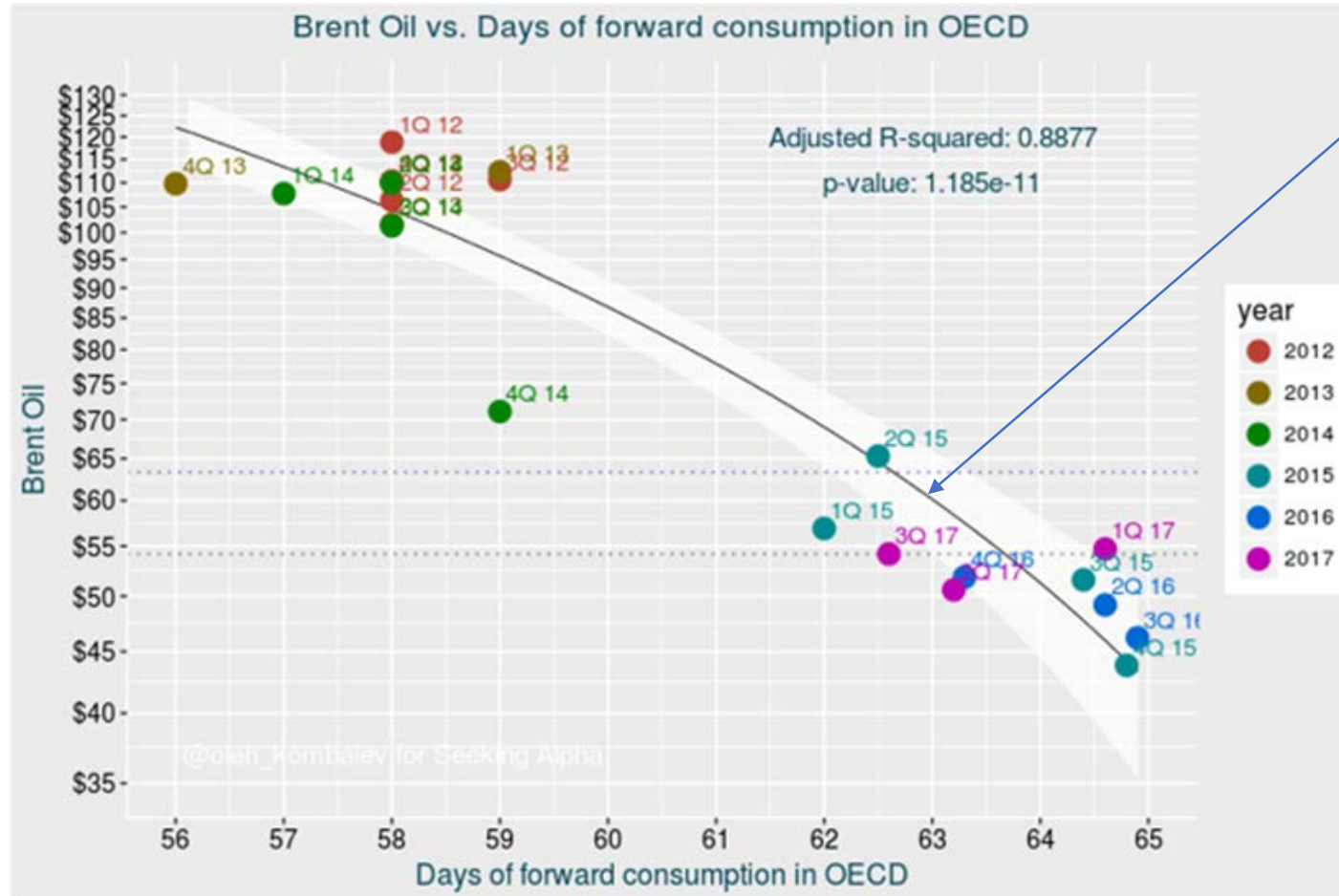
Note: Colored band around days of supply of crude oil and other liquids stocks represents the range between the minimum and maximum from Jan. 2013 - Dec. 2017.

Source: Short-Term Energy Outlook, April 2018.

- OECD inventories are more political and not as reliable
- Still shows same trends as US, with reduction in 2017 to nearly average
- Projections show a stable inventory level going forward

Inventories versus Crude Prices

Inventory levels drive prices on world wide basis



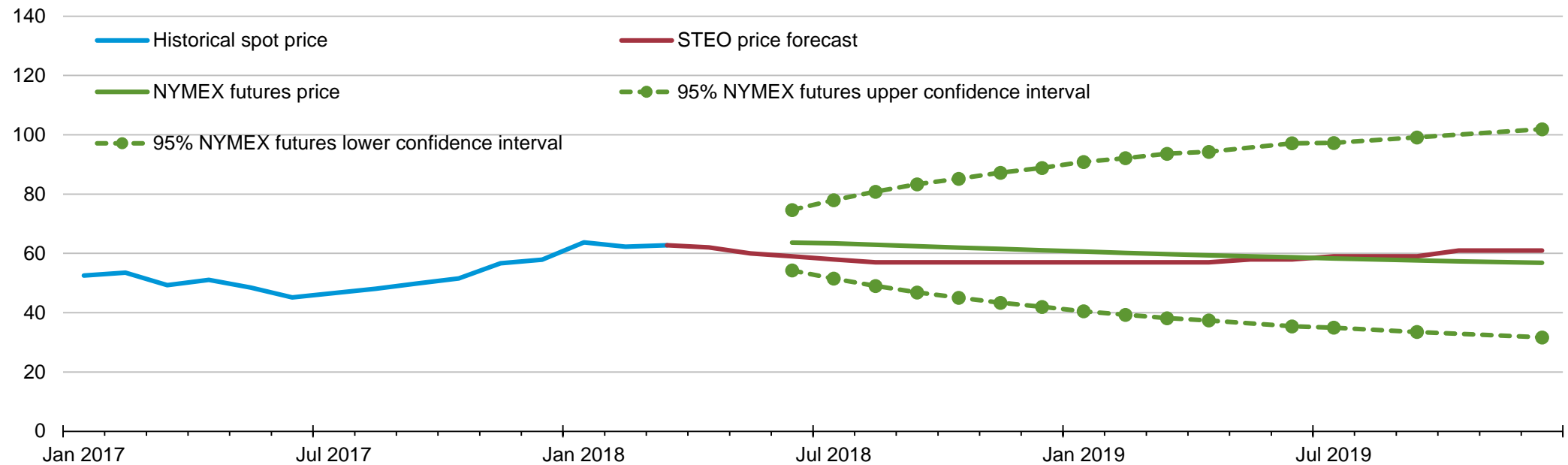
April 2018 63 Days

Oil should be at \$60

Geopolitical premium of \$10 per barrel!

West Texas Intermediate (WTI) Prices

West Texas Intermediate (WTI) crude oil price
dollars per barrel



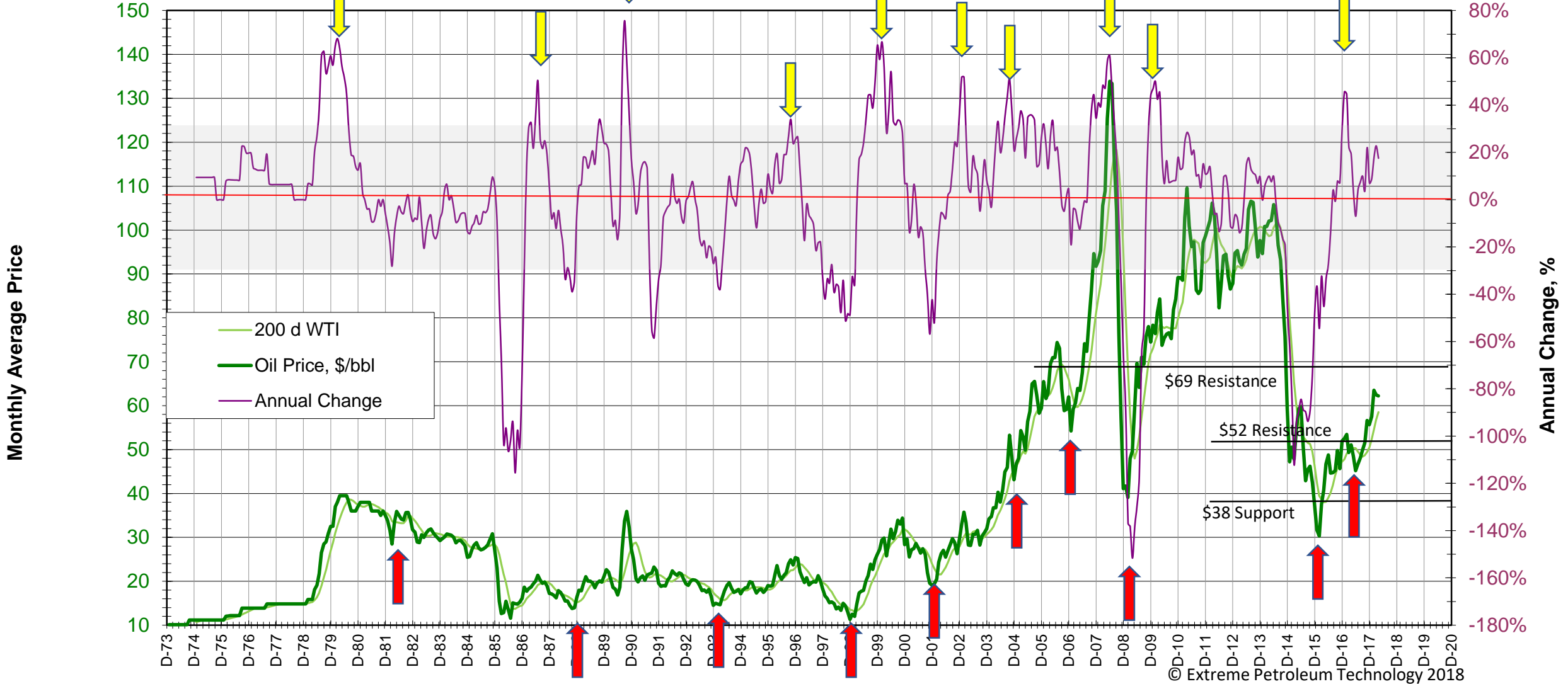
Note: Confidence interval derived from options market information for the 5 trading days ending Apr 5, 2018. Intervals not calculated for months with sparse trading in near-the-money options contracts.

Source: Short-Term Energy Outlook, April 2018, and CME Group.

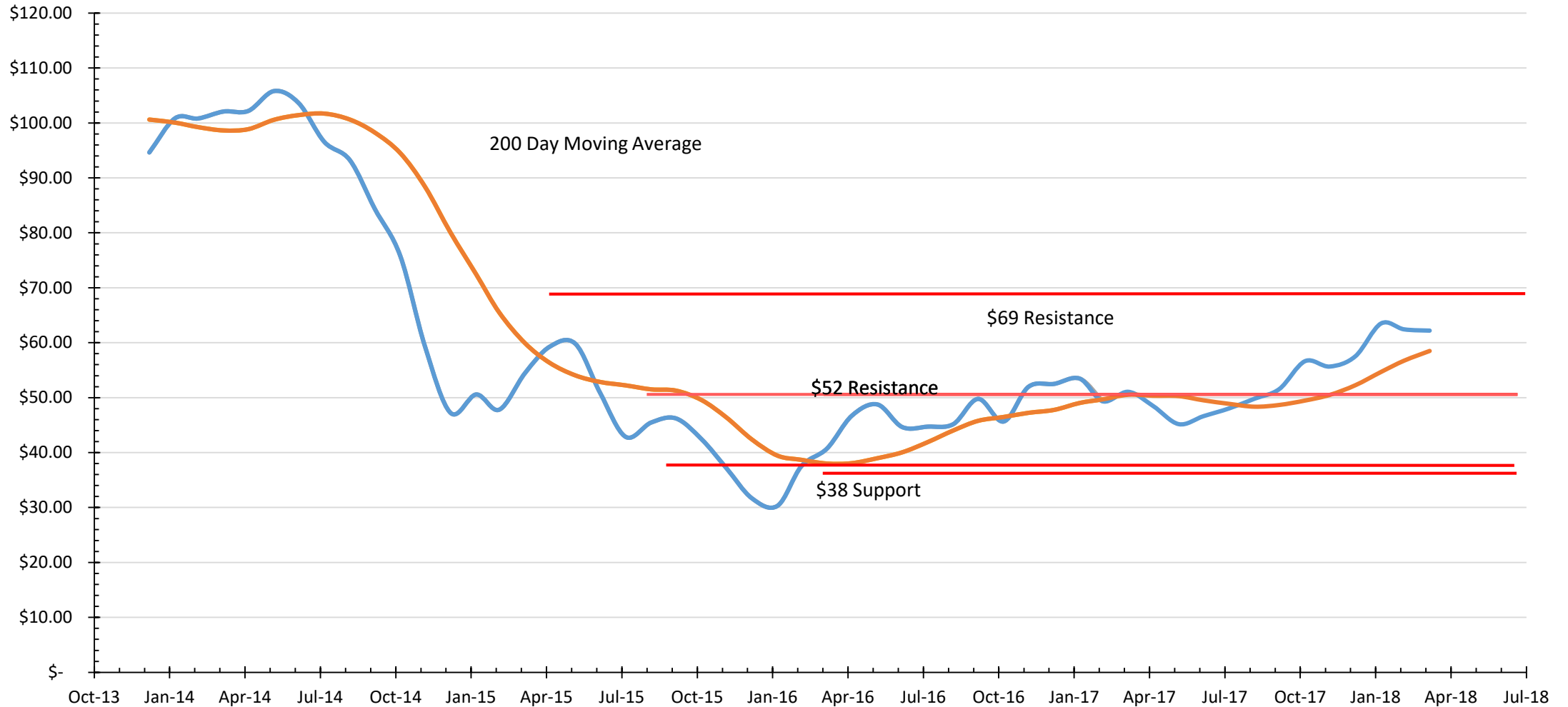
WTI Analysis Chart

West Texas Intermediate Oil Prices

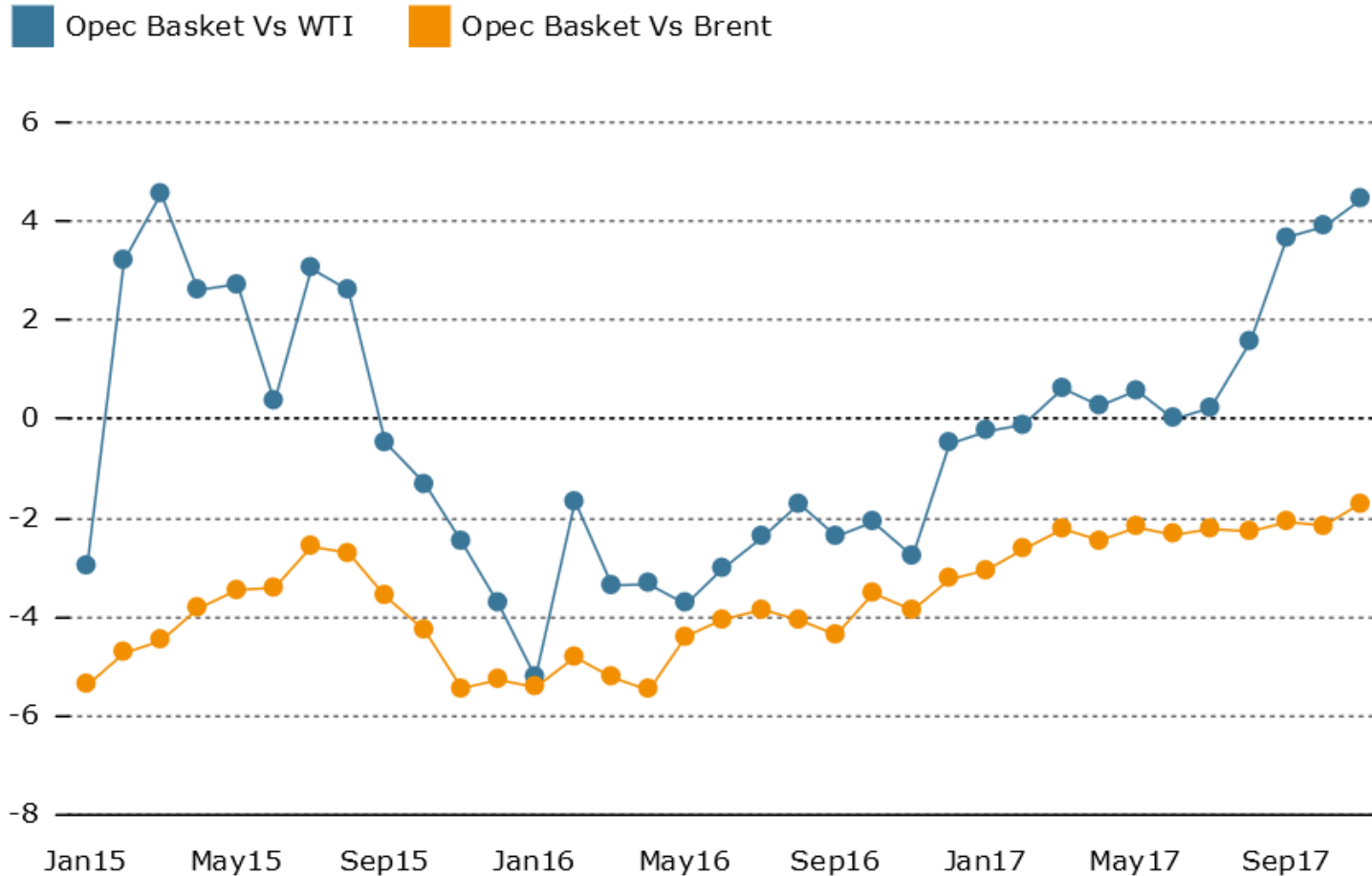
- Green curve is WTI monthly average price
- Light green curve is 200 day moving average
- Established support level at \$48, and cleanly broke \$52 resistance level. Next resistance level is \$69
- Purple curve is the oil price derivative curve
- When derivative curve exceeds 30%, it causes an opposite reaction in price curve



WTI 200 day Moving Average

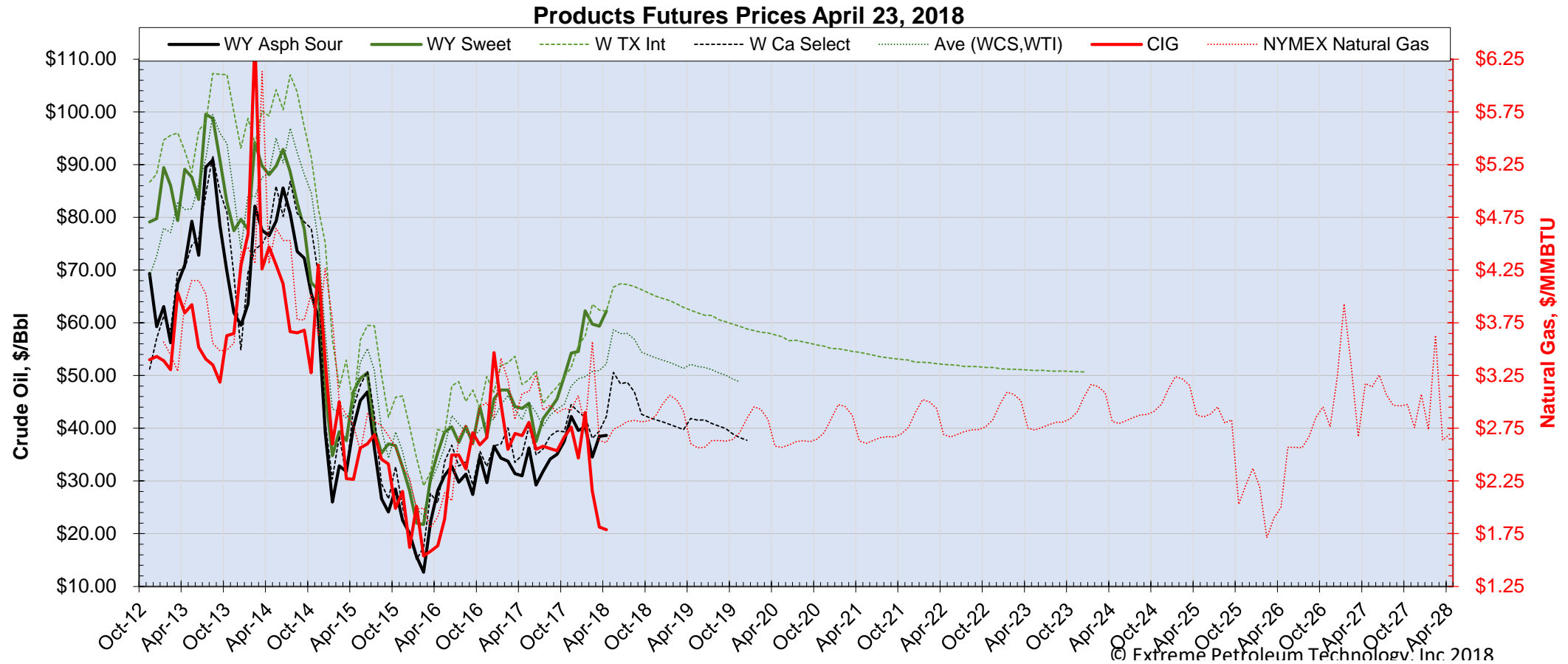


The OPEC Basket to WTI Differential



- OPEC is using this differential to manipulate US inventories
- Asia will buy either crude, whichever is cheapest
- When OPEC basket is priced above WTI, Asia buys WTI and draws down US crude inventories
- When US crude inventories drop, oil prices go up

WTI Futures



If you got the idea that oil prices will firm up over the next few years, big money disagrees with you

Anticipated 2018 Events

- Saudi Arabia is driving down US crude inventories to average levels
 - Using WTI-OPEC basket differential to accomplish this
 - OPEC inventories are not reported
- OPEC meets in June and will reconsider production cuts
- Expect US crude inventory drawdown to be complete before meeting
- That opens door to revisit production cuts
 - Abrupt end or fade out?
- Stage is then set for true world demand and supply to rebalance
- Prices will likely take a drop in second half until market sees solid trend emerge

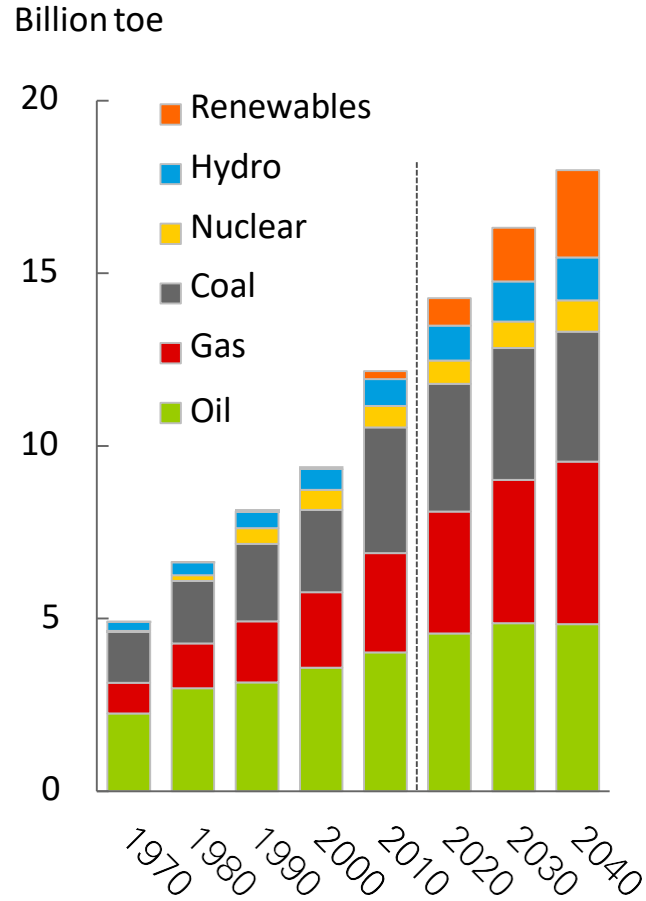
Trajectory

Long Term Oil Price Trend

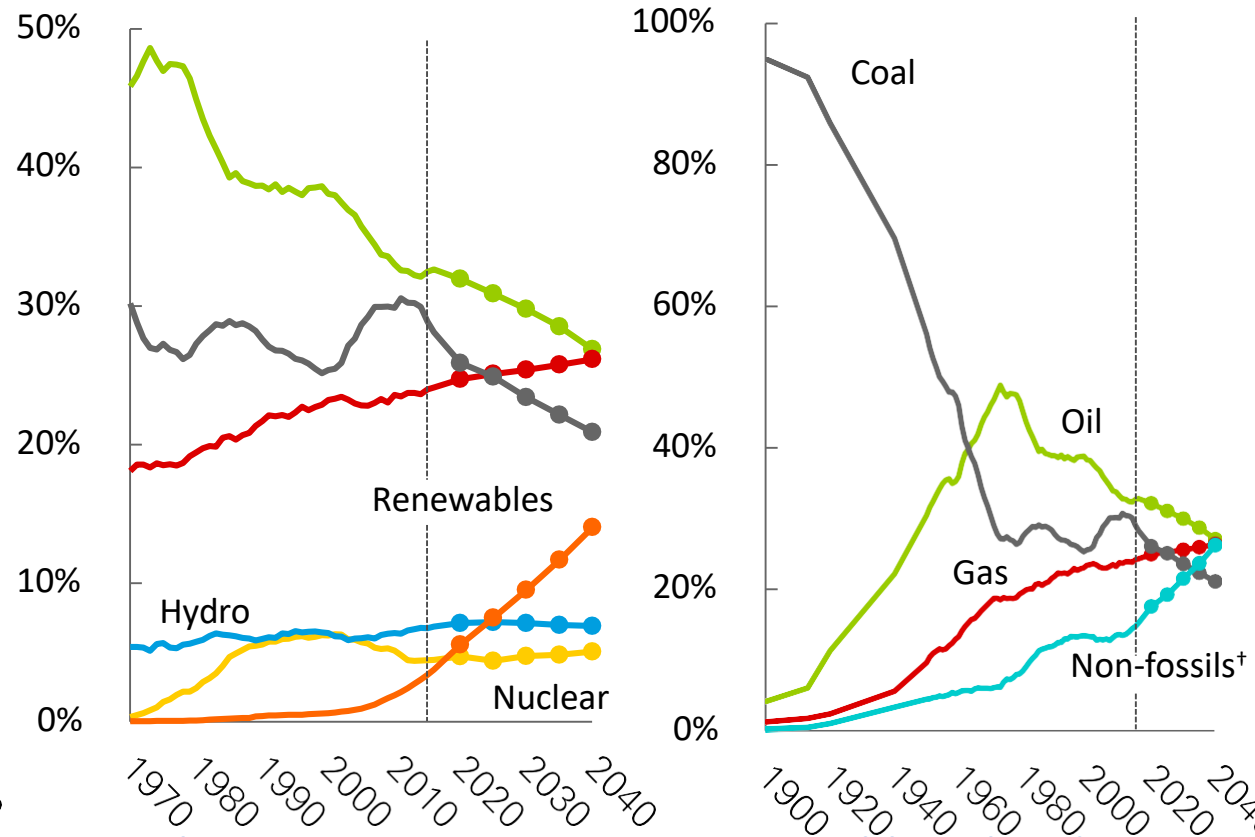


The transition to a lower carbon fuel mix continues...

Primary energy consumption by fuel



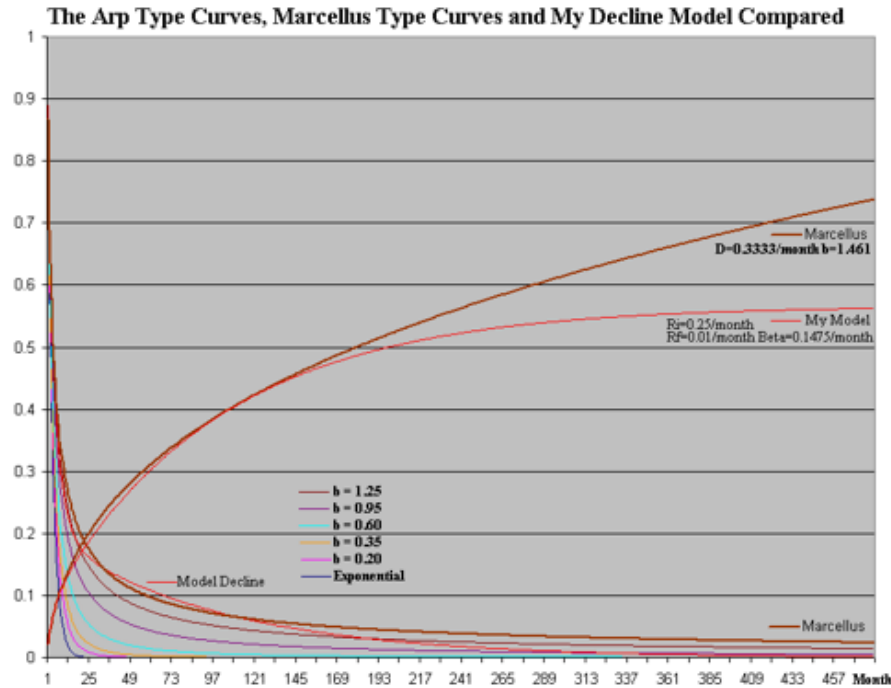
Shares of primary energy



Oil consumption continues to grow, although it decreases as a total percent of energy consumption

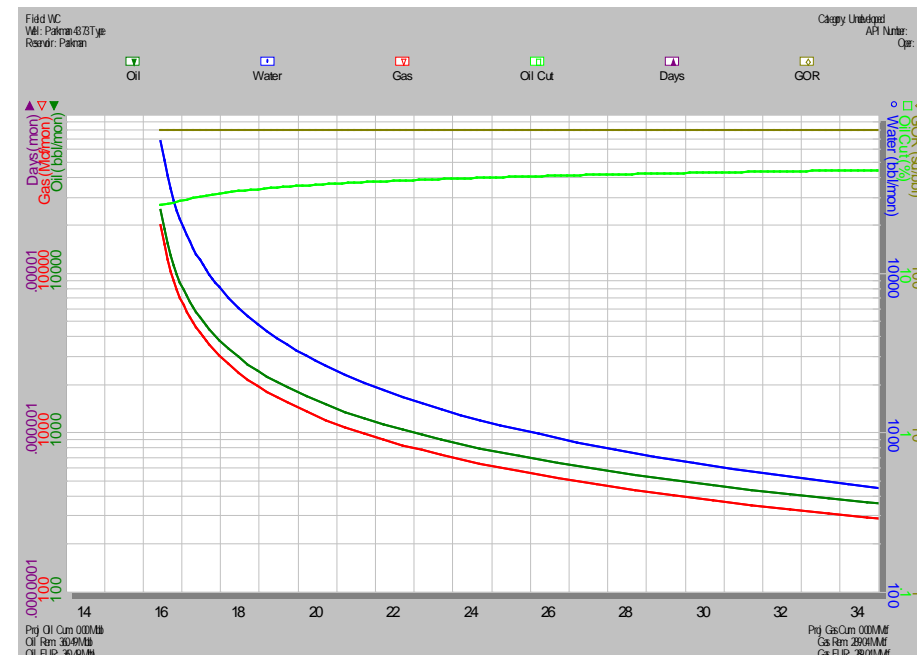
† Non-fossils includes renewables, nuclear and hydro

US Unconventional Production Declines Quickly



Long term decline projections commonly based on projection of transient flow, not stabilized flow. Consequently they tend to overestimate ultimate oil recovery.

- Declines are hyperbolic not exponential like conventional production
- Projections tend to overestimate long-term reserves

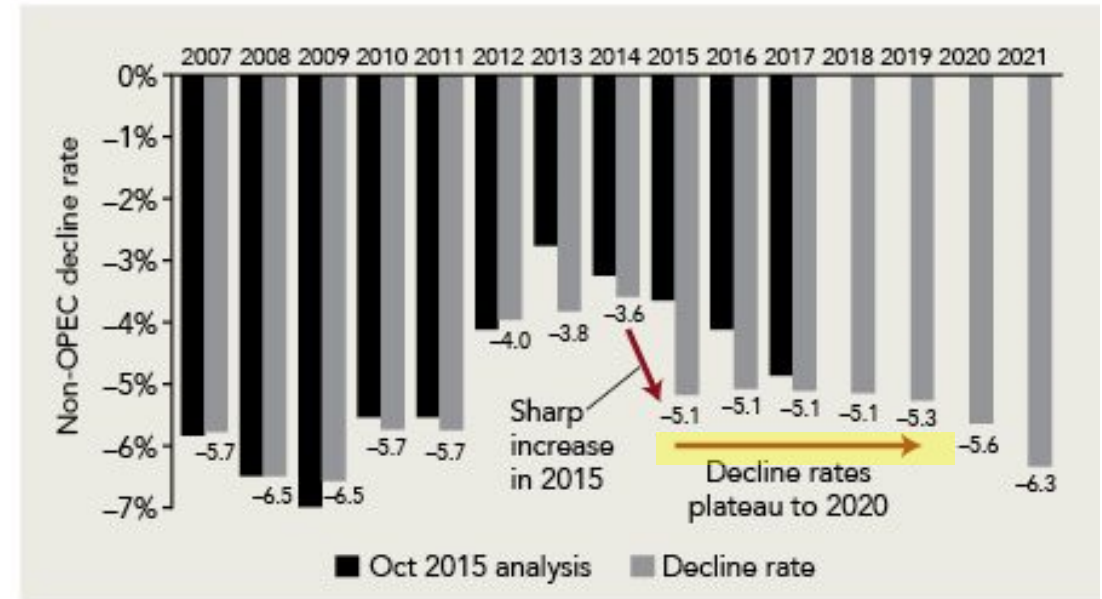


Decline Never Sleeps

T2: 2016 DECLINE RATES

	US	Europe	Bitumen
Exxon	9.9%	33.4%	
Shell	21.5%	18.6%	4.0%
BP	10.2%	17.5%	
Chevron	13.4%	14.9%	2.9%
COP	11.9%	11.6%	2.3%
EOG	21.2%	—	—

F1: ANNUAL AVERAGE NON-OPEC DECLINE RATE



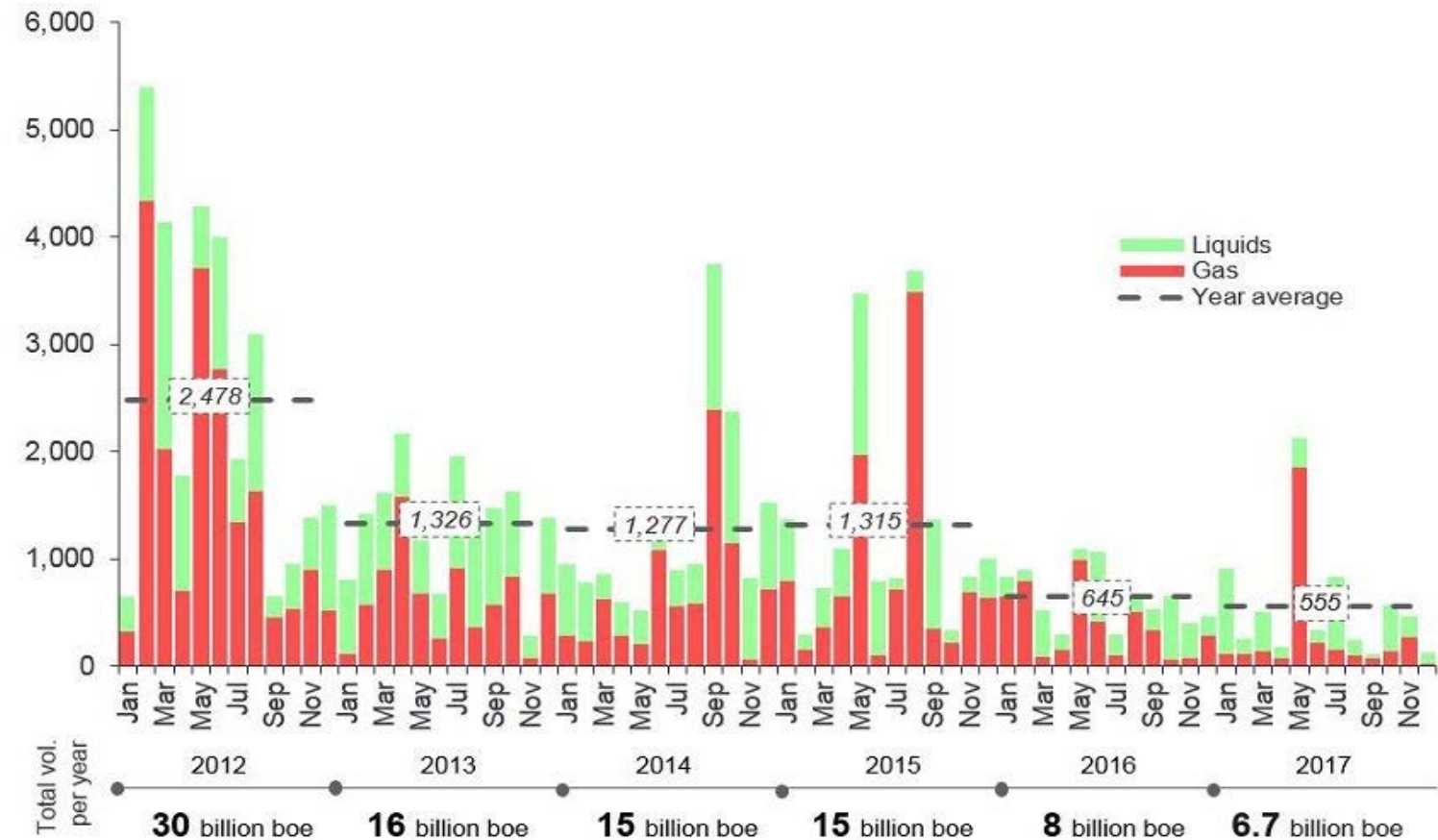
Source: Wood Mackenzie, Upstream Data Tool Q2 2017, excludes North America tight oil

A 5% decline on world production of 97 MMBOPD means a drop of 5 MMBOPD per year
A global demand growth of 2% per year means every year we need to add 2 MMBOPD
Every year requires an additional 2,557 MMBO or 7 MMBOPD just to stay balanced!

Lack of Investment in Future Supply

- Conventional discoveries have plummeted due to unconventional production and lack of investment due to low oil price
- Conventional exploration cycle is approximately 10 years
- Although unconventional will make up part of the deficit with a shorter development cycle, a supply shock could be on horizon in 10 years

Global conventional discoveries** [Million boe]



Source: Rystad Energy UCube and Rystad Energy research and analysis

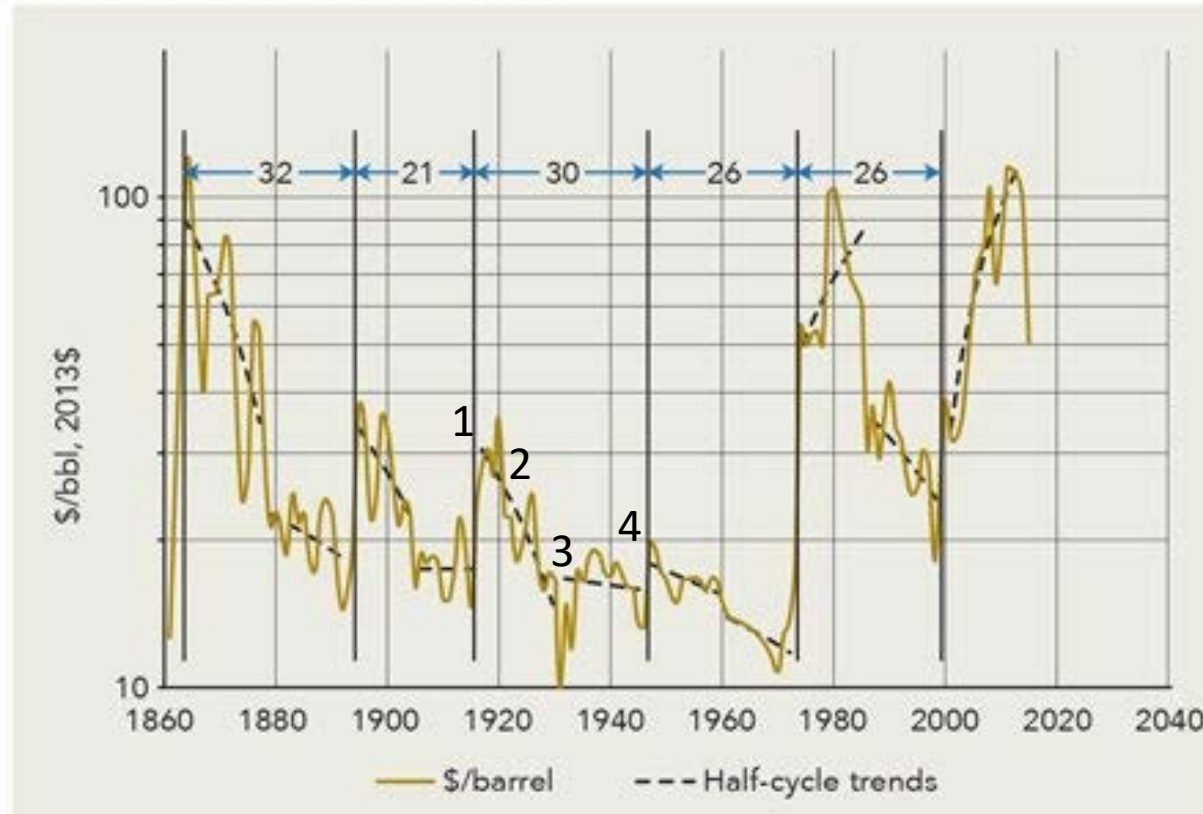
Extreme Petroleum Technology, Inc

The Guillot Supercycle

F1: GRAPH OF HISTORICAL OIL PRICES, INFLATION ADJUSTED TO 2013 DOLLARS, AND SHOWING THE FIVE COMPLETED HISTORICAL SUPERCYCLES AND THEIR DURATION IN YEARS (2015 AVERAGE PRICE BASED ON DATA THROUGH JULY ONLY)

Guillot's Classification

- Sharp upward price spikes at start
- 1 or 2 additional in first half
- Mid-cycle price crash
- Low volatility and declining real prices during second half
- Collapse at end of cycle



My Interpretation

1. Disturbance in the demand-supply balance
 2. Aftershocks, knee-jerk reactions
 3. Rebalancing
 4. Build efficiency to the point that supply cannot react to changes in market (Inelastic)
- Note use of log scale for oil prices
 - Currently in rebalancing phase until 2020
 - Efficiency build will go to 2025
 - Next supply disruption 2021 to 2030

Thank You

- To the Holy Spirit for the enlightenment to put this together
- To my wife, Kathleen, for her endless patience and support while I endeavor to relive the pursuits of that most famous roustabout Don Quixote
- To Rob Hurless with EORI for being the force of nature that brought this all together
- To all of the good people who so generously sponsor my efforts through the newsletter, especially
 - Steve Kirkwood
 - Flip Cooper
 - Shane and Joanne True
 - Allen & Crouch Petroleum Engineers
 - EORI
 - First Interstate Bank

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Boom Times Humor

Albert Einstein dies and goes to heaven only to be informed that his room is not yet ready. "I hope you will not mind spending a short time in a dormitory. We are very sorry, but it's the best we can do and you will have to share the room with others" he is told by the doorman.

Einstein says that this is no problem at all and that there is no need to make such a great fuss. So the doorman leads him to the dorm. They enter and Albert is introduced to all of the present inhabitants.

"See, Here is Robert. He has an IQ of 180!"

"That's wonderful!" says Albert. "We can discuss mathematics!"

"And here is Max. His IQ is 130!"

"That's wonderful!" says Albert. "We can discuss physics!"

"And here is Bubba. His IQ is 90!"

"That's wonderful! We can discuss the latest baseball games!"

Just then another man moves out to capture Albert's hand and shake it. "I'm Wilbur and I'm sorry, but my IQ is only 70."

Albert smiles back at him and says, "So, how high do you think oil prices are going?"