Macro Voices Presentation

Mark Gordon

Oil is Cyclical

Note: Any market analysis, estimates, and similar information, including all statements of opinion and/or belief, contained in this presentation are subject to inherent uncertainties and qualifications and are based on a number of assumptions.

From Scarcity to Abundance and Back

- Oil oscillates from scarcity to abundance
- In the last 15 years we have gone through two pricing regimes and are entering a third:
    - Peak Oil
    - Age of Abundance
    - Return to Scarcity

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Oil Prices are Reflexive

- Low oil prices bring high oil prices
- High oil prices bring low oil prices
- This is an example of Soros' reflexivity: the price changes reality and does not reflect reality.

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Inventory and Price

	WTI Price	Days of Forward Demand		
		Industry	Government	Total
Q4 1998	$10.35	56	26	82
Q3 2008	$147.27	56	32	88

- The oil price made the low and the high with the same days of forward demand for industry inventory.
- **Sentiment or the overall regime drives price, not the level of inventories.**

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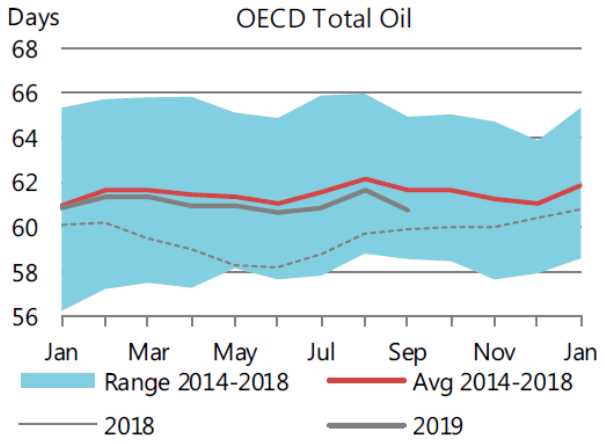
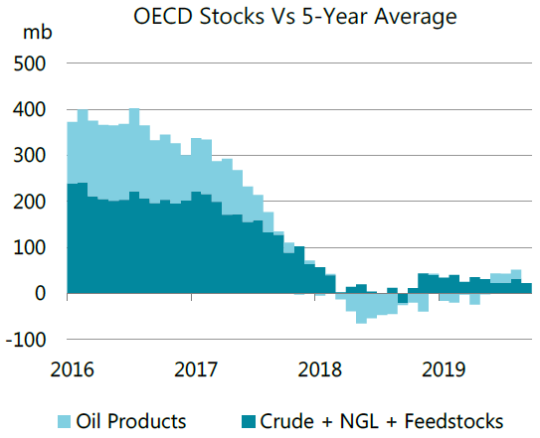
Inventory





Source: IEA Monthly Report, November 2019

- Despite the low oil price, global inventories are at normal levels. Negative sentiment has held the price in check.

- The change in inventory is more important than the level of inventory. The oil price regime or macro outlook sets the context for inventory.

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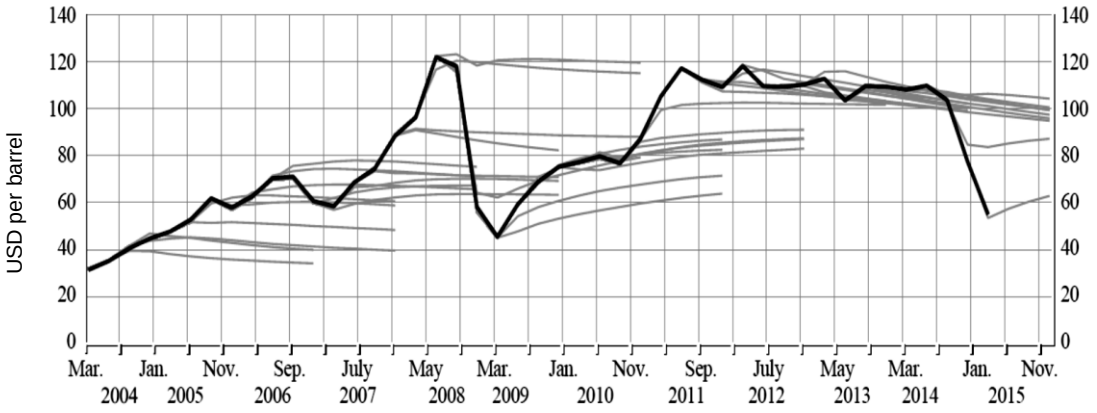
Futures are not Forecasts

Brent Crude Oil Prices and Futures



Source: www.ecb.europa.eu/pub/pdf/other/art03_eb201504.en.pdf

- **The futures curve is a projection of the present and not a forecast of the future.** When the present market is tight, the futures curve is in backwardation which incents refiners to release inventory. When the present market is loose, the futures curve is in contango which incents the refiners to build inventory.

- The futures curve is related to the present through the cost of storage and the interest rate. An arbitrage situation creates the building or releasing of inventory. **The futures curve does not forecast the future oil price but provides a mechanism to move inventories.**

- The spot price is statistically a better forecast of the future realized oil price because the futures curve has a tendency to under-forecast given that the curve is usually backwardated. The spot price, however, is not a good forecast of the future price.

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Peak Oil Misconceptions

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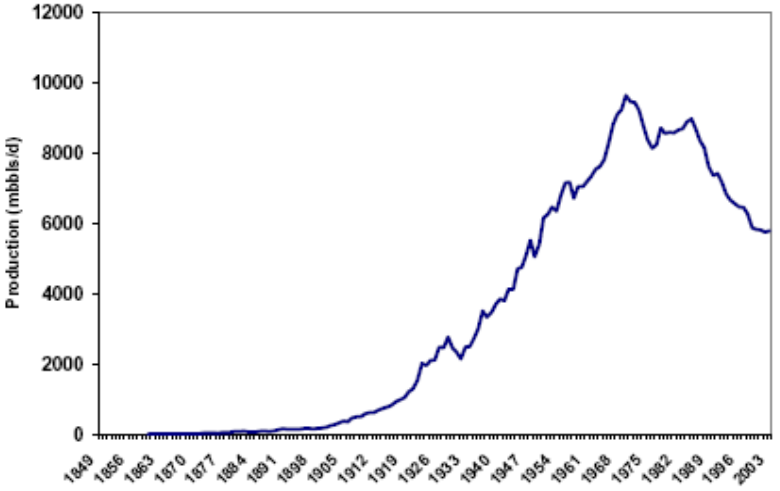
The Finitude of Oil

- There is no question that global oil production will peak. The only question is when.
- The recent surge in unconventional oil production has enabled the market to ignore peak oil.
- Amid widespread disbelief, US conventional oil production peaked in 1970. King Hubbert, a Shell petroleum geologist, had predicted the peak 14 years earlier in 1956.
- **'Peakists' are often dismissed despite Hubbert having made one of the best long term forecasts in history.**

US conventional production – 1850 to present



Source: Oil & Gas Journal Energy Statistics Sourcebook (14th Edition), EIA

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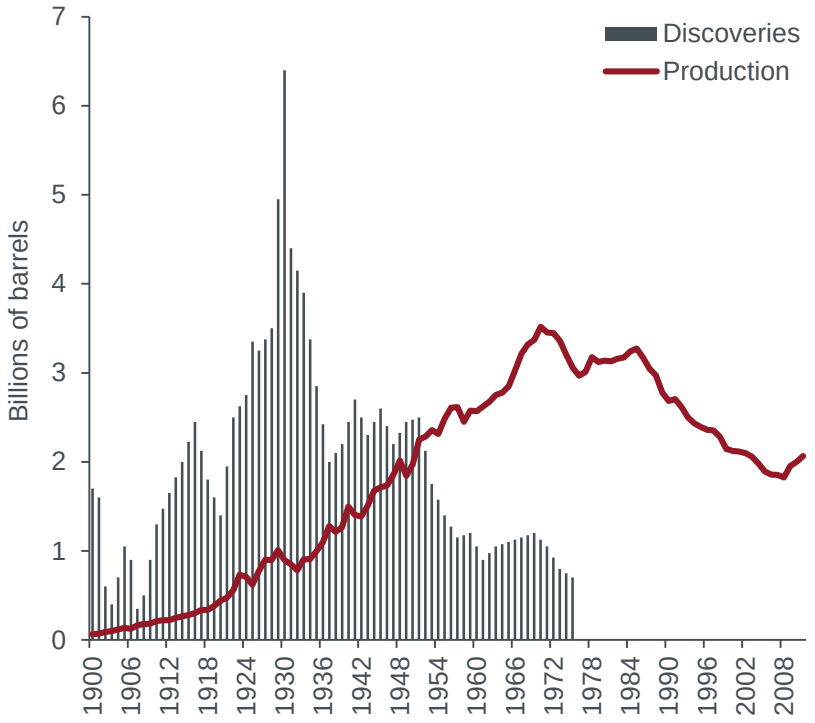
Hubbert Methodology

- Mathematically, the area under the discovery curve needs to be equal to the area under the production curve. US conventional discoveries peaked in 1930, and US conventional production peaked 40 years later in 1970.
- Given the bell-shaped curve of discoveries, Hubbert assumed that the production curve would have the same shape. **This assumption implies that oil production will peak once 50% of the resource is depleted.**
- The discovery curve creates a limit on the production curve, both on the way up and on the way down.

Lower 48 discoveries and US production



Source: Oil & Gas Journal Energy Statistics Sourcebook (14th Edition), EIA

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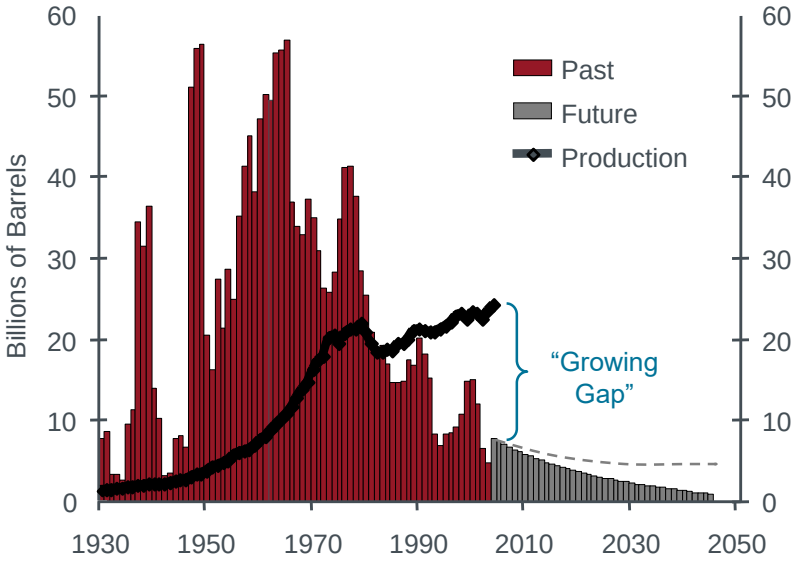
The Global Situation for Conventional Oil

- James Schlesinger (the former Secretary of Energy, Secretary of Defense, and Director of the CIA) used this chart when he testified before the Senate Committee on Foreign Relations in 2005.
- According to Schlesinger's chart, global discoveries peaked in **1962**, and global production started to outpace discoveries **by 1981.**

Trends in discoveries and production



Source: US Senate

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Global Peak Production – Standard Methodology

Peak production year (50% depletion)

EUR (Trillion B)	2.3	2.4	2.5	2.6	2.7	2.8	2.9
Year	2004	2008	2010	2012	2014	2015	2017

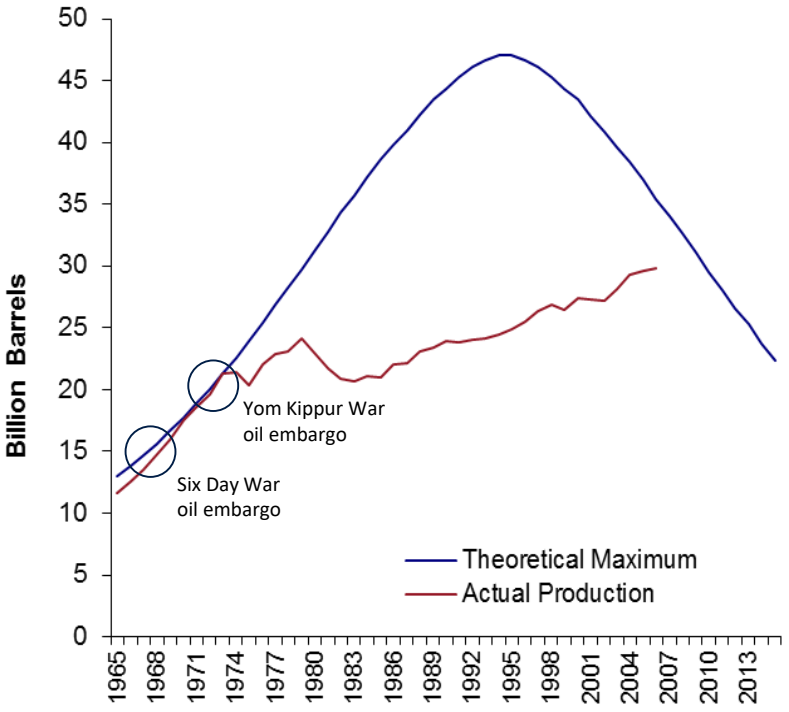
Source: BP Statistical Review of World Energy

- Standard peak oil methodology assumes the peak in production will happen at the 50% depletion point for the global Estimated Ultimate Recovery (EUR).
- **Most peak oil theorists believed the EUR is around 2.5 Trillion barrels. From their perspective, global oil production already should have begun its relentless decline in 2010. They have no ability to explain why conventional production has continued to grow.**
- **This perspective governed oil prices from 2003 to 2014 despite having a fundamental flaw.**

Excess Productive Capacity

- High oil prices in the 1970s and early 1980s caused demand destruction which ultimately restrained oil production growth. Global oil production has been below its theoretical maximum for the last forty years.
- **With production below the potential maximum, producers were able to flood the market, causing low prices and disguising the finitude nature of oil.**
- In 1967, when production was under the limit created by the Hubbert Curve, the oil embargo from the Six Day War had no effect on the oil price. However, In 1973, when production was bumping up against the Hubbert Curve, the oil embargo from the Yom Kippur War led to a four-fold increase in oil price.

Below the Hubbert Curve



Source: BP Statistical Review of World Energy

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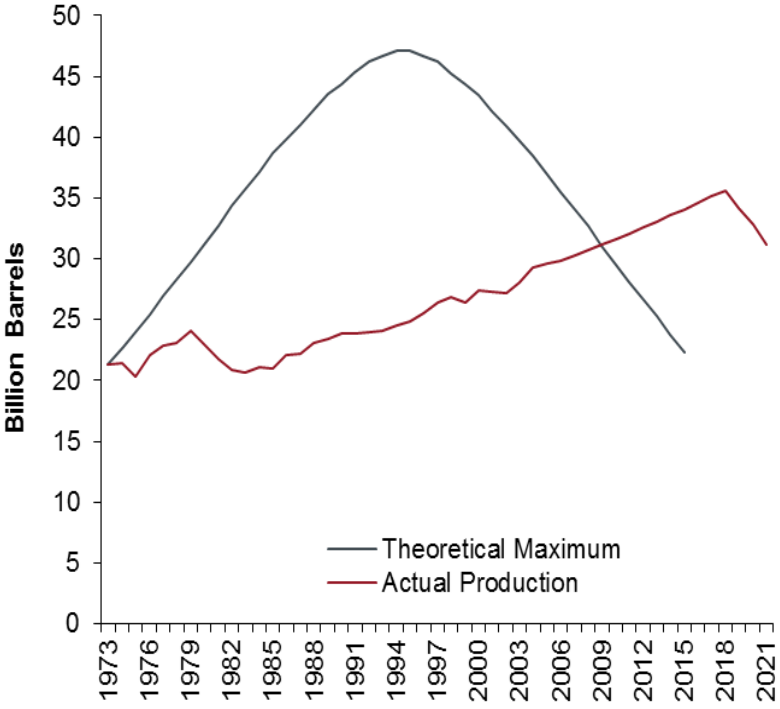
Deferring the Peak

Three important consequences of producing below the theoretical maximum:

- A deferred peak – later than expected.
- A peak past 50% depletion (actual peak likely to be closer to 60%).
- A lower production peak.

Deferred peak with rapid decline



Source: BP Statistical Review of World Energy

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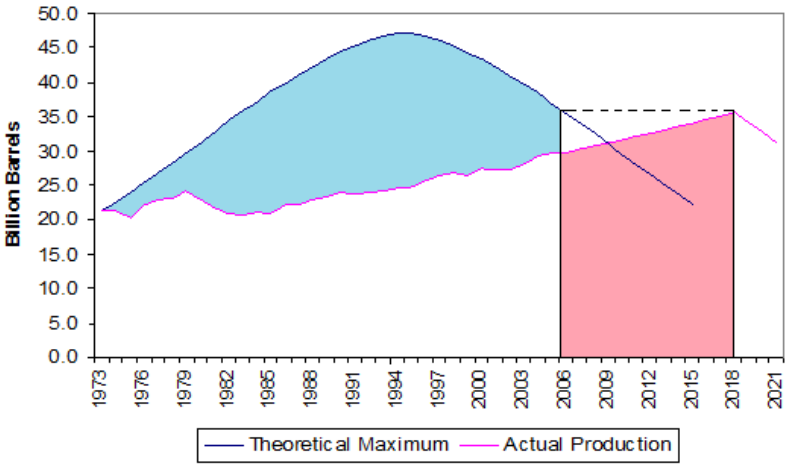
Hubbert's Limitation Still in Effect

- Hubbert methodology can be modified to take into account demand destruction. Basically, for every state of depletion, the Hubbert Curve creates a theoretical maximum limit to production.
- Global production will be back against the limitations of the Hubbert Curve once cumulative depletion and current production are equal between the actual and theoretical curves. This will happen once the red area and the blue area are equal in size.
- **Given the demand destruction created by high prices, the Hubbert Curve will come into effect at a higher state of depletion than the peak oil theorists assume.**

Deferred peak with rapid decline



Source: BP Statistical Review of World Energy

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Global Peak Production – High Depletion Methodology

Peak year		Depletion percentage			
		50%	55%	60%	65%
EUR (Trillion B)	2.3	2004	2010	2014	2018
	2.4	2008	2013	2016	2020
	2.5	2010	2014	2018	2022
	2.6	2012	2016	2020	2024
	2.7	2014	2018	2022	2026

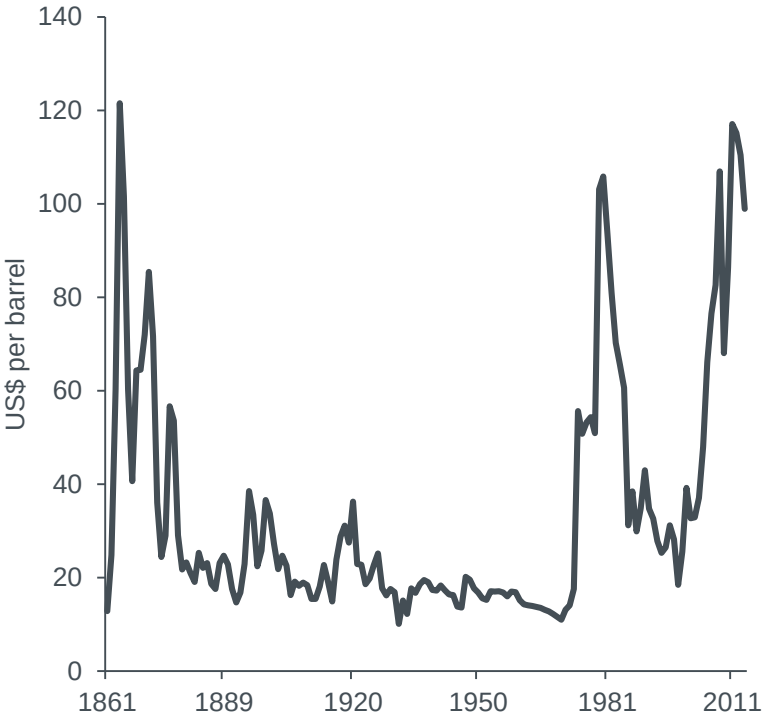
Source: BP Statistical Review of World Energy

- High depletion methodology assumes world oil production will peak past 50% depletion. This methodology explains how production can grow despite the advanced state of depletion and the overstatement of Middle Eastern reserves.
- Extrapolation suggests that peak oil will occur somewhere around 60%-65% depletion. Oil production could peak sooner for 'political' or economic reasons – the Hubbert Curve only delineates maximum possible production.

Hubbert Gets Lucky

- From 1956 (when Hubbert made his forecast) to 1970 (when US conventional production peaked), Hubbert was lucky insofar as his forecast was not affected by price; price did not destroy demand or incent supply.
- Hubberts' methodology cannot be applied to current global conventional production because the oil price has shot up and changed the dynamics of production and consumption.
- **Global conventional production, nevertheless, is in an advanced state of depletion**.

Crude oil prices since 1861



Source: BP Statistical Review of World Energy 2015

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Age of Abundance

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Age of Abundance

- The oil pricing regime shifted from ‘peak oil’ to ‘age of abundance’ starting in 2014.
- The shift was driven by three main factors:
  - Fears of Peak Demand
  - New Supply
    - Tight Oil
    - Oil Sands
    - Subsalt
  - OPEC ramps production

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Peak Demand

- During the 'Age of Abundance' regime, Peak Demand is driven by government policy to mitigate CO2 and not by market forces. The primary strategy is a government mandated transition to electric vehicles.

- During the 'Peak Oil' regime, Peak Demand was driven by the market and a fear of higher prices. Energy transition then comprised many more options including

    - LNG for trucks, trains, and ships
    - Compressed natural gas
    - Coal to liquids
    - Biofuels, Algae
    - Electric vehicles

- Without higher prices, an energy transition does not have the appropriate market signals and is based on fiat. A non-market solution is likely to fail.

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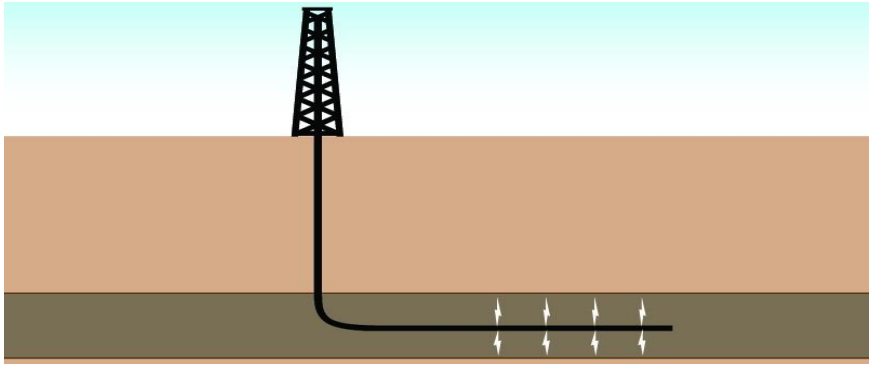
Tight Oil



- Tight oil is basically oil produced from such low quality fields that it needs to be hydraulically fractured or 'fracked'. Wells are drilled horizontally and then stimulated to make the low permeability oil flow.
- While this is not 'easy oil', the industry has become so efficient that the costs have dropped dramatically.
- There are three main tight oil fields: the Eagle Ford, the Bakken, and the Permian. The Eagle Ford and the Bakken are close to peak production.
- Internationally, only some fields in Canada and Argentina are under development. Russia has a large field that can likely be developed but the enthusiasm for international tight oil has waned.

Oil Sands

- The Canadian oil sands are a huge resource which has helped Canada grow into the fourth largest oil producer with the third largest reserves.

- Oil sands are very heavy oil which requires upgrading before it can be processed in a refinery. They are slightly more carbon intensive than regular oil.

- Environmentalists in both Canada and the United States have prevented new pipeline capacity to be built. The oil sands are currently bottlenecked with minimal ability to grow.

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Sub-salt

- A large oil basin was discovered in Brazil in 2006 below a thick layer of salt which cannot be imaged with normal seismic. Similar, although much smaller, sub salt discoveries have been made in the Gulf of Mexico and in Angola. The sub-salt globally is effectively a new oil province because it could not be previously seen.

- Brazil is bringing on the last major sub-salt discoveries in late 2019 (ramping into 2020.) Recently Brazil had a major bid round for sub-salt acreage which was a disappointment as the majors did not participate.

- Brazil will have a hard time growing production going forward without the participation of the international oil companies.

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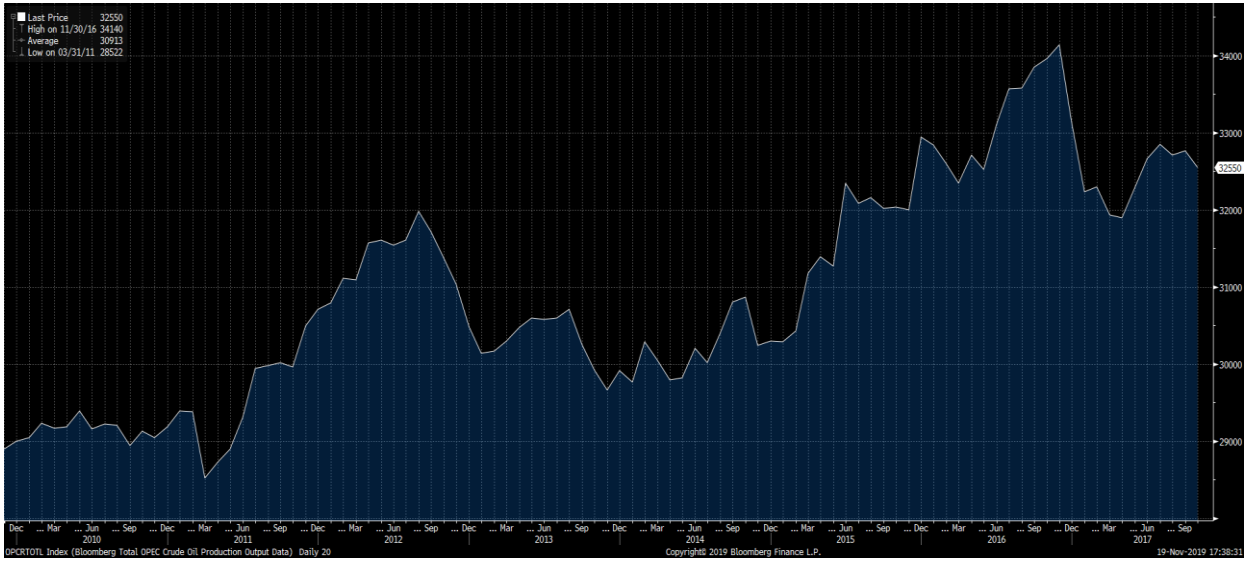
OPEC ramps Production



Source: Bloomberg

- From late 2014 to 2016, OPEC ramped production by 4mmb/d, effectively eliminating all spare capacity for a brief period of time. Part of this ramp included Iran which returned from the Obama sanctions.

- The increase in OPEC production added to the sense of abundance. Part of the reason for the ramp was that OPEC did not want to have stranded assets in an energy transition scenario.

- Similarly, Russia ramped production over the same period partly to avoid stranded assets caused by peak demand.

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Return to Scarcity

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Return to Scarcity

"We are entering an era of more oil price volatility… We believe that this year, if there are no major oil projects starting, in three to four years time we may see a significant supply-demand gap, with major consequences… This will not be filled by shale oil. This is why we may now be entering an era of greater oil volatility."

Fatih Birol, Executive Director IEA

January 13, 2017

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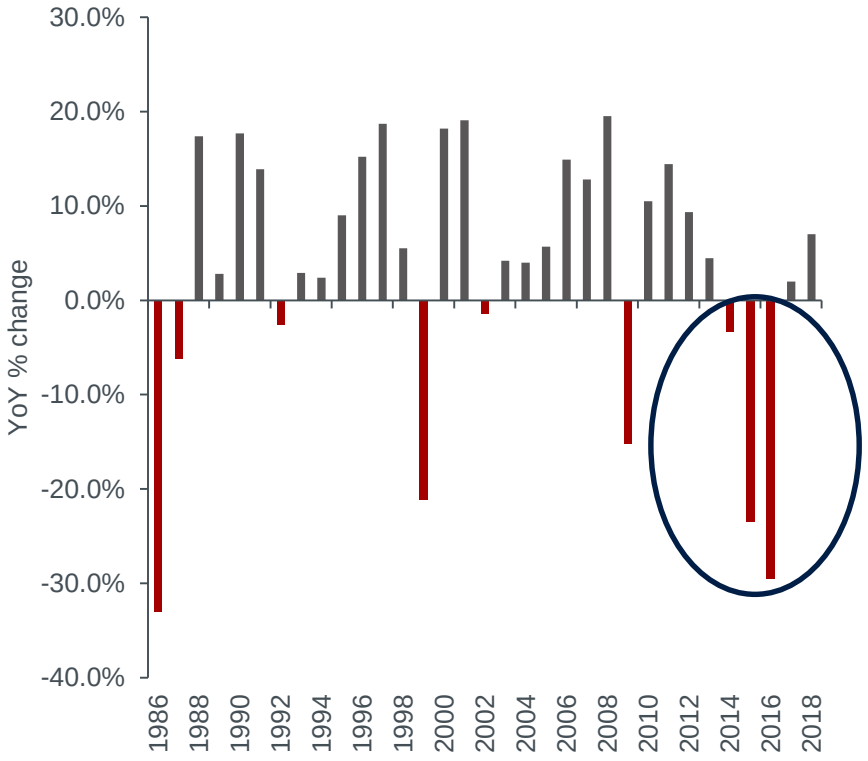
Unsurpassed Capex Cuts

- The capex cuts this cycle are the largest in history. In 1986, the only other period of large capex cuts, spare capacity was over 20% of supply versus a negligible amount of spare capacity today. **The current cycle is completely unprecedented.**

- Over 7.4 mmb/d of large projects have been cancelled or deferred. These projects take 3 to 7 years to come on, so the hole in the project queue will affect future supply.

- The capex cut in conventional oil spend at $207B is much larger than the cut in tight oil spend at $121B. We have yet to see the impact of the cuts on conventional oil given the long lead times.

Global upstream capital expenditures



Sources: Cowen, Morgan Stanley

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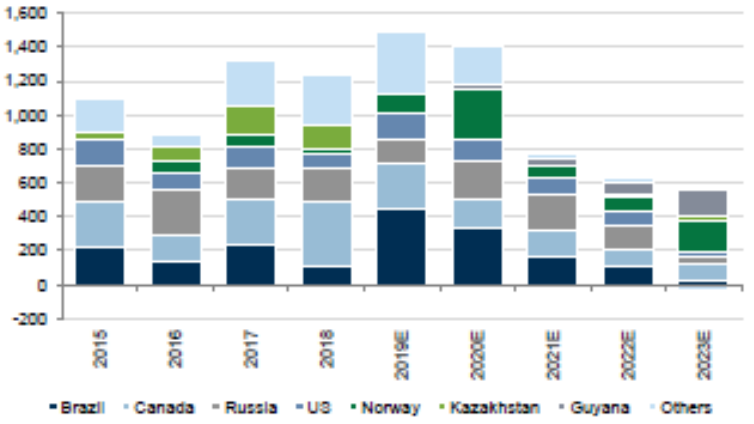
Fewer Large Projects

- A slowdown in conventional oil will begin in 2021 as the number of large projects coming to market will be fewer.
- The last large project sanctioned in the $100 oil world, Johan Sverdrup, began production in October. The last large Brazilian projects sanctioned in the $100 oil world began producing in Q3.
- Non-OPEC conventional production likely will begin to decline in 2021.
- OPEC will struggle to hold production capacity flat given their low investment levels over the last five years.

Non-OPEC project start ups

YoY oil production growth (kboe/d) from non-OPEC, excluding shale projects



Source: Goldman Sachs Investment Research

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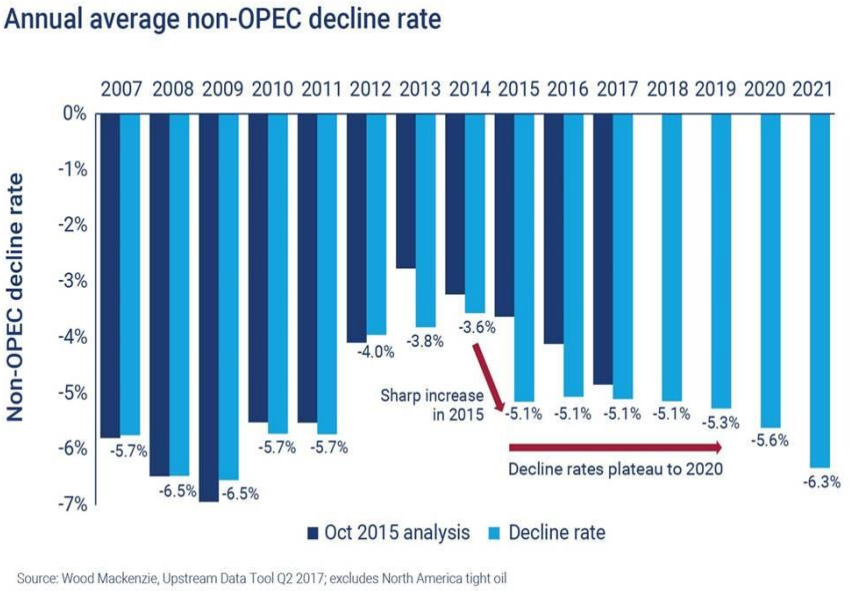
Decline Rates to Accelerate

- According to Wood Mackenzie, decline rates for non-OPEC conventional production will increase by 100 bps from 2019 to 2021.
- This alone could lower non-OPEC supply by 400,000 b/d in addition to the impact from fewer project start ups.
- OPEC decline rates are also likely to accelerate given the low level of investment over the last few years.



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

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Lower US Production Growth

- **The long term US production outlook has been substantially revised lower over the last 18 months.**

- There are multiple drivers of lower growth:
  - Only one basin is growing
  - Well productivity has peaked
  - The industry is focused on FCF
  - Resource size is smaller

- The Permian can likely grow 3.5mmb/d in aggregate while the other unconventional basins will only offset declines.

- Not only the longevity but the rate of growth has been lowered.

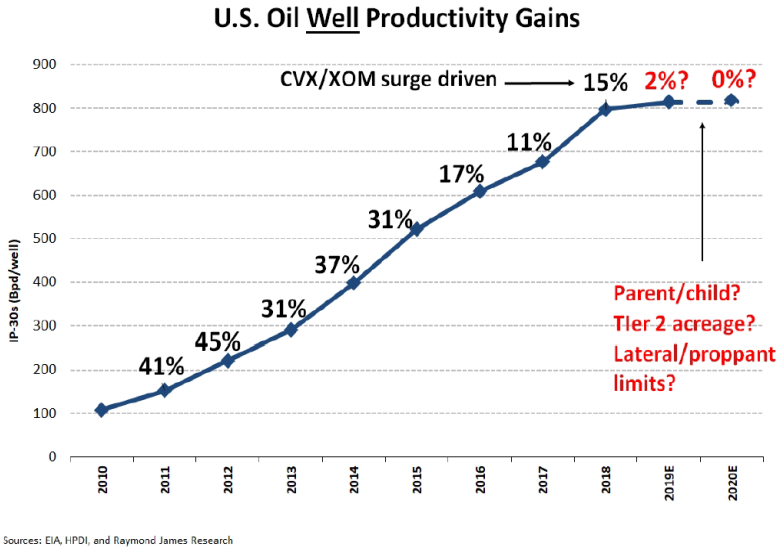
Multiple US Basins about to Plateau

Basin	Production	Status
Permian	4.5 mmb/d	Growth
Eagle Ford	1.3 mmb/d	Plateau, Slight Decline
Bakken	1.5 mmb/d	Plateau, Slight Growth
Niobrara	0.8 mmb/d	Slight growth
Gulf of Mexico	1.9 mmb/d	Declines starting late 2020
Other	2.6 mmb/d	Slight Decline

Source: EIA

Well Productivity has Peaked

- US well productivity has peaked and could begin to decline.
- Lateral lengths have been maximized and sand / fluid loadings optimized.
- Well spacing was driven too tight and needed to be widened. Tight spacing caused the parent / child issue. Wider spacing means a smaller resource.
- An even more pessimistic point of view suggests that the remaining 'tier 1' location inventory is low.
- ***To grow production from here without increasing productivity means the rig count must grow rapidly.***



Sources: EIA, HPDI, and Raymond James Research

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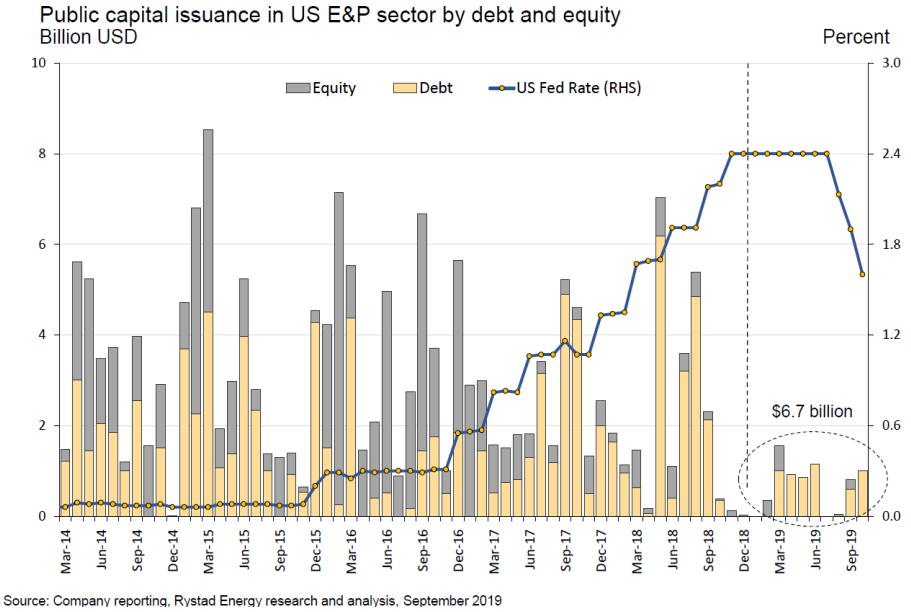
Industry Focused on FCF

- YTD in 2019, the industry has issued only $6.7B of debt and equity. This was more than 5 times higher at the peak.
- YTD in 2019, the industry has spent $6.9B on dividends and share repurchases. Before, this had been running at about $1.5B.
- The industry in aggregate is running close to FCF neutral and generating minimal growth. As the oil price increases, the industry will prioritize FCF over growth.
- ***It is difficult to estimate growth at each price level because the amount of growth that will be generated drops considerably as the industry focuses on FCF.***



Source: Company reporting, Rystad Energy research and analysis, September 2019

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Smaller Resource Base

Well Location Count Cut in Half

Source: Parsley Energy

- Now that the resource is bounded, growth rates must come down. If production can only double, it makes no sense to grow at 25%.

- In the last two years, the location count in the Permian has been cut in half as the industry has come to the conclusion that wells must be spaced wider. Fewer locations means a smaller resource and therefore lower peak production.

- It is unlikely the US will grow more than 750,000 b/d and this will need $75+ WTI.

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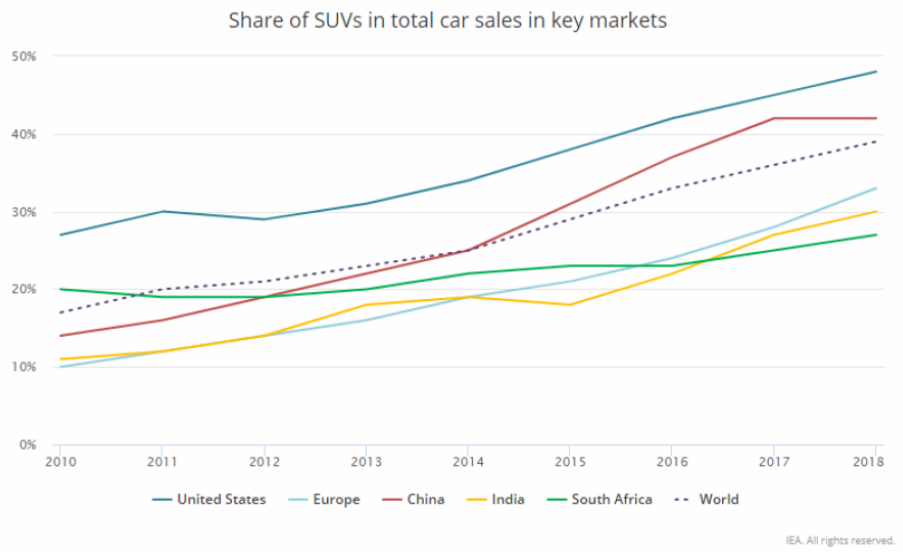
SUV Sales



- From 2010 to 2018, SUV sales went from 17% of light vehicle sales to 38%. Since 2010, 165mm SUVs have been added compared with 5mm EVs. The shift towards SUVs has completely overwhelmed any efficiency savings from EVs.

- Looking forward over the decade from 2020 to 2030 and assuming SUVs go to 50% of the sales mix, we will add close to 390mm SUVs which use 25% more fuel than a regular ICE vehicle. This will more than offset the 60-90mm EVs which could potentially be added over the same period.

- **Peak demand will not happen with low prices.**

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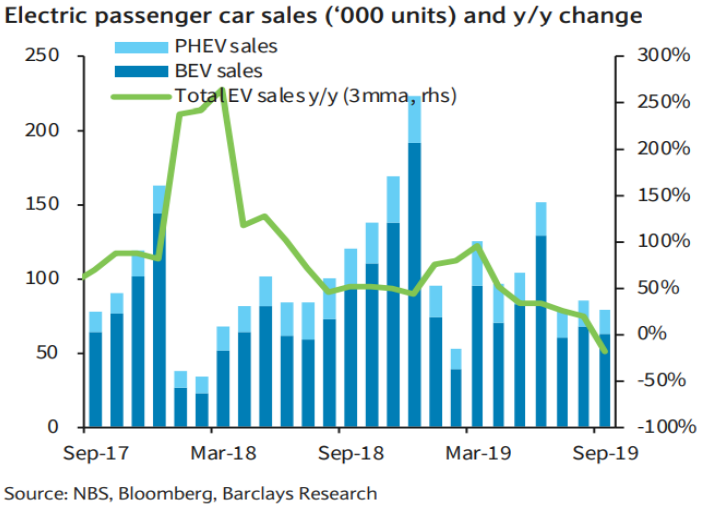
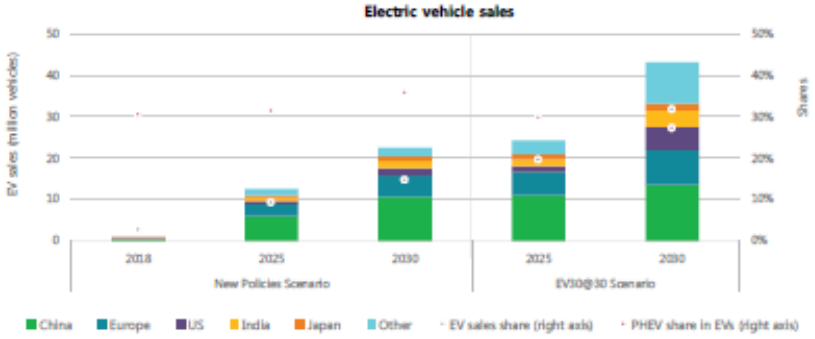
Electric Vehicles



Source: NBS, Bloomberg, Barclays Research

- **In Q3 2019, EV sales were down y/y and lost share to ICE vehicles.** Base effects will make the y/y decline greater over the next nine months. EV sales will likely be down for all of 2019 and deteriorate into 2020.
- In June 2019, China cut its EV subsidies by half causing EV sales to drop 16% y/y in Aug, 34% in Sept, and 46% in Oct. The Chinese have announced the complete removal of EV subsidies by 2021.
- Without subsidies EVs are not competitive with ICE cars for 5 reasons:
    1) Charge Time
    2) Range
    3) Battery deterioration / minimal resale value
    4) Infrastructure
    5) Price

Bottlenecks



Source: IEA

- Cobalt is an essential mineral for batteries as it increases range and lowers emitted heat. The R/P ratio for cobalt is only 42. ***If technology cannot find a way to remove cobalt from batteries, EV sales will have a hard time surpassing 8mm vehicles per year***. Furthermore, increased EV penetration will limit the cobalt available for hand held devices.

- 71% of cobalt is produced in the DRC creating a substantial geopolitical risk.

- Copper and nickel limitations also pose substantial risks to long term EV growth forecasts.

- The grid will need to double if all cars convert to EVs and there are no superchargers. If superchargers proliferate then the grid will need to grow by 4-6x to accommodate the likely surge in power demand.

- ***Forecasts for EV growth are unrealistic because they are driven by policy and not the market.***

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Inflection Point

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Inflection Point

- We are at the inflection point between the 'age of abundance' and a 'return to scarcity'. The change in pricing regimes will be caused by:
  - From the demand perspective, a truce in the trade war or a cyclical economic upswing
  - From the supply perspective, the end of non-OPEC production growth
    - The large projects sanctioned in the $100 world fully ramped
    - The structural slowdown in tight oil
- Regime shift is likely over the next six months.
- The unprecedented negative sentiment could make the shift violent.

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Saudi Put

- The Saudi budget needs over $90 Brent to balance.
- Saudi has made clear that they think a much higher oil price is an appropriate compromise between consumers and producers.
- Saudi is willing to temporarily cede market share to US shale as they do not believe shale can grow much longer.
- Even if Saudi sells a small percentage of Aramco in the local market at a low oil price, they will want a higher price for their larger secondary offering.
- **Saudi thus far has failed to reach the oil price they have been aiming for. The China / US trade war proved to be much worse than expected.**

2019 Saudi Arabia's National Budget

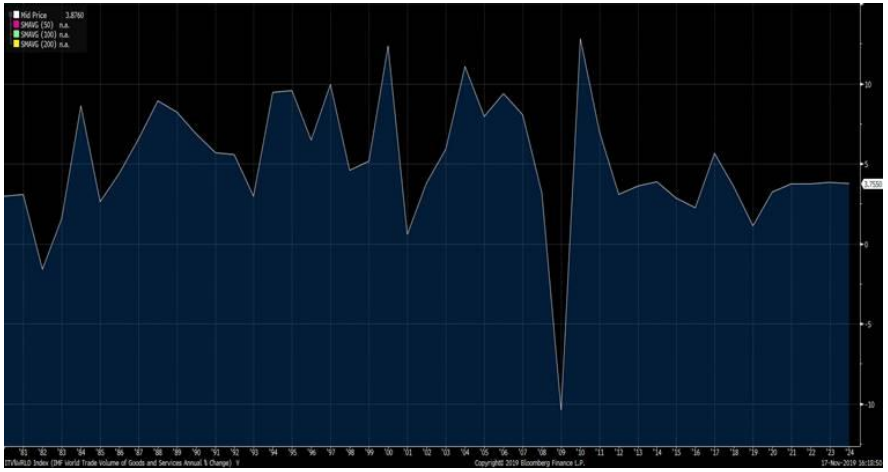
Disclosed Planned Expenditures (Bln $)	$295
Legacy welfare programs carried over	$65
Asssumed total budget (Bln $)	$360
Projected Oil Exports, Bln bbls	2.88
Projected non-oil income (Bln $)	**83.4**
Oil income revenue (Bln $)	**276.4**
Implied per barrel revenue	**$95.86**

Source: Cornerstone Analytics

Demand Weakness

- According to the IMF, world trade growth in 2019 was the fourth lowest in the data series going back to 1980 (only 2009, 2001 and 1982 worse.)
- This compares to global GDP growth in 2019 which was the eleventh lowest in the data series going back to 1980.
- Trade growth is more relevant to oil than GDP growth.
- **The China / US trade war caused a very bad year for oil and oil stocks in 2019.**
- **The demand weakness is not structural. The cyclical recovery will likely be stronger than expected because there will be a catch-up in demand.**

World Trade Growth



Source: Bloomberg, IMF

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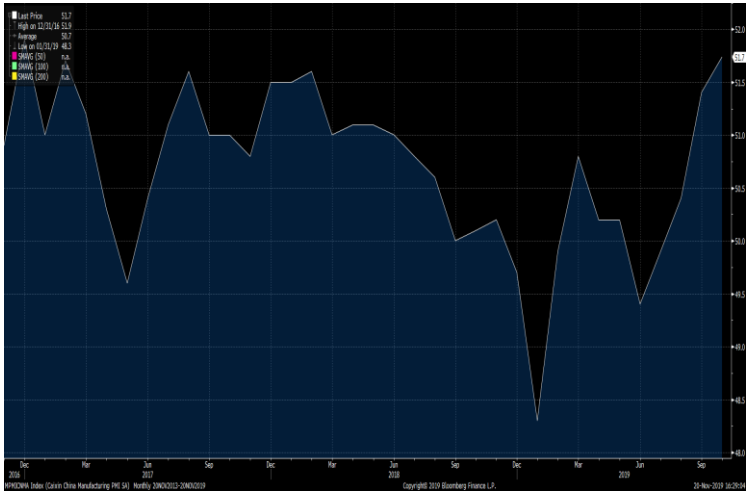
Cyclical Turn

- The Chinese Manufacturing PMI has turned up. Normally, the Chinese PMI leads global PMIs by 3 -5 months.
- The US / China trade truce has the potential to create a tailwind to growth and lower economic uncertainty.
- Global interest rates have fallen dramatically. The Fed and the ECB have both restarted balance sheet expansion.
- As the economy turns, oil demand typically has a catch up period following weak demand. Demand revisions will likely turn from negative to positive.
- ***Energy stocks are the most cyclically sensitive and have the most to gain from a rotation to cyclicals.***

Caixin China Manufacturing PMI



Source: Bloomberg, Caixin

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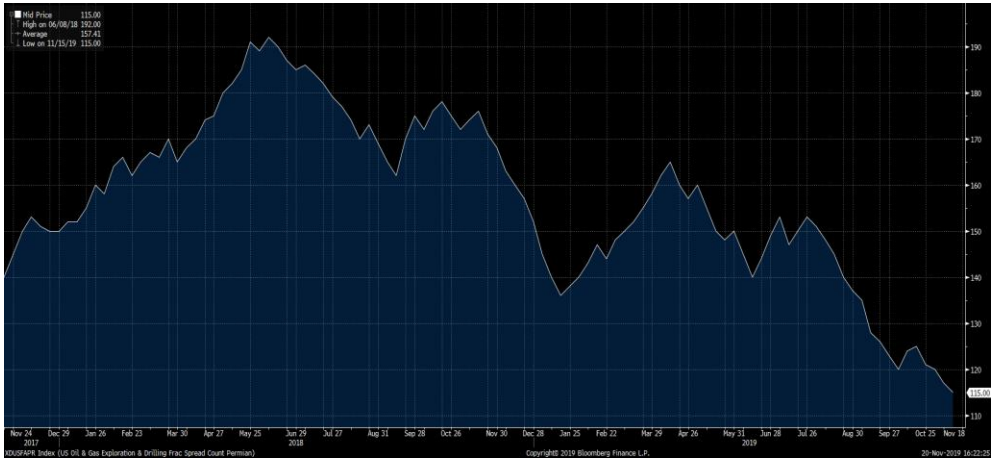
US Production Slowdown

Permian Frac Spread Count



Source: Bloomberg, Primary Vision

- From Dec 2018 to September 2019, US oil production has only grown 425,000 b/d. This compares to 1,525,000 b/d over the same period in the previous year.
- Since the last week of July, the frac spread count in the Permian has fallen 25% suggesting sequential growth into Q4 will be flat to negative.
- The US industry clearly does not work with WTI below $60.

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Variant Perception

kb/d	2019 Q3	2019 Q4	Sequential Growth	2019/2020 Growth
EIA	19,540	20,880	1,340	1,710
IEA	17,100	17,700	600	1,240
OPEC	18,300	18,900	600	1,500

Source: EIA, IEA, OPEC November reports. IEA excludes biofuels and processing gains. OPEC excludes processing gains.

- The major oil market forecasts see shockingly high sequential growth into Q4. This is despite the frac spread count falling substantially over the last few months and little sequential growth YTD.

- The ostensible explanation for the large sequential growth is that the Permian is adding pipeline takeaway capacity.

- A new pipeline would steal share from trucking or rail but it does not magically create oil. There are a lot of Drilled UnCompleted wells in the Permian (DUCs) but there are hardly any Drilled Completed wells. A Drilled Completed well is a waste of capital. A DUC can only be turned into production with a completion but we have the frac spread count numbers falling dramatically.

- ***US production growth is set to miss expectations by a wide margin over the next few months. Y/Y production growth in 2020 is likely around 500kb/d.***

Unprecedented Opportunity

- The XOP is below where it was in February 2016, when Brent was $27, and below the Great Financial Crisis low.

- Since the beginning of 2016, Brent is up is up ~71% and the XOP is down ~31%. ***This is the largest underperformance in history.***

- ***Low equity valuations have forced the industry to turn off the growth.***

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Portfolio Median EV/EBITDA

	EV/EBITDA 2020 Portfolio Median	EV/EBITDA 2021 Portfolio Median
$55 Oil	3.6x	3.0x
$65 Oil	2.9x	2.5x
$75 Oil	2.5x	2.1x

- E&P companies usually trade around 7-9x EBITDA. ***The stocks are trading at unprecedented low levels.***
- On a PV-10 basis, the portfolio median is below 0.5x while historically it would have traded at 2.0x.
- Valuations have a reflexive impact on the industry. Low valuations cause the industry to return capital instead of spending on cap-ex. High valuations cause the industry to spend on growth.
- As the market transitions from 'the age of abundance' to a 'return of scarcity', substantial multiple expansion is likely.

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Energy Transition

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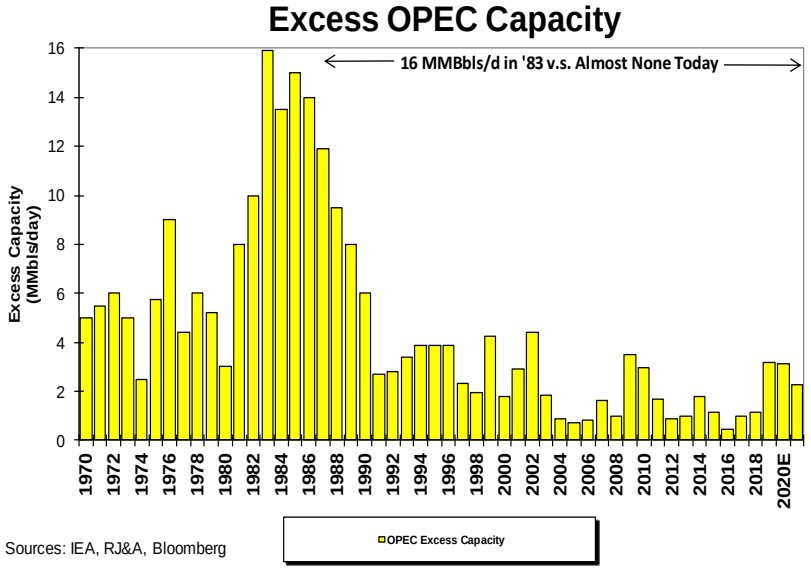
Energy Transition

- The energy transition could be government driven or market driven. Historically, transitions have been market driven:
    - Timber to coal
    - Whale oil to rock oil
- A government driven transition will involve unintended consequences of shortages and bottlenecks.
- The current transition is on track to create a substantial oil price spike. The hit to supply from underinvestment has been much greater than the hit to demand from policy.
- An energy transition will only happen with a high oil price.

Oil in a Free Market

- Spare capacity in the oil market is defined as what can be brought on in 30 days and held for 90 days. The significance of spare capacity is that the capex is already spent and there is little delay to access the oil.
- **Once OPEC reverses its cuts, spare capacity will not last long. The oil industry runs at 98% capacity utilization.**
- **Instead of equilibrium, the oil price likely overshoots on the upside just as it did on the downside.**



Sources: IEA, RJ&A, Bloomberg

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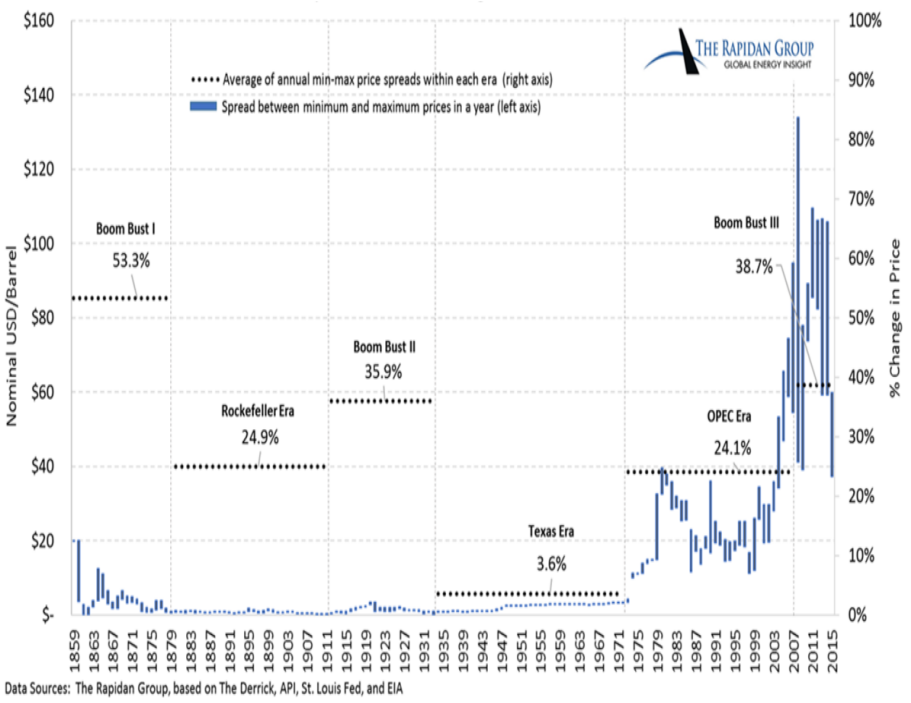
Crude Volatility

- Oil is intrinsically volatile because supply and demand are inelastic to price in both the short and medium term.
- Since 1934, the oil market has been controlled by a cartel (first the Texas Railroad Commission and then OPEC). During the Rockefeller Era, the oil market was also controlled by a cartel. With a cartel in charge, the oil market experiences less volatility.
- The oil market will move from a cartel to a free market as we approach zero spare capacity.
- **This will lead to an increase in the volatility regime and unprecedented high prices.**

Monthly crude oil price ranges, 1859-2016



Data Sources: The Rapidan Group, based on The Derrick, API, St. Louis Fed, and EIA

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