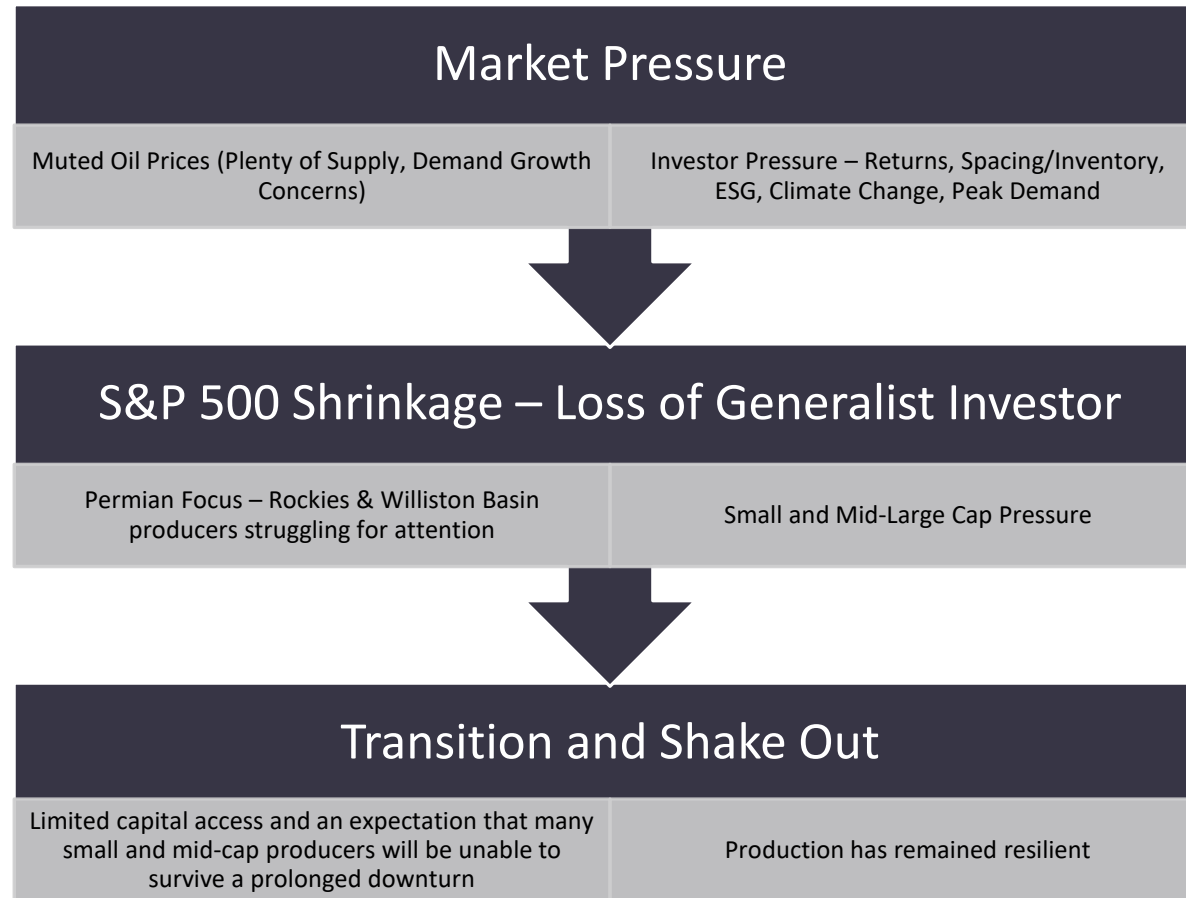


# US Shale – Under Pressure

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TRISHA CURTIS – PETRONERDS - PRESIDENT AND CO-FOUNDER  
OXFORD INSTITUTE FOR ENERGY STUDIES – OIL DAY  
NOVEMBER 15, 2019

# Market Pressure for Public Companies



# Shale Market Dynamics

---

Generalist Investor has Left  
the Oil Sector - Activists

Opportunity for  
Consolidation - PE and Small  
Players, but Significant  
Consolidation has Not Yet  
Occurred

Investor Pressure -  
Shareholder Returns/Positive  
Free Cash Flow/Share Price  
Growth? How?

BIG Shale Demand – Majors  
Pushing Permian and Short  
Cycle

Bifurcation between Majors  
and Large Caps and  
Small/Mid Caps

Well  
Spacing/Inventory/Depletion  
–  
ROR vs. NPV

# Evolution of Investor Pressure

---

Pre-2014: Need to diversify beyond the Bakken

2014 Oil Price Correction: Pump and produce, High IPs, Cash Flow

2015 to 2016: PERMANIA, Prices are sub-\$60, buy anything and everything (dry powder, no production, at any cost), FOMO

- I. Strict drilling and leasing requirements follow

2017: Begin focusing on cash flow

2018: Investor pressure on returns and free cash flow continues to build, oil prices move up

H1 2019 – Generalist investor is growing weary of shale companies. Free cash flow neutrality is not enough, serious returns are needed.

- I. Expecting mergers and acquisitions
- II. Favoring majors and short cycle
- III. Unclear what would drive share price growth at this point

# Investment Decisions are Being Pushed Toward Shorter Cycles

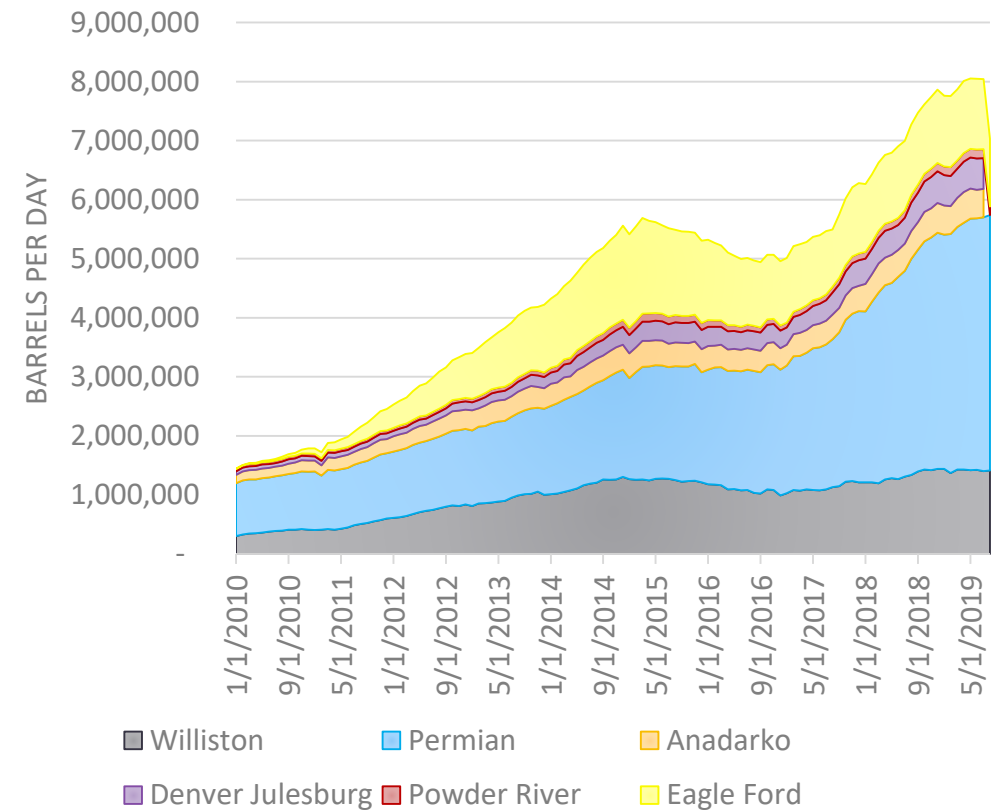
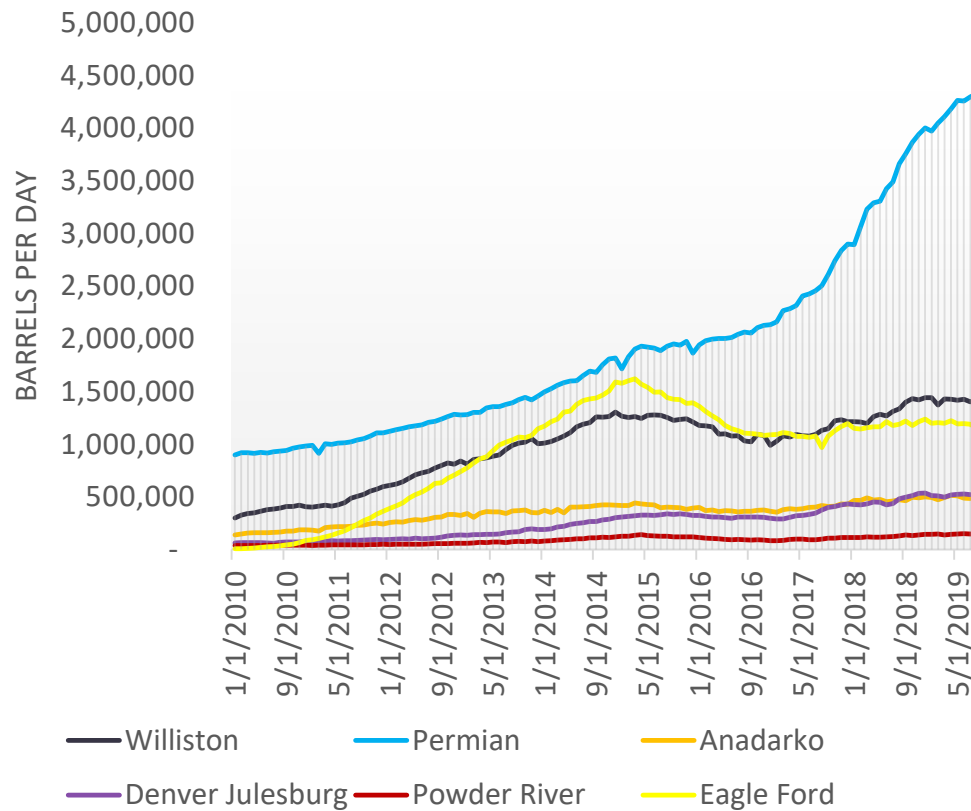


Davos Panel, January 2019

*.....the geopolitics of peak oil demand....even if its not happening today the psychology is influencing events today. ...It is making it harder for companies to raise money. It is pushing investment into short cycle...rather than...long cycle...so its already having a big influence on what's going on in markets and the energy sector even if it isn't a reality, we don't expect it be a reality for a long time.*

Megan O'Sullivan, Harvard

# US Shale Basin Liquid Production is Over 8 mbd

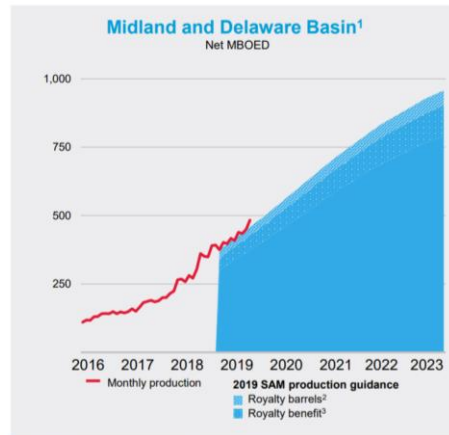


Source: PetroNerds, DrillingInfo

# Majors Continue Growth in the Permian Basin

Short cycle, complete, strong breakevens, growth now - not later.

## Permian production On track with steady rig count



<sup>1</sup>Midland and Delaware Basin production reflects shale & tight production only.  
<sup>2</sup>Royalty barrels are received by Chevron from owned acreage that has been leased to others and requires no capital investment.  
<sup>3</sup>Royalty benefit calculation based on Chevron's lower effective royalty rate versus an assumed royalty rate of 25%.

© 2019 Chevron Corporation

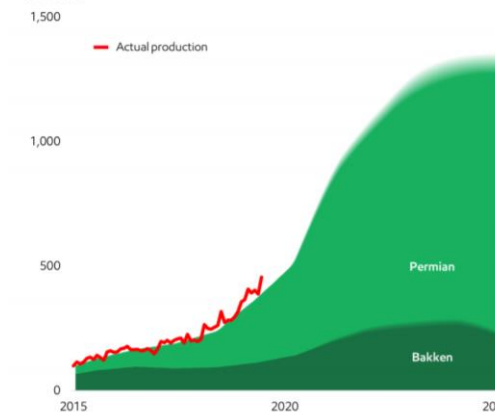


8

Source: Chevron Q3 2019 Earnings, November 2019

## UNCONVENTIONAL BUSINESS UPDATE

### PERMIAN AND BAKKEN PRODUCTION<sup>1</sup>



<sup>1</sup>See Supplemental Information

- Permian growth on track
  - Production increased 7% in 3Q, up 72% from 3Q18
- Advancing unique development
- Continued strong well performance
- Progressing processing and takeaway capacity
  - Start-up of phase 1 Delaware central delivery point and pipeline to Wink terminal in August
  - Ongoing construction of Poker Lake Unit central delivery point and Wink terminal connector

Source: ExxonMobil Q3 Earnings, November 2019

# Are well spacing issues really going to kill the boom?



THE WALL STREET JOURNAL.

MARKETS

## Shale Companies, Adding Ever More Wells, Threaten Future of U.S. Oil Boom

Newer wells drilled close to older wells are generally pumping less oil and gas and could hurt output, leading frackers to cut back on the number of sites planned and trim overall production forecasts

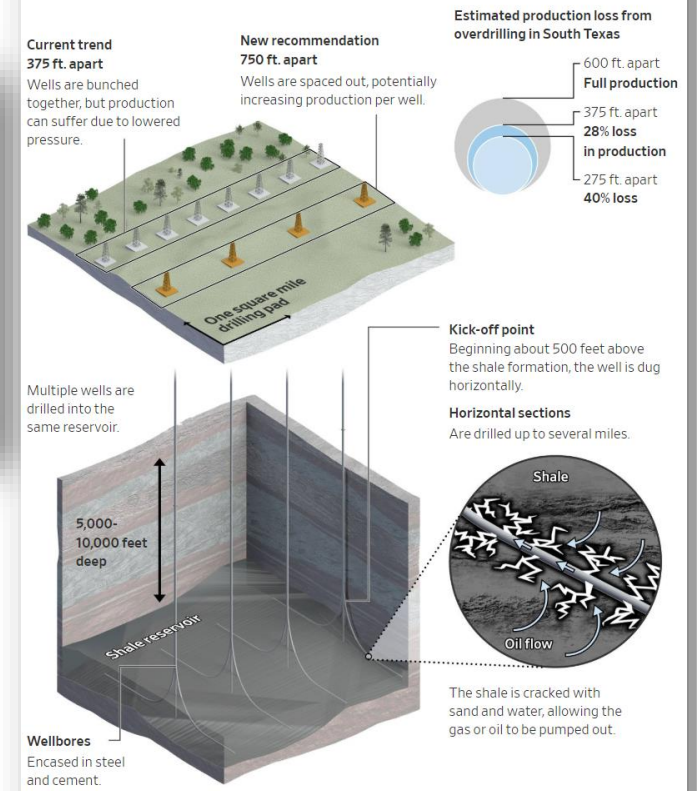
By *Christopher M. Matthews, Rebecca Elliott and Bradley Olson*

March 3, 2019 6:26 p.m. ET

0 COMMENTS

### Tight Squeeze

In recent years, oil producers have drilled "child wells" in close proximity to increase the number of drilling locations and extract more oil and gas. New studies indicate that adding too many wells diminishes production in each well.

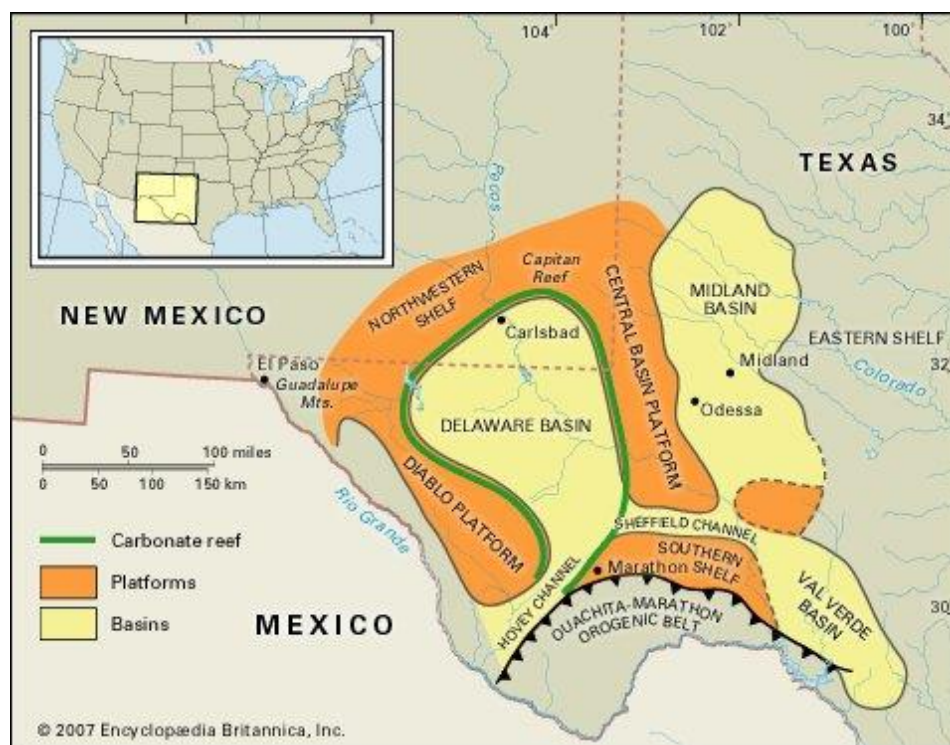


Note: drawing is schematic

Sources: StatOil (production loss); excluding mobile size: Energy Department (drilling); American Petroleum Institute (fracking).

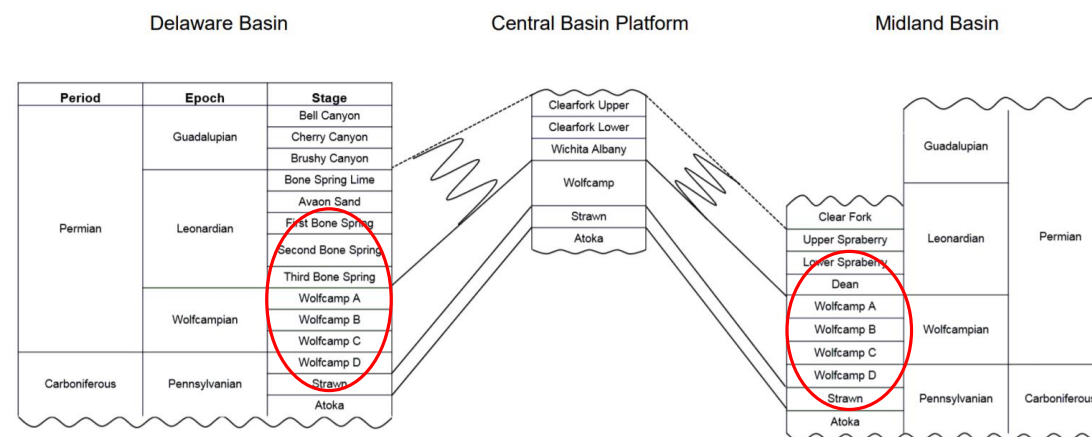


# Thinking about the amount of wells per targeted zone – both horizontally and vertically



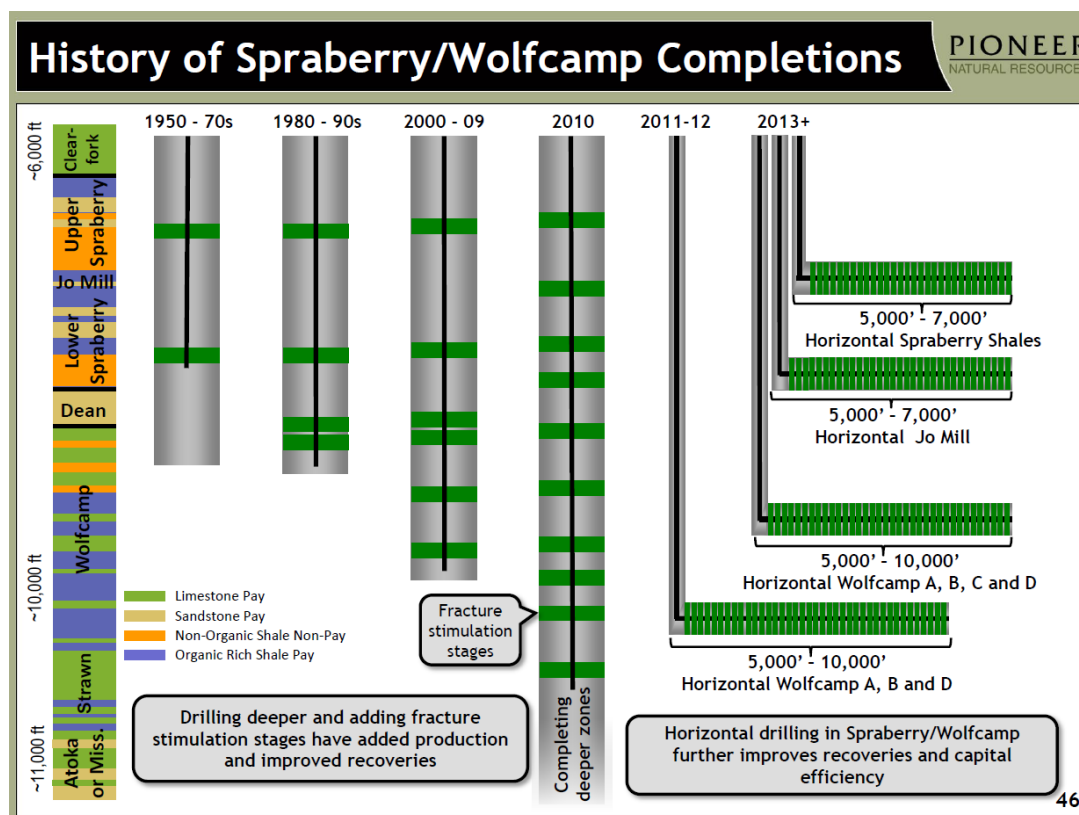
October 2018

Figure 2. Generalized stratigraphic schema of upper Carboniferous through upper Permian intervals for the Permian Basin

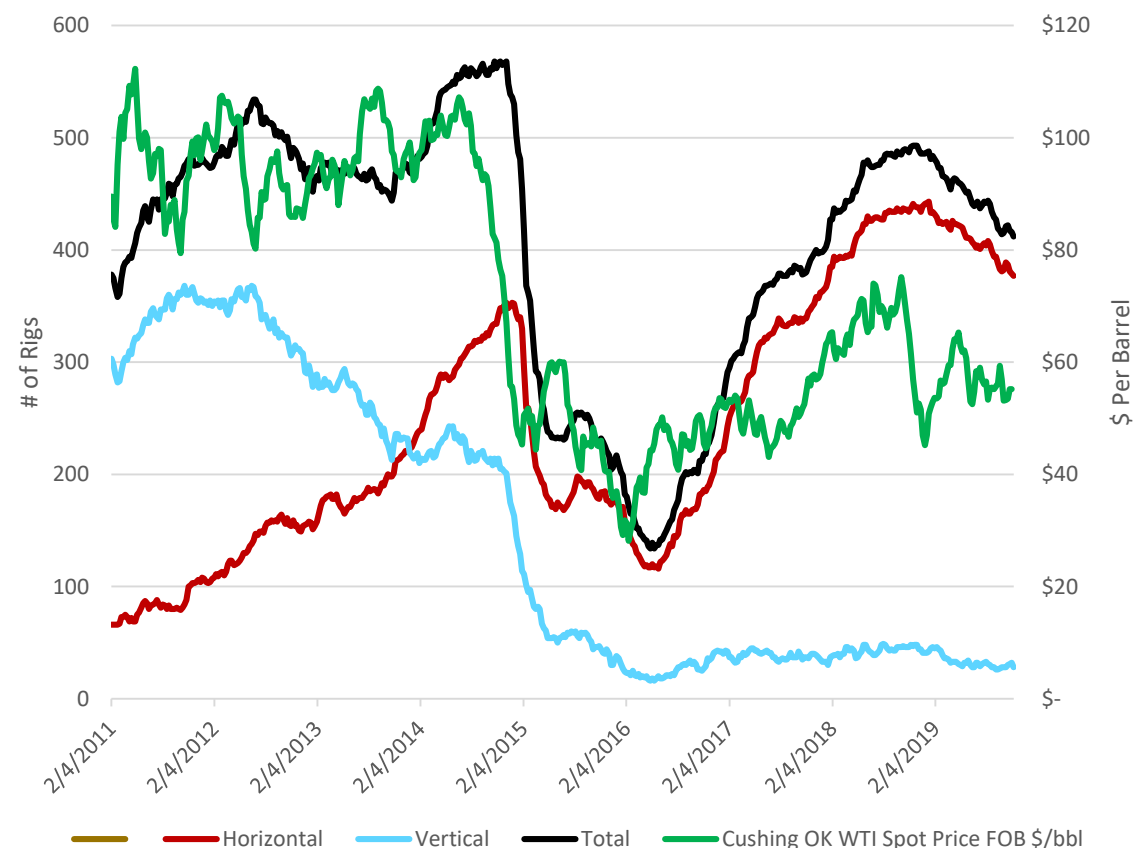


Source: U.S. Energy Information Administration based on DrillingInfo Inc., U.S. Geological Survey.

# The Permian Basin Learning Curve



Source: Pioneer Natural Resources Oct 2013 Investor Presentation



# Understanding the Hype: Long-Term Potential – “Stacked Pay”





**SCIENCE**  
Topics, centers, missions


**PRODUCTS**  
Maps, data, publications

**NEWS**  
Releases, I'm a reporter

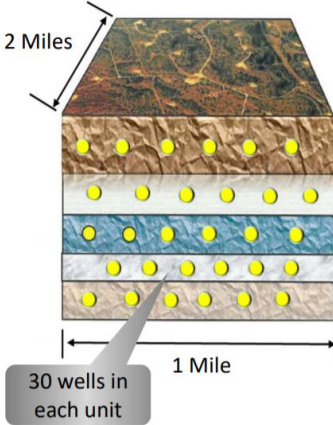
**CONNECT**  
Contact, chat, social media

**ABOUT**  
Organization, jobs, budget

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## PERMIAN BASIN – STACKED PAYS CREATE WORLD CLASS RESOURCE



- **35–50 years of drilling in core areas at current rate**
  - Over 200,000 horizontal wells to be drilled in core areas
  - 9,750 core units (1x2 mile) available for horizontal drilling with 30 wells per unit
- **2018 USGS New Resource Assessment: 46 billion barrels in just Delaware basin**
  - 33 years of production at current rate (1.4 billion barrels)
  - 2007 USGS: 1.3 billion barrels total resource in Permian basin!

## Yes...The Permian Basin Has Staying Power!

Source: EPD Fundamentals

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Fundamentals Panel – 11

# Spacing Tests Underperform and Further Spook Investors



**Bloomberg**

Business

## Permian Doesn't Look So Hot as Producers Hit Snags

By [Rachel Adams-Heard](#)

August 1, 2019, 10:39 AM MDT *Updated on August 2, 2019, 4:00 AM MDT*

- ▶ Concho plunges after being forced to slow down oil production
- ▶ ‘This is a big event for the sector,’ Evercore analyst says

2019 – “Dominator” project, 29 wells, downspace test 50 percent vertically and horizontally

## THE WALL STREET JOURNAL.

English Edition | October 24, 2019 | Print Edition | Video

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BUSINESS

## A Fracking Experiment Fails to Pump as Predicted

Encana’s cube project suggests output problems occur if oil wells are drilled too close together

By [Bradley Olson](#)

Updated July 4, 2019 5:01 pm ET

“The wells don’t perform,” said Tom Loughrey, president of Friezo Loughrey, a data-analytics firm that has questioned some shale forecasts. “They didn’t solve the problem.”

Encana said the 33 wells drilled in the RAB Davidson development through 2017 were spaced about 330-feet apart, and the company is now putting them about 500 feet apart. Rather than 60 wells from one cube in some West Texas areas, 40 to 50 might be the right number, including as many as five to six wells in each of eight different horizontal layers, spokesman Steve Campbell said.

2017 – 33 wells, only 330 ft apart

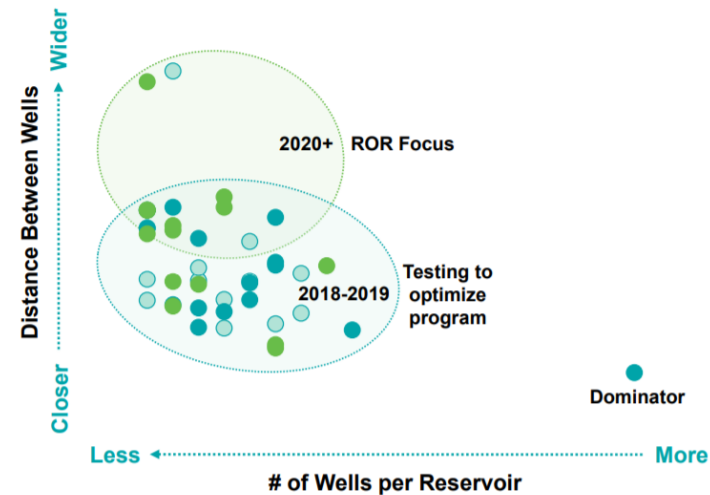
# Concho's Spacing Revisions

## Optimizing Development

### 2018-2019 Project Development

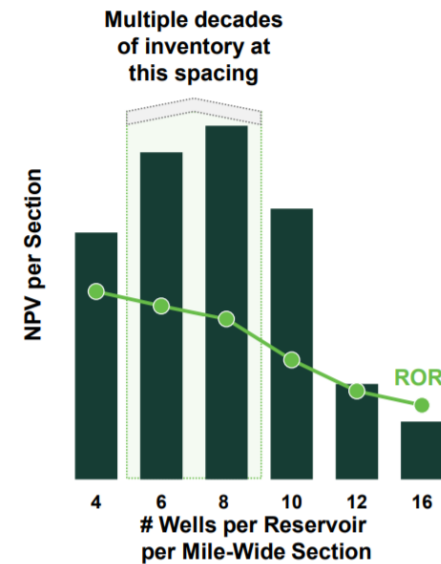
Wells per Reservoir vs. Spacing

● 2018 ● 1H19 ● 2H19



### Go-Forward Plan: **Prioritize Returns**

Optimizing Spacing – Illustrative Example



- ✓ More suitable for low/volatile commodity price environment
- ✓ Enables resilient, consistent development program
- ✓ Supports sustainable oil production & FCF growth



# How many wells can you drill?

## Substantial Economic Inventory with Conservative Spacing Assumptions

### Diamondback Spacing Philosophy:

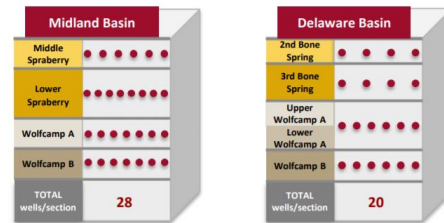
- Inventory spacing assumptions in both the Midland and Delaware basins are consistent with the conservative methodology that has been a characteristic of the company since its inception, in spite of external pressure to adopt more aggressive downspacing
- Spacing assumptions presented are not universally applicable to all areas of each particular basin
- Diamondback has moved to co-development of more economic zones together, particularly in the Midland Basin, but has not changed inter-lateral spacing assumptions within each zone

### Net Midland Basin Locations by Zone / Lateral<sup>(1)</sup>

	5,000'+	7,500'+	10,000'+	Total	Avg. Lateral
MS	184	229	289	702	7,500'
LS	252	302	352	906	7,400'
WCA	193	246	307	746	7,500'
WCB	175	246	311	732	7,600'
Other <sup>(2)</sup>	438	356	450	1,245	7,200'
Total	1,243	1,379	1,709	4,330	7,400'

Diamondback has consistently maintained conservative spacing assumptions, preferring an "at least" strategy to a "best case scenario" strategy

### Midland and Delaware Premium Zone Spacing Assumptions



### Net Delaware Basin Locations by Zone / Lateral

	5,000'+	7,500'+	10,000'+	Total	Avg. Lateral
2BS	141	96	115	353	7,200'
3BS	357	203	247	806	7,000'
WCA	302	229	248	779	7,200'
WCB	229	215	242	686	7,400'
Other <sup>(2)</sup>	305	208	167	680	6,700'
Total	1,334	951	1,018	3,303	7,100'

## Substantial Economic Inventory with Conservative Spacing Assumptions

Diamondback has consistently maintained conservative spacing assumptions, preferring an "at least" strategy to a "best case scenario" strategy

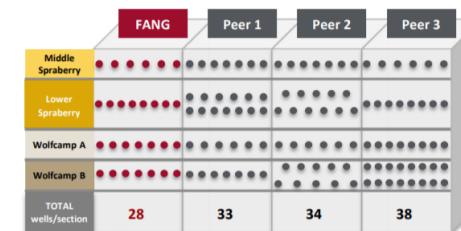
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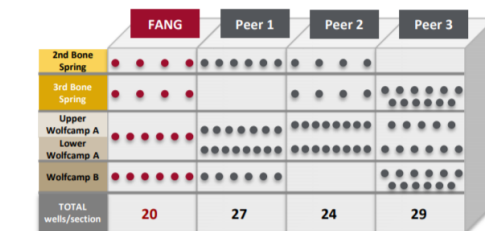
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### Midland Basin Premium Zone Spacing Assumptions vs. Peers<sup>(2)</sup>



### Delaware Basin Premium Zone Spacing Assumptions vs. Peers<sup>(2)</sup>



Source: Company data, filings and estimates. Note: locations based on internal company estimates as of 12/31/2018.  
 (1) Excludes Quinn Ranch.  
 (2) Primarily comprised of the Wolfcamp C and Dine in the Midland Basin; 1<sup>st</sup> Bone Springs, Avalon and Wolfcamp BC in the Delaware Basin.

Source: Company data, filings and estimates. Note: locations based on internal company estimates as of 12/31/2018.  
 (1) Excludes Quinn Ranch.  
 (2) Primarily comprised of the Wolfcamp C and Dine in the Midland Basin; 1<sup>st</sup> Bone Springs, Avalon and Wolfcamp BC in the Delaware Basin.  
 (3) Midland peers include CPE, QEP and PE. Delaware peers include CPE, PE and JAG.

Source: Diamondback Energy Investor Presentations, Q3 2019 and Q2 2019

# Differentiated Views on Well Spacing

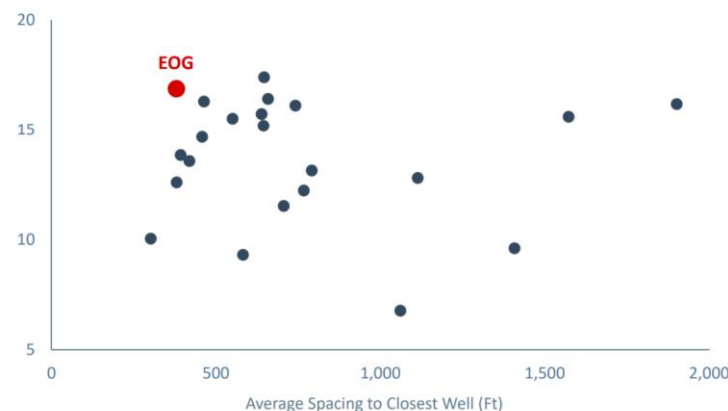
## Not a one size fits all - EOG vs. PXD on Well Spacing

### Industry-Leading Well Productivity with Tighter Spacing in 2018 Delaware Basin



6-Month Cumulative  
Oil Production  
(Bo per ft)

■ EOG ■ Peers<sup>1</sup>



Source: Citi Research and Drilling Info.

[1] Peers include APA, CPE, CROZ, CVX, CVG, DYN, FANG, JAG, MRO, MTDR, NBL, OAS, OXY, PDCE, PE, RDS, WPK, XEC, XOM and two private operators.

2Q 2019

38

### Well Spacing Optimized for Maximum Returns

#### Horizontal Development Strategies

Peers



#### "Inventory Maximization"

- ⌚ Increases well communication
- ⌚ Downspacing degrades productivity
- ⌚ Increases parent-child relationships

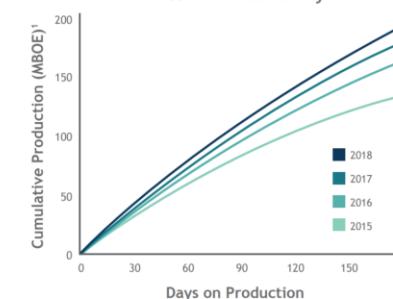
Pioneer



#### Returns Focused

- ⌚ Optimal well performance
- ⌚ Maximizes returns
- ⌚ Less capital intensive

#### Well Productivity



Pioneer's ~680,000 net acres allows for optimal development strategy minimizing parent-child impacts

PIONEER  
NATURAL RESOURCES

1) Production normalized for shut-ins. Wells grouped by POP year. Production normalized to a lateral length of 10,000'.

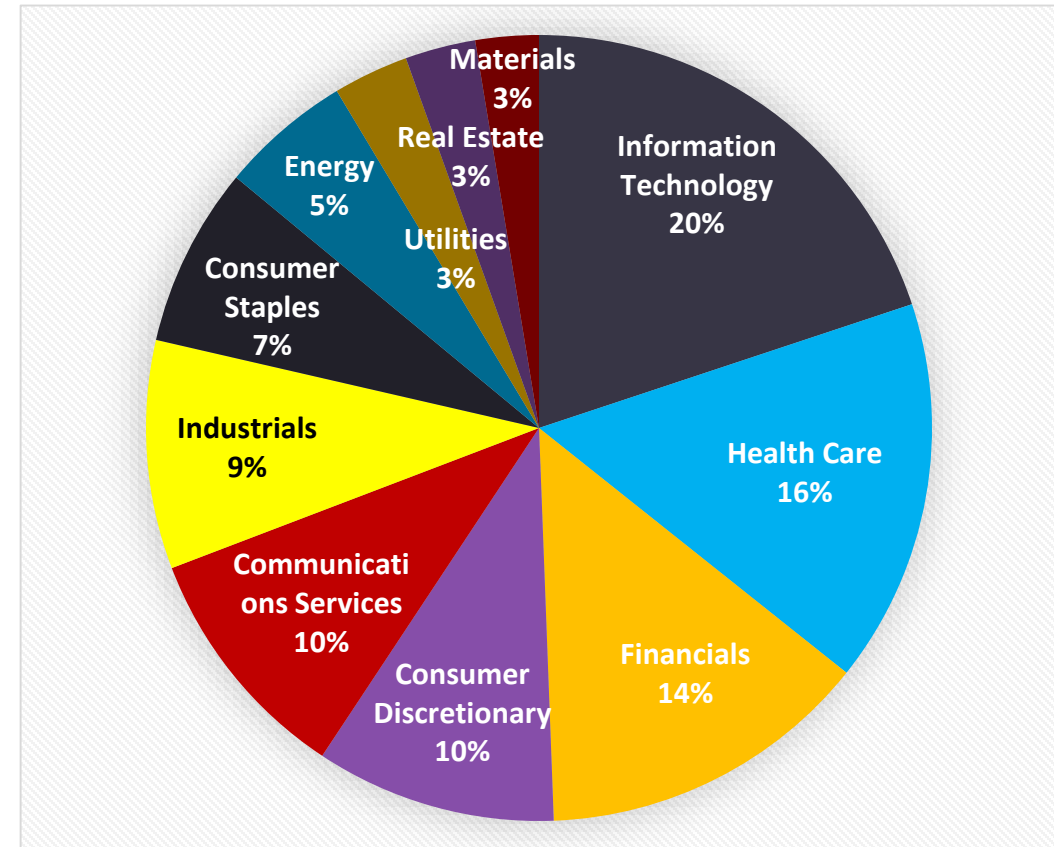
10

Source: EOG Q2 2019 Earnings, Pioneer Natural Resources September 2019 Investor Presentation

# Energy's Weighting in the S&P 500 is less than 5%

Symbol	Name	Last	Wtd Alpha	YTD %Chg	1M %Chg	3M %Chg	52W %Chg
APA	Apache Corp	22.16	-51.90	-15.58%	+0.54%	-18.77%	-54.29%
BHGE	Baker Hughes A Ge Co. Cl A	22.47	-25.60	+4.51%	-0.62%	-8.32%	-30.54%
COG	Cabot Oil & Gas Corp	17.98	-30.60	-19.55%	+4.96%	-23.59%	-24.42%
COP	Conocophillips	53.50	-30.90	-14.19%	+0.38%	-11.57%	-31.66%
CVX	Chevron Corp	113.85	-9.30	+4.65%	-2.90%	-7.70%	-8.88%
CXO	Concho Resources Inc	64.60	-57.60	-37.15%	-11.47%	-34.62%	-58.49%
DVN	Devon Energy Corp	22.60	-41.00	+0.27%	-1.05%	-17.88%	-43.70%
EOG	Eog Resources	70.92	-44.80	-18.68%	-6.15%	-18.67%	-45.54%
FANG	Diamondback Energy	85.42	-36.10	-7.85%	-12.68%	-18.80%	-36.84%
FTI	Technipfmc Plc	23.13	-18.60	+18.13%	-8.90%	-8.00%	-24.49%
HAL	Halliburton Company	18.55	-54.60	-30.21%	-1.12%	-18.78%	-55.72%
HES	Hess Corp	62.39	-5.50	+54.05%	-4.07%	-0.05%	-14.04%
HFC	Hollyfrontier Corp	53.58	-12.20	+4.81%	+16.96%	+18.15%	-23.69%
HP	Helmerich & Payne	38.31	-46.70	-20.09%	+3.29%	-22.32%	-46.28%
KMI	Kinder Morgan	20.52	+14.10	+33.42%	+0.93%	-2.66%	+12.32%
MPC	Marathon Petroleum Corp	60.74	-17.70	+2.93%	+19.90%	+11.82%	-28.77%
MRO	Marathon Oil Corp	11.56	-48.40	-19.39%	-4.54%	-15.37%	-51.26%
NBL	Noble Energy Inc	20.59	-31.10	+9.75%	-8.57%	-6.83%	-34.43%
NOV	National-Oilwell	21.04	-47.50	-18.13%	+1.69%	-3.40%	-53.53%
OKE	Oneok Inc	72.03	+9.10	+33.51%	+1.39%	+2.61%	+5.18%
OXY	Occidental Petroleum Corp	43.07	-46.80	-29.83%	-1.17%	-12.41%	-47.59%
PSX	Phillips 66	100.86	-6.50	+17.07%	+1.17%	+3.96%	-14.31%
PXD	Pioneer Natural Resources Company	125.45	-29.40	-4.62%	+1.02%	-13.81%	-30.76%
SLB	Schlumberger N.V.	31.88	-47.20	-11.64%	-3.34%	-19.27%	-49.28%
VLO	Valero Energy Corp	84.52	-18.40	+12.74%	+13.02%	+3.10%	-27.90%
WMB	Williams Companies	23.65	-15.90	+7.26%	-0.21%	-16.70%	-14.84%
XEC	Cimarex Energy Company	46.63	-51.10	-24.36%	+10.55%	-20.62%	-52.48%
XOM	Exxon Mobil Corp	68.97	-18.70	+1.14%	-0.46%	-9.77%	-19.41%
Symbol	Name	Last	Wtd Alpha	YTD %Chg	1M %Chg	3M %Chg	52W %Chg

<https://www.barchart.com/stocks/indices/sp-sector/energies>



Source: The Balance, November 2018



# Top Permian Basin Oil Producers

	Permian Basin Operator	Latest Oil Production - Barrels Per Day	Latest Gas Production - mcf/day	
1	OCCIDENTAL PETROLEUM	498,925	1,544,337	Oxy – 48%
2	PIONEER NATURAL RESOURCES	295,728	723,330	Pioneer – 38 %
3	CONCHO RESOURCES	293,581	1,012,001	Concho – 59%
4	EOG RESOURCES	250,104	851,808	EOG – 46 %
5	DIAMONDBACK ENERGY	234,795	574,155	Diamondback – 37 %
6	EXXON MOBIL	196,534	586,199	Exxon – 19%
7	CHEVRON	133,370	586,050	Chevron – 9%
8	APACHE	119,368	820,717	Apache – 54 %
9	PARSLEY ENERGY	117,763	304,094	
10	ENDEAVOR ENERGY RESOURCES	105,837	219,238	
11	CIMAREX ENERGY	100,384	804,243	
12	ENCANA	100,165	238,700	
13	DEVON ENERGY	91,061	339,470	Devon – 44 %
14	SM ENERGY	77,845	138,164	
15	MEWBOURNE OIL COMPANY	74,403	253,196	
16	SURGE OPERATING	69,306	87,436	
17	WPX ENERGY	61,839	335,473	
18	SHELL	61,272	149,224	
19	CENTENNIAL RESOURCE DEVELOPMENT	61,095	224,538	
20	NOBLE ENERGY	56,318	153,029	Noble – 34%

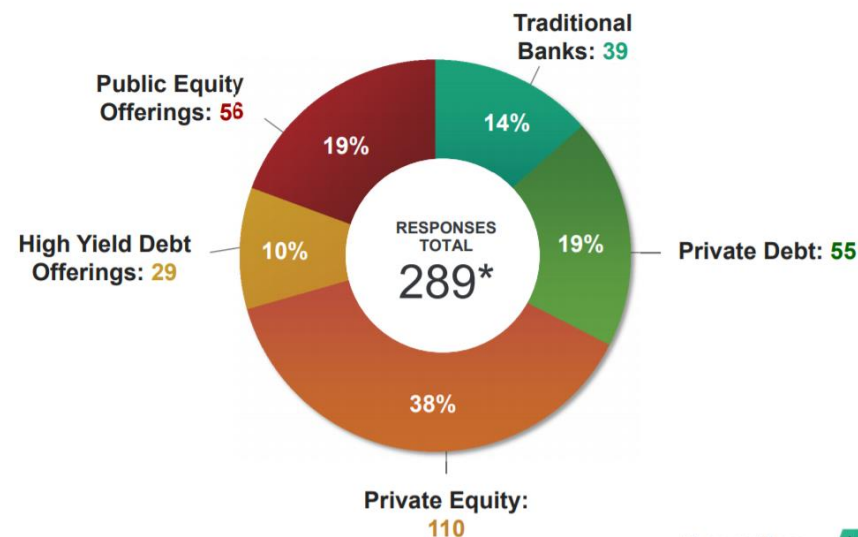
Source: PetroNerds, DrillingInfo

# 2016 vs. 2020 Capital Sourcing Shift

## Question 5:

Based on recent market conditions, which will be the top two capital sources for E&P companies over the next 12 months?

haynesboone



\*Up to two options could be selected.

Haynes and Boone  
Borrowing Base Redeterminations  
Survey: Fall 2016

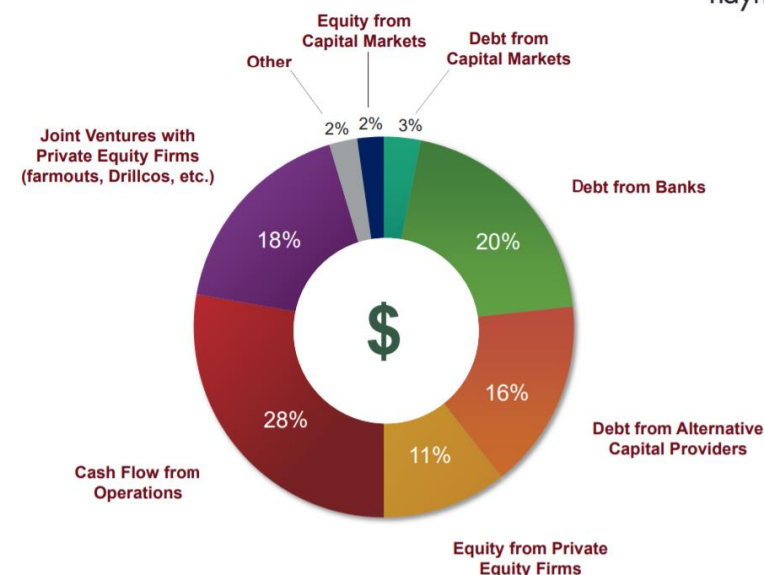


© 2016 Haynes and Boone, LLP

## Question 4:

Where are producers planning to source capital from in 2020?\*

haynesboone



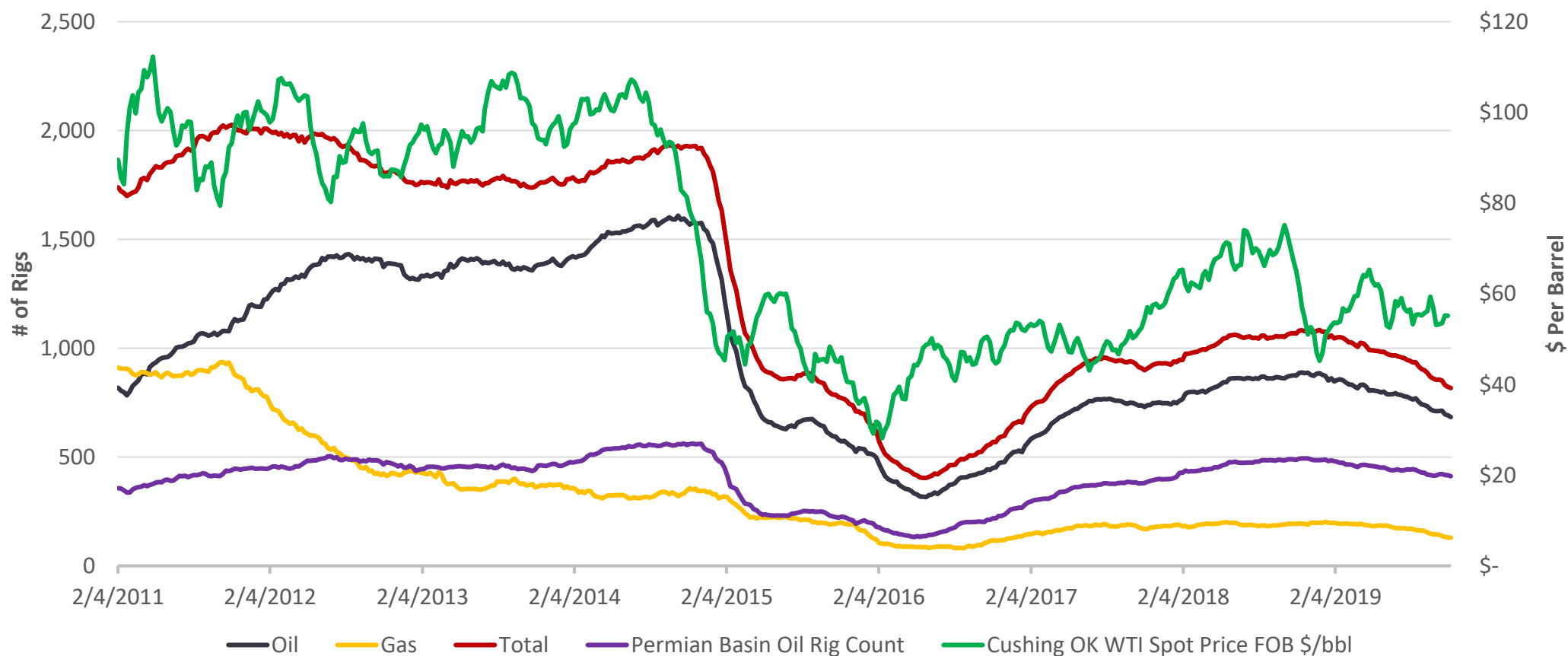
\*Respondents could select more than one option. We collected 670 responses. The figures in the chart above indicate the percent of total responses for each option.

Haynes and Boone  
Borrowing Base Redeterminations  
Survey: Fall 2019



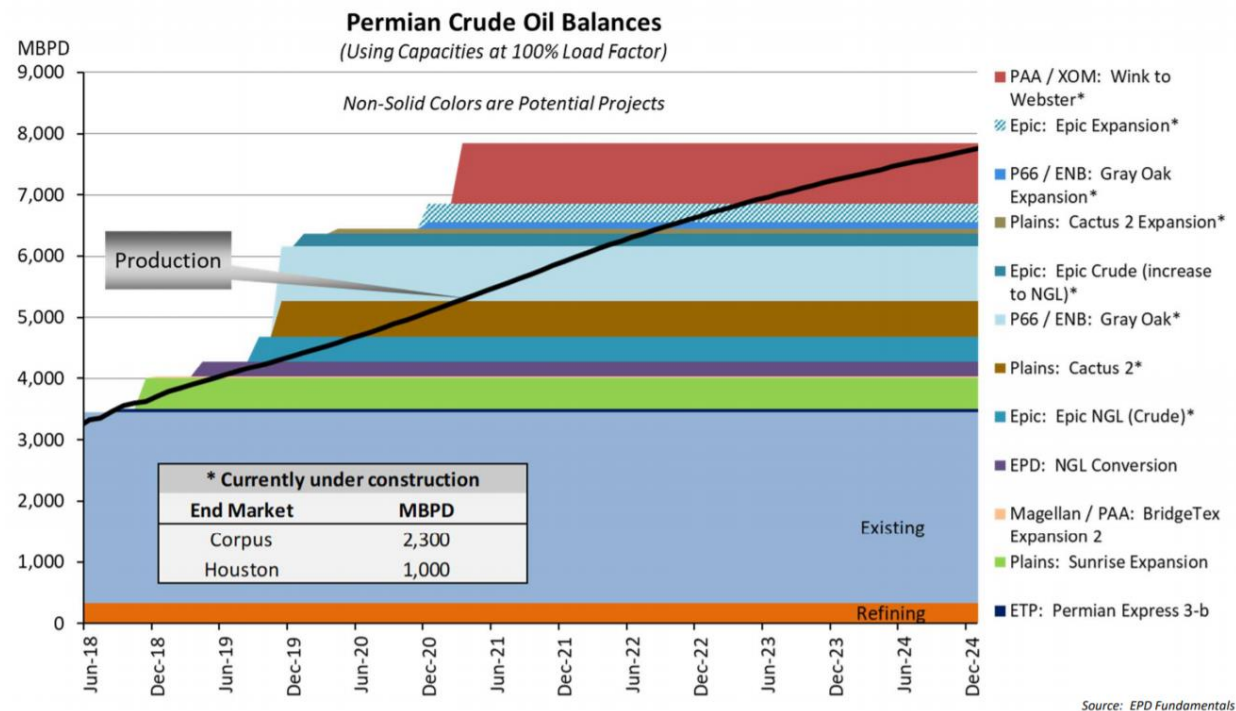
© 2019 Haynes and Boone, LLP

# Activity Levels and Oil Price



Source: PetroNerds, EIA, DrillingInfo, Baker Hughes

# Pipeline additions have created a material impact in pricing



Source: Enterprise Products Partners Analyst Meeting Presentation, April 2019

## WTI Midland (Argus) vs. WTI Financial Futures Quotes Globex





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Quotes Settlements Volume Time & Sales Contract Specs Margins Calendar

Auto Refresh Is ☒ ON

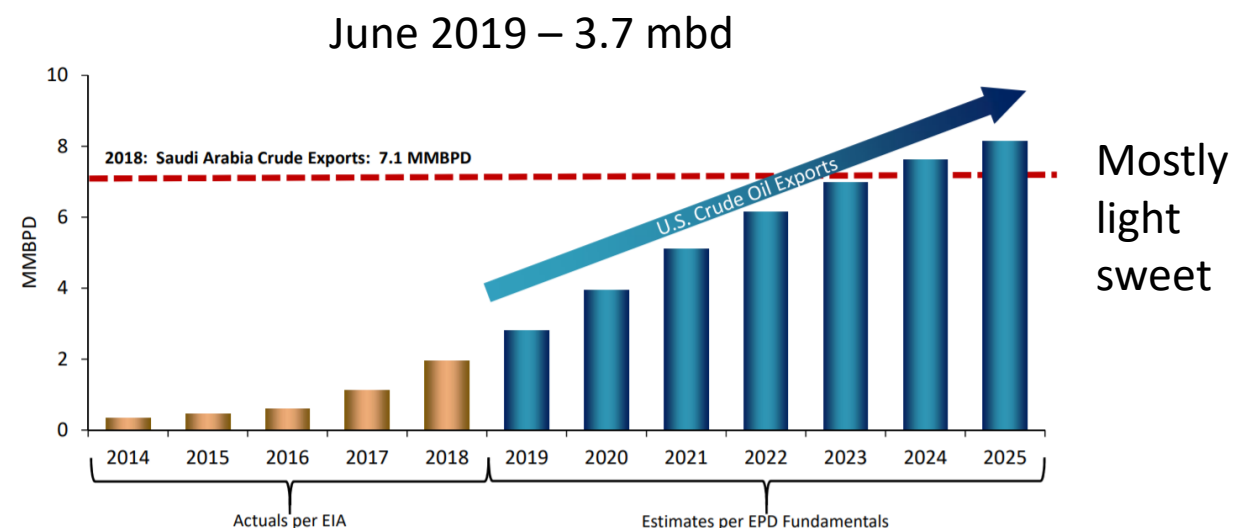
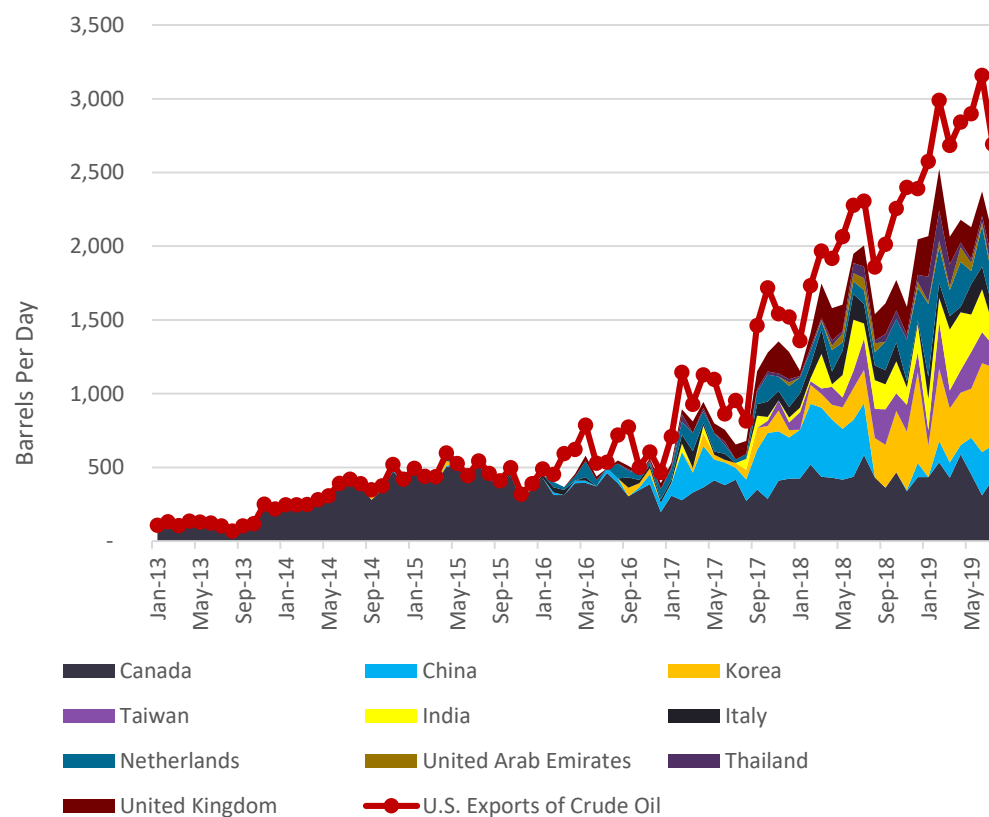
Market data is delayed by at least 10 minutes.

All market data contained within the CME Group website should be considered as a reference only and should not be used as validation against, nor as a complement to, real-time market data feeds. Settlement prices on instruments without open interest or volume are provided for web users only and are not published on Market Data Platform (MDP). These prices are not based on market activity.

Month	Options	Charts	Last	Change	Prior Settle	Open	High	Low	Volume	Hi / Low Limit	Updated
NOV 2019	OPT		-	-	1.01	-	-	-	0	No Limit / No Limit	16:36:53 CT 08 Nov 2019
DEC 2019	OPT		-	-	0.96	-	-	-	0	No Limit / No Limit	16:36:42 CT 08 Nov 2019
JAN 2020	OPT		-	-	0.98	-	-	-	0	No Limit / No Limit	16:37:38 CT 08 Nov 2019
FEB 2020	OPT		-	-	0.99	-	-	-	0	No Limit / No Limit	16:36:33 CT 08 Nov 2019
MAR 2020	OPT		-	-	0.99	-	-	-	0	No Limit / No Limit	16:37:33 CT 08 Nov 2019
APR 2020	OPT		-	-	0.99	-	-	-	0	No Limit / No Limit	16:36:33 CT 08 Nov 2019
MAY 2020	OPT		-	-	0.99	-	-	-	0	No Limit / No Limit	16:37:03 CT 08 Nov 2019

Midland Argus prices are at a slight premium to WTI

# U.S. Crude Oil Exports are Critical to Permian Development



Sources: EIA and EPD Fundamentals

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Source: PetroNerds, EIA, Enterprise Products Partners

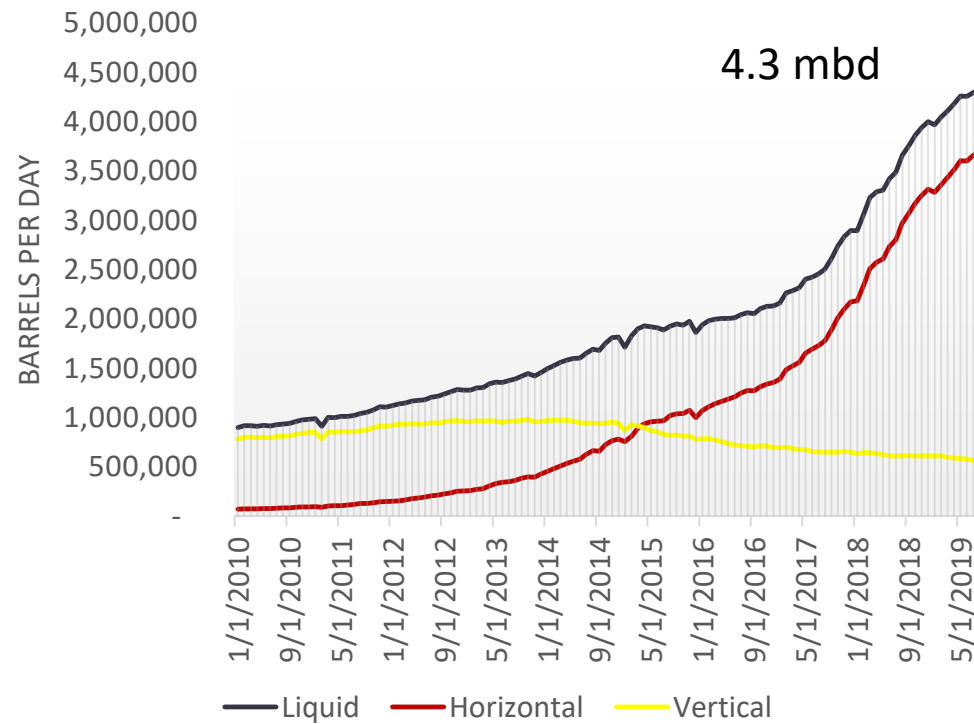
# Production, Activity, and Productivity

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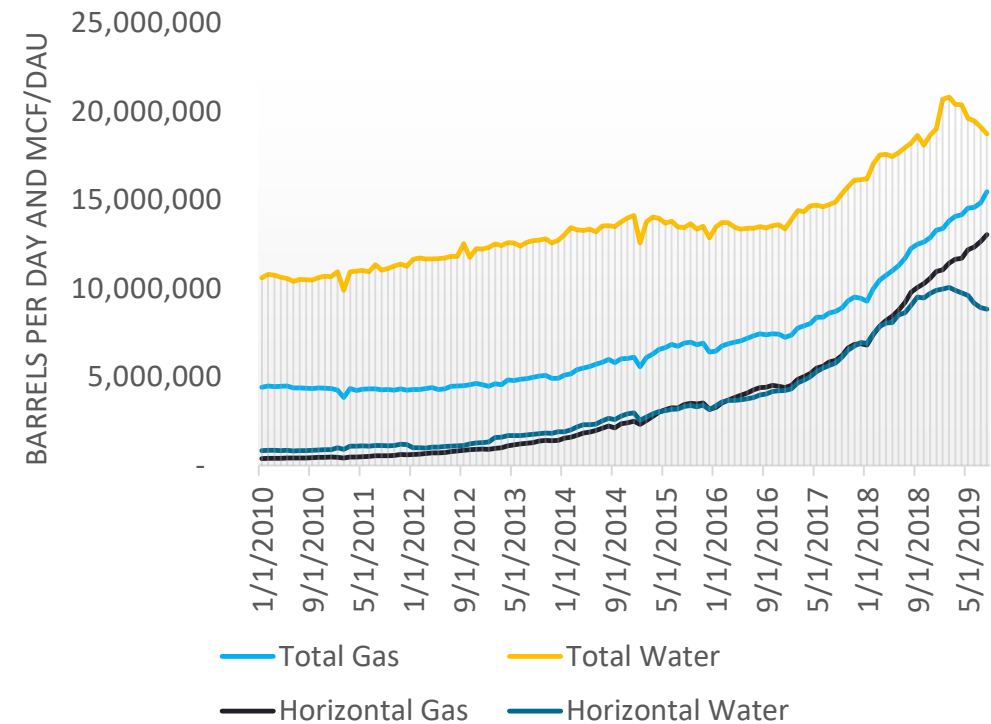
# Permian Basin Oil, Gas, and Water Production



## Horizontal vs. Vertical Well Production

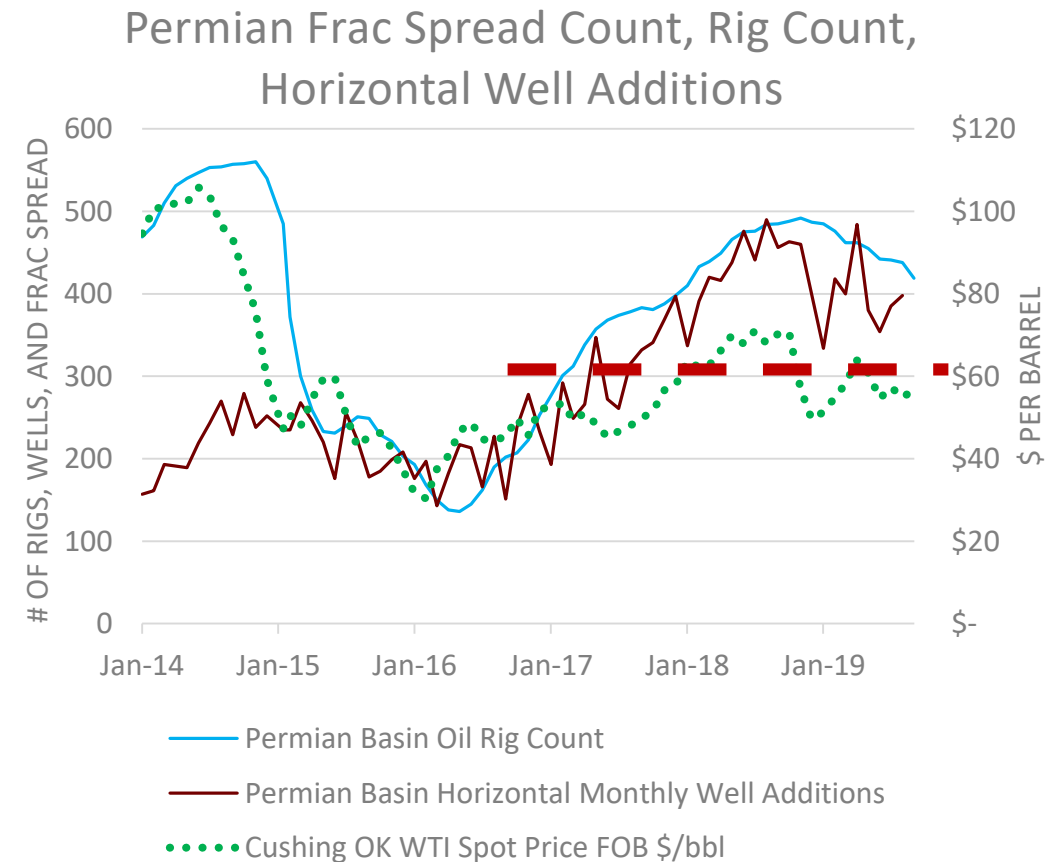
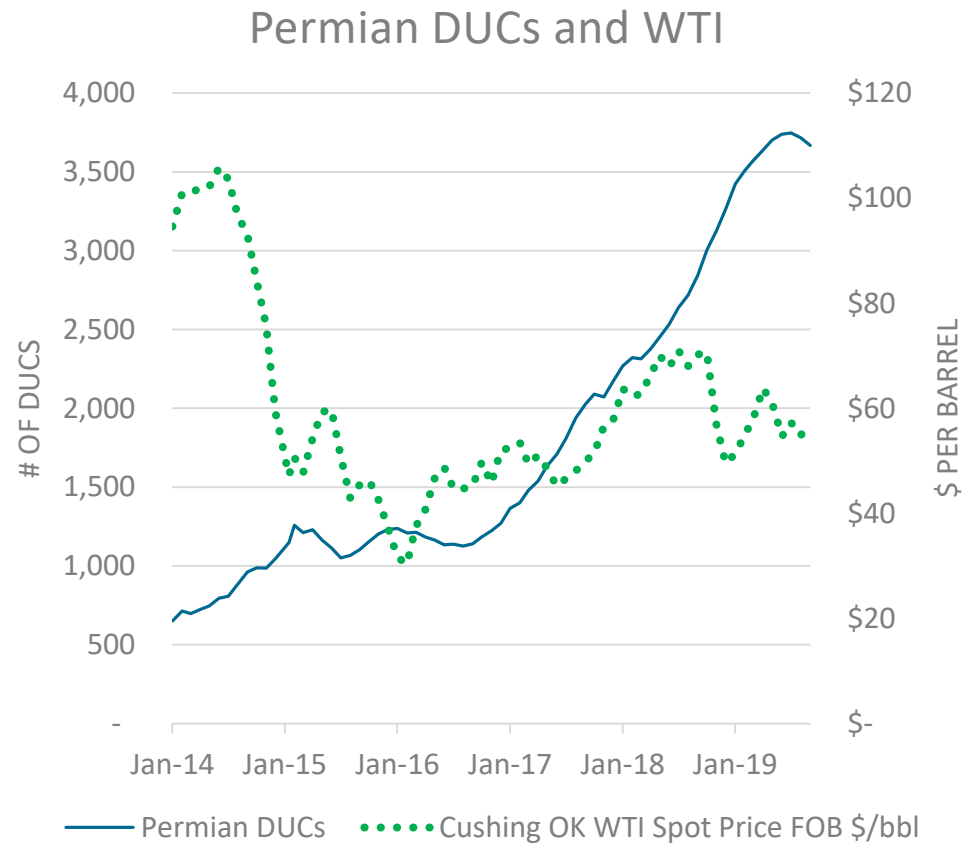


## Water and Gas Production



Source: PetroNerds, DrillingInfo

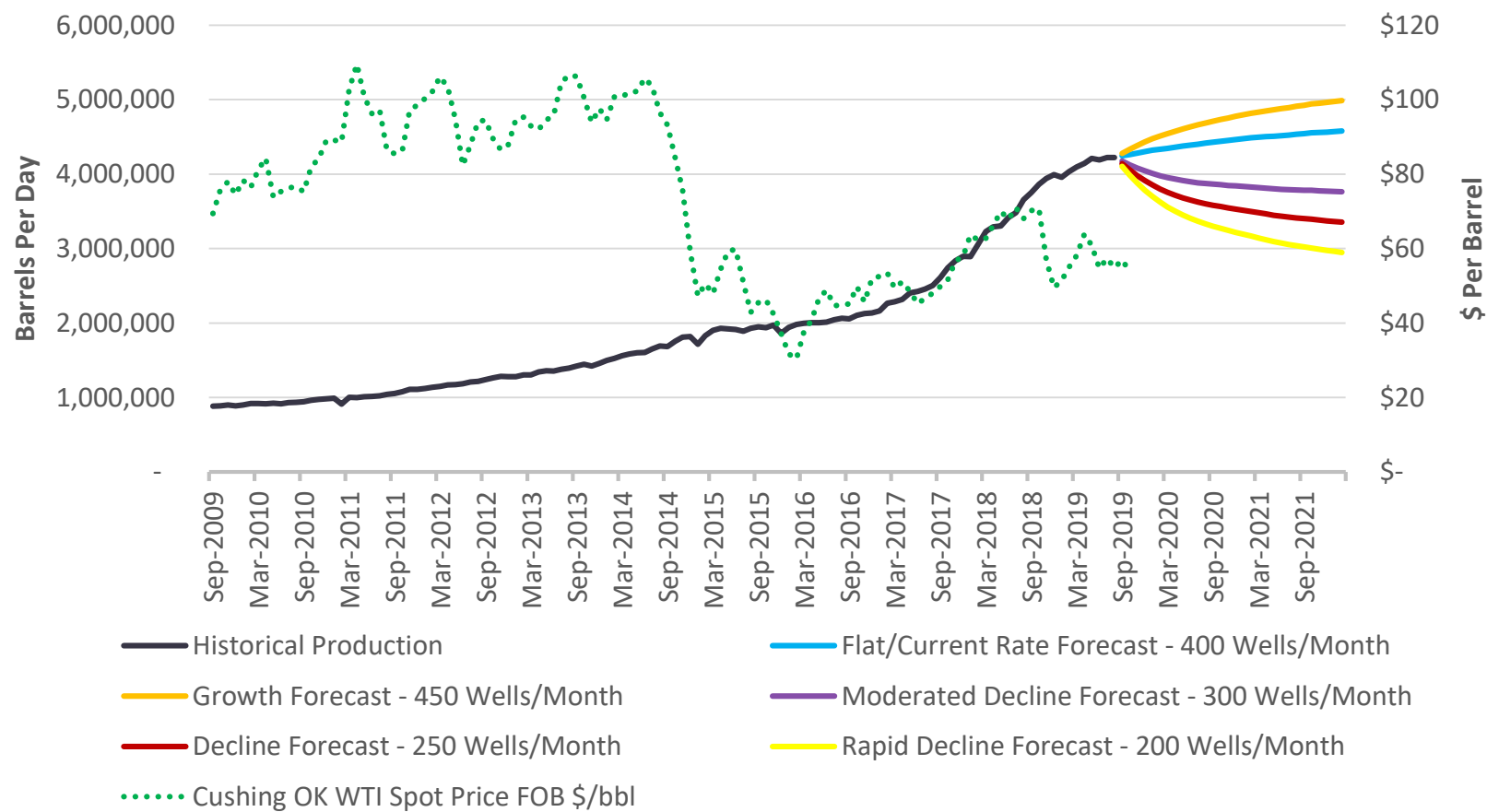
# Permian Production and Rig Count and WTI



Source: PetroNerds, EIA, DrillingInfo, Baker Hughes



# Permian Basin Forecast



The Permian Basin currently requires between 300 and 400 well additions each month remain flat above 4 mbd.

Source: PetroNerds, DrillingInfo, EIA

# Permian Basin Productivity

First 6 Month Oil Per Lateral Foot

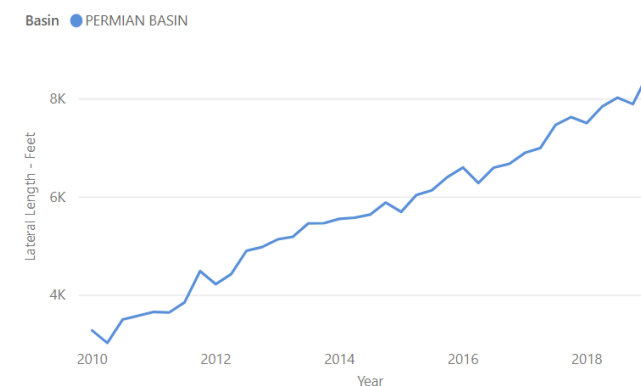


Average Vertical Depth



The sharp rise in vertical depth in late 2019 is attributable to an incomplete data set for recent well completions.

Average Lateral Length



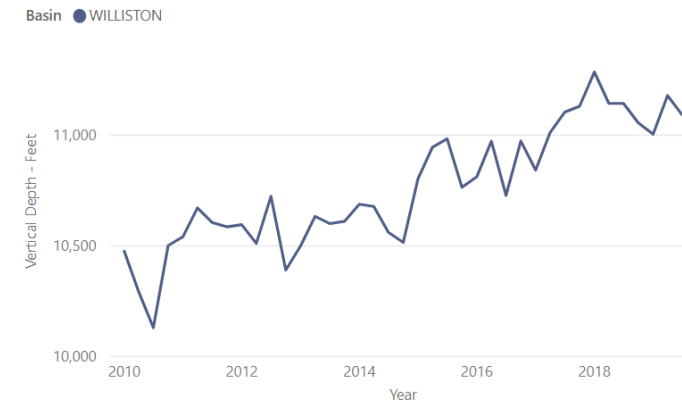
Source: PetroNerds, DrillingInfo

# Williston Basin/Bakken Productivity

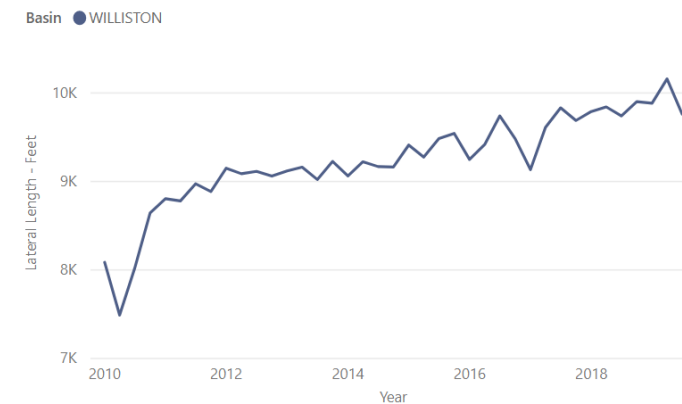
First 6 Month Oil Per Lateral Foot



Average Vertical Depth



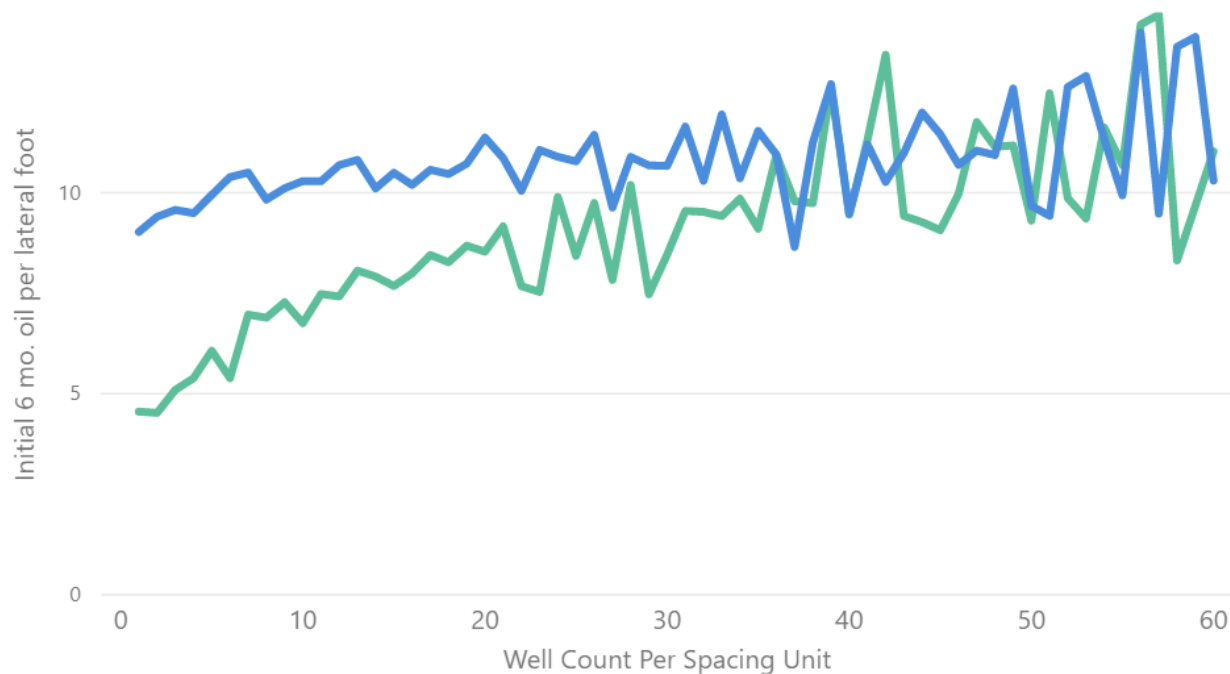
Average Lateral Length



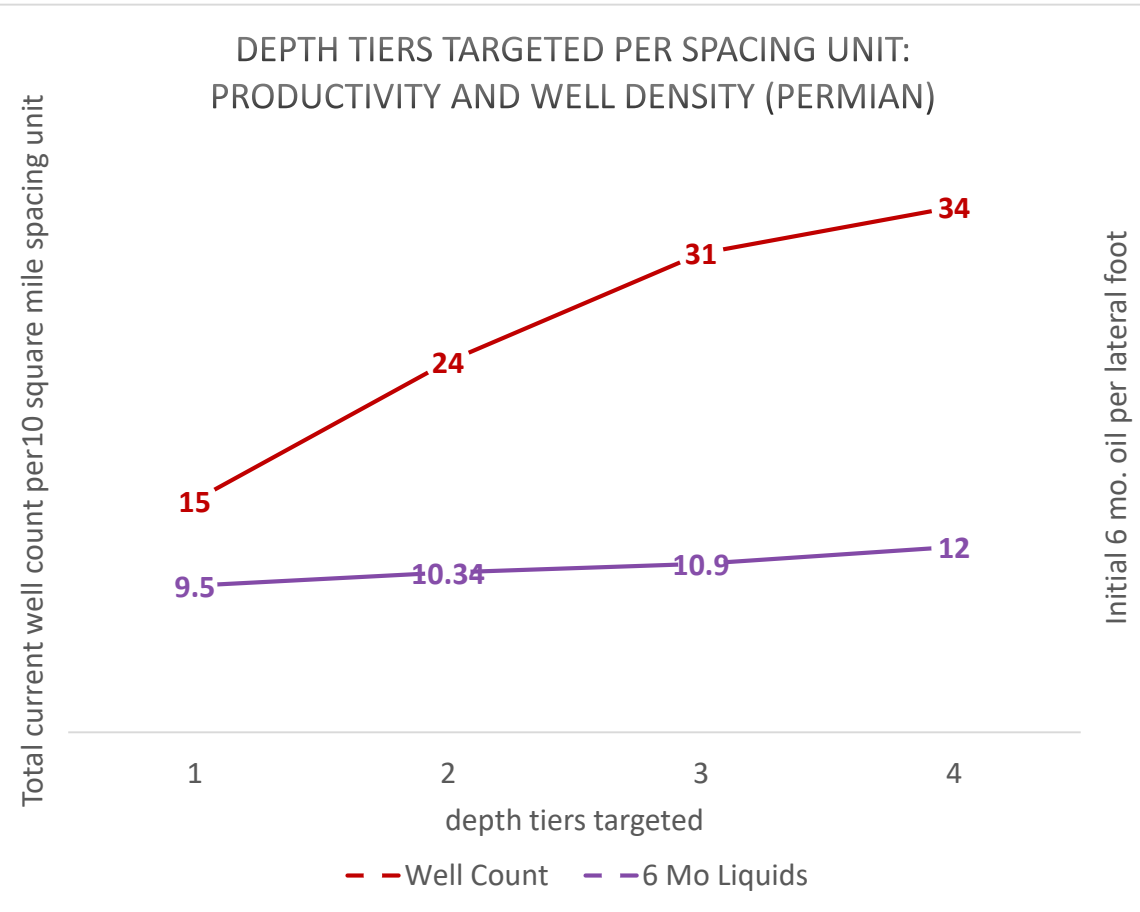
# Well Performance, Density, and Stacked Pay



basin ● PERMIAN BASIN ● WILLISTON



Horizontal wells 2014 and onwards.



# Delaware Basin Productivity

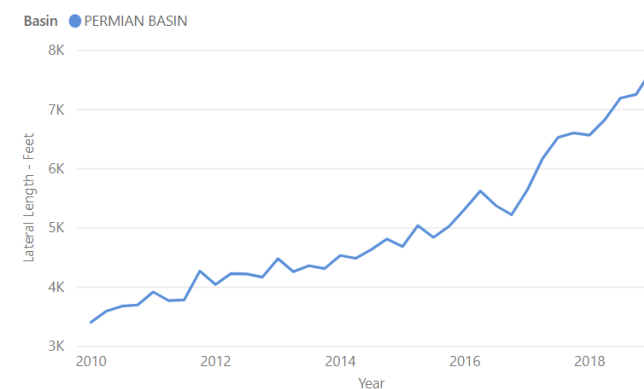
First 6 Month Oil Per Lateral Foot



Average Vertical Depth



Average Lateral Length

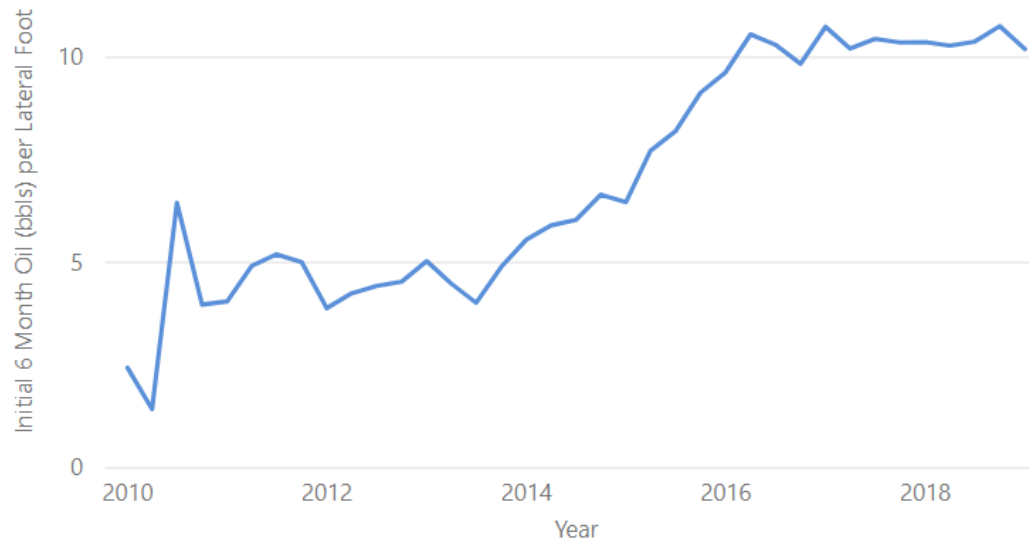


Source: PetroNerds, DrillingInfo

# Midland Basin Productivity

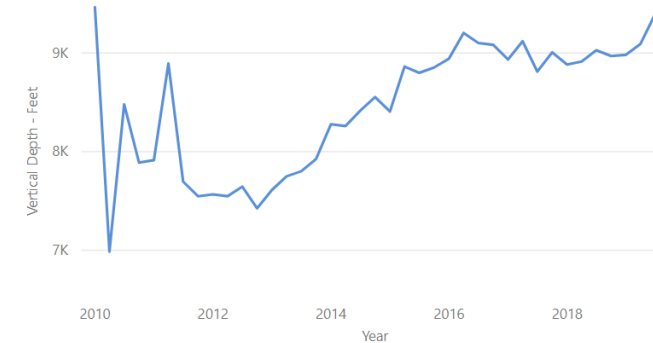
First 6 Month Oil Per Lateral Foot

Basin ● PERMIAN BASIN



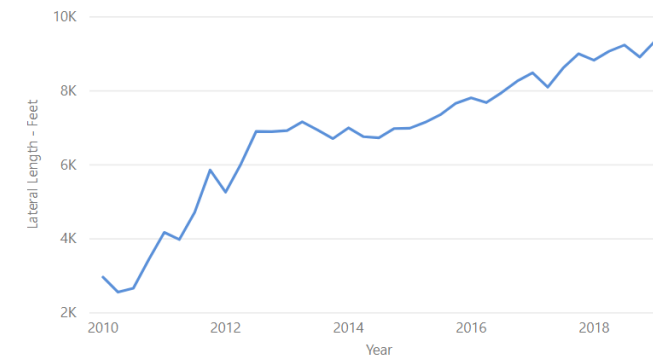
Average Vertical Depth

Basin ● PERMIAN BASIN



Average Lateral Length

Basin ● PERMIAN BASIN



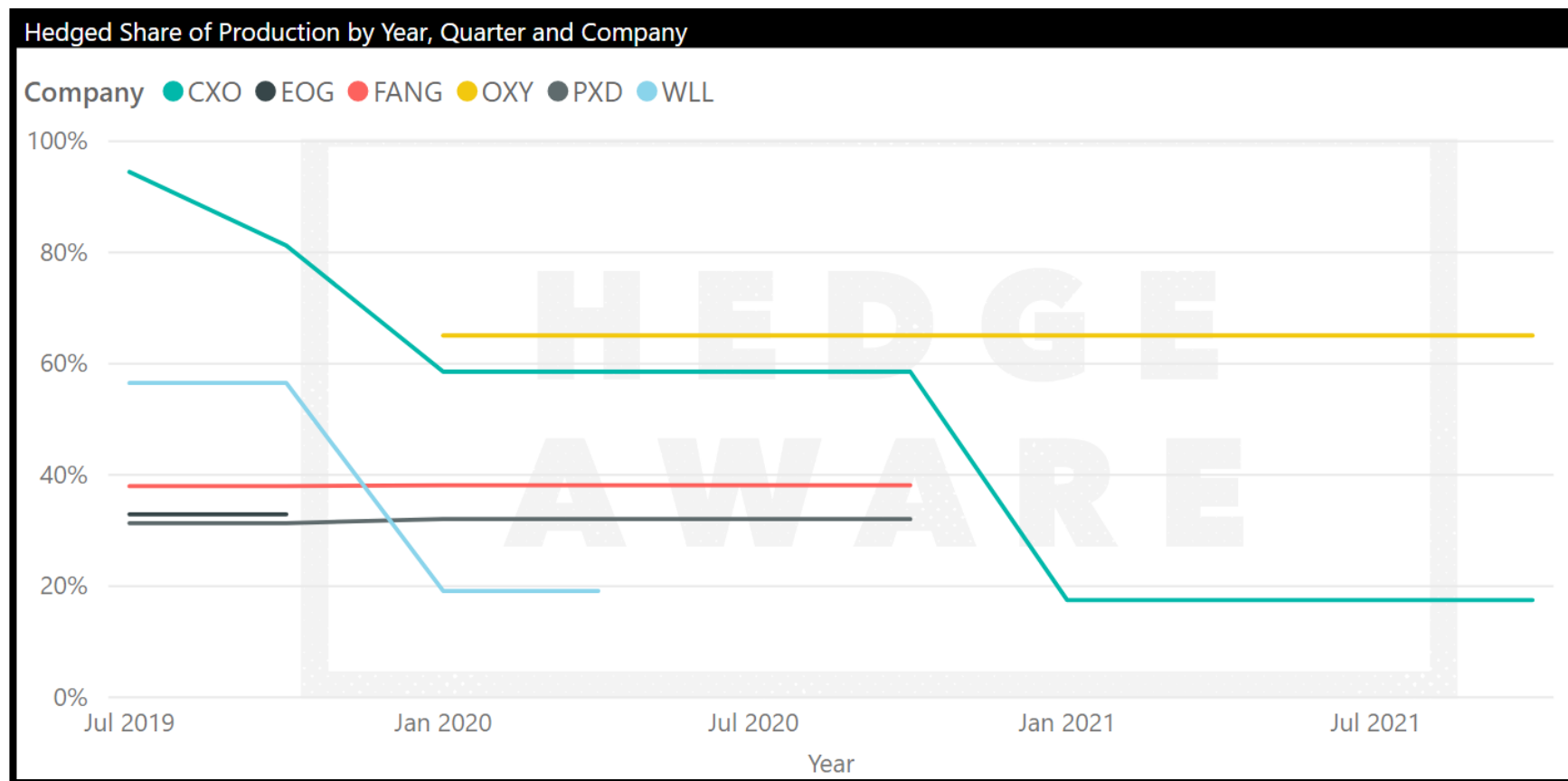
Source: PetroNerds, DrillingInfo

# Financials and Hedges

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SELECTED PERMIAN OPERATORS

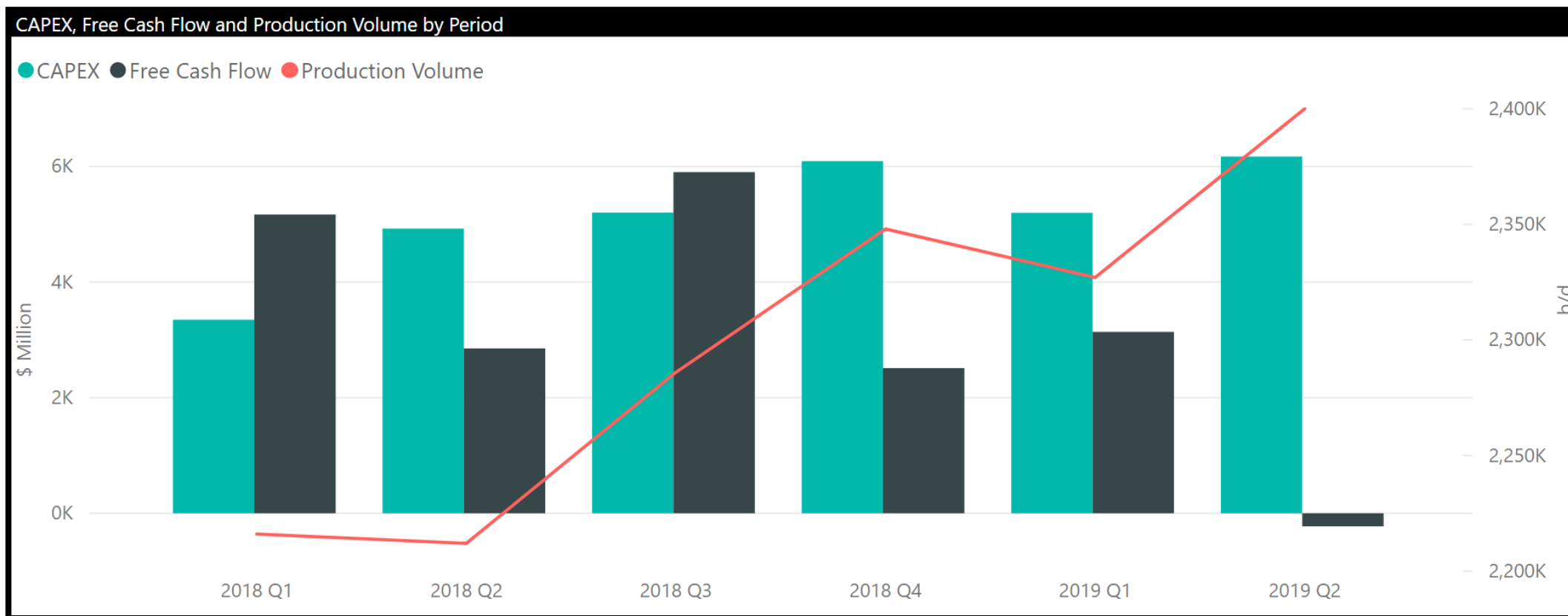
# Hedged Share of Production for Selected Operators



Source: PetroNerds, HedgeAware

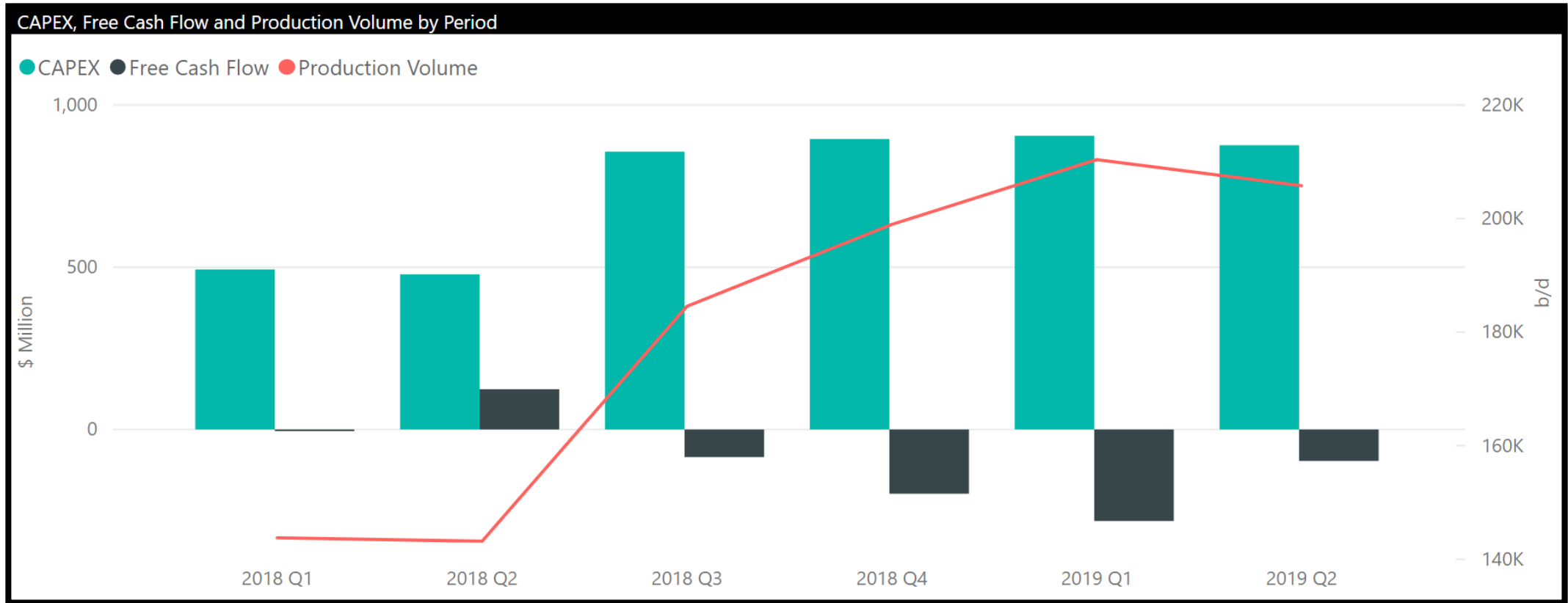


# ExxonMobil - XOM



Source: PetroNerds, HedgeAware

# Concho Resources - CXO



Source: PetroNerds, HedgeAware