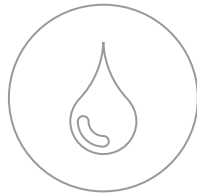


ENERGY OUTLOOK

2019 | SPRING/SUMMER

With more than 105 years in the energy industry, BOK Financial is committed to helping you succeed. In this issue of the Energy Outlook, you'll learn more about the current environment and outlook for the energy industry, as well as emerging trends in oil, natural gas and contract drilling.

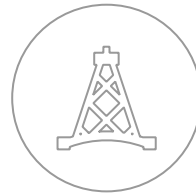
To learn more about what's happening in oil, natural gas and contract drilling, click one of the buttons below.



OIL



NATURAL
GAS



CONTRACT
DRILLING



CRUDE OIL

PRODUCTION

In 2018, petroleum and other liquid fuels production in countries outside the Organization of the Petroleum Exporting Countries (OPEC) increased by 2.5 million barrels per day, with production growth of 2.0 million b/d in the United States. Canada, Russia, Kazakhstan and Brazil collectively added an additional 0.6 million b/d. The U.S. Energy Information Administration (EIA) expects non-OPEC production to rise by 2.4 million b/d and 1.9 million b/d in 2019 and 2020, respectively. The forecasted production growth is centered in the United States as production growth in forecasted to average 1.7 million b/d in 2019 and 1.2 million b/d in 2020. Brazil is expected to be the other major contributors to production growth with combined increases of 0.3 million b/d in 2019 and 0.2 million b/d in 2020.

With rising crude oil prices through the first three quarters of 2018, U.S. production growth averaged approximately 10.9 million b/d in 2018, up 1.6 million b/d from 2017. This surpasses the previous record level of annual production in 1970. Production trends varied across the U.S., most notably, production in the Permian Basin increased by almost 1.0 million b/d in FY 2018. It's worth noting that almost all major shale basins in the US experienced production growth in the second half of 2018, with the Bakken region having the highest increase outside of the Permian, at 193 thousand b/d of growth or 18% for 2018.



US Onshore Oil Production (Thousands Barrels per Day)

	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	YOY Change
United States	9,949	9,995	10,248	10,461	10,475	10,464	10,672	10,936	11,325	11,470	11,559	11,905	11,849	+1900

Source: EIA

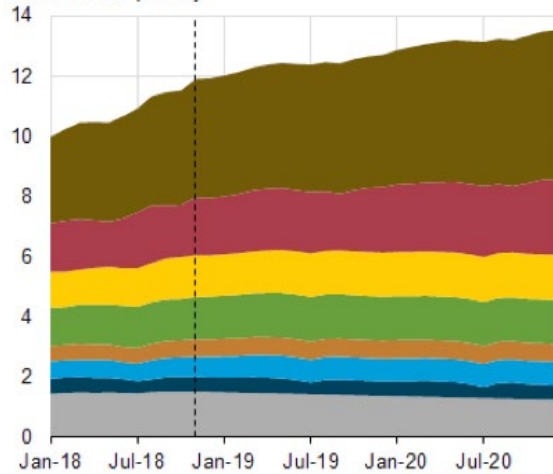
Permian Basin (Thousand Barrels per Day)

	Dec-17	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	YOY Change
United States	2,834	2,834	2,981	3,168	3,175	3,236	3,291	3,412	3,533	3,643	3,698	3,757	3,800	+966

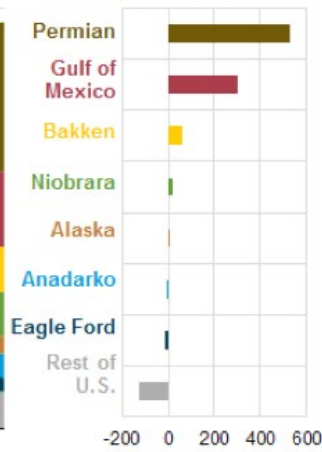
Source: EIA

U.S. crude oil production is forecast to average 12.4 million b/d in 2019 and 13.2 million b/d in 2020, according to the EIA February 2019 Short Term Energy Outlook. According to EIA, if domestic and global forecasts are realized, crude oil production at these levels would allow the US to maintain its status as the world’s leading crude oil producer in both years. The Permian basin is forecasted to be the largest contributor to the increase, accounting for 0.6 million b/d in 2019 and 0.5 million b/d in 2020. EIA expects the Permian region to produce 4.8 million b/d of crude oil by the end of 2020, which is about 1.0 million b/d more than December 2018 production levels and would comprise 36% of total U.S. crude oil production by YE 2020. Below is an EIA forecast of crude oil production by basin.

Figure 1. Monthly U.S. crude oil production January 2018 - December 2020
million barrels per day



Projected change 2019 vs 2020
thousand barrels per day



Source: U.S. Energy Information Administration, *Short-Term Energy Outlook*, February 2019





In its February Drilling Productivity Report (DPR), the EIA forecasts U.S. shale oil production will increase output in March 2019, building on increases over the past 6 months, despite a material drop in crude oil prices in Q4 2018. The DPR is used to estimate crude oil and natural gas production from the seven major U.S. shale regions that collectively accounted for ~92% of domestic crude oil production growth from 2011-2014. Net oil production from these seven shale regions is expected to increase by 84,000 barrels a day in March 2019, raising output from those basins to over 8.4 million barrels per day. The monthly projections have been steadily increasing throughout 2018. Note that through the first two months of 2019, production in those basins has continued to increase, despite a 40% drop in crude oil prices during the 4th quarter of 2018.

IMPORTS

U.S. crude oil imports totaled 5.82 million b/d in 2018, a decrease compared to 2017 imports of 7.91 million b/d. With the easing of export restrictions on domestically-produced crude oil at the end of 2015, crude oil exports increased, narrowing the spread between Brent and WTI, making importing more attractive. EIA estimates that the U.S. briefly was a net exporter of crude oil and petroleum products in November 2018. EIA forecasts that imports will continue to fall to 4.87 million b/d in 2019 then level off at 4.81 million b/d in 2020.



CONSUMPTION

The January 2019 EIA Short Term Energy Outlook indicated that total liquid fuels consumption in the U.S. increased by an estimated 500,000 b/d (2.5%) in 2018. Hydrocarbon gas fuel (HGL) consumption increased by an estimated 330,000 b/d (12.6%). Ethane being used as a petrochemical feedstock was responsible for most of the HGL increase as several new petrochemical steam cracking plants ramped up operation in 2018. EIA anticipates that several more plants, which are currently under construction, will begin operation in 2019 and 2020. For 2019, total liquid fuel consumption is anticipated to average 20.8 million b/d, a 1.5% increase from 2018. Consumption is forecasted to grow by 240,000 b/d or 1.1% in 2020. Higher consumption of HGL is the primary reason for forecasted growth.

Global petroleum and other liquid fuels consumption grew by 1.4 million b/d in 2018, averaging 100 million b/d for the year. EIA anticipates global consumption of petroleum and other liquids will grow by 1.5 million b/d in 2019 and in 2020, driven by countries outside of the Organization of Economic Cooperation and Development (OECD). Non-OECD growth is forecasted to account for 1.1 million b/d of global growth in 2019 and 1.2 million b/d in 2020. China and India will account for most of this growth.

Implied global petroleum and liquid fuel inventories increased by an estimated 0.4 million b/d in 2018, after decreased by 0.4 million b/d in 2017. EIA expects global inventories to increase by 0.2 million b/d in 2019 and by 0.4 million b/d in 2020.

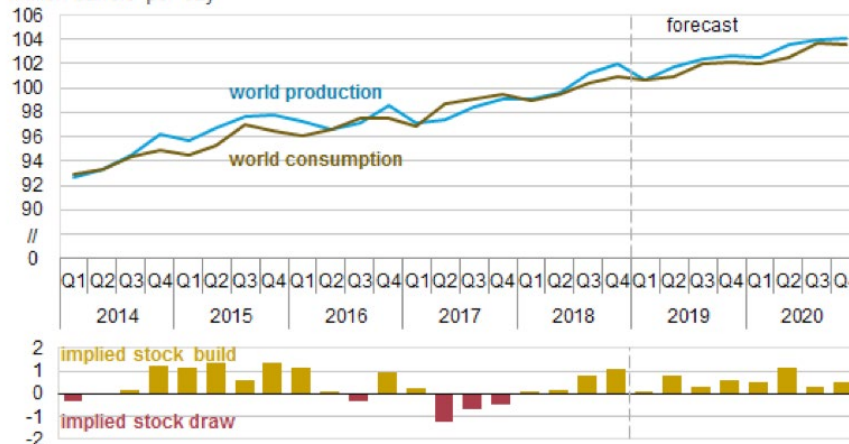


PRICING

After strong oil prices through the first three quarters of 2018, crude oil prices lost nearly 40% from the beginning of the 4th quarter to YE 2018. Increasing global inventories along with slowing worldwide demand were the primary concerns surrounding the pricing decrease. For the year, Brent crude oil spot prices averaged \$71 per barrel in 2018, \$17 per barrel increase from 2017. Brent spot prices reached a peak of \$86/b in October 2018 before falling to nearly \$50/b by the end of the year. In December, OPEC along with participating allies agreed to cut oil production by 1.2 million b/d through the first six months of 2019. Since YE, prices have steadily increased to around \$65 per barrel as of early March 2019.

EIA forecasts the Brent crude oil price will average \$61/barrel in 2019 and \$62/barrel in 2020. After increasing an estimated 0.5 million b/d in 2018, EIA expects global inventories to increase by 0.4 million b/d in 2019 and by 0.6 million b/d in 2020. EIA expects WTI crude oil prices to average \$8/b lower than Brent prices in the first quarter of 2019 before the discount gradually falls to \$4/b in fourth quarter 2019 and throughout 2020.

World liquid fuels production and consumption balance
million barrels per day



Source: Short-Term Energy Outlook, February 2019

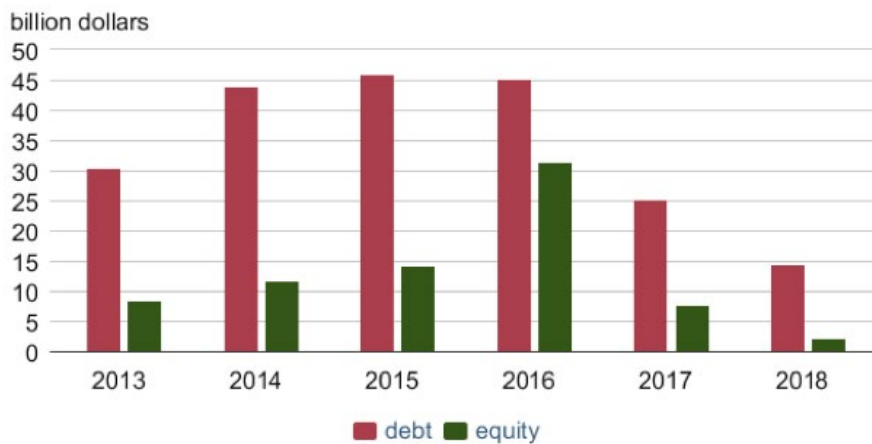




CAPITAL MARKETS

In 2018, publicly traded U.S. oil exploration and production companies issued the lowest volume of new funding since 2013, raising ~\$14 billion in debt and ~\$2.0 billion on public equity. Several factors contributed to the lower levels of financing activity in 2018. The first was higher cost of capital, driven by rising interest rates in 2018. The U.S. Federal Funds rate averaged 1.8% in 2018, the highest since 2008. In addition to higher cost of capital, oil companies have needed less outside sources of capital than in previous years. The EIA looked at a group of 46 publically traded oil producers, who collectively generated \$56 billion in cash flow from operating activity through the first three quarters of 2018. This was higher than any full year amount from 2015-2017. As a result, full year cash flow will likely be the highest annual total since 2014 for these sampled companies. Over that same period of time, those 46 companies spent \$60 billion in capital expenditures and generated \$8 billion from asset sales. As such, the majority of these companies likely had enough cash to fund their investing activities without the need to issue debt or equity. Below is a summary of debt and equity issuances since 2013.

Figure 4. U.S. exploration and production company debt and equity issuance



 U.S. Energy Information Administration, based on Evaluate Energy



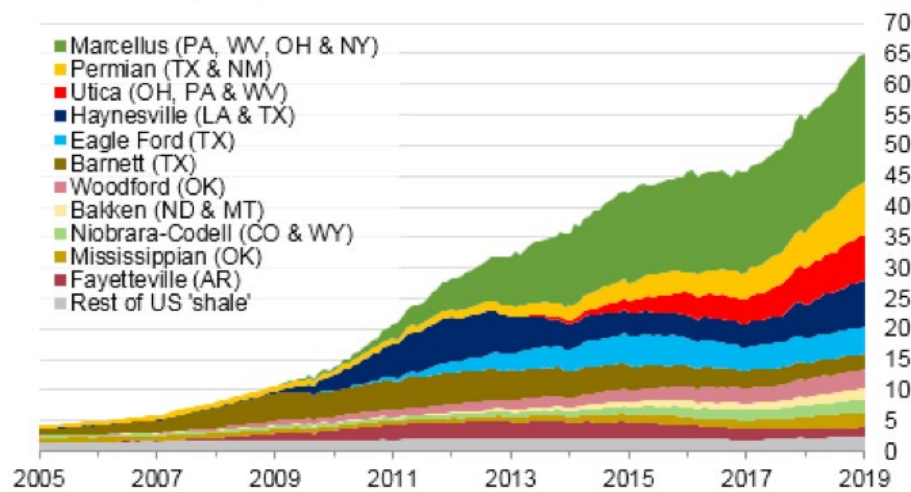
NATURAL GAS

PRODUCTION

U.S. dry natural gas production averaged 83.3 billion cubic feet (Bcf) per day in 2018, an increase of 8.9 Bcf per day from FY 2017. Natural gas production in 2019 is estimated to rise by an average of 6.9 Bcf per day from the 2018 level. The return to increasing production reflects improved drilling efficiencies, cost reductions, higher associated gas production from oil-directed drilling, and increased takeaway capacity in the Appalachia and Permian regions.

Monthly dry shale gas production

billion cubic feet per day



Sources: EIA derived from state administrative data collected by DrillingInfo Inc. Data are through January 2019 and represent EIA's official tight gas estimates, but are not survey data. State abbreviations indicate primary state(s).

EIA Natural Gas Weekly Update, February 28, 2019

Annual natural gas production increased throughout 2018 across multiple basins in the U.S. Efficiency improvements in horizontal drilling and hydraulic fracturing in the Appalachia region have driven natural gas production to increase 4.4 Bcf per day in 2018 compared to average 2017 production. This represents an 18% increase. Outside of the Appalachia regions, the Permian Basin has seen the second largest nominal increase in 2018 natural gas production at 2.7 Bcf per day for the year. On a percentage basis, the Haynesville saw the largest increase at 33% or 2.2 Bcf per day.



The U.S. exported more natural gas than it imported in 2018, with net exports averaging 2.1 Bcf/d. Rising LNG and pipeline exports have been the main contributor to a shift from the U.S. being a net importer of natural gas as recently as early 2017. U.S. natural gas exports averaged 10 Bcf/d in 2018 and is forecasted to rise ~32% to 13.2 Bcf/d in 2019 and then by 15% to 15.2 Bcf/d in 2020. EIA expects U.S. LNG exports to increase from approximately 3.0 Bcf/d in 2018 to 5.1 Bcf/d in 2019 and 6.8 Bcf/d in 2020. The increase will be driven by three new liquefaction projects coming online. By mid-2020, EIA expects U.S. export capacity to reach 9.6 Bcf/d, making U.S. export capacity the 3rd largest in the world behind Australia and Qatar.

CONSUMPTION

U.S. natural gas consumption averaged 81.6 Bcf per day in 2018, a 10% increase from 2017. EIA projects natural gas consumption to increase by 3.51 Bcf/d in 2019 and 0.9 Bcf/d in 2020. The 2018 increase in consumption was mainly driven higher consumption in the electric power sector. The EIA estimates that electric generation consumed an average of 29.0 Bcf/d in 2018, up 14% from 2017 because of warmer summer temperatures in 2018 and the addition of natural gas-fired electric generation capacity. In 2019, power sector consumption is expected to remain flat, then rise by 3.3% in 2020 due to additional natural gas-fired electric generation capacity

On an annual basis, EIA expected combined residential and commercial natural gas consumption to average 13.4 Bcf/d and 9.3 Bcf/d, respectively. This is relatively flat compared to 2018. Based on forecast from the National Oceanic and Atmospheric Administration, the EIA forecasts heating degree days to be 1% lower compared to 2018, the leading to flat forecasted residential and commercial consumption. U.S. industrial sector consumption is forecasted to increase 2.0% in 2019 due to new chemical projects that will lead to increases in the use of natural gas as a feedstock in ammonia for nitrogenous fertilizer and methanol manufactures.

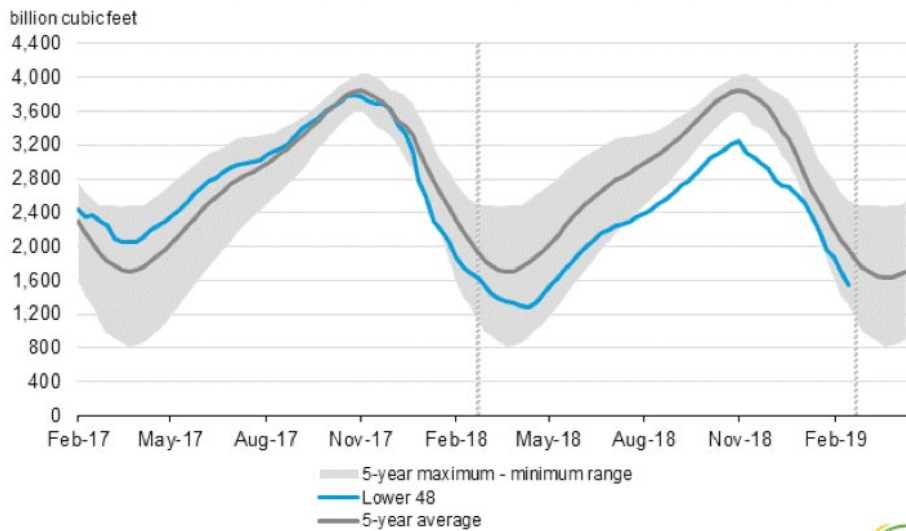


STORAGE

As of January 2019, working natural gas inventories were 2,614 Bcf, 7% lower than year ago levels and 15% lower than the five year average. Although inventories were below historical averages, due to forecasted growing natural gas production levels, EIA forecasts inventory injections to exceed five year averages from the end of March to October, bringing inventories to 3,758 Bcf at the end of October 2019. This would be slightly higher than the previous five years average for the end of October, and 16% more than the end of October 2018.

For the week ending February 28, 2019, net withdrawals to storage totaled 166 Bcf, bringing total working gas storage to 1,539 Bcf. Stocks were 154 Bcf less than last year and 424 Bcf below the five year average.

Working gas in underground storage compared with the 5-year maximum and minimum



Source: U.S. Energy Information Administration



EIA Weekly Natural Gas Storage Report February 28, 2019

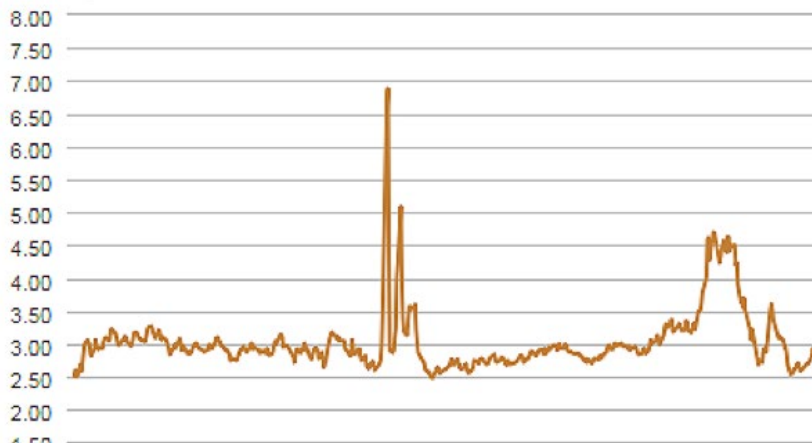


U.S. NATURAL GAS PRICES

Henry Hub natural gas spot prices averaged \$3.15/MMBtu in 2018, up 16 cent/MMBtu from 2017 levels. EIA forecasts the Henry Hub natural gas spot prices will average \$2.89/MMBtu in 2019 and \$2.92 MMBtu in 2020. Forecast prices are lower than 2018 levels as expected production growth keeps pace with domestic demand and export growth. Please note that the spikes seen in early and late 2018 were daily spot values and did not materialize into significantly higher Nymex futures prices beyond the prompt month.

Natural gas spot prices (Henry Hub)

dollars per million British thermal units



EIA Natural Gas Weekly Update, released February 28, 2019

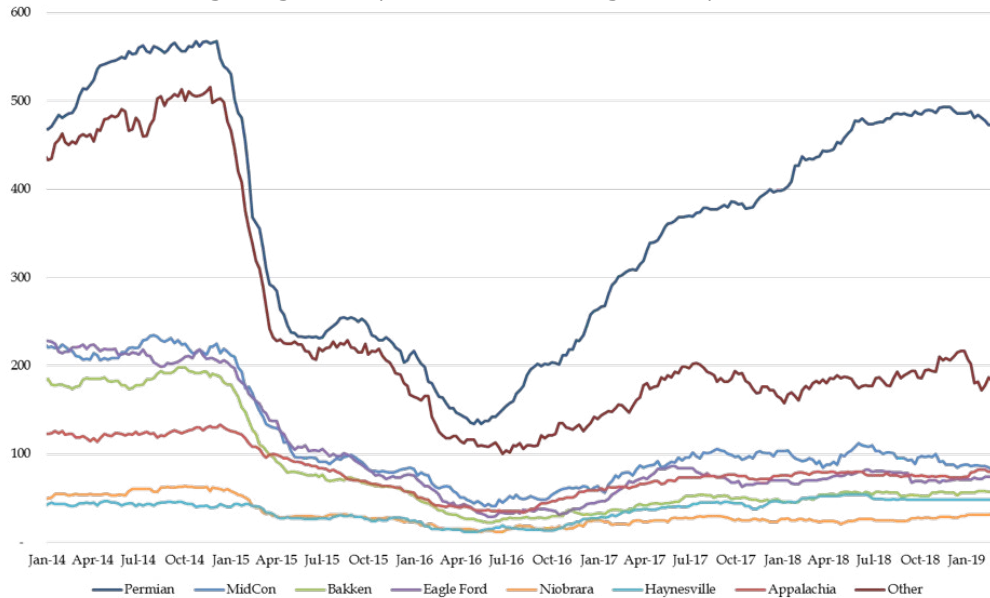
In January 2019, Henry Hub natural gas spot prices averaged \$3.13 per MMBtu, down \$0.91/MMBtu from December 2018. Despite a cold snap in late January, average temperatures for the month were milder than normal in much of the U.S., leading to lower prices. The front-month natural gas futures contract for delivery at Henry Hub settled at \$2.55/ MMBtu on February 7, a decrease of 41 cents/MMBtu from January 2.



CONTRACT DRILLING

The total number of active rigs drilling for oil and natural gas in the U.S. increased by nine for the week ended March 1, 2019. The oil rig count was down by ten to 843, while gas rigs increased by one to 181. This represents a 45 rig decrease since year end 2018 and a 57 rig increase since this same time last year. The Permian basin has shown the largest increase in rigs at 32 or 7%. The U.S. rig count peaked at over 4,500 in 1981 and hit its lowest level of 404 in May 2016.

The U.S. natural gas rig count peaked at 1,606 rigs in September 2008. In contrast,



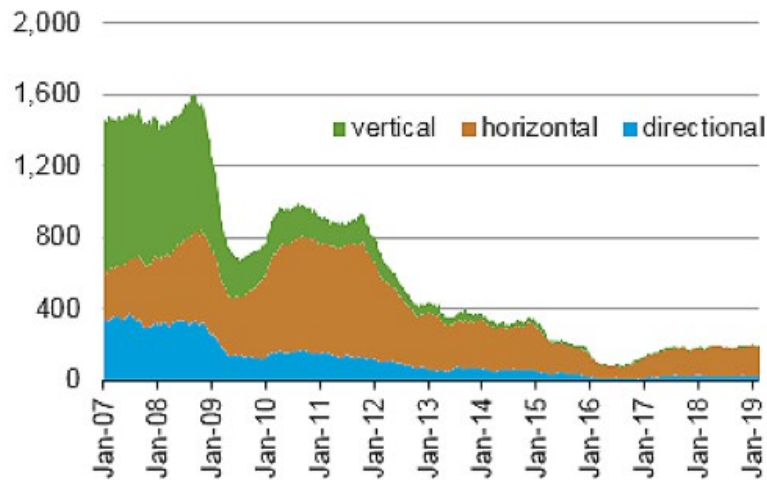
Baker Hughes North American Rig Count



it hit a low of 81 rigs in the week ending August 26, 2016. At 195 rigs, U.S. natural gas rigs are currently 88% below their peak, but they're up 141% from the August 2016 low. Natural gas production has been strong despite lower natural gas prices due to the rise in U.S. crude oil output. Natural gas is often an associated product of crude oil, and as a result, natural gas production and prices have recently been more closely correlated with U.S. crude oil rigs than natural gas rigs.

Weekly natural gas rig count

active rigs



Source: Baker Hughes Inc.

EIA Natural Gas Weekly Update, released February 28, 2019



A summary of the EIA's February 2019 Drilling Productivity Report is shown below. The report uses recent data on the total number of drilling rigs in operation along with estimates of drilling productivity and anticipated changes in production from existing oil and natural gas wells to provide estimated changes in oil and natural gas production for seven key fields. These seven regions (Bakken, Eagle Ford, Haynesville, Appalachia, Niobrara, Permian, and Anadarko) comprised roughly 92% of domestic oil production growth and virtually all domestic natural gas production from 2011-2014.

Region	Oil production thousand barrels/day			Gas production million cubic feet/day		
	February 2019	March 2019	Change	February 2019	March 2019	Change
Anadarko	587	587	-	7,666	7,706	40
Appalachia	138	141	3	31,292	31,602	310
Bakken	1,439	1,452	13	2,727	2,741	14
Eagle Ford	1,429	1,438	9	6,885	6,937	52
Haynesville	43	43	-	10,105	10,265	160
Niobrara	697	713	16	5,256	5,319	63
Permian	3,981	4,024	43	13,178	13,397	219
Total	8,314	8,398	84	77,109	77,967	858

Source: EIA Drilling Productivity Report, February 2019

According to the EIA, the seven shale plays shown above will produce an estimated total of 77.9 Bcf/d of natural gas in March, up from 77.1 Bcf/d in February. Gas production out of the plays, which had been on a downward trend through most of 2016, returned to the upside starting January 2017. From January 2017 to forecasted March 2019, natural gas production out of the seven basins has grown 30.3 Bcf/d.

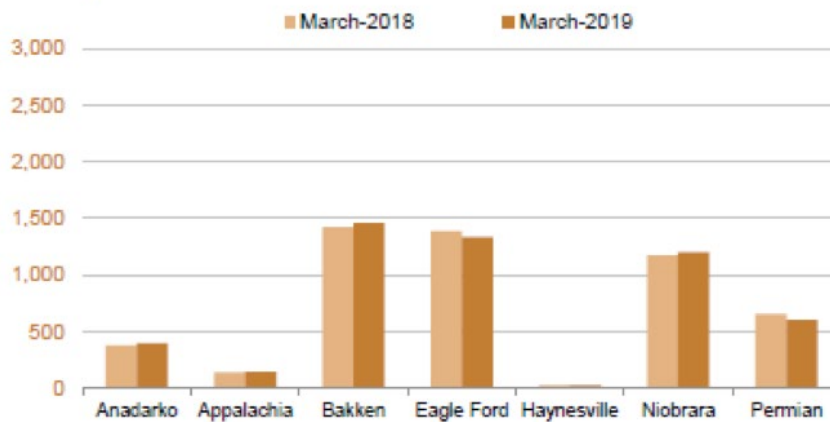


Total oil production out of the seven plays will be an estimated 8.4 million bbl/d in March 2019, compared with 8.3 million bbl/d in February, according to the DPR. EIA forecasts March oil production to increase in five out of the seven basins, with Haynesville remaining flat. From January 2017 to forecasted March 2019, oil production out of the seven basins has grown 3.7 million bbl/d. On a rig-weighted average basis, oil production per rig will be 661 bbl/d, compared to 656 bbl/d in February. New-well gas production per rig in the plays will average an estimated 3.7 MMcf/d in March, up from 3.6 MMcf/d in February.

A comparison of the new well oil and gas production per rig from March 2018 to March 2019 is shown on the following page.

New-well oil production per rig

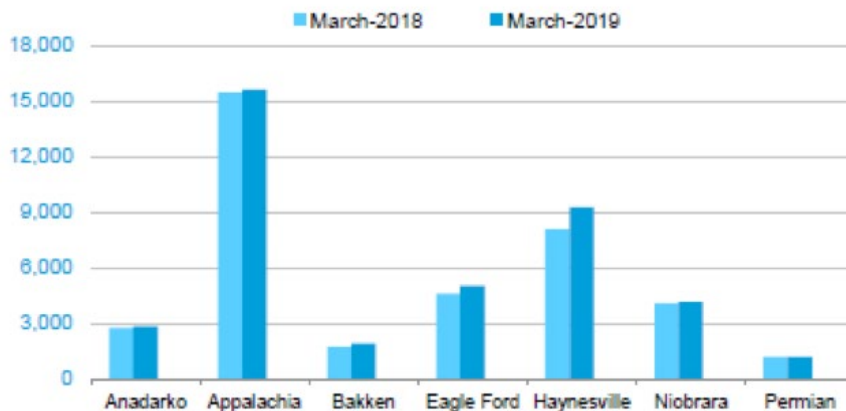
barrels/day



(Source: EIA Drilling Productivity Report, February 2019)

New-well gas production per rig

thousand cubic feet/day



(Source: EIA Drilling Productivity Report, February 2019)



Drilled but uncompleted wells (DUC) totaled 8,798 in the seven regions above at the end of January 2019, an increase of 201 from December 2018 and 1,189 from January 2018. Permian basin leads the way with 3,965 DUCs, Haynesville has the lowest at 202 as of January 2019.

Drilled but uncompleted wells (DUC)
wells

Region	December 2018	January 2019	Change
Anadarko	1,081	1,085	4
Appalachia	529	507	(22)
Bakken	730	715	(15)
Eagle Ford	1,568	1,597	29
Haynesville	202	205	3
Niobrara	516	519	(3)
Permian	3,965	4,170	205
Total	8,591	8,798	207

(Source: EIA Drilling Productivity Report, February 2019)



The information in the report was prepared by BOK Financial Credit Administration and Loan Review. BOK Financial Corporation, a financial holding company (NASDAQ:BOKF), offers services through its subsidiary BOKF, NA.

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