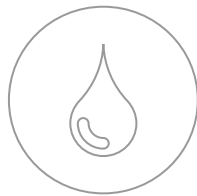


# ENERGY OUTLOOK

2018 | 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 2017, petroleum and other liquid fuels production in countries outside the Organization of the Petroleum Exporting Countries (OPEC) increased by 0.7 million barrels per day, with combined production growth of 1.0 million b/d in the United States and Canada more than offset a decrease of 0.3 million b/d decrease among the rest of the non-OPEC producers. The U.S. Energy Information Administration (EIA) expects non-OPEC production to rise by 2.00 million b/d and 1.3 million b/d in 2018 and 2019, respectively. The forecasted production growth is centered in the United States as production growth is forecasted to average 1.5 million b/d in 2018 and 1.0 million b/d in 2019. Canada and Brazil are expected to be the other major contributors to production growth with combined increases of 0.4 million b/d in 2018 and 2019. Other sources of growth for non-OPEC production growth are expected to come from Kazakhstan and Norway.

With rising crude oil prices through the second half of 2017, production growth in the last four months of the year drove a 13% year over year increase. U.S. crude oil production averaged an estimated 9.3 million barrels per day in 2017 compared to 8.9 million b/d in 2016. Fourth quarter production averaged 9.89 million b/d, which marks the second highest quarterly average dating back to 1970's fourth quarter average of 10.0 million b/d. Production trends varied across the U.S., most notably, production in the Permian Basin increased from 2.1 million b/d in January 2017 to 2.8 million b/d in December 2017. It's worth noting that multiple basins across the US, specifically the Bakken, Eagle Ford and Niobrara, have seen modest production growth throughout 2017 as technological efficiencies in drilling and completions have reduced break-evens and allowed US producers to grow production with fewer rigs



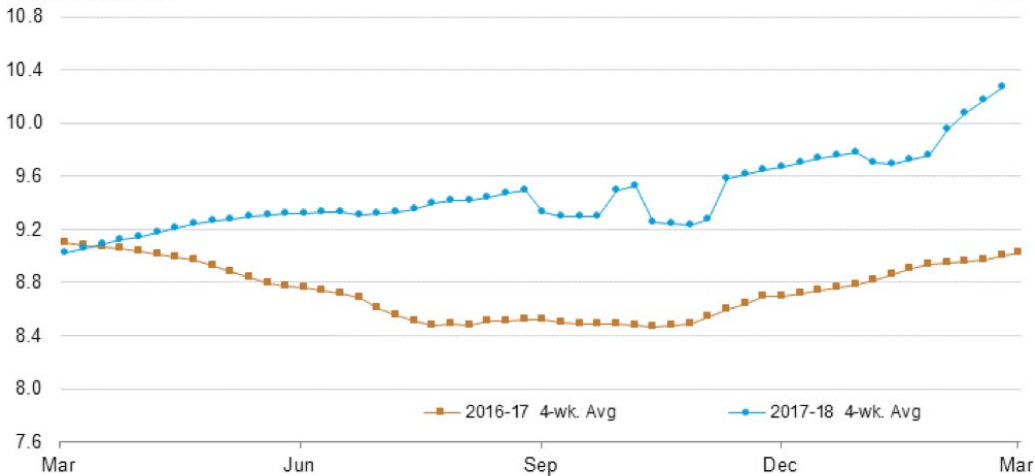
FY17 Oil Production (Thousands Barrels per Day)

	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	YOY Change
United States	8,771	8,825	9,045	9,107	9,093	9,134	9,068	9,209	9,192	9,485	9,658	10,057	9,949	+1178

Source: EIA

U.S. crude oil production is forecast to average 10.6 million b/d in 2018 and 11.2 million b/d in 2019, according to the EIA February 2018 Short Term Energy Outlook. Anticipated production growth is predicated on the expectation for more rapid near-term increases in drilling and completion activity, particularly in the Permian region.

U.S. crude oil domestic production  
million barrels per day



Source: U.S. Energy Information Administration

EIA This Week in Petroleum, released February 28, 2018

In its February Drilling Productivity Report (DPR), the EIA forecasts U.S. shale oil production will increase output in March, building on increases in recent months as higher oil prices make more U.S. drilling profitable. 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 110,000 barrels a day in March 2018, raising output from those basins to over 6.7 million barrels per day. The monthly projections have been steadily increasing since November 2017, the same month 11 oil exporters agreed to extend production cuts led by the Organization of Petroleum Exporting Countries in an effort to balance an oversupplied crude oil market. The Permian Basin of west Texas and southeastern New Mexico accounts for the majority of expected production gains, as the EIA projects drillers to raise production by 75,000 b/d in March.



## IMPORTS

U.S. crude oil imports totaled 7.91 million b/d in 2017, relatively flat compared to 2016 imports of 7.87 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. Crude oil export volumes and the number of destinations for those exports continues to increase. U.S. exports of crude oil averaged 1.0 million b/d through October 2017, on pace for a record high and increasing 445,000 b/d from the 2016 average. The Brent-WTI spread averaged \$3.57/bbl in 2017 compared to \$0.87/bbl in 2016. Please note that the Brent-WTI spread averaged \$1.67 in the first half of 2017 compared to \$5.46 in the second half. Although U.S. supply continues to grow, the main reason U.S. imports are still high is the shale oil boom and the light oil surge (i.e., crudes with lower API gravity), are not a great match for U.S. refiners. The heavier oils from Venezuela, Mexico, and Canada are critical for the U.S. refinery system, especially along the Gulf Coast, which are built to process heavier crude.

## CONSUMPTION

The January 2018 EIA Short Term Energy Outlook indicated that total liquid fuels consumption in the U.S. increased by an estimated 210,000 b/d (1.1%) in 2017. Consumption growth was led by growth in distillate and jet fuel consumption as motor gasoline consumption remained relatively flat from 2016 to 2017. Liquid fuels consumption is forecast to increase by 470,000 b/d in 2018 and by an additional 340,000 b/d in 2019. EIA forecast hydrocarbon gas fuel (HGL), to be the strongest among liquid fuel consumption growth. This growth reflects an increase in ethylene-producing petrochemical plants, which use ethane as their feedstock. Seven ethylene-producing petrochemical plants that use ethane as their feedstock are planned to begin operating in the United States by the end of 2019.

Global petroleum and other liquid fuels consumption grew by 1.4 million b/d in 2017, averaging 98.4 million b/d for the year. EIA anticipates global consumption of petroleum and other liquids will grow by 1.7 million b/d in 2018 and 1.7 million b/d in 2019, driven by countries outside of the Organization of Economic Cooperation and Development (OECD). China and India are the main contributors of non-OECD growth in consumption in 2018.

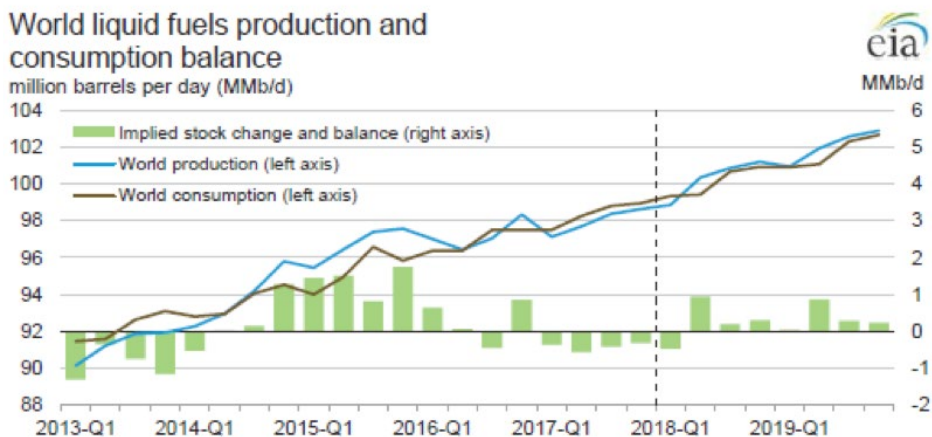


Implied global petroleum and liquid fuels inventories decreased by an estimated 0.4 million b/d in 2017, marking the first year of global inventory draws since 2013. EIA expects global inventories to increase by 0.2 million b/d in 2018 and by 0.3 million b/d in 2019.

## PRICING

After a strong start to the year, crude oil prices lost nearly 10% in early March 2017 on concerns that the OPEC production cuts were failing to reduce the global supply overhang. Up until December 2017, oil prices were largely range bound as investors weighed the impact of the first oil cut from OPEC in eight years against rising output from U.S. shale as well as non-participating OPEC countries (Nigeria and Libya). Then in November 2017, OPEC announced the extension of the existing agreement to curtail crude oil production in 2017. This, coupled with continuing draws in global oil inventory levels, led to a rise in both WTI and Brent crude oil prices in December 2017 and into 2018. Despite relatively high U.S. crude oil production, West Texas Intermediate ended 2017 at \$60/barrel, the highest end of year price since 2013. WTI crude oil prices averaged \$51/b in 2017, up \$7/b from 2016 average. Brent crude oil averaged \$54/barrel in 2017, an increase of \$10/barrel compared to 2016 levels.

EIA forecast the Brent crude oil price will average \$60/barrel in 2018 and \$61/barrel in 2019. After falling in 2017, EIA expects global inventories to increase by 0.2 million b/d in 2018 and by 0.3 million b/d in 2019. WTI crude oil prices are forecasted to be \$4/b lower than Brent prices in 2018 and in 2019.



Source: Short-Term Energy Outlook, January 2018.



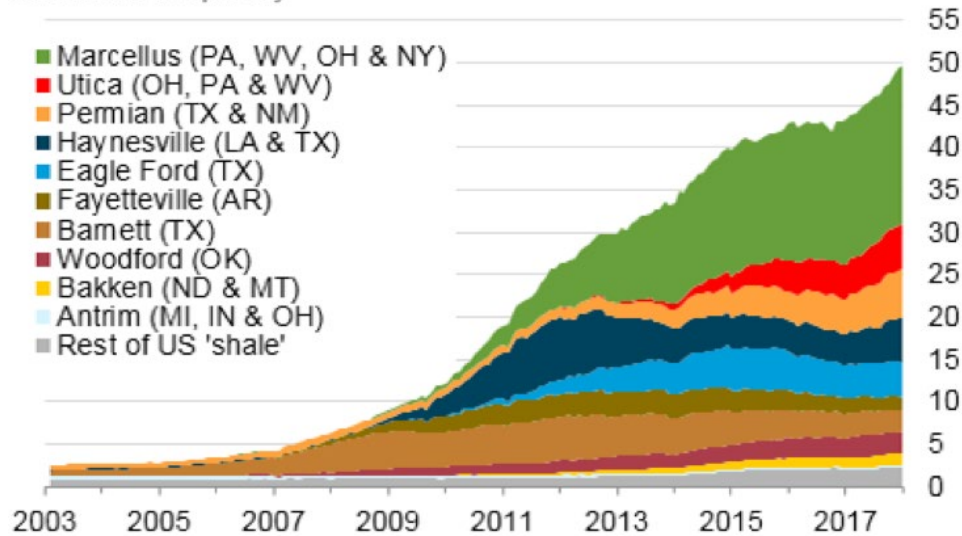
# NATURAL GAS

## PRODUCTION

U.S. dry natural gas production averaged 73.6 billion cubic feet (Bcf) per day in 2017, an increase of 1.31 Bcf per day from FY 2016. Natural gas production in 2018 is estimated to rise by an average of 6.9 Bcf per day from the 2017 level. The return to increasing production reflects a forecast of higher Henry Hub natural gas spot prices coupled with pipeline buildout, particularly in the Marcellus and Utica natural gas producing 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 2018 and represent EIA's official shale gas estimates, but are not survey data. State abbreviations indicate primary state(s).

EIA Natural Gas Weekly Update, released March 1, 2018



Annual natural gas production increased throughout 2017 across multiple basins in the U.S. Efficiency improvements in horizontal drilling and hydraulic fracturing in the Marcellus Shale have driven natural gas production to increase 2.0 Bcf per day in 2017 compared to average 2016 production. This represents a 9% increase. Outside of the Marcellus regions, the Permian Basin has seen the second largest nominal increase in 2017 natural gas production, and the largest increase on a percent basis. Natural gas production increased 1.25 Bcf per day which represents an 18% increase compared to 2016 production. As companies target Permian crude, associated gas from oil wells has caused natural gas output to rise in the basin.

U.S. natural gas pipeline exports have risen in 2017, and EIA expects the growth to continue as Mexico undergoes energy market reform. Cheap natural gas prices, rising demand in Mexico and increased pipeline takeaway capacity in both the U.S. and Mexico have led to the increase in exports. In 2017, the United States was a net exporter of natural gas on an annual basis for the first time since 1957. Liquefied natural gas (LNG) exports increased from almost zero in 2015 to an average of 1.9 Bcf per day in 2017. According to EIA, LNG exports are projected to increase to 2.3 Bcf per day in 2018 with the start of Cove Point LNG in Maryland in March 2018 and new projects at Cameron LNG and Freeport LNG on the Gulf Coast during the second half of 2018. As LNG export capacity increases throughout 2018 and into 2019, exports are forecasted to increase to 4.6 Bcf/d in 2019.



## CONSUMPTION

U.S. natural gas consumption averaged 74 Bcf per day in 2017, a 1% decrease from 2016. EIA projects natural gas consumption to increase by 3.5 Bcf/d (4.7%) in 2018 and 2.2 Bcf/d (2.8%) in 2019. The 2017 decrease in consumption was mainly driven by warmer winter temperatures and lower electric power sector use. In the U.S., heating degree days were 2% lower than 2016, and U.S. cooling degree days were 8% lower than 2016, leading to overall lower residential heating/cooling consumption. Overall electric power use of natural gas decreased 6% in 2017 due to increasing competition from renewables and competing coal prices.

On an annual basis, EIA expected combined residential and commercial natural gas consumption to increase 1.3 Bcf/d in 2018 compared to 2017, driven by forecasts of colder winter temperatures. Additional consumption growth will come from the industrial sector, which is forecasted to grow 1.2% in 2018, average 21.7 Bcf/d for the year. Industrial consumption is expected to increase by 2.6% in 2019. Most of the increased consumption in 2019 is coming from new chemical plants expected to come online. A low natural gas price environment in recent years has made it economical to increase the use of natural gas as feedstock in ammonia for nitrogenous fertilizer and methanol.

## STORAGE

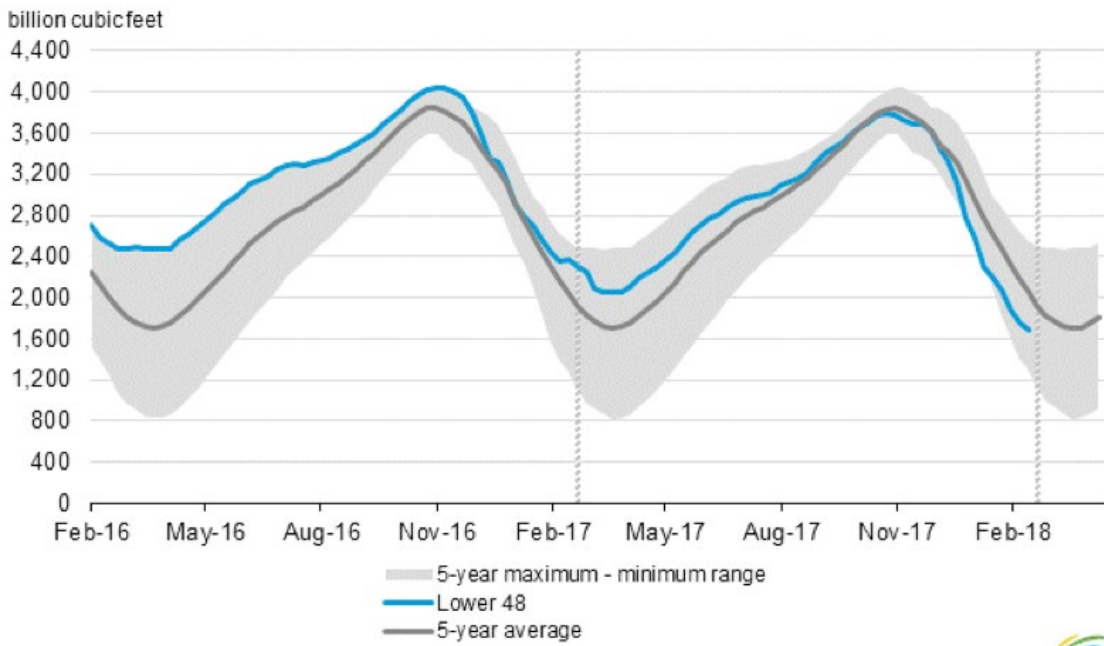
U.S. As of YE 2017, working natural gas inventories were 3,126 Bcf, 6% lower than the five year average and last year's levels. Larger than normal inventory draws in the 4th quarter were the primary drivers of below average storage levels. EIA forecast inventories to be 1,623 Bcf at the end of March 2018, which would be 6% lower than the five year average for this time of year. For 2018, EIA forecasts inventories to build slightly higher than the previous five-year average, and end October 2018 at 3,861 bcf. In 2019, EIA forecasts inventories to be about 6% lower than 2018 averages.





For the week ending February 23, 2018, net withdrawals to storage totaled 78 Bcf, bringing total working gas storage to 1,682 Bcf. Stocks were 680 Bcf less than last year and 372 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 March 5, 2018



## U.S. NATURAL GAS PRICES

Henry Hub natural gas spot prices averaged \$2.75/MMBtu in 2017, up 47 cent/MMBtu from a 17 year low in 2016. In the first half of 2017, Henry Hub spot prices have averaged \$3.04/MMBtu, with a high of \$3.42/MMBtu and a low of \$2.56/MMBtu, which were both achieved in a 30 day period between January and February of 2017. Beyond the volatility experienced in early 2017, 2H17 natural gas prices have been relatively range bound as seen in the chart below. Please note that the spikes seen in 2018 were daily spot values and were not sustained for any material period of time.

**Figure 10. Henry Hub natural gas spot prices**



 Natural Gas Intelligence

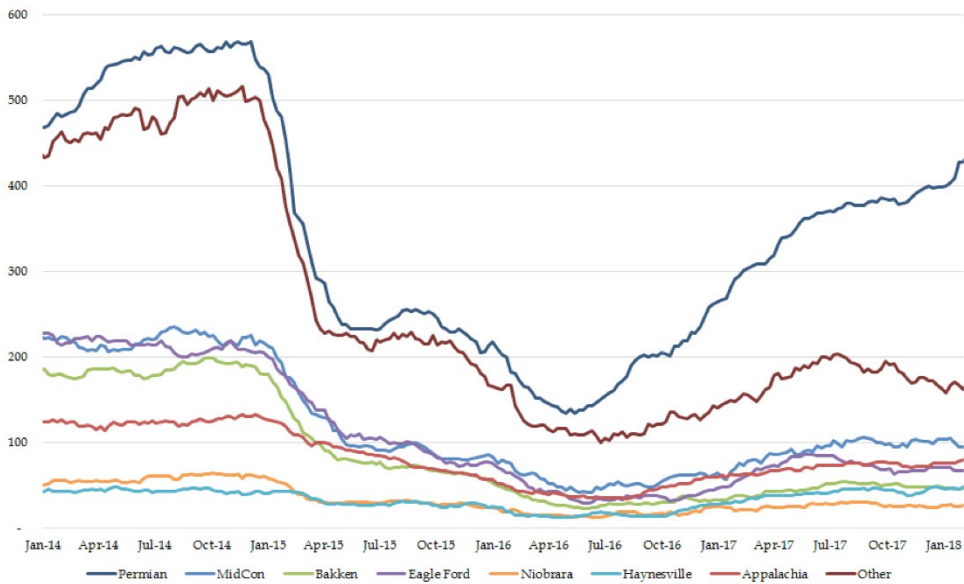
*EIA Natural Gas Weekly Update, released February 28, 2018*

In January 2018, Henry Hub natural gas spot prices averaged \$3.88 per MMBtu, up 1.06/MMBtu from December 2017. Cold temperatures east of the Rocky Mountains contributed to high levels of natural gas consumption. Additionally, reductions in production due to well freeze-offs and record high natural gas inventory withdraws in mid-January, contributed to the rising prices. EIA expects natural gas prices to moderate based on current forecasts and record growth in natural gas production. EIA forecasts Henry Hub spot prices to average \$3.20/MMBtu for all of 2018 and \$3.08/MMBtu in 2019.



# CONTRACT DRILLING

The total number of active rigs drilling for oil and natural gas in the U.S. increased by three for the week ended March 2, 2018. The oil rig count was up by one at 800, while gas rigs increased by two to 181. This represents a 52 rig increase since year end 2017 and a up 225 rigs since this same time last year. Oil rigs are up 191, and natural gas rigs are up 35 and miscellaneous rigs are down 1 in the last twelve months. The Permian basin has shown the largest increase in rigs at 126 or 41%. The U.S. rig count peaked at over 4,500 in 1981 and hit its lowest level of 404 in May 2016.



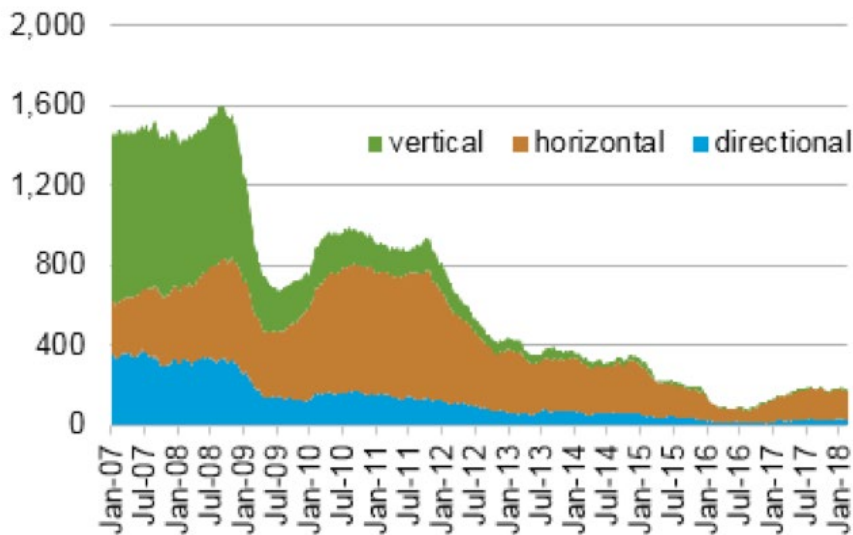
Baker Hughes North American Rig Count



The U.S. natural gas rig count peaked at 1,606 rigs in September 2008. In contrast, it hit a low of 81 rigs in the week ending August 26, 2016. At 181 rigs, U.S. natural gas rigs are currently 89% below their peak, but they're up 123% 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

EIA Natural Gas Weekly Update, released February 28, 2018



A summary of the Energy Information Administration's February 2018 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	New-well oil production per rig barrels/day			New-well gas production per rig thousand cubic feet/day		
	February 2018	March 2018	Change	February 2018	March 2018	Change
Anadarko	392	397	5	2,677	2,696	19
Appalachia	144	145	1	14,795	14,908	113
Bakken	1,404	1,421	17	1,707	1,732	25
Eagle Ford	1,287	1,345	58	5,129	5,409	280
Haynesville	25	25	-	8,137	8,140	3
Niobrara	1,133	1,144	11	4,317	4,342	25
Permian	632	632	-	1,186	1,186	-
Total	652	657	5	3,659	3,702	43

Source: EIA Drilling Productivity Report, February 2018)

According to the EIA, the seven shale plays shown above will produce an estimated total of 64.9 Bcf/d of natural gas in September, up from 64.1 Bcf/d in August. 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 2018, natural gas production out of the seven basins has grown 17.4Bcf/d.

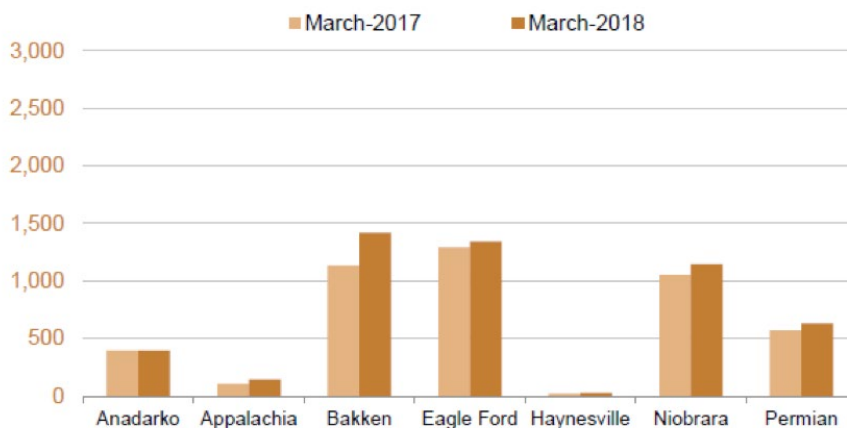


Total oil production out of the seven plays will be an estimated 6.76 million bbl/d in March 2018, compared with 6.65 million bbl/d in February, according to the DPR. EIA forecast March oil production to increase in six out of the seven basins, with Haynesville remaining flat. From January 2017 to forecasted March 2018, oil production out of the seven basins has grown 2.2 million bbl/d. On a rig-weighted average basis, oil production per rig will be 657 bbl/d, compared to 652 bbl/d in February. New-well gas production per rig in the plays will average an estimated 3.7 MMcf/d in March, flat compared to February.

A comparison of the new well oil and gas production per rig from March 2017 to March 2018 is shown below.

### New-well oil production per rig

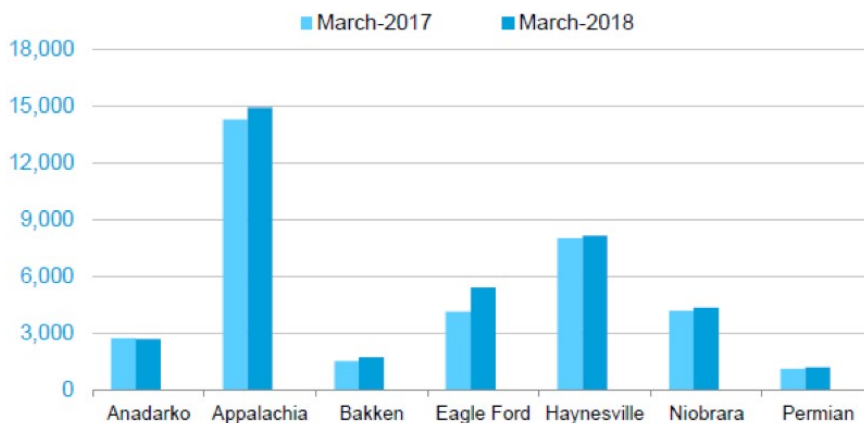
barrels/day



(Source: EIA Drilling Productivity Report, February 2018)

### New-well gas production per rig

thousand cubic feet/day



(Source: EIA Drilling Productivity Report, February 2018)



Drilled but uncompleted wells (DUC) totaled 7,609 in the seven regions above at the end of January 2018, an increase of 121 from December 2017 and 2,228 from January 2017. Permian basin leads the way with 2,880 DUCs, Haynesville has the lowest at 167 as of January 2018.

Drilled but uncompleted wells (DUC)  
wells

Region	December 2017	January 2018	Change
Anadarko	1,024	1,029	5
Appalachia	752	748	(4)
Bakken	724	721	(3)
Eagle Ford	1,478	1,511	33
Haynesville	166	167	1
Niobrara	576	553	(23)
Permian	2,768	2,880	112
Total	7,488	7,609	121

*(Source: EIA Drilling Productivity Report, February 2018)*



The information in the report was prepared by BOK Financial Credit Administration and Loan Review.

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