Shale Productivity Driving Response to OPEC Cuts
Top basins can all see growth in 2017

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Data Sources Used in this Publication

- U.S. Energy Information Administration

For more information about these data sources, Click Here

Crude Output Expectations Growing

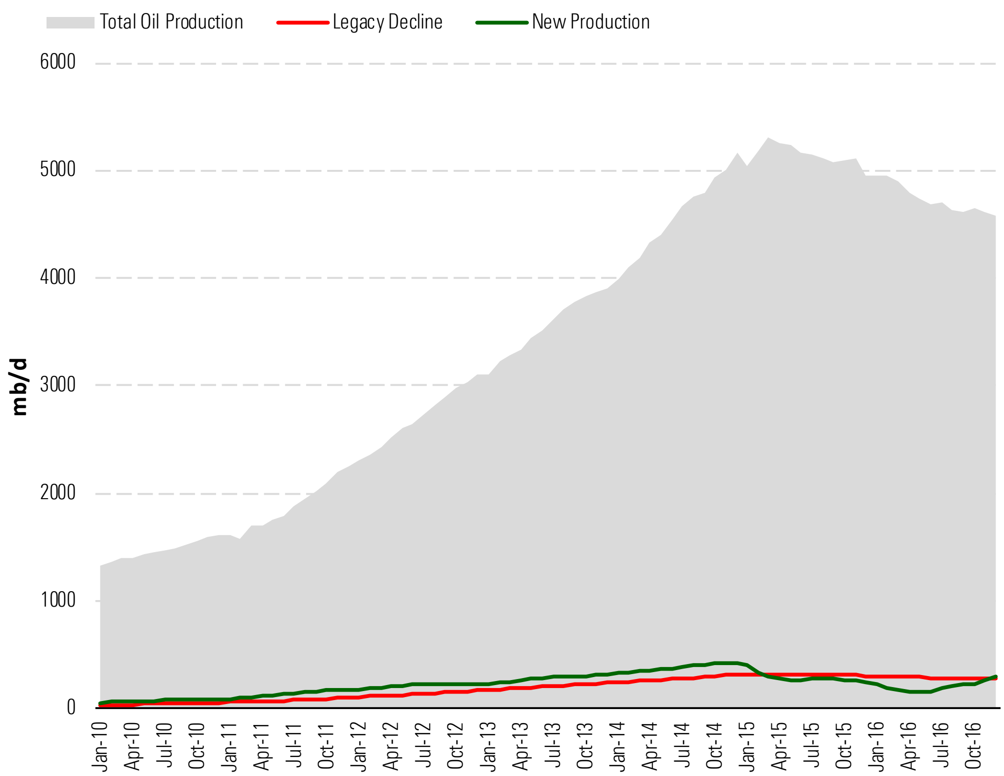
Reports from U.S. and international agencies in the past week are fueling higher expectations for shale crude production in 2017. The Energy Information Administration's, or EIA's, short-term energy outlook for January increased its overall forecast of U.S. output for 2017 by close to 200 thousand barrels/day. Weekly EIA data in early January indicated a hefty 176 mb/d increase in U.S. output since the end of 2016, and the January EIA drilling productivity report, or DPR, forecast a return to growth in shale output during the next two months. At the same time, both the International Energy Agency and OPEC increased their estimates for U.S. production in 2017, based on approximately 170 mb/d growth in shale. These estimates stem from higher crude prices following the OPEC production cut, which was agreed at the end of November, and rising rig counts in U.S. shale basins - up 35 in the past week per Baker Hughes. This note examines the latest DPR to identify where and why shale growth is occurring today, as well as prospects for further expansion this year.

New Production Outpaces Declines Again

As explained in our June note (see Shale Crude Production Recovery), the key to a sustained turnaround in shale crude production is boosting the output rate from new wells above the decline rate from existing wells. Typical shale wells have a high initial production burst followed by a rapid decline rate, such that they produce most of their output during the first two years and experience an 80% decline rate in the first 12 months. Unless new drilling and production keep up the pace, declines from older wells drag down overall output and prevent sustained growth.

Exhibit 1 shows data since January 2010 from the January 2017 DPR, published on Jan. 17. The shaded area represents crude production in the four major shale oil basins (Bakken, Eagle Ford, Permian, and Niobrara). Output from these basins peaked in April 2015 at 5.3 million barrels/day and has declined since by 0.7 mbmb/d to an estimated 4.6 mb/d in December 2016. The red line on the chart in Exhibit 1 is the EIA estimate of legacy output decline from wells producing for longer than two months. The green line represents initial production from wells less than two months old. Where the green line is above the red, incremental new production is outpacing legacy declines and overall production is rising. This was the case in these four basins up until April 2015, at which point new production fell below declines and overall output began to fall (green line crosses below the red).

Exhibit 1 Oil Production in Permian, Bakken, Eagle Ford, and Niobrara



Source: EIA, Morningstar

The latest drilling report suggests that the period of decline is coming to an end. The EIA estimates that the decline rate in these four basins for December 2016 is 274 mb/d and production from new wells is 301 mb/d, or 28 mb/d above declines. This is the first time that new production has outpaced the decline rate since February 2015, indicating that sustained growth is on the way again. Even though the EIA estimates that overall production fell by 32 mb/d between November and December, it forecasts flat overall production in January and 43 mb/d growth in February. Continued shale production growth will require further increases in the drilling rig count, but is being helped considerably by well productivity gains.

Productivity Improvement

Productivity improvement, increasing initial production from each new well, has advanced consistently throughout the shale era, even speeding up as prices declined. Productivity gains have reduced drilling costs and improved producers' return on investment encouraging new drilling at lower crude prices. Productivity mostly results from improved drilling and recovery techniques. Producers have also targeted so-called sweet spots in shale basins – where geology and pressure naturally increase initial production. At the same time, technical improvements have reduced decline rates in new and existing wells. These productivity gains mean that fewer new rigs are required to turn around declining shale production today than would have been needed in the past.

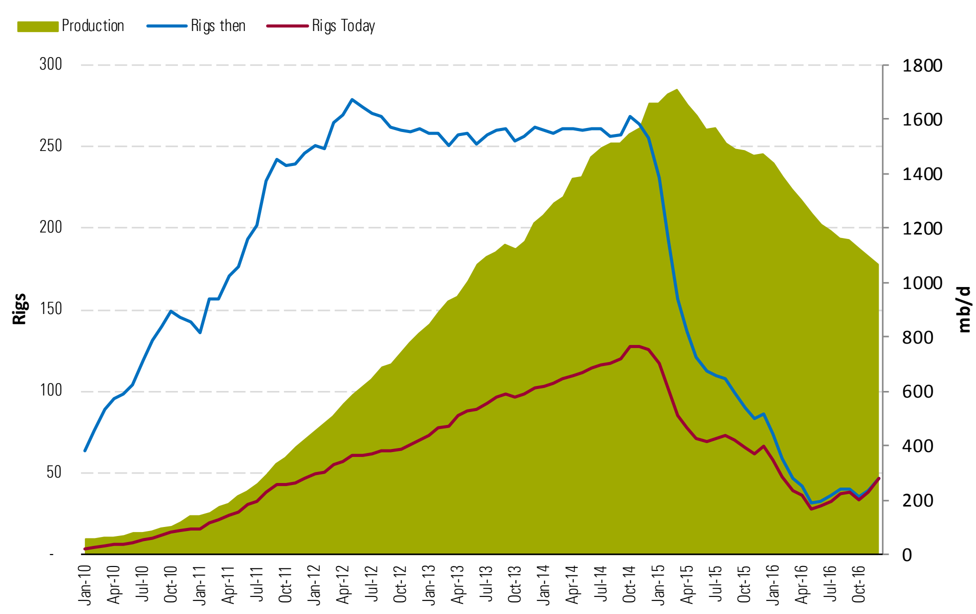
To demonstrate this concept, we compared today's drilling productivity with historical EIA rig count and production data in the Big Four oil shale basins. The analysis illustrates the speed with which today's drilling rates are catching up production lost to declines since the oil price crash. We estimate how many new rigs are needed in each basin to achieve production growth again.

Eagle Ford Needs 10 More Rigs

Exhibit 2 shows Eagle Ford crude production per the EIA drilling report since January 2010 (green shaded area, right axis), as well as historical drilling rig counts (blue line, left axis). The red line against the left axis represents the number of today's more productive rigs required to achieve historical new production levels. Eagle Ford rigs produced an average 1,373 b/d in December 2016, meaning that total new production from the 47 rigs drilling in that basin was 65 mb/d, 13 mb/d below the 78 mb/d decline rate from existing wells. Drilling activity in the Eagle Ford has recovered by 15 rigs to 47 rigs since May 2016, but we estimate that another 10 new rigs need to be drilling at today's productivity for the basin to overcome legacy declines and return to production growth.

At the height of the shale boom in October 2014, the Eagle Ford rig count peaked at 268, when output averaged 653 b/d per rig, representing new production of 175 mb/d. Today, that peak new production could be achieved using just 127 rigs, but that is more than 2.5 times the number drilling today. Thus, although we anticipate a return to growth in the Eagle Ford in coming months, production is still a long way from its heyday.

Exhibit 2 Eagle Ford Crude Production and Rig Productivity



Source: EIA, Morningstar

Bakken 23 Rigs Short

In the Bakken, the rig count has made a slightly better comeback than in the Eagle Ford, but is still down considerably relative to 2014 levels. In December, 32 rigs were drilling, producing an average 946 b/d each, or 30 mb/d of new production. That is still 22 mb/d below legacy declines, suggesting that at December's productivity rate, 23 more rigs need to be operating to see new growth. Adding 23 rigs in the Bakken is certainly possible this year, but this does represent the biggest hurdle to a return to growth among the top four shale oil basins. A return to the Bakken heyday (90 mb/d of new production in September 2014) is even more of a stretch, as this would require 95 of today's rigs, or 3 times the current tally.

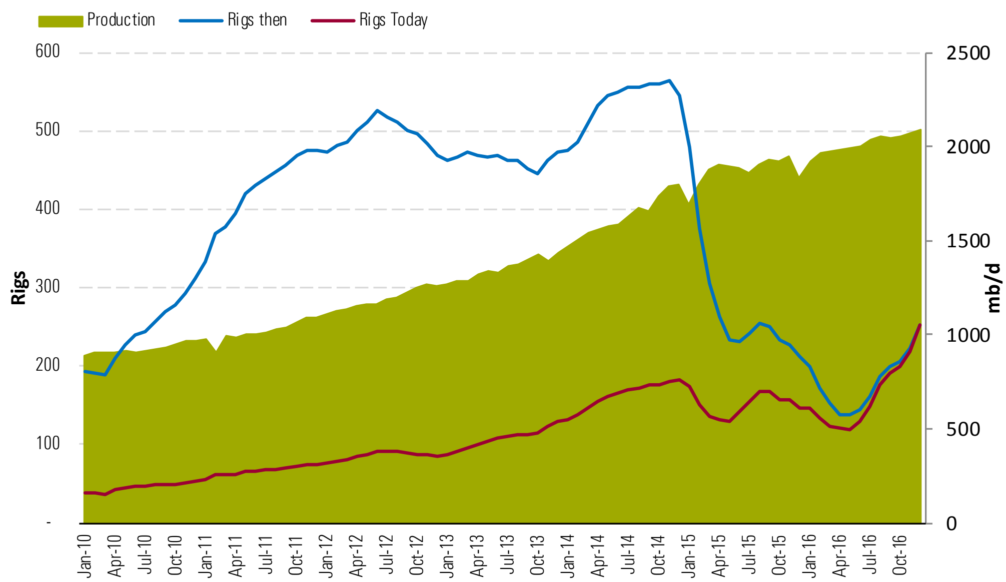
Niobrara Ready to Roll

Niobrara production has recovered better from the oil price bust than either the Eagle Ford or Bakken. Output in this Rockies basin peaked at 491 mb/d in August 2015 and declined 16% to 411 mb/d in December 2016. The drilling rig count bottomed out at 16 in May 2016 and has since more than doubled to 36 rigs, each producing an average 1221 b/d. Rig productivity has increased 71% since output peaked in August 2015. Production from new rigs in December 2016 was 44 mb/d, or 11 mb/d higher than the decline rate. With new production already outpacing declines, the basin is forecast by EIA to see its first production growth this month. At today's productivity rates, another 65 rigs would be required for the Niobrara to return to record output.

Permian More Productive Than Ever

In the Permian Basin, production only ever declined slightly for a few months in 2015 after the oil bust (Exhibit 3). Production continued to reach new peaks throughout 2016, with the January EIA drilling report estimating 2.1 mmb/d output in December and forecasting an increase to 2.2 mmb/d in February. Permian productivity has leapt in the past 18 months, with more new production coming today from less than half the rigs deployed at the peak of the shale oil boom. The Permian rig count peaked at 559 in October 2014, with each rig producing an average 204 b/d for a total 114 mb/d of new production. Productivity in December 2016 was more than 3 times higher, at 645 b/d from each of the 252 rigs operating, for a total of 163 mb/d of new production—49 mb/d higher than when the rig count peaked. In other words, the Permian is now more productive than ever, as indicated by the red line in Exhibit 3 peaking in December 2016. The latest new production estimate of 163 mb/d is 53 mb/d higher than the 110 mb/d decline rate, suggesting that robust growth will continue. The December Permian rig count has recovered 84% to 252 from its low of 137 in May 2016 as producers pile into the basin, outbidding each other in a land rush for the best acreage. Thirteen new oil-directed rigs were added in the Permian in the week ended January 20 according to Baker Hughes.

Exhibit 3 Permian Crude Production and Rig Productivity



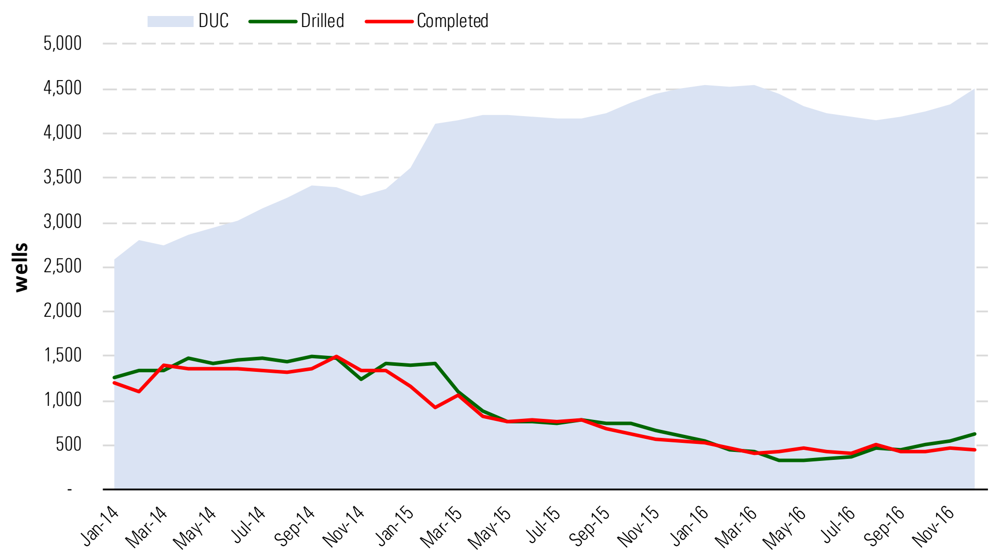
Source: EIA, Morningstar

DUC Backlog Not Yet Tapped

While the drilling rig count is growing and production shows signs of increasing in two of the four main oil basins, the number of drilled-but-uncompleted wells, (DUCs), in these plays is still increasing. As oil prices fell and capital budgets declined over the past two years, some producers chose to increase their DUC inventory rather than bring newly drilled wells on line immediately. This was done initially for operational reasons, such as a lack of frac crews, but also to store production underground, in the expectation of higher returns when prices recovered.

The EIA has produced a DUC analysis in conjunction with its drilling productivity report, showing monthly wells drilled and completions (Exhibit 4). The January 2017 report indicates that monthly wells drilled in the four major oil basins since the rig count began to recover have increased by 87%, from 334 wells in May 2016 to 624 wells in December 2016. Over the same period, the number of well completions has remained fairly level at an average of 450/month, while the number of DUCs has ticked up 1% to 4509. This indicates that while the rig count and production are recovering, producers do not yet appear to be tapping into their DUC reserves with any great gusto.

Exhibit 4 Wells Drilled, Completed, and DUC in Four Major Shale Basins



Source: EIA, Morningstar

This flat rate of completions suggests that producers are waiting on either completion crew backlogs or higher oil prices before they tap their DUC reserves. If the delays are operational, they will slow the rate of new production and increase completion service costs. Some of these DUCs are legacy wells that may never be completed, so they do not really constitute inventory. However, the data shows that the DUC backlog hasn't proven to be as easy for producers to tap as the industry expected when prices recovered.

Ongoing Challenge

The eyes of the oil market are watching the shale patch for production growth in response to OPEC's efforts to increase prices by cutting their own output. The evidence so far is that growth has returned to two of the four big oil shale basins (Permian and Niobrara) and is not far away in the Eagle Ford. The Bakken still requires a significant increase in drilling (23 rigs) at December's productivity levels to return to growth. A near-doubling of productivity in each of these basins, as well as the rollout of new drilling rigs, particularly in the Permian, has driven the return to growth.

The ramp-up in drilling has raised expectations that service costs and logistical limitations on completions will increase. The impressive productivity gains seen in the past 18 months were driven by lower prices shrinking the pool of revenue. The challenge going forward is to find similar production growth as more new rigs are deployed and the sweet-spot drilling locations get crowded out.

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