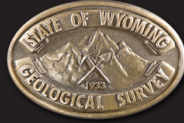


Oil and Natural Gas Resources in Wyoming

January 2020 Summary Report

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Introduction

Wyoming ranks eighth in the nation in both oil and natural gas production, according to the Energy Information Association, or EIA. Despite uncertainty in the global economy and supply gluts that threaten to slow the U.S. oil and gas industry, Wyoming oil production is forecast to reach levels not seen since 1993 for the second consecutive year. With substantial reserves of oil and natural gas (the EIA estimates Wyoming reserves are enough to supply the U.S. with 46 days of oil and 262 days of gas), a favorable regulatory environment, and operators' increased ability to lower production costs in unconventional reservoir development, Wyoming will remain a significant contributor to the national energy portfolio. The following sections describe how each major basin in the state contributes to Wyoming's oil and natural gas production.

Bighorn Basin

Although the Bighorn Basin has had steadily declining production since 1978, it still contains six of the state's top 20 oil-producing fields (Garland, Hamilton Dome, Elk Basin, Oregon Basin, Spring Creek South, and Grass Creek). Secondary and tertiary recovery techniques continue to extract significant amounts of oil from the basin's conventional reservoirs, such as the Phosphoria Formation and Tensleep Sandstone. Very little horizontal drilling has occurred in the Bighorn Basin, but the potential for unconventional development exists due to the presence of the same Cretaceous-age formations currently being developed in other basins.

Denver Basin

The Wyoming portion of the Denver Basin has experienced oil production growth of more than an order of magnitude

from 2009 through 2018. This growth is primarily due to operators' success using horizontal wells to produce from the unconventional Codell Sandstone, Niobrara Formation, and Muddy "J" Sandstone reservoirs. Associated gas production from these horizontal wells has followed the same growth track. In 2018, the Denver Basin accounted for 12 percent of the state's total oil production and is expected to exceed that in 2019.

Greater Green River Basin

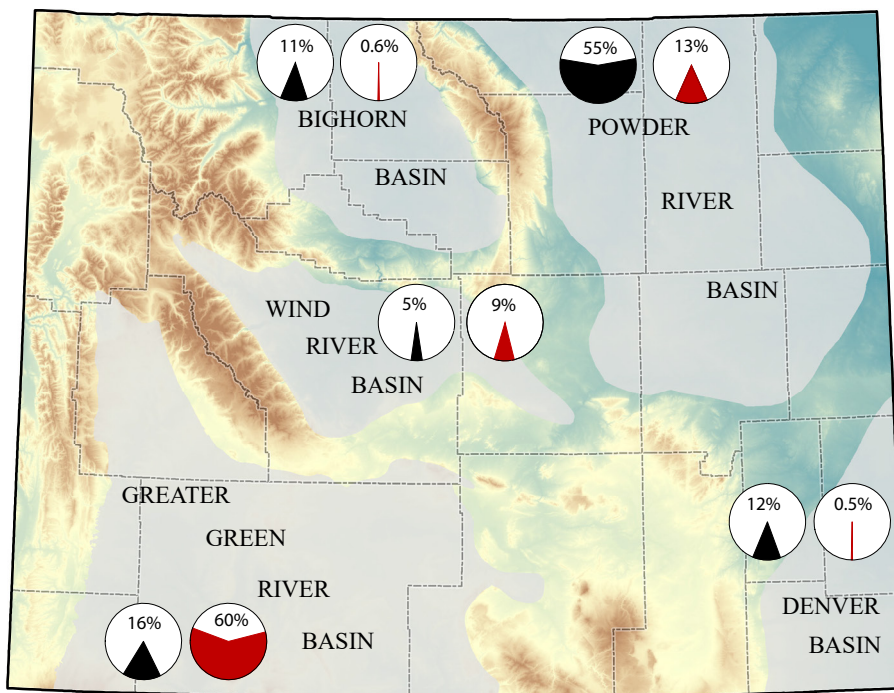
The Greater Green River Basin is the top gas-producing basin in Wyoming, accounting for 60 percent of the state's 2018 natural gas production. In fact, 38 percent of Wyoming's 2018 gas production was from the Pinedale and Jonah fields in Sublette County, two of the basin's largest and most famous gas fields. The Pinedale field, in addition to being Wyoming's top gas-producing field since 2009, has also been among the top three oil-producing fields for more than a decade. In 2018, the Pinedale field produced more than 3.77 million barrels of oil, second only to the Salt Creek field in the Powder River Basin.

Projects such as development within the Normally Pressured Lance federal area and horizontal drilling on the flanks of the Pinedale Anticline are progressing more slowly

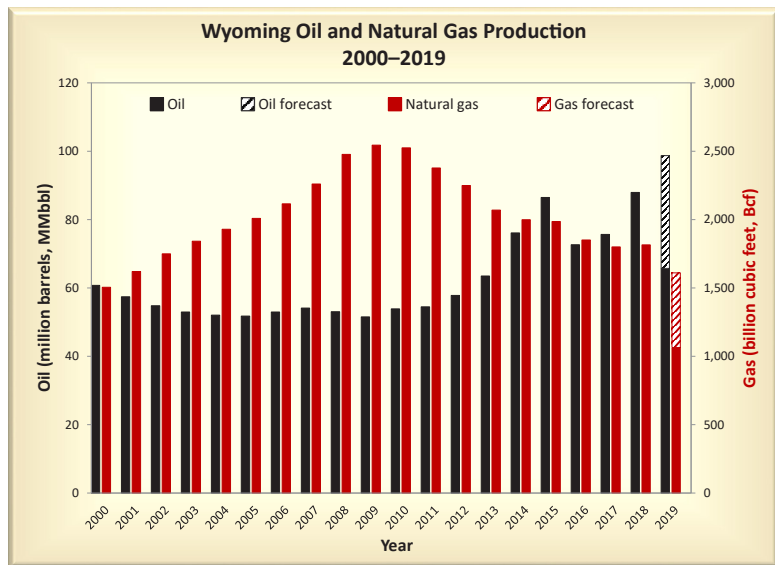
than anticipated. These long-term projects will significantly increase the basin's total natural gas production if and when they come online.

Powder River Basin

The Powder River Basin has traditionally been, and continues to be, Wyoming's top oil-producing basin, consistently accounting for at least one-third—and since 2014, more than half—of the



Map showing percentage of 2018 total statewide production for oil (black) and natural gas (red) for each of the major energy basins in Wyoming.



Annual Wyoming oil and natural gas production, 2000–2019 (actual production through August 2019; forecast production from October 2019 CREG report).

state’s oil annually. Increased production in the last decade is largely due to evolving well completion methods and reservoir targets. Operators are no longer drilling vertical wells into the basin’s high-porosity formations and anticlines. Instead, they are now successfully producing from low-porosity formations that were once considered uneconomic. Some of these unconventional reservoirs include the Mowry Shale, the Wall Creek Sandstone (member of the Frontier Formation), the Turner Sandstone (member of the Carlile Shale), the Niobrara Formation, the Shannon and Sussex sandstones (members of the Cody Shale), and the Teapot and Parkman sandstones (members of the Mesaverde Formation). The 5,000-well Converse County federal development project, which will target these Upper Cretaceous reservoirs, is expected to have a record of decision issued in 2020. However, the future of this project, and Powder River Basin oil production in general, will be susceptible to crude oil prices, surpluses, and the international market.

Although natural gas production has been decreasing since 2009, largely due to the declining coalbed natural gas industry, the Powder River Basin remains Wyoming’s second-highest gas-producing basin. Natural gas produced in association with oil from horizontal wells, along with newly discovered areas of gas condensate, are responsible for keeping the basin’s gas production from further decline.

Wind River Basin

Wyoming’s first oil well, first logged well, and the Rocky Mountain region’s deepest well are all in the Wind River Basin. Oil production in the basin has been relatively flat for the last 20 years, with enhanced oil recovery projects offsetting declines in individual well production. Gas production has also leveled off from its 2005 high mark. The basin as a whole typically accounts for less than 10 percent of the state’s oil and gas production.

In the northeastern portion of the Wind River Basin, the 4,250-well Moneta Divide federal development project is undergoing an environmental impact statement review by the Bureau of

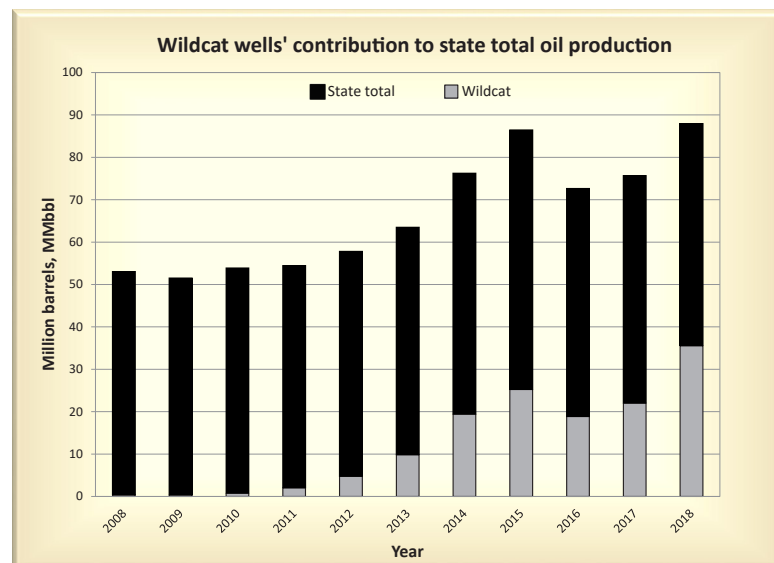
Land Management (BLM). Like other large oil and gas projects, this one will also be contingent on prices and market supply.

Oil and Gas Transport

Several new pipeline projects are in the works throughout the state. The 35-mile-long Natural Bridge natural gas pipeline was recently constructed between Black Hills Energy facilities in Casper and Wyoming Interstate Company’s interconnection supply point near Douglas. The pipeline began operating in late 2019. In eastern Wyoming, the Saddlehorn Pipeline Company is expanding its Saddlehorn pipeline to Fort Laramie, boosting capacity by more than 30 percent to a total of 290,000 barrels of oil and condensate per day. The pipeline expansion is expected to be operational in late 2020. Kinder Morgan and Tallgrass Energy will convert two natural gas pipelines in southeastern Wyoming to crude oil pipelines in order to transport more oil from the Powder River and Denver basins to the hub in Cushing, Oklahoma. In March 2019, the BLM approved Denbury Resources’ construction of the Riley Ridge and the Bairoil-to-Natrona pipelines through Sweetwater, Sublette, Fremont, and Natrona counties. These pipelines will transport CO₂ from the Riley Ridge Treatment Plant near Big Piney to the Natrona hub west of Casper to be used for enhanced oil recovery projects in Montana.

Looking Ahead

Traditional oil and gas fields defined by conventional reservoirs are becoming a thing of the past. Most new wells are being permitted as wildcat wells, especially in the Powder River Basin where operators are targeting unconventional, spatially expansive reservoirs. The Wyoming Oil and Gas Conservation Commission defines wildcats as “wells outside known fields or new wells which are determined by the Commission to have discovered oil or gas in a pool not previously proven productive.” Wildcat wells, the majority of which are Powder River and Denver basin horizontal wells, accounted for 40 percent of the state’s total 2018 oil production. This percent-contribution from wildcat wells is expected to continue its upward trend in the future.



Oil production from wildcat wells compared to state total production, 2008–2018.

Caption for cover photo: Outcrop of Niobrara Formation “B” chalk.

