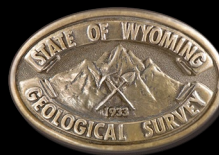


Oil, Natural Gas, and CCUS Summary of 2023



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The independent spirit that defines Wyoming's history and culture also shapes its oil and gas industry. While national prices, infrastructure, and legislation influence Wyoming's hydrocarbon industry, sometimes Wyoming bucks the trend. This is particularly true when it comes to recent trends in natural gas prices and production.

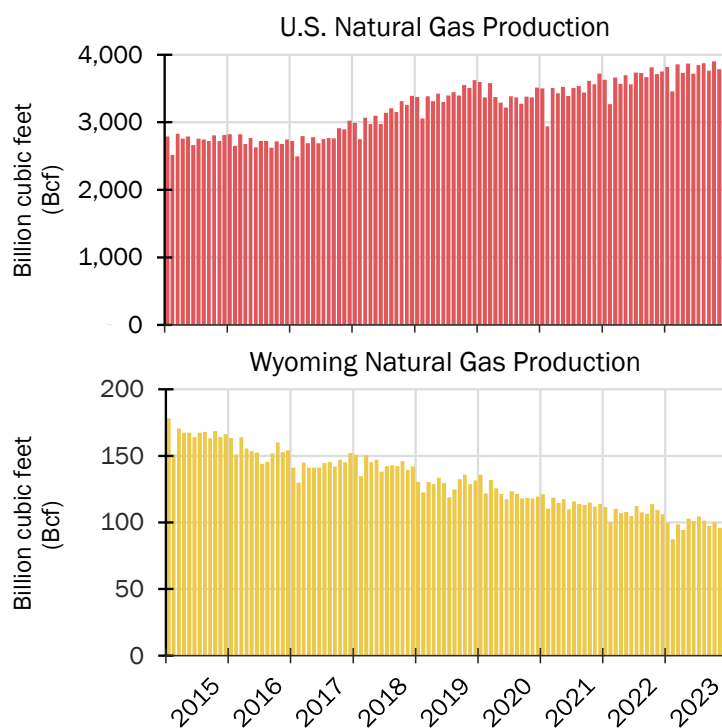
Natural gas

Natural gas production in Wyoming has been steadily decreasing since 2009, the height of the coalbed methane boom. Wyoming's trend of declining natural gas production is expected to continue, despite forecasts of increased production nationwide in the coming years.

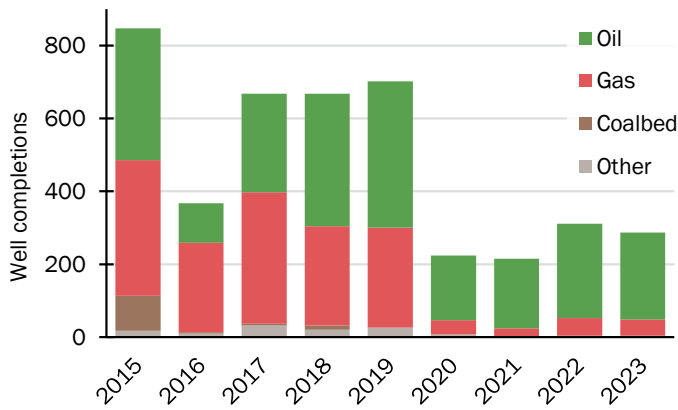
Although reported production numbers are not complete for the latter half of 2023, natural gas production from Wyoming's conventional fields and associated gas from oil wells is estimated to total approximately 1.2 trillion cubic feet for 2023, about 100 billion cubic feet less than was produced in 2022.

The main reason for declining natural gas production in Wyoming is the lack of new gas wells being drilled. As an existing well ages, its rate of production naturally slows. To maintain statewide production levels, new wells are needed to counteract the decline of older wells. The number of new gas wells plummeted in 2020 and remains low. In 2022, only 48 gas wells were completed, far less than the 274 gas wells completed in 2019. In the first half of 2023, only 18 new gas wells were completed. The low number of new gas wells appears to be an issue for the foreseeable future, as only 3 of the currently active 13 rigs in Wyoming are targeting

gas reservoirs, and associated gas produced from oil wells has not contributed enough to offset the overall downward gas-production trend. However, a sign of possible uptick in operator interest is that at least 119 applications for gas well permits-to-drill were submitted to the Wyoming Oil and Gas Conservation Commission in 2023, compared to 79 in 2022.

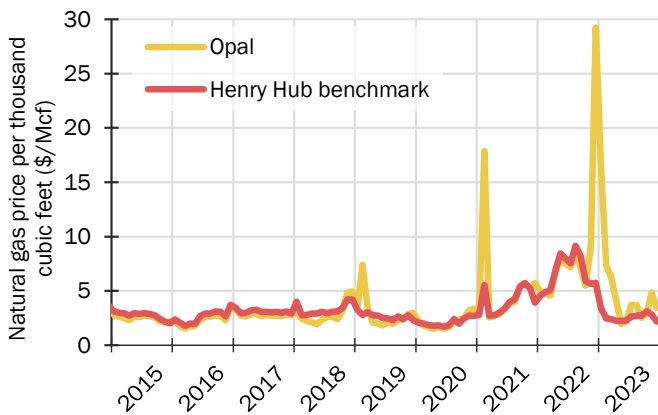


Total monthly natural gas production for the United States (top) and Wyoming (bottom), 2015–2023.



Total yearly well completions in Wyoming, 2015–2023, grouped by well class—oil, natural gas, or coalbed methane. Due to incomplete reported data, 2023 is an estimate.

Wyoming natural gas prices at two of its hubs in the western part of the state also recently diverged from national prices, most notably in late 2022 and the first quarter of 2023. In December 2022, Opal prices averaged \$23.49 per thousand cubic feet more than the Henry Hub national benchmark. In January 2023, prices at the Opal and NW Wyoming hubs averaged \$13.10 and \$12.50 more per thousand cubic feet, respectively, than Henry hub prices. While all of Wyoming hubs have since returned to more typical price differentials of \$1 or less, this unexpected price spike suggests that Wyoming natural gas prices may be more sensitive to temporary regional influences, such as local supply and demand dynamics and transportation bottlenecks, compared to elsewhere in the country.

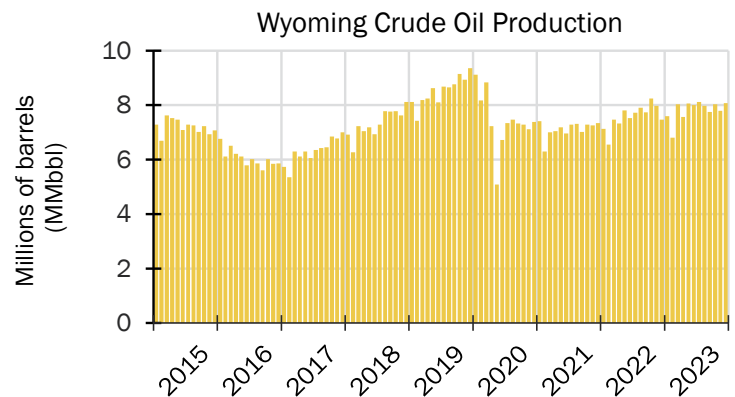
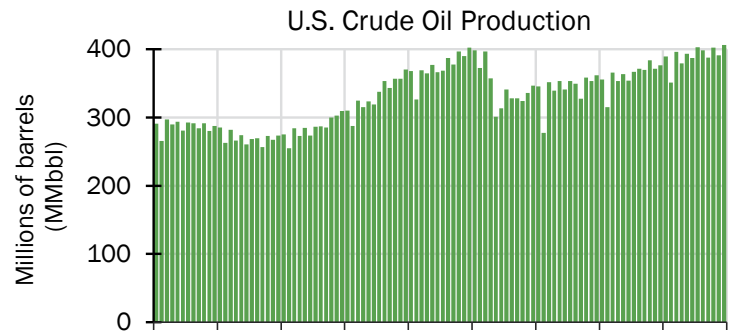


Natural gas spot prices in western Wyoming (Opal, yellow) compared to the national Henry Hub benchmark (red), 2015–2023.

Oil

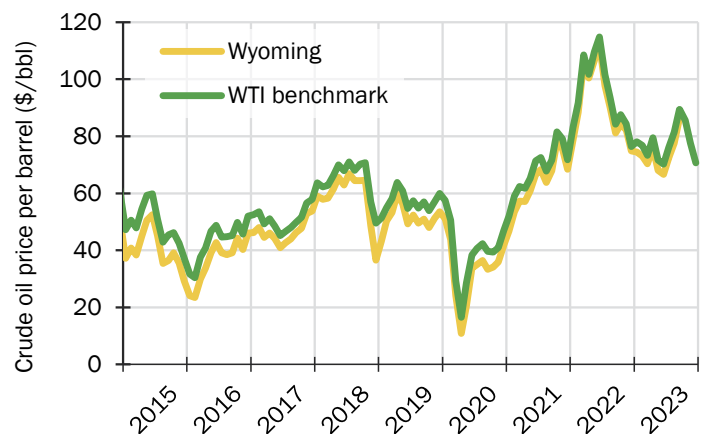
More than 95 million barrels of oil are expected to be produced in Wyoming in 2023. This will be about 3 million more barrels than was produced in 2022, and is on trend with gradually increasing U.S. crude oil production. The one difference is that nationally, oil production now exceeds pre-pandemic volumes, whereas Wyoming’s production growth has not yet surpassed its 2019 high. In contrast to natural gas, Wyoming oil production has benefited from the drilling and completion of new oil wells, which help offset the steep production

decline typically associated with an aging horizontal oil well. In the first half of 2023, a total of 110 newly drilled oil wells were completed, mostly in the Powder River Basin. This is comparable to the first half of 2022, when 118 oil wells were completed.



Total monthly crude oil production for the United States (top) and Wyoming (bottom), 2015–2023.

Wyoming crude oil prices continue to show significant recovery from the pandemic lows in 2020. Similar to crude oil production, Wyoming crude prices consistently mirror national trends, with Wyoming averaging \$3 to \$8 less per barrel than the West Texas Intermediate benchmark since 2015. Although less than 2022’s \$100-plus-per-barrel highs, oil prices in 2023 mostly followed a bullish trend, supported in part by OPEC+ production cuts and geopolitical conflicts. However, high U.S. interest rates and increasing crude oil inventories pushed prices lower in November and December.



Wyoming crude prices (yellow) compared to the national West Texas Intermediate (WTI) benchmark (green), 2015–2023.

Spotlight on pore space

While pore space has always been an important concept in the oil and natural gas industry, the conversation about it is evolving.

Pore space, or the gaps between solid particles in a rock, can hold fluids such as oil, gas, or water. How closely packed the grains in a rock are—as well as the shape and connectedness of the gaps between those grains—determines a reservoir’s porosity and permeability, and thus the ease of extracting those fluids.

Traditional targets for natural gas extraction are methane-rich reservoirs. However, in recent years there has been increased interest in non-methane gases such as helium and hydrogen. Additionally, the goals of some operators have expanded beyond extracting resources to include *injecting* pressurized gases and other fluids *into* the subsurface. Although gas injection into reservoirs can facilitate hydrocarbon extraction, such as in enhanced oil recovery, the increased demand for pore space may lead to competition and conflicts over its use. Pore space has therefore gained renewed attention and significance, especially in regards to carbon capture, use, and storage (CCUS) projects that inject carbon dioxide into deep subsurface reservoirs with the intent of sequestering the gas.

Geology of carbon capture and storage

Carbon dioxide (CO₂) is generated from power plants, industrial processes, direct air capture technologies, and the extraction of naturally occurring CO₂ from natural gas fields. After being separated and removed from the air or gas

processing streams, CO₂ can be transported via pipeline to either be used to assist in further hydrocarbon production or to be stored permanently underground.

In addition to Wyoming’s existing CO₂ pipelines and other oil and gas infrastructure, the state boasts considerable geologic potential for CO₂ storage. The state’s basins are replete with expansive saline sandstone and limestone reservoirs featuring high porosity and permeability. These reservoirs are often overlain by continuous layers of low-permeability rocks, such as shales, which serve as barriers to vertical fluid or gas migration. A considerable number of these reservoirs in Wyoming also fall within optimal pressure and depth conditions, thereby aiding both the injection and sustained sequestration of CO₂. Select organizations that provide more information on the science of carbon storage are listed in the inset box below (left).

A legal framework for carbon storage

Wyoming is unique and a frontrunner in how it manages CCUS projects. In 2008, the state Legislature passed the first two laws in the nation that established underground storage rights and a carbon storage regulation framework. Wyoming also has primacy, or enforcement authority, over its CO₂ injection wells (also known as Class VI wells)—granted by the U.S. Environmental Protection Agency to only one other state, North Dakota. While Wyoming’s legal framework for CO₂ management is multifaceted and nuanced, there are numerous resources listed in the inset box below (right) that delve into key aspects such as split estate, pore-space unitization, induced seismicity, and eminent domain.

Background material on CCUS

- U.S. Geological Survey: [What is carbon sequestration?](#)
- National Energy Technology Laboratory: [Carbon storage FAQs](#)
- Global CCS Institute: [Global status of CCS 2022](#)
- University of Wyoming Center for Economic Geology Research: [Wyoming CarbonSAFE project](#)
- Enhanced Oil Recovery Institute: [Wyoming is CCUS ready!—Story map](#)
- U.S. Geological Survey: [Geologic framework for the national assessment of carbon dioxide storage resources—Greater Green River Basin, Wyoming, Colorado, and Utah, and Wyoming-Idaho-Utah thrust belt](#)
- Wyoming State Geological Survey: [Geologic storage assessment of carbon dioxide \(CO₂\) in the Laramide basins of Wyoming](#)

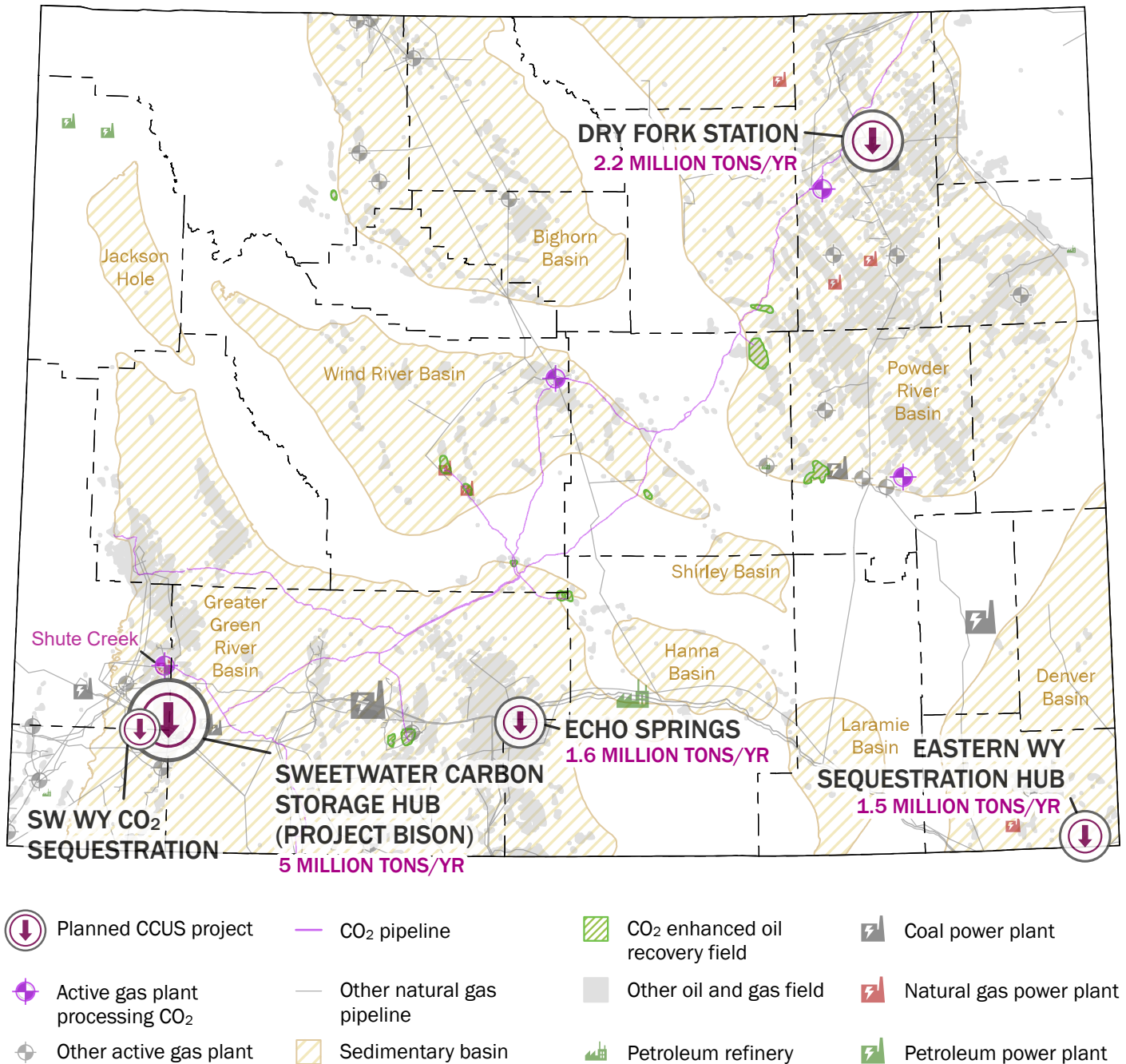
Resources on legal aspects of CCUS

- U.S. Energy Association: [Study on states’ policies and regulations per CO₂-EOR-storage conventional, ROZ and EOR in shale—Permitting, infrastructure, incentives, royalty owners, eminent domain, mineral-pore space, and storage lease issues](#)
- University of Wyoming School of Energy Resources: [What every Wyoming landowner should know about carbon capture and storage](#)
- Wyoming Department of Environmental Quality: [Underground injection control Class VI wells](#)
- [WY Statute § 30-5-501 and -502](#)
- [WY Statute § 34-1-152 and -513](#)
- [WY Statutes § 35-11-313 , -315, and -318](#)
- Global CCS Institute: [Pore space rights—U.S. overview](#)
- National Petroleum Council: [Meeting the dual challenge—A roadmap to at-scale deployment of carbon capture, use, and storage](#)

CCUS projects in Wyoming

Given its geological advantages and well-established oil, gas, and CO₂ infrastructure, Wyoming is a prime location for CCUS initiatives. A notable example is the ongoing project at the Shute Creek gas processing plant, which annually separates

7 million metric tons of CO₂ from gas streams at the LaBarge field, some of which is used in enhanced oil recovery. Plans are underway to expand this facility's capacity by an additional 1 million metric tons of CO₂ per year by 2025. Furthermore, at least five additional CCUS projects in Wyoming are currently in the planning stages.



Map of Wyoming showing planned CCUS projects and related infrastructure such as CO₂ processing plants, pipelines, oil and gas fields, power plants, and refineries. The size of CCUS projects, power plants, and refineries on the map corresponds to their operating capacity; operating capacity of CCUS projects labeled if known. The Dry Fork Station, Sweetwater Carbon Storage Hub, and Echo Springs projects are Department of Energy-funded CarbonSAFE initiatives administered in cooperation with the University of Wyoming's School of Energy Resources.

