



ISSUE BRIEF | Center for Energy & Environment

ENERGY INNOVATION PROTECTS THE ENVIRONMENT

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MAIN POINTS

- The global economy will continue to run on fossil fuels for the foreseeable future.
- American energy should be prioritized to meet the demand for fossil fuels because of its increasingly reduced impact on the surface environment.
- Technology and the pursuit of efficiency have facilitated both greater energy production and stronger environmental protection.

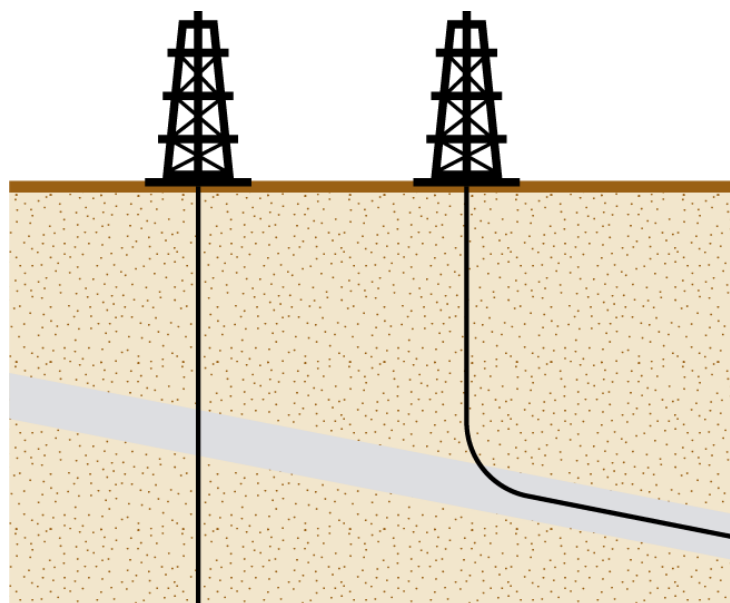
A reliable source of energy is fundamental to economic prosperity and human wellbeing. Despite efforts to promote alternative sources of energy, fossil fuels will remain the backbone of the global economy for the foreseeable future due to their abundance, versatility, and the reliability of the energy they generate. About 79% of America's energy demand is currently met with fossil fuels (U.S. Energy Information Administration, 2023b). Even President Joe Biden, who had previously vowed to “end fossil fuel,” conceded earlier this year that the United States will continue to require an abundance of oil for more than a decade to come (Peoples, 2019; Dlouhy and Natter, 2023). The U.S. Energy Information Administration (2023a) estimates that, even by 2050, 66% of energy consumed in the United States will come from fossil fuels.

Yet, not all fossil fuels are extracted in the same way, and different technologies correspondingly produce different impacts on the natural environment. Innovation in recent decades in the American energy industry has simultaneously increased the productive efficiency of oil and gas drilling and reduced its impact upon the surface environment. To meet the United States' continued demand for oil and gas, American energy—and its increasingly reduced impact upon the surface environment—should be prioritized.

Preserving the Natural Environment

The technological process of extracting oil and gas from subsurface resources has advanced dramatically in recent decades. Throughout most of the 20th century, oil and gas wells around the world were primarily drilled vertically into the ground over a wide area. As figure 1 illustrates, engineering innovation gradually has allowed for wells to be drilled at a slanted angle, which is known as directional drilling, and, more recently, in the shape of an “L” to achieve what is known as horizontal drilling.

Figure 1. Vertical and Horizontal drilling



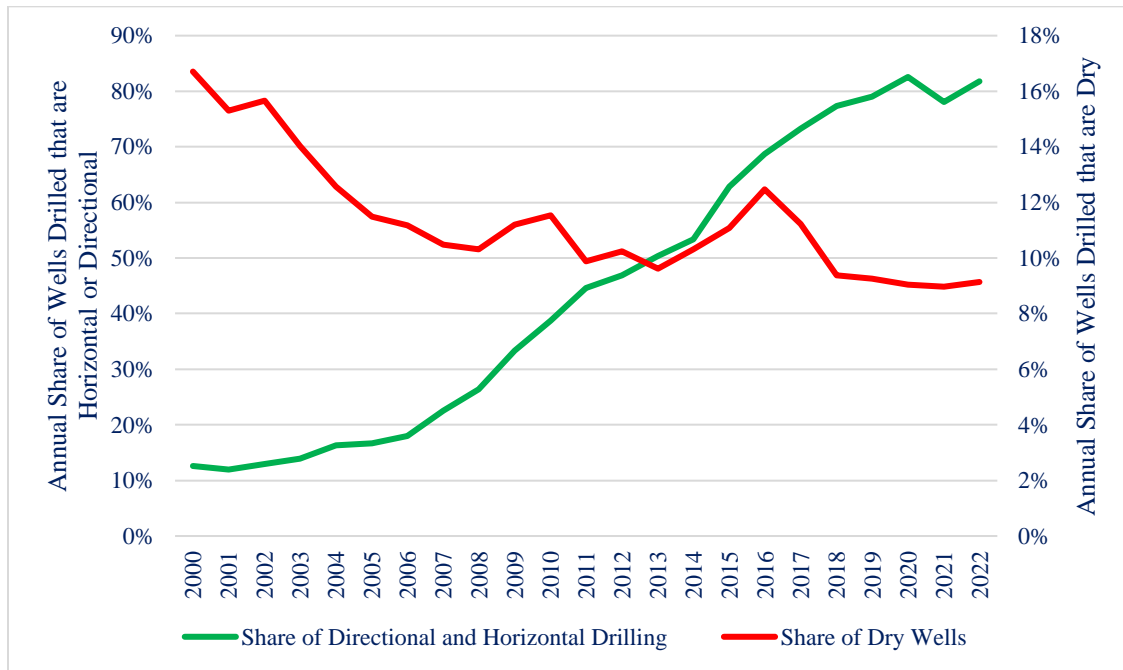
These innovations allow drillers to use a single well to retrieve oil and gas from horizontal or irregular-shaped deposits without the need for several vertical wells to achieve the same level of production. Horizontal drilling is often paired with hydraulic fracturing technology which, by creating cracks in the immediately surrounding rock, allows for even greater oil and gas production from a single well. Like other technologies—such as nuclear power or offshore wind generation—hydraulic fracturing can be used responsibly to both produce energy and preserve the natural environment and wellbeing of the surrounding community (U.S. Environmental Protection Agency, 2016).

Not only do these techniques make individual wells more productive and efficient, but, by reducing the need for vertical wells to achieve the same amount of production, directional and horizontal drilling reduces the relative disturbance to the surface environment and the natural habitats of nearby flora and fauna. For example, in fiscal year 2018, the highest recorded oil production from federal lands—and highest associated fiscal revenues—were achieved with the smallest recorded footprint of leased acres (Bureau of Land Management, 2023). The following three figures illustrate how, with the help of continual improvements to locating and extracting subterranean resources, the American oil and gas industry has progressively reduced its impact on the natural surface environment.

Figure 2 illustrates the increasing annual share of drilled wells that are directional or horizontal (left side). It also illustrates the decreasing share of wells that are ‘dry’—meaning that they are drilled but found to be unproductive (right side). Together, figure 2 shows how the American oil and gas industry has gradually shifted toward more efficient technology, while decreasing its relative disturbance on the surface environment.



Figure 2. Annual % of Drilled Wells that are Directional, Horizontal, and Dry¹



The efficiency of directional and horizontal drilling is also evident in the number of wells being drilled and their associated oil and gas production. Figure 3 illustrates how, in recent years, American oil production has trended upward (right side), while the total number of oil wells has trended downwards (left side). With the benefit of fewer dry wells and relatively more productive directional and horizontal drilling, America’s oil production has grown, while the relative impact on the environment has fallen.

¹ Data from U.S. Energy Information Administration (2023).



Figure 3. Annual Oil Production and Number of Oil Wells²

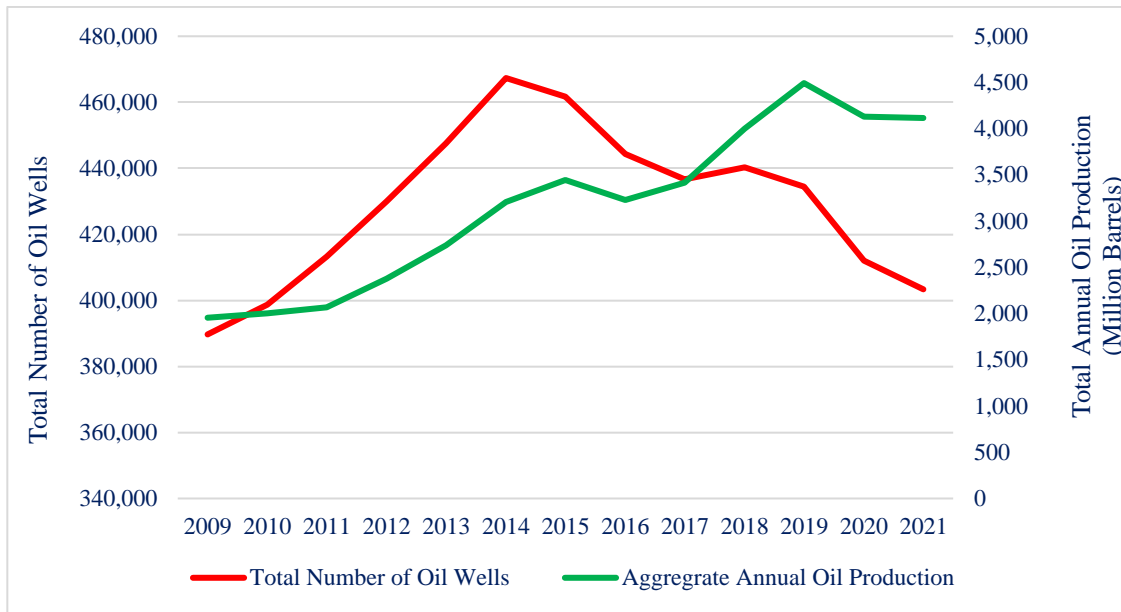
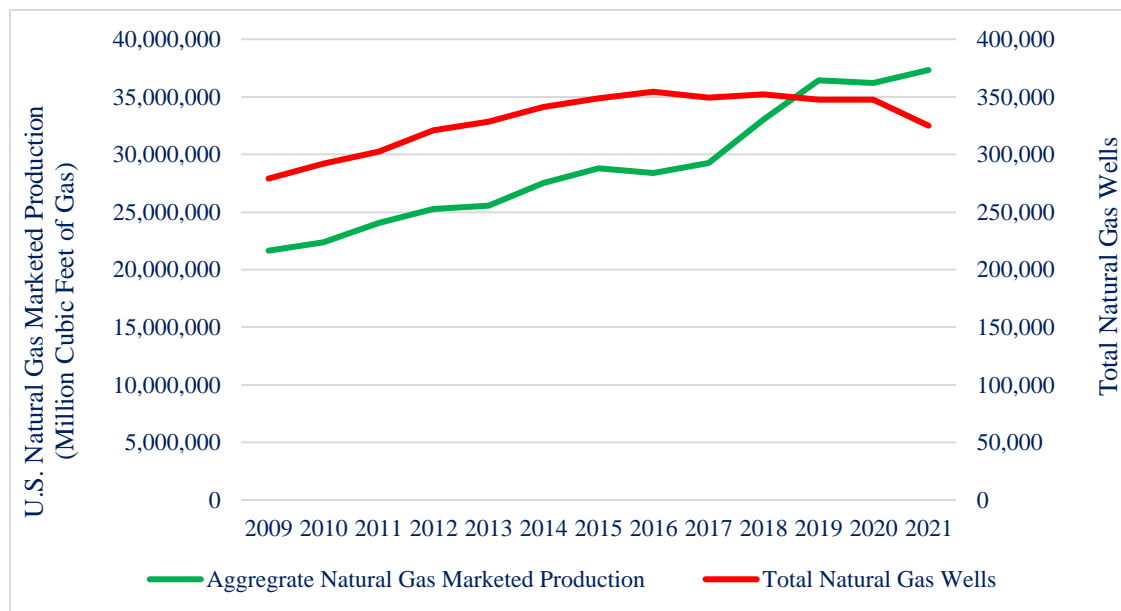


Figure 4 illustrates that, while not as stark, a similar relationship emerges for natural gas production after 2018.

Figure 4. Annual Natural Production and Number of Natural Gas Wells³



² Oil production data from U.S. Energy Information Administration (2023c); well data from U.S. Energy Information Administration (2022).

³ Natural gas production data from U.S. Energy Information Administration (2023d); well data from U.S. Energy Information Administration (2022).



Horizontal drilling thus has diminished the relative impact of environmental disturbance on a per-barrel of oil or cubic foot of natural gas basis. Yet, the environmental impact of horizontally drilled wells has also been diminished by the advent of so-called ‘pad drilling.’ Historically, individual wells were disparately drilled across a large area and a rig was transported between them to extract oil and gas. Over the past decade and a half, innovation has allowed for several wells to be drilled in close proximity—with their horizontal arms stretching in different directions—on what is known as a ‘pad.’ By concentrating wells on a pad, oil and gas production requires less surface-disturbing transportation infrastructure, such as access roads or pipelines (U.S. Department of Energy, 2016).

Protecting the Environment through Innovation

For the foreseeable future, fossil fuels will be the backbone of the global economy. Despite aggressive efforts to support alternative forms of energy, global demand for fuels such as crude oil continues to rise (Blas, 2023). Through technological innovation, the American oil and gas industry has become more efficient and, in the process, reduced its impact upon the surface environment on a per-barrel of oil or cubic foot of natural gas basis.

Federal policies that restrict American energy production while encouraging production abroad pose a risk to American economic and national security (Rollins and McPherson-Smith, 2023). Moreover, they effectively curtail the benefits associated with the American energy industry’s decreasing impact on the environment due to innovation. To meet the United States’ energy demand, American fuels, and the relatively limited disturbance to the surface environment that their extraction causes, should be prioritized.



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