Environmental Updates

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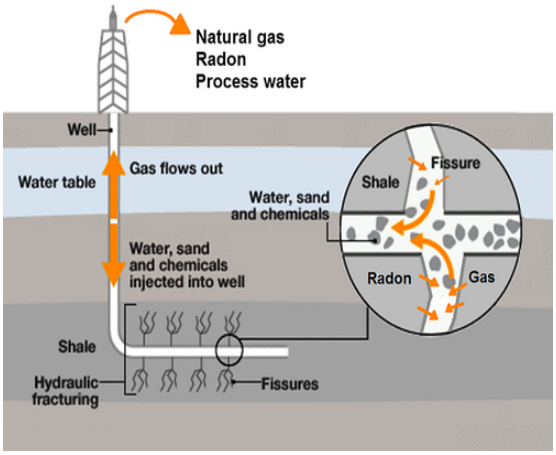
Designed for use with the Global Development And Environment Institute's *Environmental and Natural Resource Economics* textbook

Hydraulic Fracturing in the United States

Hydraulic fracturing, often referred to as hydrofracking, or simply fracking, is a controversial technique used in oil and natural gas extraction. It involves using high pressure to pump liquid, called fracking fluid, into oil and gas wells to create small fissures in underground rock formations (Figure 1). Sand and ceramic particles in the fracking fluid hold these fissures open, allowing natural gas to flow out. Hydraulic fracturing makes it possible to extract gas from shale rock formations, coal beds, and tight sandstone formations that could not be accessed with traditional drilling techniques.

Figure 1: The Hydraulic Fracturing Process

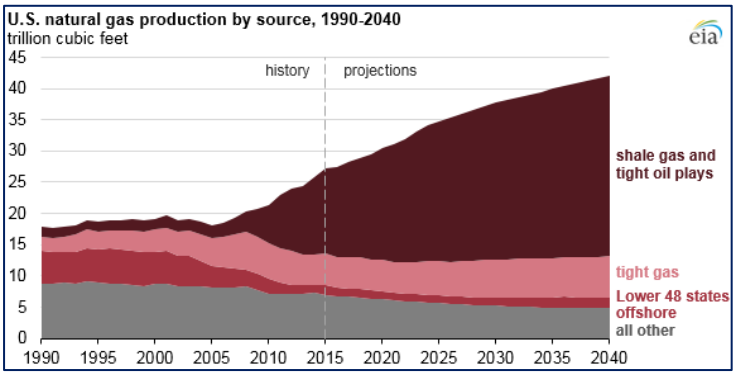


Source: Carvalho, 2017

Economic Benefits

Since becoming commercially viable in the 1990s, hydraulic fracturing has allowed for extraction of oil and gas reserves previously considered to be uneconomical. Natural gas from these sites now makes up around 50% of US production, and is expected to continue to grow rapidly.

Figure 2: U.S. Natural Gas Production by Source



Source: EIA, 2018

Figure 2 shows the past and projected growth of natural gas production in the U.S. The areas of the graph labeled "shale gas and tight oil plays" and "tight gas" represent resources that are extracted with hydraulic fracturing. Growth in production has allowed energy prices to stay low, and has helped the U.S. to reduce dependence on foreign energy sources. Hydraulic fracturing has also brought jobs to areas where new drilling sites are opened. Despite these economic benefits, the process also comes with a variety of negative environmental impacts, making it debatable as to whether or not hydraulic fracturing is actually beneficial to the communities where drilling is taking place.

Environmental Concerns

Although natural gas burns cleaner than coal, emitting around 50% less carbon dioxide per unit of energy when burned, the hydraulic fracturing process itself can be damaging to the environment. One of the major environmental concerns is chemical contamination of groundwater near drilling sites. In addition to water and sand, fracking fluid contains a mix of chemicals for increasing viscosity, decreasing friction, prevent-

ing corrosion and scale in well pipes, and preventing the fluid from freezing. These fluids can end up in groundwater through spills, injection into wells that are not structurally sound, and improper disposal or storage of wastewater. The mixture of chemicals used in fracking fluid varies by site and by drilling firm. Since firms are protected under the "trade secrets" law, they are not required to disclose the full composition of chemicals used.

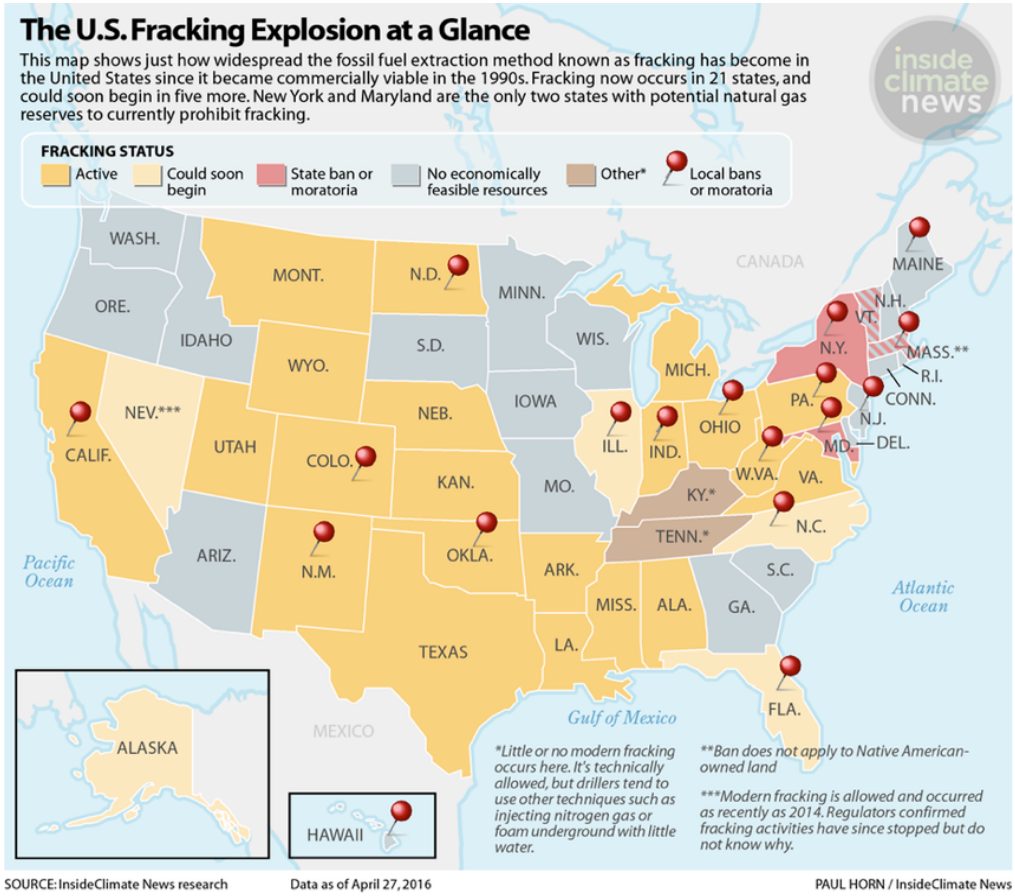
Hydraulic fracturing can also allow methane to be released into the groundwater through the fissures created, or through faulty well seals. A major Environmental Protection Agency study released in 2016 found evidence that drinking water resources can be impacted by the fracking process. For example, at one site in Wyoming the EPA found heightened concentrations of methane, benzene, xylenes, hydrocarbons, and gasoline and diesel byproducts in the groundwater that were likely due to improper wastewater storage. Other site-specific studies have found increases in congenital heart defects and low birth weight of babies born to mothers living near well sites, increases in respiratory and skin issues, and increases in aquatic animal deaths near wells that use hydraulic fracturing. Despite the potential for major health issues, the Safe Water Drinking Act, which is the federal law that protects US drinking water supplies and regulates water injected underground, exempts fracking fluid from regulation.

The large quantity of water used in the process is also problematic in areas where water resources are scarce. A single well can use up to 5.1 million gallons of water, with most of this permanently injected underground. This disposal process has been linked to an increase in earthquakes in the midwestern United States. Earthquakes can be caused by the initial injection process itself, though they are more frequently attributed to fracking fluid disposal. Oklahoma in particular has seen a spike in earthquakes of magnitude 3 or higher, going from 2 earthquakes in 2008, before large-scale hydraulic fracturing began in the state, to 889 quakes in 2015, though the number of quakes has since declined.

Fracking Bans and Regulation

The environmental concerns cited above, combined with the unknown long-term consequences of fracking, have resulted in bans in several locations across the U.S., as well as a handful of countrywide bans. Ireland, France, the Netherlands, Bulgaria and Germany have all banned hydraulic fracturing at the national level. Though fracking is both legal and poorly regulated on a national level in the United States, individual states, cities, and counties have put their own restrictions and reg-

Figure 3: Fracking Bans across U.S.



ulations in place. The figure above shows the legal status of hydraulic fracturing across the country. To date New York, Vermont, and Maryland are the only states with complete bans while 28 states require that drilling firms disclose some of the chemicals used in their process.

Under the Trump administration, hydraulic fracturing in the U.S. is expected to increase significantly as more federal lands are being opened for leasing to drilling companies. The administration has changed policies to allow for quicker issuing of drilling permits, changed the way that the royalties companies must pay for gas and oil extracted from federal lands are calculated, and shortened the window of time for the public to challenge federal land sales. The administration has also rescinded a series of regulations that was proposed under the Obama administration that would require firms drilling on federal lands to disclose what chemicals were used in their fracking fluid. These proposed rules, set to take effect in 2015, were blocked by a federal judge and the appeal process was halted once the Trump administration announced their plans to rescind them. With the current administration's focus on expanding domestic energy production combined with their continued reversal of environmental protections, regulation of hydraulic fracturing will increasingly fall to states and municipalities.

This update specifically relates to *Environmental and Natural Resource Economics: A Contemporary Approach* Chapter 11. For more information about the books, teaching materials, and research, see www.gdae.org

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