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The Facts on Fracking

By SUSAN L. BRANTLEY and ANNA MEYENDORFF

OPPOSITION to fracking has been considerable, if not unanimous, in the global green community, and in Europe in particular. France and Bulgaria, countries with the largest shale-gas reserves in Europe, have already banned fracking. Protesters are blocking potential drilling sites in Poland and England. Opposition to fracking has entered popular culture with the release of "The Promised Land," starring Matt Damon. Even the Rolling Stones have weighed in with a reference to fracking in their new single, "Doom and Gloom."

Do the facts on fracking support this opposition?

There is no doubt that natural gas extraction does sometimes have negative consequences for the local environment in which it takes place, as does all fossil fuel extraction. And because fracking allows us to put a previously inaccessible reservoir of carbon from beneath our feet into the atmosphere, it also contributes to global climate change.

But as we assess the pros and cons, decisions should be based on existing empirical evidence and fracking should be evaluated relative to other available energy sources.

What exactly is fracking, or more formally hydraulic fracturing?

Many sandstones, limestones and shales far below ground contain natural gas, which was formed as dead organisms in the rock decomposed. This gas is released, and can be captured at the surface for our use, when the rocks in which it is trapped are drilled. To increase the flow of released gas, the rocks can be broken apart, or fractured. Early drillers sometimes detonated small explosions in the wells to increase flow. Starting in the 1940s, oil and gas drilling companies began fracking rock by pumping pressurized water into it.

Approximately one million American wells have been fracked since the 1940s. Most of these are vertical wells that tap into porous sandstone or limestone. Since the 1990s, however, gas companies have been able to harvest the gas still stuck in the original shale source. Fracking shale is accomplished by drilling horizontal wells that extend from their vertical well shafts along thin, horizontal shale layers.

This horizontal drilling has enabled engineers to inject millions of gallons of high-pressure water directly into layers of shale to create the fractures that release the gas. Chemicals added to the

water dissolve minerals, kill bacteria that might plug up the well, and insert sand to prop open the fractures.

Most opponents of fracking focus on potential local environmental consequences. Some of these are specific to the new fracking technology, while others apply more generally to natural gas extraction.

The fracking cocktail includes acids, detergents and poisons that are not regulated by federal laws but can be problematic if they seep into drinking water. Fracking since the 1990s has used greater volumes of cocktail-laden water, injected at higher pressures. Methane gas can escape into the environment out of any gas well, creating the real though remote possibility of dangerous explosions. Water from all gas wells often returns to the surface containing extremely low but measurable concentrations of radioactive elements and huge concentrations of salt. This brine can be detrimental if not disposed of properly. Injection of brine into deep wells for disposal has in rare cases triggered small earthquakes.

In addition to these local effects, natural gas extraction has global environmental consequences, because the methane gas that is accessed through extraction and the carbon dioxide released during methane burning are both greenhouse gases that contribute to global climate change. New fracking technologies allow for the extraction of more gas, thus contributing more to climate change than previous natural gas extraction.

As politicians in Europe and the United States consider whether, and under what conditions, fracking should be allowed, the experience of Pennsylvania is instructive. Pennsylvania has seen rapid development of the Marcellus shale, a geological formation that could contain nearly 500 trillion cubic feet of gas — enough to power all American homes for 50 years at recent rates of residential use.

Some of the local effects of drilling and fracking have gotten a lot of press but caused few problems, while others are more serious. For example, of the tens of thousands of deep injection wells in use by the energy industry across the United States, only about eight locations have experienced injection-induced earthquakes, most too weak to feel and none causing significant damage.

The Pennsylvania experience with water contamination is also instructive. In Pennsylvania, shale gas is accessed at depths of thousands of feet while drinking water is extracted from depths of only hundreds of feet. Nowhere in the state have fracking compounds injected at depth been shown to contaminate drinking water.

In one study of 200 private water wells in the fracking regions of Pennsylvania, water quality

was the same before and soon after drilling in all wells except one. The only surprise from that study was that many of the wells failed drinking water regulations before drilling started. But trucking and storage accidents have spilled fracking fluids and brines, leading to contamination of water and soils that had to be cleaned up. The fact that gas companies do not always disclose the composition of all fracking and drilling compounds makes it difficult to monitor for injected chemicals in streams and groundwater.

Pennsylvania has also seen instances of methane leaking into aquifers in regions where shale-gas drilling is ongoing. Some of this gas is "drift gas" that forms naturally in deposits left behind by the last glaciation. But sometimes methane leaks out of gas wells because, in 1 to 2 percent of the wells, casings are not structurally sound. The casings can be fixed to address these minor leaks, and the risk of such methane leaks could further decrease if casings were designed specifically for each geological location.

The disposal of shale gas brine was initially addressed in Pennsylvania by allowing the industry to use municipal water treatment plants that were not equipped to handle the unhealthy components. Since new regulations in 2011, however, Pennsylvania companies now recycle 90 percent of this briny water by using it to frack more shale.

In sum, the experience of fracking in Pennsylvania has led to industry practices that mitigate the effect of drilling and fracking on the local environment.

And while the natural gas produced by fracking does add greenhouse gases to the atmosphere through leakage during gas extraction and carbon dioxide release during burning, it in fact holds a significant environmental advantage over coal mining. Shale gas emits half the carbon dioxide per unit of energy as does coal, and coal burning also emits metals such as mercury into the atmosphere that eventually settle back into our soils and waters.

Europe is currently increasing its reliance on coal while discouraging or banning fracking. If we are going to get our energy from hydrocarbons, blocking fracking while relying on coal looks like a bad trade-off for the environment.

So, should the United States and Europe encourage fracking or ban it? Short-run economic interests support fracking. In the experience of Pennsylvania, natural gas prices fall and jobs are created both directly in the gas industry and indirectly as regional and national economies benefit from lower energy costs. Europe can benefit from lessons learned in Pennsylvania, minimizing damage to the local environment.

The geopolitical shift that would result from decreasing reliance on oil, and more specifically on Russian oil and gas, is one that European politicians might not want to ignore. And if natural gas

displaces coal, then fracking is good not only for the economy but also for the global environment.

But if fracked gas merely displaces efforts to develop cleaner, non-carbon, energy sources without decreasing reliance on coal, the doom and gloom of more rapid global climate change will be realized.

Susan Brantley *is distinguished professor of geosciences and director of the Earth and Environmental Systems Institute at Pennsylvania State University, and a member of the U.S. National Academy of Sciences.* ***Anna Meyendorff*** *is a faculty associate at the International Policy Center of the Ford School of Public Policy at the University of Michigan, and a manager at Analysis Group.*

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