

Fracking: Energy Revolution or Environmental Catastrophe?

INTRODUCTION

For many years the United States has been highly dependent upon foreign countries to meet its energy needs. Americans spend approximately \$632 billion a year on oil alone, requiring the United States to import 10.6 million barrels of petroleum products per day. This dependence on other countries to meet their energy needs has caused concern among U.S. stakeholders. However, large discoveries of shale gas reserves in the United States have begun to change the country's energy outlook. Thanks in part to these discoveries, the United States is assuming energy independence quicker than once thought possible.

Hydraulic fracturing, also known as fracking, has played an important role in America's oil and natural gas production for the past 60 years. Roughly 35,000 wells are estimated to be processed with the hydraulic fracturing method. Natural gas consists of mainly methane and ethane, while butane and propane make up the remaining elements. Advances in technology have enabled companies to pursue hydraulic fracturing on a commercial level. With the advent of hydraulic fracturing, two polarizing sides have formed. One side argues for the positive economic benefits that hydraulic fracturing can produce. The other side claims that the negative environmental impact of hydraulic fracturing is unacceptable.

This paper will analyze the history of hydraulic fracturing, followed by the process associated with hydraulic fracturing. Next, we describe the benefits of hydraulic fracturing, followed by potential downsides to this controversial technology. We conclude by examining how fracking can be approached from a business ethics perspective. How companies choose to view their responsibilities will have a significant impact on whether fracking is accepted.

HISTORY OF HYDRAULIC FRACTURING

In 1947 hydraulic fracturing was used for the first time to extract natural gas. Two years later the Halliburton Oil Well Cementing Company performed the first two commercial hydraulic fracturing treatments. As the fracturing process evolved, opinions have varied on whether the benefits outweigh the negative consequences. The technique of hydraulic fracturing was initially conceived to restore and increase the rate at which water, natural gas, and petroleum is recovered from natural reservoirs. In 1974, the U.S. Environmental Protection Agency (EPA) ruled that fracking operations did not violate the Safe Drinking Water Act. The EPA has banned the injection of most hazardous materials in water and regulates all injected materials to ensure the safety of citizens.

Because the primary purpose of fracking is to extract natural gas—badly needed for the country's energy needs— fracking operations went relatively unobstructed for many years. In 2001, after

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local citizens around drilling areas began filing lawsuits and complaining about polluted land and water, the EPA began conducting investigations to evaluate potential risks. In March 2004, the deaths of a 64-year-old man, his 53-year-old wife, and their grandson occurred after gas seeped into their home from one of the several adjacent wells being drilled, resulting in a major release of methane gas that caused an explosion. This is just one of the many cases that have been reported in Pennsylvania. Methane is the largest component of natural gas and generally evaporates out of drinking water, but when exposed to air it can lead to lethal explosions. In northeastern Pennsylvania, methane was found in the water of sixteen different homes in a small town name Dimock.

In June 2004, the EPA reported that fracking fluids are toxic and traces of toxicity remain in the ground after hydraulic fracking is completed. However, a more recent EPA study has concluded that the high methane levels found in three families' drinking water in Pennsylvania did not come from nearby drilling activities. This finding supports proponents' arguments that properly controlled fracking activities can limit environmental impact. In January 2012, President Barack Obama voiced his support for natural gas extraction. Both sides of the argument continue, with proponents arguing for the positive attributes of fracking and critics claiming that the dangers of fracking outweigh the benefits.

PROCESS OF HYDRAULIC FRACTURING

Through the development of innovative techniques, drilling companies have developed new technologies to access trapped oil and gas located within the earth's core. Newer techniques are attempting to reduce surface footprints when drilling. Based on geologist research, a site with abundant shale formations far underground is chosen. Drillers then drill a well bore using a drill pipe and bit. Drilling mud is pumped down into the pipe to lubricate and cool down the drill bit. In addition, the mud aides in the stabilization of the pipe, preventing it from collapsing. After the appropriate distance has been chosen (approximately 5,000 feet), the drill pipe and bit are removed and a steel tube known as a "surface casing" is placed inside the well. This tube helps stabilize the well sides and reinforces the barrier between liquids outside the well—such as drinking water—and the fracking fluids inside the well. This barrier is reinforced with cement, sealing off the well.

After the cement sealing is complete, the pipe is pressure tested to ensure that no outside materials enter the pipe and no fracking fluid leaves the pipe. The drill pipe and bit are again lowered down. A special drill piece is added, enabling the drill to continue its path horizontally. The process of horizontal drilling is crucial because the shale layer extends horizontally throughout the ground. Once the desired horizontal distance has been reached, the drill pipe and drill bit are removed from the well. A perforating tool is inserted down the well to create holes within the shale layer for hydro-carbons to enter the well stream. After the perforating tool has been removed, fracking fluid is pumped down into the well. This fracking fluid is made up of water, sand, and other chemical ingredients which create tiny fractures within the shale, allowing gas to escape through the well. The pipe is then sectioned off and plugged until enough gas has gathered within the well.

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Afterward, the plugs are removed and the gas can flow from the depths of the well to the top where it is gathered, stored, and made ready for transport.

THE CONTROVERSY OF HYDRAULIC FRACTURING

Fracking has recently come under heavy scrutiny, largely from environmental groups and politicians. On the other hand, many communities welcome fracking sites to their communities because of the benefits associated with them. Fracking produces natural gas, creates jobs, generates revenue, lowers energy costs, and creates overall economic growth. The following section will discuss some of the major benefits and potential disadvantages of hydraulic fracturing.

BENEFITS OF HYDRAULIC FRACTURING

In terms of natural gas production, fracking has helped produce over 7 million barrels daily, which is the most production the United States has seen since 1993. In 2011 production exceeded 8.5 million cubic feet of natural gas. This production is only increasing and has helped contribute to lower energy prices. The additional natural gas has directly contributed to record low natural gas prices by increasing supply. It has also allowed the United States to continue toward a path of energy self-sufficiency and economic growth. Since the aggressive expansion of fracking, the United States is now the world's second leading producer of natural gas, behind Russia. Fracking has contributed to thousands of jobs, and since 2003, 80,000 new jobs have been created. This represents a 67 percent increase in the oil and gas industry. Beneficiaries of fracking include states such as Pennsylvania and North Dakota; in fact, North Dakota now enjoys the lowest unemployment rate in the United States at 3.3 percent. Greater jobs lead to higher disposable incomes and benefits in other areas of the economy. For example, North Dakota luxury car dealers have experienced record sales in the past couple of years. Fracking has also been responsible for billions of dollars in new revenue generation, including tax revenue. As mentioned earlier, this additional revenue has helped local, state, and federal government revenue generation.

Fracking has contributed to multiple indirect economic and environmental benefits as well. Since the increase in natural gas production, coal energy has begun to decline. This decline in coal burning leads to a decline in carbon dioxide (CO₂) emissions as well. Natural gas is estimated to produce approximately half of the CO₂ of coal. Natural gas is also cleaner than coal because it releases less sulfur dioxide, nitrogen oxide, and mercury emissions. Although fracking uses chemicals, these chemicals constitute about 0.5 percent of the drilling fluid.

Many energy companies claim that they try to ensure environmental safety at all of their fracking sites. They exert precautions and are sometimes able to recycle the contaminated water used for the fracking process. Additionally, the chemicals for fracking are used to minimize the fractures in the underground well sites and seal off the natural gas from clean water sites.

NEGATIVE ATTRIBUTES OF HYDRAULIC FRACTURING

Although proponents of fracking claim that the process is actually more environmentally-friendly than other forms of energy generation, critics disagree. They believe fracking is dangerous to the

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environment and inefficiently uses vast amounts of natural resources. On average it takes between 1 and 8 million gallons of water for a single fracking job. There are roughly 35,000 natural gas wells in the United States that can be fractured multiple times. Each well on average can be fractured 18 times, which uses large quantities of water. The water is then transformed into fracking fluid that contains approximately 600 chemicals, including substances known to contain carcinogens and toxins. While these chemicals might not constitute much of the mixture, the large amounts of fluids used are a concern. Each well requires two to five million gallons of water.

Critics claim that while the fracking fluid is being pumped into the rocks, methane gas, and toxic chemicals contaminate the ground water. A study at Duke University has found that methane levels are much higher in water wells near fracking sites. Contaminated water can create respiratory, sensory, and neurological damage when consumed. Large amounts of fracking fluid are left in the ground after a well is completed, although approximately 30 to 50 percent of the water used is typically recovered from a well. The chemical water that is left behind is not biodegradable. The waste fluid is left in open air pits to evaporate, which can release harmful volatile organic compounds (VOCs) into the atmosphere. VOCs have been linked to contaminated air, acid rain, and ground level ozone.

Fracking also releases methane gas into the atmosphere. Methane has a shorter life span than carbon dioxide in the atmosphere, but its ability to trap radiation in the atmosphere is 20 times greater. This contributes to global warming by disabling the heat from radiating off the surface of the earth. In addition to respiratory problems, methane gas exposure has been linked to cardiovascular problems and increases the likelihood of heart attacks. Studies have also suggested a link between fracking and earthquakes. One study suggests that the disposal wells containing roughly 4.5 million gallons of water reduces the friction between tectonic plates, causing them to slip and produce minor earthquakes.

Fracking also impacts stakeholders living close to drilling sites, sometimes negatively. One couple living on a farm close to a fracking site has experienced health problems such as nose bleeds, headaches, fatigue, and cirrhosis of the liver. They also lost many of their animals after the drilling started on their land. Another worker allegedly contracted radiation sickness after climbing into vats to clean out fracking fluid. Fracking has been known to reduce property values along with increasing automobile traffic. It takes on average 400 tanker trucks to transport all the water needed for a single fracking job. These tanker trucks contribute to increases in greenhouse gases. Many banks have refused to issue mortgages on properties where fracking leases have been sold; lenders have claimed breach of contract when leases have been sold; and insurance companies have refused to cover land and structures. Due to the risks of fracking, New York and Vermont have banned the practice, as has France.

THE IMPACT OF BUSINESS ON HYDRAULIC FRACTURING

Both sides of the fracking debate have valid arguments. Proponents claim that some of the critics' concerns can be addressed through safety precautions. Properly cemented wells prevent fracking fluid from leaking into groundwater. However, critics point out that hydraulic fracturing is largely exempt from certain federal regulations that would normally apply to drilling activities. The

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question also remains: Would a fracking disaster create as much of an environmental disaster as it would with other forms of drilling, such as the *Exxon-Valdez* or *Deepwater Horizon* oil spills? Fracking often occurs near large populations of people, making the safety of stakeholders an extreme concern for drilling companies.

The EPA has mandated some precautions that drilling companies must take when fracking. For instance, they are making it mandatory for fracking wells to have pollution control equipment in place to catch methane and VOCs by 2015. Rules will also limit the amount of methane emissions that can be released from fracking. In a recent report, the EPA has also lowered the amount of greenhouse gases released from natural gas production. Between 1990 and 2010, tighter controls in the industry are estimated to have reduced methane emissions by 850 million metric tons. However, critics maintain that fracking is still a dangerous activity, both for consumers and the environment.

On the other hand, businesses can take this opportunity to use best practices to reduce environmental pollution. Some energy companies are committed to researching less harmful fracking processes. For instance, the CEO of Tamboran announced that it would attempt to use fracturing without chemicals in Ireland. If fracking can be performed without the use of chemicals, the concerns about toxic fracking chemicals leaking into water sources can be decreased. Other suggested ways fracking companies can become more socially responsible is by attempting to recycle the water used whenever possible, safely dispose of water that cannot be reused, train employees in proper safety procedures, and maintain roads and provide support for communities in which fracking is taking place. Businesses that adopt best practices and make safety a top priority can help guard against health and environmental risks.

CONCLUSION

The controversy over fracking is not likely to be solved anytime soon. While proponents point out the economic benefits of hydraulic fracturing, opponents are quick to highlight the possible environmental dangers. Regulatory authorities have gotten involved as well. Some states and even countries have banned fracking because of the potential health and environmental dangers. The EPA is investigating the consequences of fracking and has set some regulations for fracking activities.

However, the newness of hydraulic fracturing means that there is not a clear consensus on its long-term impact. Although fracking has technically been used for 60 years, it is only recently that it has received much public attention. It is important for both businesses and regulatory authorities to monitor fracking activities continually to ensure that it is not creating significant health and environmental harm. Drilling companies can also take the lead in ensuring that best practices are implemented, including investigating more environmentally-friendly methods and supporting communities close to drilling sites. Companies that take a proactive stance in investigating, monitoring, and improving hydraulic fracturing can gain a good reputation and a competitive advantage, particularly in the face of proposed regulations impacting the industry.

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QUESTIONS

1. Which stakeholders are likely to be more affected by fracking activities?
2. What are the advantages and disadvantages of fracking?
3. Describe how energy companies could implement best industry practices when engaging in fracking activities.

Sources

- Kevin A. Hassett and Aparna Mathur, "Benefits of hydraulic fracking," American Enterprise Institute, April 4, 2013, <http://www.aei.org/article/economics/benefits-of-hydraulic-fracking/> (accessed June 26, 2013).
- Kate Kernsher, "How Hydraulic Fracking Works," *How Stuff Works*, 09 03 2013, <http://www.howstuffworks.com/environmental/energy/hydraulic-fracking.htm> (accessed June 26, 2013).
- Bureau of Labor Statistics, "Local Area Unemployment Statistics," <http://www.bls.gov/web/laus/laumstrk.htm> (accessed June 26, 2013).
- Dong, Linda. "Dangers of Fracking." N.p., n. d. Web. Web. 21 Apr. 2013. <<http://dangersoffracking.com>>.
- Green Car Congress, "Pew Survey finds broad support for Keystone XL; splits on fracking; slippage in seeing warming as very serious," April 3, 2013, <http://www.greencarcongress.com/2013/04/pew-20130403.html> (accessed June 26, 2013).
- "What Goes In and Out of Hydraulic Fracturing," <http://dangersoffracking.com/> (accessed June 26, 2013).
- Catskill Mountainkeeper, "Overview of Fracking," 2012, <http://www.catskillmountainkeeper.org> (accessed June 26, 2013).
- "The Pennsylvania Guide to Hydraulic Fracturing, or 'Fracking'," State Impact Pennsylvania, <http://stateimpact.npr.org/pennsylvania/tag/fracking/> (accessed June 26, 2013).
- "What is Fracking and Why Should It Be Banned?" Food & Water Watch, <http://www.foodandwaterwatch.org/water/fracking/> (accessed June 26, 2013).
- Catskill Mountainkeeper, "Fracking Air Pollution," 2012, <http://www.catskillmountainkeeper.org/our-programs/fracking/whats-wrong-with-fracking-2/air-pollution/> (accessed June 26, 2013).
- Kelly Connelly, David Barer, and Yana Skorobogatov, "How Oil and Gas Disposable Wells Can Cause Earthquakes," State Impact Texas, <http://stateimpact.npr.org/texas/tag/earthquake/> (accessed June 26, 2013).
- Duke University, "Methane Levels 17 Times Higher in Water Wells Near Hydrofracking Sites, Study Finds," *ScienceDaily*, May 10, 2011, <http://www.sciencedaily.com/releases/2011/05/110509151234.htm> (accessed June 26, 2013).
- Josh Fox (producer), *GasLand*, film, <http://www.gaslandthemovie.com/whats-fracking> (accessed June 26, 2013).
- D. Holmes, D. (2013). "Fracking," 2013, <http://www.propublica.org/series/fracking> (accessed June 26, 2013).
- Joan Howard, "Fracking Pros and Cons: Weighing In On Hydraulic Fracturing," *Huffington Post*, http://www.huffingtonpost.com/2011/11/10/fracking-proscons_n_1084147.html?utm_hp_ref=fracking (accessed June 26, 2013).
- Annie Lukins, "Fracking Practices in the United States: A Timeline," *Oberline Headwaters*, http://oberlinheadwaters.com/wp-content/uploads/2012/05/fracking_timeline.pdf (accessed June 26, 2013).
- Shelley Stark, "Let's add up fracking pros and cons," *The Athens News*, November 20, 2011, <http://www.athensnews.com/ohio/article-35415-lets-add-up-fracking-pros-cons.html> (accessed June 26, 2013).
- Abraham Lustgarten, "Water Problems from Drilling Are More Frequent Than PA Officials Said," *ProPulica*, July 31, 2009, <http://www.propublica.org/article/water-problems-from-drilling-are-more-frequent-than-officials-said-731> (accessed June 13, 2013).
- U.S. Energy Information Administration, "Frequently Asked Questions," U.S. Energy Information Administration, June 3, 2013, <http://www.eia.gov/tools/faqs/faq.cfm?id=727&t=6> (accessed June 18, 2013).
- Rich Smith, "Big Oil Isn't as Profitable as Everyone Thinks," *DailyFinance*, October 20, 2012, <http://www.dailyfinance.com/2012/10/20/big-oil-isnt-as-profitable-as-everyone-thinks/> (accessed June 18, 2013).
- Ben Wolfgang, "Methane study, EPA debunk claims of water pollution, climate change from fracking," *Washington Times*, April 29, 2013, <http://www.washingtontimes.com/news/2013/apr/29/pa-environment-agency-debunks-fracking-water-claim/?page=all> (accessed June 25, 2013).
- Ellen Cantarow, "Fracking ourselves to death in Pennsylvania," *Grist*, <http://grist.org/climate-energy/fracking-ourselves-to-death-in-pennsylvania/> (accessed May 23, 2013).
- Ryan Dezember and Matt Day, "Oil-Drilling Boom Under Way," *The Wall Street Journal*, February 10, 2011, <http://online.wsj.com/article/SB10001424052748704858404576134553990567750.html> (accessed May 15, 2013).
- The Economist staff, "Shale of the century," *The Economist*, July 2, 2012, <http://www.economist.com/node/21556242> (accessed May 15, 2013).
- Jim Efstathiou Jr. and Kim Chipman, "The Great Shale Gas Rush," *Bloomberg BusinessWeek*, March 7-13, 2011, pp. 25-28.
- Environmental Protection Agency, "Overview of Greenhouse Gases," <http://epa.gov/climatechange/ghgemissions/gases/ch4.html> (accessed May 15, 2013).
- Robert Jackson, "Expert answers your questions on fracking," *USA Today*, April 24, 2013, <http://content.usatoday.com/communities/sciencefair/post/2012/04/expert-answers-your-questions-on-fracking/1#.UZP2gvUmx8E> (accessed May 15, 2013).
- Tara Patel, "The French Say No to 'Le Fracking,'" *Bloomberg BusinessWeek*, April 4-10, 2011, pp. 60-62.
- Jim Roth, "The Shale Gas Revolution," *China Brief*, March 2012, pp. 14-15.
- Tennille Tracy, "Firms Given Time on Fracking," *The Wall Street Journal*, April 19, 2012, A3.
- Bryan Walsh, "The Gas Dilemma," *Time*, April 11, 2011, pp. 40-48.
- Jonathon Weisman, "In Western Pennsylvania, an Energy Boom Not Visibly Stifled," *The New York Times*, June 20, 2012, <http://www.nytimes.com/2012/06/21/us/an-energy-boom-in-western-pennsylvania.html?pagewanted=all&r=0> (accessed May 23, 2013).

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John Upton, "Study links fracking to drinking water pollution," *Grist*, <http://grist.org/news/study-links-fracking-to-drinking-water-pollution/> (accessed June 26, 2013).

"Leitrim to be 'guinea pig' for zero chemical fracking," *Leitrim Observer*, September 9, 2011, <http://www.leitrimobserver.ie/news/leitrim-to-be-guinea-pig-for-zero-chemical-fracking-1-3042738> (accessed June 26, 2013).

Michael A. Levi, "Make sure fracking is done right," *CNN*, May 28, 2013, <http://www.cnn.com/2013/05/27/opinion/levi-energy-surge-fracking> (accessed June 26, 2013).

Gail Nambrick, "Fracking: Pro and Con," *Tufts Now*, December 11, 2012, <http://now.tufts.edu/articles/fracking-pro-and-con> (accessed June 26, 2013).