

Case Study: Hydraulic Fracturing In New York State

Steven Cohen and Courtney Small

Introduction

Hydraulic fracturing, or “hydrofracking”, is an important sustainability management issue in the United States. Hydrofracking is a practice used to extract natural gas or oil from geological shale rock formations. Hydrofracking has been a method of gas and oil extraction for decades, but recent technological developments have allowed energy companies to extract unconventional, or previously unattainable, deposits of this energy source.

Upstate New York, along with parts of Pennsylvania, Ohio, and West Virginia, sits atop the Marcellus Shale, an underground geological formation that contains a huge quantity of natural gas. The estimated economic benefits from extracting natural gas have been compared to the gold rush or oil boom. However, the process may pose environmental and health threats to local residents and has others concerned about the longer term climate impacts. Environmental risks from fracking can occur during the extraction, cleanup and transport stages of the process. And, while many see fracking as a cornerstone of the transition to a clean economy, others worry that it will divert attention and money from renewable energy.

This case outlines the issue of hydrofracking and the political debate leading up to New York State Governor Cuomo’s decision to pursue a plan that would divide Southern New York into fracking and non-fracking zones based on the desire of specific communities to participate in fracking in their area.

Hydrofracking in the US

Hydrofracking is a process by which an extractive company procures natural gas resources from geological formations call “shale”. Shale gas is trapped within shale sedimentary rock formations and this process releases the natural gas for use as an energy source. The hydrofracking method involves injecting water, sand and chemicals into rock formations 1 - 8,000 feet deep in order to break open the shale formation and extract natural gas. The technological ability to drill horizontally has opened up

Figure 1: Marcellus Shale Distribution



Source: NYT Dot Earth Blog

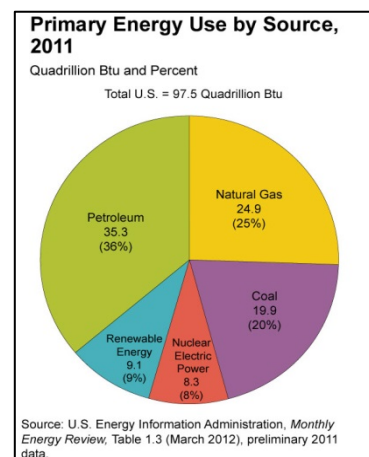
previously unreachable deposits of shale, or unconventional shale. Horizontal drilling allows companies to extract much more from a site, further incentivizing investment.

The May 2013 *Short-Term Outlook* by the U.S. Energy Information Administration (EIA) reports that 27.8% of domestic energy use is natural gas. It is our nation’s second largest source of energy expected to grow annually.ⁱ Natural gas currently produces electricity at nearly the same retail cost per kilowatt-hour as coal, and is less expensive than nuclear, solar, or wind power (Mellquist 2011: 32). Shale gas is a locally produced source of energy. Hydrofracking centers of production provide local jobs, and residents can lease their land for royalties on the energy extraction, incentivizing local participation, particularly in economically stressed areas. Given the continuing political focus on “energy independence” and job creation, natural gas is often presented as the answer to many problems. Due to its abundance natural gas is also considered a bridge fuel, meaning that it can be a greener energy alternative to coal while renewable energy technologies and markets of scale develop. Natural gas emits only half as much carbon dioxide (CO2) as coal and approximately 30% less than fuel oil (Ground Water Protection Council 2009: 5). Since CO2 makes up a large fraction of U.S. greenhouse gas emissions, increasing the role of natural gas in U.S. energy supply relative to other fossil fuels would lower our greenhouse gas emissions.

Natural gas is seen to have an advantage over other fossil fuels because it burns cleaner and produces less environmental pollutants than coal or oil given its simpler chemical structure (Tertzakian 2006). Natural gas still produces 117 pounds of CO2 per million Btu of energy burned: a large quantity of greenhouse gases compared to the negligible emissions from renewable or nuclear energy. But, in comparison to coal, which produces in the low 200’s pounds of CO2 per million Btu of energy, or diesel fuel and heating oil at 161 pounds of CO2 per million Btu of energy, natural gas is cleaner (U.S. EIA “How much carbon dioxide is produced” 2013)

Figure 2: Primary Energy Use by Source, 2011

The US is focused specifically on natural gas because of its relative abundance. Industry and government alike have attempted to estimate how much shale gas is present in the United States, and estimates vary. The Energy Information Administration (EIA) suggests that “there are 482 trillion cubic feet of shale gas in the United States”.ⁱⁱ The EIA also estimated that the Marcellus Shale alone could power the entire energy consumption needs for the United States for six years.ⁱⁱⁱ However, there is no scientific consensus on the amount of shale gas in the U.S. since different researchers have provided a wide range of



Source: EIA. “Primary Energy Use by Source”

estimates. These estimates also assume certain technological ability, and as technology develops, extraction can yield higher amounts from the same shale deposit. Despite the remaining uncertainty around just how much is available, natural gas will remain a significant portion of our energy portfolio. As oil extraction becomes more expensive and increasingly risky, natural gas, the cheaper and 'greener' alternative, may be seen as more attractive.

Environmental Concerns

Hydrofracking for gas is a technically complex with the potential to damage the environment.. The proximity of shale gas to drinking water is the main concern: "With hydrofracking, a well can produce over a million gallons of waste water that is often laced with corrosive salts, carcinogens like benzene and radioactive elements like radium."^{iv} "Some of the chemicals used in fracking include benzene, toluene, ethylbenzene and xylene, all of which can cause health problems in significant doses."^v Exposing the water table to these chemicals and elements can have lasting and destructive effects on the drinking water reserves. It is important that this wastewater is properly removed and stored so that the chemicals, salt, sand, and methane do not mix with drinking water. A Cornell University study suggests that exposure to fracking chemicals can cause illness, reproductive issues and even death to humans and animals.^{vi} Exposure to these chemicals can result in cancer and other chronic illnesses.

During the process of extraction, chemicals and water are pumped back up from the site. Risks also occur during the cleanup and transportation stages of the process. Spills and mishandling of this mixture can pollute surface water, as well as get mixed in runoff. A 2011 GIS analysis revealed a greater impact of hydraulic fracturing on surface water than originally believed to be the case. Sediment contamination and wastewater negatively affect surface waters with contaminants including "friction reducers, cross-linkers, breakers, surfactants, biocides, pH adjusters, scale inhibitors, and gelling agents."^{vii} These contaminants also have a detrimental effect on aquatic life. The scale of water needed to complete the process is also cause for concern. Two studies by the Western Organization of Resource Councils (WORC) and Ceres, a sustainable business organization, demonstrate the impact of hydrofracking on water depletion and the need for immense amounts of water for the process.^{viii} While companies do recycle the water from the process – up to about 80% - the water depletion is detrimental to fresh water reserves in the areas of production.

Additionally, the process of extraction releases large amounts of methane (CH₄) gas that has two negative effects: 1) methane gas in water is unsafe to drink; and 2)

methane is a greenhouse gas. When burned, natural gas produces less pollution than coal or oil, but it is not pollution free.

Recent studies have also found that fracking can cause small earthquakes and that the disposal of wastewater post-fracking can produce even larger earthquakes (Profeta 2013). The transportation of materials involved in hydrofracking is also detrimental to the environment. Over a thousand trips by trucks are needed to transport up to “twelve thousand feet of steel pipe, three hundred cubic yards of concrete, 250 tons of sand, thirty tons of chemical additives, and more than five million gallons of water.”^{ix} These truck trips release pollutants into the air, contribute to global warming and further exacerbate the environmental issues associated with hydrofracking.

The lack of comprehensive environmental and health studies that directly correlate negative impacts to hydraulic fracturing clouds the issue, particularly because the chemicals used in the process are not legally required to be disclosed. Comprehensive studies are needed to adequately assess the environmental and health impacts of hydraulic fracturing.

Federal Regulation

To encourage energy production, then President George W. Bush signed the Energy Policy Act of 2005, exempting companies from regulations that governing the impact of fracking chemicals. Sometimes this is referred to as the “Halliburton Loophole”, due to Vice President and former Halliburton CEO Richard Cheney’s role in formulating this policy. This provision exempts the hydrofracking industry from the Clean Air Act (CAA), the Clean Water Act (CWA), the Safe Drinking Water Act (SDWA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly referred to as Superfund. These exemptions have significant implications for our drinking water, air, health and legal rights:

1. Under the Clean Air Act a citizen could sue a company for exposure to these chemicals that cause hazards to health.
2. Under the Clean Water Act, a hydrofracking site would be considered a point source regulated for emitting toxic substances.
3. According to the Safe Drinking Water Act a hydrofracking site would not be able to pollute close to a groundwater supply.
4. Under Superfund, the company drilling for natural gas would be required to clean up any substances deemed to be a danger to human health.

A proposed Fracturing Responsibility and Awareness of Chemicals Act (the FRAC Act), which would revoke these exemptions, has not passed in Congress. In March 2012,

President Obama used his executive authority to form an interagency working group to encourage hydrofracking. Acknowledging the role natural gas plays as a necessary bridge fuel and a strategic boost to the economy, the executive order importantly notes the need for interagency oversight and disclosure of chemicals.^x The Executive Order notes, “Its production creates jobs and provides economic benefits to the entire domestic production supply chain ... with appropriate safeguards, natural gas can provide a cleaner source of energy than other fossil fuels... To formalize and promote ongoing interagency coordination, this order establishes a high-level, interagency working group that will facilitate coordinated Administration policy efforts to support safe and responsible unconventional domestic natural gas development.”^{xi} Additionally, the Federal government decided that companies engaged in hydrofracking on public lands would be required to disclose the chemical composition of their fracking liquids. The U.S. EPA is studying the impact of hydrofracking on drinking water resources and is expected to release a final report in 2014.^{xii}

In his Climate Change Address in June 2013, President Obama acknowledged natural gas’ contribution to lowering our country’s carbon pollution. He promised to work with industry to make the practice cleaner and safer, but his focus on the job creating potential and the effect on lower energy bills for Americans made it clear that natural gas extraction remains a priority of the federal government.

While this issue was being highlighted by the President, drilling companies were allowed a 60-day comment period extension for a rule which would regulate drilling on public lands. The extension was announced after industry groups and environmentalists said they “needed more time to digest a 17-page fracking rule issued last month,” (Daly 2013). The rule requires companies to disclose chemicals used in operations and sets standards for the proper construction of wells and disposal of wastewater.

Figure 3: Lower 48 States

State Regulation

While the federal government delays its final decisions on fracking, States can lead policymaking in this area. States have the authority to regulate this practice if they choose to do so. Additionally, zoning laws in municipalities often require



distinct areas of industry and residence. States have taken different approaches to regulating gas extraction. As you can see in figure 3, shale gas is readily available throughout the country. Notably, southern New York sits atop the Marcellus Shale – one of the largest sources in the country.

Pennsylvania also sits atop the Marcellus Shale and may serve as an example for Governor Cuomo as he seeks to determine how to regulate fracking in New York State. In Pennsylvania, unconventional wells are allowed in 37 counties.^{xiii} In February 2012, Pennsylvania Governor Tom Corbett signed Act 13, which regulates a payment system for ‘unconventional wells’ in the state.^{xiv} The law protects the extractive companies in two important ways: 1) If a chemical is deemed to be a ‘trade secret,’ the company can withhold the composition of the chemical; and 2) Even if a health service provider attributes a medical emergency to that ‘trademarked’ chemical composition, they will be required to sign a confidentiality statement.^{xv} Some consider Pennsylvania’s guidelines too lenient and industry-friendly. A study by the University of Buffalo cites 2,988 violations from 2008 to 2011 in 4,000 wells, “25 of which are ‘major’ which include events like blowouts at gas wells, land spills and water contamination.”^{xvi} Proponents of hydrofracking in New York claim that allowing fracking, with stricter regulations, could provide the benefits of the industry without many of the risks that Pennsylvania faces.

Illinois is taking that stricter approach. In June 2013, Governor Pat Quinn signed the nation’s strictest regulations for high-volume oil and gas drilling. The law establishes rules for companies to follow during fracking, such as disclosure of chemicals and testing of water before and after drilling. Companies will also be held liable for contamination. In a news release announcing the law after it was enacted, Quinn observed that: "This new law will unlock the potential for thousands of jobs in Southern Illinois and ensure that our environment is protected," Illinois is the first state in the country to require chemical disclosures before and after fracking to require companies to test water several times before and after the fracking process. Success will depend on the ability to enforce and provide oversight for these tests. (Badwin 2013)

New York State is still deliberating on the fracking issue. In order to effectively regulate hydraulic fracturing we need to understand:

- What happens to the high-pressure liquid that is injected into the ground, after the gas is released?
- How do we make sure it is collected and de-toxified before it is released back into the environment?

- Who pays for the monitoring and inspection of gas extraction processes and the costs of any infrastructure or equipment required to keep the process from causing environmental damage?

The Proposed Solution

A preliminary proposed plan limits hydrofracking in Southern New York, focusing on areas in economic decline. Though it would permit hydraulic fracturing, it limits the effects on New York's watersheds. The proposal includes the following restrictions on fracking^{xvii}:

- High-volume fracturing would be prohibited in the New York City and Syracuse watersheds, including a buffer zone;
- Drilling would be prohibited within primary aquifers and within 500 feet of their boundaries;
- Surface drilling would be prohibited on state-owned land including parks, forest areas and wildlife management areas;
- High-volume fracturing will be permitted on privately held lands under rigorous and effective controls; and
- The Department of Environmental Conservation (DEC) will issue regulations to codify these recommendations into state law.

The DEC's review requires "rigorous control" over this process by doing the following:^{xviii}

- Protecting drinking water through well water protection, additional well casing, spill control, storm water control and water withdrawal management;
- Properly handling flowback water and its disposal;
- Working with local governments for permitting and zoning compliance;
- Identifying fracking chemicals and chemical alternative evaluations;
- Protecting the air through required air pollution controls on engines and limiting flaring gas; and
- Conserving forestland and grassland by requiring best management practices.

Even with these restrictions, the DEC asserts that 85% of the Marcellus Shale is available for natural gas extraction. The department argues that this is a good balance of regulation and room for economic growth.

Timeline in New York State

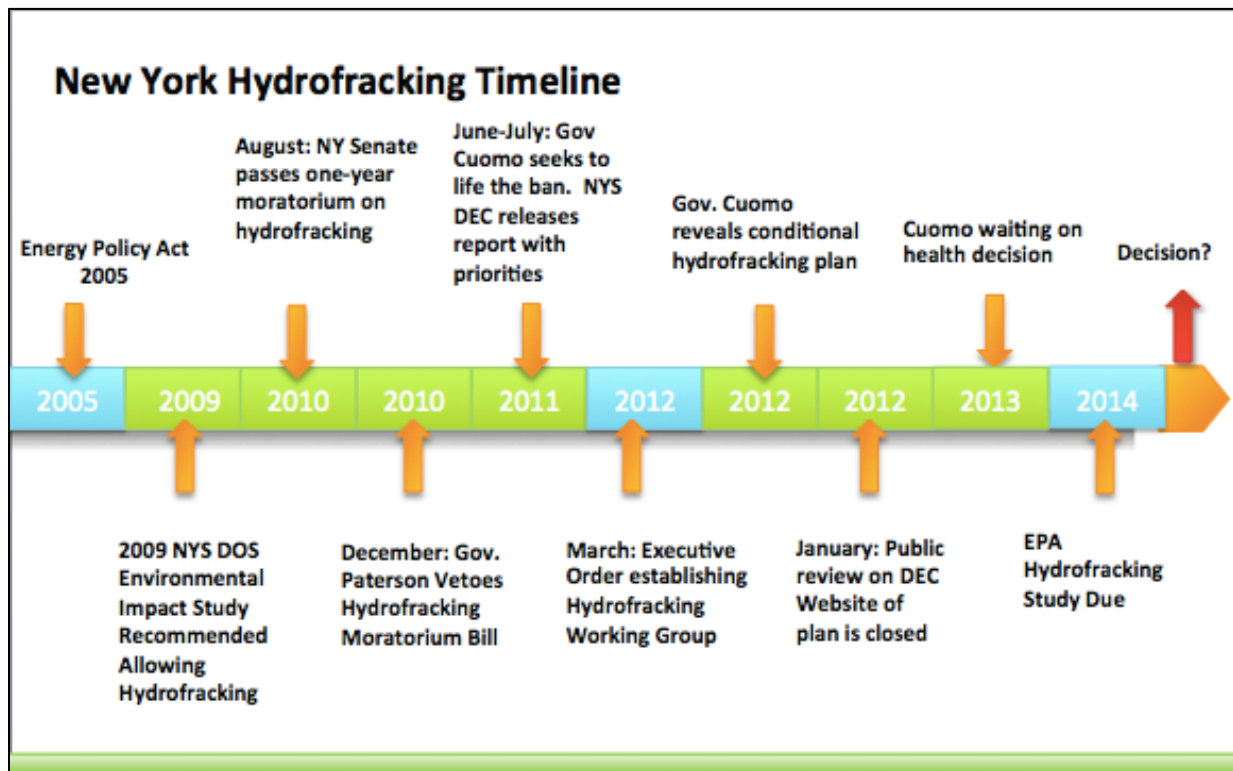
Through 2010-2013, New York State has taken a precautionary approach to hydrofracking. Former Governor Paterson vetoed a bill in 2010 that would ban hydrofracking in the state but simultaneously ordered a one-year moratorium on the practice. Under Governor Andrew Cuomo in 2011, the Department of Environmental Conservation (DEC) issued a report on fracking that received more than 13,000 comments.^{xix}

In 2012, the New York State Senate proposed SB 6892, which eventually died in committee. Through this bill, the Department of Environmental Conservation would store and maintain data of waste tracking and provide accessibility to the general public. New York already currently tracks hazardous waste but it is not used in the hydrofracking industry yet, through a “chain of custody” form used to “track the generation, transportation, and receipt of hazardous waste;” however, this does not apply to hydraulic fracturing waste (NYS DEC “Chapter 1: The Hazardous Waste Manifest System”).

Local pro-fracking and anti-fracking groups have been very active during this moratorium and evaluation process. Community efforts have led to hydrofracking bans within specific New York areas. The Tompkins County town of Dryden and the Ostego County town of Middlefield banned hydrofracking in May 2013, affirmed by the New York Appellate Court.^{xx} In addition, the community of Red Hook in Brooklyn, New York passed three laws on May 14, 2013, despite the County Supervisor’s absence. These laws work to try to effectively ban hydrofracking, and include “a law to ban brine on local roads, a law to ban “disposal of natural gas or oil drilling waste products within the town”, and a law to amend “the existing zoning law to define in greater detail the probation on heavy industry in the town.”^{xxi} Rockland County Legislature Chairwoman Harriet Cornell introduced a resolution that passed on June 4, 2013 that prohibits the treatment of hydrofracking wastewater in any wastewater treatment plant in Rockland County. In addition, the ban prohibits the use of hydrofracking brine to treat roads in the county.^{xxii} These regulations work together in an effort to limit hydrofracking in New York.

In 2012, the New York State Senate considered SB 6892, which eventually died in committee. Through this bill, the Department of Environmental Conservation would store and maintain data of waste tracking and provide accessibility to the general public. New York currently tracks hazardous waste through a “chain of custody” form used to “track the generation, transportation, and receipt of hazardous waste;” however, this does not apply to hydraulic fracturing waste (NYS DEC “Chapter 1: The Hazardous Waste Manifest System”).

The DEC planned to issue regulations to codify these recommendations into state law, but has already missed the previous deadlines of November 2012, February 2013, and May 2013. The recent delays were at the request of the health department, which needed more time for its health impact study. As of July 2013, Governor Cuomo has been waiting to hear from his state health commissioner, Dr. Nirav Shah, about his meeting with EPA officials in Washington on the issue. Cuomo has promised a decision before the 2014 election. At the time of this writing, the Cuomo administration has not decided on hydrofracking in New York State. Governor Cuomo has stated that there is no definitive decision date, demonstrating that the State is seriously investigating the issue prior to making a decision. (See **Figure 4: New York Hydrofracking Timeline** below timeline.)



The Challenge

Like mountain top removal and deep water drilling, hydrofracking is a high-tech way of extracting fossil fuels that can have a devastating impact on surrounding ecosystems. The increased use of these technologies is an indication that fossil fuels are getting harder to find and more difficult to extract from the earth. This will continue until we build a fossil-fuel free economy. Unfortunately, we do not yet have the technology we need to create a renewable energy economy. In the interim, we need to be very careful

while we extract these precious resources. The Deepwater Horizon catastrophe should provide lessons that regulatory oversight is necessary and that a regulatory body cannot be kept by an industry. New York State is taking the lead in attempting to regulate this practice with the goal of remaining an economic opportunity.

New Yorkers consume a lot of energy, and parts of upstate New York have been in economic decline for decades. Those are issues the governor must address. However, we also need to protect our lands and drinking water from environmental damage. Even from a purely cost avoidance perspective, environmental damage to drinking water would more than offset the economic benefits of natural gas extraction. Moreover, while we can replace natural gas with other forms of energy, there is no substitute for water. We humans are biological creatures requiring water to survive. Sustainability management requires that we learn how to power our economy while protecting our planet.

The hydrofracking issue is a management issue. Operating procedures will need to be in place to monitor the practice to avoid spills and to ensure chemical waste is properly disposed of. Particularly, as the NYS DEC points out, hydrofracking requires increased safety precautions, redundancies of protection measures, a standard method of handling waste, a rigorous tracking method and rigorous oversight. A more sophisticated and competent approach to management requires information, scientific analysis and the exercise of great care before we mine the planet's resources.

Extractive companies are extremely interested in the amount of natural gas ready to unlock. Without the regulatory framework that would require them to clean up their post-extraction waste, natural gas is relatively cheap and technically feasible to extract using this method. To avoid potential costly regulation, these companies are spending millions of dollars on lobbying and advertising, to assure regulators and citizens that the practice will both be safe for their drinking water and profitable.

The size of these gas deposits is enticing, and their ability to lower the price of electricity and home heating may prove irresistible. Unfortunately the cost to repair the damage hydrofracking will cause to our ecosystems is not included in the price of the gas. Communities will pay those costs, long after these energy companies have departed having extracted energy and wealth and left behind severe environmental degradation.

Similar to many other environmental issues with money at stake, environmentalists want to ban hydrofracking and gas companies want to pretend that fracking presents no risk. Environmentalists call for increased research that directly proves some of the negative effects associated with hydrofracking. Somewhere in between exists a regulatory middle ground, which both ensures safety and allows for economic opportunity. Regulating

properly will ensure that those who benefit from this cheap energy source contribute to the cost for ensuring that it is done well. In some fashion, this cost should be built into the price of this resource.

If companies want to drill in New York, they have to do it correctly. If there is no safe way to drill, or if a particular ecosystem is too fragile or too important to risk damage, then the gas extraction would be prohibited in that location. If natural gas is truly to be a “bridge fuel” its economic benefits should propel us to a cleaner energy portfolio and it should not destroy our environment in the process.

ⁱ <http://www.eia.gov/forecasts/steo/tables/?tableNumber=15#startcode=2012> “Short Term Energy Outlook” Energy Information Administration. August 2012. Retrieved August 7, 2012.

ⁱⁱ Urbina, Ian. January 28, 2012. “New Report by Agency Lowers Estimates of Natural Gas in U.S.” New York Times. Retrieved August 7, 2012. http://www.nytimes.com/2012/01/29/us/new-data-not-so-sunny-on-us-natural-gas-supply.html?_r=1

ⁱⁱⁱ Urbina, Ian. January 28, 2012. “New Report by Agency Lowers Estimates of Natural Gas in U.S.” New York Times. Retrieved August 7, 2012. http://www.nytimes.com/2012/01/29/us/new-data-not-so-sunny-on-us-natural-gas-supply.html?_r=1

^{iv} <http://www.nytimes.com/2011/02/27/us/27gas.html?pagewanted=all>

^v Urbina, Ian. February 28, 2011. “Regulation Law as Gas Wells’ Tainted Water Hits Rivers” New York Times. Retrieved August 7, 2012. <http://india.nydailynews.com/newsarticle/07336e3a60fe629f0a666391a7ecffc0f/interior-sets-new-drilling-rules-on-public-land>

^{vi} Ramanugan, Krishna. March 7, 2012. “Study suggests hydrofracking is killing farm animals, pets” Cornell Chronicle Online. Retrieved June 2012. <http://www.news.cornell.edu/stories/March12/FrackingAnimals.html>

^{vii} Entrenkin S, Evans-White M, Johnson B, Hagenbuch E. Rapid expansion of natural gas development poses a threat to surface waters. *Frontiers in Ecology and the Environment*. November 2011; 9:9: (503-511). Accessed June 4, 2013. Available at: <http://www.jstor.org/stable/23034467>.

^{viii} Platt, John. Fracking Water Use Draining Resources, Especially in Western U.S., New Studies Find.

TheHuffingtonPost.com., Inc. May 9, 2013. Accessed June 4, 2013. Available at:

http://www.huffingtonpost.com/2013/05/09/fracking-water-use-draining-water_n_3239879.html?utm_hp_ref=green

^{ix} Bishop RE, Lampre DJ, Brian WO, Wilber T, Arnowitt, M. “Fracking:” A Roundtable. *Journal of Appalachian Studies*. Spring/Fall 2012; 18: 1/2: (31-47). Accessed June 4, 2013. Available at:

<http://www.jstor.org/stable/23337707>

^x Cohen, Steve. April 16, 2012. “The Real Energy Future” New York Times. Retrieved June 2012.

http://www.huffingtonpost.com/steven-cohen/obama-hydrofracking_b_1427987.html

^{xi} Cohen, Steve. April 16, 2012. “The Real Energy Future” New York Times. Retrieved June 2012.

http://www.huffingtonpost.com/steven-cohen/obama-hydrofracking_b_1427987.html

^{xii} EPA. “Natural Gas Extraction - Hydraulic Fracturing” Updated August 1, 2012. Retrieved August 7, 2012.

<http://www.epa.gov/hydraulicfracture/>

^{xiii} http://www.puc.state.pa.us/naturalgas/naturalgas_marcellus_Shale.aspx

^{xiv} Pennsylvania Public Utility Commission. “Act 13” Retrieved June 2012.

http://www.puc.state.pa.us/NaturalGas/pdf/MarcellusShale/12_Act13_FAQs.pdf

^{xv} Hond, Paul. “The Glass Menagerie.” Columbia Magazine. Summer 2012.

^{xvi} Friends of Natural Gas. May, 15, 2012. "New York regulations would prevent Pennsylvania hydrofracking problems, report says." Retrieved June 2012. <http://www.friendsofnaturalgasny.com/2012/05/new-york-regulations-would-prevent-pennsylvania-hydrofracking-problems-report-says/>

^{xvii} Department of Conservation. June 30, 2011. "New Recommendations Issued in Hydraulic Fracturing Review" Retrieved June 2012. <http://www.dec.ny.gov/press/75403.html>

^{xviii} Department of Conservation. June 30, 2011. "New Recommendations Issued in Hydraulic Fracturing Review" Retrieved June 2012. <http://www.dec.ny.gov/press/75403.html>

^{xix} Department of Conservation. September 2011. "Revised Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program (September 2011)" Retrieved June 2012. <http://www.dec.ny.gov/energy/75370.html>

^{xx} Cantarow Ellen. New York's Zoning Ban Movement Fracks Big Gas. Truthout. May 9, 2013. Accessed June 4, 2013. Available at: <http://www.truth-out.org/news/item/16252-new-yorks-zoning-ban-movement-fracks-big-gas>

^{xxi} Imboden, Sarah. Red Hook passes laws to ban hydrofracking. The Observer Serving Red Hook, Rhinebeck, Milan & Tivoli. June 3, 2013. Accessed June 4, 2013. Available at: <http://www.rhobserver.com/15995/red-hook-passes-laws-to-ban-hydrofracking/>

^{xxii} Traum, Robin. Opposition To Use of Hydrofracking By-Products. *New City Patch*. June 2, 2013. Accessed June 4, 2013. Available at: <http://newcity.patch.com/groups/politics-and-elections/p/opposition-to-use-of-hydrofracking-byproducts>