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Hydraulic Fracturing and Water Resources: Separating the Frack from the Fiction
Executive Summary

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Executive Summary

Natural gas has been touted by some as a key "bridge fuel" that will transition the United States toward a more low-carbon energy economy. Energy analysts, including the United States Energy Information Administration (U.S. EIA), project that the United States will become increasingly reliant on natural gas. According to U.S. EIA estimates released in January 2012, natural gas production is projected to increase by nearly 30% over the next 25 years, from 22 trillion cubic feet in 2010 to 28 trillion cubic feet in 2035.[1] The growth in natural gas production is driven by a dramatic increase in domestic shale gas production, and by 2021, the United States is projected to be a net exporter of natural gas.

Although extracting natural gas from unconventional sources is more complex and costly than conventional natural gas recovery, technological improvements have made extraction from unconventional sources more economically viable in recent years. In particular, the combination of horizontal drilling and hydraulic fracturing has greatly increased the productivity of natural gas wells. These new techniques, however, have raised concerns about the adverse environmental and social impacts of these practices, especially related to impacts on water resources.

Hydraulic fracturing, or fracking, refers to the process by which a fluid – a mix of water, sand, and chemical additives – is injected into wells under high pressure to create cracks and fissures in rock formations that improve the production of these wells. Hydraulic fracturing was first developed in the early 20th century but was not commercially applied until the mid-to-late 1940s. Hydraulic fracturing is standard practice for extracting natural gas from unconventional sources, including coalbeds, shale, and tight sands, and is increasingly being applied to conventional sources to improve their productivity. It has been reported that hydraulic fracturing is used on 90% of all oil and gas wells drilled in the United States, although insufficient data are available to confirm this estimate.[2]

Hydraulic fracturing has generated a tremendous amount of controversy in recent years. There are daily media reports on this topic from outlets across the United States and in a host of other countries, including Canada, South Africa, Australia, France, and England. It is hailed by some as a game-changer that promises increased energy independence, job creation, and lower energy prices. Others are calling for a temporary moratorium or a complete ban on hydraulic fracturing due to concern over environmental, social, and public health concerns.

To better identify and understand what the key issues are, the Pacific Institute conducted extensive interviews with a diverse group of stakeholders, including representatives from state and federal agencies, academia, industry, environmental groups, and community-based organizations from across the United States. This paper provides a short summary of the key issues identified in the interviews and in an initial assessment and synthesis of existing research.

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[1] U.S. Energy Information Administration (U.S. EIA). 2012. *Annual Energy Outlook 2012 Early Release Overview*. http://www.eia.gov/forecasts/aeo/er/pdf/0383er(2012).pdf.

[2] Carrillo, V. 2005. *Testimony Submitted by Victor Carrillo, Chairman, Texas Railroad Commission Representing the Interstate Oil and Gas Compact Commission*. http://archives.energycommerce.house.gov/reparchives/108/Hearings/02102005hearing1428/Carrillo.pdf.

It especially examines the impacts of hydraulic fracturing and unconventional natural gas extraction on water resources and identifies areas where more information is needed. Our focus throughout the report is on shale gas, although we discuss other unconventional natural gas sources where information is readily available. For the purpose of this report, we use a broad definition of hydraulic fracturing to include impacts associated with well construction and completion, the hydraulic fracturing process itself, and well production and closure.

Despite the diversity of viewpoints among those interviewed, there was surprising agreement about the range of concerns and issues associated with hydraulic fracturing. Interviewees identified a broad set of social, economic, and environmental concerns, foremost among which are impacts of hydraulic fracturing on the availability and quality of water resources. In particular, key water-related concerns identified by the interviewees included (1) water withdrawals; (2) groundwater contamination associated with well drilling and production; (3) wastewater management; (4) truck traffic and its impacts on water quality; (5) surface spills and leaks; and (6) stormwater management.

Much of the media attention about hydraulic fracturing and its risk to water resources has centered on the use of chemicals in the fracturing fluids and the risk of groundwater contamination. The mitigation strategies identified to address this concern have centered on disclosure and, to some extent, the use of less toxic chemicals. Risks associated with fracking chemicals, however, are not the only issues that must be addressed. Indeed, interviewees more frequently identified the overall water requirements of hydraulic fracturing and the quantity and quality of wastewater generated as key issues.

Most significantly, a lack of credible and comprehensive data and information is a major impediment to identify or clearly assess the key water-related risks associated with hydraulic fracturing and to develop sound policies to minimize those risks. Due to the nature of the business, industry has an incentive to keep the specifics of their operations secret in order to gain a competitive advantage, avoid litigation, etc. Additionally, there are limited number of peer-reviewed, scientific studies on the process and its environmental impacts. While much has been written about the interaction of hydraulic fracturing and water resources, the majority of this writing is either industry or advocacy reports that have not been peer-reviewed. As a result, the discourse around the issue is largely driven by opinion. This hinders a comprehensive analysis of the potential environmental and public health risks and identification of strategies to minimize these risks.

Finally, the dialog about hydraulic fracturing has been marked by confusion and obfuscation due to a lack of clarity about the terms used to characterize the process. For example, the American Petroleum Institute, as well as other industry groups, using a narrow definition of fracking, argues that there is no link between their activities and groundwater contamination, despite observational evidence of groundwater contamination in Dimock, Pennsylvania and Pavillion, Wyoming that appears to be linked to the integrity of the well casings and of wastewater storage. Additional work is needed to clarify terms and definitions associated with hydraulic fracturing to support more fruitful and informed dialog and to develop appropriate energy, water, and environmental policy.