The Takeaway
Policy Briefs from the Mosbacher Institute for Trade, Economics, and Public Policy

Water Use for Hydraulic Fracturing:

A Texas Sized Problem?

DAVID LECLERE
Mosbacher Institute, The Bush School

MOSBACHER INSTITUTE
TRADE ★ ECONOMICS ★ PUBLIC POLICY

Energy production in the United States has undergone a fundamental transformation over the last 10 years, largely due to the emergence and rapid proliferation of hydraulic fracturing across the nation. This technology has paved the way for the United States to become the largest producer of oil and gas in the world.[1] However, the technology has come under intense scrutiny for, among other things, the large amounts of water required for production at each well. This is particularly true in a state with large demands on its limited water supply, such as Texas.

Hydraulic fracturing (HF) is a drilling process whereby a mixture of water, sand, and minute quantities of chemicals are used to create small fractures under the earth in order to stimulate production, or extend the life, of new and existing oil and gas wells. These fractures create paths that allow for oil and gas to be produced

WHAT'S THE TAKEAWAY?

The state of Texas could face a 2.7 trillion gallon shortfall of water by 2060.

Hydraulic fracturing requires large amounts of water for each well. Tax incentives should be offered to companies that substitute brackish groundwater for fresh.

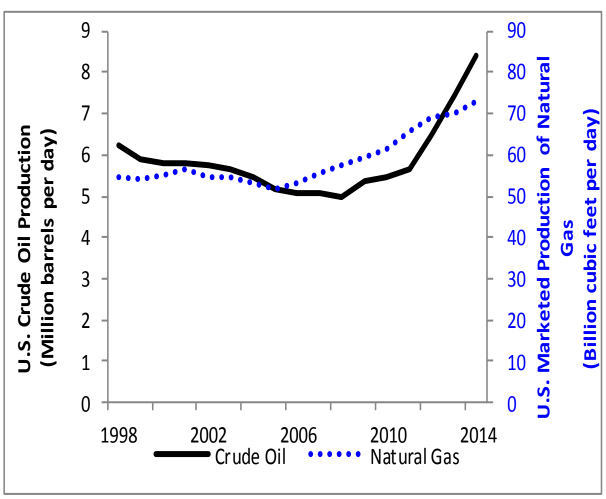
Accurate and transparent data reporting on water use and incentives to discourage inefficient use are necessary and should be applied to all categories of water consumers.

The Bush School of Government & Public Service, Texas A&M University
TEXAS A&M UNIVERSITY

from reservoir formations at an increased rate. Typically, HF wells require roughly 5 million gallons of water per well.[2] HF, combined with horizontal drilling, allows oil and gas operators to not only prolong the life of some existing wells, but also to tap into previously inaccessible formations like the Eagle Ford Shale.

The boom in HF has provided a myriad of benefits for the United States, including reduced carbon emissions, a resurgence of American manufacturing, and plentiful supplies of cheap natural gas. Due to the readily available supply produced through HF, natural gas prices in the U.S. are considerably lower than in other major international markets, particularly Europe and Asia. Whereas natural gas sells for roughly $9-$12[3] and $13-$18[4] per million British thermal units (Btu) in these regions, respectively, prices in the U.S. hover around $4 per million Btu.[5] Current U.S. oil and gas production stands in stark contrast to the production lows of the mid-2000s. Figure 1 highlights just how dramatic the growth in production has been. Current oil production is 67 percent higher than in 2008, while natural gas production has increased by 74 percent over the lows of 2005.

Figure 1: U.S. Crude Oil and Marketed Natural Gas Production: 1998-2014



Source: Energy Information Administration. 2014. U.S. Natural Gas Supply, Consumption, and Inventories. U.S. Petroleum and Other Liquids Supply, Consumption, and Inventories.

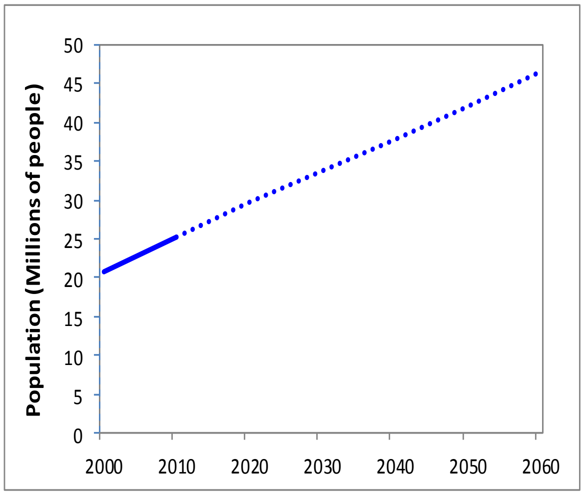
> *Typically, HF wells... [require] roughly 5 million gallons of water per well.*

Nowhere has the growth in hydraulic fracturing been more pronounced than in the Eagle Ford Shale. The Eagle Ford Shale is a massive geologic formation located in South Texas that spans 30 mostly-rural Texas counties stretching from Brazos County in the northeast to Webb County in the southwest. With the advent of HF and horizontal drilling, more than 200 operators have been able to tap into previously inaccessible shale reserves to produce abundant amounts of oil and gas. Oil and gas production in the Eagle Ford has undergone exponential growth since 2010 and shows no signs of slowing down.

HF AND WATER STRESS IN TEXAS

From 2000–2010, the population of the state of Texas grew faster than any other state in the U.S., exacerbating existing pressures on the state's water supply.[6] This rate of growth is expected to continue with no end in sight. As Figure 2 shows, the state's population is expected to grow eighty-two percent by 2060, from 25.1 million residents to 46.3 million.

Figure 2: Projected Population Growth in Texas: 2000-2060



Source: Texas Water Development Board. 2012. *Water for Texas 2012 State Water Plan. Austin, TX*

Unsurprisingly, demands on the state's water supply are expected to grow rapidly as well, from 18 million acre-feet per year to nearly 22 million acre-feet by 2060.

Recognizing the problem facing their state, voters in Texas approved state ballot measure Proposition 6 in November 2013, authorizing the state to provide $2 billion for the State Water Implementation Fund for Texas. However, the 2012 state water plan—the state's strategy for meeting water needs—estimated that Texas could face a shortfall of 2.7 trillion gallons of water a year by 2060, and that filling the gap would take an estimated $53 billion in new infrastructure.[7] Proposition 6 is an important first step for Texas in addressing its water needs, but with only $2 billion allocated to the State Water Implementation Fund, the state remains poorly positioned to complete the massive infrastructure improvements called for by the state water plan.

With much of the state continuing to face a prolonged period of drought, many interests across the state have sought someone to blame. It should be no surprise then that as the boom in hydraulic fracturing coincides with increased stress on the state's water supplies, that the technology has come under scrutiny for its water use. Many blame hydraulic fracturing as a major contributor to the problem, pointing to the large amounts of water needed to fracture each well.

A recent economic and policy analysis performed by students at the Bush School of Government and Public Service examined the linkage between HF and stress on water supplies within the Eagle Ford Shale.[8] This analysis found that within the Eagle Ford Shale, fresh groundwater aquifers are overdrawn by roughly 200,000 acre-feet per year, or nearly 2.5 times their recharge rate.[9]

> *Texas could face a shortfall of 2.7 trillion gallons of water a year by 2060.*

However, the research also found that absent HF, aquifers within the region would still be massively over-tapped. The report states that "HF operations now make up the third largest use of groundwater in the area. Irrigation still makes up more than half of all groundwater used in the Eagle Ford. The amount of groundwater being used for irrigation alone exceeds the recharge rate by more than 50%."[10]

POLICY RECOMMENDATIONS

Given the extent of the water issues facing Texas, a number of policy actions are needed.[11] Incentives should be used to encourage reductions in HF water use. Oil and gas companies could be offered severance tax reductions to substitute brackish groundwater for fresh groundwater. Companies limiting fresh groundwater use for HF also could be recognized by the Texas Railroad Commission or Texas Commission in Environmental Quality for their environmental stewardship with a "Green Star" designation.

However, HF technology is not the only or even the most significant contributor to the longstanding problem of water stress in Texas. Accurate and transparent data reporting on all water consumption (irrigation, municipal use, mining, and others) and policy changes to address inefficient water use practices in all sectors are needed. Without broad water regulation efforts the state will continue to suffer from overuse of its most precious resource—water.

This Takeaway draws heavily from a 2014 Bush School capstone report, *Water Use in the Eagle Ford Shale: An Economic and Policy Analysis of Water Supply and Demand*, by **Benton Arnett, Kevin Healy, Zhongnan Jiang, David LeClere, Leslie McLaughlin, Joey Roberts,** and **Maxwell Steadman.** Their faculty advisor was **Dr. James M. Griffin.**

David LeClere is a graduate of the Bush School of Government and Public Service and a former research assistant at the Mosbacher Institute.

Sources

[1] Crooks, Ed, "US petroleum production hits 44-year high," *Financial Times*, June 15, 2014. http://www.ft.com/intl/cms/s/0/37afc468-f48f-11e3-a143-00144feabdc0.html#axzz36Ke2zWBQ.

[2] "Hydraulic Fracturing: The Process," *FracFocus Chemical Disclosure Registry*, downloaded June 18, 2014. http://fracfocus.org/hydraulic-fracturing-how-it-works/hydraulic-fracturing-process.

[3] YCharts, "European Union Natural Gas Import Price," Nov 2014. http://ycharts.com/indicators/europe_natural_gas_price.

[4] YCharts, "Japan Liquefied Natural Gas Import Price," Nov 2014. http://ycharts.com/indicators/japan_liquefied_natural_gas_import_price

[5] Roy, Sumit, "U.S. Natural Gas Export Era Begins In 2015, Fueling Upside In Prices," *Seeking Alpha*, June 23, 2014. http://seekingalpha.com/article/2282733-u-s-natural-gas-export-era-begins-in-2015-fueling-upside-in-prices.

[6,7] Texas Water Development Board, *Water for Texas 2012 State Water Plan. Austin, TX,* 2012.

[8,9,10,11] Arnett, Benton, Kevin Healy, Zhongnan Jian, David LeClere, Leslie McLaughlin, Joey Roberts, and Maxwell Steadman, "*Water Use in the Eagle Ford Shale: An Economic and Policy Analysis of Water Supply and Demand*," The Bush School of Government & Public Service, April, 2014. http://bush.tamu.edu/research/capstones/mpsa/projects/2014/Hydraulic%20Fracturing%20in%20the%20Eagle%20Ford%20Shale.pdf .

ABOUT THE MOSBACHER INSTITUTE

The Mosbacher Institute was founded in 2009 to honor Robert A. Mosbacher, Secretary of Commerce from 1989-1992 and key architect of the North American Free Trade Agreement. Through our three core programs–Integration of Global Markets, Energy in a Global Economy, and Governance and Public Services–our objective is to advance the design of policies for tomorrow's challenges.

Contact:
Jennifer Moore, Assistant Director | The Mosbacher Institute for Trade, Economics, and Public Policy

Bush School of Government and Public Service
4220 TAMU, Texas A&M University
College Station, Texas 77843-4220

Email: bushschoolmosbacher@tamu.edu
Website: http://bush.tamu.edu/mosbacher