

Safe & Responsible Development

The Science Behind America's Natural Gas Production

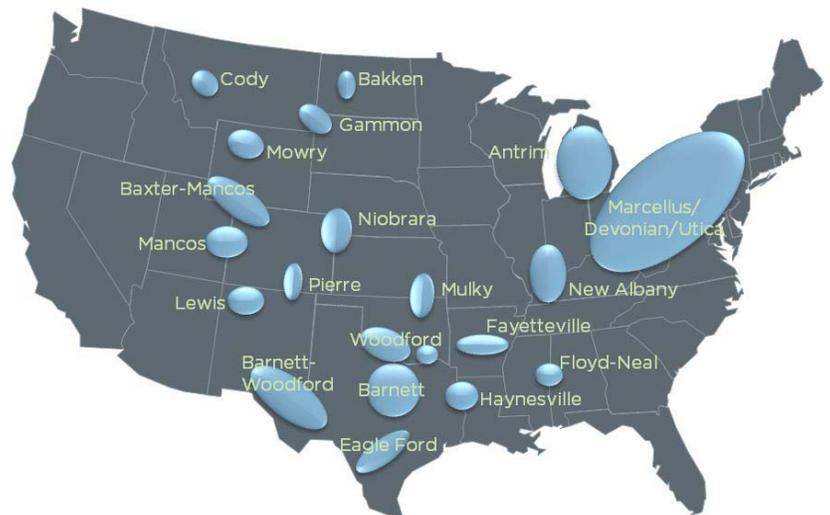
Our nation is faced with an unprecedented opportunity that can advance our environment, our economy and our energy security. Modern technology is now unlocking vast supplies of clean natural gas—right here in America—that can power our nation for generations to come. Natural gas companies understand that with this opportunity comes the responsibility to be dedicated stewards of local land, air and water. We are committed to helping communities where we conduct our operations understand the proven, scientific safeguards and vigilant regulatory oversight that is in place today to help ensure that natural gas continues to be produced in harmony with the local environment. Communities should not have to choose between advancing their economic interests and safeguarding their natural resources. With responsible natural gas production, our nation can advance both priorities together.

Cleaner Energy across America

Increased utilization of this cleaner, abundant and domestic energy resource in power generation and transportation will dramatically accelerate U.S. efforts to reduce air pollution.

Natural gas vehicles can help cut our nation's dependence on foreign sources of energy. And, because natural gas burns cleaner than other fuel sources, with less pollutants and no mercury, increasing its use in power generation could dramatically speed U.S. efforts to advance cleaner air in our communities.

Currently, natural gas is vastly underutilized for power generation. This means there is substantial potential—right now—to accelerate our nation's clean energy leadership without additional time and capital expenditures for new plants or new transmission facilities. Natural gas also is a clean, reliable partner with renewables, enabling their continued expansion by providing dependable back-up power on overcast or calm wind days.



Responsible development of natural gas from dense shale formations thousands of feet below the earth's surface gives us efficient access to vast new supplies of this cleaner energy resource.

The result? More jobs, less dependence on foreign oil and a cleaner, smarter energy future for our nation.

The Power of Progress

The industry has an ongoing commitment to continually reducing its environmental impact. Here are key highlights in our efforts to be good neighbors and good stewards of the land.

Smaller surface impact. The average well site today is just 30 percent of the size of its 1970s counterpart—and today's wells can access over 60 times more below-ground area.

Fewer wells, more clean energy. Half as many wells are needed to produce the same amount of clean energy as 20 years ago.

Less waste. We can retrieve the same amount of gas while producing 30 percent less waste than a decade ago.

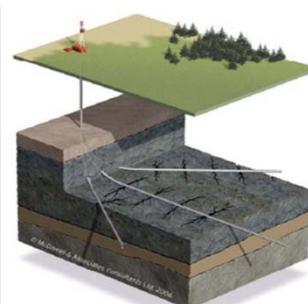
Fewer air emissions. More efficient operations also mean less energy consumption, and thus less air emissions, per unit of natural gas produced.

How the Process Works

The vast increases in our domestic natural gas supplies over the last several years have been made possible by two technologies that allow us to tap into deep supplies of natural gas that were once thought to be inaccessible.



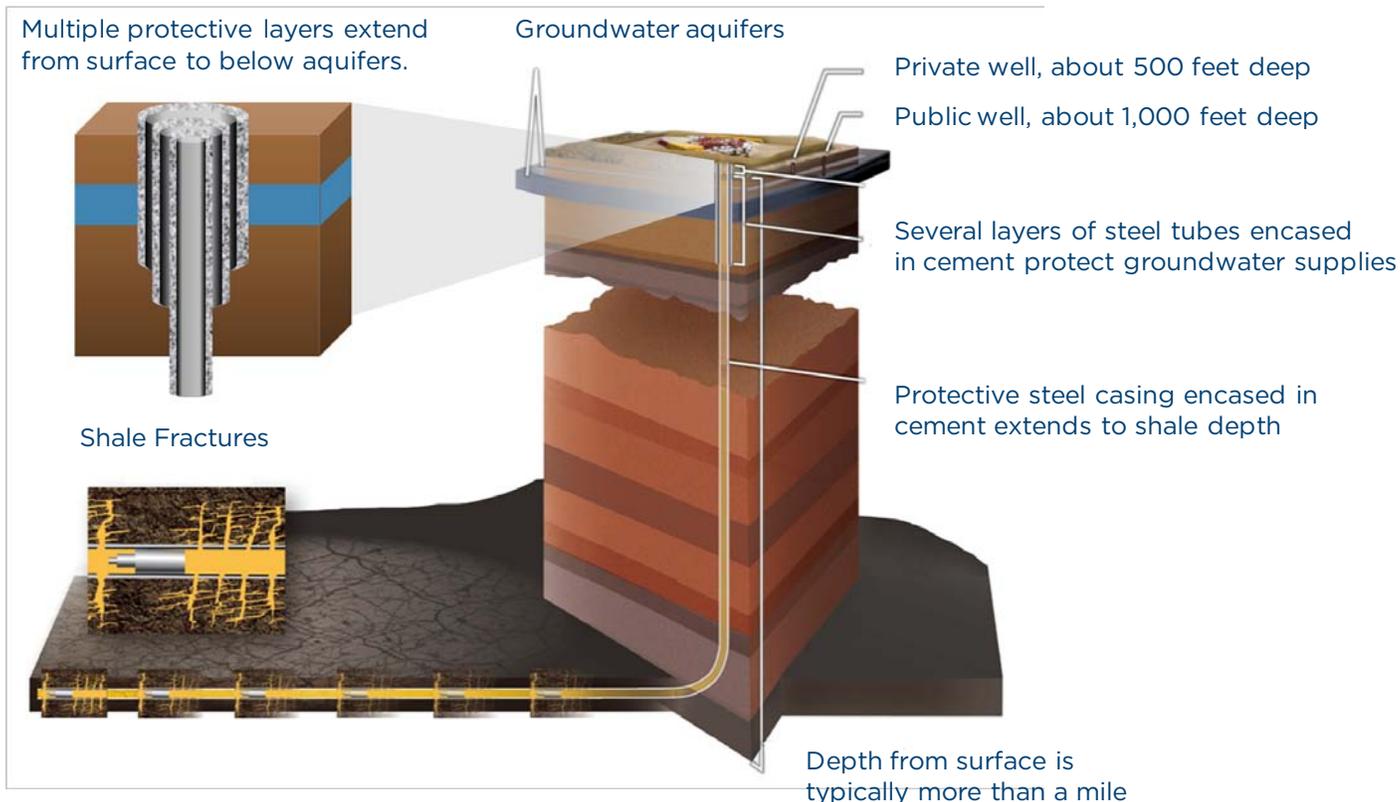
Traditional Wells



Horizontal Drilling

The first of these technologies is horizontal drilling. That's pretty much exactly what it sounds like—we drill one vertical hole that can then branch out into several horizontal cuts once the correct depth has been achieved. This is an important advancement because it significantly reduces the surface impact of drilling activities by giving access to more of the natural gas formation underground from fewer wells above ground. Thanks to horizontal drilling, today's average well site is just 30 percent of the size of its 1970s counterpart and can access 60 times more below-ground area. Continued technological advancements mean fewer wells recovering even greater reserves and creating less surface disturbance and waste.

The other technique that allows us to tap into new supplies of natural gas is hydraulic fracturing. As illustrated below, hydraulic fracturing or “fracking” takes place typically a mile or more below the earth’s surface. Today, the process is minimally invasive and involves drilling a small hole (typically about 15” in diameter), which is lined with multiple layers of steel encased in cement to seal off development activities from any fresh water supplies and to allow for the safe extraction of natural gas. Then pressurized water, sand and additives (less than 0.5 percent of the overall mixture) are used to create small, often millimeter-thick fissures in carefully targeted sections of the shale rock. This releases the natural gas, allowing it to safely rise to the surface within the self-contained system.





Drilling
2 – 4 weeks



Fracturing
3 – 5 days



Producing
decades
surrounding land reclaimed

What is the Environmental Track Record?

Hydraulic fracturing is routinely and safely used in communities across the country. The U.S. Environmental Protection Agency (EPA), Ground Water Protection Council (GWPC), and Interstate Oil and Gas Compact Commission (IOGCC) have all examined the process and found it to be safe. With the recent growth of hydraulic fracturing, the EPA is again examining this technique. The agency’s initial study is slated to be released by the end of 2012 with an additional report expected in 2014. We are confident that a science-based review will affirm the safety of hydraulic fracturing. The natural gas community is keenly aware that with the opportunities natural gas provides comes the responsibility to be dedicated environmental stewards in the communities where we do our work. We understand that just as important as accessing this clean energy resource is making sure we put safety first.

ANGA Supports Public Disclosure of Hydraulic Fracturing Chemicals

A broad range of industry participants, including America’s Natural Gas Alliance, the Independent Petroleum Association of America and the American Petroleum Institute, support FracFocus.org—a public database of hydraulic fracturing fluids developed by the Ground Water Protection Council (GWPC) and the Interstate Oil and Gas Compact Commission (IOGCC). The GWPC represents state regulatory agencies that work to protect local ground water supplies. The IOGCC represents state regulatory agencies tasked with day-to-day oversight of natural gas development. The state-based public registry of hydraulic fracturing fluids includes information on a well-by-well basis for operations on both government and private lands.

What Additives Are Used?

The mixture is approximately 99.5 percent water and sand.

The remaining 0.5 percent consists of highly diluted additives.

While specific mixtures vary depending on the unique traits of each geological formation, Material Safety Data Sheets are required by law to ensure precise information is instantly available onsite in case of an emergency.

What about Water Usage?

Water is a precious natural resource. A big part of our industry’s commitment to environmental stewardship revolves around our ability to use water wisely and to be attuned to community water needs. It is not unusual for a typical deep shale gas well stimulation to require between 2 million and 4 million gallons of water. These numbers are significant, but they are small relative to the amount of water continually required to generate power from other energy sources.

A study by Harvard Kennedy School's Belfer Center for Science and International Affairs concluded that because natural gas power plants use so much less water than other power plants, cultivation of shale resources would actually lead to LESS water use than the alternatives.

Strong Regulatory Oversight

Natural gas production is subject to federal, state and local regulations that govern every aspect of our operations, from initial permits to worker safety to wastewater disposal. Federal rules governing our activities include:

- The [Clean Water Act](#) regulates surface water discharges and storm-water runoff.
- The [Clean Air Act](#) sets rules for air emissions from engines, gas-processing equipment and other sources associated with drilling and production activities.
- The [Safe Drinking Water Act](#) regulates the disposal of fluid waste deep underground (far below fresh water supplies and separated by approximately one mile of impermeable rock).
- The [National Environmental Policy Act](#) requires permits and environmental impact assessments for drilling on federal lands.
- The [Occupational Safety and Health Act](#) sets standards to help keep workers safe. These include requiring Material Safety Data Sheets to be maintained and readily available onsite for any chemicals used by workers at that location.
- The [Emergency Planning & Community Right-to-Know Act](#) requires storage of regulated chemicals in certain quantities to be reported annually to local and state emergency responders.

Additionally, each state has regulatory agencies that enforce federal law and administer state rules. State regulations include the review and approval of permits for all aspects of drilling activities, such as well design, location, spacing, operation, water management and disposal, waste management and disposal, air emissions, wildlife impacts, surface disturbance and worker health and safety. State-led enforcement, in conjunction with current federal oversight, is considered critical because drilling practices are customized to the unique geological characteristics of different parts of the country, making state-level expertise essential to the oversight process. While states may adopt their own standards, by law they must be at least as protective as federal standards.

A Made-in-America Opportunity

Natural gas is a clean, abundant and domestic energy source that supports more than 2.8 million jobs across our country. It is a true game-changer that we can put to use now for our nation's economy, environment and energy security.

More information about safe and responsible natural gas development is available at <http://anga.us/issues--policy/safe--responsible-development/dig-deeper>

Find out more about natural gas at www.ANGA.us.

Natural Gas. Smarter Power Today.



How Much Is 5 Million Gallons?

It's the amount of water consumed by:

- a 1,000 megawatt coal-fired power plant in 11 hours
- a 1,000 megawatt nuclear power plant in 6 hours
- five acres of corn in a season
- an average golf course every 37 days

Unlike these activities, which are continuous, natural gas wells use this process only a handful of times over their 40- to 50-year life.