


Solving the Climate Change Puzzle

Natural Gas — Clean, Abundant, Efficient, American





Low-carbon natural gas is a clean, efficient, abundant and American source of energy that must be an important part of the solution to the global climate issue. America's natural gas industry is developing resources of natural gas found onshore and offshore in the United States responsibly and delivering it safely to homes and businesses.

As new technologies and natural gas reserves emerge, our industry stands ready to deliver a high efficiency, low carbon energy future.

As the united voice of the natural gas industry, the Natural Gas Council is pleased to provide you with an overview of the industry from the “burner tip” back to the “wellhead.” Please contact any of the associations listed in the back of this booklet if you would like to learn more about the natural gas industry in the United States.



Introduction



What is natural gas?

Natural gas is the earth's cleanest fossil fuel, comprised of four parts hydrogen and one carbon atom (CH₄). It is colorless, shapeless and odorless in its pure form, and today, it meets the essential human needs of 171 million Americans.



Where does natural gas come from?

Beneath our feet, vast resources of energy are now available to meet the nation's growing demand thanks to the natural gas industry's technological advancements, such as hydraulic fracturing and horizontal drilling. That energy will keep flowing for future generations as the natural gas industry invests billions of dollars and successfully creates new technologies to economically harness the power of the earth's abundance.

ORIGIN - The natural gas we use today began as microscopic plants and animals living in the ocean millions of years ago. As they thrived, they absorbed energy from the sun, which was stored as carbon molecules in their bodies. When they died, they sank to the bottom of the sea and were covered by layer after layer of sediment. As the plants and animals became buried deeper in the earth, heat and pressure began to rise. The pressure, combined with a high degree of heat, compressed the biomatter and produced natural gas.

MIGRATION - After natural gas was formed, it tended to migrate upward through tiny pores in the surrounding rock. Some natural gas seeped to the surface, while other deposits traveled until they were trapped under impermeable layers of rock, shale or clay. These trapped deposits are where we find natural gas today.



How does natural gas get to our homes and businesses?

Local natural gas companies receive their natural gas supply through delivery points known as “utility transfer stations,” which are positioned along large gas-carrying interstate and intrastate transmission pipelines. Transfer stations are owned, operated and maintained by the local natural gas utility and mark the point at which it assumes custody of the gas.

After the natural gas passes through the transfer station and then through the “city gates,” the local natural gas utility moves the gas through an extensive network of distribution pipes that carry the natural gas directly into homes, offices, schools, hospitals and other buildings. There are 2.3 million miles of distribution and service pipeline in the United States, enough pipe to wrap around the earth 92 times. The distribution network also includes measurement and pressure regulators, gas storage facilities, and valves and meters, all of which must be operated, maintained and upgraded by the local natural gas utility.

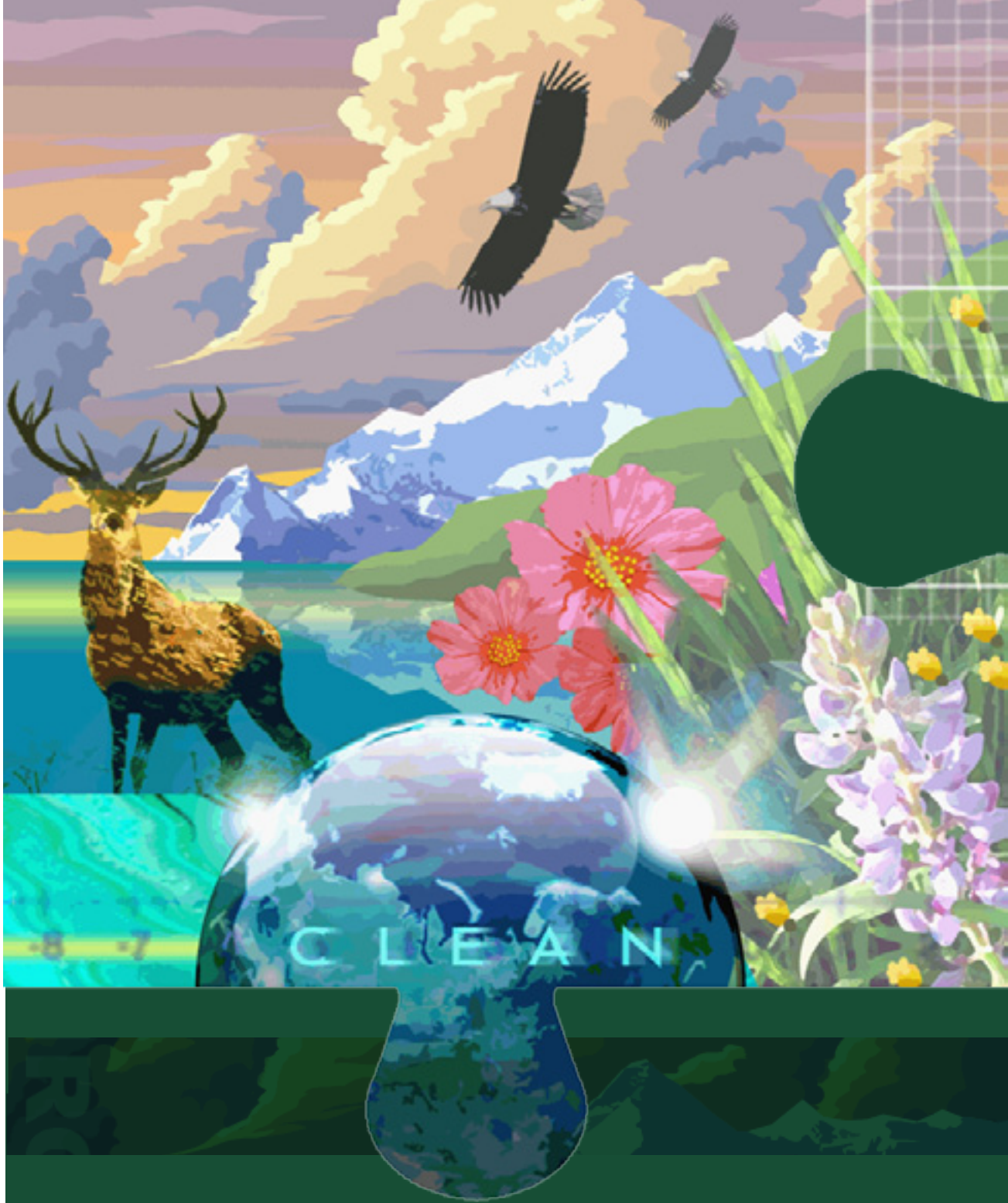


Why natural gas?

CLEAN NATURAL GAS IS TODAY'S PRIMARY ENERGY SOLUTION AND THE FUEL OF THE FUTURE.

For nearly a century, natural gas has played a key role in making America a prosperous and secure nation, and it is now poised to play an even more important role in meeting the challenge of global climate change. Clean natural gas has the ability to grow our economy, enhance America's energy security and leave to future generations a cleaner, healthier, and stronger country — and planet.





Environment

Natural gas is the cleanest fossil fuel available today.

It produces less sulfur dioxide (a primary precursor of acid rain), less nitrogen oxide (a primary precursor of smog) and less particulate matter (tiny soot that affects health and visibility) than fuel oil or coal. Natural gas emits 45 percent less CO₂ than coal and 30 percent less CO₂ than oil.

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Because of its clean and efficient nature, natural gas has become increasingly popular for the generation of electricity. As a result, more and more each year, new natural gas technologies are contributing to cleaner electricity production.

And residential and small commercial natural gas customers are making significant strides by using this efficient fuel. America's 70 million natural gas customers have collectively succeeded at doing what no other energy users have done — holding consumption steady. Despite the fact that the number of natural gas customers has doubled since 1970, consumption has remained about the same. By using natural gas in their homes and businesses, insulating their windows and doors, and using energy-efficient appliances, natural gas customers are using about 1 percent less energy than they did in 1980—and this rate of decline has accelerated to about 2 percent annually since 2000.

For America's energy producers, environmental protection and safety are top priorities. That's why America's natural gas and oil producers have spent nearly \$200 billion during the past 20 years to develop and implement new environmental technologies aimed at keeping our air clean, our water safe, and the amount of land disturbed at an absolute minimum.

New and evolving technology is helping natural gas producers pull new resources from old, mature fields. Today, the recovery rate of an initial discovery could grow by 10 times in volume through the use of state-of-the-art technology. Consequently, the United States has been able to fully replace the natural gas reserves it has produced for 10 of the last 11 years. And these additions have kept pace even though less than half as many wells are drilled today as compared to the 1980s.

The technological advances made in natural gas extraction have enabled America's producers to:

- **Leave smaller footprints and move less land.** The average well site footprint today is 30 percent smaller than it was in 1970, and through the use of extended reach drilling, an average well can now access more than 60 times more subsurface area than was possible previously.
- **Drill fewer wells to add the same reserves.** Today, the U.S. industry adds two times as much natural gas and oil to the nation's reserve base per well than in the 1980s.
- **Reduce air pollution.** Greater efficiency and improved technologies mean there is less energy consumption per unit of natural gas produced and, as a result, less air pollution.



For homeowners, making the switch to natural gas appliances not only offers energy-saving benefits but also ensures a comfortable and responsible home. Natural gas is the cleanest burning fuel the earth produces, and it offers safe, reliable, affordable and efficient energy to meet America's energy needs today and into the future.

End-Use

The direct use of natural gas in a residential or commercial

capacity, such as space heating, water heating, cooking and clothes drying can increase the productivity of available energy supplies, reduce overall energy costs and reduce emissions. The direct use of natural gas can result in a 60 percent energy reduction when compared to electricity.

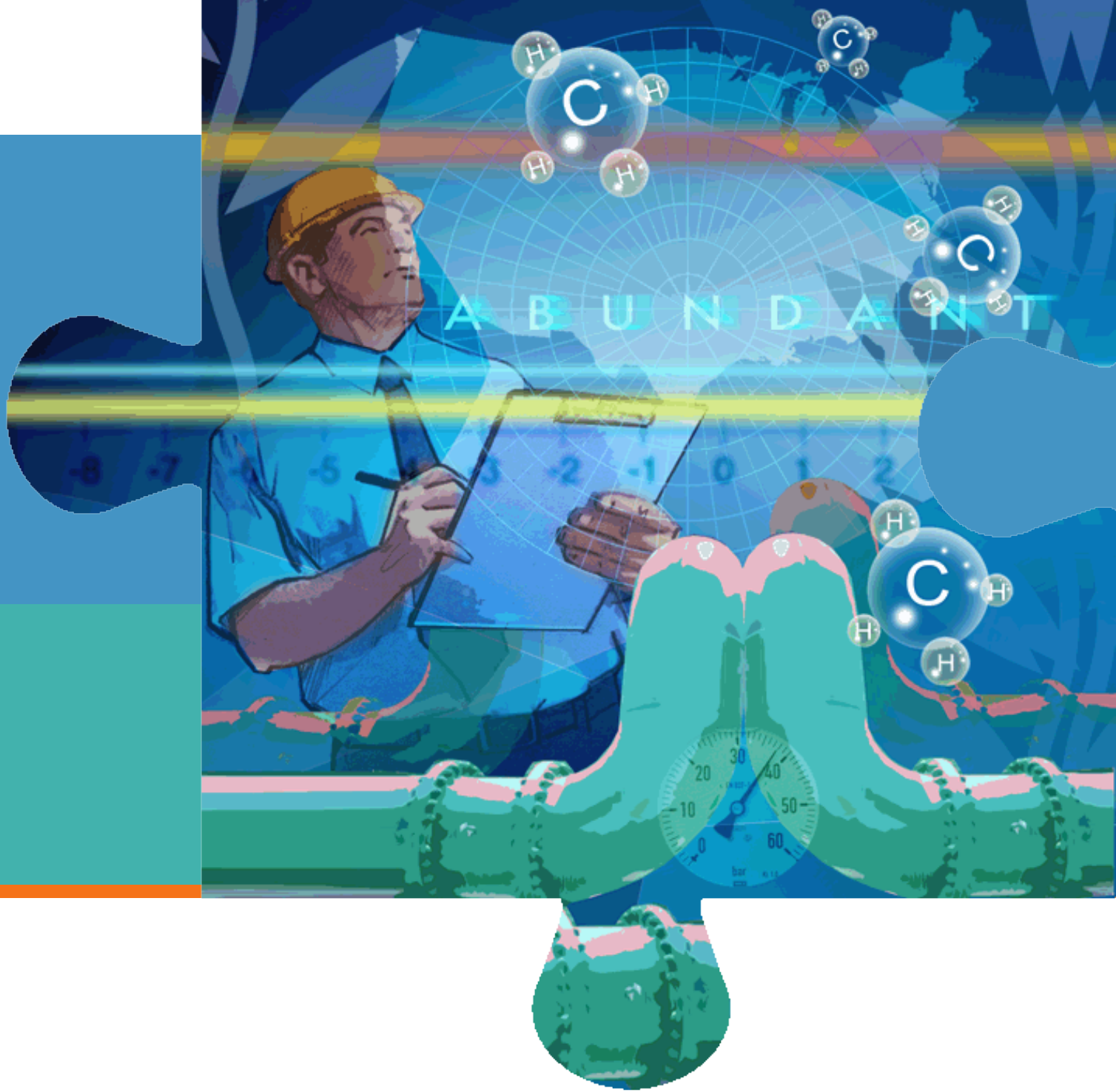
And natural gas appliances are an affordable choice. For example, natural gas water heaters have lower average energy costs than electric or fuel oil models. Over the nine-year life span of a water heater, using natural gas could save families more than \$2,000.

Combined-heat-and-power generation systems using natural gas, sometimes referred to as cogeneration, have provided heat and electrical energy efficiently at commercial and industrial sites for many years. Today, these technologies are becoming available to homeowners through advanced appliances. They not only provide back up for intermittent renewable generation but also can provide important regulation services necessary to ensure the stability and reliability of an increasingly “smart” energy grid.

Another rapidly growing end-use for natural gas is the natural gas vehicle. Right now there are thousands of delivery trucks, port vehicles, airport vehicles, transit buses, school buses, trash trucks, shuttle vans and other urban-based vehicles operating around the country solely on clean natural gas. Exhaust emissions from a typical natural gas vehicle are much lower than those from gasoline-powered vehicles. Specifically, natural gas vehicles can reduce exhaust emissions of CO₂ by 30 percent in comparison. Natural gas is the cleanest burning alternative transportation fuel commercially available today.

New technology has allowed natural gas to play an increasingly important role in the clean generation of electricity. Natural gas-fired generation now provides more than 20 percent of America’s clean electricity production and could produce much more clean energy as the nation moves forward with climate legislation.

This wide array of end-use applications for natural gas illustrates how natural gas is the fuel of the future for America. By using natural gas in our homes, businesses and vehicles, our country can collectively save money, reduce emissions and achieve greater energy security.

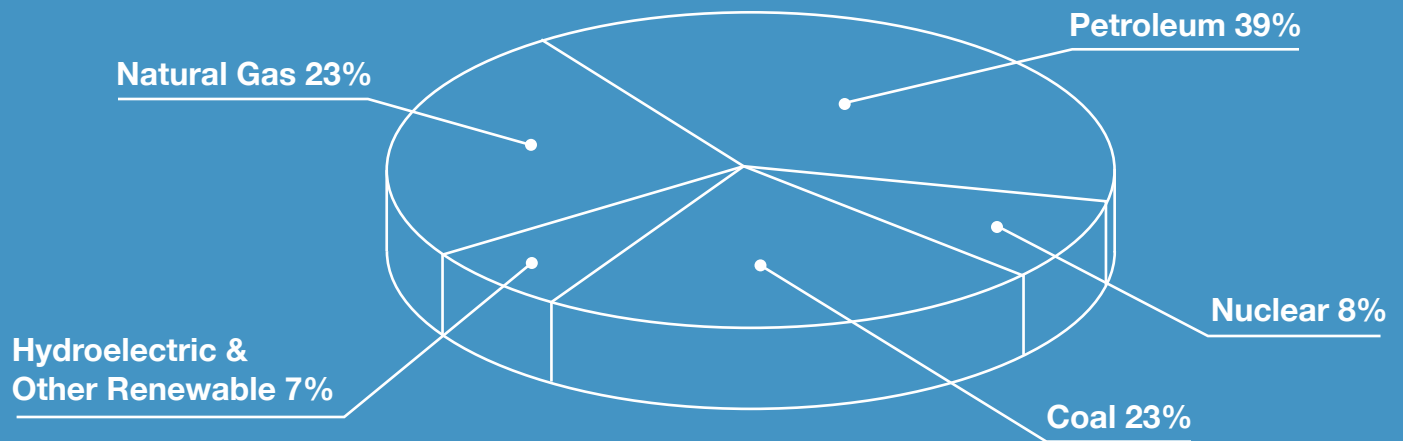


Supply

Will natural gas supply be sufficient to satisfy future demand?

The answer is yes, based on the abundance and diversity of the natural gas resource base, as well as the ability of gas to deliver “now.” There is no question that the natural gas resource base is capable of meeting existing and new market demands. Recognizing the abundance of the resource, however, is not sufficient – there must also be access to the resource.

What Makes America Run?



**Natural gas is now.
The technologies are
here today to find,
develop and consume
low-carbon natural gas
efficiently, economically
and to the benefit of
the consumer and the
environment.**

The outlook for natural gas supply is very positive given the development of new natural gas shale plays and offshore resources, the potential for pipeline natural gas from the arctic, liquefied natural gas, underground and aboveground storage and other pipeline infrastructure.

It is absolutely critical that national energy policies emphasize supply diversity for natural gas. Domestic natural gas supply must not be held hostage to a belief that one supply source will cure all requirements for the gas supply future.

Domestic natural gas reserves and estimates of undiscovered resources have grown significantly, in great part due to the emergence of technologies that unlock newly discovered reserves such as natural gas from shale. There have been a number of recent studies pointing to the magnitude of America's natural gas resource base, indicating that there are more than 100 years of supply.

And there are staggering quantities of natural gas in and around the United States that we do not take into account today, including natural gas that is frozen, under pressure in the waters of the U.S. Outer Continental Shelf (OCS) and beneath permafrost in Alaska and northern Canada. When you include frozen natural gas in the supply outlook, the numbers are astounding. One supply estimate of this gas is 200,000 trillion cubic feet - close to 9,000 years of supply at current U.S. consumption levels.

Production from key onshore and offshore natural gas resource areas can be part of a viable long-term domestic energy policy, but significant economic and policy hurdles exist that may impede efficient development. Uneven public policy decisions that restrict access to public lands slow development of these resources.

Today, 83 percent of the natural gas used in the U.S. is from American wells, and about 15 percent is from Canada. Did you know that, according to the Energy Information Administration, 98 percent of U.S. net natural gas supply in 2030 could be from domestic sources? To get there, however, Congress will need to open more federal lands for exploration and development.



Transmission

The pipeline transmission system, the “interstate highway” for natural gas, consists of 220,000 miles of high-strength steel pipe 20 inches to 42 inches in diameter. It moves huge amounts of natural gas thousands of miles from producing regions to local natural gas utilities and sometimes directly to large users of natural gas. Compressor stations every 75 to 100 miles boost the pressure that is lost through the friction of gas moving through steel pipe.



Natural gas pipelines, which transport approximately 25 percent

of the energy consumed in the United States, are an essential part of the nation’s infrastructure. Other than an occasional pipeline marker along a roadway, evidence of these transport systems is largely unseen.

Public safety is the pipeline industry’s number one priority. The industry has a proven record of providing reliable, continuous delivery of natural gas. The men and women working at the companies that build and operate the North American interstate natural gas pipeline system have created the safest mode of energy transportation in the world today and are committed to maintaining that record.

Together, natural gas pipeline and utility companies spend approximately \$7 billion per year to ensure that natural gas is delivered safely and reliably.

Natural gas pipeline professionals work closely with the U.S. Department of Transportation (DOT). DOT’s Pipeline and Hazardous Materials Safety Administration’s Office of Pipeline Safety (PHMSA) is the primary safety regulator of the energy pipeline system. PHMSA’s regulations address the entire life cycle of pipelines, providing multiple layers of protection for the public.

The safety performance of pipeline systems is a matter of public record and this information is constantly analyzed and used to improve performance safety.

Infrastructure expansion goes hand-in-hand with supply development. This includes pipelines, storage and liquid natural gas terminals. The United States is not “done” when it comes to natural gas infrastructure build-out. In fact, we are currently experiencing one of the largest pipeline construction booms in U.S. history. Industry members have invested \$51 billion this decade to maintain and expand the U.S. natural gas transmission pipeline system, including the construction of more than 10,800 miles of new, high capacity interstate pipelines. In contrast, during the same period of time, just over 1,000 miles of new high voltage interstate electricity transmission lines were constructed.

A predictable regulatory process is a fundamental requirement for building capital-intensive infrastructure projects. With the help of sound government policies, interstate natural gas transmission pipeline companies can continue to deliver natural gas to communities safely and reliably.



Exploration & Production

How We Explore and Produce Natural Gas

LOCATING NATURAL GAS RESOURCES

Searching for natural gas supplies historically has been a risky and costly business. The cost to develop a single natural gas well on land can cost several million dollars. In the deep offshore waters, that number can rise into the hundreds of millions for a single well. But through new technologies, natural gas producers are better able to identify natural

gas formations far beneath the ground. The result: fewer wells need to be drilled to find the target. That's good for the environment and for business.

Today, the natural gas industry is one of the largest users of supercomputers in the world. Advancements include 3-D seismic and 4-D time lapse visualization, remote sensing, satellite/earth imaging systems, logging and interpretation technologies (looking at tests of the earth's crust) and more.

In 1988, the success rate for finding hydrocarbons in the ground was about 25 percent. Today, about 65 percent of the wells drilled find American energy supplies.

DRILLING AND PRODUCTION

Techniques such as horizontal drilling and hydraulic fracturing have also made finding and producing natural gas more efficient and successful. Through horizontal drilling, the drill bit can navigate multi-directionally underneath the ground to find accumulations of natural gas. Using this technique, natural gas producers can find supplies from miles away— thus protecting the environment. Hydraulic fracturing is an innovative technique that involves pumping fluids or water into the wellbore with enough pressure to create fractures in the rock formation thousands of feet below the surface. Through these fractures, natural gas moves into the wellbore and up to the surface. Fracturing has been around for more than half a century and has been used to extract natural gas safely from 1 million wells across the country.

Because of these advancements, America has seen a large boost in natural gas production between 2007 and 2008, due primarily to the increase in new, active shale plays of natural gas across the country.

There are approximately 22 shale basins located onshore in more than 20 states in the United States. The natural gas produced from the "tight" rock formations, shales and coal seams is responsible for more than 45 percent of U.S. natural gas production.

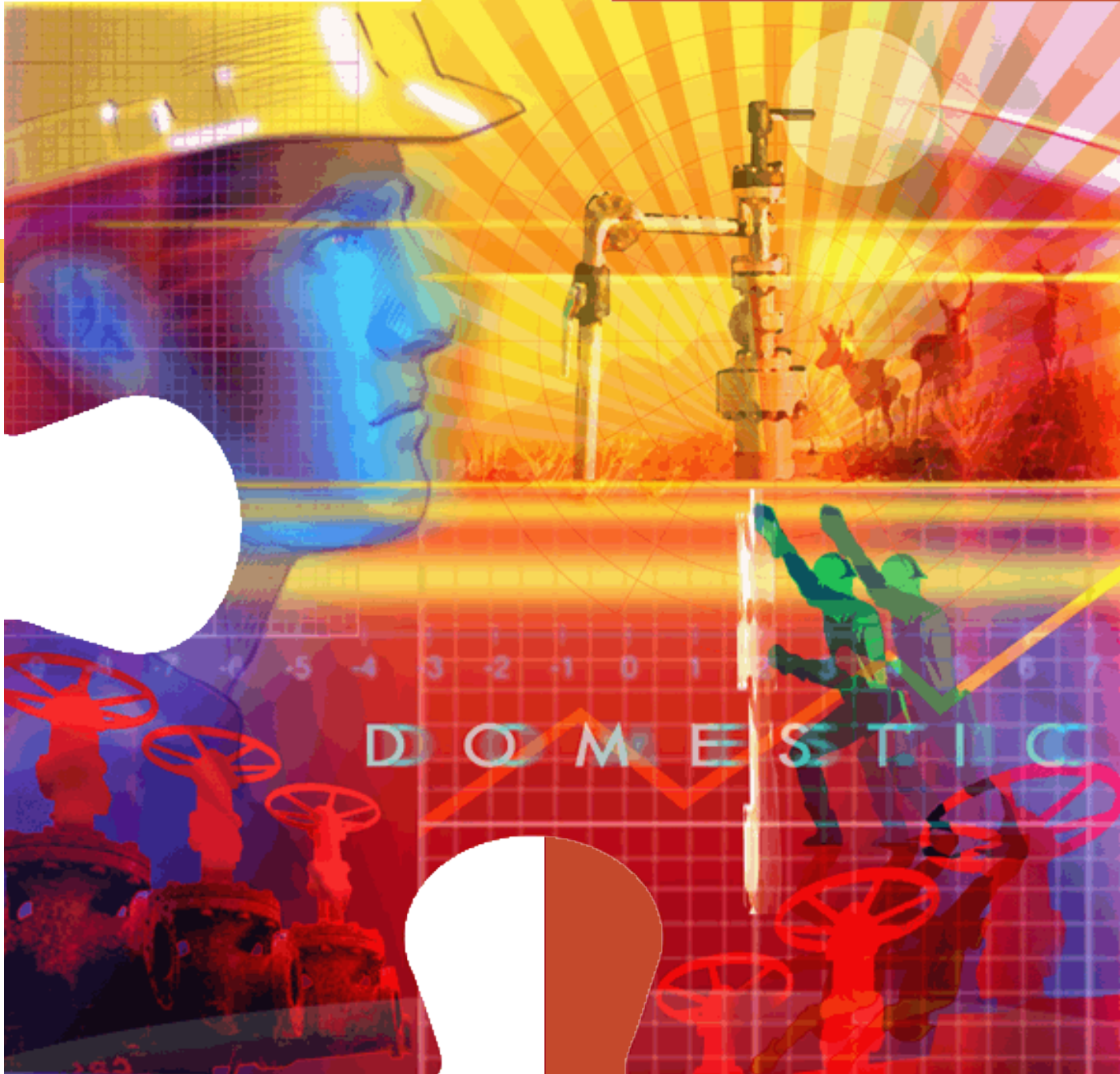
New technology such as lighter drilling rigs and improved drillbits have resulted in lower waste volume, enhanced well control, less time on site, fewer wells, smaller footprints, reduced fuel use and emissions and protection of the environment.

PRODUCTION DURATION

From the time the pad preparation begins for a single well, the entire process of setting up the rig, drilling, fracture stimulating ("fracing") and installing operational equipment takes two to eight weeks (this period varies from well to well, depending on drilling depth, location, formation and numerous other variables associated with exploration and production). During the approximately three weeks of drilling, operations run continuously 24 hours a day until completed. Fracing may take three or four additional days and is usually restricted to daylight hours.

MORE NATURAL GAS WILL BENEFIT AMERICAN CONSUMERS

Clean-burning natural gas is found on America's federally owned land, both onshore and offshore in the OCS. The OCS supplies 14 percent of America's natural gas. And in FY2008, the Minerals Management Service estimated that the U.S. Treasury received \$6.4 billion from federal offshore and onshore natural gas royalties. Unfortunately, vast resources of natural gas located offshore and onshore in the Intermountain West remain off-limits. The potential resources in the Intermountain West alone could heat 50 million homes for the next 60 years.



Did you know that royalties and revenues from energy production are often the second largest source of revenue for the federal government, second only to income taxes? In fact, \$17.3 billion was dispensed to the U.S. Treasury and \$2.59 billion went to 35 states as a part of their federal revenue sharing program in 2008.

Jobs & the Economy

When looking at the economic impact of natural gas, it is important to note that there are roughly 4 million Americans employed either directly or indirectly by the natural gas industry. Natural gas development added nearly \$400 billion to the U.S. economy in 2008.

When most people think of natural gas, they think of

it as America's most popular home-heating fuel. But it is also a major contributor to America's economic well-being. Natural gas is critical to sustaining the American economy because it is efficient, clean burning and found in abundance throughout North America.

Natural gas comprises almost one-fourth of all energy used in the United States and is directly linked to jobs and economic health. It is the backbone of American manufacturing; it is used to make steel, glass, chemicals, textiles, automobiles, food and many other products.

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These well-paying jobs also help employ other Americans in a variety of businesses—including automobile manufacturing, housing construction, retail sales and more. According to data provided by the Department of Commerce's Bureau of Economic Analysis, every \$1 million of revenue generated by natural gas utilities increases national economic output by \$2.66 million, employee earnings by \$450,000 and employment by 14 workers. Pull quote- Did you know that royalties and revenues from energy production are often the second largest source of revenue for the federal government, second only to income taxes? In fact, \$17.3 billion was dispensed to the U.S. Treasury and \$2.59 billion went to 35 states as a part of their federal revenue sharing program in 2008.

A 2008 study conducted by ICF International reported that America's vast domestic natural gas and oil resources could generate more than \$1.7 trillion in government revenue, create an additional 160,000 new jobs and enhance the nation's energy security by significantly boosting domestic production.

The increased use of natural gas could help America to achieve greater energy efficiency and energy independence, and create and retain jobs, all while making an immediate positive impact on the environment. Natural gas is essential to America's economic future. That is why it is important that Congress works to ensure that more natural gas is available now and in the future... it's in their hands.

Four Associations, One Mission: Natural Gas

The Natural Gas Council is comprised of four associations which represent the natural gas industry—from the burner tip to the wellhead:

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The American Gas Association, founded in 1918, represents 202 local energy companies that deliver clean natural gas throughout the United States. There are more than 70 million residential, commercial and industrial natural gas customers in the U.S., of which almost 93 percent — more than 65 million customers — receive their gas from AGA members. Today, natural gas meets almost one-fourth of the United States' energy needs.

AGA (202) 824-7000, www.aga.org



The Interstate Natural Gas Association of America (INGAA), founded in 1944, represents the interstate and interprovincial natural gas pipeline companies of North America, and speaks for the companies that own and operate those lines.

INGAA (202) 216-5900, www.ingaa.org



The Independent Petroleum Association of America (IPAA), founded in 1929, represents the thousands of independent oil and natural gas producers and service companies across the United States. Independent producers develop 90 percent of domestic oil and gas wells, produce 68 percent of domestic oil and produce 82 percent of domestic natural gas.

IPAA (202) 857-4722, www.ipaa.org



The Natural Gas Supply Association (NGSA), founded in 1965, represents major integrated and large independent companies which explore for, drill and supply approximately one-third of America's natural gas. Some of NGSA's members are also members of IPAA.

NGSA (202) 326-9300, www.ngsa.org



