

Energy
and the
Community



2013

Benefits *for*
Everyone



HARTENERGY

HOME GROWN

A revolution in energy supply is sweeping across America. It's exciting for U.S. consumers, and its changes are rippling far beyond our borders. Some now say that by 2020 the U.S. could be the No. 1 oil and gas producer in the world.

What is going on, and what does it mean for you and your family? The benefits are many, from abundant and secure energy supplies to lower costs for heating and cooling your home to the creation of many new jobs.

This special report explains how U.S. companies discovered these new energy supplies, and what these supplies mean to the overall economy.

Importantly, we want to demonstrate that development can be done in harmony with the environment.

Energy companies are eager to do their part and to do it safely. Read on to learn about the challenges and solutions.

We're all in this together, so let's make sense of it, keep the lines of communication open, and work together to create the kind of future we all want: safe, clean and fueled with plenty of domestically produced energy.



—**Leslie Haines**
Editor-in-chief

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Energy and the Community

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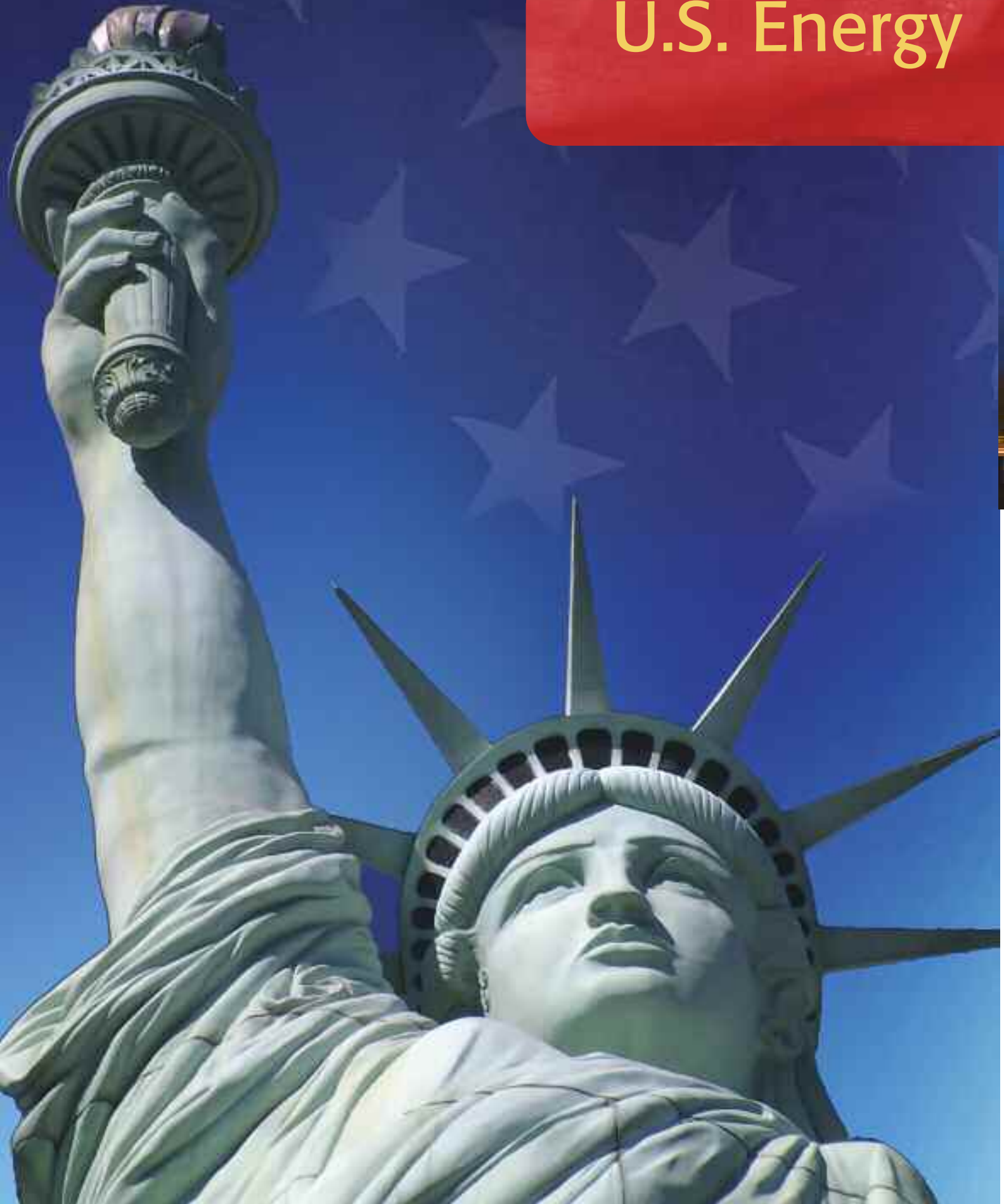


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U.S. Energy



Self-Sufficiency Is Fast-Becoming a Reality



New techniques have led to more domestic oil and natural gas production than was ever thought possible. Today, the U.S. holds the promise of energy self-sufficiency.

For generations of Americans, “energy independence” has seemed unachievable. And despite evidence of national security and economic benefits to be gained from reducing our reliance on imported oil, there seemed to be no solution. The U.S. had plentiful oil and natural gas resources remaining, but they were trapped in “unconventional” formations, and producers didn’t have the technology to get them out of the ground cost-effectively.

Today, that situation has changed dramatically.

In just the past five years, horizontal drilling and hydraulic fracturing have allowed development of oil and natural gas from shales and other unconventional formations in the U.S. that were previously considered inaccessible. As a result, there is a new energy outlook for the U.S. In combination with other energy sources and efficiencies, this emerging supply of oil and natural gas can meet the country’s needs for years to come.

The world is taking notes of the strides the U.S. is making toward energy self-sufficiency. In November 2012, the International Energy Agency (IEA) made a stunning prediction: the U.S. could pass Saudi Arabia as the world’s leading producer of oil by 2020. The U.S. is already far and away the

world’s largest producer of natural gas, which is widely recognized for its environmental benefits.

In September 2012, U.S. crude oil production averaged almost 6.5 million barrels per day—the highest volume in nearly 15 years, according to the U.S. Energy Information Administration (EIA). Since September 2011, U.S. production has increased by more than 900,000 barrels per day. The states with the largest increases are Texas and North Dakota.

From September 2011 to September 2012, Texas production increased by more than 500,000 barrels per day, and North Dakota production rose by more than 250,000 barrels per day, according to the EIA. Smaller-volume producing states, such as Oklahoma, New Mexico, Wyoming, Colorado, and Utah, are also contributing more domestic oil production.

Natural gas production in the U.S. has also soared. The EIA forecasts that U.S. natural gas production will rise about 44% from 2011 to 2040. Almost all of this increase in domestic natural gas production is due to production from unconventional shales, using horizontal drilling with hydraulic fracturing.

Becoming a global leader

How can this evolution in domestic energy production help U.S. social, economic and national security initiatives? Reducing the costs of imported

oil is one way. According to U.S. Census Bureau data, the combined cost to the U.S. of importing crude over the past five years nearly equals that of the preceding two decades, notes Greg Haas, a Hart Energy analyst.

In its recent report, the IEA notes that as the U.S. becomes the largest global oil producer in about seven years, U.S. oil imports will fall, “to the extent that North America becomes a net oil exporter around 2030. The United States, which currently imports around 20% of its total energy needs, becomes all but self-sufficient in net terms—a dramatic reversal of the trend seen in most other energy-importing countries.”

While there is much discussion of energy independence for the U.S., the IEA says that term can be misleading. A better term is “self-sufficiency.” As the IEA notes, “No country is an energy ‘island’ and the interactions between different fuels, markets and prices are intensifying.”

How is the U.S. role in oil and gas supply changing in terms of its position globally? The EIA reports that U.S. oil supply grew almost 12% from 2009 to 2011. As of 2011, the U.S. was third in oil production worldwide, behind global leader Saudi Arabia, and Russia.

The U.S.’ closest neighbor and trading partner is benefiting from the same technologies in oil and gas production. Canada is now the leading supplier of crude oil to the U.S. “The United States is import-

ing record amounts of crude oil from Canada, even though the total amount of crude oil America buys from foreign suppliers is falling. As a result, the share of Canadian oil as a percentage of total U.S. oil imports during January–August 2012 increased to 28% compared to 25% in 2011,” the EIA said in a recent report.

North America—the U.S., Canada, and Mexico—provides a little less than a fifth of the world’s oil. The Mideast all together produces a little less than a third of world oil supply.

Also significant, this rising domestic production can be sustained.

In summer 2010, the EIA said the U.S. has 25.2 billion barrels of proven oil reserves, an increase of almost 13% from the 2009 estimate. For natural gas, the increase in reserves was similar: an expansion of almost 12% to 317.6 trillion cubic feet (Tcf). Because the review of reserves involves rigorous evaluation of data, the estimates take more than a year to be made final. The 2011 numbers will be released around August 2013.

It is also important to note that the government reserve numbers are conservative. Beyond proven amounts or reserves, oil and gas companies have larger volumes of probable reserves and still higher levels of possible reserves that are not taken into account.

So, for all the rapidly increasing production, domestic oil and gas reserves are increasing even faster. On the oil side, production decreased reserves by 2 billion barrels, while discoveries, revisions, and adjustments increased reserves by 4.9



Many communities in the U.S. have benefited from the oil and gas industry’s involvement in programs such as food drives.

U.S. Crude Oil Imports



U.S. oil import forecast up to 2015 from Simmons & Co. International; low, medium, and high range scenarios.

billion barrels, for a net increase in reserves of 2.9 billion barrels as of 2010.

In natural gas, the story was the same. Production reduced reserves by 23.2 Tcf, while discoveries, revisions, and adjustments added 57.1 Tcf, for a net increase in reserves of 33.8 Tcf. That means that as fast as increased production is pulling energy out of the ground, even more is being found. Observers believe the U.S. has a sufficient natural gas resource to meet demand for 100 years or more.

According to analysis by ICF International commissioned by American Clean Skies Foundation, “the current recoverable gas resource base represents more than 150 years of U.S. gas demand at current levels.”

Commodity prices’ role in self-sufficiency

Oil and gas prices will play a role in the U.S. path to self-sufficiency. When unconventional resource development started, it was concentrated in natural gas. The resulting production growth has been staggering. Production from the Marcellus shale, under Pennsylvania and neighboring states, blossomed from just 2 billion cubic feet (Bcf) in 2008 to 476 Bcf in 2010. But as a result of greater supplies of gas, the price for the commodity tumbled. Then producers switched their efforts to finding more oil, because its price was higher.

There is still a great deal of natural gas being produced from existing wells, as well as gas that is pro-

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EDUCATION, MENTORING, VETERANS SUPPORT

Abrahams Group is a woman-owned firm that incorporates social science expertise with effective communications strategies to support National Resiliency. In the aftermath of Hurricane Katrina, our firm was chosen by NOAA/OFCM to conduct an information flow review to identify gaps in hazard communications in a coastal city. From the outgrowth of that research and the knowledge that effective communication is the first line of defense against chaos or crisis, the Abrahams Communication Model© was created.

Our team successfully developed actionable messages for the public and forged cross collaborations using social science research to build community partnerships to mitigate loss and save life. To date, this successful model is being used in Mobile, Alabama, as part of a disaster plan evacuation tool for the elderly.

We exhibit corporate responsibility by fostering relationship and capacity building with diverse populations and support education programs. Our company CEO has developed a mentoring class entitled “Urban Science: Here and Now” for students interested in STEM fields (science, technology, engineering, math) at the Manchester Academic Charter School in Pittsburgh, Pennsylvania. As stakeholders in the Marcellus shale footprint, one of our goals is to educate elementary student leaders about the potential benefits derived from domestic energy production.

In March of 2012, Abrahams Group invited Dr. Warren Washington, history maker and 2010 National Medal of Science award winner, to Pittsburgh. During his two-day visit he was a distinguished presenter at both Carnegie Mellon University and to the 30th Annual Charles Drew Science Fair students and the Neighborhood Academy, an independent, faith-based college-prep high school designed to help urban students become first-generation college students.

We also value the importance of the American Jobs Act & Civic Leader Engagement through two worthwhile endeavors:

Veterans Opportunity Network, a Wounded Warrior SDVOB enterprise that sponsors shale industry events and highlights innovation in the unconventional gas industry that is the driving force and clear path to employment opportunities for our American heroes. Another initiative is a Veterans Affairs and Department of Labor program to provide eligible veterans with education benefits.

National Manufacturing Reshoring Initiative. We are an advocate for Long-Stanton Manufacturing Co., an Ohio-based seven-generation family-owned metal stamping and metal fabrication company. We support their goal to help create jobs in the Utica shale to help balance U.S. state and local budgets, motivate job seekers to enter into the skilled manufacturing force and strengthen the defense industrial base in the Northeast shale footprint. AbrahamsGroup.com

duced in association with oil, so gas supplies have remained elevated, and prices have recovered only slowly. Relative to gas, oil prices in the past couple of years have remained higher. Oil is a global commodity. It moves in response to growing demand in the developing world, but also in reaction to geopolitical developments, especially in the Middle East.

In contrast, gas is primarily a regional market. The U.S., Canada and Mexico are linked by pipelines, but there is as yet no meaningful export of gas from the continental U.S. The state of Alaska exports to Asia, but is not connected to Canada or the U.S.

Canada is building a liquefied natural gas export terminal (natural gas must be liquefied in order to be transported on tankers) on its Pacific Coast, and several export terminals are planned in the U.S., but exporting gas, or the possibility of one day exporting oil, has met with opposition.

Observers believe the U.S. has a sufficient natural gas resource to meet demand for 100 years or more.

A recent report from the EIA, however, found that liquefied natural gas exports would not hurt the U.S. economy overall. And the ICF analysis, which expects large volumes of exports to begin

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A LETTER TO NEIGHBORS

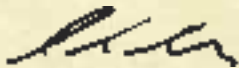
Dear Neighbor,



As a young college graduate I was fortunate enough to get a one-year Junior Geologist position with two elderly Houston wildcatters, Clint Lueth and Stan Pyndus. That was the beginning of a love affair with an industry that has lasted 30 years and continues to grow. The oil and gas industry creates value every day. It reduces U.S. involvement in foreign conflict and supports family agriculture, via private mineral royalties, to the tune of 75 Willie Nelson Farm Aid events.

At Drillinginfo we have a young demographic. Like me, they came to the industry with their eyes closed. Being able to work with our clients, among the most gracious folks on Earth, our employees come to appreciate our wonderful industry and the benefits it provides to the world in general. They combine this knowledge with the beautiful altruism of the young, and involve Drillinginfo in many charitable events within the communities where we live and work. Food pantries, Habitat for Humanity, educational outreach, historical preservation, youth sports, and fighting diseases are just a few of the community programs in which Drillinginfo and its employees participate. And we are not alone. The U.S. oil and gas industry has a long history of giving back. The level of charitable giving by this industry is unsurpassed by any other.

From winning a world war, to building hospitals and universities, to creating and supporting charities of all kinds, to the equally important but more mundane task of providing high-paying and sustainable employment all along the educational spectrum, the oil and gas industry carries far more than its own weight while providing the basic building block of civilization...cheap energy for the planet. Drillinginfo is proud to be a part of this great industry. DrillingInfo.com



Allen Gilmer
CEO and Co-founder, Drillinginfo

around 2016, notes that “these are capital-intensive projects that generate large direct and indirect impacts on the economy.”

As of Thanksgiving 2012, the domestic price for natural gas was \$3.83 per thousand cubic feet (Mcf). That is close to the break-even level for many gas producers, but at that price very little additional drilling will be economical. At about \$6 or \$6.50 per Mcf just about all of the gas fields in the U.S. are viable. So supply could increase if demand grows to where the current glut of natural gas is reduced.

At the same time, the price of West Texas Intermediate crude oil, the benchmark for North America, was about \$87 per barrel. At that level, most unconventional oil fields in North America are profitable, so new wells are continuing to be drilled.

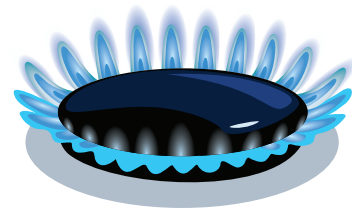
Demand for oil and natural gas also waxes and wanes as prices fluctuate. Still, U.S. production of both fuels is growing.

Today, U.S. energy self-sufficiency is not only likely—it is imminent. With the resource having been established, the focus is turned to prudent ways to manage this domestic oil and natural gas resource—while preserving the environment, ensuring national security, bolstering the economy, and opening new ways to manage U.S. energy needs far into the future. ■

—Gregory DL Morris



20-year Low
in energy carbon-dioxide-related emissions reported by EIA in late 2012; most significant cause is low natural gas prices prompting greater use of gas in electricity generation



150 Years
period of U.S. natural gas demand that can be met by current recoverable resource base

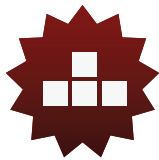
Source: ICF International Tech Effect study, for American Clean Skies Foundation; IHS Global Insight; America's Natural Gas Alliance (ANGA)





America Rallies Behind Local OIL PRODUCTION

Energy independence is often a hot topic in the United States, but where does our country actually stand these days in terms of oil production?



The Basics

The last year the U.S. was truly energy independent was

1952.^[1]

During his 2012 State of the Union address, President Barack Obama said the U.S. relied less on foreign oil than it has in any of the last 16 years.

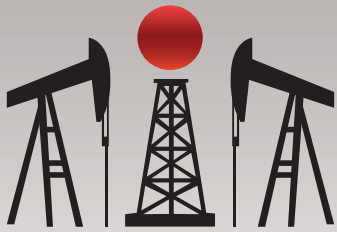


This change could contribute to the U.S. becoming the top energy producer in the world by 2020. ^[3]

Domestic production doesn't yet offset the large volume of imported oil, but net imports of energy have been a declining share of the total energy demand in the U.S. ^[4]

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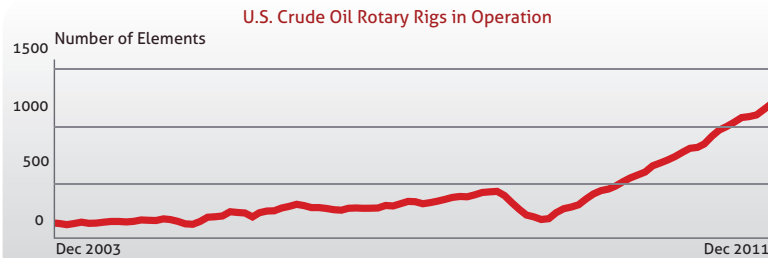


793 to 1,208
domestic rigs in 2012. ^[6]



Reversing the Trend

The number of operating crude oil rotary rigs has steadily *increased* over the last 9 years. ^[5]

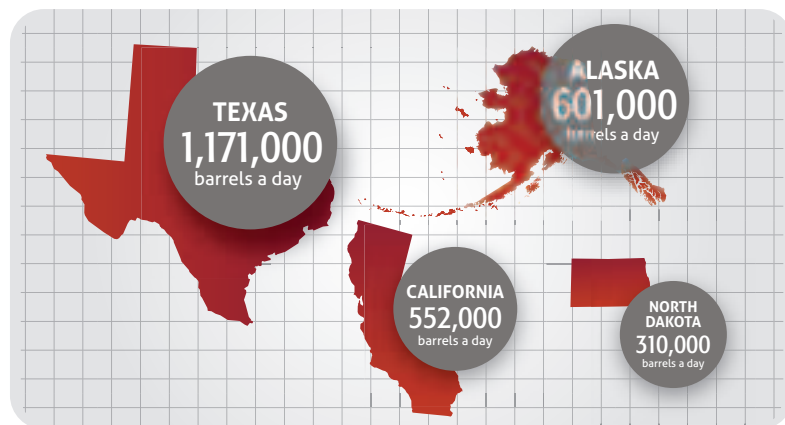


Oil activity has driven an increase of activity in the unconventional space, particularly the horizontal drilling in the Permian Basin. ^[8]



Producers by State

The United States may be producing more oil recently, but which states have generally contributed the most oil? In 2010, the top 4 states that produced the most crude oil were: ^[9]



Experts say the U.S. might produce more than

2 billion



barrels of domestic oil this year. ^[7]

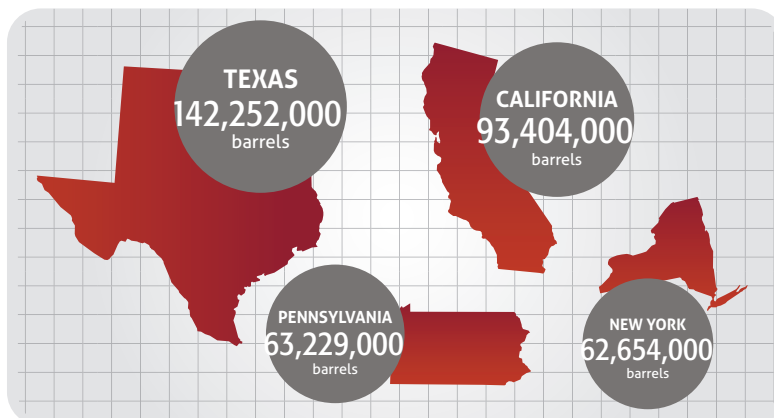
Conclusion

As experts discuss what they think is in store for the future, it's clear that trends are being reversed in domestic oil production.



Consumers by State

Which states **consume** the most oil in the country? In 2010, the top 4 states that consumed the most distillate fuel oil were: ^[10]







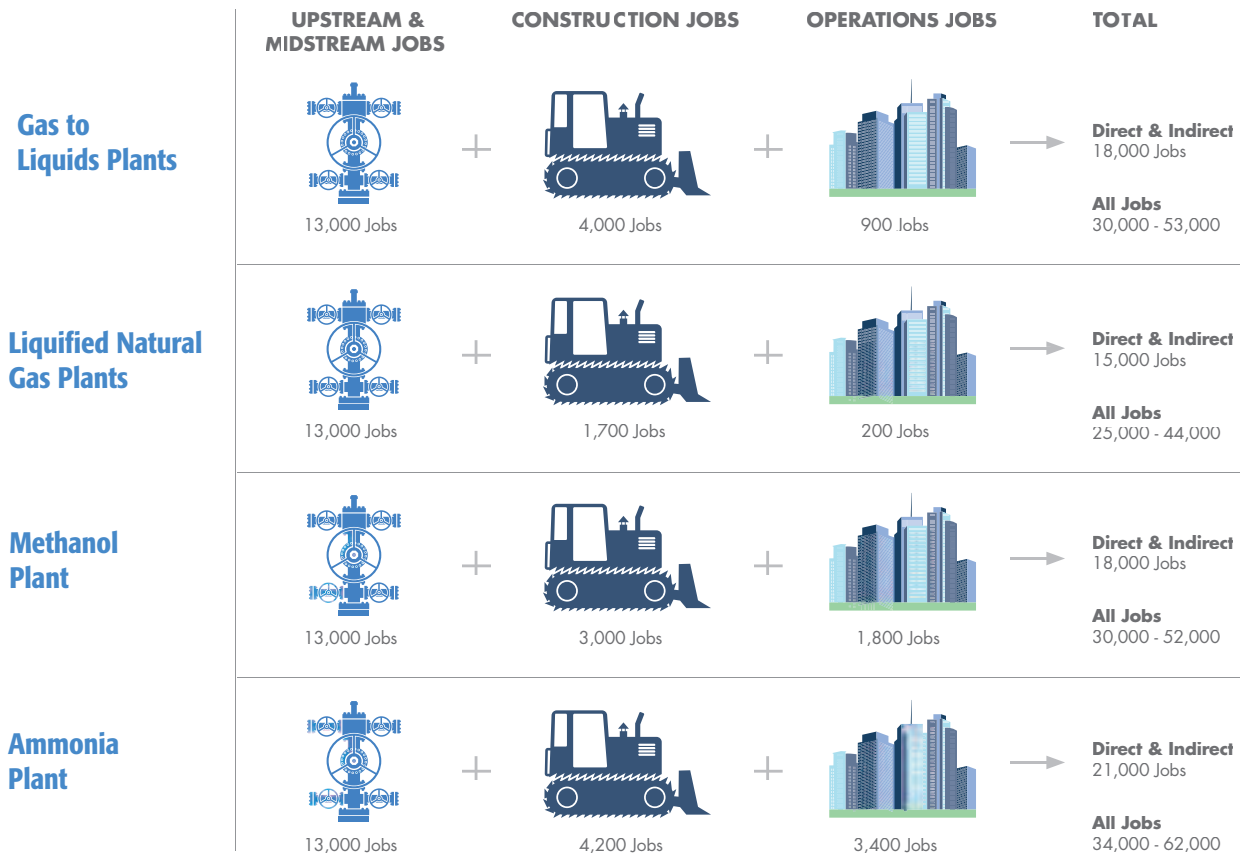
A Manufacturing *and* Jobs Renaissance

The chemicals, metals and equipment industries are seeing billions in investment in response to the oil and natural gas boom. Environmental gains are being made in tandem, as the U.S. energy growth story gains steam.

The U.S. national employment picture can be summed up as a tale of two cities. Minot, North Dakota, population 43,000, sits on the edge of the Bakken shale, a formation of dense rock that has recently vaulted the state into second place in U.S. oil production, just behind Texas. Thanks to soaring demand for both skilled and unskilled labor in the oilfields and in services throughout the region, the unemployment rate in Minot, as of September 2012, was 2.2%, according to the U.S. Bureau of Labor Statistics.

Binghamton, New York, population 47,000, sits on the edge of the Marcellus shale, a formation of dense rock that has been on the leading edge of an oil and gas boom in Pennsylvania and neighboring states to the south and west. New York State has not issued permits to the oil and gas companies seeking to produce from the Marcellus shale, as environmental concerns continue to be debated. The unemployment rate in Binghamton in September 2012 was 9%.

Domestic Job Impacts of Alternative Uses of Natural Gas (per billion cubic feet per day of production)



Source: ICF Foundation/American Clean Skies Foundation

The story is the same all over the country as domestic oil and gas companies develop unconventional resources. Using techniques perfected in recent years, companies can produce from the rock where oil and gas were formed, rather than just hunting for reservoirs where the hydrocarbons have migrated and been trapped.

The resource boom has reversed a downward trend in domestic production and manufacturing feedstocks, while shoring up the economics of manufacturing. Just as important, it has been a job-creating dynamo for the U.S. economy. And, it has led to a shift in the North American economy overall.

Pete Stark, senior research director at global energy analysis firm IHS, says, “the recent headlines have all been about how the U.S. could overtake Saudi Arabia as the top producer of oil. But the real story is not comparisons to Saudi, it is the total

fundamental and strategic change in the domestic supply and industrial base.”

Stark calculates that each additional million barrels of oil or equivalent that the U.S. produces is worth \$30 billion a year in gross domestic product (GDP). “That is without the magnifiers,” he adds. “Overall we are looking at the potential boost to the economy of \$300- to \$400 billion a year.”

A global shift

This is not just a national or North American shift, but a global one as well. For example, there are various reasons why both heavy and light manufacturing left North America over the past several decades, but the cost of labor, raw materials and transportation were three main drivers. Behind both labor and raw material costs is the cost of energy.

Developing countries in Asia gained the advantage not just from low-cost labor, but also from low-cost raw materials. The chemicals and plastics

sector is a prime example. From toys to electronics, most of the finished consumer goods flowing in container ships east across the Pacific Ocean are made from synthetic materials.

The new reality of cheap and plentiful natural gas in North America means that it costs less to heat homes and cook food. And it means that commodity plastics, made from the components of natural gas, are also becoming less expensive and more available. In turn, lower costs of raw materials, transportation and energy can overcome some of the other costs, and can help bring manufacturing back to the U.S. and Canada.

According to the American Chemistry Council, the trade association for chemical and plastics companies, a 25% increase in the supply of ethane (one of the natural gas liquids), which is the most im-

portant raw material for plastics, is expected to generate \$16 billion in capital investments, 17,000 high-paying technical jobs in the industry, 400,000 jobs of all kinds in the general economy, and \$130 billion in total economic output.

The council also notes that “stable, competitive natural gas prices are already improving the balance of trade in U.S. manufactured goods. For example, in 2005 the price of natural gas was about \$7 per million Btu (British thermal units) and the U.S. trade deficit in basic chemicals was \$9.4 billion. In 2010, with the price of gas around \$4 per million Btu, there was a trade surplus in chemicals of \$4.6 billion.”

One of the signal moments in the U.S. manufacturing renaissance came when Methanex Corp., based in Vancouver, B.C., the world’s largest maker of methanol, announced it would dismantle two

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PROTECTING A GLOBALLY IMPORTANT BIRD AREA



In 1923, the Audubon Conservation Project established a system of island sanctuaries along the Texas Coast that has now grown to more than 13,000 acres. These sanctuaries are home to more than 20 species of colonial waterbirds, several of which are considered endangered or threatened.

Chester Island (formerly Sundown Island) is a low-lying dredge spoil island built in 1962 to provide sanctuary to colonial waterbirds, specifically to the Brown Pelicans that once called the Texas Coast home. When this

project first started, 20 breeding pairs of Brown Pelicans were brought to the coast. Today, Chester Island is home to over 2,500 breeding Pelican pairs as well as colonial water birds that nest on the island in the spring and migrants that use the island during spring and fall migrations or as a rest stop. In fact, Chester Island was declared a globally “Important Bird Area” in 2010.

In 2009, Energy XXI had been looking for an environmental project to support when the opportunity to become a corporate sponsor of Chester Island became available. Since 2010, Energy XXI employee volunteers and their families have participated in a workday to help create more habitat for nesting birds. This includes beach cleanups, tree planting, updating and working on rainwater collection systems, treating the area with fertilizer and water and repairing signs and posts.

Protecting Coastal Shorelines

The demobilization of pipelines can create a large amount of rip-rap that ends up unused and left for waste. Rip-rap is rock or other material that can be used to armor shorelines against scour, water or ice erosion. It works by absorbing the impact of waves as they shoot up the wall and fall back down. Over the past few years, Energy XXI has donated several hundred tons of rip-rap to the town of Grand Isle for controlling erosion. Energyxxi.com

huge methanol plants in Chile, and move them to Geismar, Louisiana, to take advantage of the price and availability of natural gas on the U.S. Gulf Coast. In November Methanex was granted an air permit to operate the first of the two relocated plants to be in service in 2014.

Steeling the show

The chemical industry has gotten the bulk of attention among industries that stand to gain from the shale-gas boom in North America. But the steel industry may be the sector that has already gained the most from the drive toward North American energy self-sufficiency. It has not gotten the same attention, however, in part because its relationship to the oil and gas industry is not quite as obvious.

Nevertheless, the two sectors have a close and highly reciprocal relationship. From the very start of the shale-gas and tight-oil (another type of formation that can be produced today) growth, drilling contractors began to place huge new orders for drill string, the lengths of pipe that are threaded together to actually do the drilling. Casing pipe, which is used to secure the top several hundred feet of a well, has also been in high demand. Add to that the other oilfield services equipment and drill rigs specially designed for horizontal drilling, and the immediate surge of steel demand by the oil and gas industry is clear.

Once the oil and gas is out of the ground, many miles of gathering and transmission pipe, not to mention groups of storage tanks and new processing facilities, mean the demand for steel does not stop at the wellhead. Metals increase demand for oil and gas just as hydrocarbon production increases demand for steel, aluminum and specialty metals. Aluminum smelting in particular is one of the most intensive of all heavy industries in terms of electrical demand. The two major ways of making steel are the traditional blast furnace and the electric arc furnace, which melts shredded scrap metal as a raw material, using huge amounts of electricity.

Even in the traditional blast furnace, natural gas is starting to replace metallurgical coal in some operations. Downstream from primary manufacture, gas-fired furnaces are being used to re-heat raw steel as it is processed into finished components.



A quick count of major metals projects that have been announced and can be directly related to increased demand from the oil and gas boom tallies almost two dozen initiatives worth many billions of dollars. They include two Alcoa projects, one an expansion at its Upper Burrell, Pennsylvania works, and the other a completely new facility at Lafayette, Indiana, due in service in two years.

The U.S. steel industry is benefiting from growing demand and lower fuel costs.

All the major steel makers are in action as well: U.S. Steel at two sites in Ohio; ArcelorMittal, the largest steel company in the world, at its Cleveland works; and Nucor, with a huge new facility under construction in two phases near New Orleans. Several companies have new processing plants in the works that will use electricity provided mostly from new gas-fired power plants to reduce raw ore to a concentrated form.

Following the value chain from the metal makers, heavy-equipment manufacturers are expanding to take advantage of the new supply of competitively priced raw materials. One prime example is a new Caterpillar plant at Athens, Georgia, making tractors and excavators. Even Airbus, the European aircraft company and fierce rival of U.S.-based

Boeing, is planning an aircraft manufacturing center in Mobile, Alabama.

All this new manufacturing involves billions of dollars in capital investment. But there are two other notable factors. One is that the investments are being made mostly in traditional manufacturing states, the so-called Rust Belt areas, like Ohio, Pennsylvania and Indiana. The other important factor is that many of these new operations are labor-intensive, meaning they will require many new permanent jobs.

Environmental benefits

For all the direct economic gains of the unconventional oil and gas renaissance, the one that may be the most compelling is the indirect benefit to the environment. According to a recent study by MIT, “in a carbon-constrained economy, the relative im-

portance of natural gas is likely to increase even further, as it is one of the most cost-effective means by which to maintain energy supplies while reducing carbon dioxide (CO₂) emissions. This is particularly true in the electric power sector, where, in the U.S., natural gas sets the cost benchmark against which other clean power sources must compete to remove the marginal ton of CO₂.”

The study goes on to highlight the inter-relationship of the economy and the environment. “In the U.S., a combination of demand reduction and displacement of coal-fired power by gas-fired generation is the lowest cost way to reduce CO₂ emissions by up to 50%. For more stringent CO₂ emissions reductions, further decarbonization of the energy sector will be required; but natural gas provides a cost-effective bridge to such a low-carbon future.” ■

—Gregory DL Morris

Community Partners

Reducing Environmental Impacts

GreenHunter Water, Grapevine, Texas, values our relationship with the community. Each of our water management products and services helps natural gas and oil producers reduce their impact on the environment and public infrastructure while helping to increase safety for their employees and nearby residents.

Water disposal

Starting with our state-of-the-art Class II commercial injection wells, GreenHunter Water provides upstream oil and gas companies with ensured daily capacity for salt-water disposal. Salt water is the largest by-product of unconventional resource exploration and production activities and Class II wells are the EPA's preferred means of disposal for oilfield fluids.

Reducing truck traffic

To help reduce truck traffic, GreenHunter's cradle-to-grave tracking system (RAMCAT™) and advanced logistics capabilities integrate next advanced technologies including remote monitoring, cellular and satellite communications, GPS tracking and centralized bulk storage depots with barging facilities that will allow transport of oilfield brine on navigable waterways in double-hulled barges. Our estimates show up to 60% reduction in truck road time when our barging operations are fully operational.

Water storage, recycling and reuse

The advanced technologies for shale production include horizontal drilling and hydraulic fracturing to stimulate production from previously uneconomic formations. Massive amounts of water – regularly exceeding 5 million gallons per well, are required for this process. Traditionally, this water was stored at the well pad in earthen “impoundments” or in large “tank farms.” Our next-generation modular above-ground tank system (MAG Tank™) provides oilfield operators a standardized and flexible approach to water storage that eliminates disruptive landscape “cut-and-fill” activities and reduces tank-farm-related truck traffic, congestion and emissions by up to 90%.

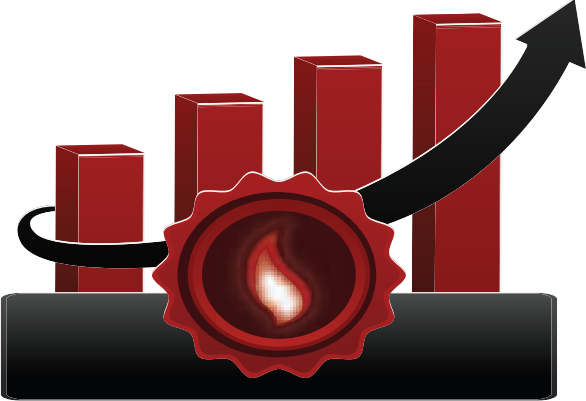
GreenHunter also helps producers recycle and reuse production brine and flowback water with our Frac-Cycle™ service that employs best-in-class filtration, mechanical and chemical clean-up programs. This service preserves scarce water resources while harvesting our abundant shale oil and gas reserves as we become energy independent. GreenHunterEnergy.com

..... WILL

NATURAL GAS

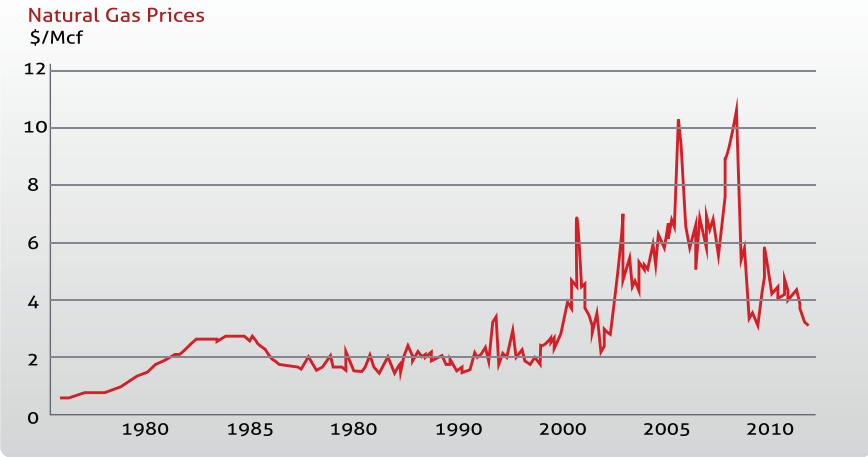
FUEL OUR FUTURE

ECONOMY?







MANUFACTURING AND PRODUCTION

Because natural gas prices are at a 10-year low, energy is inexpensive, so companies have been moving manufacturing back to the United States. [3]



- The U.S. had a gross production of about **28 trillion cubic feet (Tcf)** of natural gas in 2011. [1]
- The **U.S. surpassed Russia** as the largest gas producer in the world. [2]
- The use of **shale drilling** helped this increase in production. [1]

Because the **price of natural gas dropped**

-  The cost of **manufacturing** has gone down.
-  Thousands of **jobs** have been created.
-  **Electricity** rates have lowered.

Other means of production have benefited from this price drop.

With the boost of natural gas usage in the electric power sector, coal consumption is expected to decline. [6]

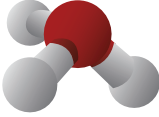
Natural gas is a **key component** in fertilizer companies' products. [4]

Their profit margins have improved. [4]



The sector's coal demand is expected to fall about **5% in 2012.**

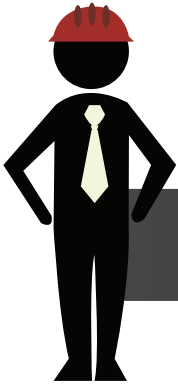
Natural gas's share of power generation in the U.S. is expected to increase to **27.1%** this year.



Natural gas is used to create anhydrous ammonia, too. [5]



JOB CREATION



In President Obama's 2012 State of the Union address, he said natural-gas development could create more than

600,000 jobs by 2020. [7]

The Marcellus play alone created 123,000 new jobs since 2009. [8]

2/3 of these jobs had an average salary of

\$77,000. 



Drilling Marcellus shale added about

\$10 billion

in value to the 2011 Pennsylvania economy. [9]



Household Benefits

25% of energy in the U.S. 

is made from natural gas. [10]

More than **50%** of U.S. households 


use natural gas for heat. [10]



Average disposable household income is expected to grow more than

\$2,000

per year by 2035. [11]

The *savings in household energy cost and lower prices* for consumer purchases have led to this *growth.* 

Conclusion

The increase of natural gas production and the accompanying lower prices can help to stimulate the economy and create jobs for Americans.



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- [3] http://www.cbsnews.com/8301-505123_162-57384014/us-recovery-fueled-by-record-low-natural-gas-prices/
- [4] <http://www.forbes.com/sites/ycharts/2012/03/15/natural-gas-glut-killing-drillers-and-enriching-fertilizer-companies/>
- [5] <http://web.extension.illinois.edu/state/newsdetail.cfm?NewsID=26510>
- [6] http://www.ugcenter.com/US-Coalbed/Power-Sectors-Coal-Consumption-Dwindles-Natural-Gas-Usage-Grows_98589
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HARTENERGY



SHALE 101

Oil and natural gas production from shales has spread across the U.S. Here are the basics.



What are shales?

Shales are fine-grained sedimentary rocks that can be rich sources of petroleum and natural gas. Over the past 10 years or so, the combination of horizontal drilling and advanced hydraulic fracturing has allowed oil and gas companies to access large volumes of shale gas and oil that were previously not economic to produce.

Shale gas and oil plays are continuous accumulations usually covering immense areas, producing from shale rock. They are unique in that they are

both source rock for conventional oil and gas production, and a producing reservoir as well. There is little to no risk in locating the hydrocarbons in these plays, especially if many traditionally drilled vertical wells have been completed in the area, as this provides a producer with well logs and other production history and geological information.

Shale gas and oil are found within shale reservoirs, and the geologic history of an area will determine if a particular shale will produce dry gas, Btu-rich (wet) gas and condensate, or crude oil.

Shale-gas production

The production of natural gas from shales has rejuvenated the natural gas industry in the U.S. According to the U.S. Energy Information Administration's Annual Energy Outlook 2012 (released in July 2012), U.S. natural gas production is projected to increase from 21.6 trillion cubic feet annually in 2010, to 27.9 trillion cubic feet in 2035, a 29% increase.

Almost all of this increase is thanks to anticipated growth in shale-gas output, which is estimated to increase from 5 trillion cubic feet annually in 2010 to 13.6 trillion cubic feet in 2035. Shale gas will make up an increasing percentage of all U.S. gas produced.

Shale-oil production

The most prolific shale-oil production is now coming from the Bakken play in North Dakota and Montana. The surge has vaulted North Dakota past Alaska, to become the second-highest oil producing state in the U.S. after Texas. North Dakota was pro-

ducing 574,000 barrels per day in May; experts think it will reach 600,000 a day by year-end 2012.

Risk factors

The risks of shale drilling for companies stem more from being able to perform effective and economic well completions, so fracture stimulations (fracs) enter the formation effectively to increase production without harming the formation.

In addition, there are risks aboveground, of how to handle produced water that flows to the surface from the completed well, and air emissions from production facilities. Also, operators must mitigate the effects on local roads, other infrastructure and communities in which drilling and production occurs.

After the Barnett shale play in North Texas took off in the mid-2000s, operators began to lease in all other major basins in North America, looking for similar plays in which to apply new horizontal frac methods. They have since developed world-class plays such as the Bakken oil shale in North Dakota, the Eagle Ford oil and gas shale in South

Community Partners

NEW ENERGY SOARS BACK INTO AMERICA'S SHALE REGIONS

With Halcón Resources soaring into America's shale regions, new energy from people you know and trust is now back in key communities around the country. Spanish for "hawk," Halcón was founded by seasoned energy industry leaders who have been an integral part of these regions for years. Using the same community-focused approach to our operations as our management has in previous ventures, Halcón will invest in the community, contribute to its progress of its citizens and help fuel an economic revitalization of towns and neighborhoods in the geographic areas where we operate.

More than merely working in communities, we are committed to treating your hometown like our hometown. That means being a good neighbor, creating positive relationships with landowners and leveraging operating policies and procedures based on sound environmental and safety stewardship. Most of all, we strive to conduct business in a highly ethical manner and think of the people with whom we do business as true partners, knowing that a successful relationship results in a win for both sides.

Our management group is proud to be taking flight again as Halcón—an independent energy company focused on the acquisition, production, exploration and development of onshore liquids-rich assets in the U.S. While we have a new name, you can count on the same commitment to doing business the right way.

HalconResources.com

Texas, the Haynesville gas shale in northern Louisiana and the Marcellus gas shale in Pennsylvania. Other shale plays are in various stages of development.

The extraction techniques of horizontal fracturing that have proven themselves in shale plays are now being applied to traditional basins and plays to recover more oil and gas. ■

—Leslie Haines

The boom in the oil and gas industry has helped to boost the U.S. economy when other industries have struggled.



A SHIFT IN THE ENERGY SYSTEM

Natural gas has seen widespread gains in supply over the last few years in **North America** with the growing application of horizontal drilling and multi-stage fracturing.

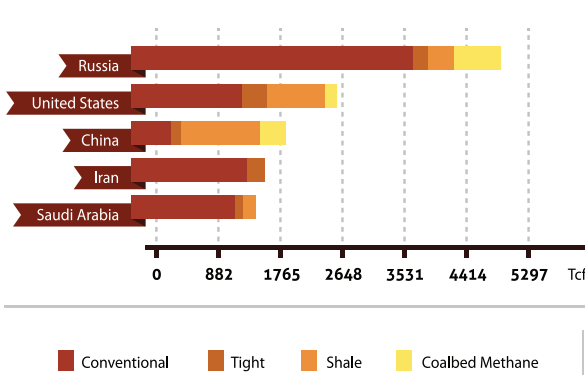
* **As gas supply continues to grow**, the need for increased uses of this prime fuel is also growing.

Some would say this is causing a major stir amongst the world's nations that are looking to **shift toward an efficient alternative to petroleum.**



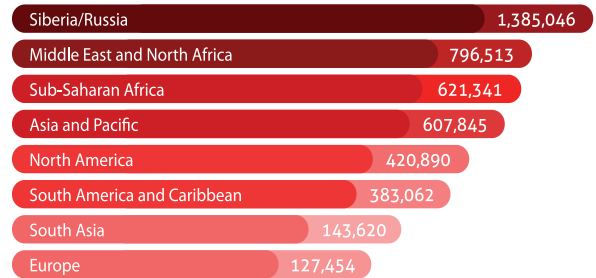
* Gas Resources Around the World *

Top Countries for Recoverable Natural Gas [1]



Undiscovered Natural Gas [3]

Gas: billion cubic feet, by mean



Currently Accessible Unconventional Resources [1]

Unconventional natural gas is a type of gas that does not occur in a conventional reservoir—instead of using traditional means of extraction, access to these resources requires additional technologies.



U.S.



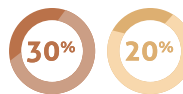
- * Tight Gas
- * Coalbed Methane
- * Shale Gas

Australia



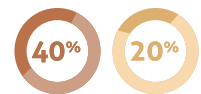
- * Coalbed Methane

India



- * Coalbed Methane
- * Shale Gas

China



- * Coalbed Methane
- * Shale Gas

Shale Gas Locations [5]

Shale Gas Present on Every Continent



* Major shale gas plays

Source: EIA

U.S. Dry and Liquid Natural Gas Production [2]

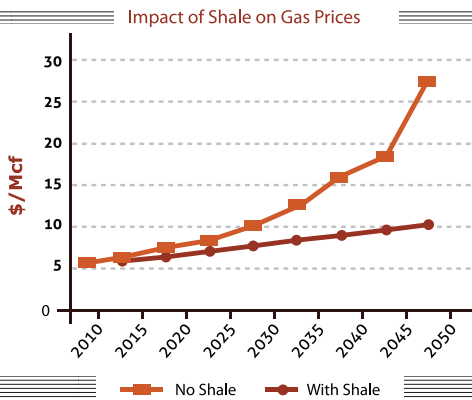
(Billion Cubic Feet)

	Gross Withdrawals	Marketed Production	Extraction Loss ^a	Dry Gas Production ^b	Supplemental Gaseous Fuels ^c	Net Imports	Net Storage Withdrawals ^d	Balancing Item ^e	Consumption ^f
2012									
January	2,575	RE ² 2,160	109	RE ² 2,051	6	150	545	R ⁻ 20	2,732
February	2,380	RE ¹ 1,999	102	RE ¹ 1,897	5	140	459	R ⁻ 13	R ² 2,489
March	R ² 2,539	RE ² 2,134	R ¹ 109	RE ² 2,025	6	125	-39	R ⁻ 7	R ² 2,110
April	R ² 2,450	E ² 2,078	105	E ¹ 1,973	5	132	-137	-28	1,944

R Revised Data | E Estimated Data | RE Revised Estimated Data

A United States Without Shale [6]

Though shale gas plays are difficult to get to, without them **natural gas prices will soar.**

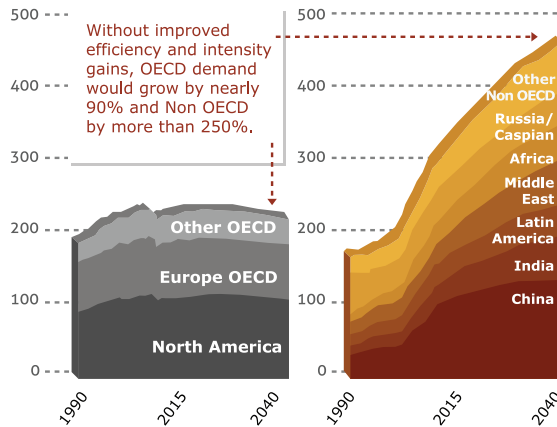


Source: "The Influence of Shale Gas on U.S. Energy", Jacoby, O'Sullivan and Polesev, January 2012

Who needs energy? [4.7.8]

OECD Energy Demand
Quadrillion BTUs

Non OECD Energy Demand
Quadrillion BTUs



* OECD=Organization for Economic Cooperation and Development

Natural gas could very well increase its share of the world's energy mix.

As technology advances, we may enjoy an increase in the supply of natural gas around the world and a surge in global economic activity related to the use of this premium, low-cost fuel.

HARTENERGY

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Fracing's Role: An Open Discussion

Hydraulic fracturing technology and its role in growing natural gas and oil production in the U.S. has placed the energy industry in the public eye.

As recently as five years ago, only those living in traditional oil and natural gas producing states like Texas, California, or Oklahoma knew many details about oil and gas production. If you lived far away from drilling rigs or the families making their livelihood from the oil and gas industry, chances are you only took note of the industry if gasoline prices rose suddenly.

Today, it's a different world. Hydraulic fracturing technology, and the discovery of how to use this technology with horizontal drilling to produce oil and natural gas from "unconventional" formations in the U.S., have placed the energy industry in the public eye.

The words "fracing" and "unconventional" are on the front pages of newspapers and Internet sites. They have become part of our daily conversation, whether we live in New York City or West Texas or North Dakota or Chicago.

We want to understand where energy comes from and how it is produced. We want to understand its benefits as well as its impacts on the environment, so that we can ensure we take full

advantage of this vast domestic resource—but safely, and in a way that preserves the quality of life today and for future generations.

Fracing facts

Fracing technology is the driver of this vast new resource of domestic oil and gas now being developed and produced in the U.S. But what is fracing?

Hydraulic fracturing is a process used in most natural gas wells drilled today in the U.S. Millions of gallons of water, sand and chemicals are pumped underground to break apart the rock and release the gas in unconventional formations like shales.

The technology was developed in the 1940s and has been used in thousands of wells in the U.S. and worldwide. In the 1990s, it began to be applied to "unconventional" formations like shales.

Producers' success in using this technology is the reason we hear so much in recent years about a vast new resource base in the U.S., one that we now can produce. In combination with other energies, like wind and solar, this resource base can make the U.S. energy self-sufficient.

What does unconventional mean? It means the formations can't be explored, developed or produced by "conventional" processes, which typically involve using the natural pressure of the wells



or pumping to produce oil or natural gas. Instead, unconventional natural gas and oil is trapped in the pores of rocks like shale. The pores are tiny and not linked. About 25 years ago, innovators realized they could open up and link these pores if they “fraced” the formations and then applied water and sand at high pressures to keep the fractures open, so the wells could produce.

This is what has opened up vast new areas to production in the U.S., such as the Marcellus shale in the Appalachian Basin, the Eagle Ford shale in South Texas, and the Bakken shale in North Dakota. Producers joined fracing technology with horizontal drilling technology. They drilled vertically into a formation and then turned the bit to drill horizontally along the formation and then fraced it, to make the wells productive.

Answers to questions

Not surprisingly, as oil and gas drilling began to boom once more in the U.S. and spread to more populated areas like the Appalachian Basin, which hadn’t seen much activity for many years, controversy over the safety of fracing erupted. The result is that the industry has become more open about its operations.

Today, it shares the ingredients it uses in fracing on sites such as fracfocus.org, and has formalized best practices to ensure safety and lessen environmental impacts. Communities continue to demand research and adequate regulations to not only ensure fracing is safe, but also that air emissions are within safe levels and water quality is protected.

Advocates of fracing say the technology is bringing dramatic increases in oil and natural gas

Community Partners

ENERGY TO HELP™



Wherever you find Halliburton employees in the 80 countries around the world where the company operates, you will find Halliburton people giving their time, talents and money to improve the communities in which they live and work. In 2011, Halliburton employees reported more than 50,000 hours of volunteer work. From repairing homes owned by the elderly, to collecting food and bottled water for victims of natural disasters, Halliburton employees have consistently demonstrated the Energy to Help™ in their communities.

Not only do our employees give of their time, but they

also give generously through Halliburton’s global workplace giving program, Giving Choices. This program takes place each October in the United States, Canada, Mexico, the United Kingdom, Australia, New Zealand, India, Indonesia, Singapore and Malaysia, and invites employees to pledge money toward the charities of their choice. These pledges are then matched with a percentage contribution by the company. This program also takes place in seven Middle Eastern countries during the holy month of Ramadan. In 2012, Halliburton employees globally pledged more than \$3.4 million to assist their local communities through this workplace giving campaign.

In 2011, Halliburton donated more than \$3.9 million to nonprofit organizations and educational institutions in 50 countries. In addition, in-kind contributions of our Landmark software totaled more than \$1.6 billion. The software is being used by students studying engineering and geosciences to help them gain valuable hands-on experience in new and emerging technologies critical to the energy industry.

Founded in 1919, Halliburton is one of the world’s largest providers of products and services to the energy industry. With more than 70,000 employees in approximately 80 countries, the company serves the upstream oil and gas industry throughout the life cycle of the reservoir—from locating hydrocarbons and managing geological data, to drilling and formation evaluation, well construction and completion, and optimizing production through the life of the field. Halliburton.com

Shale-gas production has slashed carbon emissions and saved consumers more than \$100 billion per year.

production, resulting in job creation and economic benefits in the U.S. that are already visible. And they say the environmental benefits from using more natural gas are helping to shrink the carbon footprint and slow climate change by reducing greenhouse gases.

Many experts agree that the industry's track record has demonstrated its ability to use the technology in an effective and environmentally prudent manner. Still, the onus remains on the oil and gas industry to use best practices and to respond openly and fully to communities' concerns about this technology.

Fracing is helping the U.S. to lessen its dependence on foreign-produced energy and so, it is viewed as enhancing national security while creating jobs and economic benefits domestically. It is also enabling U.S. manufacturers to benefit from the currently low cost of natural gas and natural gas liquids, which they use as a fuel, feedstock or components in many of their products.

Fracing has allowed U.S. natural gas production to beat previous production records. Despite low prices for natural gas, U.S. producers are on track in 2012 to top their record 2011 production. Gas produced in the first six months of 2012 in the U.S. came to 11.9 trillion cubic feet, compared with 11.2 trillion in the first six months of 2011, according to the U.S. Energy Information Administration.

Total production in 2011 exceeded 2010 production by 7.8% and topped the previous record, set in 1973. That supply increase has resulted in lower prices for natural gas and gas-generated electricity for consumers.

Research, including peer-reviewed studies from Carnegie Mellon University and Argonne National Laboratory, suggests that if properly extracted and distributed, the impact of natural gas on the climate is significantly less than that of coal. Safely fracing natural gas can mean more prosperous and healthier communities, a cleaner environment and a reliable domestic energy supply.



\$41 Billion
savings to natural gas
consumers in 2017



3 Million
number of jobs supported by
unconventional oil and gas activity
by 2020

Source: ICF International Tech Effect study, for American Clean Skies Foundation; IHS Global Insight; America's Natural Gas Alliance (ANGA)

Here are some comments from observers outside of the oil and gas industry about hydraulic fracturing technology.

'Good news'

"Good news about energy is rare. Energy use and its costs are rising worldwide, most countries remain dependent on oil imports, and little progress has been made toward curbing climate change. So, the world should take notice of the recent dramatic increase in estimates of unconventional sources of natural gas in North America and elsewhere, perhaps the greatest shift in energy-reserve estimates in the last half century.

In the past few years, thanks to technological advances, vast amounts of natural gas—particularly gas trapped in underground shale basins—have become economically viable... As gas acts as a substitute for oil, demand for oil will fall, putting downward pressure on oil prices. This will lessen, but certainly not eliminate, the geopolitical influence that major oil-exporting countries enjoy today."

John Deutch, emeritus professor at MIT, former MIT chair of chemistry, dean of science, and provost; former U.S. Undersecretary of Energy, Deputy Secretary of Defense, and CIA Director

The science

The three concerns most often expressed about fracking involve chemicals used in fracking, water contamination, and water disposal. A Stanford University professor of geophysics addresses each:

Chemicals: "Hydraulic fracturing fluid is mainly water, with small amounts of a thickening agent added—usually guar, the same thickening agent used in making ice cream. There is also some biocide, to kill bacteria in the water, as well as a little bit of a friction reducer."

Water contamination: "There have been fears that hydraulic fracturing fluid injected at depth could reach into drinking water aquifers. But, the injection is typically done at depths of around 6,000 to 7,000 feet and drinking water is usually pumped from shallow aquifers, no more than one or two thousand feet below the surface. Fracturing fluids have not contaminated any water supply and with that much distance to an aquifer, it is very unlikely they could."

Disposal: "When that water comes back up the well, it has picked up chemicals present in the shale that aren't good for human health or the environment. The water that comes back can be very saline and can contain chemicals such as selenium, arsenic, and iron. That water has to be disposed of properly, which can mean injecting it into a storage well that has been permitted by the Environmental Protection Agency to standards that will prevent leakage ...

Alternatively, it can be treated and reused, which is the preferable solution. More and more, that is what is being done in the northeastern U.S. So the water goes right back into the shale from where it came."

Mark Zoback, professor of geophysics, Stanford University, and member of a DOE panel addressing safety and environmental aspects of shale-gas production

Shale deposits and aquifers

"In general, shale-gas deposits lie in depths greater than 3,000-4,000 feet, while fresh water aquifers are usually at depths of a few hundred feet ... The thick strata of impermeable rock separating the water tables from the shale-gas deposits should ensure absolute separation of one from the other... The fact remains that poorly sealed wells or wells lacking adequate steel jackets could allow dangerous contamination. Cement sealing and steel jacketing of wells is a standard practice in the oil industry."

Leonardo Mauger, Harvard Kennedy School, Belfer Center for Science and International Affairs

Multiple lines of protection

“Best practices in natural gas drilling provide multiple lines of protection for groundwater resources ... We are a big country with big energy needs. Natural gas is an energy solution that works today, at utility scale with current technology. Shale gas is the most promising natural resource find in decades. We should utilize it.”

Jon Olson, associate professor, Petroleum and Geosystems Engineering Department, University of Texas at Austin

Tapping vast supplies

“Fracing has helped tap vast supplies of oil and natural gas in the United States and will be a critical part of the country’s future energy extraction process. Fracing has been vital for job creation and helped create affordable natural gas prices that have attracted many energy-intensive industries to the

U.S. Although there has been much concern over fracing contaminating drinking water through gas migration and use of chemical additives, the process has proven to be safe, and successfully regulated at the state level for decades.

Federal attempts to further regulate fracing are both redundant and unnecessary. Congress should act to prevent federal agencies from creating additional layers of red tape that would slow energy production and much-needed economic growth in the United States...”

Nicolas Loris, economist and energy policy analyst, The Heritage Foundation

The future

“Driven by technological breakthroughs in unconventional gas production, major increases in U.S. natural gas reserves and production have led

Community Partners

COMMITTED SERVICE TO COMMUNITIES

For more than 35 years Holland Services has provided a broad range of services to the energy industry. Throughout that time, our organization and our people have been proactive supporters directly in the communities where we live and work. Beginning with our ownership and management we have embraced the importance of being good stewards of our environment, good corporate citizens in our communities, and committed individuals contributing our time, talent, and resources to various causes across the nation and throughout the year.

We partner with organizations, coalitions and other groups in legitimate, fact-based efforts within our communities to communicate the many benefits that our industry delivers every day. Energy independence for our country, meaningful employment for thousands of individuals, and tax revenues that make it possible for states and municipal governments to offer services and maintain infrastructure, are but a few examples of these benefits.

Our talented professionals are active in local trade, social, civic and fraternal organizations so we have hundreds of touch points with which to communicate the truths and facts associated with the flow of information (and many times misinformation) that comes through the media, the internet, and word of mouth.

Holland Services team members have been directly involved with such worthwhile national organizations as Habitat for Humanity, Boys and Girls Clubs, and local efforts such as cancer wards of children’s hospitals, shelters for battered women, food and clothing drives, and more.

Holland Services is proud to be a part of *Energy and the Community*, a noncommercial, nonpartisan report published by a highly respected media organization to present the facts regarding the safe production of oil and gas across our land. Moreover, we are proud to be part of an industry that, almost single-handedly, is securing energy independence for the United States of America. HollandServices.com

to supply growth significantly outpacing forecasts in recent years. As a result, natural gas producers have sought new and additional sources of demand for the newfound volumes...

Less than a decade ago, the U.S. was facing a major shortfall in the supply of natural gas as declining conventional production and reserves were outpaced by rising demand... This development itself depends on the safe and sustainable continuation of fracing...

While several studies are ongoing into the effects of shale-gas production on the environment, there has been no conclusive evidence found to date that links the practice of fracing to groundwater contamination."

The Brookings Institute Energy Security Initiative

The jobs picture

"The U.S. is sitting on huge supplies of energy on

its land and off its coasts. We can access it through methods like hydraulic fracturing and ultra-deep drilling more cheaply, safely and efficiently than ever before... No one objects to a thorough analysis of potential safety concerns. That's prudent...

Any objective analysis would have to conclude that the production of shale will put people back to work; provide money for schools, public safety, and infrastructure... and make America more energy secure... And it can be done safely."

Thomas Donohue, president/CEO, U.S. Chamber of Commerce

U.S.: 'Saudi Arabia of natural gas'

The CEO of General Electric is encouraging further development of fracing, horizontal drilling and gas extraction research.

"Shale-gas resources will enable the U.S. to be a leader in gas production... The U.S. is the Saudi

Community Partners

LIVING OUR VALUES



A key dimension of Marathon Oil Corp.'s business and one that we believe is fundamental to our current and future success is our commitment to something we call "Living Our Values." Living Our Values encompasses all of the things that guide our behavior and underpin the way we approach our business around the world.

It includes protecting the health and safety of our employees and neighbors, as well as protecting and preserving the environment for current and future generations. At the same time, it includes adhering to a strict code of ethical conduct and the highest levels of business integrity, and it also includes caring for and giving back to the communities in which we live and work, supporting numerous community-based organizations and projects through financial and volunteer support.

Such community involvement takes many different forms. These efforts range from a Marathon Oil-led malaria eradication project in Equatorial Guinea, to the funding of a tree seedling grow-out site in Houston designed to provide an ongoing supply of trees to enhance the environment in and around the city, to supporting

educational programs and road safety initiatives in the Eagle Ford shale play of South Texas.

These and many other community projects supported by Marathon Oil demonstrate how we are working to help address the needs of communities that are worlds apart geographically, yet inextricably linked by the common thread of humanity and the global community in which we all live and work. MarathonOil.com

Arabia of natural gas... Energy is going to be incredibly important on the global stage and for the United States.”

Jeffrey Immelt, CEO, General Electric

A manufacturing advantage

“At the national level, natural gas is fueling an American manufacturing renaissance. When natural gas prices are low, Dow, and other manufacturers, particularly chemical manufacturers, respond by making investments and adding jobs. Dow uses natural gas for energy as well as a feedstock to produce the building blocks for various chemicals and plastic products.”

Seth Roberts, director of energy, Dow Chemical

The regulatory picture

“Federal rules are not necessary and have the effect of weakening the effectiveness of Wyoming’s rules... Unnecessary and duplicative regulations will reduce jobs and revenue... These (proposed federal rules) result in a layered regulation pushing investment from public lands and exacerbating that shift. The result is fewer jobs, less economic development and a dangerous precedent for future federal regulatory actions...”

In 2010, Wyoming was the first state in the nation to develop and adopt rules for public disclosure of chemicals used in hydraulic fracturing operations... States are and have always been the primary regulators of the oil and gas industry.”

Wyoming Gov. Matt Mead, in a letter to the Department of Interior, opposing plans by the BLM to impose federal rules for fracking

States’ role

Fracing can be done safely, and states, not the federal government, should take the regulatory lead, says a former assistant EPA administrator. He explains that depending on the type of formation and how drilling occurs, techniques and practices may differ and that a federal one-size-fits-all approach may not work.

“Of all of the real options to lower energy prices, I think fracing is a good option. I think it can be done safely, but we have to be careful. That is the reason we have a lot of fail-safes, safety measures and knowledge.”

J. Winston Porter, former assistant administrator for the

U.S. EPA, now president of Environmental Strategies, an independent research and consulting firm

Working together

“What we need is not more stringent regulations, but more appropriate regulations. And these can best be set at the state level by collaboration with stakeholders and industry. The gas shale drilling industry works to design and operate cost-effective drilling programs, while minimizing the impact of its operations on the environment. With the right technology, the industry can meet both of those goals.

We also want the public and regulatory officials to know how we operate, how we protect the environment, and how we abide by the regulations... Appropriate regulations, based on sound science and engineering principles—developed by consensus—are welcomed.”

David Burnett, petroleum engineer and director of technology, Texas A&M Global Petroleum Research Institute

Water quality

Noting ongoing delays in New York for more studies of fracing, this researcher responded:

“(N.Y. Gov. Andrew) Cuomo’s decision validates the anti-fracers’ study-it-to-death strategy. Their goal is to create the illusion that horizontal fracturing pollutes drinking water—even though the EPA has publicly, if reluctantly, acknowledged that there is not one documented case of such pollution...”

From a scientific perspective, no reason exists to even suspect unknown health or environmental issues will turn up—because hydraulic fracturing is not a new technology. It has been perfected over decades and tweaked in recent years to horizontally access deeply buried shale gas.”

Jon Entine, senior research fellow, Center for Health and Risk Communication, George Mason University

Ensuring farmland is safe

“The New York Farm Bureau believes that high volume hydraulic fracturing (HVHF) is critically important to the future of the economy in New York State. At the same time, the state must have the needed staff and the strongest permit requirements for HVHF drilling operations to ensure that farmland, water resources and our communities are not negatively impacted...”

The longer the Department (of Environmental Conservation) defers the decision-making process on HVHF, the more difficult it will be to revitalize New York's rural economy using the considerable natural resources we have available."

Dean Norton, president, New York Farm Bureau

575

Number of years U.S. natural gas reserves would meet domestic electricity needs at current fuel demand and generation levels. At those levels, the fuel supply would last three centuries longer than the U.S. has been in existence.



Hydrocarbons are the building blocks of plastics and pharmaceuticals

Source: Institute for Energy Research; AAA's Chuck Mai, OERB

Emissions levels at 20-year low

"The shale-gas revolution makes a reality many things thought impossible. It was thought impossible to slash U.S. carbon emissions back to 1990 levels by 2012. It was thought impossible to massively, quickly cut carbon emissions, and at the same time, lower energy bills. Shale-gas production has slashed carbon emissions and saved consumers more than \$100 billion per year. Truly astonishing."

John Hanger, attorney and energy consultant, former secretary of the Pennsylvania Department of Environmental Protection and commissioner of the Pennsylvania Public Utility Commission

Praise for chemical registry website

"While shale gas has been a bright spot in an otherwise gloomy economy, the use of hydraulic fracturing is under assault. Despite the fact that hydraulic fracturing has been employed for half a century at comparable depth of thousands of feet, opponents of natural gas insist that groundwater is now being contaminated."

This claim, no matter how many times it is repeated, lacks substantive data to support its conclusions as both the natural association of state groundwater agencies and the multistate governmental agency representing states' oil and gas interests have found no evidence of groundwater contamination from hydraulic fracturing fluids.

Additionally, to assuage concerns about the content of fracturing fluids and to increase transparency, the industry has chosen to voluntarily disclose what additives are used at each well site via the FracFocus (fracfocus.org) database...

These advances in technology mean we have a bright energy future. The natural gas resources that we can recover with today's technology are enough to supply our needs at current rates of consumption for over 100 years. Future supplies of both oil and gas promise to be much larger if we do what the U.S. does best and continue the trajectory of innovation."

Daniel Simmons, director of regulatory and state affairs, Institute for Energy Research and former director of The Natural Resources Task Force at the American Legislative Exchange Council. IER is a Washington, D.C.-based non-profit organization conducting research and analysis of energy functions, operations, and regulations

“FracFocus has worked well for disclosure of chemicals. Fracing technology is a tremendous tool for this nation and for the industry to allow us to continue to make progress to reduce our dependence on foreign fuels.”

Bob Abbey, recently retired director, Bureau of Land Management

Most significant U.S. energy development in generations

“The production of shale gas through fracing is the most significant development in the U.S. energy sector in generations... It is good for consumers’ pocketbooks by helping to reduce energy costs... It spurs economic growth by bringing industrial jobs back to the U.S.—jobs that left several years ago when domestic natural-gas supplies were

Shale Play Depth to Aquifer (ft) Depth to Shale (ft)

Marcellus	850	4,000-8,500
Woodford	400	6,000-11,000
Haynesville	400	10,500-13,500

Source: MIT

considered scarce and expensive... (shale production) reduces U.S. dependence on coal...

Today’s nimble natural gas plants even allow more renewable power to be integrated into the electricity grid than coal does... Fracing is too important to foul up.”

N.Y. Mayor Michael Bloomberg, in a recent op-ed piece, co-written with George Mitchell, often credited with pioneering shale-gas development ■

—Gary Clouser and Susan Klann

Community Partners

SUPPORTING COMMUNITIES



Following founder Scott Noble’s philosophy that it is important to be not only successful, but significant as well, the leadership and employees of Noble Royalties Inc. and Compass Royalty Management LLC have worked to make a difference in the communities in which they work and live.

Noble Royalties’ efforts to give back to the community begin with the leadership of president and CEO Scott Noble, who is involved actively in a number of organizations that support education and schools. He serves as the vice chairman of the national board of the Phi Kappa Psi fraternity and has been instrumental in the success of the American Leadership Academy, a week-long leadership school that gives college students practical business and life lessons that they can apply throughout their careers. He has also been very active with Texas Special Olympics and Empower African Children, among many others organizations.

Noble’s example is carried forward in many employee-driven activities that range from corporate food, clothing and blood drives throughout the year to the many individual organizations to which Noble and Compass employees give their time and talents. The range of community activities and organizations that Noble employees support is as diverse as the employees themselves.

As a company, Noble Royalties has been active in helping new royalty owners around the country to have the tools they need to manage their minerals and royalties themselves through educational town hall meetings. In 2012, Noble Royalties has hosted more than 25 town hall meetings around the country covering topics ranging from lease basics to hydraulic fracturing to tax and estate planning. In Cuero, Texas, Noble hosted those meetings together with the Chisholm Trail Heritage Museum. As part of the effort, Noble made a contribution to the museum on behalf of every town hall meeting attendee, leading the Cuero Chamber of Commerce to name Noble Royalties a Business of the Month in 2012, a rare distinction for businesses not headquartered in Cuero. NobleRoyalties.com

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HYDRAULIC FRACTURING AND SAFETY



Opponents say Hydraulic Fracturing (also called fracking) is dangerous, and causes lasting environmental damage. The energy industry says it's safe, tightly regulated and is the key technology that provides clean energy to the US. Who's right?

? What is FRACKING?

Water and sand are pumped at high pressures into underground oil and gas reservoirs. The pressures—which can be in the range of 10,000 pounds per square inch—causes the rocks to crack, or fracture, providing pathways for natural gas and oil to be produced.¹¹¹

FRACKING IS DANGEROUS



Fracking is a new gas extraction method.¹¹



All of the chemicals used in fracking liquid have not been disclosed to the public.¹²



Fracking uses millions of gallons of water.¹³



Water from fracking can contaminate the public drinking water supply.¹⁴



AIR QUALITY CAN BE DEGRADED BY FRACKING.¹⁵



FRACKING IS SAFE



Hydraulic fracturing was developed more than 60 years ago.¹⁶



Chemicals are used in small amounts in hydraulic fracturing and they are disclosed under state and federal regulations and industry programs.¹⁷



Hydraulic fracturing uses a small fraction of the water consumed by the public; energy companies have developed extraction methods that use less water.¹⁸



Wells are constructed with multiple layers of cement and casing to protect drinking water zones, preventing any contamination.¹⁹



Chemicals used in hydraulic fracturing are used in everyday products, like ice cream and beer.²⁰



Emissions into the air during the hydraulic fracturing process are temporary and can be controlled. These are minor and do not affect health.²¹

WATER USED IN HYDRAULIC FRACTURING IS RECYCLED, SENT TO WATER TREATMENT FACILITIES, OR OTHERWISE PROPERLY DISPOSED OF.²²



THE HEALTH, SAFETY, AND ENVIRONMENTAL CHALLENGES IN SHALE ENERGY EXTRACTION ARE MANAGEABLE.

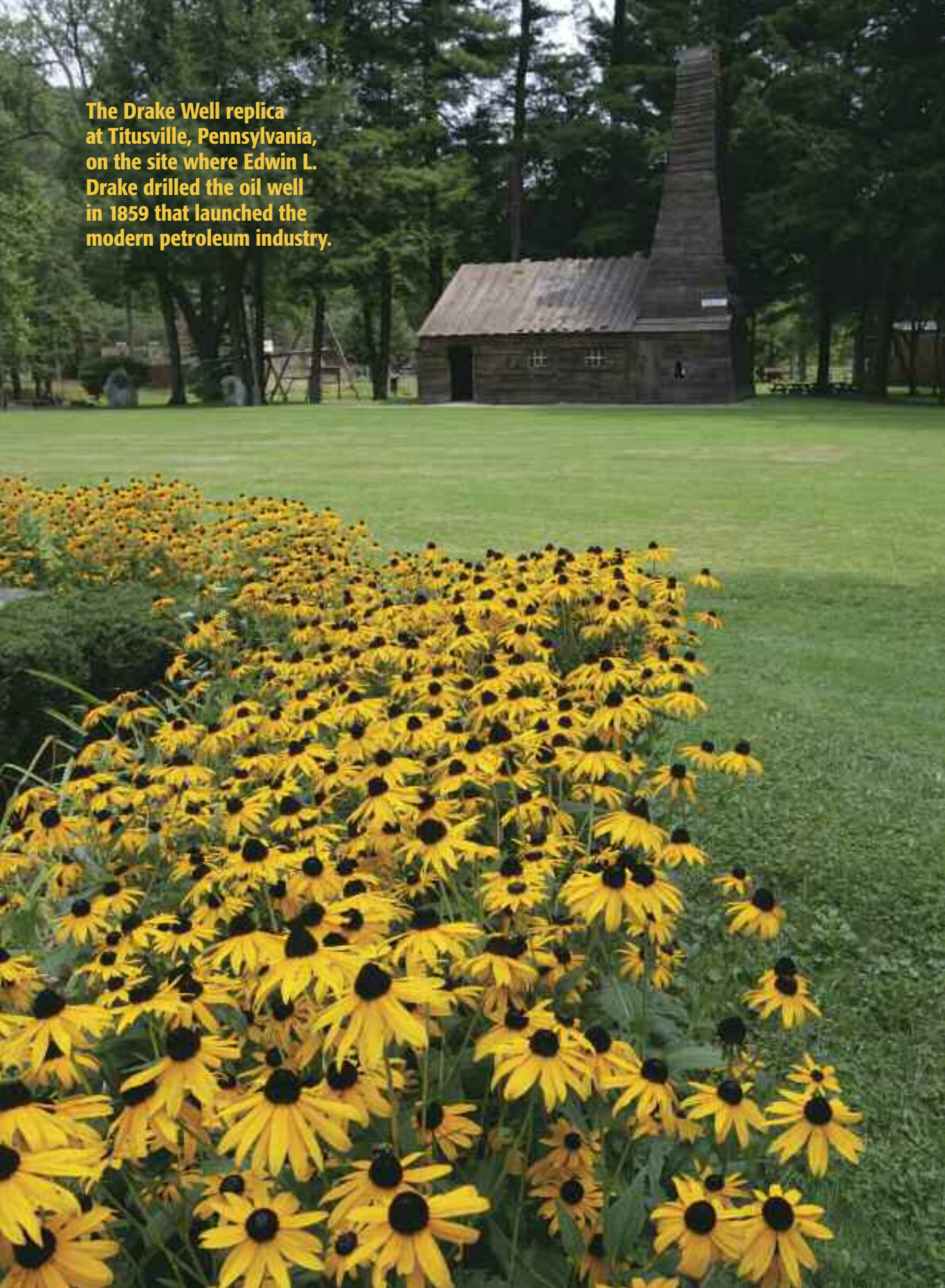
HYDRAULIC FRACTURING IS A WELL UNDERSTOOD AND RELIABLE TECHNOLOGY THAT BENEFITS AMERICANS BY PROVIDING LOW-COST DOMESTIC ENERGY.

HARTENERGY

FOOTNOTES:

- 1) <http://www.gop.com/president/transition/transitionteam/energy/energy-19.html#sthash=74949494>
- 2) <http://www.gop.com/president/transition/transitionteam/energy/energy-19.html#sthash=74949494>
- 3) <http://www.gop.com/president/transition/transitionteam/energy/energy-19.html#sthash=74949494>
- 4) <http://www.gop.com/president/transition/transitionteam/energy/energy-19.html#sthash=74949494>
- 5) <http://www.gop.com/president/transition/transitionteam/energy/energy-19.html#sthash=74949494>
- 6) <http://www.gop.com/president/transition/transitionteam/energy/energy-19.html#sthash=74949494>
- 7) <http://www.gop.com/president/transition/transitionteam/energy/energy-19.html#sthash=74949494>
- 8) <http://www.gop.com/president/transition/transitionteam/energy/energy-19.html#sthash=74949494>
- 9) <http://www.gop.com/president/transition/transitionteam/energy/energy-19.html#sthash=74949494>
- 10) <http://www.gop.com/president/transition/transitionteam/energy/energy-19.html#sthash=74949494>
- 11) <http://www.gop.com/president/transition/transitionteam/energy/energy-19.html#sthash=74949494>

**The Drake Well replica
at Titusville, Pennsylvania,
on the site where Edwin L.
Drake drilled the oil well
in 1859 that launched the
modern petroleum industry.**



Communities and Industry: Working together

Communities and oil and gas producers have a lot to learn from one another. Here are examples of how they have come together to forge successful partnerships and solve concerns.

The essence of community relations is a sense of mutual responsibility, says Karlene Roberts, professor of business administration at the University of California at Berkeley and director of its Center for Catastrophic Risk Management.

More and more, communities and oil and gas producers across the U.S. are recognizing not only the benefits, but also the necessity, of working together.

Communities that are impacted by oil and gas activity are concerned about impacts such as fracking and water safety, air emissions, dust and traffic, and noise. The challenge for producers is to be willing and full participants in an ongoing dialogue with the public when these concerns arise—and even better, before concerns arise. They need to educate families and community leaders about what they are doing, and be creative and responsive in devising ways to solve concerns. And, communities expect that there will be a means in place for them to communicate concerns and report problems.

“In a certain region or sector there is usually a standard set by some company that everyone else in the industry recognizes,” says Roberts. It raises the bar in a way that tends to improve the performance of the entire industry.

When fracking became a lightning-rod issue in

regions such as the Appalachian Basin, communities and others wanted disclosure of the fluids used in fracking, to make sure they didn’t pose health or environmental risks.

Ray Walker, chief operating officer of Range Resources Corp., Fort Worth, a major operator in the Marcellus shale in the Appalachian Basin, says he understands industry’s initial reluctance to disclose frac-fluid details (service companies that develop the fluids in many cases considered the combination of chemicals used in fracking to be trade secrets).

“Lots of people had lots of concerns, valid concerns,” he says. “The industry had a lot of valid answers, but we were not connecting the two. It seemed to the population that we were not even listening. That enabled people to get fixated on things like ‘secret’ chemicals.”

Range’s decision to publish its frac-fluid details was a seminal moment, says Walker. “Before that, we were deluged with inquiries. Since our disclosure, we have not gotten one, single question.”

Adding to conflicts with the public relating to unconventional resource (for example, shales) development was the fact that in many states, the rules had not kept up with the technology, because until the advent of unconventional resource development, drilling activity in those states had been minimal.

“We realized in Pennsylvania that the regulations were not up to date,” says Walker. “They did not address the things they should.”

“We made the decision to invest in additional casing and cement in our Marcellus wells. Then we went to the state Department of Environmental Protection and showed them our wells and said they needed to improve the standards.”

Walker reiterates a common theme among producers today: “We are only as strong as our weakest link.”

Community Counts

Towns are few in the Piceance Basin of Colorado, which reaches from Gunnison in the southeast, through Grand Junction on the Western Slope and up to Rangely in the northwest. But the communities in the region matter, says Adell Heneghan, director of environment, health, and safety for

“Lots of people had lots of concerns, valid concerns. The industry had a lot of valid answers, but we were not connecting the two.”

—*Ray Walker, chief operating officer, Range Resources Corp.*

PDC Energy Corp., an oil and gas producer based in Denver.

“The major concerns of residents in the area are truck traffic and dust; also noise, odors, and lights

Community Partners

EDUCATION AND ENVIRONMENTAL RESTORATION



The Oklahoma Energy Resources Board has been serving Oklahoma and the nation since 1994. We are proud to bring our strong tradition of education and environmental restoration to people throughout the community.

Over the past 18 years, the OERB has worked successfully to voluntarily restore more than 12,300 abandoned oilfield sites across Oklahoma, spending more than \$75 million on the effort. Funded generously by the oil and natural gas industry, the OERB has returned the land back to a useful state at no cost to the landowners or communities who reach out for assistance. This mission remains the OERB's top expenditure and one of its most impactful undertakings.

The OERB has committed more than \$25 million to student education outreach. The OERB has teamed with teachers from 95% of Oklahoma's school districts to ensure students have quality science and math programs in their schools. Using the OERB's science and energy curricula, OERB teachers are sharing one-of-a-kind lesson plans that contain hands-on, relevant activities to engage students in learning about scientific method and discovery. Annually, the OERB provides nearly \$1 million in free classroom supplies and support to teachers and students, including science lab equipment, books, electronics and sponsored field trips.

Beyond grade school, we provide millions in college scholarships, mentoring and technical training for students whose goals include making oil and natural gas their passion and their career. The OERB hopes to empower teachers and students to become the nation's next energy leaders.

Now, more than ever, it is the oil and natural gas industry that brings pride and strength to our great state. The industry employs more than 350,000 Oklahomans directly or indirectly while providing nearly \$1 billion annually for government services and helping our nation become less dependent on foreign oil.

For more information, visit OERB.com or join Facebook at facebook.com/OERBAdvancingEnergy.

at night. Working with other operators in the basin, we formed a dedicated non-profit organization called Community Counts,” she says.

An executive director was hired to handle the nonprofit reporting requirements and to coordinate operations. All of the participating companies put the Community Counts logo and toll-free number on their vehicles and equipment. Operators at the call center, which is in the region, field all questions and route the inquiry, with as much background information as possible, to the relevant company.

“As part of being involved in Community Counts, member companies promise to call back on all inquiries,” says Heneghan. That commitment arises from experience in the area. “We have been active in this area for 40 years, and we have to reach individuals and families, not just the community at large.”

Community Counts has been in operation since 2009. Heneghan says the call center has worked extremely well, given the area’s population base and other factors. She hopes to expand the idea to other areas where the company operates, such as Wattenberg Field in the Denver-Julesburg Basin in eastern Colorado, where oil and gas drilling is booming.

Heneghan stressed the local community aspect of the call center. “If the person making the call says she lives on this road off that highway or just past a certain place, the person taking the call has to know where that is. It is very important to the caller that the representative knows the area.”

Most of the calls are informational, but there have been instances of more serious problems. “One situation that stands out in my mind was when a driver for one participating company was seen harassing wildlife,” says Heneghan. “It was reported to Community Counts. After an investigation, including talking to the driver and witnesses, the driver was terminated.” The story illustrates how call centers can be responsive and effective.



The energy industry recognizes the importance of communications.

Looking at the bigger picture, Heneghan says there are many great efforts across the industry, but there is more work to do. “As a concerned, committed company, that is something we think about a great deal.”

The sky’s the limit

Caiman Energy LLC literally took to the air to minimize the impact of a construction project on communities in rural West Virginia. The midstream (natural gas gathering and processing) company, based in Dallas, had to construct nine miles of electrical transmission lines to a new compressor station that was being built. Bringing in the components for the big towers for the power lines on trucks would have meant closing U.S. Highway 250, the main route diagonally across the lower West Virginia panhandle, for repeated, extended stretches while the flatbed trucks crawled along.

Caiman had already been active in the region for many years, and had in place a robust network of community relationships. As a result, the company got the message loud and clear from the public that the highway closures would be extremely disruptive.

“So, instead of hauling the towers along the highways, we hired a heavy-lift helicopter and carried them over the highway,” says Jack Lafield,



chairman and chief executive of Caiman. “We coordinated with the highway patrol so the roads would only have to be closed briefly as the loads were actually going over.”

Reflecting on his experience with Caiman and with other companies previously, Lafield says that while solutions are always local, the issues are universal.

1859

first oil well drilled in the U.S.



Products from petroleum include fuels, fertilizers, & pesticides



Seismic data is used to create a 3-D map of what lies below the surface.

Source: OERB; Adventures in Energy, API

“No matter where you live or operate, communication is at the top of the list. When I was at Crosstex Energy building compressor stations in the Barnett shale (in Texas), area residents were concerned with noise and light and truck traffic just as they are in the Marcellus regions of West Virginia.”

He points out that there are many oil companies based in Fort Worth, compared with the Appalachian Basin. “But when we actually started putting wells and infrastructure near residential communities there, we had just as many local concerns as we do in Pennsylvania today,” he notes. “And Pennsylvania and West Virginia were oil-producing states long before Texas was, but the industry has not been active in those areas for decades. So when we come back, it’s all new again.”

That point was driven home recently when Caiman began working on plans for compressor stations and other projects in the newly emerging Ohio Utica shale play. The oil regions of southeast Ohio are some of the oldest in North America, having been developed just a few years after the pioneering wells in Petrolia, Ontario, and Titusville, Pennsylvania. But that legacy was almost irrelevant when Caiman began the permitting process.

“The Ohio regulators asked us if we would be using new technology,” says Lafield. “Our response was, no, this technology is 40 years old. So we took them on a field trip to West Virginia to visit our facilities and constructions sites in the Marcellus.

“We have also held town-hall meetings in the new communities,” he says. “For those, we have included contractors and regulators.”

Often there is a sense between companies and communities of “we” and “they,” Lafield notes. “Hiring locally really helps resolve that.”

The company also decided to put its company logo and telephone number on all of its vehicles. “Our lawyers advised us that was a liability,” says Lafield, “but we took the other approach: we wanted people to know who we were and what we were doing.”

Stepping up and stepping out

Another Marcellus and Utica operator, Eclipse Resources, based in State College, Pennsylvania, has a policy of testing all water wells within 2,500



“No matter where you live or operate, communication is at the top of the list.”

—Jack Lafield, president and chief executive officer, Cairman Energy LLC.

feet of the entire horizontal portion of all of its wells. This procedure goes above and beyond what is required under state regulations in Ohio.

“We make a point of doing this before we drill, and we make a point of giving samples to each landowner,” says Benjamin Hulbert, president and

chief executive officer. Eclipse is a newly formed, private oil and gas company.

Community relations requires resolution and action on multiple levels, Hulbert says. On Eclipse’s web page there is a statement front and center that the company “believes strongly in conducting our business in an environmentally responsible and safe manner.” Such public pronouncements set a standard, and actions like its well testing and distribution of its findings demonstrate execution.

“Virtually every well we have tested has shown some methane, or other problems, and that is before we have begun to drill,” says Hulbert. “The landowners are grateful that they can get those problems addressed, and we have a baseline against which to test after drilling.”

Truck traffic is the other big issue in Eclipse’s territory. “That is real, not just community perception.

Community Partners



BEING A GOOD NEIGHBOR

At Pioneer, we are determined to harness the industry’s latest technologies for discovering new resources. While our business is finding and producing oil and natural gas, we are equally committed to being a good neighbor in our operating areas.

Part of Pioneer’s dedication to community well-being and success is empowering employees to make a difference. Our employees continually seek out events, organizations and initiatives to support with their time, talents and dollars, striving to improve the quality of life for others.

We are proud of their volunteerism, charitable giving and servant leadership. Their ongoing efforts are supported by significant financial sponsorship from Pioneer and include:

- repairing and building houses in partnership with Habitat for Humanity;
- mentoring K-12 students;
- fundraising for numerous charitable organizations;
- volunteering with local organizations, such as food banks and shelters; and,
- giving to United Way for the benefit of its participating agencies.

For several years, Pioneer has participated in a local gas assistance grant program in Colorado to assist seniors with their home heating bills.

A Focus on Youth and Education

Although Pioneer contributes to a diverse group of charities, service organizations and educational institutions, our corporate focus for charitable giving is on youth and education. We encourage education in young adults by partnering with our employees, local communities, community colleges and universities. We offer support to the engineering and geoscience schools of several major universities as well as provide financial and intellectual resources that enlighten, assist and encourage elementary and secondary students.

Since 1993, Pioneer’s Scholarship Foundation has provided funds to employees’ children through a competitive application process. Additionally, Pioneer funds scholarships each year to graduating seniors in communities where we operate.

Our commitment to community goes beyond catchphrases like “corporate social responsibility.” It’s ingrained in the culture at Pioneer and is part of how we do business, every day. pxd.com.

We try to prepare people, and we try to minimize the impact. But it does disturb the site when we are actively drilling.”

Hulbert says the oil and gas industry could have done a better job of preparing the public for the impacts of drilling and minimizing those impacts in the early days of the Marcellus shale, but notes that as a result of lessons learned, operations have gone much better in the early days of the emerging Utica shale activity. “In Ohio we have been much more proactive, but also the regulations have been better.”

Two of the company’s most common proactive efforts are to repave and improve roads in advance of bringing in the cavalcade of rigs and service trucks, and training first responders and upgrading their equipment. Hulbert and other executives, as well as local officials, agree that those initiatives are simple and effective.

“Most producers are bonded to fix the roads after the development, but we have done some roads in advance,” says Hulbert. Widening intersections, adding passing lanes, or providing turning lanes in places where there will be truck congestion is also appreciated by communities. “We have also trained first responders through the community college systems,” he notes.

At the other end of the U.S. from the Marcellus shale, Laredo Energy is active in Webb and Zapata counties in South Texas, a long-time area of oil and gas activity. “The biggest concern in our operating area is dust,” says Glenn Hart, president and chief executive officer. “It is very dry. The only solution is to drive slowly, 10 or 15 miles per hour.”

Water, surprisingly, is not an issue. “We drill commercial-grade water wells 2,000 feet deep and tap different sources than the ranch wells that are about 700 feet deep,” he says.

Community Partners

API: A STANDARDS PROGRAM FOR EXCELLENCE

The discovery of the abundance of North America’s shale resources is game changing and welcome news for our nation and its economy. Realizing the benefits of natural gas and oil production from these resources will require environmentally responsible development, and it will require that operators go beyond complying with laws and regulations but engage in effective dialogue with communities and other stakeholders in the area or region where drilling and production activities occur. Perhaps more than ever before, constructive relationships between operators and neighboring communities are essential for project success during the field development phase.

The national debate over domestic energy development makes clear that public acceptance of the benefits from America’s resources is neither automatic nor unconditional. Nowadays, public expectations for operators extend to consideration of the socioeconomic impacts of operations, and the respect offered neighbors in the communities that see themselves as affected by those operations. To address these expectations, operators must communicate with people who live and work neighboring any given resource development project.

Since 1924, the American Petroleum Institute (API) has been the leader in developing consensus-based standards on equipment and operations for the oil and natural gas industry. API, along with industry experts, is addressing the challenges presented by increased development from shale through communication with the public through grassroots community outreach, online resources such as EnergyFromShale.org and by preparing a document that will set forth principles and guide engagement with communities and regions where development occurs. API standards are used by industry professionals to improve the operational integrity and cost-effectiveness of their operations, comply with legislative and regulatory requirements, safeguard health, and protect the environment.

To ensure their projects combine operational safety and environmental performance with a positive return on investment, companies need to focus companywide attention on these deliverables and set objectives that incorporate community expectations. Operators should also provide information to communities and project neighbors, adhering to principles of integrity, transparency and consideration for community concerns and values. Through the document now taking shape under its standards program, API intends to make use of the practices of companies that demonstrate excellence in this area, and to equip operators with practical tools for interaction with communities and community leaders. API.org

“We like to hear from the people we work with, the people on whose land we operate and who have experienced what we do.”

—**Glenn Hart**, president and chief executive officer, Laredo Energy

Hart believes that with the conflict over fracking, “we all had to take a second look at everything we are doing. It has helped both the public and the industry make sure nothing bad happens. Most responsible citizens in the industry detest that a few bad apples have spoiled things for the rest of us.”

The tonic, he says, is fair and reasonable regulation—“yes, regulations are good and necessary.”



Landowners can aid in communication with the public at large, he says. “We like to hear from the people we work with, the people on whose land we operate and who have experienced what we do. We have invited our landowners to town-hall meetings and to regulatory hearings.”

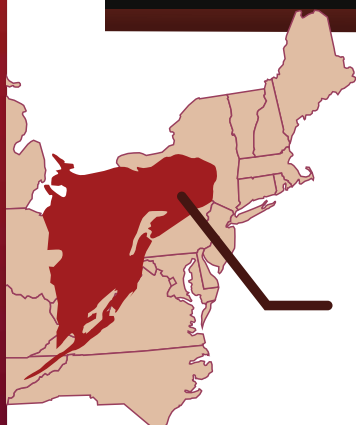
There are many, many more examples across the U.S. of how communities and oil and gas producers are working together to anticipate and solve community concerns. Creative partnerships are being forged every day between companies and the communities where they operate. ■

—Gregory DL Morris





ANATOMY OF MARCELLUS SHALE



THE BASICS

Marcellus Shale is a formation of black shale that covers **95,000 square miles** underground from West Virginia and Ohio to Pennsylvania and New York. [1][2]

The shale formation is carbonaceous and might contain pyrite concentrations and limestone beds. [3]

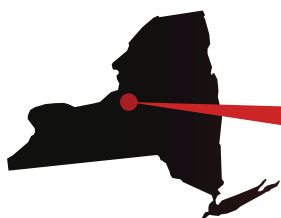
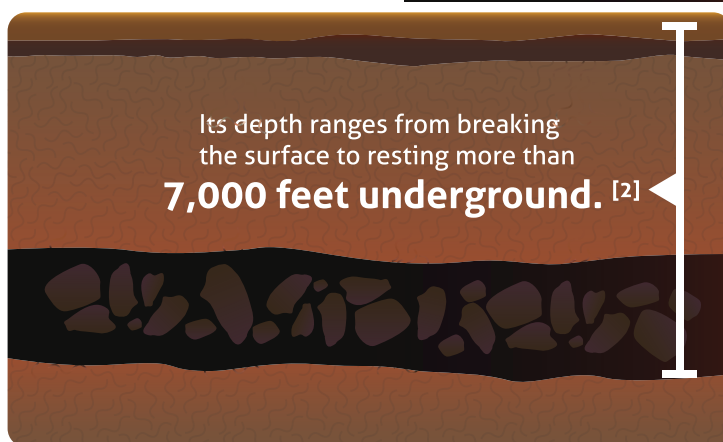


It's estimated that the Marcellus Shale could contain about 489 trillion cubic feet of natural gas. [2]



This shale might be the 2nd-largest natural gas field in the world. [4]

Its average thickness is **50 feet to 200 feet.** [1]



It gets its name from a surface exposure located near the village of Marcellus in New York. [7]

FORMATION AND DISCOVERY



When the Marcellus Shale formed, organic material lay within the deposited mud. As pressure and heat turned the mud into shale, it also turned the organic material into natural gas. [5]

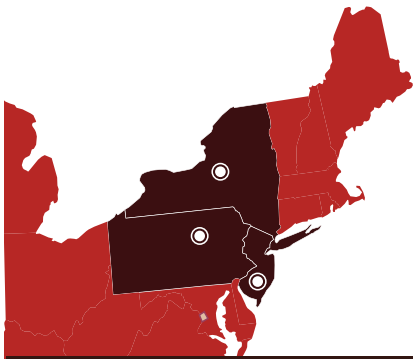
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[4] http://marcelluscoalition.org/wp-content/uploads/2011/10/MSF_Fast_Facts_Large.pdf



PRODUCTION

The Marcellus Shale is still in its early phases of development. [8]

It's expected to dominate the gas market in the areas of ***New York, New Jersey, and Pennsylvania*** and meet most of the demand in the region. [9]

Natural gas is retrieved from impermeable shale through the use of:

Horizontal drilling [2]

Wells are drilled down to a depth above the formation.

Drilling occurs through the rock for several thousand feet.

The well is curved so the hole is drilled horizontally.

Hydraulic fracturing [2]

A majority of the Marcellus Shale will be exposed to this method.

Fluid and propping material (like sand) are pumped down the well in multiple stages to create fractures in the rock.

CONCLUSION

The use of horizontal drilling and multi-stage hydraulic fracturing has made it possible to access the large volumes of energy resources contained in the Marcellus Shale. The great potential of the shale as a domestic energy source, for both natural gas and for natural gas liquids, has inspired widespread exploration and production across the area.

Different characteristics play into the commercial potential of shale:



Depth [7]

Drilling is expected to be focused on areas where Marcellus Shale is more than **2,000 feet deep**.



Thermal Maturity [7]

The Marcellus Shale contains both dry gas and wet gas.

- In southwestern Pennsylvania, there's wet gas.
- In northeastern Pennsylvania, the gas is dry.



Permeability [7]

Hydraulic fracturing works to create and hold open little fractures in the shale, which serve as pathways for the gas. [5]



Porosity [7]

Marcellus Shale contains pyrite, which provides natural pathways not usually present in "tight shales." [5]

HARTENERGY

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Fracing *and* Earthquakes

With 2 million wells having been stimulated using hydraulic fracturing techniques, protocols have been developed to identify and respond to seismicity levels that might be a concern.

We live on a dynamic planet where change is the only thing that is constant. The solid Earth beneath our feet is actually shifting positions at the rate our fingernails grow. Continental plates slide past, dive under, and crash into each other growing mountains, erupting volcanoes, and causing remarkable earthquakes.

Tectonic forces cause rocks to shift a little every day. Most of the seismic energy released by the planet goes unnoticed by humans. The earthquake magnitude scale measures events according to the energy released. The scale is logarithmic, meaning that each step lower represents 32 times less energy.

Human activity can also induce seismicity. Industrial activity such as mining, dam building, waste water injection, and fracing may result in seismic events.

The process of fracing, dating back to 1947, breaks

rock to stimulate hydrocarbon flow through tiny fissures in a reservoir. To date, more than two million wells have been stimulated using short periods of controlled pressure to crack rocks and increase petroleum flow. Owing to the small volume of water used in any single stage of fracing, the events induced typically have magnitudes between (-3) and (-1). For reference, a magnitude (-2) releases equivalent energy to a gallon of water dropped to the floor from chest height.

Waste-water injection involves larger volumes than fracing and over a longer period of time, but at lower pressures, such that the fluid should disperse without causing any seismic events. According to the EPA's numbers, approximately 144,000 oil and gas-related injection wells are pumping more than 2 billion gallons of liquid under the U.S. every day. The number of reported induced seismic occurrences felt at the surface is only a handful.

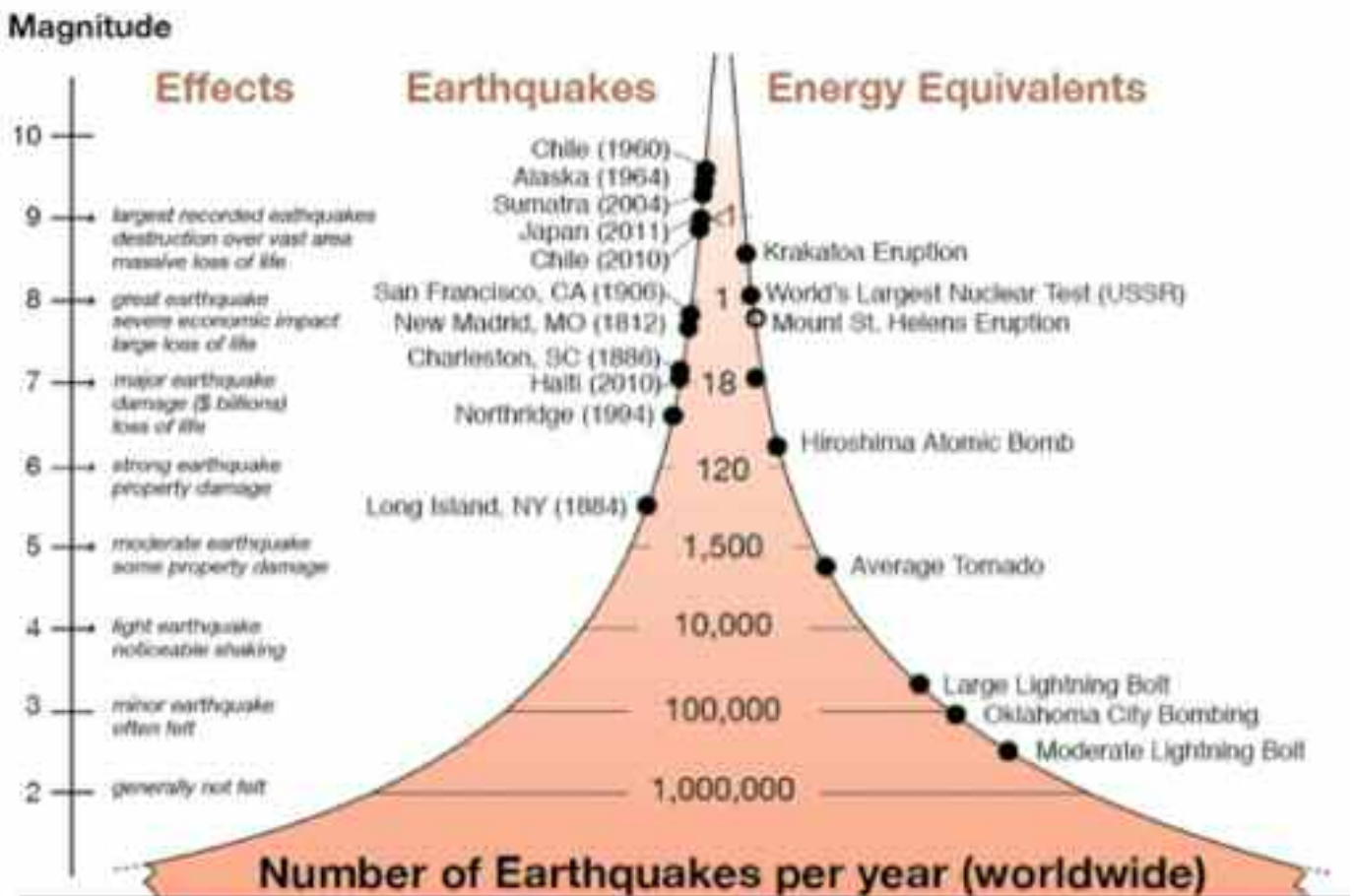
Different jurisdictions and industries have already developed protocols to allow operations, while minimizing the risk to surface infrastructure from induced seismicity. These conventions are now migrating to the oil and gas field. The protocols involve proper placement of wells and a prescribed response to observed seismicity levels.

Seismic imaging is used to evaluate well locations and ensure operations are not placed near detected zones of weakness. A “traffic light” system has been proposed for providing a response protocol to monitored seismicity levels. This system dictates a “green light” when observed seismic events are less than a prescribed threshold (typically magnitude 0). A “yellow light,” or caution condition, requires closer observation of the well when the seismicity is between this low threshold and a moderate threshold (typically 1.5 -2). A “red light” condition above this higher level threshold requires that pumping in the well cease and the fluids be allowed to flow back until the level of seismicity returns to the green level.

Industry and governments around the globe are working together to manage a balance between industrial activity and public safety. The E&P community continues to seek ways to be better stewards of our environment. ■

Peter Duncan is president and chief executive officer of MicroSeismic Inc., a Houston-based geophysical service company.

A “traffic light” system has been proposed for providing a response protocol to monitored seismicity levels.



Source: IRIS.edu.



Community Partners

BOOKS AND MORE

Strad Energy Services, Denver, a well-site infrastructure activation company, is committed to helping develop resources responsibly and safely throughout North America. Our every day mission is to provide high-quality products and trusted service that is backed with an excellent safety program.

With branches operating in over 30 communities across North America, Strad believes it is also our responsibility to be a partner in the social and economic development of these areas. By giving back to the communities in which we live, work and operate, Strad can positively contribute to community life and development with donations of time, materials and finances.

Since Strad began operations in 2003, we have encouraged our employees to contribute time, talent and resources to support local organizations. We are proud that our efforts to date have benefitted diverse areas including: education, culture and the arts, youth and family initiatives, the environment, local athletics and community leadership institutions.

With many of these local initiatives so important to Strad, the company launched its *Strad Cares* program in 2011. It was developed to parallel our business approach to look for innovative, forward-looking projects and organizations that need support in our communities.

In 2012, Strad added *Book Trust* to our list of benefitting groups. *Book Trust* is an organization that empowers elementary-aged children from low-income families to choose and own books to inspire a passion for reading. Each child that participates receives a small monthly amount of money to spend on books of his or her choice—usually 20 titles a year. Strad's is pleased that our financial contributions go directly to cover book costs for children across the United States.

Ultimately, the end goal with the *Strad Cares* program is for Strad Energy Services to help build stronger communities that are positively impacted by the energy industry.

StradEnergy.com



The Potential of the

Bakken

REGION

The Bakken spans from **North Dakota** to eastern **Montana** and into **Saskatchewan** and southwestern **Manitoba** in Canada. ^[1]



Energy Security Benefits

One estimate states that the Bakken could produce more than

1 MILLION BARRELS



per day by **2020** because of: ^[4]

It's a **petroleum system** characterized by: ^[2]

- * Regional hydrocarbon charge.
- * Organic-rich source rocks.
- * Low-porosity and permeability reservoirs.

This source rock has been said to have potentially generated more than **3.65 billion barrels of oil.** ^[9]



== **NORTH DAKOTA** ==
contains a significant amount of activity.

- * There are more than **3,500 Bakken wells** in the state, and another **1,500 wells** permitted or in progress. ^[3]

So what does this large formation mean for the U.S.?

The availability of **rigs.**



The number of crews available to perform **hydraulic fracturing.**



Job Growth Benefits

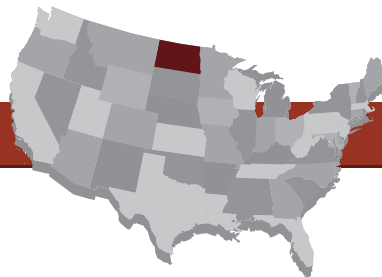
From 2004 to July 2012,

the number of **jobs available** in the **oil and gas** producing counties in **North Dakota**

has increased **more than 100%**.



North Dakota alone is producing more than **500,000** barrels of oil daily.^[6]



The **Bakken shale** drove almost

\$5 billion

in direct economic activity in **2009**.^[7]



The state's unemployment rate is only **3.3%** **5 percentage points lower** than the national rate.

The **U.S. Interior Department** has taken notice of the Bakken's impact, as well.^[8]

U.S. Interior Secretary Ken Salazar said:

"With the help of **new technology**, the Bakken play here in North Dakota is generating **impressive energy production** for our country and creating thousands of **American jobs**, as well as substantial royalty revenues for the state, tribes, and taxpayers."

Conclusion

The Bakken region offers a lot of **potential** for the United States, both in terms of an **increase in energy supply** and an increase in job creation and **economic gain**.



Sources:

HARTENERGY

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[2] http://www.ugcenter.com/Bakken/EP-Focuses-the-Bakken_68160

[3] <http://www.businessweek.com/ap/2012-05/D9V2KJE01.htm>

[4] <http://www.forbes.com/sites/christopherhelman/2012/06/04/bakken-bazhenov-shale-oil/>

[5] <https://www.dmr.nd.gov/oilgas/stats/historicalbakkenoilstats.pdf>

[6] <http://oversight.house.gov/hearing/americas-energy-future-part-ii-a-review-of-unnecessary-and-burdensome-regulations/>

[7] http://www.oilandgasinvestor.com/Exploration-Production-Industry-News/CERAWeek-Tillerson-Sees-North-America-Leading-Historic-Energy-Transformation_97410

[8] http://www.oilandgasinvestor.com/item/How-President-Obamas-Speed-Up-Drilling-Helps-Service-Stocks_98956

[9] <http://www.usgs.gov/newsroom/article.asp?ID=1911#.UDJ5cN2PV1E>



Who Sets Oil And

Volatile oil and natural gas prices are the result of

Commodity prices are rarely, if ever, set at the wellhead. Just as farmers don't control the price of wheat or ranchers the price of cattle, energy producers don't control the price at which they sell their products.

Instead, prices are set by a host of unpredictable domestic, international, economic and political factors. Even the weather affects oil and gas prices.

Studies show that of all commodities—wheat, sugar, orange juice, pork bellies, platinum, copper, gold, whatever—oil, gas and electricity are the most volatile of all.

Their daily prices on the New York Mercantile Exchange (Nymex) change more often, and to a greater degree, than those of other commodities. This in turn affects the price that buyers of the product

will pay at the wellhead. Producers can mitigate this volatility, in part, by price-risk management (commonly called hedging) or by selling forward a portion of their production at an agreed price.

Over time, there has understandably been a strong correlation between Nymex crude oil prices and the cash or spot price for West Texas Intermediate (the U.S. benchmark crude traded on Nymex).

The Nymex price is formed by a complex set of factors, not the least of which are perceptions of traders and speculators. As the old joke goes, when traders from Long Island emerge from the subway, Manhattan's weather sets the tone for that day's trading. More seriously, analysts note the effect on Nymex of speculative hedge funds and others who can move the price based on their



Gas Prices?

a number of intersecting factors.

own perceptions. When oil can swing by as much as several dollars per barrel in one day, that's not only world supply and demand affecting the price, it's someone's perception.

Who trades on Nymex? It varies, but as of October of 2012 roughly 50% of participants were "commercial traders" using futures or options for hedging purposes. Typically, these may be oil companies, refiners, end-users such as airlines and manufacturers, as well marketers involved directly in the industry who understand oil and gas fundamentals. "Non-commercial traders" made up almost 46%, these often being speculators, hedge funds and Wall Street investment houses. The remaining few percent is made up of odd-lot holders of a small number of contracts. Each day they react to weather conditions, global and national news

events, and weekly and monthly reports from various agencies.

Some of the most closely watched data on international supply, demand and storage come from three sources: the International Energy Agency (IEA) in Paris; the American Petroleum Institute, a Washington-based trade group; and the U.S. Department of Energy's Energy Information Administration (EIA).

It is difficult to monitor and measure specific production and demand numbers on a global basis. It is also difficult to track barrels or cubic feet that are in storage owned by governments and individual companies, and barrels that are in transport on the high seas.

In the end, all this leads back to wholesale oil and gas buyers and brokers posting the cash price

they will pay each day. Typically they arrange to buy for a 30-day period, as negotiated with the producer. Increasingly, these cash prices are tied to the closing price recorded on Nymex a day or two earlier.

No. 2 heating oil began trading on Nymex in 1978, crude oil futures in 1983, natural gas in 1990, and electricity in 1996. Instantaneous price transparency and computerized communication affect the worldwide price each day and in overnight trading as well.



\$110 Billion
annual U.S. government revenues
generated by unconventional oil and
gas industry in 2020



Tires properly inflated and
aligned saves 3% gas usage

Source: ICF International Tech Effect study, for American Clean Skies Foundation; IHS Global Insight; America's Natural Gas Alliance (ANGA) Institute for Energy Research; AAA's Chuck Mai, OERB

FACTORS AFFECTING PRICES

When prices rise.

From the demand side, the global or U.S. economy improves, or turns out to be more robust than was forecast, boosting the need for oil used in transportation, oil or gas in manufacturing and petrochemicals, or other. A colder-than-normal winter hikes demand in Canada, U.S., Europe, Russia and Japan. A hotter-than-normal summer boosts air-conditioning demand.

From the supply side, prices may rise because global oil production or the amount in storage is lower than forecast, lagging demand growth. Maybe the guesstimates were wrong. Or unexpected and/or temporary production shortfalls occur due to hurricanes in the Gulf of Mexico, problem wells, disappointing drilling results, project delays in bringing new production to market, pipeline restraints, or civil unrest in producing areas such as Nigeria or Colombia. The global or U.S. rig count might fall unexpectedly, or by more than forecast, leading eventually to reduced available supply. Refineries are shut-in due to emergency or routine maintenance.

Geopolitics affect prices, too. OPEC meetings and informal OPEC pronouncements can spook oil markets and traders. War in the Middle East or elsewhere causes major supply disruptions. Guerillas may sabotage oil or gas pipelines or other production facilities. State or federal regulation, legislation or tax changes can make drilling and production more economic, thus boosting activity.

When prices fall.

From the demand side, prices may fall when a slowdown in overseas or U.S. economies reduces demand for oil or refined products (diesel fuel, jet fuel, kerosene, etc.) or natural gas. A warmer winter than usual can reduce the need for heating oil or gas.

From the supply side, global oil production or U.S. gas output may turn out to be higher than forecast, or higher than demand, creating a supply glut. The amount of oil or natural gas in storage keeps rising, outpacing demand and creating a glut that takes time to be absorbed by the market.

Unexpected production increases can occur due to more drilling, or more success per well drilled because of technology advances. Or, more companies can enter the industry and start drilling. As oil prices rise, unaccounted-for inventories surface, curtailing the price rise.

Geopolitically, OPEC meetings or pronouncements can spook oil markets and traders. And state or federal regulations, legislation or tax changes can suddenly make drilling and production less attractive.

Thus, there are many factors in energy commodity price volatility, both global and domestic, economic and geopolitical.

—Leslie Haines

The vast majority of oil and gas traded on Nymex is never delivered. Instead, the trade is closed, or liquidated, by assuming an equal and opposite position in the market. What's left is the paper profit or loss.

If delivery is taken of the product, oil must be delivered at Cushing, Oklahoma, where many major oil pipelines intersect and there are millions of barrels of storage capacity. Natural gas must be delivered at the Henry Hub, a gas pipeline intersection near Erath, Louisiana.

However, with often limited access or desire to close out trades at Nymex delivery points, paper settlement, as noted above, is chosen by the vast number of participants that comprise what today is truly a world market for crude oil.

Nymex boasts that WTI is “the deepest and most liquid global energy benchmark,” trading

nearly 900,000 futures and options contracts daily. Through October of this year, trading in WTI futures has averaged 570,529 contracts per day. For natural gas futures, average daily contract volume has been 387,555 contracts.

Nymex describes WTI as “the world’s most actively traded energy product,” but its historical leadership has at times come under challenge lately by Brent crude futures contracts, traded in London on the ICE Futures Europe exchange, in another sign of a global market for crude.

Brent crude oil, a blend of oils produced in the North Sea, has grown in popularity because of its ability to reach markets throughout the world by ship, enhancing its global relevance.

Reflecting Brent’s growing popularity, daily trading in Brent futures contracts averaged 567,000 contracts from January 1 through November 20,

Community Partners

SAFETY AND THE ENVIRONMENT



Triangle Petroleum understands the value and importance of making positive contributions to the communities where we live and work. Every day we are implementing innovative ideas to protect our environment and keep our employees and community members safe. By repositioning roadways to redirect traffic around residential homes and by drilling on multi-well pads, Triangle has not only provided safer communities for local families, but we have also minimized our truck traffic by over 50%.

In continuing to focus our efforts on minimizing truck traffic, Caliber Midstream, our recently-funded joint venture with First Reserve Energy Infrastructure Fund, is currently constructing a pipeline system in McKenzie County, North Dakota, that is estimated to reduce commercial truck traffic hauling crude oil, produced water and freshwater by an average of 150 truckloads per day.

While constantly seeking new methods to improve practices, Triangle strives to protect the environment and minimize our footprint as much as possible. Triangle is one of the first E&P players in the Williston Basin of North Dakota to develop a biodegradable solution to dispose of our drilling cuttings. As a result, the cuttings can be safely buried back into the ground and the land restored to its original state.

To be an integral part of the community, Triangle believes health, safety and environment come above all else. We provide rigorous safety training for all of our employees and make sure best safety practices are always in place. Our goal is to bring value to the communities where we live and work through our advanced safety program and environmental awareness. TrianglePetroleum.com

2012, approaching WTI's average trading volume of 575,000 contracts over the same period, according to Bloomberg.

However, average trading volume of Brent futures contracts exceeded that of WTI for each month from April through October, Bloomberg said.

—Leslie Haines

**Prices are formed
by a complex set
of factors.**



Community Partners



Whiting Petroleum Corp.'s community outreach programs are instilled in the company's culture and philosophy. We are committed to be good corporate citizens in the communities in which we operate.

Whiting's flagship community outreach program is the "Food Bank of the Rockies." During the past several

years, the contributions of Whiting and its employees have provided more than one million meals to hungry men, women and children across Colorado.

Whiting supports institutions of higher learning in North Dakota and Montana through financial contributions and by hiring their graduates. Whiting's donations to the University of Colorado at Boulder enabled construction of a new computer center at the Leeds School of Business.

The company's involvement in the "Pick Up the Patch!" program covered more than 125 miles of roadways with over 800 bags of trash picked up across western North Dakota. Whiting recently joined together with the Petroleum Council and the Game and Fish Department in an effort to reduce impacts on wildlife in North Dakota.

We strive to give back to the communities that have helped Whiting be successful.
Whiting.com





Communities

Companies

Communities And Companies: A Two-Way Street

Successful resolutions require openness, trust and participation by all parties involved.

It's inevitable that from time to time difficult situations arise between businesses and the communities they serve. The quick spark of a crisis can be easy to spot. The long, slow burn of a controversy—one that takes weeks, months or even years to bubble up—is harder to define, but just as important to address. Regardless, open avenues of communication, mutually agreed-upon facts, trust and a context in which all players feel positively invested are the ultimate goals for successful resolutions.

What is the difference between crisis and controversy? Regardless of the size of their potential impact, crises are narrow in scope, because they are defined by a specific event or series of events in the life of a company or community. A life-threatening accident, ill-timed or heated comments by a chief executive officer or local figure, a systems malfunction—regardless of what sets it off, a crisis starts when a clearly drawn, recognizable line has been crossed.

Agreement that there is a crisis at hand offers a collecting point from which resolution may emerge. In most cases, a crisis subsides once all affected parties believe the resulting problems have been addressed or, at the very least, acknowledged.

Controversies, by contrast, don't have easily definable boundaries. They are often the result of long-simmering disagreements that stem from an

inability to communicate effectively and arrive at a mutually agreed-upon set of facts.

And facts, of course, are the keys to mutual understanding and resolution. The most difficult controversies are those where one side sees a problem and the other does not.

The result of ongoing, unaddressed controversy is that misunderstanding rules the day. Bias may undermine negotiations, each side develops its own set of facts and rules of engagement, negative perceptions take hold, and distrust comes to define interactions. Controversy can contaminate a relationship to the extent that many players come to see agreement as impossible. Such an environment is ripe for crisis.

A two-way street

What is the key to stemming the damaging consequences of controversy? Acknowledging controversy is the first step to reframing the debate in a way that puts all players on even footing.

The steps a community must take to ensure peaceful coexistence aren't all that different than those businesses must take. Disagreements and biases must be acknowledged, and both sides must work to put aside the "us vs. them" mentality.

A successful relationship is a two-way street. Businesses would not thrive without the communities on which they depend for labor, services and

consumers. The assumption that businesses don't have a stake in their communities is no more productive than the assumption that the public won't welcome an open dialogue. Businesses do have a stake. Acknowledging it gives local communities the power to remind businesses, "Hey, we're in this together."

Listen and be heard

Pro-active, open communication is the best way to ensure that controversies are addressed, that preventable crises are averted and that unforeseen crises are resolved quickly. Good relations are the key to good business, to continued success and to long-term profitability. By engaging with businesses, communities can assure their seat at the table where important decisions are made.

What can communities do as controversies begin to bubble up or a crisis hits? It's important to know where to direct questions and concerns. Local stakeholders asked to speak on a company's behalf are there to answer questions and engage. Be willing to participate in the conversation. Working together toward a practical solution is the goal.

A successful strategy

First, work to establish a set of facts on which all parties can agree. Even if there is more disagreement than agreement, creating a baseline is a useful starting point that helps open discussion on a positive note and lays the groundwork for successful communication and interaction. If a controversy is to be addressed successfully, both sides can't operate from different frameworks and different sets of facts.

Community Partners

ENERGY EDUCATION

As the voice of the Texas oil and gas industry, The Foundation for Energy Education's mission is to expand public knowledge, and in the process build a future that serves the best interests of both our citizens and industry.

The Foundation for Energy Education works to educate the general public about the oil and gas industry through various media campaigns and outreach programs with a specific focus on school education by presenting educational facts and materials on natural resources such as oil and gas into Texas classrooms.

The Foundation also works to promote the use of natural gas by communicating its many advantages as a solution to the state and nation's energy and environmental challenges. Foundation membership includes a variety of industry companies, professionals, and members of the general public that are interested in Texas' and the nation's energy future.

The Foundation for Energy Education believes that developing a stronger partnership with the general public results in better community relations and viable and beneficial energy policies that can lead to greater success in addressing energy industry workforce issues.

The Foundation for Energy Education is a 501(c)(3) nonprofit affiliate of the Texas Alliance of Energy Producers. It provides information to citizens, to improve public knowledge of oil and gas issues and presents energy education to schoolchildren in classrooms all across Texas.

FoundationForEnergyEducation.org

Likewise, both sides should acknowledge where disagreements exist. Disagreeing on one or multiple issues does not in itself hinder communications; it simply sets parameters for discussion moving forward. Acknowledging a controversy does not immediately resolve the disagreement from which it stems, but it can hold the controversy in check. In some cases simply avoiding the worst is a successfully agreed-upon outcome—a victory.

Finally, as parties come together to address a controversy each side must pick their battles carefully and understand that just as a controversy doesn't develop overnight, neither does its resolution. Open avenues of communication, mutually agreed-upon facts, trust and a context in which all players feel positively invested are the ultimate goals. ■

—Casey Nikoloric

Shared Value

For decades, we have bought into the construct that corporate profits always come at the expense of the greater good, accepting the notion that there is an inevitable trade-off between business performance and social progress. It is an “us and them” mentality in which one side treats the other as an obstacle.

This outdated mindset has been fueled by mistrust in business—a crisis of confidence in capitalism that has dominated public opinion for many years. The paradigm has been institutionalized in decades of poor public policy choices and, in some cases, poor business decisions that have valued short-term financial gain over long-term benefits.

A new model is taking shape—a framework that recognizes that business is a powerful force for innovation, growth and change. It reinvents the relationship between business and community and places “shared value” at the center of economic success.

Its proponents include McKinsey & Co., Harvard Business School professor Michael E. Porter and Kennedy School fellow Mark R. Kramer. Porter and Kramer are the co-founders of FSG, a global social impact consulting firm and the authors of “Creating Shared Value: How to Reinvent Capitalism and Unleash a Wave of Innovation and Growth” (Harvard Business Review, February, 2011).

The idea that companies can do good and do well at the same time isn't a new one. It's been discussed for some time in theories like the “triple bottom line” (people, planet and profit), “impact investing” and “corporate sustainability.” What is taking hold in new form is the idea that shared value is integral to profitability and competitive position as well as the overall health of local communities and their residents.

When shared value is embraced, business and society come together and put the greater good at the center of the way they operate. Companies no longer leave it at the margins in social responsibility and philanthropy programs viewed as necessary expenses required to bolster reputation.

Instead, company success is connected with social progress on a fundamental level. Solving social problems is no longer left entirely to governments and nonprofit organizations. And communities learn to regulate in ways that encourage shared value instead of working against it. The result is that companies, communities and nonprofits collaborate in new ways to meet human needs.

An example involves developing skilled workers. Tom Tunstall, research director for the Institute for Economic Development at the University of Texas San Antonio, says the Institute estimates that approximately 15% of the 54,000 new jobs expected in the Eagle Ford shale by 2021 will require a college degree, and a little more than 10% will require direct experience in the energy business. Community colleges, universities, local governments and business groups in emerging resource plays across the country are organizing training programs for those who need them, with business playing a central role in curriculum planning and teaching. A federally funded program called ShaleNet will train pipeline operators and oil-field technicians nationwide.

There are many such examples, all with a common theme. Large-scale social change comes from better cross-sector coordination than the isolated intervention of individual organizations. When nonprofits, governments, business and the public come together around a common agenda, good things happen.

—Casey Nikoloric

GLOSSARY OF ENERGY TERMS

Like many businesses, the oil and gas industry has terms, units of measure, abbreviations and other lingo that may be unfamiliar to the public. Here are the basics.

HYDROCARBONS

Coalbed methane (CBM)—Recoverable volumes of gas from development of coal seams (also known as coal seam gas, or CSG).

Conventional gas resources—Generally defined as those associated with higher permeability fields and reservoirs. Typically, such a reservoir is characterized by a water zone below the oil and gas. These resources are discrete accumulations, typified by a well-defined field outline.

Dry natural gas—is fairly pure methane gas. It is natural gas that remains after 1) the liquefiable hydrocarbon portion has been removed from the gas stream (i.e., gas after lease, field, and/or plant separation); and 2) any volumes of non-hydrocarbon

gases have been removed where they occur in sufficient quantity to render the gas unmarketable. Note: Dry natural gas is also known as consumer-grade natural gas.

Liquefied natural gas (LNG)—Natural gas (primarily methane) that has been liquefied by reducing its temperature to -260 degrees Fahrenheit at atmospheric pressure. Once a liquid, it can be more readily transported by ship to end-use markets, then regasified for movement through a pipeline.

Shale gas—Natural gas produced from wells that are open to shale formations. Shale is a fine-grained, sedimentary rock composed of mud from flakes of clay minerals and tiny fragments (silt-sized particles) of other materials. The shale acts as both the source and the reservoir for the natural gas.

Tight oil—Tight oil plays are those shale plays that are dominated by oil and associated gas, such as the Bakken shale in North Dakota.

Tight gas—Recoverable volumes of gas and condensate from development of very low permeability sandstones.

Unconventional gas resources—Reservoirs in which oil or gas do not flow without the aid of fracturing technology. The main categories are coalbed methane, tight gas, and shale gas, although other categories exist, including methane hydrates and coal gasification.

West Texas Intermediate oil (WTI or Cushing)—A crude oil produced in Texas and southern Oklahoma that is light (low density) and sweet (low sulfur). It serves as a benchmark or “marker” for pricing a number of other types of crude streams. It is physically stored and traded in the domestic spot market at Cushing, Oklahoma, the primary oil trading hub in the U.S. Nymex prices are referenced at Cushing



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as well, for paper trades. **Nymex**, the New York Mercantile Exchange, is a futures market in which a seller promises to deliver a given quantity of a commodity at a specified place, price, and time in the future. Oil, natural gas and other related commodities are traded on Nymex.

Wet gas—includes all the natural gas liquids (see below) and typically has a higher Btu (British thermal unit) content of at least 1,500 Btu.

COMMON MEASUREMENTS

M is the Roman numeral for a thousand. Production of 67 Mcf of gas per day is 67,000 cubic feet. **MM** represents a million, so production of 67 MMcf of gas per day is 67 million cubic feet per day. **B** represents a billion, thus production of 67 Bcf of gas per day is 67 billion cubic feet. **T** represents a trillion, so proved reserves of 2 Tcf of gas are 2 trillion cubic feet of gas.

Bbl represents a barrel, or 42 gallons of oil. Production of 80 Mbbl of oil per day is 80,000 barrels.

Cf represents cubic feet and is usually the measurement of natural gas, as in “a well produces 2.5 MMcf per day.”

Cfe represents cubic feet of gas equivalent. It is usually the measurement of the mathematical combination of natural gas and oil or gas liquids, ranked together by heating content or Btu value. The conversion is usually 10,000 or 6,000 cubic feet of gas per one barrel of oil or gas liquids. (The ratio usually reflects the recent market value of 1 Mcf of gas in comparison with 1 barrel of oil or gas liquids.)

Thus, 10 MMcfe is 10 million cubic feet of gas equivalent. If the true mixture is 50% natural gas and 50% liquids

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(oil or gas) and the mathematical rate is 10:1, then 10 MMcfe consists of 5 MMcf of gas and 500 barrels of oil or gas liquids.

BOE—is barrels of oil equivalent. It is usually the measurement of a mathematical combination of natural gas and oil or gas liquids. The conversion is usually 10,000 or 6,000 cubic feet of gas per one barrel of oil or gas liquids. Thus, 10 MMBOE is 10 million barrels of oil equivalent. If the true mixture is 50% natural gas and 50% liquids (oil or gas) and the conversion rate is 10:1, then 10 MMBOE consists of 500 Bcf of gas and 5 million barrels of oil or gas liquids.

Cf/d—is cubic feet of gas per day. Another abbreviation of this is cfpd.

Bbl/d—is barrels of oil per day or barrels of gas liquids per day. Another abbreviation is bpd.

Btu—a British thermal unit, measures stored energy, primarily used to describe the heat content of nat-

ural gas. One million Btu is generally the equivalent of 1,000 physical cubic feet; however, some natural gas contains fewer or more impurities than others and therefore has a higher or lower stored-energy content and, thus, market value. Natural gas is traded on Nymex in Btu rather than cubic feet.

FIELD TERMINOLOGY

A **dry hole** occurs when no oil or gas is found in the well, or the quantity of oil or gas that was found is insufficient to justify the expense of bringing the well into production.

A **delineation well** or appraisal well is drilled near a discovery well. It helps define the boundaries of the oil or gas reservoir, and assists in deciding whether to incur additional spending to drill more wells to fully develop the field and produce the oil or gas. A delineation or appraisal well can be deemed a dry hole.



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A **development well** is drilled where there has been a discovery, as a result of an exploratory well, and is usually drilled after delineation or appraisal. Oil or gas is produced from this well. A development well is rarely a dry hole.

Downstream Refining, distribution and retailing of oil and gas products.

EUR or estimated ultimate recovery—is the amount of oil or gas estimated to be produced over a well's lifetime, prior to plugging and abandoning the well because it is no longer economic to produce.

An **exploratory well** is drilled to find oil or natural gas where none has been produced before.

A **field** is an area that contains a single reservoir or related reservoirs with the same geological structural feature or stratigraphic condition. It may contain dozens or hundreds of wells.

Fracture stimulation (frac job)—Also called hydrofracing. An operation that involves large pumps that inject, at high pressure, many gallons of water or other fluids, and pounds of proppant (sand or ceramic) down the well casing and out into the formation. The mixture fractures the rock so oil or gas can be released through the fractures and flow up the well bore.

Horizontal drilling—Drilling a horizontal section in a well (used primarily in a shale or tight oil well), typically thousands of feet in length.

Midstream—Downstream of the wellhead, including gathering, gas and liquids processing, and pipeline transportation.

Net pay—is the thickness of productive oil- or gas-saturated rock that has been encountered during drilling. A company may drill a 15,000-foot well and encounter 300 feet of net pay in several intervals of 100 feet each, for example. The development well is designed to produce only from the net pay.

Permeability—The capacity of a rock to transmit fluids. A tight rock, sand or formation will have low permeability and thus, low capacity to produce oil or gas, unless the well can be fracture-stimulated to increase production.

A **play or trend** is an area or region where there is a great deal of drilling and production activity and involves a group of geologically related fields and prospects. A play is a set of known or postulated oil and gas accumulations sharing similar geologic, geographic, and temporal properties, such as source rock, migration pathway, timing, trapping mechanism, and hydrocarbon type. A play differs from an assessment unit; an assessment unit can include one or more plays. A play is often used to refer to a natural gas accumulation, i.e., a natural gas shale play, an oil play.

Porosity—The volume of small to minute openings in a rock that allow it to hold fluids.

A **prospect** is a lease or individual well that may be drilled because geology indicates it will probably be productive.

Prospective acreage—is where there are geologic, seismic and/or other reasons to believe the subsurface may contain oil or gas. Drilling will be necessary to form a conclusion.

Proved acreage—is where the existence of oil or gas has been proven by drilling exploration and appraisal wells.

Proved reserves—are reserves of oil or gas that can be economically produced under current economic conditions and commodity prices, and given current technologies, within five years, according to complex guidelines in force by the Securities and Exchange Commission (SEC).

Proved developed reserves—are reserves that can be expected to be recovered through existing wells, with existing equipment and known operating methods.



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PUDs—Proved undeveloped reserves that may be soon drilled and placed into production using existing technologies, recovered from new wells on undrilled, proved acreage, or from existing wells where a relatively major expenditure is required for completion.

Reservoir—A porous and permeable subsurface formation that contains oil or gas and is surrounded by rock that separates the oil or gas contents from other reservoirs.

Seismic—An earthquake or earth vibration including those that are artificially induced.

Stripper well—A gas well that produces 6 Mcf a day or less, or an oil well that produces 10 barrels a day or less. Thousands of such wells are found in 29 producing states. (See National Stripper Well Association at nswa.us.)

Upstream—Oil and gas extraction, including exploration, leasing, permitting, site preparation, drilling, completion, and long-term well operation.

Wellbore—That part of a well that is below the surface. Hole diameters vary with the type and purpose of wells.

OFFSHORE TERMS

Deep water—is water greater than 1,000 feet or 305 meters deep.

FPSO—Floating production, storage and offloading vessel, a ship that collects oil production, stores it, then offloads it into tankers that take it to shore.

Floater—Nickname for any offshore drilling rig that floats as opposed to being moored to the sea floor.

Jack-up rig—A self-contained combination drilling rig and floating barge, fitted with long support legs that can be raised or lowered independently of each other. The first one was built in 1954.

Outer Continental Shelf—Offshore federal domain divided into lease blocks that may be leased

at periodic federal lease sales under a sealed bid system. Such leasing began in 1954. These blocks are from 3 to 230 miles offshore. (Waters less than 3 miles from shore are owned by the states and are called state waters.) There are more than 7,500 leases on the OCS.

Platform—Either a drilling or production facility offshore.

Shallow water—is less than 1,000 feet or 305 meters deep, according to definitions of the U.S. Dept. of the Interior, which manages offshore activity through two agencies: the Bureau of Ocean Energy Management (BOEM) and Bureau of Safety and Environmental Enforcement (BSEE).

Ultra-deepwater—is water deeper than 5,249 feet or 1,600 meters. Companies are now able to drill in water up to 10,000 feet deep, with wells going as deep as 27,000 feet below the subsea surface.

INTERESTS AND CONTRACTS

Gross acres or gross wells—are the total acres or wells in which a working interest is involved. Net acres and net wells are calculated by factoring in working interest. For example, if a company's working interest in 100,000 acres is 30%, then its ownership is 30,000 net acres. If the company's working interest in 100 wells is 45%, then its ownership is 45 net wells.

Farm-in or farm-out—is an agreement in which the owner of a working interest in an oil and gas lease gives some or all of that interest to another party (company) that will drill on the leased acreage. The party farming out the working interest usually retains a royalty or reversionary interest from the party that is farming in.

Royalty interest—is the right to receive a specified amount of the gross income or production from a mineral property. A royalty interest, as opposed to a working interest, is not charged with the costs of exploration or development drilling, or operation, and is therefore treated as a nonoperating interest for federal income tax purposes.

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Working interest—is the percentage of ownership that the company has in a joint venture, partnership, consortium, project, acreage or well. A working interest owner pays his share of the well drilling and operating costs, and shares in the cash flow.

NATURAL GAS LIQUIDS

Compression—To move natural gas through pipelines, it must be compressed to save space and push it further down the pipeline. Most gas is compressed at 1,000 psi (pounds per square inch).

Frac spread—A measure of profitability for processing plants. It's the difference between the sales price of natural gas liquids (the processing output) and the cost of natural gas (the processing input).

Natural gas processing plant—Facilities designed to recover natural gas liquids from a stream of natural gas that may or may not have passed through lease separators and/or field separation facilities.

These facilities control the quality of the natural gas to be marketed. Cycling plants are classified as gas-processing plants.

NGLs or natural gas liquids—Usually measured in barrels rather than in cubic feet. Six marketable products are produced from the natural gas stream at the wellhead. These are separated at a gas-processing plant. During times of high gas demand, the Btu content of ethane may be more valuable left in the natural gas stream, rather than being sold as a separate product.

The components of NGLs are: ethane (chiefly used to produce ethylene in petrochemical plants); propane, used as a heating source and some vehicle fuel; butane, sold as bottled fuel or as a petrochemical feedstock; isobutane, used as a petrochemical feedstock; LPG or liquefied petroleum gas, and used as fuel; and natural gasoline, an NGL with vapor pressure between that of condensate and LPG. It is used as a feedstock for nylon, plastics and cosmetics. LNG is liquefied natural gas. ■





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