HAYDEN HARPER

Natural Gas 101

What is natural gas?

Natural gas is a hydrocarbon gas mixture comprised of mostly methane (70-90%). It is found with other fossil fuels in reservoirs typically found 2,000 to 10,000 ft below the earth's surface.

How is natural gas formed/created?

Millions of years ago, the remains of plants and animals decayed, called organic material, and built up in thick layers. Over time, the mud and soil changed to rock, covered the organic material and trapped it beneath the rock. Pressure and heat changed some of this organic material into coal, some into oil (petroleum), and some into natural gas.

How do we get Natural Gas?

The search for natural gas begins with geologists. They locate the types of rock that are known to contain gas and oil deposits. Over the last century technological advances in exploration techniques have shifted the industry from a wildcatting to strategic low risk development. Seismic interpretation and better drilling controls have provided the largest technological advances. Seismic data allows the geologist to interpret radio waves to better predict the location of hydro carbons. Twenty years ago only 1 of 9 holes would be deemed successful and with these advances the odds have reversed themselves.

Permitting:

Once a geologist has selected a drilling location, it has to be staked and permitted by a surveyor. Then after the proper environmental precautions are taken, the drilling site is created which includes creating a level drilling area, digging a pit for drilling cuttings and water and building an access road.

Drilling:

http://www.adventuresinenergy.org/Exploration-and-Production/index.html

Logging

Logging tests are performed during or after the drilling process to allow geologists and drill operators to monitor the progress of the well drilling and to gain a clearer picture of subsurface formations. There are many different types of logging, but essentially they consist of a variety of tests that illuminate the true composition and characteristics of the different layers of rock that the well passes through. The main components of a log report show the porosity and temperature of the formations. Logging is also essential during the drilling process. Monitoring logs can ensure that the correct drilling equipment is used and that drilling is not continued if unfavorable conditions develop.

Completion

Once they finish logging, they must run and cement the casing -- place casing-pipe sections into the hole to prevent it from collapsing in on itself. The casing crew puts the casing pipe in the hole. The cement crew pumps cement down the casing pipe. The pressure from the drill mud causes the cement to move through the casing and fill the space between the outside of the casing and the hole. Finally, the cement is allowed to harden and then tested for such properties as hardness, alignment and a proper seal.

After casing has been run a perforating gun is lowered into the well to the production depth. The gun has explosive charges to create holes in the casing through which oil and natural gas can flow. After perforation they run a small-diameter pipe (tubing) into the hole as a conduit for oil and gas to flow up the well. A device called a packer is run down the outside of the tubing. When the packer is set at the production level, it is expanded to form a seal around the outside of the tubing. After the casing has been perforated, further stimulation (fracturing) often follows this process. Fracturing is when fluids are injected underground at high pressures then the formations fracture, and the oil or gas flows more freely out of the formation.

How is Natural Gas stored and delivered?

Natural gas is moved by pipelines from the producing fields to consumers. Since natural gas demand is greater in the winter, gas is stored along the way in large underground storage systems, such as old oil and gas wells or caverns formed in old salt beds. The gas remains there until it is added back into the pipeline when people begin to use more gas, such as in the winter to heat homes.

When chilled to very cold temperatures, approximately -260 degrees Fahrenheit, natural gas changes into a liquid and can be stored in this form. Because it takes up only 1/600th of the space that it would in its gaseous state, Liquefied natural gas (LNG) can be loaded onto tankers (large ships with several domed tanks) and moved across the ocean to deliver gas to other countries. When this LNG is received in the United States, it can be shipped by truck to be held in large chilled tanks close to users or turned back into gas to add to pipelines.

When the gas gets to the communities where it will be used(usually through large pipelines), the gas is measured as it flows into smaller pipelines called "mains". Very small lines, called "services", connect to the mains and go directly to homes or buildings where it will be used.

How is natural gas measured?

We measure and sell natural gas in cubic feet (volume) or in British Thermal Units (heat content). Heat from all energy sources can be measured and converted back and forth between British thermal units (Btu) and metric units.
One Btu is the heat required to raise the temperature of one pound of water one degree Fahrenheit. Ten burning kitchen matches release 10 Btu. A candy bar has about 1000 Btu. One cubic foot of natural gas has about 1031 Btu. A box 10 feet deep, 10 feet long, and 10 feet wide would hold one thousand cubic feet of natural gas.

How is natural gas used?

Approximately 23 percent of the energy consumption of the U.S. comes from natural gas. Slightly more than half of the homes in the U.S. use natural gas as their main heating fuel. Natural gas is also an essential raw material for many common products, such as: paints , fertilizer, plastics, antifreeze, dyes, photographic film, medicines, and explosives. We also get propane when we process natural gas. Propane is the fuel many of us use in our barbecue grills. Natural gas has thousands of uses and industry depends on it. It's used to produce steel, glass, paper, clothing, brick, electricity and much more! Homes use it too. More than 62 percent of homes use natural gas to fuel stoves, furnaces, water heaters, clothes dryers and other household appliances. It is also used to roast coffee, smoke meats, bake bread and much more. It is also used for electrical generation that cools many homes (due to its clean burning features it has recently become a popular choice for power generation, as a coal replacement)

How does natural gas impact the environment?

Natural gas burns more cleanly than other fossil fuels. It has fewer emissions of sulfur, carbon, and nitrogen than coal or oil, and when it is burned, it leaves almost no ash particles. Being a clean fuel is one reason that the use of natural gas, especially for electricity generation, has grown so much and is expected to grow even more in the future. Of course, there are environmental concerns with the use of any fuel. As with other fossil fuels, burning natural gas produces carbon dioxide which is a very important greenhouse gas. Many scientists believe that increasing levels of carbon dioxide and other greenhouse gases in the earth's atmosphere are changing the global climate.

Also, as with other fuels, natural gas also affects the environment when it is produced, stored and transported. Because natural gas is made up mostly of methane (another greenhouse gas), small amounts of methane can sometimes leak into the atmosphere from wells, storage tanks and pipelines. The natural gas industry is working to prevent any methane from escaping. Exploring and drilling for natural gas will always have some impact on land and marine habitats. But new technologies have greatly reduced the number and size of areas disturbed by drilling, sometimes called "footprints." Satellites, global positioning systems, remote sensing devices, and 3-D and 4-D seismic technologies, make it possible to discover natural gas reserves while drilling fewer wells. Plus, the use of horizontal and directional drilling make it possible for a single well to produce gas from much bigger areas than in the past.

Natural gas pipelines and storage facilities have a very good safety record. This is very important because when natural gas leaks it can cause explosions. Since raw natural gas has no odor, natural gas companies add a smelly substance to it so that people will know if there is a leak. If you have a natural gas stove, you may have smelled this "rotten egg" smell of natural gas when the pilot light has gone out.

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Sources: Energy Information Administration, Natural Gas Annual 2007, December 2008.
Energy Information Administration, Annual Energy Review 2007, June 2008.

Why is it better than solar and wind?

"In 2007, wind and solar generated less than 1 percent of U.S. electricity. Even a tenfold expansion will leave their contribution small. By contrast, oil and natural gas now provide two-thirds of Americans' energy. They will dominate consumption for decades. Any added oil produced here will mostly reduce imports; extra natural gas will mostly displace coal in electricity generation. Neither threatens any anti-global warming program that Congress might adopt.

Encouraging more U.S. production also aids economic recovery, because the promise of "green jobs" is wildly exaggerated. Consider. In 2008, the oil and gas industries employed 1.8 million people. Jobs in the solar and wind industries are reckoned (by their trade associations) to be 35,000 and 85,000, respectively. Now do the arithmetic: A 5 percent rise in oil jobs (90,000) approaches a doubling for wind and solar (120,000). Modest movements, up or down, in oil will swamp "green" jobs."

http://www.realclearpolitics.com/articles/2009/05/04/the_bias_against_oil_and_gas_96324.html

Why is it better to invest in Nat gas than bio fuels?

Despite all the hope, the finish line is not close. Helena Chum, a research fellow at the National Renewable Energy Laboratory, estimates that next-generation biofuels now cost anywhere between $5 and $1,000 a gallon, with a median of about $25. That won't work, even in a Prius.

http://www.forbes.com/2009/04/28/biofuels-ethanol-virent-technology-breakthroughs-biofuels.html

How LNG will affect the natural gas market?

Liquefied Natural Gas is gas chilled to liquid form for transportation by tanker to destinations not connected by pipeline. The map below shows the LNG receiving terminals that we have in the United States. The largest LNG exporters are Indonesia and Russia. Trinidad and Tobago also has a strong LNG presence and is hoping to export to the United States. Currently the US is seeing meeting natural gas demand through domestic resources. However, if more power plants turn to natural gas as the power source, LNG could become an important player.

Sources:
http://www.naturalgasfacts.org/quickfacts.pdf
http://www.naturalgas.org/overview/background.asp
http://www.eia.doe.gov/basics/naturalgas_basics.html
http://www.adventuresinenergy.org/index.html
http://science.howstuffworks.com/oil-drilling.htm

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Contact us directly for more information:

Hayden harper

1818 Lombardy Circle
Charlotte, NC 28203

P: 704.343.2447
F: 704.343.4691

E: info@haydenharper.com

www.haydenharper.com