



Natural Gas – Key Takeaways

Below you will find a number of key points from this course. Defined terms are underlined>.

Week One: Exploration of Natural Gas

Natural gas is a fossil fuel and is also called methane.

Methane is a green-house gas that is 20 more time potent than carbon dioxide.

Natural gas and crude oil were formed from the bodily remains of minute marine life that lived between 300 to 400 million years ago in ancient oceans.

Landfills, agricultural waste from dairies, chicken and pig farms and food processing waste produce natural gas when they decompose. This is known as **biogas** which can then be turned into renewable natural gas.

The natural gas that we use in our homes, power plants and industries has a standard energy content of 1,032 Billion Thermal Units (Btu) per cubic foot.

1 Mcf = 1 Dekatherm = 1 MMBtu = **1,000 cubic feet**

1,000 cubic feet can heat a home for 4.6 days, generate electricity for about 24 days, fuel a bus for 24 miles, drive a natural gas vehicle for 276 miles, or make 63 pounds of fertilizer.

Shales are fine-grained, sedimentary rock composed of mud that is a mix of flakes of clay minerals and tiny fragments

The U.S. federal government does not regulate natural gas or oil drilling. Instead, the individual states regulate the exploration and drilling activities.

Oil and gas bearing shale deposits are found in the Appalachian, Rocky Mountain area, Texas and the U.S. Gulf coast.

George Mitchell combined horizontal drilling with hydraulic fracking.

When the shale is fractured, it takes a proppant like sand to “prop” or keep the fissures open.

Week Two: Natural Gas Processing, Transmission & Storage

When gas comes out of the ground it is gathered through a series of pipes called **gathering lines**.

Treatment plants remove impurities like water, sulfur, carbon dioxide and other substances.

Processing plants remove valuable natural gas liquids from the treated gas.

The Federal Energy Regulatory Commission (FERC), regulates all interstate natural gas pipeline's

Natural gas pipeline transports gas by using compressor stations, which are located every 50 to 70 miles.

There are three types of underground **gas storage facilities**:

1. depleted oil well reservoirs
2. salt caverns
3. aquifers.

Week Three: Liquefied Natural Gas, Distribution, & Construction

LNG is natural gas that is super cooled to -260°F.

By super cooling natural gas, we reduce its volume to the 1/600th of the original size. For example, 600,000 ft³ of natural gas would become 1,000 cubic feet of LNG.

Natural gas can be compressed and is called "compressed natural gas or **CNG**. When compressed, its volume is reduced to 1/200th of the original volume.

LNG Supply Chain.

1. Natural gas production
2. Processing and liquefaction of the gas (super cooling it)
3. Shipping
4. Regasification and
5. Use by customers

LNG export terminals produce LNG for global buyers on specially made ships called LNG carriers.

There are three types of **liquefaction plants**.

1. Large base-load plants
2. Peak shaving plants
3. Small scale LNG plants

LNG import terminals receive LNG by pumping LNG from the carrier to a large LNG Storage Tank

LNG Bunkering is practice of providing LNG fuel to a ship for its own consumption.

The “**Keep it in the Ground**” movement contains environmental groups that are against fracking natural gas and oppose projects at FERC as well as in the courts.

Interstate pipelines transport natural gas across the country over long distances.

Intrastate pipelines operate within a given state and do not cross a state boundaries.

The Pipeline and Hazardous Materials Safety Administration (PHMSA), regulates intrastate natural gas pipelines and deals with the safety of all distribution lines.

A natural gas **pipeline company** just transports gas.

A natural **gas utility** provides gas service to residential, commercial and industrial customers.

The pressure of an interstate or intrastate natural gas pipeline is between 200 pounds per square inch (psi) and 1,500 psi.

Gas mains are large pipes less than 4 inches in diameter that conduct and distribute gas to lesser pipes or ducts

Polyethylene plastic pipe was first introduced in the 1960s and makes up 90% of the 40,000 miles of new mains constructed each year in the United States.

Week Four: Safety & Customer Service

Overall, there were over 3141 incidents, 369 injuries and 78 deaths caused by natural gas and liquid pipelines between 1999 and 2014.

The number one concern facing the natural gas industry is corrosion.

Internal corrosion occurs when corrosive substances are transported through pipelines.

External corrosion occurs from moist soil or ground water.

Almost 8,000 families had to be evacuated from a suburb in Los Angeles when the Aliso Canyon Gas Storage facility leaked methane.

Faulty weld repairs by Pacific Gas & Electric on a natural gas distribution line killed 8 people and injured 60 people in San Bruno, California.

The 2015 East Village Gas Explosion in New York City was caused by an illegal tap into a gas main and killed 2 people, injured 19 people, and destroyed 3 adjacent buildings.

NYSEARCH is a non-profit, collaborative Research, Development & Demonstration (RD & D) organization. They focus on improved installation, maintenance, and repair of natural gas quality. They also look at pipe location and integrity, direct and remote assessments, new materials, damage prevention and leak detection.

NYSEARCH developed a monitoring system which uses a flexible sensor tape that contains micro linear resistance corrosion sensors on a live steel transmission gas main to monitor any evidence of corrosion in real time.

Natural gas pipelines and distribution lines inspect their lines using a pipeline inspection gadget or what is called a **PIG**.

A natural gas utility's **call center** is its first line of customer service. It deals with request for service, billing, complaints, and emergencies like digging near a gas line or reports of gas leaks and explosions.

Technicians install or replace meters, turns your service on or off, and inspects suspected gas leak.

Two types of gas service

Firm - Usually residential service is always firm since we are guaranteed service

Interruptible - Industrial users are usually offered this service and may get a better price.

Components of a residential natural gas bill

- The customer charge is for the gas meter that is measuring how much gas you use.
- The distribution charge is the charge for the volume of gas you actually use.
- The purchase gas adjustment is a pass-through charge from the gas utility for the cost of the natural gas it buys on the open market.
- Charges for maintenance of the distribution system plus a profit for the natural gas utility company.

The Gas Technology Institute provides numerous field training modules that pipeline operators can use to train their employees and comply with the PHMSA regulations.