



JUST THE FACTS

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The Journey from Wellhead to Burner Tip

November marks the time when nearly every energy consumer in Pennsylvania decides to turn up the thermostat and start heating their homes or apartments. With about 66 percent of residential properties in the state relying on natural gas to make them comfortable, it also kicks the system to deliver that energy - safely and reliably - into high gear. With most people unaware of the steps involved to get natural gas from where it is produced to where it is needed, PIOGA thought it made sense to offer a primer about supplying gas from wells to end users – a process that requires an intricate system of pipelines and infrastructure, involving the work of many trained and skilled technical professionals along the way, and regulated by state and federal agencies.

Wellheads and Gathering Lines

It is fairly well known that methane (natural gas) is extracted from underground rock formations at a wellhead, where it undergoes initial processing to separate naturally occurring byproducts, if present. These can include valuable items, such as oil and natural gas liquids that can be “fractionated” into ethane, propane and butane and used for a variety of purposes (referred to as “wet gas,” noted below), as well as water vapor and small amounts of contaminants.

In situations involving public utility service, the processed natural gas is then generally delivered into an underground gathering line, typically between 4-30 inches in diameter, where its volume is measured at a meter for sales purposes and where it begins the route to the network of transmission and distribution pipelines and infrastructure.

Cryogenic Processing/Compression

Wet gas next goes through a cryogenic process, which includes exposing the gas to temperatures of about 120 degrees Fahrenheit to separate methane from the liquid content, along with other treatment processes. Liquids are then further separated into their specific products at a fractionation plant, while the methane can be placed back into a pipeline network for compression and transportation. Dry natural gas requires less processing prior to undergoing compression.

Compressor stations are constructed at points along the natural gas transportation system to place the gas under significant pressure and allow greater quantities of it to be conveyed in longer interstate transmission lines. Gas needs to be maintained under pressure as it travels in pipelines, requiring stations to be placed at 40-100 mile intervals to regularly re-compress the gas and ensure a consistent flow through the pipeline system. Compressor stations are manned and monitored by trained technicians to ensure natural gas is compressed to levels that can be placed safely in the pipelines, with additional remote monitoring capabilities at central locations operated by midstream and transmissions companies.

Storage

The natural gas storage system in the U.S. plays an important role in allowing gas to be placed underground during periods of low demand and then accessed and delivered quickly and efficiently to end users when needed. Storage facilities are often geologic formations where natural gas was previously extracted, allowing the depleted pores to hold gas once again. Depleted reservoirs account for about 85 percent of storage capacity in the U.S., with certain aquifers and salt caverns making up the remainder.

Potential storage formations are evaluated by geologists to determine their suitability and safety, then tested for integrity and ability to contain gas. Once permitted by state and federal regulators, gas can be injected into the depleted formations and monitored for safety. Pennsylvania has 48 underground natural gas storage facilities - the most of any state – and has the fourth-largest capacity in the nation at about 763 billion cubic feet of gas.

Transmission Lines

Once processed and compressed, gas commonly enters high-volume intrastate or interstate transmission pipelines to get closer to consumers. There are more than 305,000 miles of transmission lines in the U.S., and more than 210 pipeline systems. The Federal Energy Regulatory Commission (FERC) is responsible for reviewing permit applications and authorizing the construction of interstate pipelines. Once built, they are regulated at the federal level by the U.S. Department of Transportation's (USDOT) Office of Pipeline Safety. Pipelines that do not cross state boundaries are regulated by individual states; the state Public Utility Commission (PAPUC) has that responsibility in Pennsylvania.



Local Distribution Companies

The final transportation stage to deliver natural gas to most customers includes local distribution companies, which typically consist of privately or publicly held utilities or systems owned and operated by municipal governments. These entities use equipment to reduce the pressure on the gas to levels that allow for use in residential, commercial and industrial settings. Gas is then distributed through a system of smaller-diameter underground pipes to consumers. As an example, natural gas traveling through interstate pipelines may be compressed to as much as 1,500 pounds per square inch (psi), while gas traveling through a local distribution network requires as little as 3 psi of pressurization and only ¼ psi at the customer's meter. It is estimated that there are more than two million miles of distribution pipes in the U.S.

Regulation and Safety

Every step of the process to extract, process, transport, store and distribute natural gas is regulated in some manner, often with built-in redundancies. Using Pennsylvania as an example, regulators include (depending on the location of wells or infrastructure) the state Departments of Environmental Protection, Conservation and Natural Resources, and Transportation. The PAPUC also has responsibility to regulate certain aspects of the industry. County soil and conservation services, river basin commissions and ordinances at the municipal level extend the regulatory framework. As noted above, federal regulation includes agencies within the USDOT and FERC.

The Facts

The system to safely deliver natural gas in the U.S. is an essential part of the nation's energy infrastructure and economy, with hundreds of thousands of people dedicated to ensuring the integrity of that system. The American Gas Association (AGA) estimated in 2021 that a total of 77 million end users – residential, commercial and industrial customers – chose natural gas as their energy source. Similarly, AGA reported that the industry added about 775,000 new customers and an average of 20,700 miles of pipe each year between 2019-2021 to meet new demand for natural gas. PIOGA is proud to play a significant role in this system by serving as the Keystone to America's Energy Future.



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