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 **17/ENG07/006**

 **PETROLEUM ENGINEERING**

 **PTE 316 (FUNDAMENTALS OF NATURAL GAS ENGINEERING)**

 **ASSIGNMENT SUBMITTED TO DR UDEAGBARA**

1. **Discuss in detail the different methods of storing gas**

 Natural gas–a colorless, odorless, gaseous hydrocarbon–may be stored in a number of different ways. It is most commonly held in inventory underground under pressure in three types of facilities. **These underground facilities are depleted reservoirs in oil and/or natural gas fields, aquifers, and salt cavern formations**. Natural gas is also stored in liquid or gaseous form in above–ground tanks.

Each storage type has its own physical characteristics (porosity, permeability, retention capability) and economics (site preparation and maintenance costs, deliverability rates, and cycling capability), which govern its suitability for particular applications. Two important characteristics of an underground storage reservoir are its capacity to hold natural gas for future use and the rate at which gas inventory can be withdrawn–called its deliverability rate.

Most existing natural gas storage in the United States is in depleted natural gas or oil fields that are close to consumption centers. Conversion of a field from production to storage duty takes advantage of existing wells, gathering systems, and pipeline connections. **Depleted oil and natural gas reservoirs are the most commonly used underground storage sites because of their wide availability.**

In some areas, most notably the Midwestern United States, natural aquifers have been converted to natural gas storage reservoirs. An aquifer is suitable for gas storage if the water-bearing sedimentary rock formation is overlaid with an impermeable cap rock. Although the geology of aquifers is similar to depleted production fields, their use for natural gas storage usually requires more base (cushion) gas and allows less flexibility in injecting and withdrawing. Deliverability rates may be enhanced by the presence of an active water drive, which supports the reservoir pressure through the injection and production cycles.

Salt caverns provide very high withdrawal and injection rates relative to their working gas capacity. Base gas requirements are relatively low. Most salt cavern storage facilities have been developed in salt dome formations located in the Gulf Coast states. Salt caverns have also been made (by a process called leaching) in bedded salt formations in Northeastern, Midwestern, and Southwestern states. Cavern construction is more costly than depleted field conversions when measured on the basis of dollars per thousand cubic feet of working gas capacity, but the ability to perform several withdrawal and injection cycles each year reduces the per-unit cost of each thousand cubic feet of gas injected and withdrawn

1. Why is compressor stations necessary in oil and gas industry?

 A **compressor station** helps the transportation process of [natural gas](https://en.wikipedia.org/wiki/Natural_gas) from one location to another. Natural gas, while being transported through a gas pipeline, needs to be constantly pressurized at intervals of 40 to 100 miles. Siting is dependent on terrain, and the number of gas wells in the vicinity. Frequent elevation changes and a greater number of gas wells will require more compressor stations.The gas in compressor stations is normally pressurized by special turbines, motors and engines.

The compressor station, also called a pumping station, is the "engine" that powers an interstate natural gas pipeline. As the name implies, the compressor station compresses the natural gas (increasing its pressure) thereby providing energy to move the gas through the pipeline.

Pipeline companies install compressor stations along a pipeline route. The size of the station and the number of compressors (pumps) varies, based on the diameter of the pipe and the volume of gas to be moved.

1. Outline the key component parts of compressor station and what are their functions?

 **Compressor Unit –** The compressor unit is the piece of equipment which actually compresses the gas. Some compressor stations may have multiple compressor units depending on the needs of the pipeline. The compressor unit is a large engine which typically works in one of three ways:

**Turbines with Centrifugal Compressors –** This type of compressor is powered by a turbine to turn a centrifugal compressor and is powered by natural gas from the pipeline itself.

**Electric Motors with Centrifugal Compressors –** This type of compressor also utilizes centrifugal compressors to compress the gas; however, instead of being powered by a natural gas fueled turbine, they instead rely on high voltage electric motors.

**Reciprocating Engine with Reciprocating Compressor –** This type of compressor uses large piston engines to crank reciprocating pistons located within cylindrical cases on the side of the unit. These reciprocating pistons compress the gas. These engines are also fueled by natural gas.

**Filters and Scrubbers –** As mentioned above another component of compressor stations are filters and scrubbers which remove water, hydrocarbons, and other impurities from the natural gas.

**Gas Cooling Systems –** When the natural gas is compressed its temperature rises. This is usually offset by having the gas travel through cooling systems which return it to temperatures that will not damage the pipeline.

**Mufflers –** Mufflers are typically present to help reduce the noise level at compressor stations. These are especially important if the compressor station is located near residential or other inhabited areas.