

Tikrit University

College of Petroleum Processes Engineering

**Department of Petroleum and Gas Refining
Engineering**

Gas Technology

Forth Class

Lectures 3

By

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Classification of Gaseous Fuels

Gaseous Fuels can be can be classified into:

(A) Fuels naturally found in nature:

- Natural gas
- Methane from coal mines

(B) Fuel gases made from solid fuel

- Gases derived from Coal
- Gases derived from waste and Biomass
- From other industrial processes (Blast furnace gas)

(C) Gases made from petroleum

- Liquefied Petroleum gas (LPG)
- Refinery gases
- Gases from oil gasification

(D) Gases from some fermentation processes.

The Importance of Gaseous Fuels

- Generally VERY clean burning. Little soot. Operate with low XSA.
- Easy to burn - No grinding or atomization. Excellent mixing
- No problems with erosion or corrosion
- No ash
- The gas is easy to clean. E.g. if sulfur is present, it may be easily removed prior to combustion.
- Simplest combustion plant of all { Burners, Control system, No ash problems, Heat exchangers, Can be started up and shut down very easily and quickly }.

Disadvantages of gaseous fuels

- Problems with distribution and storage
- Explosion risk - very volatile.
- Relatively costly. Offset by cheaper and more efficient plant.

Natural gas classification

(A) Conventional natural gas

- Conventional gas is a gas that is trapped in structures in the rock that are caused by folding and/or faulting of sedimentary layers.
- Natural gas from conventional deposits is found in sandstone or limestone formations. These formations are very porous.
- Conventional gas is largely extracted through the drilling of a vertical well from surface into the gas accumulation in porous, permeable gas reservoirs.

There are three types :

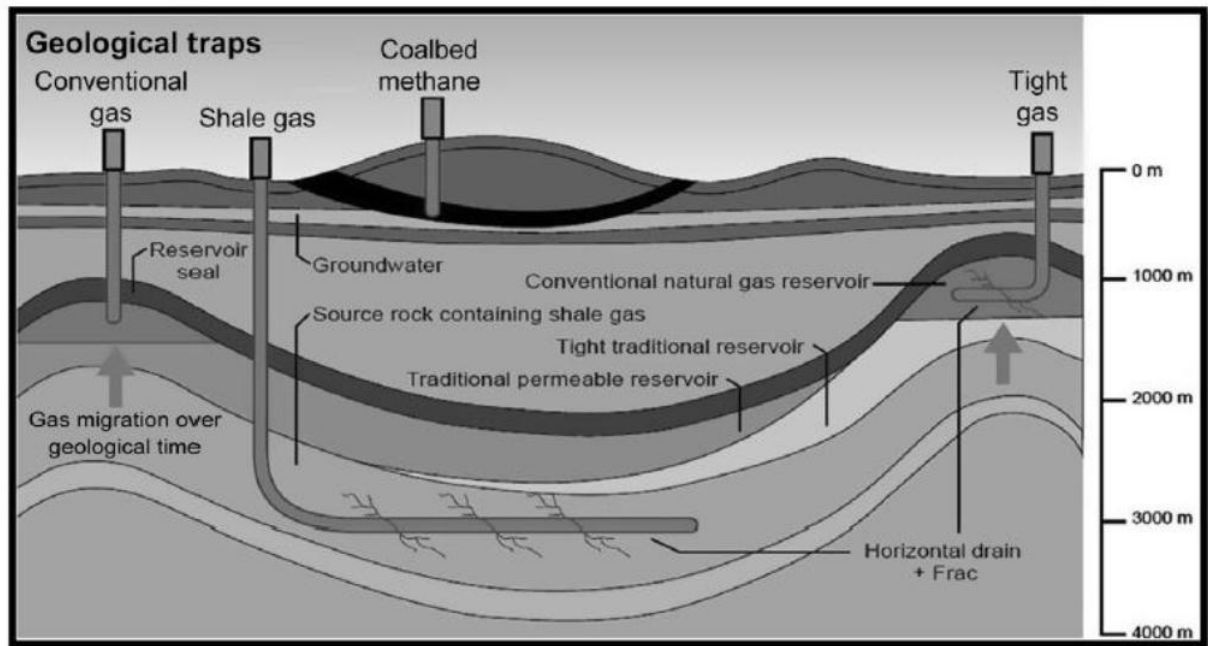
- **Nonassociated gas:** is from reservoirs with minimal oil.
- **Associated gas:** is the gas dissolved in oil under natural conditions in the oil reservoir (sometimes called gas-cap gas) or it is free gas in contact with the crude oil , All crude oil reservoirs contain dissolved gas and may or may not contain associated gas.
- **Condensate:** refers to gas with high content of liquid hydrocarbon at reduced pressures and temperatures.

(B) Unconventional natural gas

- Unconventional gas is gas that is trapped in impermeable rock that cannot migrate to a trap and form a conventional gas deposit.
- Unconventional natural gas deposits are difficult to characterize overall, but in general they are often lower in resource concentration, more dispersed over large areas, and require well stimulation or some other extraction or conversion technology.
- To access this unconventional gas, the well is first drilled vertically to reach the required depth and then horizontally through the target unit, More than one horizontal section can be drilled from the one vertical well, increasing exposure to the target layer.

Unconventional gas reservoirs include tight gas, coal bed methane (coal seam gas), gas hydrates, and shale gas.

- 1. Coal-Bed Methane (CBM):** This is the generic term given to methane gas held in underground coal seams and released or produced when the water pressure within the seam is reduced by pumping from either vertical or inclined to horizontal surface holes.
- 2. Shale Gas:** Large continuous gas accumulations are sometimes present in low permeability shale, (tight) sandstones, siltstones, sandy carbonates, limestone, dolomite, and chalk. Such gas deposits are commonly classified as unconventional, because their reservoir characteristics differ from conventional reservoirs, and they require stimulation to be produced economically.
- 3. Gas Hydrates:** A gas hydrate is a molecule consisting of an ice lattice, or "cage," in which low molecular weight hydrocarbon molecules, such as methane, are embedded. The two major conditions that promote hydrate formation are:
 - **high gas pressure and low gas temperature.**
 - **the gas at or below its water dew point with free water present.**



Natural gas accumulations in geological traps

can be classified :

- **reservoir** is a porous and permeable underground formation containing an individual bank of hydrocarbons confined by impermeable rock or water barriers and is characterized by a single natural pressure system.
- **field** is an area that consists of one or more reservoirs all related to the same structural feature.
- **pool** contains one or more reservoirs in isolated structures.

Wells in the same field can be classified as .

- **Gas wells** are wells with producing gas-oil-ratio (GOR) being greater than 100,000 scf/stb.
- **Condensate wells** are those with producing GOR being less than 100,000 scf/stb but greater than 5,000 scf/stb;
- **Oil wells** are wells with producing GOR being less than 5,000 scf/stb .

Natural gases commonly are classified according to their liquids content as either **lean** or **rich** and according to the sulfur content as either **sweet** or **sour**.