

2. NATURAL GAS

- Natural gas is a highly flammable gaseous hydrocarbon consisting primarily methane (CH_4).
- Natural gas is the cleanest burning fossil fuel. Colorless and odorless in its natural state.
- When it burns, natural gas produces mostly carbon dioxide, water vapor and small amounts of nitrogen oxides.



- As with crude oil, it is formed from decayed organic material. It may be mixed with oil (at pressures found in the reservoirs) or trapped in regions in which crude oil is not abundant.
- Natural gas found alone in reservoirs is called *nonassociated gas*, and when it is found in the same reservoir as crude oil, it is called *associated gas*.



- There are two general types of natural gas, defined by their methane content, that reflect differences in the formation processes:

Biogenic gas ($\pm 95\%$ methane), or “dry” gas, which was formed by bacterial decay at shallow depth.

Thermogenic gas ($<95\%$ methane), or “wet” gas, which is a lower quality gas formed at high temperatures. Wet gas on the other hand contains compounds such as ethane and butane, in addition to methane.

i. Origins of Natural Gas

- Natural gas is more ubiquitous than oil. It is derived from both land plants and aquatic organic matter and is generated above, throughout, and below the oil window.
- Thus, all source rocks have the potential for gas generation. Many of the source rocks for significant gas deposits appear to be associated with the worldwide occurrence of coal dated to Carboniferous and Early Permian times (roughly 360 million to 271 million years ago).

ii. Types of Natural Gas Deposits

- Natural gas can be contained in a variety of different types of deposits that must be accessed if the natural gas is to be used.
- Natural gas is contained in four types of deposits:

Conventional Gas

Unconventional Gas

Shale Gas Deposit

Tight Gas Deposit

Coal Bed Methane

- Natural gas has been extracted from conventional natural gas deposits for a long time, the unconventional resources are resources that are being extracted using substantially new techniques.
- Conventional gas is obtained from reservoirs that largely consist of porous sandstone formations capped by impermeable rock, with the gas trapped by buoyancy. The gas can move to the surface through the gas wells without the need to pump.
- Unconventional gas is natural gas trapped in very dense rocks with low permeability that prevents gas flowing into wells in commercial volumes. Unconventional gas generally requires hydraulic fracturing to improve reservoir permeability and extract the gas resource in commercial quantities.

○ The three most common forms of unconventional gas are:

- **Shale Gas:** Shale gas is natural gas found inside a fine-grained sedimentary rock called shale. Shale is porous (there are lots of tiny spaces inside it), but it is non-permeable, which means the gas cannot flow through it. Shale gas requires the use of hydraulic fracturing for extraction.
- **Tight Gas:** Tight gas is similar to shale gas in that it is trapped inside a porous, non-permeable reservoir rock. The only difference between the two is that the term tight gas includes natural gas trapped inside reservoir rocks that are not shale.
- **Coal Bed Methane:** Coal bed methane is natural gas consisting mostly of methane, which is trapped inside coal seams. This is extracted while the coal is being mined, as diminishing the pressure in the coal seam allows the gas to flow out of the seam and into a wellbore, where it is extracted.

What is fracking?

A technique known as hydraulic fracturing or fracking is used to break open rock and release natural gas. This involves pumping fluids into the well at high pressure. The fluids are made up of around 99% sand and water, with 1% chemicals added to help the gas flow more freely. Hydraulic fracturing typically takes place a kilometre or more below drinking water supplies. Concrete and steel barriers are inserted into the wells to prevent any drilling or fracturing fluids from entering local water supplies.

iii. Uses of Natural Gas

1. The largest single application for natural gas is as a domestic or industrial fuel. However, several specialized applications have developed over the years. The clean-burning characteristics of natural gas have made it a frequent choice as a nonpolluting transportation fuel.
2. Carbon black, a pigment of colloidal dimensions, is made by burning natural gas with a limited supply of air and depositing the soot on a cool surface. It is an important ingredient in dyes and inks and is used in rubber compounding operations.

- 
3. More than half of the world's ammonia supply now is manufactured via a catalytic process from methane. It is used directly as a plant food or converted into a variety of chemicals such as hydrogen cyanide, nitric acid, urea, and a range of fertilizers.
 4. A wide array of other chemical products can be made from natural gas by a controlled oxidation process—for example, methanol, propanol, and formaldehyde, which serve as basic materials for a wide range of other chemical products.

iv. Environmental Impact of Natural Gas

- Natural gas is the cleanest-burning hydrocarbon and emits between 45% and 55% lower greenhouse gas emissions than coal when used to generate electricity, according to IEA data.
- Compared to coal-fired power plants, modern natural gas-fired power plants emit less than one-tenth of the pollutants.

- Methane is a potent greenhouse gas. When it is released into the atmosphere it has a much higher global warming impact than CO₂. Natural gas consists mainly of methane.
- Efforts to address climate change therefore require the industry to reduce both deliberate and unintended methane emissions from production to the final consumer.

NATURAL GAS

Advantages	Disadvantages
Environmentally clean	Limited quantities
Economical	Highly combustible
Convenient	Non-renewable source of energy
Safe to use	Emits carbon dioxide
Available abundantly	Long processing process
More efficient	Leakage
Easy to deliver	Storage