MODULE 1

Jennifer Okeke

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- Describe the chemical compositions of LPG, their distinct properties, and the numerous steps that lead from production to end-user.

- Understanding the environmental effect of LPG as well as its safety.

LPG- Liquefied Petroleum Gas

The term LPG refers to liquefied petroleum gas. It is a non-renewable energy source, like all fossil fuels. Crude oil and natural gas are used to make it. LPG is made up of three or four carbon atom hydrocarbons. Propane (C_3H_8) and butane (C_4H_{10}) are the two most common components of LPG. Other hydrocarbons in trace amounts may also be present. LPG burns easily in the air, has a similar energy content to gasoline, and has twice the heat energy of natural gas. As a result, it is a wonderful fuel for heating, cooking, and automobiles. Normally, the gas is held in a steel container, cylinder, or tank as a liquid under pressure. The type of LPG used and the ambient temperature will determine the pressure within the container.

LPG Composition

Propane, butane, propylene, butylene, and isobutane are the main components of liquefied petroleum gas (LPG). LPG is a highly combustible combination of various hydrocarbon gases that are commonly used as a cooking fuel in homes. In certain autos, it is also utilized as fuel. Propane and butane are the primary active components of LPG.

Propane

Propane has the chemical formula C_3H_8 and is a hydrocarbon. It's one of the main ingredients of liquefied petroleum gas (LPG). Under typical temperature and pressure circumstances, this organic compound is known to exist in the gaseous phase (STP). Propane, on the other hand, may be compressed into a liquid if enough pressure is applied. It should be noted that propane is often created as a by-product of petroleum refining and natural gas processing. When propane is released from its pressurized container, it is known to vaporize fast. This is due to propane's

comparatively low boiling point (roughly equal to -42.2 degrees Celsius). It's also worth noting that propane has a melting point of -187.7 degrees Celsius (85.5 degrees Kelvin). Propane has a molar mass of 44.097 grammes per mole. It is a colourless and odourless gas under normal circumstances

Butane

C_4H_{10} is the chemical formula for butane, an organic molecule. One of the combustible components in LPG is this hydrocarbon. Butane is a colourless gas with a fragrance similar to natural gas or gasoline that occurs at ordinary temperature and pressure conditions. Butane, on the other hand, can be compressed into a liquid and transported quite easily. Butane has two structural isomers: n-butane and isobutane. The former has a straight four-membered carbon atom chain, whereas the latter has a branching structure. It's worth noting that isobutane is sometimes referred to as methylpropane. Butane has a molecular mass of 58.124 grammes per mole. The melting point of this organic compound is between -140 and -134 degrees Celsius. This hydrocarbon's boiling point ranges from -1°C to 1°C.

Isobutane

2-methylpropane, or isobutane, is an organic molecule having the chemical formula $CH(CH_3)_3$. This is a structural isomer of butane and one of the ingredients of LPG. It's vital to remember that butane and isobutane have different melting and boiling temperatures. Isobutane has a melting point of -159.42 degrees Celsius and a boiling temperature of -11.7 degrees Celsius, making it an isomer of butane. In addition, isobutane is frequently utilised as a propellant in aerosol cans.

Propylene

Propylene, sometimes spelt propene, is a chemical molecule having the formula C_3H_6. One carbon-carbon double bond exists in this unsaturated hydrocarbon. It is frequently used as part of LPG.

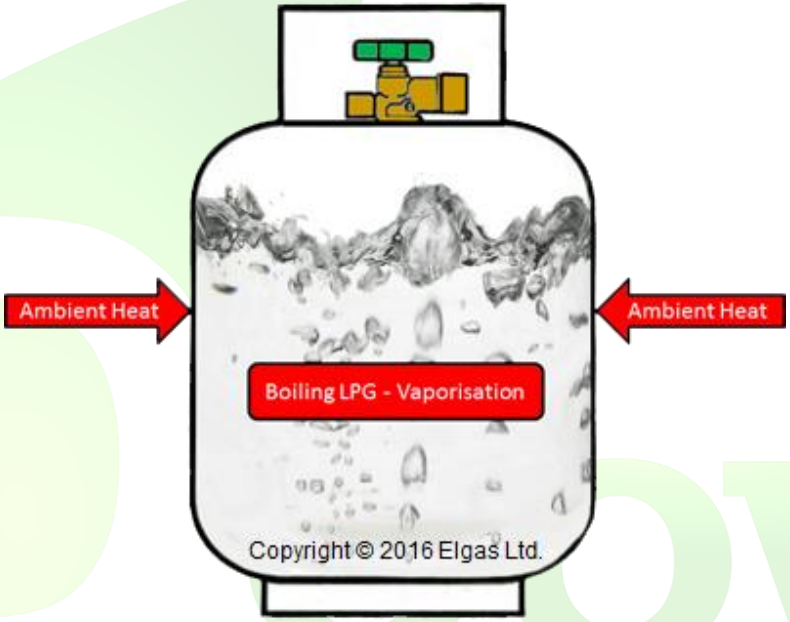
Propylene has a molar mass of 42.081 grammes per mole. This chemical compound has a boiling point of -47.6 degrees Celsius. Propylene has a melting point of -185.2 degrees Celsius. Propylene is a colourless gas that exists under normal circumstances. It should be emphasised, however, that this gas may be compressed into a liquid.

Butylene

Butylene (sometimes spelt butene) is an organic chemical molecule with the formula C_4H_8. Because the double bond can appear at numerous positions in the four-membered parent carbon chain, butene is known to have many isomers. 1-butylene, 2-butylene, and isobutylene are the most common isomers of butylene.

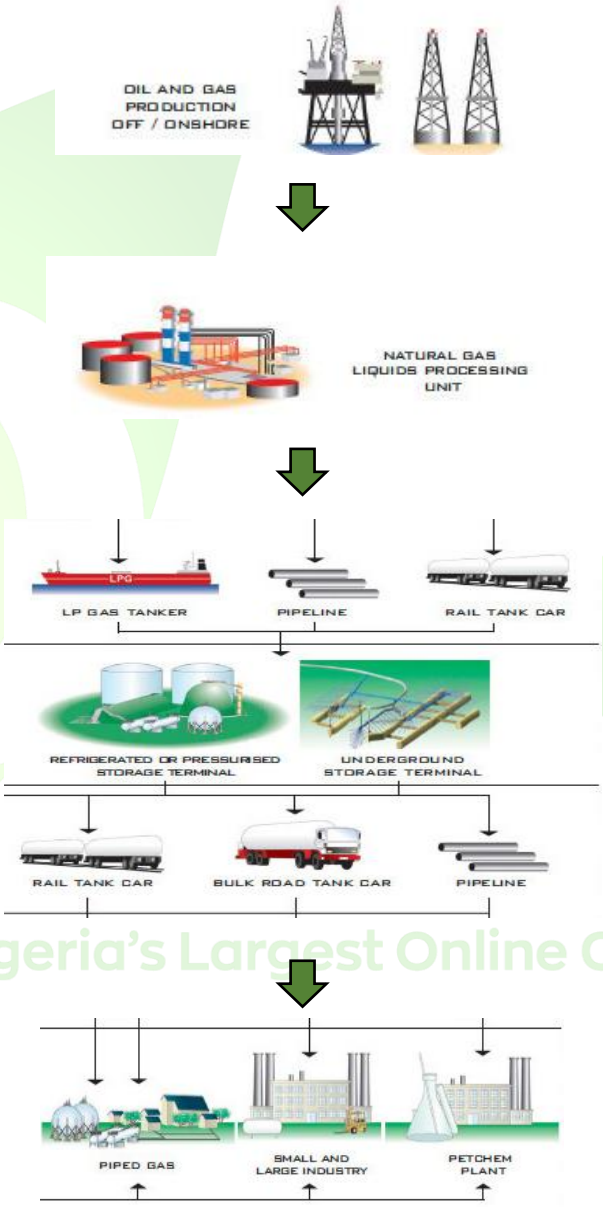
It should be noted that at typical temperature and pressure circumstances, all of the isomers of butene described above occur in the gaseous phase (STP).

How is LPG produced?



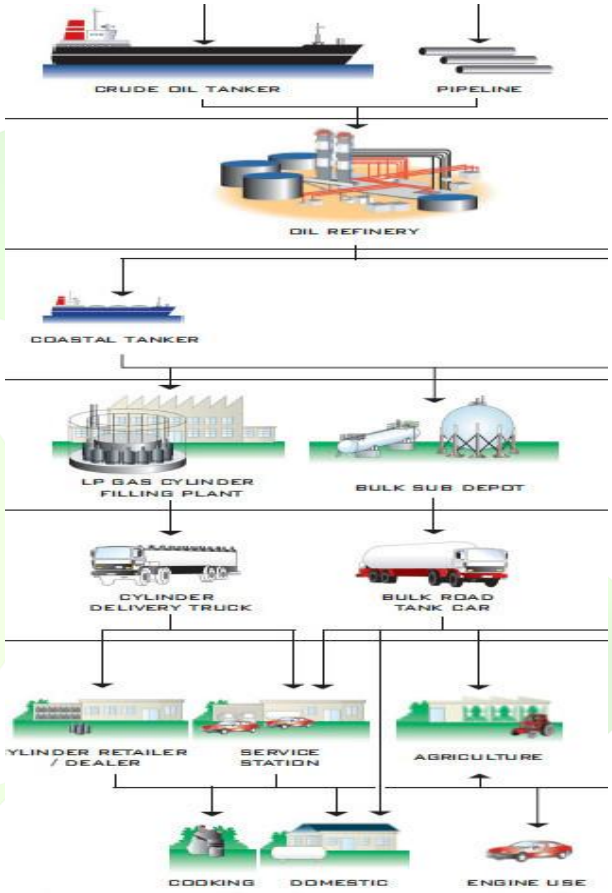
LPG is made by refining crude oil or processing raw natural gas, both of which are fossil fuel-based. Propane and butane are the principal LPG ingredients, with minor quantities of other natural gas liquids. LPG is easier to store and carry once it has been pressurized.

Processing Raw Natural Gas: LPG is made by extracting it from "wet" natural gas streams as they emerge from wells. Liquefied petroleum gas (LPG) is made by removing it from the raw natural gas stream during natural gas processing, approximately 60% is extracted from raw natural gas. LPG is obtained by the separation of natural gas during the fabrication of LPG gas refrigeration (NGL fractionation process).



Pictorial Representation of Processing Raw Natural Gas

LPG refinery process: LPG is also produced during fractional distillation of crude oil. To transport or store it, LPG needs to be liquefied under pressure. LPG can be stored or transported in LPG cylinders or vessels. If released from pressure, LPG gas is emitted. After being manufactured, LPG is liquefied at low pressure so that it may be stored and transferred, approximately 40% is obtained from crude oil refinery processes.



Pictorial Representation of LPG Refinery Process

LPG is produced by fractional distillation of crude oil using an LPG fractionation type of LPG manufacturing method and is derived from crude oil refining (LPG production process).

General Procedures

- **Production is the first step**
  The treatment of NGLs results in the creation of "field grade LPG." This treatment is required to produce: a) oil that can be transported to refineries, and b) natural gas that meets commercial criteria.

- **Getting Around**
  While crude oil is delivered by tankers or pipes from production sites to refineries, LPG is transported by massive LPG carriers, pipelines, or trains to storage stations.

- **Refining and Storage**
  The oil refining process can also produce butane and propane. Products that are imported in significant quantities are stored at LPG storage facilities.

- **Getting Around**
  The LPG is subsequently transported to cylinder filling factories and intermediate-size storage locations via train, road, coastal tanker, or pipeline.

- **Filling and storing the bottles**
  Bottling factories fill cylinders with butane and propane. LPG is often kept in intermediary storage centres in pressurised tanks (vessels or spheres).

- **Dissemination**
  LPG may be carried in cylinders or bulk almost anyplace. Butane and propane cylinders are transported by trucks from the bottling factory to merchants, as well as individual and

professional clients. In the meanwhile, tiny bulk vehicles transport LPG from storage facilities to various customers.

- **End Users**
  End-users can purchase LPG from cylinder sales sites such as commercial establishments or service stations near their homes. Customers that want higher quantities of LPG can buy it in bulk.

Environmental Effect of LPG

Unlike other refined fuels and petroleum products, propane in its inert condition is clean and ecologically beneficial. It is non-toxic. When butane is burnt, it creates just carbon dioxide as a byproduct, unlike certain other flammable gases created from natural gas.

Unlike an oil spill, there are no long-term consequences. It creates minimal exhaust emissions and is particularly eco-friendly as a car fuel.

Unfortunately, the only environmental damage it may do when spilt in significant quantities is the freezing of plants and other living things and it is less commonly available than petrol and diesel and gives fewer kilometres for the same tank size.

LPG is more environmentally benign than coal, petrol, diesel, or coal-fired power since it emits less CO2 and produces fewer particle pollutants. LPG is a considerably better choice for the environment than other energy sources, such as coal-fired power, because it emits less CO2.

For efficient house heating, hot water, and cooking, gas has historically been the preferred fuel.

The advantage comes from LPG's chemical makeup, which creates fewer CO2 emissions when burned.

For example, replacing your electric hot water system with a 6-Star LPG continuous flow hot water system may cut your hot water use's greenhouse gas emissions by around 75%.

It's also worth noting that LPG continuous flow emits fewer greenhouse gases than an electric-boosted solar system.

Leading manufacturers are now manufacturing 6-Star and higher-rated units, delivering even more Greenhouse advantages, and enhancing the environmental benefits of continuous flow hot water.

Because there is minimal difference between LPG and natural gas, the statistics for 'gas' may be used for both.