MODULE 1

Jennifer Okeke

DOOWE

MODULE 1

- What is Autogas? and its properties as a transport Fuel.
- Why Autogas is an advantage as a transport fuel?
- Properties of Autogas.

What is Autogas?

Autogas also known as Liquefied petroleum gas (LPG) is a mixture of gases that can be found in natural gas or dissolved in oil. LPG's gaseous components – propane and butane – are easy to liquefy at room temperature, thus its name.

LPG is produced as a by-product of the refining of petroleum and can be obtained during natural gas and oil extraction. Propane and butane are the two major components of LPG. Propane (C_3H_8) is a saturated hydrocarbon with a calorific value of 11,070 kJ.kg-1 and an energy value of 46 MJ.kg-1.

Butane - C_4H_{10} is a highly flammable and liquefiable gas with a calorific value of 10,920 kJ.kg-1 and an energy value of 45 MJ.kg-1.

LPG is a mixture of propane, butane, and other minor amounts of other chemicals. The mixture of propane and butane is liquefied by cooling it to a low temperature or compressing it. In comparison to the gaseous phase, the volume of the mixture is reduced 260 times when liquefied. LPG is a gasoline-like fuel. It has a density of 0. 55kg.l-1 and an energy value of 45 MJ.kg1. In gaseous form, LPG is heavier than air but lighter than water in liquid form.

LPG is not poisonous when considering its impact on human health, however, it is unbreathable and has mildly toxic consequences.

The mixture of propane and butane is colourless and odourless. Additional components are required to detect LPG leaking. Because LPG is utilized as a fuel, the octane number is quite significant. This value ranges from 106 to 110, which is higher than the octane number of petrol, ensuring greater resistance to detonation by moving the ignition moment closer to the front of the piston's top dead centre.

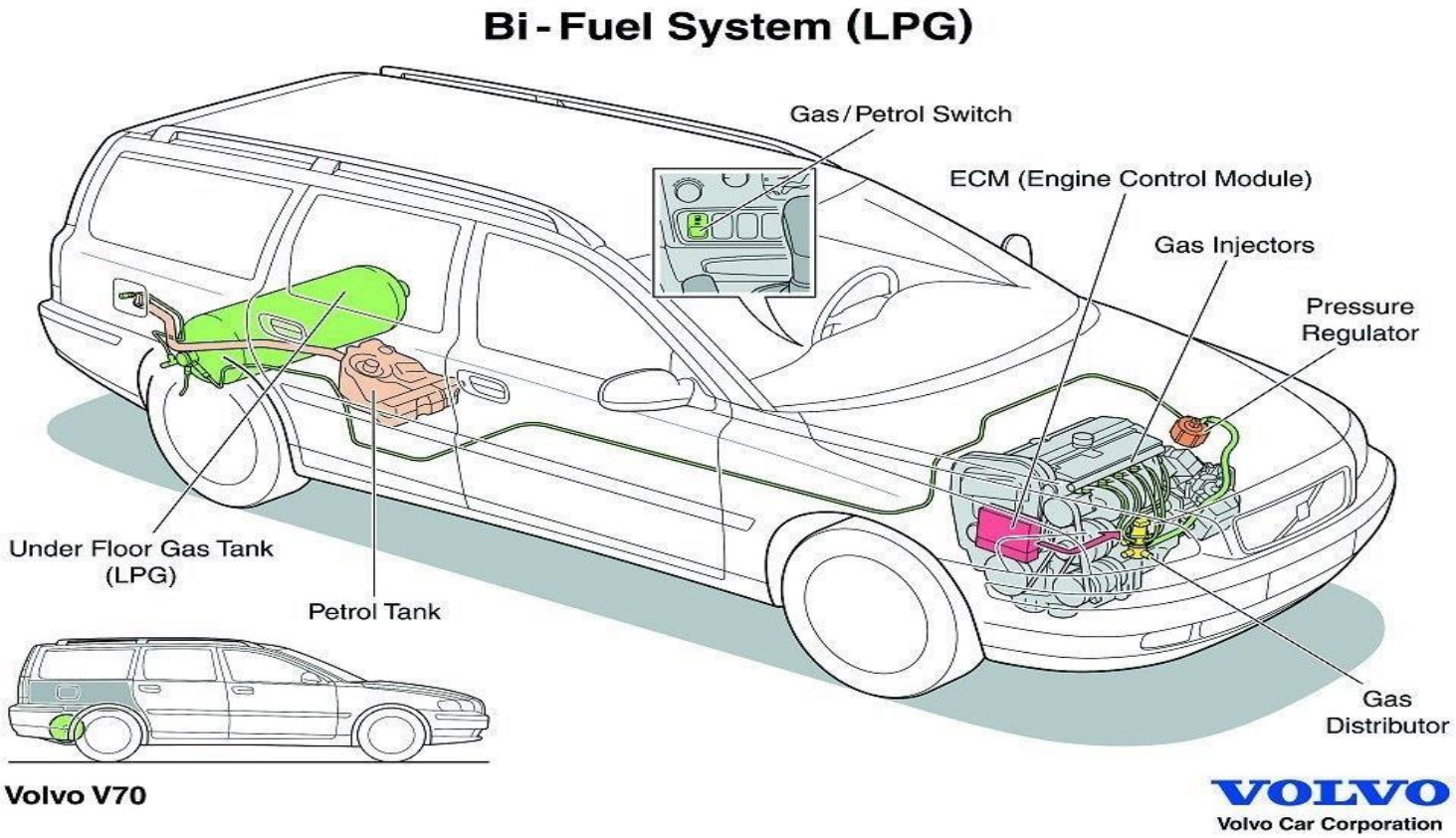
It was expected that by now, one million vehicles out of the average 12 million on Nigerian roads would be running on CNG and LPG as part of measures to ease tensions over the proposed increase in petroleum pump prices and protect the environment from the hazards of Premium Motor Spirit (PMS). It was also thought to make the shift to a clean energy source easier. Due to lack of planning, this vision is yet to be realized, but let's look at how this Autogas can be beneficial if it is put into consideration.

Identification of a car that runs on LPG

Autogas conversions are not required by law to display any identification in this nation, and the police do not suggest it because it may promote vandalism, but they can be recognized by:

An Autogas conversion will have a separate filler for the Autogas intake in addition to the original petrol intake; the Autogas filler is normally located behind the petrol intake at the back of the vehicle. However, it can also be located in a variety of places, such as on the tow bar or the rear bumper of the car.
A marketing sticker from the installer, which could be on the front, back, or both windscreens.
During an operational issue, however, it may not be able to detect these things.

Schematic of an Autogas CAR for Volvo



Why Autogas is an advantage as a transport fuel

We will be looking at its advantages in 3 aspects;

Environmental Benefits:

The engine runs smoother, and there is no difference in the car's noise or vibration. When using Autogas, very little carbon monoxide is released, and the exhaust gases include less dangerous compounds than when using gasoline or diesel.

LPG has a 0% global warming potential (GWP) according to the UN International Panel on Climate Change (IPCC), indicating that it is not a greenhouse gas. To put things in perspective, CO2 has a GWP of 1, while methane has a GWP of 25. In comparison to other hydrocarbons, LPG produces less carbon dioxide per unit of heat produced. At the same time, dangerous nitrogen oxide (NOx) and particulate matter (PM 2.5) emissions from Autogas are insignificant. These characteristics not only make Autogas a cleaner transportation fuel than gasoline and diesel but also when compared to compressed natural gas (CNG).

So, if you want to switch to an alternative fuel because you care about the environment, you shouldn't hesitate to use this clean fuel.

Engine Life and Performance Quality:

- Autogas's high octane concentration ensures a smoother run and extends engine life.
- Engine noise is reduced, resulting in a smoother and more environmentally friendly ride.
- To ensure great quality, unlike other fuels, no additives are necessary.
- Autogas is superior to gasoline because it allows for greater combustion and less banging.
- Less carbon implies less fouling of spark plugs and points, as well as less wear and strain on the engine.

- Autogas, unlike domestic LPG, has no unsaturated fats, sulphur, or water, which can corrode and damage car parts.
- Because it is a gaseous fuel, the engine oil is not diluted, resulting in longer engine life and lower maintenance expenses.
- Unlike diesel, the driver does not need to change his driving style. Cold starting is not an issue, and engine performance is nearly identical to that of gasoline.
- Because there are no acids or carbon deposits on the engine parts, Autogas extends the life of the engine. The engine life of Autogas vehicles is expected to be double that of Petrol/Gasoline vehicles.
- Autogas is completely free of lead and benzene, and it is cleaner and leaves no trace. There is much less carbon deposit on the engine, and engine oil life is extended without diluting.

Fuel Economy and Cost Savings:

This vehicle is extremely cost-effective to operate. Running expenses are reduced by up to 40% compared to gasoline, in addition to cost savings through increased engine life- Autogas is beneficial to the engine of your vehicle. LPG does not harm the engine because it is a cleaner burning fuel that leaves little residue. Rather, it extends the life of the engine's components. Because it is a high-octane fuel, it also ignites more quickly, meaning that there is no pre-ignition or knocking. Even when the engine is completely cold, an Autogas engine will heat up faster. This is great for the engine since quicker and faster combustion equals less knocking. This also results in a quieter riding experience. Autogas-powered engines are expected to last up to twice as long as petrol-powered engines.

And cheaper maintenance costs- This is a natural extension of the preceding benefit. Your maintenance and servicing costs will remain minimal since Autogas causes very little damage to

the engine and its components. Autogas leaves little carbon or acid deposits on the engine, and there is little corrosion or damage to the engine's parts. As a result, your spark plugs, valves, and pistons stay cleaner and smoother for longer.

The overall cost of the conversion can easily be recouped by the savings gained by using Autogas instead of gasoline.

When compared to Petrol or Diesel, there is no spillage when filling the tank, and there is no chance of theft or pilferage.

Properties of Autogas

What Are the Properties of LPG?

At 100°C (212°F), water boils and turns into a gas (steam). LPG (propane), on the other hand, boils at -42°C or -44°F and turns into gas vapour. Because LPG is stored under pressure in a gas cylinder, it remains liquid. The density of the liquid is about half that of water. LPG is a colourless and odourless gas in its natural state. To ensure safety, an odorant is applied.

LPG's Components

Propane, butane, isobutane, butylene, propylene, and combinations of these gases are the main components of LPG, all of which have different LPG qualities. Depending on the pressure and temperature of the LPG gas, it is either liquid or gas (vapour). Propane, butane, or a blend of the two gases are frequently used in both home and commercial LPG compositions. Liquefied Petroleum Gas (LPG) is created during the processing of natural gas and the refining of petroleum. Natural Gas Liquids (NGL) contain the same composition and gas temperatures as LPG, plus a few additional gases not found in LPG. Ethane, ethene, butylene, propylene, propane,

isobutene, butadiene, pentane, pentene, and pentanes plus, as well as propane, butane, and isobutane, are all NGL components of LPG.

Components of LPG

Propane, butane, isobutane, butylene, propylene, and combinations of these gases make up Liquefied Petroleum Gas (LPG). Crude oil refining and natural gas processing yield LPG gas components. At room temperature and pressure, they are liquid under pressure and gas.

Properties of LPG

- Obtained from the processing of naturally occurring gas (NAG) or gas associated with crude oil.
- It's odourless and colourless. Before distribution, an odorizing agent is added to give it its distinct odour.
- In liquid form, it's half the weight of water. Before it vaporizes, it will float on water.
- Pressure easily liquefies it, and it takes up just about 1/250th of its gaseous volume. As a result, a high quantity of LPG can be kept in a short space.
- Commercial butane or commercial propane are both acceptable options. In terms of use, both are similar, although propane has a lower boiling point and thus a higher storage pressure. Commercial propane is primarily used outdoors, while commercial butane is primarily used indoors.

EXPLAINED

LPG (properties of propane and butane) has the following qualities: LPG is liquid under pressure but becomes gaseous in ambient conditions. The weight of LPG vapour varies from 1.55 (propane)

to 2.08 (butane). Depending on the propane-to-butane ingredient ratio in the LPG gas mixture, the boiling point of LPG ranges from -42°C to -0.4°C.

LPG (propane) has the following characteristics: -42°C boiling point, -188°C freezing point, heavier than air density, C3H8 chemical formula, 1967oC flame temperature, 470°C autoignition temperature, -104°C flashpoint, temperature-based pressure, Ethyl Mercaptan odour, 2.15 per cent to 9.6 per cent LPG/air flammability limits, and more.

Specific Heat Capacity of LPG

The energy content of LPG is about 25MJ per litre. The LPG energy value of one gallon of propane is 91,547 BTU (60°F). In addition, 25MJ equals 6.9kWh.

Density of LPG

At 0°C (32°F), propane has a vapour density of 1.882 kg/m3. At 25 °C (77 °F), propane liquid has a density of 0.493 g/cm3 or 4.24 pounds per US gallon. Propane expands at a rate of 1.5 per cent for every 5.56°C (10°F) increase in temperature.

LPG is a gas that is 1.55 (propane) to 2.08 (butane) times heavier than air at 1 atm pressure and 20°C. LPG is liquefied at 37.8°C (100°F) under a low pressure of 1,220 kPa (177 psi). At 25°C, the density of LPG liquid propane is slightly less than half that of water, while at -40°C, it is about 60 per cent.

LPG is lighter than water, with a density of around 12 times that of water. Butane liquid is lighter than water, with a density of around 60% that of water. At 25°C, liquid propane has a density of 495 kg/m3.

LPG Gas Structure and Chemical Formula

LPG is mostly made up of propane and butane, whereas natural gas is mostly made up of methane. Propane (C3H8) and/or butane (C4H10) make up the majority of LPG, with smaller percentages of other NGL hydrocarbons such as ethane, isobutane, and pentanes. When under pressure, LPG has the physical structure of both a liquid and a gas.

The LPG structure (propane structure) is a three-carbon molecule with the chemical formula C3H8 for LPG gas. One molecule of propane is made up of three carbon atoms and eight hydrogen atoms.

The LPG structure (butane structure) is a four-carbon molecule with the formula C4H10, consisting of four carbon atoms and ten hydrogen atoms.

These are also LPG gas chemical formulae (formulas). Models of the LPG structure of a propane molecule and the LPG structure of a butane molecule are shown in the images.

There are several chemical formulas for LPG gas (formulae). C2H6 is the chemical formula for ethane. C3H8 is the chemical formula for propane. Because isobutane is an isomer of butane, they both have the same chemical formula, C4H10. The chemical formula for pentane (n-pentane) is C5H12, but it is only a gas above 36.1°C. Pentanes and higher hydrocarbons are liquids or waxy solids.