



Retrofitting – aftermarket vehicle conversion.

Benefits of using liquefied petroleum gas LPG include:

- smoother, quieter and cleaner running engines than those using conventional petrol
- the life span of the engine can be extended by as much as 50%
- lower emissions output, leading to less environmental pollution
- much lower fuel costs
- as the engine runs cleaner, servicing costs are reduced
- if the vehicle is designed to be a dual fuel car, (one that operates on either petrol or LPG) its range is increased
- resale values may be increased because the car is cheaper to run than its competitors
- the storage container for LPG in cars is normally of stronger construction than that of petrol tanks and as a result, crash damage safety is improved
- LPG has a high ignition temperature, around twice that of petrol, making it less likely to spontaneously combust and reducing the risk of fire

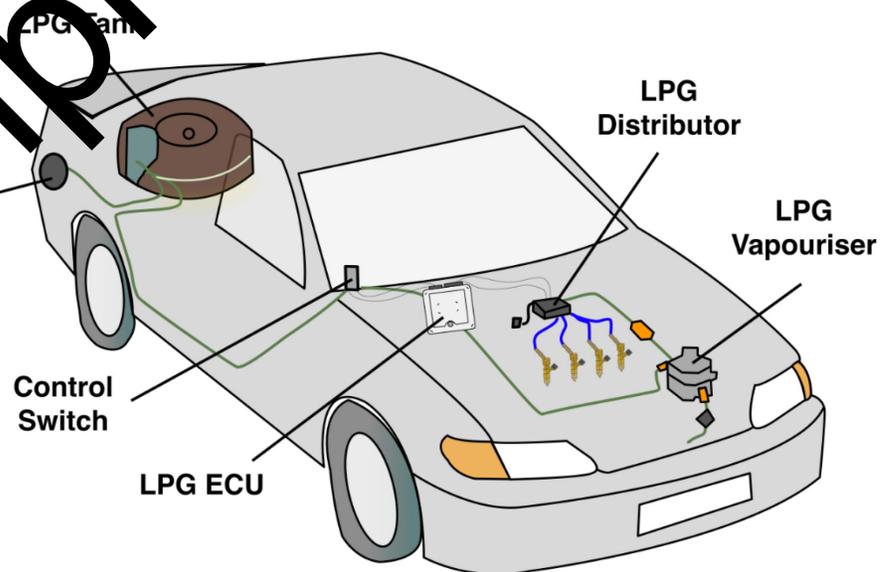


Figure 3.17 An LPG equipped car



Remember that an LPG tank will never really be empty. As fuel is used and pressures fall, eventually the propane left over will remain as a gas.

An LPG tank should also never be completely filled. It is recommended that tanks are only taken to around 80% capacity to allow for expansion and contraction of the propane due to different ambient temperatures.

Unfortunately, LPG has a lower energy density than petrol and therefore fuel consumption is increased, but a lower duty of tax will often offset this higher consumption as a lower overall cost.

When compared to conventional petrol or Diesel engined vehicles, the emissions produced are far less harmful to health and the environment. Table 3.6 shows how petrol and Diesel compare to liquefied petroleum gas LPG.

Table 3.6 Emissions comparison between petrol, Diesel and LPG

LPG compared to petrol	LPG compared to Diesel
75% less carbon monoxide	60% less carbon monoxide
40% less oxides of nitrogen	90% less oxides of nitrogen
87% less potential of forming ground level ozone	70% less potential of forming ground level ozone
85% less hydrocarbon	90% less particulate matter (soot)
10% less carbon dioxide	

To combust properly inside an engine, petrol and Diesel need to be vaporised, as it is the fumes that burn not the liquid fuel. Complicated methods are needed to introduce petrol or Diesel, such as a carburettor or fuel injection, and turn it into a vapour. An advantage of using LPG as alternative fuel source to power vehicles is its very low boiling point of between -0.6 degrees Celsius for butane and -42 degrees Celsius for propane. Because of its very low boiling point, most LPG used for vehicles is based on propane. With LPG you only require some form of simple nozzle to introduce the fuel and it will vaporise easily.

Converting a standard car to run on LPG

Although LPG is a very safe fuel to use for vehicle propulsion, care must be taken when converting a car to run on propane, otherwise safety may be compromised.

If the car is to be operated as a dual fuel vehicle, a second tank must be fitted to store the LPG. The tank may be cylindrical in shape and need a mounting space in the boot, or it can be round and take the place of the spare wheel. A filling hose will be required and an external filling point will need to be added to the vehicle body, normally close to the location of the petrol filling point. LPG from the tank can then be transferred to the engine via copper piping routed along the underside of the car.

A solenoid valve and filter are mounted in the fuel delivery line in order to remove dirt particles and prevent the flow of LPG when a dual fuel engine is being run on petrol.

A small regulator unit is then mounted on the engine's intake system, which warms the propane with heat from the engine cooling system, turning it into gas.

A mixer/distributor takes information from various engine sensors or ECU and introduces a controlled amount of gas to the intake manifold via injectors. The regulator and mixer unit will normally include a safety circuit which will cut the flow of propane gas to the inlet manifold if the engine should stall or cut out.

Special electronic circuitry is then required so that:

- a functioning fuel gauge can be created for the LPG system
- an automatic or manual switching system can be created to allow the engine to swap between petrol and LPG
- petrol fuel injection can be simulated electronically to the ECU to avoid the engine management system storing diagnostic trouble codes when the engine is running on LPG; this is achieved using a component known as an 'emulator'

Service an LPG system

How to:

1. Wearing appropriate PPE, conduct a visual inspection of all the LPG system components to check the security and condition.
2. Remove system pressure by closing the gas shut-off valve, starting the engine, and allowing it to stall. This will use up any liquid LPG in the supply pipes.
3. Locate the fuel filter in the supply line and carefully undo the pipes. Work in a well-ventilated area to ensure that any LPG gas leakage does not cause a fire risk.
4. Remove any fuel filter mountings and replace filter.
5. Once fitted, open the gas valve and re-pressurise the system.
6. Check for leaks on the filter pipe work using a gas test leak solution.
7. Start and run the engine so that it reaches normal operating temperature and fully warms all system components; especially the LPG vaporiser. (Then switch off.)
8. Locate the LPG vaporiser (also known as the reducer) in the engine compartment.
9. Place a container under the vaporiser, open the drain bung and allow any sludge build-up to fully drain from the system.
10. Close vaporiser drain bung.
11. Run engine and check for correct function and operation.

Compressed natural gas (CNG)

An alternative to LPG is high pressure compressed natural gas (CNG). CNG can be produced from a number of sources and is mainly composed of methane. When crude oil is extracted from the ground, around 3% is natural methane gas.

It can be used to fuel normal internal combustion engines instead of petrol. The combustion of methane produces the least amount of CO₂ of all fossil fuels. Petrol cars can be retrofitted to CNG and become bi-fuel natural gas vehicles (NGV) in a similar way to LPG conversion. Because the original petrol tank and petrol fuel operating system stay, the car becomes 'dual fuel'.

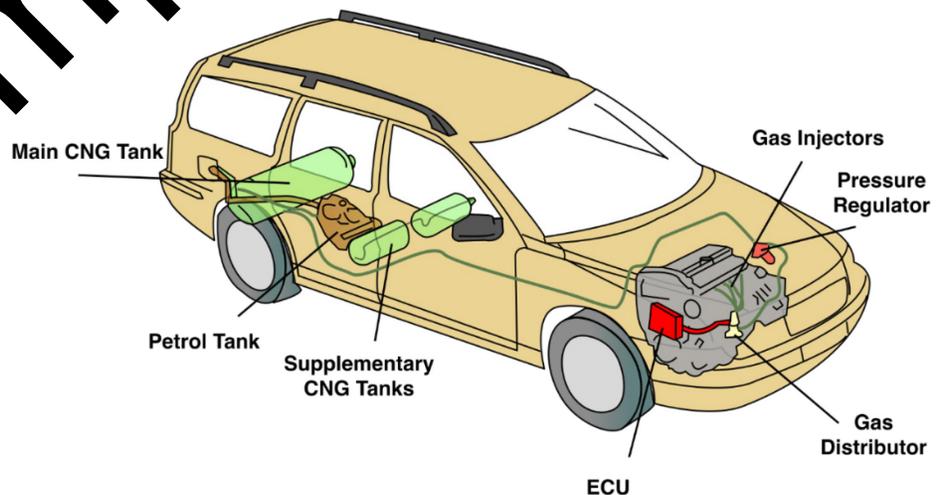


Figure 3.18 A CNG equipped car