FUEL ALTERNATIVES

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South Africa is one of the largest emitters of CO_2 emissions in the world. The country is responsible for nearly half the CO_2 emissions for the entire continent of Africa, and about 1.1% of global emissions.

With a global focus towards alternative energy sources to reduce pollutants and greenhouse gases, renewable energy sources show significant promise as alternative transport fuel for fleets. In addition the evolution to alternative energy sources helps conserve non-renewable energy sources such as fossil fuels, which results in less consumption and lower fuel prices. These supply and demand forces have been a contributing element in the recent reduction of crude oil prices.

Natural gas and alternative fuels as an energy source for mobility have been widely proven to be cost effective and more eco-friendly and there are currently more than 24 million natural gas vehicles operating worldwide.

South Africa has been slow in adopting alternative energy sources, but there is a renewed focus on using natural gas for mobility. Various South African companies and public sector entities have been working closely together to create a renewable energy strategy – the infrastructure to support this initiative will be expanded exponentially in the near future.

Fuel accounts for 44 – 48% of all fleet costs and the cost of fuel has increased by approximately 13% year on year for the past 10 years. This steady increase in the fuel price has paved the way for the development of fuel saving technologies. EQSTRA Fleet Management investigates some of the different types of fuel available on the market today

1. Natural Gas

Natural gas is an alternative fuel that burns cleanly and is widely available through utilities that provide natural gas to homes and businesses. There are vast deposits of natural gas available and, although it is a non-renewable resource, these deposits will not be depleted in our lifetime. The use of natural gas offers the following advantages:

- Reduces carbon monoxide emissions by 90-97 %
- Reduces carbon dioxide emissions by 25 %
- Reduces nitrogen oxide emissions 35-60 %
- Potentially reduces non-methane hydrocarbon emissions by 50-75%
- Emits fewer toxic and carcinogenic pollutants
- Emits little or no particulate matter
- Eliminates evaporative emissions

Over and above these lower emissions, the maintenance costs of natural gas vehicles are very low and in many countries throughout the world natural gas vehicle owners receive tax incentives to operate these vehicles.

Unfortunately and due to the fact that there are relatively few natural gas vehicles available, such vehicles are initially expensive to purchase. However, conversion kits are available which allow car owners to drive with a mixture of petrol/diesel and natural gas.

2. Ethanol

Ethanol is an alcohol-based alternative fuel made by fermenting and distilling crops such as corn, barley or wheat. It can be blended with gasoline to increase octane levels and improve emissions quality. Although it is a renewable resource, ethanol subsidies can have a negative impact on food prices and availability.

In addition:

- Ethanol has a high-octane rating which results in increased engine efficiency.
- However, ethanol has a lower energy content than gasoline and consumption per kilometre is therefore greater.
- Can be used in specialized cars and trucks known as Flexible Fuel Vehicles in concentrations up to 85 percent.
- Is frequently used as an additive to gasoline, in concentrations of up to 10 percent.

Ethanol is used as an alternative fuel for aircraft. Aviation grade ethanol, (AGE-85) is an 85 percent ethanol blended fuel that is beginning to replace 100 octane low lead aviation gasoline, which has been the standard fuel for reciprocating engine aircraft since World War II.

3. Hydrogen

Hydrogen can be mixed with natural gas to create an alternative fuel for vehicles that use certain types of internal combustion engines. Hydrogen is also used in fuel-cell vehicles that run on electricity produced by the petrochemical reaction that occurs when hydrogen and oxygen are combined in the fuel "stack."

The advantages associated with hydrogen include the following:

- **Carbon-emission free -** unlike other sources of power, these fuel cells do not emit harmful carbon emissions in the air that cause pollution and affect global warming.
- **Accessible and renewable -** its supply in the atmosphere is abundant.
- **Fuel efficiency -** hydrogen produces more energy per pound of fuel compared to petrol and diesel, and is therefore more fuel efficient. Cars powered by hydrogen fuel cells can run further than petrol and solar-powered vehicles.
- Can be produced domestically from several sources, reducing dependency on foreign oil.
- Produces nearly zero ozone-forming emissions, as it releases only water vapour into the air.

However, there are a number of disadvantages associated with hydrogen, including:

- **Nitrogen dioxide emission -** although these cells do not emit carbon after burning, they give out nitrogen dioxide and other emissions. Nitrogen dioxide is a toxic gas and can be harmful when ingested by humans.
- **Storage issues -** apart from taking much time to separate the compounds of hydrogen, this element is also a challenge to move and transport.
- **Cost prohibitive -** aside from the cost of transportation, the time it takes to break down its elements makes the process expensive as well. If no other options are found to make the process faster and easier, hydrogen as fuel cells will remain pricey. In

addition, vehicles equipped with hydrogen fuel cells are much too expensive for the average consumer.

- **Highly Flammable** – there are serious concerns over the safety of using hydrogen fuel cells in cars and other applications because of the fear of explosion, especially in higher concentrations.

4. Biodiesel

Biodiesel is an alternative fuel based on vegetable oils or animal fats. Sunflower oil and palm oil are frequently used to produce biodiesel fuels and can be used in their natural form as a fuel if the vehicle has a vegetable oil fuel converter. Biodiesel can also be blended with petroleum diesel and used in unmodified engines.

Biodiesel is most commonly sold in blends with normal diesel; B5, which is 5 percent biodiesel and 95-percent petroleum diesel, and B20, or 20 percent bio diesel.

Biodiesel is safe, biodegradable, and reduces air pollutants associated with vehicle emissions, such as particulate matter, carbon monoxide and hydrocarbons.

5. Hybrid

Hybrid vehicles use two or more distinct types of power, such as an internal combustion engine to drive an electric generator that powers an electric motor, e.g. diesel-electric trains use diesel engines to drive an electric generator that powers the electric motor. Other means to store energy include pressurized fluid in hydraulic hybrids. The basic principle with hybrid vehicles is that the different motors work better at different speeds; the electric motor is more efficient at producing torque, or turning power, and the combustion engine is better for maintaining high speed.

Hybrid vehicles offer a number of advantages, including:

- Cleaner energy **-** hybrids run on a combination of gas and electricity, and therefore emit less pollution than petrol or diesel vehicles.
- Regenerative braking - much of the energy produced during braking is captured and fed to the battery. This action increases the charge available to the electric motor, which results in less fuel consumption. It can also extend the life of the brakes.
- Reduced fuel dependence - with their superb efficiency, hybrids help reduce dependence on oil.
- Weight savings - many hybrids are constructed using lightweight materials, and therefore do not consume as much energy as their full-weight counterparts.
- Smaller engines - because they don't have to power the car alone, the petrol engines used in hybrid cars are usually small, light, and highly efficient.
- Higher resale value - hybrid versions of popular vehicles remain in high demand on the used car market. With a hybrid, you will likely recoup a higher percentage of your original investment when you trade or sell.

Despite these advantages, most hybrids are built for economy, not speed. Total output and acceleration lag. To conserve weight, hybrids are usually not equipped with sport-tuned suspensions and other performance enhancements found on non-hybrid models. In addition, the location of the battery pack often results in less-than-ideal weight distribution, which can affect handling.

Although the gap is narrowing, hybrids remain more expensive, sometimes by a significant margin. Additionally, hybrid vehicles generally cost more to repair, and not all mechanics have the equipment and know-how to fix them properly.

6. Propane

Propane—also called liquefied petroleum gas or LPG—is a by-product of natural gas processing and crude oil refining. Already widely used as a fuel for cooking and heating, propane is also a popular alternative fuel for vehicles.

Propane produces fewer emissions than gasoline, and there is also a highly developed infrastructure for propane transport, storage and distribution. It is price competitive with petrol/diesel, is produced domestically and shows a reduction in some greenhouse gas emissions. However, it is only about 85% as energy effective as petrol and natural gas production creates methane, a greenhouse gas that is 21 times worse for global warming than CO2.

7. Electricity

Electricity can be used as a transportation alternative fuel for battery-powered electric and fuel-cell vehicles. Battery powered electric vehicles store power in batteries that are recharged by plugging the vehicle into a standard electrical source. Fuel-cell vehicles run on electricity that is produced through an electrochemical reaction that occurs when hydrogen and oxygen or another oxidising agent are combined.

The movement towards electric vehicles is gaining momentum in South Africa. Although our vast distances, lack of charging infrastructure and the high cost of electric vehicles are like to stifle the adoption of electric cars, the momentum is growing. Jaguar has recently invested R30 million to install 82 new charging stations in major hubs and along major holiday routes across South Africa. Furthermore, brands such as Nissan and BMW are also working to increase access to public charging infrastructure across the country.

Electricity for transportation is highly efficient. Studies conducted by EFM have shown that there is great potential with regards to electric vehicles though the current range of the vehicles and the lack of infrastructure to support these vehicles are hurdles in the short term at least.

8. Methanol, P-Series Fuels and Solar

Methanol, also known as wood alcohol, could become an important alternative fuel in the future as a source of the hydrogen needed to power fuel-cell vehicles.

P-Series fuels are a blend of ethanol, natural gas liquids and methyl tetrahydrofuran (MeTHF), a co-solvent derived from biomass. P-Series fuels are clear, high-octane alternative fuels that can be used in flexible fuel vehicles. .

A solar fuel is a synthetic fuel produced directly/indirectly from solar energy through photobiological (i.e. artificial photosynthesis), thermochemical (i.e., using solar heat supplied by concentrated solar thermal energy to drive a chemical reaction), and electrochemical reaction. Light is used as energy source with solar energy being transduced to chemical energy, typically by reducing protons to hydrogen or carbon dioxide to organic compounds. A solar fuel can be produced and stored for later usage, when sunlight is not available, making it an alternative to fossil fuels.

With petrol prices steadily increasing, EQSTRA believes it is worthwhile investigating alternative fuels to be ready for technological advances in the future. Speak to your account manager who will arrange for a consultation with your fleet manager to discuss the various options available.

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EQSTRA email address: info@eqstrafleet.co.za 12 Corobrik Road, Meadowdale, Johannesburg, South Africa