



# Fueling commercial vehicles of the future

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With commercial vehicle operators under more pressure than ever, they are faced with the day-to-day task of maximising profits, while ensuring they comply with current and future emission regulations.

As a result, many operators are now looking at the pros and cons of the fuels they use to power their vehicles to help reduce costs while meeting emission requirements. This process includes assessing the possibility and timings of a switch from traditional diesel to alternative fuel options.

## Alternative fuels to traditional diesel

Moving forward, alternative fuels to traditional diesel are expected to be a growing part of the commercial vehicle energy mix. While numerous alternatives have been, or are in the process of being developed, the leading contenders likely to have a significant impact are biofuels, Liquefied Natural Gas (LNG), Compressed Natural Gas (CNG) and electricity. These alternative fuels can be renewable depending on the source of feedstock or energy used.



### Biofuels

The two main biofuels for use in diesel vehicles are **Hydro Treated Vegetable Oil (HVO)** and **Fatty Acid Methyl Esters (FAME)**.

#### HVO

- HVO has better combustion qualities than diesel and produces lower PM (Particulate Matter) and NOx (Nitrogen Oxide) emissions.
- HVO also has the advantage that it can be used as a replacement or added to traditional diesel without engine modification<sup>1</sup>.
- However, HVO availability is limited and may continue to be challenged as existing and future legislation requirements increase demand.

#### FAME

- FAME can produce lower PM emissions than diesel.
- However, it may require additional processing in order to mitigate fuel system operational issues. For example, FAME has more impurities than HVO that can cause filter blocking at lower temperatures. FAME also has a higher potential to promote microbiological growth.
- FAME must be blended with diesel, as engine manufacturers typically specify a maximum concentration of FAME.

## Natural gas

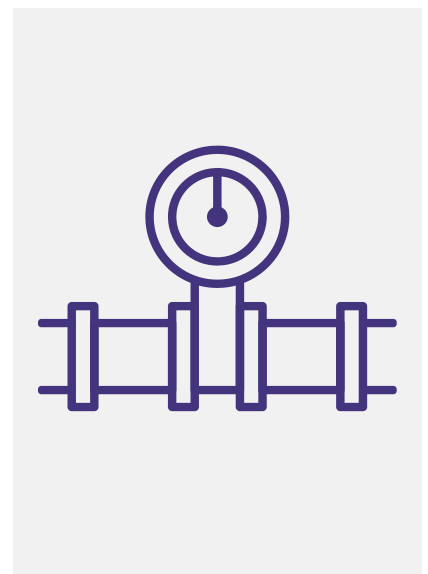
Natural gas is a fuel that is also gaining traction in the market. **LNG** and **CNG** both have very low PM and NOx emissions at the outlet of the engine and can reduce CO<sub>2</sub> (Carbon Dioxide) emissions by 10 – 15% compared with diesel. This means some LNG and CNG trucks may meet the current stringent European emission requirements with a simpler after-treatment system than diesel trucks, reducing or avoiding the need to use AdBlue, etc.

#### LNG

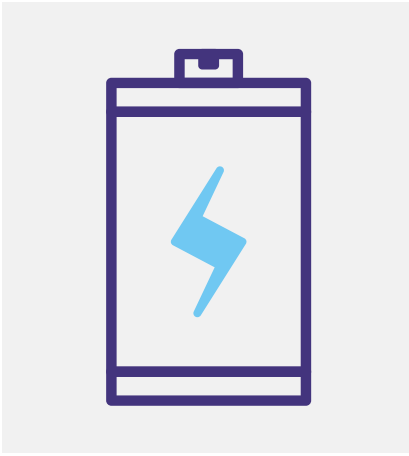
- LNG requires cryogenic tanks and vehicles are typically more expensive than diesel alternatives.
- However, LNG could prove a compelling choice for larger vehicles with a high annual mileage (typically, 100,000 km or more). Newer vehicles have good ranges of up to 1,000 km and once the infrastructure is in place, LNG is typically available at a lower cost than diesel.

#### CNG

- CNG has approximately half of the energy density of LNG, making it more suitable for shorter distance / regular return to base fleets due to the trade-off between energy storage and vehicle payload. This fuel may particularly appeal for use in waste disposal vehicles and buses.
- It also has a lower cost of installation compared with LNG and refueling is performed at lower pressure, so requires less stringent safety measures.



<sup>1</sup>Vehicle manufacturer fuel requirements should be checked when considering use of 100% HVO



## Electricity

Electricity is also a fuel being used to power automotive vehicles

- However, a very large battery would be required given the power requirements of large commercial vehicles, potentially impacting the maximum payload. At the moment, the primary applications for electric commercial vehicles are city buses and urban delivery vehicles operating in low emission zones, with short / medium return to base operations.

## Total cost of ownership

Before switching to alternative fuels, operators need to consider factors such as:

- vehicle cost
- fuel availability
- total distance
- typical routes
- average mileage

Undertaking a Total Cost of Ownership (TCO) analysis will also help to determine the best fuel and vehicle mix for a fleet.

## The future of diesel

While trials and the use of alternative fuels are widely reported, diesel will continue to be a significant part of the fuels mix for large commercial vehicles, now and into the future.

Engine manufacturers continue to develop diesel fuelled vehicles to help achieve very low emissions of particulates and NOx. At the same time, leading oil companies continue to invest in research and development to improve the performance of diesel. For example, ExxonMobil has developed Esso Diesel Efficient™ fuel. This fuel is designed to clean up deposits on fuel injectors, helping to improve engine performance. Tests at Millbrook, one of the most comprehensive test facilities in the world for conducting independent fuels testing, conducted with heavy duty vehicles over a five month period of normal daily on-road operations found that Esso Diesel Efficient™ fuel helped to reduce emissions<sup>2</sup>; 10% NOx, 22% PM and 2.8% CO<sub>2</sub>, and improve fuel consumption by an average of 2.8% when compared to unadditised diesel. This fuel is available in UK and in 5 other countries across Europe.

## A mixed fuels future

With regulations evolving rapidly, commercial operators focused on optimising TCO, and the infrastructure to supply some alternative fuels still in its infancy, change is one thing that is guaranteed in the commercial vehicle sector moving forward. It's for this reason that it's important for commercial vehicle operators to choose reputable fuel suppliers who they can work with to develop the optimum fuels solution for their business.

Vehicle type, engine type, driving behaviour, and other factors also impact fuel and vehicle performance, emissions, and fuel economy. You can find out more about Esso Diesel Efficient™ fuel and the independent tests performed at Millbrook Proving Ground Ltd. at <https://wholesalefuels.esso.co.uk/en/customer-type/advantages-diesel-efficient-for-heavy-duty-vehicles>

<sup>2</sup> Independent tests performed at Millbrook Proving Ground Ltd., UK:

- Compared the performance in heavy-duty vehicles of Esso™ unadditised diesel with Esso Diesel Efficient™ fuel
- Used third-party customer trucks (Euro III and Euro V specifications)
- Covered approximately 110,000 miles/177,000 km
- Five months of normal daily on-road operations (motorway, rural, and urban environments)
- Took trucks out of service periodically for lab testing
- Test results range of 2.1% to 3.4% lower fuel consumption

Millbrook has expertise in automotive, test, and propulsion technologies and remain pioneers in low carbon development. (ISO Certification - ISO 17025, ISO 9001 and ISO 14001.)

Esso Diesel Efficient™ fuel claims are based on internal and third-party vehicle engine testing, laboratory testing, and/or industry or other scientific literature. Basis for comparison for all claims is versus Esso™ unadditised diesel. Vehicle type, engine type, driving behaviour, and other factors also impact fuel and vehicle performance, emissions, and fuel economy. Esso Diesel Efficient™ fuel may be used in all heavy-duty and light-duty vehicles, but results may vary. Fuel economy testing was performed in the UK using on-road trucks.



# Fueling Commercial Vehicles of the Future

Commercial vehicle operators are under more pressure than ever. Faced with the task of maximising profits, they need to ensure they comply with current and future emission regulations.

The leading alternative fuels to traditional diesel for fueling commercial vehicles are **biofuels**, **Compressed Natural Gas (CNG)**, **Liquefied Natural Gas (LNG)** and **electricity**, which can be renewable depending on the feedstock or source.



## Biofuels

The two main biofuels for use in diesel vehicles are **Hydro Treated Vegetable Oil (HVO)** and **Fatty Acid Methyl Esters (FAME)**.



### PROs\*

### CONS\*

#### HVO

BETTER COMBUSTION QUALITIES

LOWER PARTICULATE MATTER (PM) AND NITROGEN OXIDE (NOx) EMISSIONS

ADDED TO DIESEL WITHOUT ENGINE MODIFICATION\*\*

#### FAME

CAN PRODUCE LOWER PM EMISSIONS

FUTURE AVAILABILITY MAY BE LIMITED AS DEMAND INCREASES

#### HVO

IMPURITIES MAY INCREASE RISK OF FILTER BLOCKING AT COLD TEMPERATURE

AMOUNT THAT CAN BE BLENDED IN DIESEL LIMITED BY ENGINE MANUFACTURERS

#### FAME

HIGHER POTENTIAL TO PROMOTE MICROBIOLOGICAL GROWTH

\*Compared to diesel

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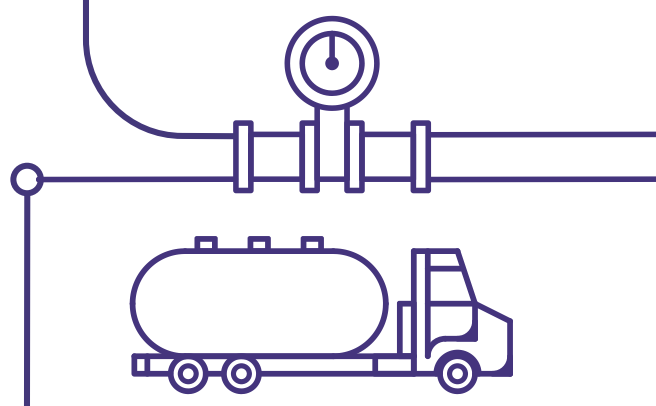
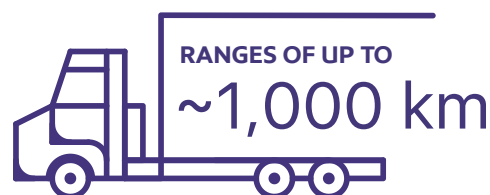
\*Compared to diesel

## Natural gas

**CNG  
LNG = Lower PM and NOx emissions\***

Whilst vehicles are higher cost, LNG is typically available at a lower cost than diesel

\*compared to diesel

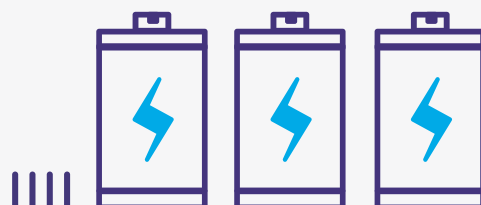


### CNG AND LNG TRUCKS

may meet the current stringent emissions legislation requirement with simpler after-treatment systems compared to diesel

## Electricity

The primary applications for electric commercial vehicles are city buses and urban delivery vehicles operating in low emission zones



### LARGE COMMERCIAL VEHICLES

Very large battery would be required to meet the payload requirement for heavy duty trucks



## The future of diesel

While trials and the use of alternative fuels are widely reported, diesel will continue to be a significant part of the fuels mix for large commercial vehicles, now and into the future.

## Esso Diesel Efficient™ fuel:

This fuel is designed to clean up deposits on dirty fuel injectors, helping to improve engine performance.<sup>1</sup>

ExxonMobil has developed **Esso Diesel Efficient™**



Esso Diesel Efficient™ helps to lower emissions<sup>1</sup>

In real world trucks, Esso Diesel Efficient™ reduced fuel consumption by an average of 2.8%<sup>1</sup>

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