The Green Pages
NEW FUELS GUIDE
SPRING 2021 • ISSUE 5

Welcome to the latest edition of our new fuels supplement

At the PEIMF, we support our members with education and help on traditional petroleum products and services and INSITE is always packed with information. Virtually all editorial contributions are provided by PEIMF members (which is a great member benefit).

'**The Green Pages**' is a series of regular special supplements, in which we endeavour to cover many aspects of new and alternative fuels, during the huge changes and developments in the industry.

Electric vehicle charging is in everyone's consciousness, but there is a lot more going on, for both fuelling and the infrastructure involved.

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Car registrations
February 2021

February

	2021	2020	% change	Mkt share -21	Mkt share -20
Diesel	6,761	17,347	-61.0%	13.2%	21.8%
MHEV diesel	2,758	2,000	37.9%	5.4%	2.5%
Petrol	26,752	48,219	-44.5%	52.1%	60.6%
MHEV petrol	5,187	3,308	56.8%	10.1%	4.2%
BEV	3,516	2,508	40.2%	6.9%	3.2%
PHEV	3,131	2,058	52.1%	6.1%	2.6%
HEV	3,207	4,154	-22.8%	6.3%	5.2%
TOTAL	51,312	79,594	-35.5%		

Year to date

	YTD 2021	YTD 2020	% change	Mkt share -21	Mkt share -20
Diesel	17,844	46,625	-61.7%	12.6%	20.4%
MHEV diesel	8,979	6,918	29.8%	6.3%	3.0%
Petrol	71,855	139,153	-48.5%	50.6%	60.8%
MHEV petrol	14,019	9,606	45.9%	9.9%	4.2%
BEV	9,776	6,562	49.0%	6.9%	2.9%
PHEV	9,255	6,844	35.2%	6.5%	3.0%
HEV	10,033	13,125	-23.6%	7.1%	5.7%
TOTAL	141,561	228,873	-38.1%		

BEV - Battery Electric Vehicle. **PHEV** - Plug-in Hybrid Electric Vehicle. **HEV** - Hybrid Electric Vehicle. **MHEV** - Mild Hybrid Electric Vehicle

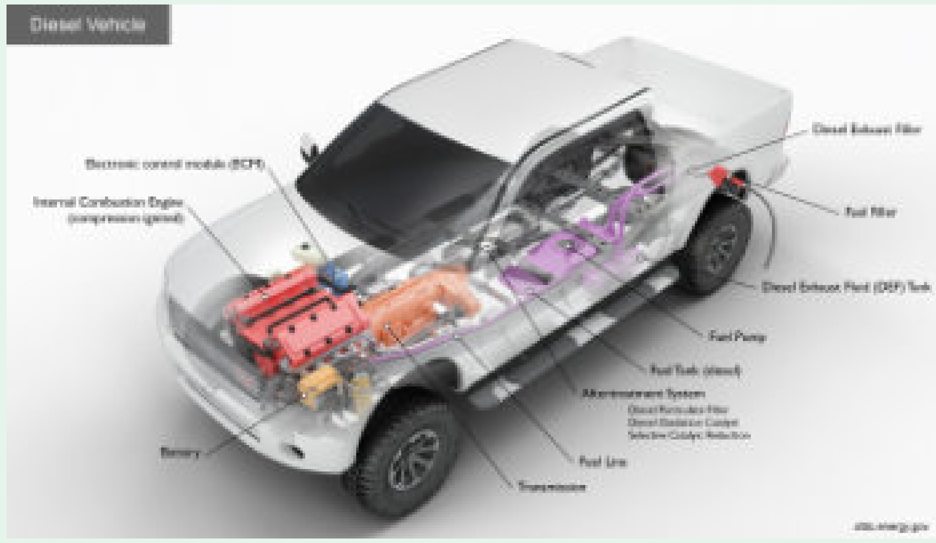
These figures are courtesy of the society of motor manufacturers and traders: www.smmt.co.uk

Top Gear – Green Pages style!

In The Green Pages, we're committed to providing information and education on the whole range of new fuelling technologies availability to the industry.

With the acceleration to the Government's 'Road to Zero', it's important to not just understand what these new fuels are, but how the vehicles actually work. So for those of you with a 'Clarkson-like' interest in how these vehicles are actually propelled, the next 3 pages will be a help to you. The shaper-eyed amongst you will notice that these are left hand drive U.S. models!

Biodiesel in diesel vehicles

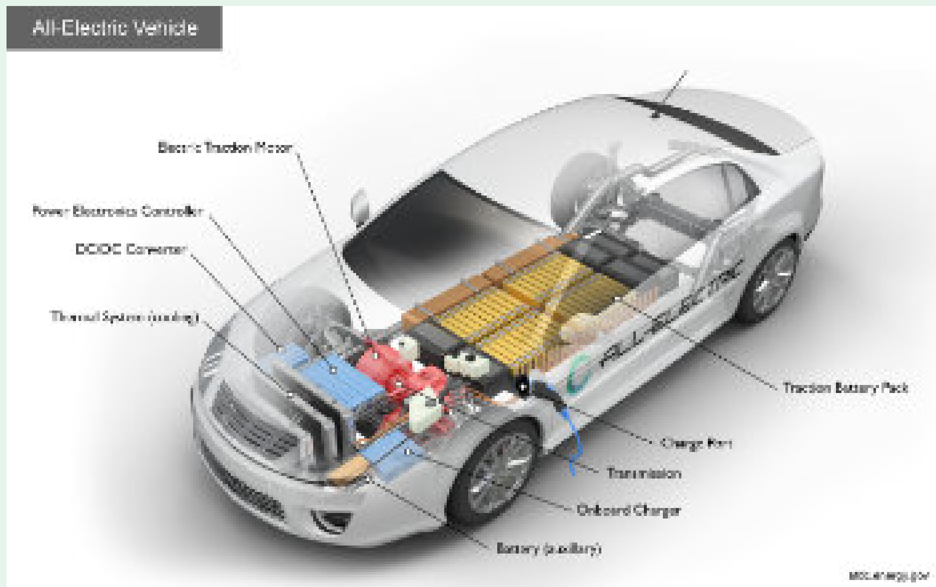


Biodiesel and conventional diesel vehicles are essentially one and the same. Although light-, medium-, and heavy-duty diesel vehicles are not technically alternative fuel vehicles, almost all are capable of running on biodiesel blends (always check before use).

Biodiesel raises the cetane number of the fuel and improves lubricity. A higher cetane number means the engine is easier to start and reduces ignition delay. Diesel engines depend on the lubricity of the fuel to prevent moving parts from wearing prematurely.

Electric vehicles (EV)

All-electric vehicles use a battery pack to store the electrical energy which powers the motor. EV batteries are charged by plugging the vehicle in to an electric power source.

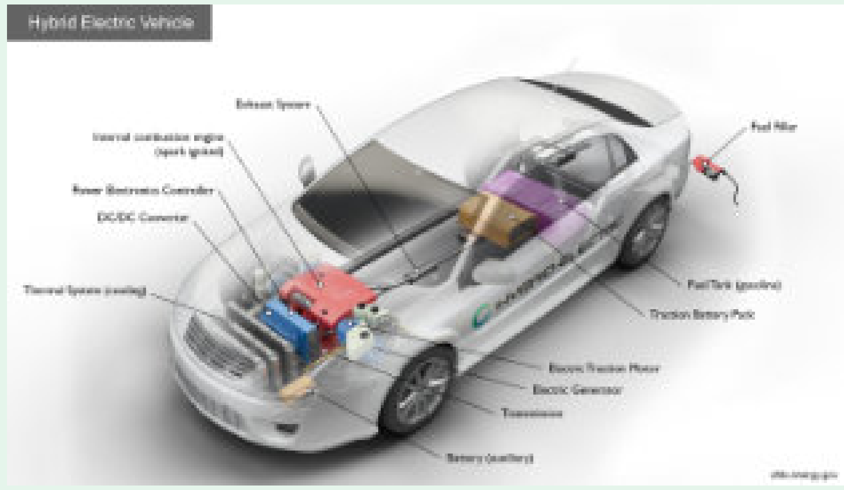


Today's EVs generally have a shorter range (per charge) than comparable conventional vehicles, but this will undoubtedly change over time. Efficiency and range of EVs varies substantially based on driving conditions, e.g extreme outside temperatures tend to reduce range, because more energy must be used to heat or cool the cabin.

EVs are more efficient under city driving than on the motorway. City driving has more frequent stops, maximising the benefits of regenerative braking, while motorway travel typically requires more energy to overcome increased drag at higher speeds.

Hybrid electric vehicles (HEV)

Hybrids are powered by an internal combustion engine (ICE) in combination with one or more electric motors, using energy stored in batteries. HEVs combine the benefits of high fuel economy and low tailpipe emissions, with the power and range of conventional vehicles.

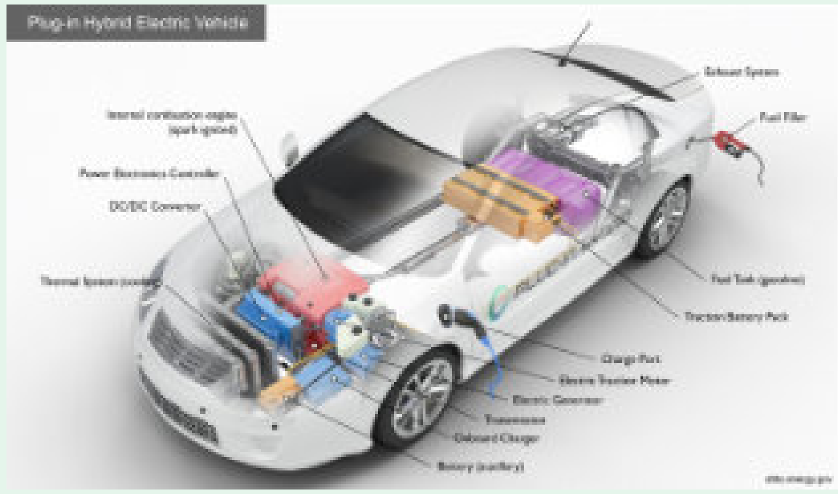


In an HEV, the extra power provided by the electric motor may allow for a smaller combustion engine. The battery can also power auxiliary loads and reduce engine idling when the vehicle is stopped. Together, these features result in better fuel economy without sacrificing performance.

The vehicle uses regenerative braking and the internal combustion engine to charge. It captures energy normally lost during braking, by using the electric motor as a generator and storing the captured energy in the battery.

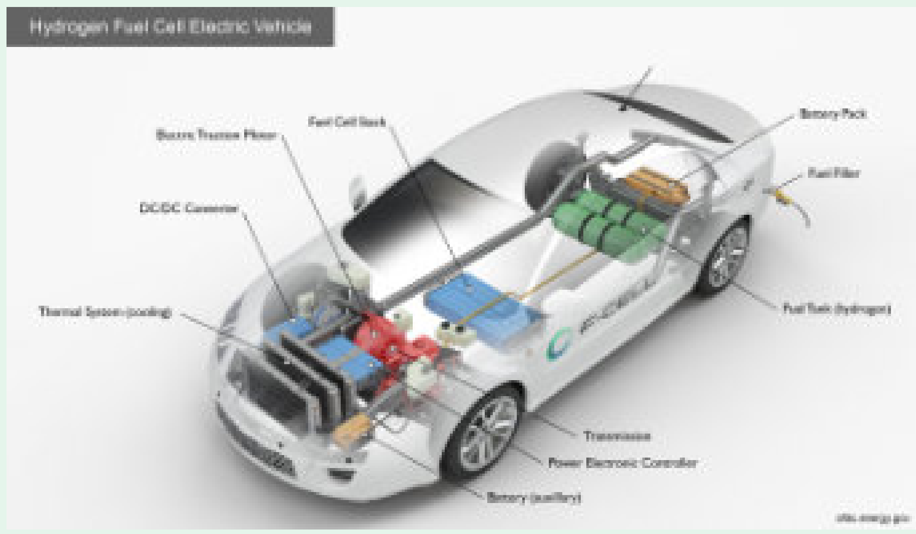
Plug-in hybrids (PHEV)

Plug-in hybrid electric vehicles use batteries to power an electric motor, as well as another fuel, such as petrol or diesel, to power an ICE. PHEVs can charge their batteries through charging equipment and/or regenerative braking. Using electricity from the grid can reduce operating costs and fuel use, relative to conventional vehicles. PHEVs may also produce lower levels of emissions, depending on the electricity source and how often the vehicle is operated in all-electric mode.



During town driving, most of a PHEV's power can come from stored electricity. PHEVs generally have larger battery packs than hybrid electric vehicles. This makes it possible to drive moderate distances using just electricity (about 15 to 60-plus miles in current models) commonly referred to as the "electric range" of the vehicle. The ICE powers the vehicle when the battery is mostly depleted, for example during rapid acceleration.

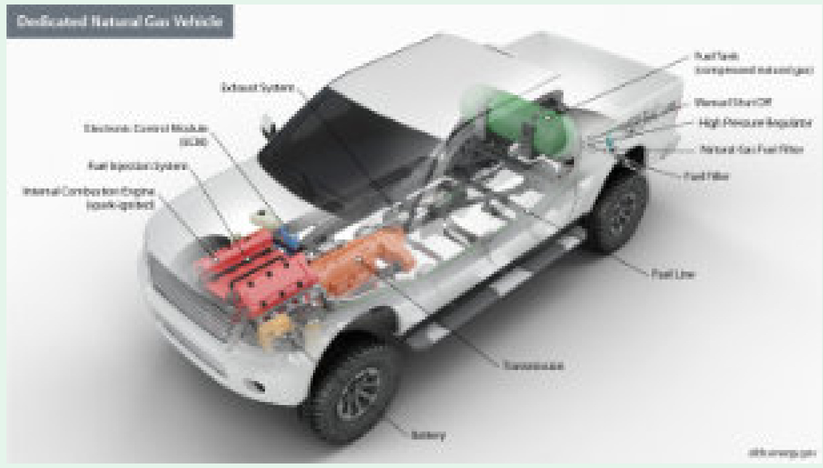
Hydrogen



Energy is stored as hydrogen in a tank on the vehicle and then converted to electricity by the fuel cell. Unlike conventional internal combustion engine vehicles, these vehicles produce no harmful tailpipe emissions, only emitting water vapour and air. They can be refuelled quickly and have a potential driving range over 300 miles.

The battery recaptures braking energy, providing extra power during short acceleration, and smooths out the power delivered from the fuel cell, with the option to idle or turn off the fuel cell during low power needs.

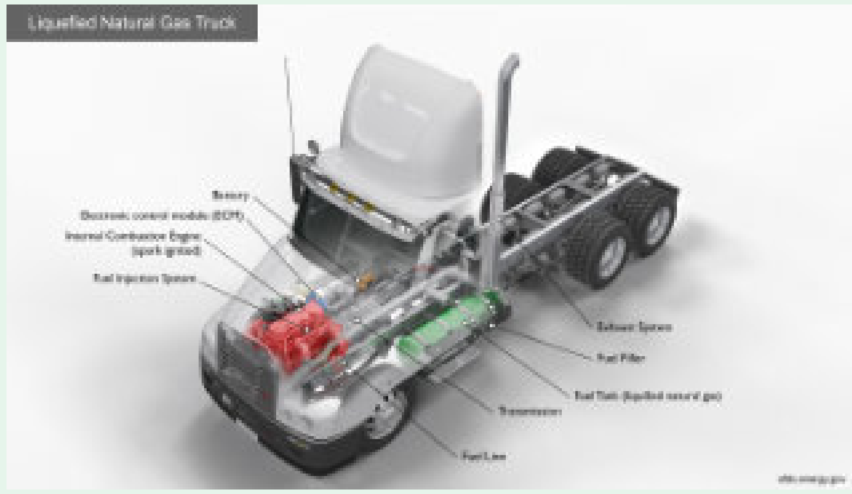
Compressed natural gas (CNG)



Natural gas powers over 20 million vehicles worldwide. It can be ideal for high-mileage, centrally-fuelled fleets, because they can provide similar fuel range support for applications not involved in long-haul routes, where fuel stations may be sparse. Plus the benefit from reduced greenhouse gas.

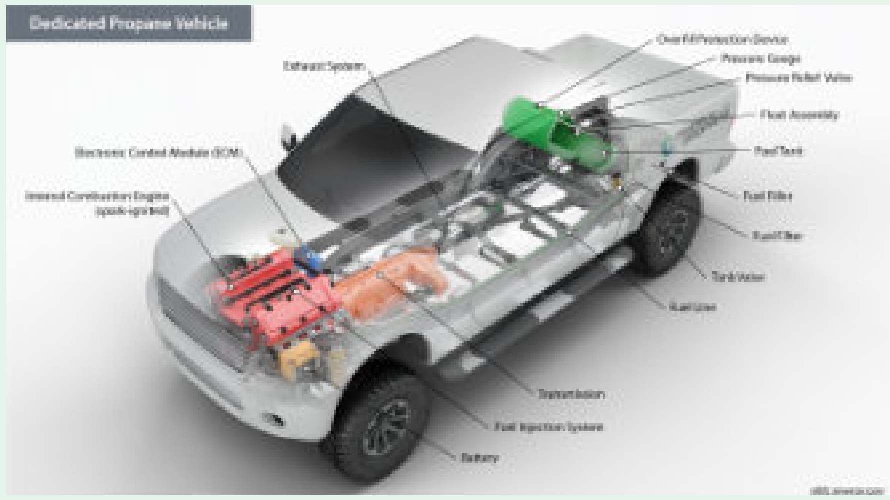
CNG vehicles operate much like petrol engines, with spark-ignited internal combustion engines. Natural gas is stored in a fuel tank, or cylinder, typically at the back of the vehicle. The CNG fuel system transfers high-pressure gas from the fuel tank through the fuel lines, where a pressure regulator reduces the pressure to a level compatible with the engine fuel injection system. Finally, the fuel is introduced into the intake manifold or combustion chamber, where it is mixed with air and then compressed and ignited by a spark plug.

Liquefied natural gas (LNG)



Heavy-duty LNG vehicles work much like petroleum-powered vehicles with a spark-ignited internal combustion engine. The natural gas is super-cooled and cryogenically stored in liquid form, usually in a tank on the side of the truck. LNG is typically a more expensive option than CNG and is most often used in heavy-duty vehicles to meet longer range requirements. Because it is a liquid, the energy density of LNG is greater than CNG, so more fuel can be stored on board the vehicle. This makes LNG well suited for Class 7 and 8 trucks traveling greater distances.

Liquefied petroleum gas (LPG)



LPG / propane (or Autogas) vehicles are available from original equipment manufacturers (OEMs) or via conversion.

Propane vehicles operate much like petrol vehicles, with spark-ignited internal combustion engines. There are two types of propane fuel-injection systems available: vapour and liquid injection.
In both types, propane is stored as a liquid in a relatively low-pressure tank, usually at the rear of the vehicle. In vapour-injected systems, liquid propane travels along a fuel line into the engine compartment where it is converted to a vapour by a regulator. Liquid propane injection engines do not vaporise the propane until it has reached the fuel injector, allowing for more precise control of the fuel delivery and improved engine performance and efficiency.

The RTFA: Driving the uptake of sustainable, renewable fuels

The PEIMF AGM in January was one of those strange 'Covid-affairs,' where the speakers are greeted with 40 or so blank cameras and muted mics, and the only voice is the poor old presenter.

rtfa Renewable Transport Fuel Association

But 'silver-linings' and all that! We were blessed with the involvement of Gaynor Hartnell, who is the Chief Executive of the Renewable Transport Fuel Association. The RTFA is a new organisation (born out of the Renewable Energy Association) specialising in the drive of the uptake of sustainable renewable and low carbon fuels. The voice of the UK's renewable liquid and gaseous fuel producers and suppliers.

These fuels are delivering valuable carbon savings today, and the companies that produce them will be the innovators and investors of the future. They will be making fuels for those sectors of transport that cannot ultimately be electrified, such as heavy freight, aviation and marine.

The PEIMF and the RTFA are developing a great understanding and here we introduce them to you, with a brilliant overview of the range of sustainable fuels out there.

The RTFA are calling upon Government to have greater ambition in the fight to reduce carbon emissions from transport. Time is short.

BIODIESEL

Biodiesel achieves greenhouse gas savings of 87% – 92% compared to diesel. It is made from oil and fat-based waste residues and oil crops. Waste-based raw feedstocks are preferable, as these give the best greenhouse gas saving and sustainability.


First biodiesel produced from fatberg feedstock, mocked up to look like limited edition single malt whisky.

Standard diesel sold at forecourts contains around 7% biodiesel, and for this reason is known as B7. This fuel meets the EN590 standard for ultra low sulphur diesel. Higher blends (of 20%, 30% and even 100% can be used) and typically require some modification to the engine and fuel storage infrastructure. B100 (100% biodiesel) must comply with European Biodiesel Standard EN14214, whilst B20 and 30 must meet EN16709.

Argent tanker loading B100 for delivery to customers fuelling depot

Some bus and truck manufacturers (OEMs) do not warranty the use of higher blends in their vehicles. This may be due to the required tests not having been done, rather than genuine concerns over engine impact.

Biodiesel is produced by reacting waste oil with methanol to produce Fatty Acid Methyl Ester. Glycerine is produced as a by-product. There are 3 biodiesel manufacturers in the UK, and all are members of the RTFA. The RTFA is keen to see more fleet operators using higher biodiesel blends, as well the biodiesel content of retail fuel increased from 7 to 10%


Inside the biodiesel production facility at Stanlow

BIOETHANOL

UK produced bioethanol can achieve GHG savings of over 85%. Bioethanol is made from fermenting starch rich biomass (such as feed wheat or corn). This process produces ethanol with by-products of CO_2 (which can be sold for use in the drinks industry) and DDGS.

DDGS stands for distillers' dried grains and solubles, and is a protein-rich solid which is used as an animal feed. Feed wheat is high-starch, low-protein grain, which is unsuitable for making milling flour for human consumption. The fermentation process turns the starch to alcohol and concentrates the protein in the animal feed by product. It's a virtuous circle, and of great benefit to UK agriculture, and means that we need to import less soy-based animal feed from South America. Bioethanol can also be made from water.

The RTFA - *continued*

Nova Pangaea Technologies (UK) Ltd is developing technology for converting lignin-rich feedstocks into ethanol, along with high value chemicals.

The petrol sold on public forecourts in the UK contains around 5% bioethanol, but that should soon change. E10 (petrol with up to 10% bioethanol) is sold in many countries and the UK will follow suit this September.

Ensus UK and ABSugar make bioethanol in the UK, and Vivergo, also owned by Associated British Foods, has a plant which is currently mothballed, awaiting the introduction of E10.

BIOMETHANE (THE RENEWABLE EQUIVALENT OF NATURAL GAS)

Methane is increasingly used to fuel heavy duty vehicles in the UK. It is used in cars elsewhere (particularly in Italy) but this is not envisaged for the UK. Fossil methane, or natural gas, can achieve a GHG saving of around 15% compared to diesel, but the renewable equivalent, biomethane, can achieve savings in the region of 85% – 110%.

Biomethane achieves negative carbon emissions when produced from animal manure, as it is captured instead of being released into the atmosphere during manure storage. All biomethane supplied to vehicles in UK is dispensed from companies that are members of the RTFA. A map showing the ever-increasing number of locations where HGV drivers can fuel with gas can be found at www.gasvehiclehub.org

Gas can be used either in compressed from or liquefied, and predominantly in >40 tonne HGVs. The cost of ownership and GHG benefits are greatest on the heaviest duty cycles.

Compressed biomethane requires more storage space on the tractor, and is generally used on 2 axle tractor configurations. Compressed biomethane is stored at pressures of [250bar], whilst liquified is stored at 5 – 10 bar but requires refrigeration at around -160 Celsius.

Compressed biomethane (CBM) may be supplied directly or via mass balance. LNG will always be mass balanced. Mass balancing in this context is putting biomethane in the gas distribution grid in one location, and taking an equivalent amount of gas out in another location, but having the sustainability characteristics of the biomethane follow the contractual pathway taken by the gas. Natural gas and Biomethane both pay a fuel duty of 24.7p/Kg and VAT at 20%. This fuel duty rate is fixed to 2032, with a review in 2024.

A Volvo tractor unit fuelled by liquefied biomethane

BIOPROPANE (RENEWABLE EQUIVALENT OF LPG

LPG is a fossil fuel, and biopropane is the renewable equivalent. RTFA member Calor Gas supplies biopropane for both transport and heating. Biopropane is a by-product of the production of HVO. LPG is a mixture of propane and butane and is a by-product of natural gas and oil extraction and oil refining. It boils at a low temperature and is stored in pressurised steel vessels such as gas bottles or bulk LPG tanks. It can be used as a vehicle fuel and is particularly used in forklift trucks.

DROP IN FUELS

Any renewable or sustainable fuel that can be blended with conventional fossil fuels at any level, whilst still meeting the relevant fuel standard (be that for petrol, diesel, aviation or gaseous fuels) is known as a “drop in” fuel. The Department for Transport regards renewable liquid drop in fuels that can be blended with petrol and diesel as strategically important; encouraging their development through the Renewable Transport Fuels Obligation via the development fuels sub-target.

To qualify as development fuels, these fuels must be made from wastes or residues, but not feedstocks that typically go to make biodiesel (i.e. not made from segregated oils or fats). Drop in paraffinic diesel can also be made from non-bio sources. For example; hydrogen can be reacted with CO2, to make methane, which can then be put through the Fischer Tropsh process. Shell does this with its GtL (gas to liquid) product using natural gas, but here we are talking about the renewable version.

A typical feedstock for producing drop in liquid fuel would be residual waste. This is a mixture of biomass waste and waste plastics that cannot be recycled. The resulting fuel would be partly renewable, and partly recycled carbon fuel.

HVO (HYDRO-TREATED VEGETABLE OIL)

HVO is a drop in fuel, closely aligned to the chemical composition of diesel and with identical performance characteristics; warranty concerns are therefore not an issue. The Zemo Partnership (formerly the LowCVP) did a study on high blend biofuels, and noted that 99% of the Euro VI HDV fleet is estimated to be compatible with HVO. GHG savings are typically around 90%.

HVO is made from similar feedstocks to biodiesel, but is more expensive to produce. Although HVO is 100% renewable it pays the same full fuel duty as diesel.

HYDROGEN

The attraction of hydrogen is that it has zero tailpipe emissions, and vehicles can be refuelled quickly and have a long range. Set against this are the energy losses involved in production.

There are various different ways of producing hydrogen, and the upstream (or “well to tank”) emissions vary significantly depending on the production pathway. Renewable hydrogen can be made by electrolysing water using renewable electricity. This is the simplest form of a ‘Renewable Fuel of Non-Biological Origin’ (RFNBO). Another route for making renewable hydrogen is from syngas produced from biomass, known as biohydrogen.

Hydrogen from steam – reforming natural gas requires carbon capture and storage in order to be a low carbon proposition.

For use in transport (i.e. in fuel cells) the hydrogen has to be extremely low in moisture and very high purity (99% plus). At standard room temperature and pressure hydrogen has one third the calorific value of natural gas and half the calorific value of diesel. Pressurising and then storing hydrogen in excess of 700 bar to enable high-pressure filling is energy intensive.

RECYCLED CARBON FUELS (RCFS)

RCFs are liquid and gaseous fuels made from unrecyclable fossil fuels e.g. plastics or industrial. There is great interest in producing transport fuel from end of life tyres. As car tyres are around 40% biomass-derived, and truck tyres have twice that amount of biogenic content fuel made from them would be part renewable and part RCF.

The Department for Transport is considering whether to include these fuels within the Renewable Transport Fuel Obligation and a consultation on changes to the RTFO is due soon.

RENEWABLE AVIATION FUEL / SUSTAINABLE AVIATION FUEL

The Renewable Transport Fuel Obligation has a specific sub-target for strategically important fuels, and aviation fuel is one. Aviation fuel has stringent specification criteria and fuels must be certified in order to be used in commercial flights.

There are a number of aviation fuels derived from biomass that have been certified, and several others are in the approval process. Renewable aviation fuels can also be made from renewable hydrogen or from recycled carbon sources, such as industrial off-gases e.g. from steel production. This process involves fermenting the off gases to make ethanol, which is then synthesised into aviation fuel via A2J (alcohol to jet) technology. Renewable bioethanol sources can also be used for A2J.

For further information on all these fuels, or on the organisation, go to www.rtfa.org

On the buses!

World's first hydrogen double deckers

Fifteen 60-seat hydrogen double-decker buses opened their doors in Aberdeen in January.

Built by Wrightbus in Northern Ireland, the buses are operated by First Bus, in a project led by Aberdeen City Council.

They are reportedly more efficient than their electric equivalents, with the refuelling of 25 kg of hydrogen taking less than 10 minutes, offering a range of 250 miles, similar to that of diesel, or additional hydrogen tanks can be installed.

Hydrogen buses emit only water and create no noise pollution. Aberdeen council says it has plans to make its own hydrogen.

In the short term a gas tanker truck would be required to deliver the hydrogen to the bus garage but, in the longer term the hydrogen could be delivered via the existing mains gas pipelines.

These buses can be suitable for both inner city or rural garages, where there is no suitable electricity grid.

This £8.3 million project has been funded by Aberdeen City Council, European Union Fuel Cells and Hydrogen Joint Undertaking, and the Scottish Government.

The city already owns hydrogen and electric vans, road sweepers, and cars through a car share scheme.

All aboard!! The first hydrogen train

The first-ever hydrogen-powered train is now running on the UK mainline. HydroFLEX, took two years of development work and more than £1 million of investment by both Porterbrook and the University of Birmingham, plus a £750,000 grant from the Department for Transport (DfT).

DfT says the technology deployed for the train will also be available by 2023 to retrofit current in-service trains to hydrogen, helping decarbonise the rail network and make journeys greener and more efficient.

The next phase of HydroFLEX will be the development of a hydrogen and battery-powered module that can be fitted underneath the train, which will allow for more space for passengers in the train's carriage.

The Transport Secretary has also unveiled plans to make Tees Valley the UK's first hydrogen transport hub. This would bring together industry and scientists to help create hundreds of green jobs, plus a £6.3 million funding for a green hydrogen refuelling station and 19 hydrogen-powered refuse vehicles in Glasgow.