# What you need to know about: **ALTERNATIVE FUELS**





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### INTRODUCTION

If the government follows recommendations published by the influential National Infrastructure Commission (NIC), new trucks powered by diesel engines could be banned in the UK by the year 2040.

The Freight Transport Association (FTA) accepts this as a "feasible target for the logistics industry", provided there is enough government support, while the Road Haulage Association (RHA) is less convinced, describing the NIC recommendations as "simplistic" because they fail to make clear what government has to do to make moves to diesel alternatives realistic.

A government spokesman said: "We are taking action now to incentivise freight companies to move to cleaner HGV fleets, including through investment in research and development for greener vehicles and by introducing higher charges for the dirtiest lorries using our roads.

"Tackling the issue of pollution and investing in green technologies is a priority, which is why we have a £3.5bn plan to improve air quality and reduce harmful emissions."

But scarcely anyone now disputes one of the central points made by the NIC report, as well as by many others from across the industry and beyond: that effective action on carbon emissions and air quality is urgently needed. For commercial vehicle operators this means greater pressure than ever before to find alternatives to diesel and petrol engines.

The primary aim of this guide is to assist van and truck fleet managers aiming to make this change as part of a drive towards more sustainable freight transport. There are no quick and easy solutions, and much depends on the specific requirements of any particular operation.

For instance, it is clear that there are already more viable alternatives to diesel for light commercial vehicles (up to 3.5 tonnes) than for heavier trucks. Hence we have split this guide into two separate sections.

Should you wish to discuss any of these issues in more detail, please don't hesitate to contact your Fraikin Account Manager, or call 0800 052 4455.

#### Low emission van guide



Battery electric will certainly not be the best low- or zero-emission alternative to conventional diesel or petrol engines for every light commercial vehicle operation. Five other options, in addition to battery electric, are explored indepth in a comprehensive recent low-emission van guide published jointly by the Low Carbon Vehicle Partnership (Low CVP) and Cenex, the Centre of Excellence for Low Carbon and Fuel Cell technologies.

For reference, Low CVP, established back in 2003, now has around 200 members including bodies from both the private and public sector. Cenex has been operating since 2005 as an independent, not-for-profit consultancy focused on low-carbon vehicles and associated infrastructure.

**Download the guide here:** www.bit.ly/lowcvpguide

# VANS AND LIGHT COMMERCIAL VEHICLES

As the NIC report Better Delivery: The Challenge for Freight acknowledges, pure electric (battery-powered) drivelines are now becoming a viable zero-emissions alternative in diesel or petrol vans, far more rapidly than in trucks. In a growing number of "last-mile" delivery routes, the operational and financial advantages of the latest electric van models now often outweigh factors such as limited range, lower payload and much higher initial capital cost, which have long been electric van bugbears. Take DPD, for instance, one of the UK's biggest parcel-delivery firms. It recently became the first UK customer for the new eVito electric van from Mercedes-Benz. It plans to place 10 into service in London, where the first fully-electric DPD last-mile delivery centre was opened in Westminster in 2018. Eight more all-electric DPD 'micro-depots' for London are planned, which will be followed by a nationwide rollout of a full EV (electric vehicle) DPD fleet.

Rob Fowler is DPD UK's general manager in charge of corporate social responsibility and general planning. "Reducing and neutralising our carbon footprint by providing smarter and more efficient urban delivery solutions, and investing in innovation, are at the heart of DPD's DrivingChange programme," he says. "We want to be the leader in alternative fuel vehicles in the UK, and the Mercedes-Benz eVito, like the larger eSprinter – which we also look forward to seeing – is integral to our EV strategy. Aside from their zero tailpipe emissions and exemplary environmental credentials, both vehicles offer the volume and payload potentials that make them genuinely viable propositions."



### THE ALTERNATIVE OPTIONS

The Low Emission Van Guide focuses on the following alternative options:

#### **Battery electric**

These vehicles store energy in batteries (usually lithium-ion) and deliver power to the wheels through electric motors. Limited range and long charging times have been seen as the main potential problems, but both are improving markedly with the latest models. The number of operators using battery electric vans for last-mile deliveries is growing fast.

### Plug-in hybrid and extended-range electric

Both these vehicle types have internal combustion engines (petrol or diesel) as well as battery-powered electric motors. These 'hybrid' drivelines overcome the range limitations of pure battery electric vehicles but price and complexity tend to be high.

### Liquefied petroleum gas (LPG) and bioLPG

LPG is a fossil fuel and a by-product of oil refining. The liquid gas is stored on vehicles in high-pressure tanks and fed to spark-ignition engines. BioLPG is a new renewable fuel, chemically the same as LPG but is not created from fossil fuels but rather from renewable feedstocks.

### Compressed natural gas (CNG) and biomethane

Natural gas is, in effect, methane: the same fuel used widely in the UK for domestic heating and cooking. Biomethane is an ultra-low-carbon variant of CNG made from renewable sources. Both these gases are carried on vehicles in high-pressure tanks.

#### High-blend biodiesel, also known as hydro-treated vegetable oil (HVO) and fatty acid methyl ester (FAME)

These fuels are generally not yet available on forecourts but can be supplied in bulk. They are increasingly favoured by vehicle manufacturers because they can – almost – be used as a direct replacement for conventional diesel fuel. Engines and tanks need no modification to run on HVO, but FAME blended with conventional diesel at greater than about seven per cent concentration can mean modifications are required to fuel storage and fuel injection equipment.

#### Hydrogen fuel-cell and dual-fuel

A fuel-cell vehicle employs hydrogen fuel cells to charge a battery which then powers an electric motor in the normal way. On vans, this option is used as a range extender so the battery can be recharged and/or the vehicle can be refilled with hydrogen. Dual-fuel systems mix and burn hydrogen and diesel in a compression ignition engine. High costs and a lack of refuelling infrastructure are seen as two of the main bugbears but hydrogen is still widely regarded as a safe, clean energy source which can dramatically cut carbon emissions.



#### **Diesel comparison**

For each option the guide provides easily digestible technology overviews, whole-life costing examples and case studies. An extremely useful summary matrix shows at a glance how each alternative fuel compares with diesel under the following long list of headings:

- Whole-life costs
- Financial incentives
- Market status
- Ideal operating location
- Ideal refuelling location
- Example use
- Range between refuelling
- Payload impact
- Refuelling considerations
- Fuel lifecycle CO<sub>2</sub> emissions
- Air quality emissions
- Ultra low emission vehicle status

After using this LowCVP/Cenex guide to determine which fuel best suits their particular operation, fleet managers may well then want to focus in on specific van models. One of the most highly-regarded websites providing detailed van comparisons is www.vanchooser.net, run by Bristol-based Carmen Data.

### TRUCKS

The zero-emission options being presented more and more to truck operators are described tactfully in the NIC's Better Delivery report as showing "varying levels of promise". A finite supply of sustainable biofuels, the financial cost and energy intensity of producing synthetic fuels, and the need for significant coverage of overhead electric wires on much of the UK's and continental Europe's main road network are among the factors making these options to diesel unattractive to operators at present, the NIC accepts. Battery electric and hydrogen are emerging as the most viable alternatives to diesel, it suggests, seemingly confident that availability of such drivelines will really begin to take off as early as next year (2020).



#### **Dual-fuel conversions**

Dual-fuel conversions of truck diesel engines (running on a mixture of diesel and natural gas) had been growing in popularity among UK truck fleets, mainly on the basis of lower fuel costs and lower green gas emissions. But a CSRF study of five aftermarket dual-fuel conversions revealed a serious snag: methane slip. The upshot is that several big fleets, including supermarkets Sainsbury's, Tesco and Waitrose have abandoned dual-fuel conversions.

#### **Purely gas**

Pure gas engines (running on liquefied or compressed natural gas) are becoming increasingly popular among some UK truck fleets, including online supermarket Ocado and fast-growing Greater Manchester firm Abbey Logistics, which runs a fleet of about 400 tractor units and 500 liquid and powder tank trailers.

Abbey Logistics has been at the forefront of gas engine truck trials in the UK, with vehicles from IVECO and Volvo. Last August it became the first tanker operator in the UK to trial the innovative LNG 6x2 Volvo FM tractor.

Darren Newman is Volvo Group UK's LNG/ CNG Account Manager. "The Abbey trial is an important milestone for our new LNG technology," he said. "It is the first true 44-tonne test we have done. I believe our LNG technology will be a game-changer because it can deliver diesel comparable torque ratings, so important in bulk transport, whilst significantly reducing operating costs and reducing the climate impact of heavy transport." Ocado recently took delivery of 29 IVECO Stralis NP 40-tonne tractor units, after extensive trials with a demonstrator.

Stuart Skingsley of Ocado, says: "We were attracted to the Stralis NP when it was launched as it appeared to be the step change in technology that would drive gas-powered trucks to a new place in the market. The demonstrator vehicle received positive feedback from our drivers, and our own experience driving the vehicle was also positive.

"The green credentials of this vehicle are clear, and once we had reviewed the fuel costs against our existing diesel fleet it was clear there was also a cost benefit to running these cleaner, quieter vehicles."

To support the new fleet, fuel supplier Gasrec was commissioned to build a dedicated refueling site at its Hatfield depot, becoming the first UK retailer to self-fund the purchase of an onsite gridconnected station outright.

### THE HYDROGEN CONUNDRUM

Though nearly everyone now appears to accept that electric trucks and buses in general will become increasingly common at some point in future, there is precious little consensus about exactly where and when they will oust diesel engines and even less about the true viability of hydrogen fuel cells.

Some respected figures, including the head of the British Compressed Gases Association, Doug Thornton, and Andy Walker, Technical Marketing Director at catalyst manufacturer Johnson Matthey, are among those convinced that hydrogen fuel-cell electric vehicles are now, as Thornton puts it, "in pole position to make an immediate impact on air quality". Other equally well-respected experts in this field disagree fundamentally, none more so than David Cebon. He is a University of Cambridge professor in mechanical engineering and director of the Centre for Sustainable Road Freight (CSRF), a body set up seven years ago by him and Alan McKinnon, a professor at Edinburgh's Heriot-Watt University.

The CSRF is funded largely by a grant from the Engineering and Physical Sciences Research Council (EPSRC) but it has also attracted strong support from more than 20 commercial partners, including some of the UK's biggest transport and logistics contractors and own-account fleets.

Former Daf Trucks UK Marketing Director Tony Pain became an especially active CSRF advocate following his retirement five years ago: "The only way to achieve deep reductions in CO<sub>2</sub> emissions from the road-freight sector is to combine highly-focused vehicle engineering with systematic improvements in freight distribution systems. This is the mission in life of the CSRF."

David Cebon does not mince his words on hydrogen fuel-cells. "Hydrogen is a bad choice of energy vector for powering heavy goods vehicles," he says. "Generating hydrogen is extremely wasteful, because converting electricity into hydrogen (by electrolysis of water) is only about 75% efficient, while converting hydrogen into electricity (in a fuel cell) is only about 50% efficient, at best." Cebon acknowledges that there are other more efficient ways of producing hydrogen, by steam reforming of methane, for instance, but he points out that unless this is accompanied by a carbon capture and storage (CCS) scheme, total greenhouse gas emissions are as great as those generated by burning the methane directly in a gas engine of the kind becoming increasingly popular in trucks. "So the only way that hydrogen can possibly make sense from an energy viewpoint requires CCS as a prerequisite," he argues.

Despite Cebon's reservations, major commercial fleets have already successfully adopted hydrogen technology, with two examples highlighted on the following page.



# **HYDROGEN CASE STUDIES:**

### **Fife Council**

Two refuse-collection trucks working for Fife Council in Scotland are believed to be the first of their kind anywhere with hydrogen/diesel dual-fuel conversions.

The two dual-fuel Econics are being run by Fife Council as part of the Levenmouth Community Energy Project, funded by the Local Energy Challenge Fund created by the Scottish Government in November 2014. The project will run for five years until 2020, based in a redeveloped part of Methil Docks in Fife.

Electricity generated by wind and solar power is being used to power a hydrogenproducing water electrolysis system. The gas is then stored and used for hybrid vehicles. As well as the Econics, these

#### **Transport for London**

Transport for London (TfL) is another high-profile backer of hydrogen as an alternative fuel. It has ordered 20 hydrogen-fuelled double-decker buses, built by Wrightbus of Northern Ireland, to go into service next year on three London routes.

The TfL announcement about its £12 million investment in these buses, claimed to be the first hydrogen doubledeckers anywhere, came shortly after the introduction of London's new ultra low emission zone (ULEZ) came into effect in April 2019. European Union funding for these hydrogen-fuelled London buses comes from European Commission agencies such as the Fuel Cells and Hydrogen Joint Undertaking (FCH JU) and the Innovation and Networks Executive Agency (INEA).

vehicles include 10 Ford Transit vans with

10 battery-powered Renault Kangoo vans

qualify as zero-emission, it is claimed,

project's '100% green' charging station.

www.brightgreenhydrogen.org.uk

More information at

diesel/hvdrogen dual-fuel conversions and

with fuel-cell range-extenders. The Kangoos

when their batteries are charged using the



# FOR TRUCKS, READ COACHES

A report entitled Coach of the Future may seem an unlikely source of information helpful to truck operators trying to find their way through a confusing array of data on diesel alternatives. But just such a report, published recently by the International Road Transport Union (IRU), can be used as a rich source of relevant and helpful data. There are clear parallels between many long haul truck operations and those of a typical coach operator. Among the assumptions in the IRU report, for instance are:

- Average distance per trip above 500km, mainly on motorways or non-urban roads
- Average annual mileage at least 60,000km
- Baseline vehicle for comparison with alternative fuel options is a Euro VI diesel

The options explored in this report are bio LNG, HVO (hydro-treated vegetable oils), and diesel/electric hybrid, all of which are certainly relevant to truck operators. In one table comparing capital and operating costs against a Euro VI 2018 diesel vehicle, bioLNG comes out at 3.7% less, whereas hybrid diesel costs are 4.3% higher and HVO biofuel is 13.4% higher. This IRU report is a useful guide for truck fleet and coach operators to all the factors that need to be taken into account before taking big decisions on which alternative fuel to diesel should be settled on.



# WHOLE-LIFE COSTS



As the NIC's Better Delivery report underlines, total whole-life costs of zeroemission trucks will have to at least match those of the familiar diesel-fueled variety before uptake of zero emission options accelerates rapidly. Getting the sums right first time on those whole-life costs is vital.

Recharging battery electric HGV fleets is likely to require grid reinforcements, smart charging, energy storage, or a combination of these elements, to enable depot charging, according to NIC chairman Sir John Armitt.

The expenditure required for hauliers to install and maintain charging infrastructure for battery electric trucks at depots is likely to be significant, though could be outweighed by the cheaper costs of electricity as a fuel, says the NIC report. Hydrogen trucks would require additional hydrogen production facilities, though the infrastructure implications beyond this will depend upon developments outside of the transport sector itself, particularly whether the UK's heating supply network is converted to carry hydrogen.

"The decision about whether HGVs transition to battery electric, hydrogen, dual-fuel (or another zero-emission option) will be market-led, but the speed of uptake will be determined by government policy, cost and developments in the wider European commercial vehicle market," says the report. "Regardless of the eventual UK EU relationship, it is imperative that the UK works with the EU to plan the transition to zero emission fuels, ensuring cross border road freight continues unhindered and that manufacturers have confidence to produce a sufficient supply of zero-emission vehicles."

# CLEAN CONNECTED COMPLIANT

### fraikin.co.uk/cleanair

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#### Where can I find more information?

National Infrastructure Commission www.nic.org.uk

Low Carbon Vehicle Partnership **www.lowcvp.org.uk** 

Centre of Excellence for Low-Carbon and Fuel-Cell Technologies www.cenex.co.uk

Centre for Sustainable Road Freight **www.csrf.ac.uk** 

Road Haulage Association **www.rha.uk.net** 

Freight Transport Association **www.fta.co.uk** 

British Vehicle Rental and Leasing Association www.byrla.co.uk

International Road Transport Union **www.iru.org** 

Office for Low Emission Vehicles www.gov.uk/government/ organisations/office-for-lowemission-vehicles

Van Chooser www.vanchooser.net

Disclaimer: Produced in June 2019, this guide aims to highlight some key trends and technologies concerning alternative fuels. However, it is intended for information purposes only and we do not make any warranty or representation on the completeness, correctness, accurateness, adequacy, usefulness or reliability of such information. Fraikin will not accept any liability based on any information provided in this document.

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