The road to tomorrow starts today

The future of alternative fuels in commercial transportation

Introduction

It's no secret that conventional fossil fuels are nearing their expiration date. For the past few decades, supply, sustainability, and pollution have been among the hottest topics for industry, politics and just about everything in between. Conversely, over the past couple of years especially, the importance of transport has never been more obvious, with global Covid-19 responses making daily headlines. Closer to home, the UK is tightly gripped by a shortage of HGV drivers, which is having ripple effects across all links in the national supply chain.

As we move towards the Government's ban on new petrol/diesel car & van registrations deadline of 2030, with personal and business transport so heavily reliant on conventional fossil fuels like diesel, where do we go from here?

In August 2021, the UK government announced ambitious new plans to "kick start a world-leading hydrogen economy", in-turn creating over 9,000 jobs and attracting investments to the tune of £4 billion by 2030. Within this, Downing Street plans to support industry in drastically slashing their emissions with £105 million in funding to affect a 'green industrial revolution'.

In short, 2030 will come disturbingly quickly, but as we go about our day-to-day lives, it feels like some way off. Despite the 2030 ban on new petrol or diesel-powered vehicles, these so-called ICE (Internal Combustion Engine) vehicles will still have their place in society for many years to come, but for those of us with shorter change cycles, or a greener conscience, what's available now?

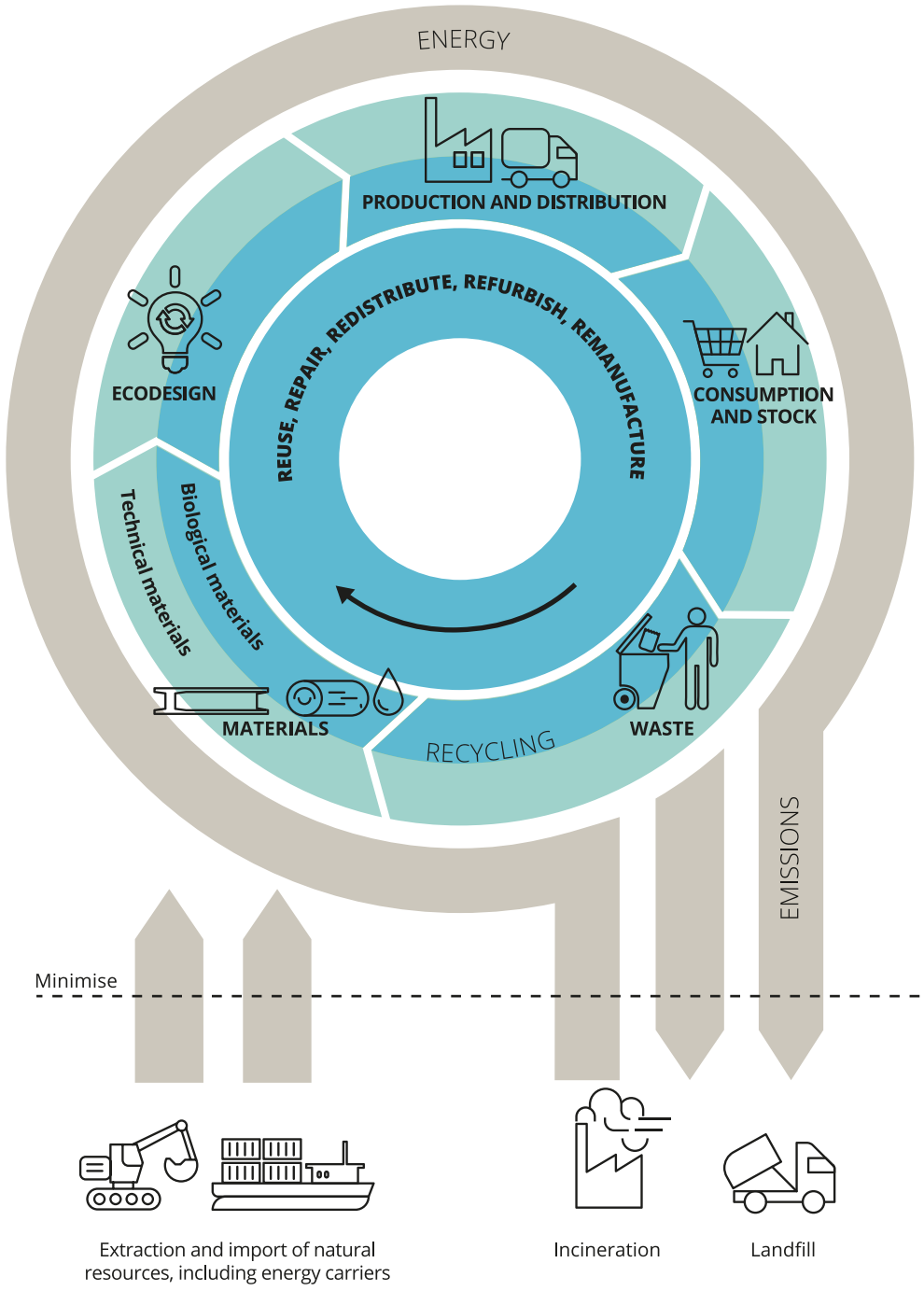
Well, electricity as a form of propulsion has been our starter for ten in the mainstream now for at least a decade, following the introduction of volume cars such as the Nissan Leaf and the rise of Tesla. Aside from small-scale, 'boutique' outfits or engineering firms reimagining ICE commercial vehicles, we've not really seen much in that time that offers a truly viable proposition for the business operator.

Small vans like Nissan's soon-to-be-replaced eNV200 had the market more or less to itself for the majority of that time and it's only within the last two years that the big names have come to the table, see Stellantis' and Ford's recent offerings. We're also seeing exciting players entering the game from start-ups that have received heavy investment such as Arrival and Volta Trucks, two examples that are beginning to make real waves with bespoke products taking home-grown British engineering to mass-market.

The UK's charging infrastructure is a big deal too, with new networks and facilities appearing by the day, though that too can still present its own issues with outages, vehicle compatibility and ignorance from the general public when it comes to convenient parking space. Our own 'Living with your EV' white paper looks at this area in greater detail.

venson

Circular economy system diagram[1]



What else is out there?

For heavier transport needs, natural gas has been playing its part, with new production methods making CNG (Compressed Natural Gas) and LNG (Liquified Natural Gas) greener and greener. The mostly methane (CH4)-based substance has only taken to passenger transport as far as mass-transit buses are concerned, but in haulage or cargo transport, its heyday is coming.

You may have heard the term 'Fuel Cell' bandied around for at least 15 years, with Japanese vehicle manufacturers really leading the charge in this area. Both Honda and Toyota have had passenger cars on offer for some time in the FCX Clarity and Mirai respectively and BMW have dabbled in the tech but have yet to offer anything to buyers. Hyundai recently introduced the Nexo SUV and so far, joins both generations of the Toyota Mirai as the only examples to reach UK shores.

What is a Fuel Cell?

Well, they're not a million miles away from batteries, producing power for an electric motor so long as there is fuel, which in this case is hydrogen. Not quite in the realms of magic, the cell contains two electrodes around an electrolyte. One takes a supply of air and the other hydrogen; a reaction takes place producing heat and water as an 'exhaust' and electricity to supply the motor. The vehicle will drive just like any other EV, but without the need for charging per se, just refilling with hydrogen from time to time in the same way as a conventional ICE vehicle. And, with pure water being the only emission, there are zero pollutants, with far fewer moving parts equating to exceptionally quiet operation too.

Fuel cell technology is now making its way with some speed into commercial vehicles with the Stellantis group announcing that its Peugeot, Citroën & Vauxhall mid-size vans, Europe-wide, will see the introduction of a hydrogen fuel-cell powertrain before the close of 2022, with vans predicted to hit the UK by 2023. In this case, the highly efficient fuel cell can produce enough power for an estimated 250mi range in just three minutes. Elsewhere, Renault is planning hydrogen power for its large van range, while Land Rover is planning to expand its new Defender range and INEOS too with the soon-to-launch Grenadier 4x4.

Climbing the weight scales, US-based Hyzon Motors has begun customer deliveries of its hydrogen fuel cell trucks, based on heavily modified existing diesel trucks from the likes of DAF. Hyundai, already marketing fuel cell cars, recently launched the powerful, long range and fuel-cell powered H2 XCIENT in Switzerland marking the desire to expand further into mainland Europe, North America, and Chinese markets. Mercedes-Benz are well into testing the GenH2 truck, hoping for a customer launch in 2027.

Mercedes' parent company Daimler Truck will be teaming up with Volvo Trucks to share development costs and expertise. It's a similar story across the board now, as DAF and MAN are expecting to begin trials imminently and in September 2021, the IVECO Nikola joint-venture inaugurated its new factory in Ulm, Germany. With BEV and fuel cell iterations of its IVECO S-WAY-based Tre in the prototype phase, a tie-in with the Port Authority of Hamburg will see the company supply up to 25 vehicles for operational testing later this year. Renault Trucks expects to offer hydrogen power later this decade.

The hydrogen fuelling network is relatively limited at present, with just 11 stations, five of which are nestled around London. Fear not though, as this will continue to grow expediently as the Government's hydrogen economy plan starts to pick up pace. Look at our hydrogen power white paper for greater insight here too.

Diesel is not dead yet. We've got the best part of a decade until bans on new ICE sales come in to effect, by which time there should be an enormous range available dependent on circumstance. At the current rate of progress, electric vehicles should reach ICE-rivaling ranges with ever speedier charging times and practical public charger availability.

Sustainable supply of bio-natural gas should be plentiful for HGV operators with fuelling station investment continuing to grow. Finally, hydrogen, currently in its relative infancy is due, figuratively, to explode imminently with massive global interest and research. With an estimated 9,000 new jobs in the pipeline as part of UK Government plans, its big business and probably the game-changer we've all been waiting for. Speaking of waiting, there's still the matter of this 'by 2030' part, so it seems that while we know the direction we're headed, the road to mass-decarbonisation is still long and winding. So, where's the smart money looking, and where too should you be?

[1]https://www.eea.europa.eu/soer/2020/soer-2020-visuals/circular-economy-system-diagram/view

The Alternative Fuel Economy

What are the alternative fuels?

Broadly speaking, while alternative fuels used to mean any form of power which was derived from sources other than petroleum, increasingly and for the purposes of this paper, the term alternative fuels has come to mean anything which is not fossil fuel derived. Natural gas is a singular exception, for the reasons given below, however when it comes to the pillars of the UK's alternative fuel economy, main 'clean' options are electricity, biofuels, compressed natural gas, nuclear energy, and hydrogen.

As mentioned, the smart money is indeed looking at alternative fuels, and in some depth. As the UK Government has begun to apply both the pressure and the incentives to the private sector to meet the new emissions targets, private and public money is now pouring into the research and development of alternative fuels, their production, the infrastructure surrounding them and their delivery to end users – and in large volumes.

In August 2021, it was found[1] that the UK's low carbon economy is worth a staggering £200 billion, incorporates more than 75,000 businesses and employs more than 1.2 million people. When this is compared to the construction industry, which worth £133 billion, or manufacturing at just £55.6 billion, the true scale of the UK's green economy comes to light.

It should also be noted that this green economy has grown largely from the private sector, as until recently, governmental support for such projects was patchy at best and at worst, non-existent.

However, as part of the road to 2030, this is changing rapidly. Announced in 2020, the UK government has a 10-point plan to kick start what it calls the "green industrial revolution." This plan will set in motion, both the de-carbonisation of the UK, while at the same time, helping to level-up the UK economy by focusing investment evenly across the country. The former industrial heartlands of the UK; Yorkshire, the West Midlands, Scotland, and Wales will receive the backing to drive this new green economy, and with it, build sustainable jobs and industries for the future.

A £1 billion 'Energy Innovation Fund' will invest in the green technology projects needed to help de-carbonise the UK, and this money will trickle down into the transport sector via infrastructure provision, and improvements to the current technology available for the commercial vehicle sector.

The support of transport and industry is key to this plan and is covered by the following points:

- **Offshore wind farms will be increased in size, with the aim of quadrupling their output to 40GW by 2030, a move which is hoped to support up to 60,000 jobs, while increasing the ability of the UK's power supply to deal with the demands of electrified transport.**
- **As covered in greater detail below, the Government will support the creation of a hydrogen industry in the UK, aiming to produce up to 5GW of low-carbon hydrogen for industrial, transport and home use by 2030. With up to £500 million available for this by 2025, over £250 million is earmarked for developing new, green hydrogen production plants.**
- **Nuclear power is once again back on the Government's agenda, with the aim of developing a new generation of small scale and advanced reactors for carbon free energy production. Funded by £525 million of investment, this is hoped to bring with it a further 10,000 jobs, while providing a new era of clean energy for the UK.**
- **A drive to manufacture electric vehicles will see a push for plants in the West Midlands, the North East, and Wales, aimed at accelerating the EV transition, while further bolstering the electric infrastructure across the country to better support these vehicles. £1.3 billion is being made available for the rollout of charging points to aid this transition.**

[1] https://kmatrix.co/uk-lcegs/

What does this mean for the CV sector?

The future looks both bright and green, although the road to this carbon-neutral state of play is not without its challenges. In short, the gap between the current state of alternative fuel infrastructure available for the commercial vehicle sector, and where it would need to be to be net-zero by 2050 is wide – and will not be easy to bridge.

That is not to say that it is impossible however, and indeed, with the amount of capital now being made available to the private sector to expedite these changes across the UK, the adoption of alternative fuels by the CV industry will become increasingly simple in the medium to long term even if, as for the reasons outlined below, an immediate transition is not easily achievable across the country in the immediate short term.

Electric Vehicle technology

& commercial transport

How it Works

Electric Vehicle (EV) technology works identically in both commercial and passenger vehicle applications, and while the amount of energy stored and consumed may differ between these two sectors, the basics of the technology, the infrastructure around them and the issues faced by users are the same.

EVs work by taking electricity from the national grid, or a generation source, which is stored in rechargeable battery packs and used to power an electric motor which in turn drives the wheels.

Pros and Cons

In theory there are some major advantages to EVs when compared to traditional ICE vehicles, and this relative lack of componentry is one of them. Maintaining an EV requires little beyond consumables such as tyres and brakes, meaning that theoretically, vehicle downtime for mechanical works is minimised for operators, allowing for commercial units to remain in profitable use for as long as possible.

Financially, when this reduction in maintenance is factored in alongside the relatively cheap cost of electricity when compared to diesel or petrol, the use of EV technology in a commercial setting should come with a reduced cost of ownership when compared to ICE alternatives. However, there are several key areas surrounding the introduction of commercial EVs which need consideration by operators before any wide scale introduction of such vehicles.

The initial purchase cost of ECVs is higher than that of ICE vehicles, partly due to economies of scale, but mainly due to the high cost of the raw materials needed for the battery packs. In the case of the Vauxhall Vivaro van, while the base diesel van costs £21,500 the all-electric e-Vivaro starts from £29,500, an increase of 38%. According to Vauxhall's own savings comparison tool, running the e-Vivaro should save an average user £1,197 a year compared to the diesel unit; however, the higher cost of purchase would mean more than six years would be needed before the savings were felt by a cash buyer.

A major consideration for any potential commercial operator of an E-CV is that of range. For lighter commercials (vans) this problem can be particularly acute, with the majority of electric vans on the market having a range of 150 miles or less. While the Renault Zoe commercial has an admirable range of 245 miles to a charge, its payload is limited.

The more popular panel vans on the market often struggle with operational range, and when viewed alongside their diesel or petrol counterparts, can fall short of the ability to complete a working day. The VW ABT eTransporter (82 miles range) the Mercedes eVito (93 miles range) the LDV EV80 (127 miles range) and the Renault Master ZE (74 miles range) are suitable for urban use or use on predefined routes with access to charging at the destination, as there is one more consideration for E-CVs which is crucial for operators, charging.

While there are now more than 42,000 charge points across the UK in over 15,000 locations[2], the way electric cars are charged is different from that of ICE vehicles. While filling a petrol, diesel or CNG tank takes just minutes, EVs take much longer to charge which would need to be factored into operational schedules. While it may be highly convenient to charge a private EV overnight on a driveway, allowing an hour's downtime into a driver's route might well have greater implications for commercial users, more so when the need for the fast-charging stations necessary to achieve this time are not always easy to come-by in rural areas.

Range is less of a factor in E-HGV applications, as tractor units and rigid chassis layouts can carry larger battery packs, allowing for ranges of over 200 miles. While this may not give the continent -crossing ability of a diesel unit, this is often enough for intercity use across the UK and Europe.

[2]https://www.edfenergy.com/electric-cars/charging-points

Major players in the market

While the electric LCV market is rapidly gaining ground and public acceptance, especially in urban areas, the current range of electric trucks available to commercial operators is reasonable, but tiny in comparison to ICE alternatives.

EV Commercial vehicles currently on sale in the UK:

1. DAF LF ELECTRIC

Available as a 5.3m and 5.85m wheelbase, the LF Electric has a GVW of 19 tonnes, and a payload of 11.7 tonnes. Aimed at the distribution market, it has a 260kW motor, and a 282kWh battery pack, giving it a maximum range of 280km. With the ability to fast charge to 80% in just two hours, the DAF has been well received by press and operators alike.

2. Renault D ZE

The Renault D Electric range is available with between 4,4m and 5,3m wheelbases. With a light GVW of 16 tonnes, it has a payload of up to 9.4 tonnes. In its largest capacity form, it comes with a 395kWh battery, combined with a 185kW electric motor for a range of up to 300km.

3. Volvo Electric Trucks

Swedish firm Volvo offers a range of electric trucks for different applications.

The medium sized FL, with 4,4m or 5,3m lengths, and a GVW of 16.7 tonnes, a range of up to 300km, and the ability to fast charge its 211kWh battery in under two hours, is designed for urban delivery use.

The FE is designed for more demanding urban uses such as refuse collection and light construction work. With three axels and up to 27 tonnes of GVW, it enjoys the same battery and charging specs as the FL, however for heavy duty work, it has a range of up to 120km.

The largest available Volvo truck is the FM, designed for extra-urban use. With up to 44 tonnes GVW and 490kW of battery power, the FM enjoys similar charging times to its smaller stablemates, but a range of up to 300km when specified with the biggest batteries.

4. Fuso Ecanter

The Fuso Ecanter is a light duty truck designed for urban deliveries. With a 7.5 tonne GVW, and a range of 100km from its 82.8 kWh battery, it has the ability to fast charge in two hours, or overnight if preferred.

5. Tevva Truck

Proudly British manufacturer, Tevva has just unveiled its 7.5 tonne Truck intended for mass production in the UK. With pre orders available and a delivery date of Q3 2022, the Truck has a range of up to 160 miles in pure electric drive, or 310 miles with a range extender – which will also be offered as a hydrogen fuel cell.

6. Volta Zero

Volta Trucks has launched its all-electric truck, the Zero, and has taken 2500 pre orders. A 16 tonne truck, designed for inner city use, the Zero has a range of 95-125 miles, and is estimated to save 1.2M tonnes of CO2 by 2025 by operators switching away from ICE powered alternatives.

Electric Vans

The electric van market has matured far more rapidly in the UK than the EHGV market. In part, because the zero-emissions nature of the vans make them ideal in urban areas, where the comparative lack of range compared to ICE alternatives is less of an issue, they have become increasingly accepted by buyers in a short space of time.

While there are too many ELCVs on the market to list, the latest platform, shared between some of the most popular vans on the market, the Citroen e-Dispatch, Peugeot e-Expert, Vauxhall Vivaro-e and the Toyota Proace Electric all enjoy fast charging capabilities, and a range of up to 211 miles with the fitment of 75kWh batteries.

Also of note is the new Mercedes Benz e Sprinter, which has launched with a combined range of 95 miles, with a payload of 731kg, and an impressive 11M2 it enjoys a fast-charge ability of up to 80% in under 120 minutes.

Much like the truck market, we're seeing rapid ramping up of smaller, more start-up operations, who look to be enroute to delivering a bloody nose to the big names. ARRIVAL has been engineering its van and setting up a factory here in the UK and is imminent in releasing it to market. With dedicated 'walk-in' courier models direct from the factory, the company is targeting major fleets off the bat, already securing an enormous 10,000-unit order from UPS. ARRIVAL claims that the vehicle will carry a comparable list price to that of an equivalent diesel van, hints at the possibility of significant TCO savings and offers a comparatively impressive 112-to-211-mile range, battery pack dependent.

There are already some substantial UK fleets operating some serious numbers of EV vans, including British Gas (Vauxhall & Nissan) and DPD (MAN, Nissan & Maxus), with DFDS having placed a triple-figure order of Volvo EV trucks in October 2021.

Compressed/ Liquified Natural Gas

& commercial transport

While technically speaking, 'natural gas' in the conventional sense qualifies as a fossil fuel, it burns in far cleaner fashion than petrol or diesel. As research into the technology has progressed, new and 100% renewable methods of creating natural gas fuels have emerged. Identified with a prefixed 'Bio', the renewable biogas comes via the breakdown in waste products often found in agriculture.

What is the difference between CNG/Bio-CNG and LNG/Bio-LNG? – Well, CNG, or Compressed Natural Gas, is formed by squeezing natural gas formed during the breakdown of carbon-based organisms, methane (CH4) in the most part, to less than 1% of its original volume. It is colourless, odourless and non-toxic, making it far more ecologically friendly than petrol or diesel. It's perfect for short to medium range work or back-to-base, achieving similar economy to a conventional petrol engine, but at a considerably reduced cost.

On the flip side, Liquified Natural Gas (LNG) is created when that same starting gas is purified and chilled to a particularly balmy -164°C, thus below its boiling point, changing it into a liquid. While this remains far cheaper than diesel, more costly and complex storage and dispensing methods are required. However, a vehicle running on LNG is capable of greater journey ranges as the liquified gas stores more energy through its density.

That increasingly important 'bio' comes from a sustainable method of manufacture. In this instance, anaerobic digester (AD) plants are the new refineries. Organic waste products, such as food waste or cattle manure are fed into giant domes where, in the absence of oxygen, micro-organisms begin the process of breaking down the waste to produce a biogas.

This gas is a combination of carbon dioxide (CO_2) and methane (CH_4) and can be captured for use in heating systems, injected into the grid or used to power natural gas engines once cooled or compressed. The left-over solids can be used as fertiliser, now rich in nitrogen (N), locking that carbon dioxide into the ground, conditioning the soil, and keeping it away from the atmosphere.

Recent advances in AD technology have seen world-renowned whiskey manufacturer, Glenfiddich, use their distilling waste to create fertilizer for their barley growing partners and clean bio-CNG for its new trucks, supplied by Italian commercial vehicle giant, IVECO. This completely closed, zero waste loop system is referred to as the 'circular economy' and is 100% sustainable in its operation.

Now, IVECO has been spearheading a shift towards natural gas as a fuel for commercial vehicles for the past two decades, seeing the circular economy as the door to negative greenhouse gas transport. It has seen great traction in mainland Europe, while the UK was a little slower to get off the ground. In recent years, development of the UK's natural gas refuelling infrastructure has grown significantly with a massive 78% increase in gas dispensed for HGVs in 2020 alone. And, according to the Gas Vehicle Network, an estimated 90% of this was biomethane.

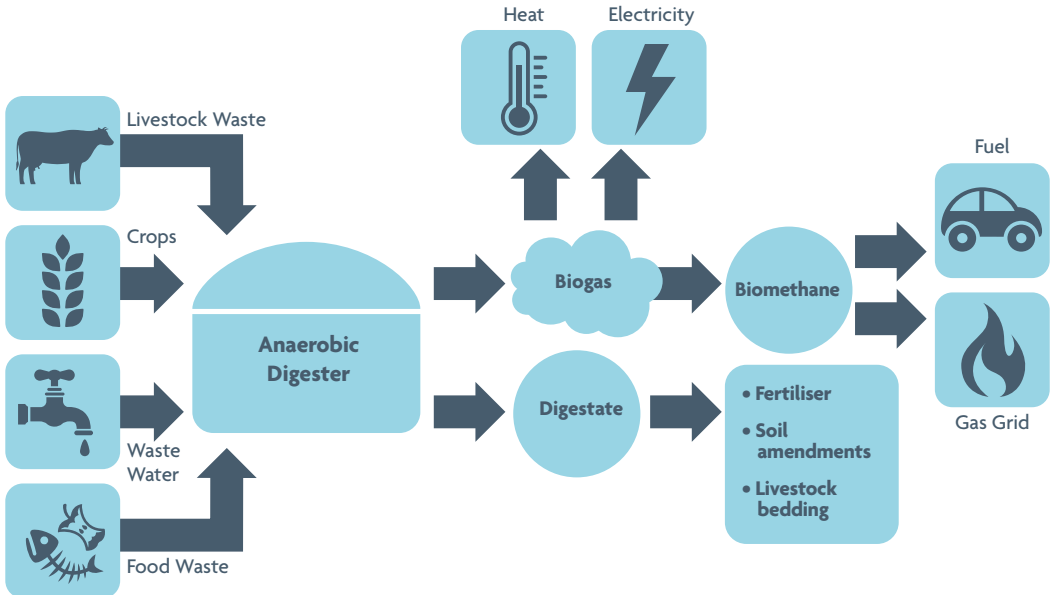
By the end of 2021, there were more than 700 IVECO 'Natural Power' (NP) trucks on UK roads, with more than 45,000 sold internationally. The brand leads the pack, relying solely on natural gas, while other manufacturers such as Volvo offer diesel-assisted natural gas trucks. Some of the UK's most prominent truck fleets investing here so far include Ocado, Hermes, Moy Park, (IVECO), ASDA (Volvo) and the John Lewis Waitrose Partnership (Scania).

A natural gas-fuelled engine is still an internal combustion after all, bearing close resemblance to their petrol or diesel counterparts. While they're not quite zero emission, IVECO claim that it's, for example, emit up to 95% less CO_2, 90% less NO_2 and 99% less particulate matter than their diesel equivalent when run on biogas. Aside from dramatically slashing emissions, they have several other benefits too. Gas vehicles emit roughly half the noise of a diesel, meaning they can operate during night hours in urban areas and are free to travel through low emissions and clean air zones (such as London and Bristol).

They're physically far cleaner from an operational sense, with CNG filling methods notably similar to that of diesel minus the slimy residues. LNG however requires some safety training, due to the cryogenic nature, but again, a far more pleasant experience over splashing heavy oil into a tank. The biggest benefit to running a natural gas fleet of course though is that the technology is readily available in the here and now. It's proven, it's sustainable and there's no need to change any processes. There's no wasted time as vehicles charge, no short ranges, or fluctuations due to weather or climate.

With the hugely positive effect a natural gas fleet can have on a business' carbon footprint, it's clear that this can act as a stable bridge to zero emission hydrogen down the line. With all the research and development costs that have been racked up behind the scenes, naturally a gas vehicle commands a premium to purchase. However, in 2018, the government has levelled this playing field by freezing the fuel duty on alternative fuels at half that of diesel until 2032. What this means is that the gas truck will offer a payback against an equivalent diesel within about two years.

You'd be forgiven for thinking that natural gas is aimed squarely at the heavy truck market, but you would be wrong, let us enlighten you.



Current State of Play

While some manufacturers have embraced natural gas power, others have chosen to explore other paths. LNG makes more sense for longer-distance heavy vehicles, CNG is applicable back down the weight ranges.

IVECO

As discussed earlier, the Italian commercial vehicle manufacturer is arguably a pioneer in this area, entering the market in 1996 with a strong offering of turbocharged 'Natural Power' badged engines produced by sister company FPT Industrial. Based upon its proven diesel collective, they have been adapted to run a spark ignition on the 'otto' cycle like a petrol, utilising multi-point fuel injection and carefully optimised stochiometric combustion. Only a simple 3-way catalytic converter is required near the end of the exhaust pipe, negating the need for exhaust gas recirculation, particulate filters, and exhaust after-treatments. The range includes two inline 6-cylinder 'CURSOR' units with three power choices, the smaller 'TECTOR' and a 4-cylinder 'FIC', both with a single power output. For operators looking to purchase natural gas vehicles, the company operates a natural gas consultancy to help manage the introduction to fuelling infrastructure.

IVECO S-WAY – At the top of IVECO's product tree is the 19 to 44t heavy truck, available as a rigid and tractor unit. Unique in the marketplace, IVECO's S-WAY is the only factory-built tractor available as a 44t 6x2 running solely on gas with zero need for any diesel or AdBlue. Formerly physically badged 'NP' for Natural Power, from the 2022 model-year, IVECO is fully integrating the gas powertrain models into the wider line-up as its customer base continues to grow. IVECO's gas engines will run on either fuel, with multiple tank options to fulfil a multitude of range desires. A combination of CNG and LNG tanks on a single vehicle are on the table too with a maximum LNG range of 1,600km (4x2 tractor). Sitting at the top of the range is the 12.9-litre CURSOR 13 which produces a healthy 460hp and diesel-equivalent 2,000Nm of torque. The 8.7-litre CURSOR 9 can be had with either 340hp & 1,500Nm or 400hp & 1,700Nm.

IVECO X-WAY – The off-road-ready sibling is expected to take on more arduous tasks with raised ride-heights, thicker chassis, and toughened components. As such it is only offered with the range-topping 460hp CURSOR 13. This unit is only available in the full width AS sleeper cab.

IVECO Eurocargo – The well-known Eurocargo serves as IVECO's urban and regional transport offering and takes the CNG-only 6.7-litre TECTOR 7 at 204hp & 750Nm. Perfect for parcel and municipal operations, the Eurocargo CNG is available from 11 to 16 tonnes with the lighter models utilising the lower '2-step' cab and the 15-16t built with the taller '3-step' cab.

IVECO Daily – This is where the IVECO range gets interesting as they currently offer the only factory-built natural gas-fuelled van in the UK market. Like its larger stablemates, it uses a gas-adapted version of the heavy-duty 3-litre F1C diesel engine and puts out 136hp with 350Nm of torque driving the rear wheels. It is also a market-first in being the premier light CNG vehicle to be available with an 8-speed automatic, IVECO's highly recommended HI-MATIC.

Identifiable by blue-highlighted front grille and badging, IVECO offers Daily CNG in panel van and chassis cab from 3.5t GVW to class-exclusive 7.2t GVW. A 'Recovery Mode' variant is offered that includes a small emergency fuel tank, adding a 60mi range should one find themselves caught short on gas. Interestingly, IVECO Daily CNG can capitalise on the increased GVW allowance, which permits those driving on a B-category licence to drive an alternatively-fuelled LCV with a gross-weight of up to 4.25t – up from 3.5t – to compensate for payload eaten up by heavier fuel tanks.

Scania

Another common sight on British roads is Scania. With the exception of its largest, flat-floor long-distance S-Series, it too offers a range of natural gas trucks ranging from 18-32t rigids and a 40t tractor running on CNG or LNG. Much like IVECO, the gas engines waste no fuel through the 'otto' cycle, utilising a spark ignition. Here the range includes a turbocharged in-line 5-cylinder with a pair of power outputs and a single 6-cylinder option. Maximum CNG range is around 500km while LNG tractors are capable of 1,000km. An LNG rigid offers more space for larger tanks to give a 1,600km range.

R-Series – Scania's second largest cab is ideally-suited to longer line-hail work and features two gas engines. First is the 9.3-litre OC09 with either 280hp & 1,350Nm or 340hp & 1,600Nm. There's also a 12.7-litre OC13 which makes 410hp & 2,000Nm.

G-Series – Slightly smaller, but more versatile, the Scania G-series drops the least powerful engine, retaining the 340hp OC09 and the 410hp OC13.

P-Series – Scania's urban/regional offering is also available in both rigid and tractor, making use of the smaller 9.3-litre OC09 at 280hp or 340hp.

L-Series – Scania's latest arrival to the range is the ultra-low-slung L-Series, built to offer urban operators a rigid or tractor offering top-class visibility of vulnerable road-users by keeping as low as possible. Here, it's both 280hp and 340hp versions of the smaller OC09.

Volvo

A major player in the truck market, Volvo too offers natural gas versions of their key models. At the heavy end, the regional/line-haul-centered FM and long-distance FH focus solely on LNG, while the urban/back-to-base FE rigid accepts CNG. Volvo's LNG engine is based on the mainstream 6-cylinder diesel range, but instead runs on gas with a small amount of diesel required in the combustion cycle to ignite the gas.

FH LNG – Volvo's top-weight truck is available as both a rigid or tractor and utilises the 12.8-litre G13C in its natural gas variants, offering two power outputs. One matches 420hp with 2,100Nm while the other gives 460hp and 2,300Nm. The Volvo FH LNG offers multiple tank sizes and axle configurations, with a maximum range of 1,000km. With a reliance on diesel for ignition, there is still a requirement for AdBlue.

FM LNG – The versatile Volvo FM utilises a smaller cab than its larger sibling, therefore cutting unnecessary weight on regional work. It too can be had as a tractor or rigid with the same natural gas engine range as the FH.

FE CNG – Unlike the bigger trucks in the range, Volvo's 9-litre G9K will run solely on CNG, producing 320hp and 1,356Nm. The FE CNG is available as a rigid, stretching from 18 to 26 tonnes with an operating range of around 400km. Amidst a focus on visibility of vulnerable road users at the forefront of most urban fleet operators mind, it is worth noting that a low-entry cab is also available on the FE range.

Renault

With Renault focusing on electrification, there's just a single rigid model in its range featuring a natural gas engine. It's CNG only and aimed head-on at the urban transport market offering a range of 400km for back-to-base work.

Range D-Wide – Closely related to the Volvo FE, the D-Wide is Renault's larger 18-26t urban rigid and utilises the same 9-litre G9K producing 320hp and 1,356Nm.

Mercedes-Benz

Working more heavily along the electrification lines, Mercedes' gas commercial offering only comprises a single model with a 6-cylinder CNG unit. Much like Renault, it's targeted toward the urban user with municipal services at the forefront of its customer-base.

Econic – Mercedes has long been an advocate of the low-entry cab, historically with very little competition. Often bought by refuse businesses, the 'bus door' equipped Econic range works well for crewed multi-stop routes. Recent concentration on visibility in town sees the range embracing wider use as a construction vehicle with primary operations within the M25. The Econic NGT utilises the 7.7-litre M936G engine, which runs on CNG and produces 302hp and 1,200Nm of torque.

Refuelling

The UK has an abundance of filling stations for petrol and diesel vehicle, but not only affecting those considering electric vehicles, 'range anxiety' has traditionally cast a shadow over natural gas too. Range anxiety comes about when a driver can't be completely sure where and when they'll next be able to top up. Careful route planning has enabled those fortunately placed with the ability to adopt early, but much like with the EV charging network, the gas filling station network is now seeing extensive growth.

Firstly, some gas suppliers operate public access or contract access stations while others will install a private station on a business' property. This is often dependent on the volume of gas consumed, geographical location and the type of operation. A private station might be used for back-to-base work with a large fleet utilisation, they may also choose to share access with other local businesses.

Public access stations are usually located in high-traffic areas on strategic routes that would suit gas transport. Usually these will be near a motorway junction in the vicinity of a large industrial area.

CNG filling stations are a far simpler operation and either work with a direct connection to the grid supply, or like a conventional petrol station with storage tanks that are either topped up by tanker supply or swapped out with skid-mounted mobile tanks. Grid-connected stations operate at a higher pressure and can therefore allow a greater number of pumps and fast-filling (within minutes). Physically 'filling up' is no different, simply plugging a nozzle into the filler receiver and pushing a button.

An LNG filling station is slightly more complex, requiring cryogenic tanks and earthed dispenser that 'pumps' at up to 120PSI. Appropriate training should be undertaken before use and correct PPE worn in operation. With the liquid gas at temperatures of around -164°C, there comes a risk of burns to skin if it comes in contact. LNG is always stored in on-site tanks replenished by tanker or tank-swap as a grid-connection is not possible.

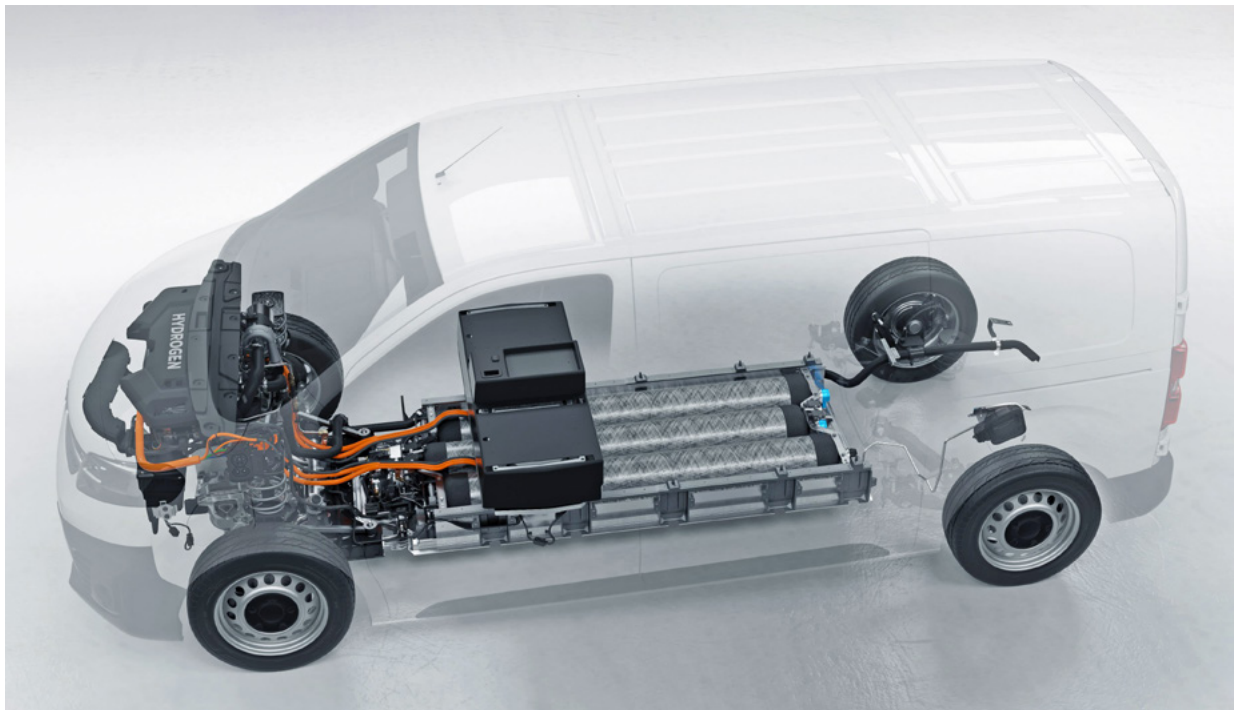
Environmental risk is greatly reduced with natural gas being non-toxic and non-corrosive. LNG will not burn as a liquid and a spillage will evaporate leaving no residue. It will only burn should an ignition source be present as it evaporates. CNG is lighter than air and will immediately and safely disperse.

In the event of a traffic accident, it is worth noting that neither fuel will cause ground or water contamination, evaporating without trace, and the vehicle tanks are much stronger than those of a petrol or diesel-fuelled vehicle. However, as these fuel systems are pressurised, manual shut-off valves should be closed if equipped and the tanks examined by an expert before recovery. A safe distance ought to be maintained, as leaking liquified gas will still be extremely cold before it warms and dissipates into the atmosphere. In production, an artificial smell may have been added in order to allow leak detection, this is usually unpleasant and 'eggy'.

According to the Gas Vehicle Hub (www.gasvehiclehub.org), there are currently a total of 34 CNG and LNG filling stations across the UK with that number growing at a significant rate along major trunking routes. Companies such as Roadgas specialise in bespoke on-site solutions, while Gasrec currently operate Europe's largest gas filling station alongside a mixture of private and public stations. CNG Fuels recently secured a huge £80 million investment to expand the UK's network further and will soon be opening what is billed as the world's largest public access station in Avonmouth, Somerset with 14 high-speed dispensers allowing the refuelling of up to 80 HGVs per hour.

Fuel Cell technology

& commercial transport



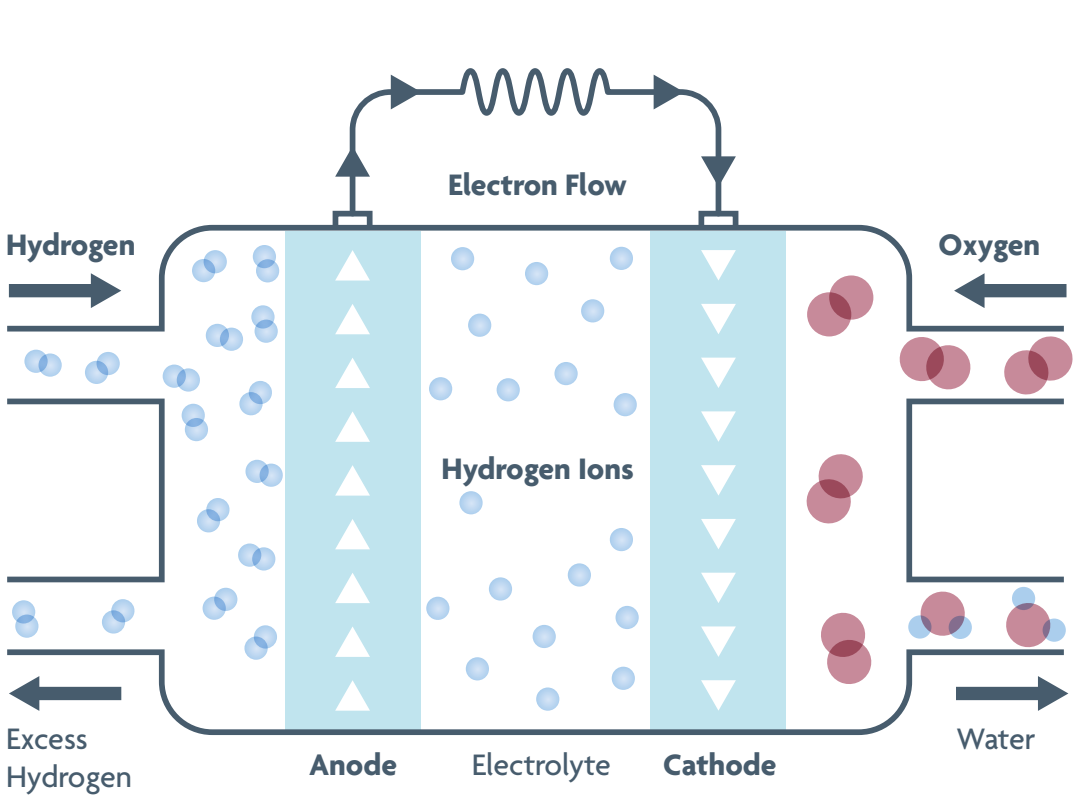
Hydrogen gas makes great sense as an alternative fuel source for commercial vehicles. As an abundant element which, in gas form is also energy dense and highly combustible, hydrogen propulsion has been around in various forms since the 1800s.

When burned, the only bi-product of hydrogen is water, making it emissions-free at the tail pipe, and indeed many manufacturers have experimented with compressed hydrogen-powered ICE over the years, however the latest and most advanced form of hydrogen propulsion is via fuel-cell technology.

Hydrogen Fuel Cell Electric Vehicles (HFCEV) run on electricity, in the same way as Battery Electric Vehicle (BEV). While a BEV must stop and recharge its batteries at static charging points, a HFCEV is able to produce its own electricity on the move however, thanks to fuel cell technology.

To create electricity in a fuel cell, pressurised hydrogen gas is stored in the vehicle in tanks, much like petrol or diesel would be with an ICE. Inside the fuel cell itself, the hydrogen and oxygen undergo a reaction across a membrane, in which the electrons are split away from the protons to form an electrical current. The only biproduct of the reaction is water.

As hydrogen gas is relatively energy-dense, the supply of hydrogen needed to form electricity for movement gives a far greater driving range than is possible in a traditional BEV. Re-filling hydrogen tanks is a faster process than charging a battery, meaning that drivers are not faced with potentially long waits during journeys. As an added benefit, the need for heavy lithium-ion batteries within the vehicle is eliminated, meaning that vehicle efficiency is also increased.



Use in Commercial Vehicles

The run up to 2030 in the UK, and the countdown to 2050 globally is accelerating the move away from ICE and forging towards an EV and fuel-cell powered future. The next 10 years are set to be the decade in which hydrogen fuel-cell technology comes of age, with many manufacturers releasing fuel-cell powered vehicles onto the market, both as light commercial and heavy goods vehicles.

The largest current barrier to adoption in the UK is one of infrastructure. As it stands today in the UK, gas production, transport, storage, and distribution to end users are all highly localised at best. With just 11 hydrogen filling stations currently available in the UK, of which more than half are located in the South East of England, it is clear that a major investment will be needed before hydrogen fuel becomes a viable option for any more than the most specialised operators.

However, in no small part thanks to the Government's investment and incentives package as outlined previously, this is set to change rapidly in as little as the next five years and when it does, manufacturers will be ready with available products.

Heavy Goods Vehicles

First to market globally with a working hydrogen fuel-cell powered HGV is the US-based Hyzon Motors. Named simply the 'Heavy Duty Trucks', the heavy commercial platform from Hyzon is being built in 10 different configurations, from traditional tractor/trailer and rigid platform layouts, through to refuse collection and cement trucks, Hyzon is confident in the ability of its fuel-cell technology in vehicles of up to 50 tonnes GVW using 500kW electric motors. Thanks to large capacity hydrogen tanks, and their highly efficient fuel cell technology, Hyzon suggest a real-world driving range of between 250-380 miles, depending on loading. Delivery of these heavy-duty trucks began in August 2021, beating far more established competitors to the market by months.

Italian manufacturer IVECO has begun a joint venture with Nikola to produce a hydrogen fuel cell EV based on the underpinnings of the successful IVECO S-WAY. Called the Tre, development testing is well underway, showing an expected real-world range of up to 500 miles and easy power delivery thanks to the powerful 480kW motors. The first delivery of these trucks for public testing will see up to 25 examples being delivered to the Port Authority in Hamburg by 2022.

MAN trucks has begun testing its HFCEV version of their existing EV trucks, the eTGE and the eTGM. Prototypes are already in pre-production testing, and early examples are being delivered for customer trials this year, full production is expected to begin from 2023.

Dutch based manufacturer group DAF has been working on a hydrogen powered range of HGV platforms, in partnership with Toyota, Shell and Kenworth Trucks, and while several examples of the USA-based Kenworth Zero Emission Cargo Transport 'big rig' have already completed intensive testing cycles, it is expected that a European version of the same tech will begin testing imminently on the continent.

Mercedes-Benz is testing the hydrogen fuel cell powered GenH2 Truck across Europe, in partnership with Volvo Group. Both companies are sharing the development costs of the project, while lobbying the EU to harmonise hydrogen infrastructure across the continent. With a stated aim of becoming a leading global manufacturer of HFCEV, commercial manufacturing of a range of commercial trucks is due to commence in 2025.

Light Commercial Vehicles

The Stellantis group has announced that its Peugeot, Citroën & Vauxhall mid-size vans would be offered with a hydrogen fuel-cell powertrain by the end of 2021, but the first vehicles are now due to hit the roads this year. Developed by sister company Opel, the highly efficient 45kW fuel cell and three 700 bar hydrogen tanks are capable of producing an estimated 250mi range, with refuelling from empty being possible in just three minutes.

Renault has announced that the Renault Master ZE hydrogen van will be revealed later this year, intended to be an emissions free LCV for longer distance use than its current range of BEV vans. Thanks to its fuel cell technology, produced in conjunction with Renault's hydrogen partner, Plug Power, the Master and the smaller Kangoo ZE will enjoy ranges of between 280 and 310 miles between refuelling.

Current State of Play

There are two main challenges in the way of wide-spread adoption of hydrogen vehicle technology: cost and lack of infrastructure. Neither can be solved overnight, and neither will be able to be resolved without governmental and commercial intervention.

Even with the huge investment taking place in the next five to 10 years the infrastructure needed for more widescale use is still a long way off where it needs to be. The 11 hydrogen filling stations that are currently available across the UK will not allow for any more than localised use by a few vehicles.

While this makes the free movement of passenger and Light Commercial Vehicles next to impossible, for vehicles which operate around a centralised hub, or on pre-defined routes with access to fuel at either end, this obstacle can be overcome with relative ease and a reasonable investment.

Smaller hydrogen hubs would solve the problem of refuelling, and with private companies such as JC working on a range of 'portable' (30 tonne) hydrogen hubs, this will allow for accelerated adoption of hydrogen fuel-cell use in commercial vehicles, especially in construction, refuse collection, urban delivery operations and airport service vehicles within the next five years.

The Road Ahead

When the Government first announced the intention to become carbon neutral by 2050 and followed up with the ban on new ICE vehicles in 2030, there was quite rightly, consternation amongst the motoring public and commercial operators alike. Even just two years ago, there was a gaping lack of public acceptance, infrastructure, and ICE alternatives to choose from, which made the proposed legislation seem near impossible to implement without causing huge economic disruption.

In a relatively short space of time however, thanks to a combination of pledged governmental funding alongside a rapidly maturing marketplace for producers of alternative fuel options, it seems that public opinion and appetite for non-ICE commercial vehicles is changing. With a slew of manufacturers having either released, or imminently releasing viable, alternatively fuelled commercial vehicles onto the market in both the LCV and HGV sectors, the products on offer have come a long way in a short space of time, which is further bolstering public opinion on the viability of a carbon-neutral future.

While it is true that the UK's infrastructure around the production and distribution of alternative fuels is currently a long way behind where it needs to be to allow for a commercial vehicle sector that is 100% fossil-fuel free, the ramping-up of investment in key areas such as EV charging points, energy production for CNG and hydrogen hubs suggests that the industry is keen to meet these targets either on, or ahead of schedule, making the UK's commercial transport sector not just green, but profitable.

Glossary of Terms

CV	Commercial Vehicle
LGV	Light Goods Vehicle
HGV	Heavy Goods Vehicle
EV	Electric Vehicle
BEV	Battery Electric Vehicle
PHEV	Plug-in Hybrid Electric Vehicle
FCEV	Fuel Cell Electric Vehicle
CNG	Compressed Natural Gas
LNG	Liquified Natural Gas
ICE	Internal Combustion Engine
HFCEV	Hydrogen Fuel Cell Electric Vehicle
(Renault) **ZE**	Zero Emission
Kg	Kilograms
t	Tonnes
EU	European Union
GVW	Gross Vehicle Weight
ULEZ	Ultra Low Emissions Zone
kW	Kilowatt
kWh	Kilowatts per Hour

Appendix

https://www.gov.uk/government/news/uk-government-launches-plan-for-a-world-leading-hydrogen-economy

https://group.met.com/fyouture/pros-and-cons-of-fossil-fuels/62

https://www.autoexpress.co.uk/news/108960/2030-petrol-and-diesel-ban-what-it-and-which-cars-are-affected#:~:text=All%20new%20conventional%20petrol%20and,Government%20has%20yet%20to%20define.

https://www.iveco.com/uk/products/pages/iveco-gas-powered-truck.aspx

https://www.fptindustrial.com/global/en

https://afdc.energy.gov/fuels/natural_gas_basics.html

https://vanfleetworld.co.uk/new-demonstrator-vehicle-shows-future-for-hydrogen-fuel-cell-vans/

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69400/anaerobic-digestion-strat-action-plan.pdf

https://www.ngvnetwork.co.uk/resources

https://www.ngvnetwork.co.uk/media/e9f6453da1f8607e2a66f1f1ea0ff2ea/GVN-Response-to-Targeting-Net-Zero-Next-steps-for-the-RTFO.pdf

https://www.gasrec.co.uk/about-gas-power

https://www.ngvglobal.com/blog/volvo-trucks-displays-new-fe-cng-in-london-1020

https://www.volvotrucks.co.uk/en-gb/trucks/alternative-fuels/gas-powered-trucks.html

https://www.scania.com/uk/en/home.html

https://www.renault-trucks.co.uk/product/renault-trucks-d-wide-cng

https://gasvehiclehub.org/is-natural-gas-right-for-me/getting-connected/

https://www.mercedes-benz-trucks.com/en_GB/models/econic/drive-concept/engines.html

https://cngfuels.com/2021/05/14/worlds-largest-biomethane-refuelling-station-will-support-low-carbon-hgv-deliveries-in-wales-and-south-west/

Venson Automotive Solutions Ltd
Venson House
1 A C Court
High Street
Thames Ditton
Surrey KT7 0SR
Tel: 0330 094 7803

www.venson.com

email: sales@venson.com

@venson_Fleet

Published March 2022