The Green Pages
NEW FUELS GUIDE
WINTER 2022/23 • ISSUE 12

BMW iX5 Hydrogen defies the extreme cold

The BMW iX5 Hydrogen is undergoing its final winter testing in one of the coldest regions in the world. Tests confirm: the hydrogen fuel cell drive defies even the lowest temperatures.

The BMW Group impressively demonstrates with the BMW iX5, how enormously reliable and suitable for everyday use alternative CO2-free drive systems are; offering unlimited driving pleasure even in extreme weather conditions. This trend-setting insight is provided by current winter testing of the BMW iX5 Hydrogen, with its innovative hydrogen fuel cell technology.

The sustainable model proves itself in one of the coldest regions in the world, right on the Arctic Circle, undergoing numerous driving tests on public roads as well as at the BMW Group's test centre in Arjeplog in northern Sweden.

The data obtained so far from the demanding test programme represents a significant milestone for the BMW Group, in developing CO2-free driving pleasure. Despite harsh, below-zero, temperatures and the most challenging conditions such as ice and snow, all drive components of the BMW iX5 Hydrogen – from the fuel cell system to the hydrogen tanks and the power buffer battery to the central vehicle control unit – impressively underlined their reliability and suitability for everyday use.

SMALL SERIES TO BE PRODUCED BEFORE THE END OF 2022

Testing under extreme weather conditions is a prerequisite in the vehicle development process. Once the vehicle's reliability has been put through its paces in a wide variety of situations, series production can begin. The BMW iX5 Hydrogen has been successfully undergoing extensive long-distance and weather tests for some months, as part of the BMW Group development process.

The aim is to produce a small series of the model by the end of 2022. At the same time, the company is committed to rapidly expanding the hydrogen filling station network:

"The winter testing under extreme conditions clearly shows that the BMW iX5 Hydrogen can also deliver full performance in temperatures of -20 °C and therefore represents a viable alternative to a vehicle powered by a battery-electric drive system,"

says Frank Weber, Member of the Board of Management of BMW AG, Development.

"For us to be able to offer our customers a fuel cell drive system as an attractive sustainable mobility solution, a sufficiently extensive hydrogen infrastructure also needs to be in place."

One particularly fascinating feature of the hydrogen fuel cell drive; even at extremely low temperatures, it is in no way inferior to a conventional combustion engine in terms of everyday usability. Drivers have the full system power at their disposal shortly after starting – even in the freezing cold. The range is also unrestricted. What's more, it only takes three to four minutes to fill up the hydrogen tanks, even in frosty conditions.

FUEL STOPS

One of the most important prerequisites for individual mobility with fuel cell vehicles is not only having hydrogen produced from regeneratively generated energy, but also a nationwide supply infrastructure. This is why the BMW Group supports the EU Commission's efforts to implement the Alternative Fuels Infrastructure Regulation (AFIR) for developing hydrogen filling stations, plus an electric charging infrastructure in parallel.

The BMW Group's wide-ranging commitment to hydrogen fuel cell technology underlines its clear claim; to be the most successful and sustainable premium manufacturer for individual and clean mobility, offering a wide range of CO2-neutral drive systems.

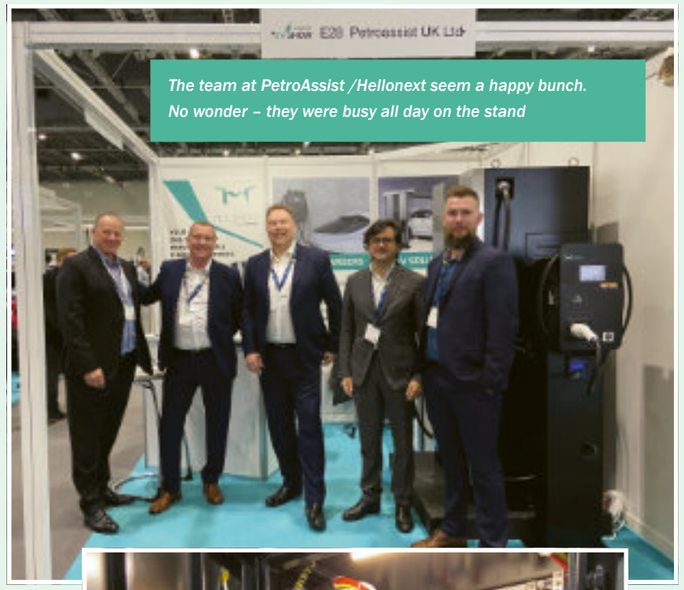
A whole new world?

LONDON EV SHOW

The London EV show came to town again just before Christmas; and this time it's grown into the busy Excel Centre. We popped in to see what was going on and were blown away with all the technology. The range of projects and services were remarkable, but we still have to ask the question "where's all the power going to come from?"

DELIGHTED TO SEE THESE PEIMF MEMBERS AT THE SHOW

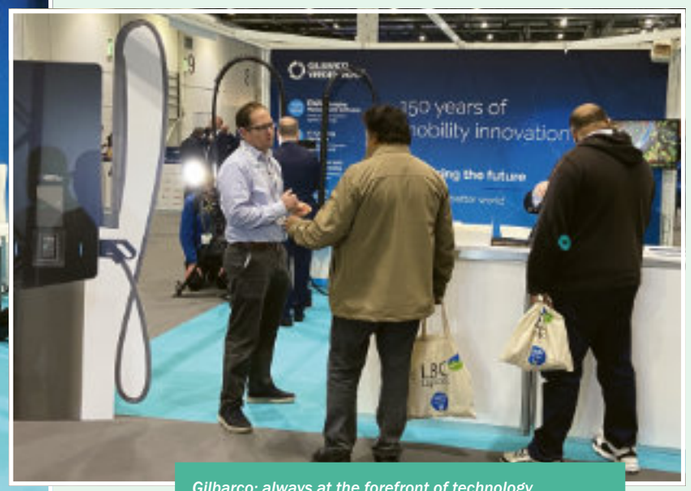
She looks intelligent!



The team at PetroAssist /Hellonext seem a happy bunch. No wonder – they were busy all day on the stand

Inside the impressive Hellonext box of tricks

Tom waxing lyrical on the merits of their Everse charger

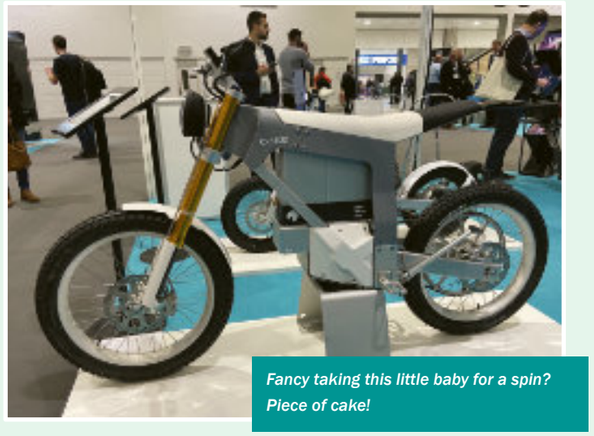


Gilbarco: always at the forefront of technology

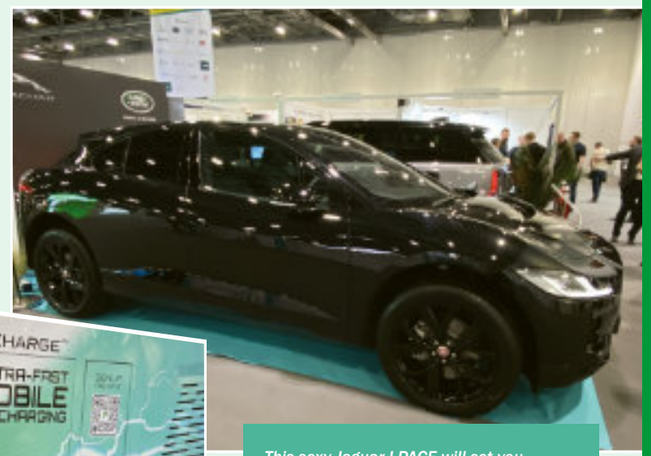
Sacre Bleu! Even the 2 CV is getting in on the act.

We've come a long way since the Hillman Imp! Not the sort of Tesla you see every day of the week

Not sure if the kids will find this in their Christmas stocking!



Fancy taking this little baby for a spin? Piece of cake!



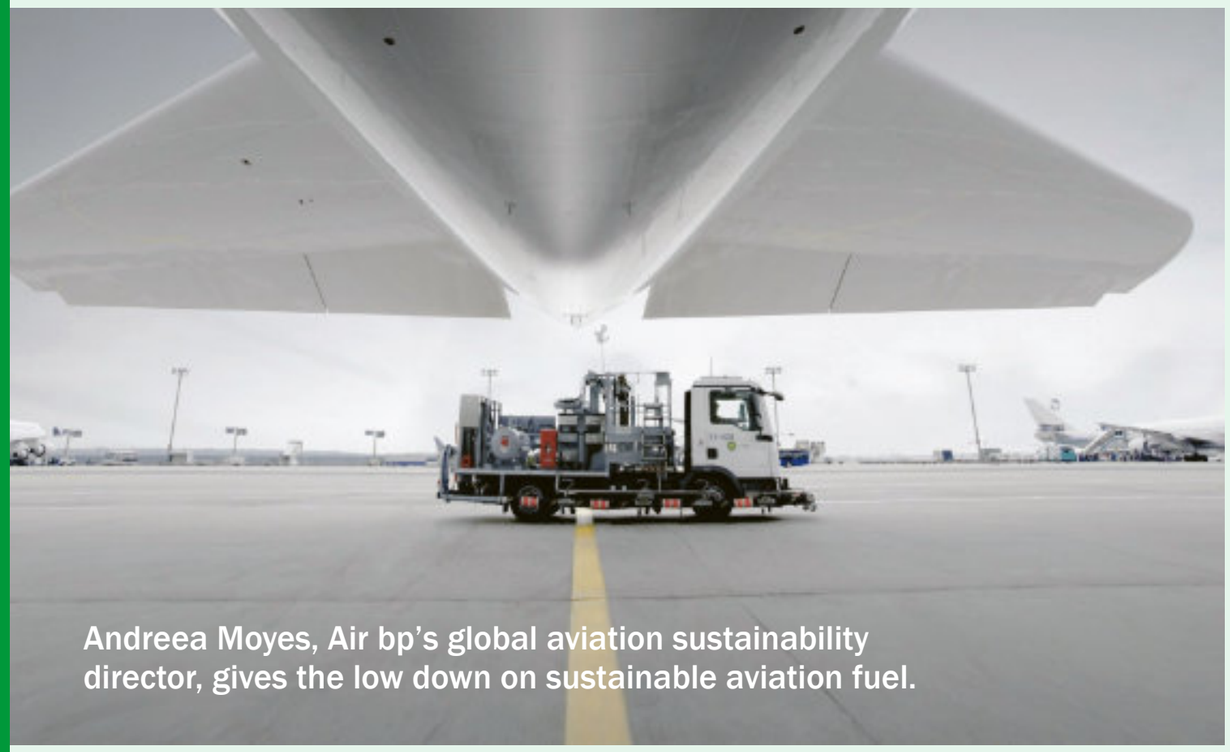
This sexy Jaguar I-PACE will set you back a cool £79K and should give you just under 300 miles. Apparently winner of the World Car Of The Year.

'Power to the people' Ultra-fast mobile EV charging

WINTER 2022/23 • ISSUE 12 • THE GREEN PAGES - NEW FUELS GUIDE

Sustainable aviation fuel. What is it and why is it important?

Waste to wingtip



Andreea Moyes, Air bp's global aviation sustainability director, gives the low down on sustainable aviation fuel.

THE USE OF SUSTAINABLE AVIATION FUEL (SAF) IS ON THE RISE, BUT WHAT IS IT EXACTLY?

SAF stands for sustainable aviation fuel. It's produced from sustainable feedstocks and is very similar in its chemistry to traditional fossil jet fuel. Using SAF results in a reduction in carbon emissions, compared to the traditional jet fuel it replaces, over the lifecycle of the fuel. Some typical feedstocks used are cooking oil and other non-palm waste oils from animals or plants; solid waste from homes and businesses, such as packaging, paper, textiles and food scraps that would otherwise go to landfill or incineration.

Other potential sources include forestry waste, such as waste wood, and energy crops, including fast growing plants and algae. Air bp's SAF is currently made from used cooking oil and animal waste fat.

WHY IS SAF IMPORTANT?

Jet fuel packs a lot of energy for its weight, and it is this energy density that has really enabled commercial flight. Today, there aren't any other viable options for transporting groups of people quickly over very long distances, so we're dependent on this type of fuel in aviation. A return flight between London and San Francisco has a carbon footprint per economy ticket of nearly 1 tonne of CO2.

With the aviation industry expected to double to over 8 billion passengers by 2050, it is essential that we act to reduce aviation's carbon emissions and SAF is one way in which Air bp is doing that.

HOW MUCH CARBON DOES IT SAVE?

SAF gives an impressive reduction of up to 80% in carbon emissions over the lifecycle of the fuel, compared to traditional jet fuel it replaces, depending on the sustainable feedstock used, production method and the supply chain to the airport.

WHAT ARE AIR BP'S SOURCES OF SAF?

When it comes to sourcing SAF, Air bp has a portfolio approach. We agree off-take agreements with third-party producers; and this security of demand can help these third parties secure investment.

Secondly, we invest in third-party production facilities. Air bp's collaboration with California-based Fulcrum is one example. Air bp entered into a strategic partnership with Fulcrum BioEnergy in 2016 and Fulcrum is building its first plant in Reno, Nevada, which will produce sustainable transport fuel made from household waste. Fulcrum intends to construct additional facilities and will supply Air bp with SAF from several different plants.

Thirdly, bp is investing in its own refineries and facilities. One such example is the sale of ISCC plus SAF Air bp announced in July at bp's Castellon refinery in Spain; and in October 2021 the refinery became the first globally to achieve the ISCC CORSIA certification.

IS IT SAFE TO USE?

SAF can be blended at up to 50% with traditional jet fuel and all quality tests are completed as per a traditional jet fuel. The blend is then re-certified as Jet A or Jet A-1. It can be handled in the same way as a traditional jet fuel, so no changes are required in the fuelling infrastructure or for an aircraft wanting to use SAF. In 2016, we were the first operator to commence commercial supply of SAF through an existing hydrant fuelling system, at Norway's Oslo Airport.

IS SAF SUITABLE FOR ALL AIRCRAFT?

Any aircraft certified for using the current specification of jet fuel can use SAF.

WHO HAS AIR BP SUPPLIED?

To date, Air bp has supplied SAF at over 20 locations across three continents. Air bp's SAF has been used to fuel many different types of aircraft from small private jets to large passenger aircraft. We have a supply chain established in Sweden, from which we are supplying locations across the region. It was this supply chain that enabled us to fuel Braathens Regional Airlines for its 'Perfect Flight' back in May 2019, which combined the latest in aircraft efficiency and the use of SAF to cut lifecycle emissions compared to regular flights on the same route.

HOW DOES THE COST OF SAF COMPARE TO TRADITIONAL JET FUEL?

SAF is currently more costly than traditional fossil jet fuel. This is down to a combination of the current availability of sustainable feedstocks, plus the continuing development of new production technologies. As the technology matures it will become more efficient, and so the expectation is that it will become less costly for customers. We are seeing increased uptake of SAF as our customers and their passengers increasingly recognize and value the benefits of the emission reductions.

IS SAF REALLY THE KEY TO MAKING AVIATION GREENER?

SAF can drop straight into existing infrastructure and aircraft. It has the potential to provide a lifecycle carbon reduction of up to 80% compared to the traditional jet fuel it replaces. SAF will play a really important role in meeting the aviation industry's carbon reduction targets, however, we need to use all the options to reduce carbon that we have available.

There are several broad opportunities for carbon reduction across the industry such as more efficient aircraft design, smarter operations and the development of future technologies like electrification. In that regard, in 2016 Air bp became the first aviation fuel supplier to be independently certified carbon neutral for into-plane fuelling operations at all its global operated locations.

SO WHY AREN'T MORE AIRLINES USING SAF?

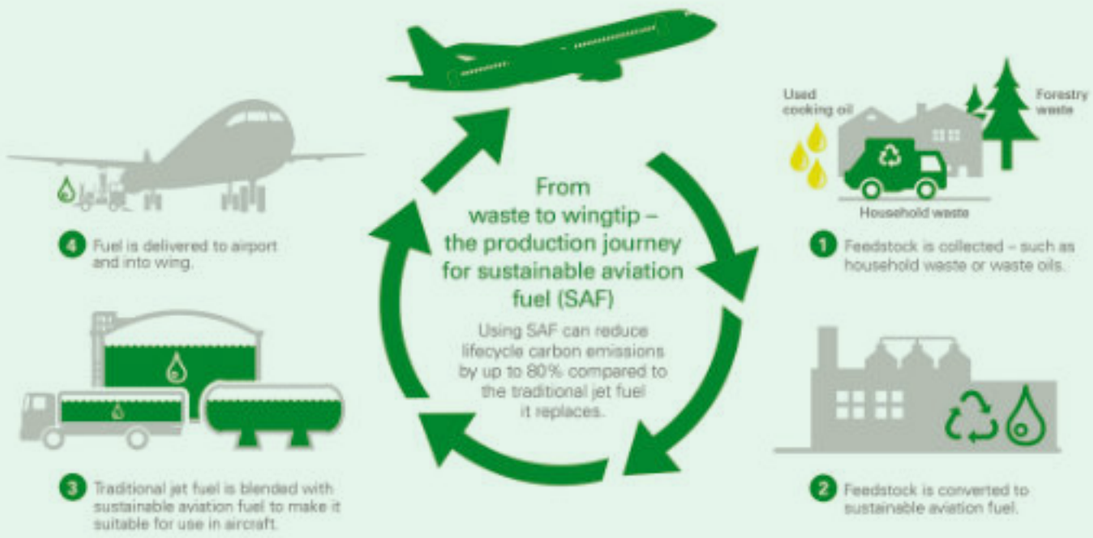
At the moment production of SAF is limited, as the higher cost is preventing wider uptake. Air bp is working on helping create more demand in the short-term which will lead to more production, and hopefully lower costs in future.

HOW CAN WE ACCELERATE THE GROWTH OF SAF?

There is real commitment from the industry to reduce carbon emissions, but governments also need to create the right policies to accelerate the growth of SAF. Increasing production requires long-term policy certainty to reduce investment risks, as well as a focus on the research, development and commercialization of improved production technologies and innovative sustainable feedstocks.

On an individual level, some airlines are now providing passengers and corporate customers with the option to fund the use of SAF in order to reduce emissions associated with your ticket, and we think these are really positive initiatives.

The key to greater acceptance and deployment of SAF is reduction in costs. Over the long term, that will require investment in advanced technologies to process feedstocks more efficiently at greater scale and investment in the development of sustainable and scalable feedstock options. However, in the short-term, interim support from governments and other stakeholders through policy incentives is needed. This support needs to be part of a long-term framework to give investors the confidence to make the big investments required to grow supply.



Fuelling the future with LNG

If you need to manage your fuelling costs AND protect the environment, then Liquid Natural Gas (LNG) fuel can be the way to go.

MAKEEN ENERGY

According to figures from Statista.com, 396,000 diesel-driven trucks occupy the roads of the UK, emitting significant amounts of CO2 every day. Only 504 are Ultra Low Emission vehicles. LNG is an alternative fuel that significantly lowers carbon emissions without sacrificing the running range of the vehicle.

WELL KNOWN SUPPLIER

K C ProSupply is well known in the marketplace for our work in installing and servicing LPG Autogas filling stations. As part of our group re-branding we have now changed our name to Makeen Gas Equipment UK. Our sister company Makeen Energy LNG are experts in the field of installing and maintaining LNG refuelling systems. To diversify our product range, Makeen Gas Equipment UK are now working in collaboration with Liqal and GasRec to install and maintain LNG fuelling stations throughout the UK for both automotive and marine applications. These vary from road freight HGV's to large ferries.

Positioning the LNG storage vessel

The air to air vapouriser

Working with Liqal, Makeen Gas Equipment UK can offer a complete filling system and service package for your transportation network. Makeen Energy (Denmark) have also installed LNG bunkering systems to fuel ferries, to reduce the reliance on heavy oils and to comply with the clean maritime plan to reduce harmful emissions.

Positioning of the compressor module

STEP BY STEP INSTALLATION

The proposed refuelling site was cleared and a concrete base laid. The vertical LNG tank was Installed, along with compressors and control panels. The filling station was then installed and the project was tested, certified and a training programme agreed, all within a time period of 3 months!

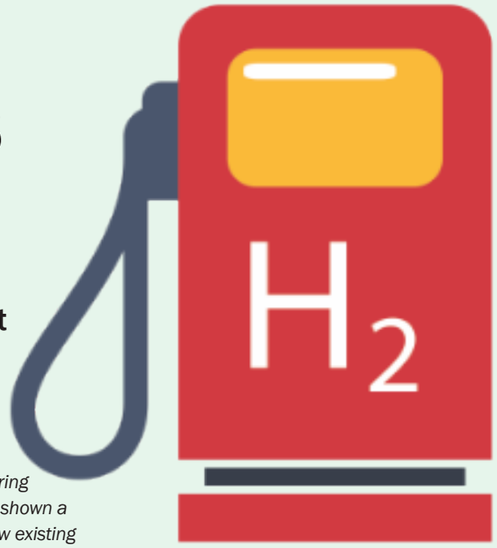
Left: The finished installation

Below: Just like a normal filling station

Here in the UK, we were approached to design and install a bespoke filling station for Reed Boardall. The aim was to supply their fleet of LNG powered tractor units through their central distribution port in Roecliffe, as part of their environmental strategy with the added advantage of cost reductions. Designs were agreed and construction commenced in November 2020.

WINTER 2022/23 • ISSUE 12 • THE GREEN PAGES - NEW FUELS GUIDE

Hydrogen on service stations



Forecourt Trader of the Year winner, and Top 50 Indie, Exelby Services is to partner with hydrogen refuelling specialist Element 2, to develop two hydrogen refuelling stations in the North of England.

The Coneygarth A1(M), Yorkshire and Golden Fleece (M6), Cumbria sites are making a claim to becoming the first public service stations in the UK to provide hydrogen refuelling services for hydrogen-powered HGVs.

Exelby Services Managing Director Rob Exelby, said:

"Following the ever-increasing global focus on tackling climate change, now is the time to be proactive and embrace low- and zero-carbon alternatives to diesel.

"We're proud to be partnering with Element 2, who have shown a great understanding in how existing fuelling networks operate. With their expertise, we can implement hydrogen refuelling on our existing service areas to offer a one-stop-shop for all road users; as we transition to net-zero."

Tim Harper, chief executive officer, Element 2, added:

"This partnership is a pivotal moment in bringing hydrogen refuelling to the UK's roads. Together with Exelby Services, we will provide a turnkey solution for refuelling hydrogen HGVs on key haulage routes in the North of England.

We're building the UK's network of hydrogen refuelling stations in response to growing demand from fleet owners and operators, as they accelerate the transition of their HGV fleets to zero emissions, which will be critical in helping the UK meet its zero carbon targets."

INFRASTRUCTURE AND SUPPORT

Element 2 will install hydrogen refuelling infrastructure at the two service stations, including provision for hydrogen tanker supply, storage, compression and dispensing. This is in addition to providing Exelby with technical and logistical support during planning.

While the two permanent hydrogen refuelling stations are being developed, Element 2 will deploy its mobile hydrogen refueller to meet current client demand for low-carbon fuel at Exelby's Carlisle site.

Exelby Services plans to integrate hydrogen into its forecourt operations around the country.

Earlier this year at the Forecourt Trader Summit 2022, Rob Exelby said he was looking at future fuels and new systems with hydrogen refuelling, especially trucks, explaining that there was some very promising data from initial trials with hydrogen and combustion fuel cells. He also spoke about the huge investments on sites like the hydrogen plant at Teeside. "A *stone's throw from us up the road. So potentially there will be key infrastructure and we want to play a part in that."*

Exelby Services was crowned Forecourt Trader of the Year in 2021 for its A19 Services North site. The company owns and operates five Shell service areas and truckstops in the North of England, covering the A1(M), A19, M6 and M62 major transport routes.

Certas Energy to roll out nationwide HVO

First to offer HVO at HGV refuelling sites

Certas Energy customers nationwide can now power their operations with Hydrotreated Vegetable Oil (HVO); and instantly cut up to 90% of their business' greenhouse gas emissions.

Certas Energy launched its new 'Leading With Energy' strategy in May 2022. As well as fuelling its own fleet with the low carbon diesel alternative, the UK's leading fuel distributor has launched HVO delivery to businesses across the UK. The drop-in renewable fuel is also available at selected Certas Energy refuelling sites, including its Thurrock HGV refuelling site – making Certas Energy the first in the UK to offer HVO fuel to HGV fuel card users at the pump. The company has plans to roll out supply across more of its nationwide network of HGV refuelling sites over the coming months.

WHAT IS HVO?

HVO is a drop-in diesel alternative that offers a cleaner way to fuel commercial on and off-road fleets than traditional red or white diesel, with no engine modifications required. The roll-out of HVO across Certas Energy's extensive network underpins the company's commitment to supporting UK businesses on their transition journey to net zero.

Niki Holt, Head of Commercial at Certas Energy, said:

"Our nationwide HVO offering marks a major milestone for our company and, more importantly, our customers. The renewable diesel alternative provides an immediate and simple carbon reduction benefit for businesses working towards cleaner operations – it's simply drop in and go.

"This seamless fuel change means diesel-dependent industries can make a smooth, frictionless transition and realise significant sustainability benefits, without delay or disruption. We are proud to be leading with energy by offering a viable route for businesses looking to lower their carbon footprint, today."

PRACTISING WHAT THEY PREACH

Certas Energy is not just delivering on its promise to bring HVO to customers. The company is also adopting the fuel across its own delivery fleet. Following a successful trial at two depots, which saw almost 1,000 tonnes of CO2 emissions cut from operations in just one year, Certas Energy is already well on the way to rolling out HVO across its 900-strong fleet.

With industry forecasts predicting significant demand for renewable diesel over the coming years, Certas Energy has already committed significant investment to expand its offer. The transition to HVO is one of several decarbonisation initiatives implemented by Certas Energy as part of its commitment to both support the UK's journey to net zero as well as to dramatically reduce its own operational CO2 emissions (50% reduction by 2030).

www.certasenergy.co.uk

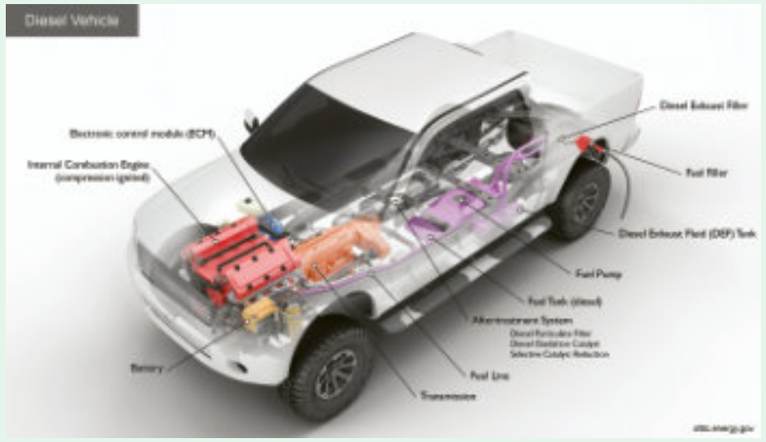
Top Gear – Green Pages style!

The sharp-eyed amongst you will have clocked that this feature first appeared a while ago. Well it's back – by popular demand – for those that missed it first time round.

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



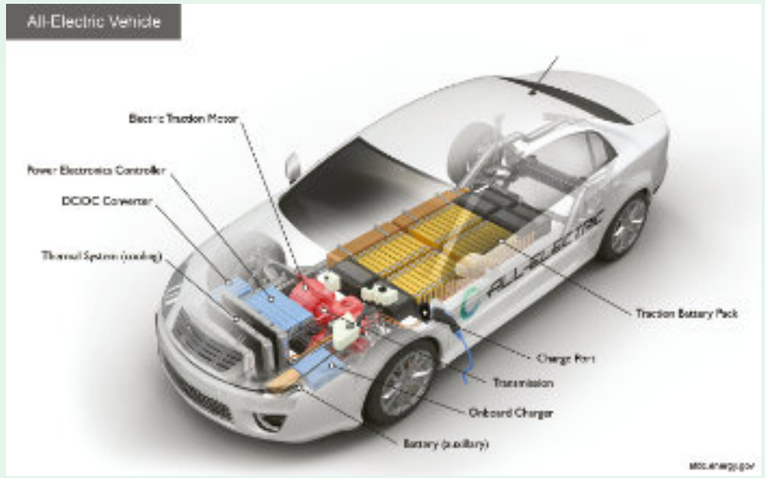
Biodiesel and conventional diesel vehicles are essentially one and the same. Although light-, medium-, and heavy-duty diesel vehicles are not technically alternative fuel vehicles, almost all are capable of running on biodiesel blends (always check before use).

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.

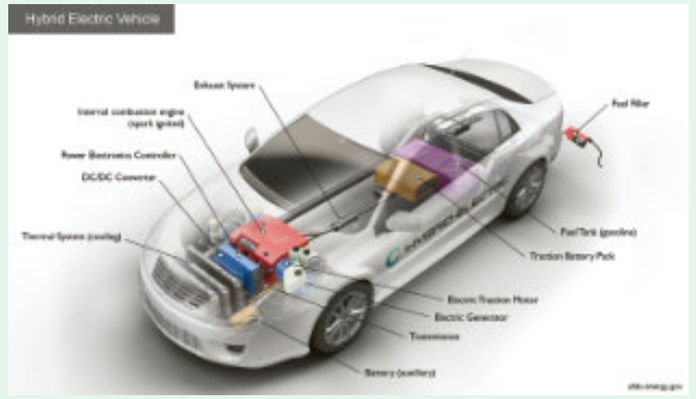


EVs are more efficient under city driving than on the motorway. City driving has more frequent stops, maximising the benefits of regenerative braking, while motorway travel typically requires more energy to overcome increased drag at higher speeds.

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.

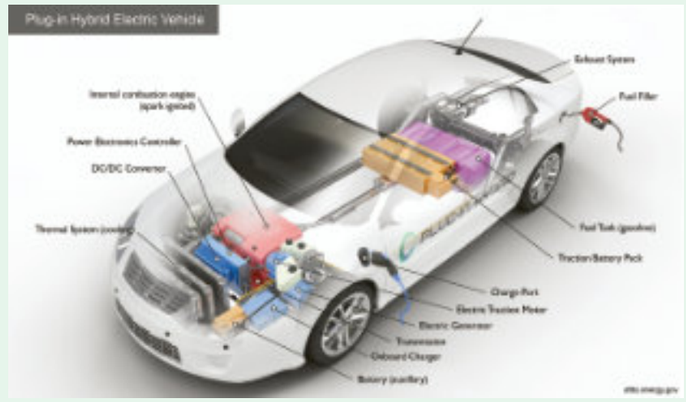
In an HEV, the extra power provided by the electric motor may allow for a smaller combustion engine. The battery can also power auxiliary loads and reduce engine idling when the vehicle is stopped. Together, these features result in better fuel economy without sacrificing performance.



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.

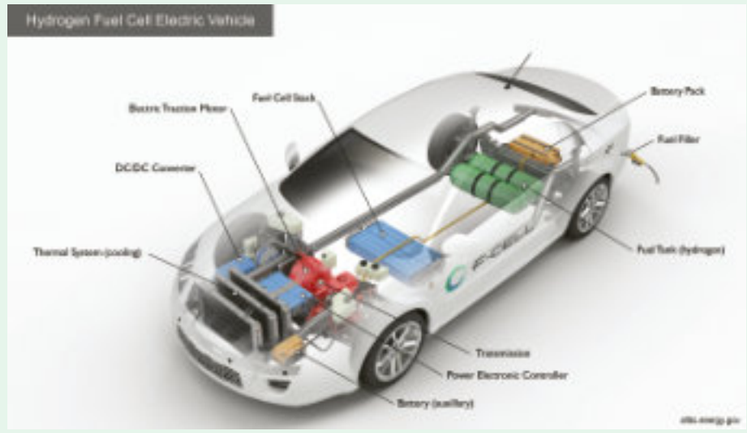
Plug-in hybrids (PHEV)

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

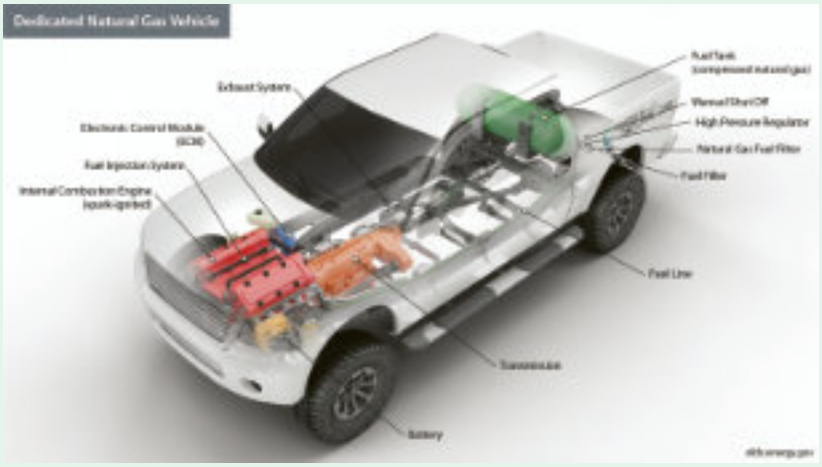


Energy is stored as hydrogen in a tank on the vehicle and then converted to electricity by the fuel cell. Unlike conventional internal combustion engine vehicles, these vehicles produce no harmful tailpipe emissions, only emitting water vapour and air. They can be refuelled quickly and have a potential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

WINTER 2022/23 • ISSUE 12 • THE GREEN PAGES - NEW FUELS GUIDE

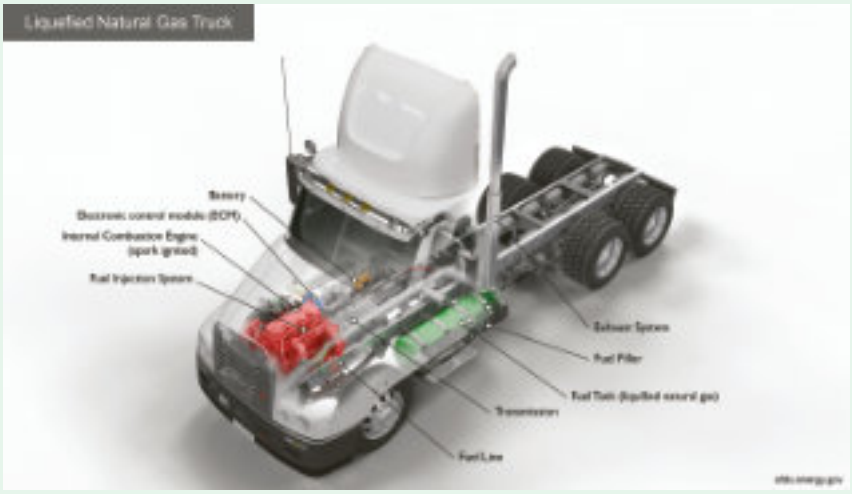
Compressed natural gas (CNG)



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.

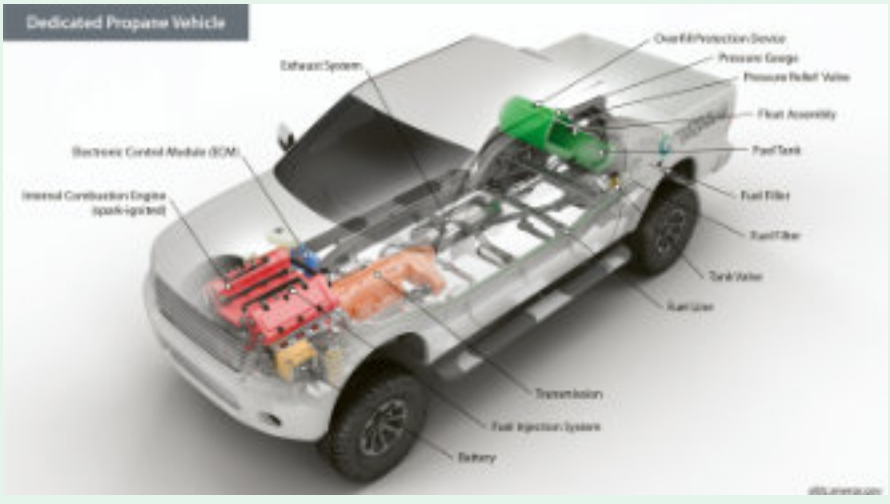
CNG vehicles operate much like petrol engines, with spark-ignited internal combustion engines. Natural gas is stored in a fuel tank, or cylinder, typically at the back of the vehicle. The CNG fuel system transfers high-pressure gas from the fuel tank through the fuel lines, where a pressure regulator 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.