Alternative Fuels for use in the motoring and car rental industry

By Eloise Methven

Alternative fuels are fuels or power sources which serve, at least partly, as a substitute for fossil oil sources in the transport sector [1]. This research paper will aim to assess at a basic level the various alternative fuels on offer and how they could possibly be used in ICE (Internal Combustion Engine) cars as alternatives to conventional fossil fuels. This is part of a movement towards reaching lower and net zero emissions goals in support of the car rental industry's quest for greener credentials and decarbonisation. However, economic challenges and the lack of necessary infrastructure pose a challenge to the full electrification of the industry, with the complete usage of BEV (Battery Electric Vehicles) cars in the transport sector still decades away. Despite existing ZEV mandates and past incentives, many older combustion cars remain on the roads, undermining the effectiveness of political guidelines, regulations and sustainable goals. High BEV costs and infrastructure challenges are still a hurdle, hence the need to look at alternative fuels as a solution to complement the transition to full electrification and support existing ICE models

ACRISS is looking at alternative fuels that might become available for use in the car rental industry which it represents. One of ACRISS' main services is to provide a classification system and coding of vehicle models according to a number of factors including fuel type, therefore understanding the different options available is key to keeping the ACRISS Car classification system up to date and future proof.

Background:

The transport sector is a major emitter of greenhouse gases and other pollutants. A study from the UK government has stated that the transport sector was responsible for 27% of total emissions in 2019, making it the biggest emitting sector in the UK [2]. Despite current efforts to decarbonise this sector, any reductions in the emissions of cars and taxis, particularly in the UK, have been offset by an increase in the sales of vans. Whilst many businesses are resisting electrification due to its associated challenges, existing alternative fuels can be used in conjunction with conventional fuels as an alternative to decarbonising this industry. In this way, decarbonisation can be achieved through a generally more energy efficient and less expensive method when compared to electrification.

Alternative fuels – Synthetic Fuels

Synthetic fuels (also known as e-fuels) can be broadly defined as any liquid fuel not derived from crude oil. These fuels can be used in existing internal combustion engines, offering a cleaner alternative to conventional fossil fuels. Viewed simplistically, synthetic fuels are produced through various chemical processes that convert carbon dioxide and hydrogen into liquid fuels. Various feedstocks, such as coal or biomass, are involved in the production process. These hydrocarbon abundant resources can then go through gasification to obtain the carbon dioxide and hydrogen needed to obtain synthetic fuels [3]. The environmental impact of obtaining these feedstocks may also need to be considered. Obtaining coal, for example, impacts the carbon footprint of these synthetic fuels, and the use of biomass may exacerbate existing problems wherein increasing amounts of agricultural land are required to obtain a sufficient amount of biomass that would enable production of synthetic fuels on a commercial scale.

An alternative process to producing these synthetic fuels can be considered through electrolysis. Through electrolysis, water is separated into hydrogen and oxygen. This hydrogen is then mixed with CO_2 to make synthetic methanol that is then refined into synthetic fuels [4]. While this process is quite energy intensive, the electricity can be sourced through renewable energy sources to minimise the environmental impact, especially when compared to sourcing this energy through fossil fuels. Synthetic fuels can also be produced from gases composed of hydrocarbons through a process called gas-to-liquid (GTL). Natural gas is converted to a liquid fuel by decomposing it to a 'synthesis gas' (consisting of hydrogen and carbon monoxide) which is refined into a synthetic fuel [1]. However, many of these processes require further simplicity to ensure the production of synthetic fuels is economically viable. Furthermore, renewable energy sources are not evenly distributed geographically, meaning that some countries may have to import increasing amounts of renewable energy to meet with the rising demand for synthetic fuels as part of the decarbonisation of the transport sector. The high economic cost of synthetic fuels can also be explained by the complexity of the chemical synthesis and refining process [5]. Whilst synthetic fuels are an ideal alternative due to their similar characteristics to conventional fuels, they may not be economically viable when compared to other alternative fuels.

The environmental impact of synthetic fuels needs to be carefully considered in the context of decarbonisation. A study from CleanEnergy [3] has shown that synthetic fuels can be a carbon negative source. Through renewable energy and captured carbon dioxide, synthetic fuels can be 100% carbon neutral. E-fuels significantly reduce particulate matter (PM) and nitrogen oxide (NOx) emissions by 50% compared to traditional fossil fuels [3]. Using carbon capture in the production process could potentially capture up to 2 billion tonnes of carbon dioxide annually. This allows for the potential to utilise carbon dioxide, a waste product in fossil fuel combustion. Utilising this carbon dioxide can help decarbonise the energy sector as well, providing extra societal benefits by reducing pollutants in the atmosphere. Synthetic fuels as a carbon negative source would not only allow for greater sustainability in the transport sector, but also contributes towards attaining the sustainable development goals outlined by the United Nations for clean and affordable energy. Increasing the demand for synthetic fuels in the transport sector may also allow the sector to reduce its dependence on fossil fuels for energy. Surplus electricity from renewable sources can be utilised to produce synthetic fuels, allowing for grid stabilisation. Furthermore, the production of synthetic fuels could promote investment into renewable energy infrastructure that may also benefit the manufacturing of BEVs. Synthetic fuels' compatibility with existing internal combustion engine vehicles enables an almost carbon-neutral operation and can complement electromobility as part of a wider movement towards the de-fossilisation of traffic.

Another key thing to consider is the efficiency and scalability of synthetic fuels' production and its application. Synthetic fuels are compatible with existing fuel infrastructure, meaning no additional capital is required for the transportation or storage of synthetic fuels. This facilitates a smooth transition without requiring extensive infrastructure changes. Production methods are often modular and scalable, allowing the production of synthetic fuels to be generally more efficient than biofuel production methods. Further advancements in technology combined with decreased renewable-energy costs may make sustainable fuels a more economically viable option when compared to other alternative fuels, with production costs having decreased by 10-15% in recent years. However, synthetic fuels still require significant financial commitments, with $1 billion required for infrastructure alone [3]. While synthetic fuels are a promising alternative, further development in technology is required to for these fuels to replace conventional fuels. Despite this, synthetic fuels are ideal for use in ICE vehicles, as many of these cars will remain on the roads even after political guidelines, particularly in the UK, aim to phase out these vehicles after 2035. The 'drop-in' technology would prevent most of the 1.4 billion cars in circulation from being scrapped, which could cause significant environmental damage through attempted disposal of these cars [3]. Another factor in the efficiency of synthetic fuels is its potential to utilise waste materials and sustainably sourced biomass whilst offering consistent and high-quality properties that make it stable and reliable. The relevance of these fuels is limited by its lower energy efficiency compared with battery-electric vehicles, as the e-fuel engine involves an additional energy conversion compared to BEV vehicles. A battery-powered vehicle can cover 3 to 4 times as many kilometres as an ICE vehicle using synthetic fuels [5].

Many pilot projects worldwide are testing and validating synthetic fuels technology. A prominent example is Porsche's development of synthetic fuels from renewable energy sources [6,7,8]. Porsche AG has collaborated with HIF Global, Siemens Energy, ExxonMobil and other international partners to build the 'Haru Oni' pilot plant in Punta Arenas, Chile. Chile has a constant and strong wind, resulting in a surplus of renewable energy that they are unable to use locally. This constant wind means production costs are generally low and abundant wind energy can be exploited to produce eFuels. This new eFuel produced at 'Haru Oni' is a near carbon neutral hydrocarbon from mainly water and carbon dioxide. This industrial eFuel plant is a milestone in the development of synthetic fuels, being one of the first in the world. Porsche has invested more than US$100 million to assist HIF in the production of these eFuels, with 130,000 litres produced annually. Due to rising demand for synthetic fuels as an alternative to conventional fuels, the amount produced is expected to increase to 55 million litres of fuel by 2026 [6,7,8]. The development in the production of eFuels is promising, but currently the necessary political framework conditions are lacking to enable the production of synthetic fuels on an industrial scale [9], so other alternative fuels must also be considered.

Alternative fuels - Biofuels

Biofuels are a renewable, biodegradable fuel derived from organic materials such as plants and animal waste. It is produced from biomass, which is abundantly available and a renewable and eco-friendly material (emits fewer sulphur and nitrogen into the environment). Biofuels are a crucial factor when it comes to the transition to a carbon-neutral bioeconomy. The two main types of biofuels used in cars are bioethanol and biodiesel. These mainly come from the first-generation of biofuels which have been used in the transport sector for a while, but there are still many gaps in its usage. Biofuels produce fewer pollutants than traditional diesel and can be used directly or blended with conventional fossil fuels. Biofuels are a vital alternative fuel in Europe, accounting for 4.4% in EU transport [1]. The sustainability of biofuels depends on its production method and on whether it causes indirect land use change. Therefore, regions for production need to be considered carefully, as production of biofuels is a water intensive process that requires significant agricultural land. The quality of the fuel also heavily depends on local weather conditions, which can heavily affect the quality of the biofuel. Overall, the sustainability of biofuels is weaker compared to synthetic fuels. Biofuels only offer a limited reduction in carbon dioxide emissions compared to synthetic fuels and synthetic fuels are generally more energy efficient. Biofuels are still a valuable alternative fuel, as they are more economically viable for use in the transport sector, depending on the generation of biofuels used.

The European Commission [1] has increased incentives for advanced biofuels to mitigate against the impacts of first-generation biofuels, which are the main type of liquid biofuel available commercially. Advanced biofuels include the second-, third-, and fourth-generation of biofuels which are made from lignocellulosic biomass, residues, waste and other non-food biomass (including algae and microorganisms). First-generation biofuels remain the most commercially suitable as they do not require intensive pretreatment. However, these biofuels' usage in transport is limited due to shortage of feedstock and blending limits. On the other hand, advanced biofuels have a greater potential for reducing greenhouse gas emissions, with the additional benefits of improved properties and compatibility with existing infrastructure. Advanced biofuels are mainly produced from non-food-based feed stock and are grown on small, non-arable land, solving the issue posed by first-generation biofuels. Second-generation biofuels involve the bioconversion from waste material, but its costly pretreatments make it a less desirable alternative. Third-generation biofuels include biodiesel produced from algae, a renewable source for production. Fourth-generation biofuels have the potential to act as a carbon negative source using genetically modified feedstocks. However, the feedstocks involved in the production of fourth-generation biofuels are expensive and rare. These biofuels have great potential economically and sustainably but are held back by the depletion of natural resources and environmental degradation. Biomass itself can be problematic, as it requires expensive and high-energy processes, such as the pretreatment process. Advanced biofuels require further development in technology to enable large scale production but can be cost-effective and complement traditional fossil fuels to gradually reduce the transport sector's dependence on them.

Similar to synthetic fuels, biofuels are compatible with existing fuel infrastructure. First-generation biofuels are widely available as blends with convention fossil fuels which are compatible with most vehicles. Current blends available in Europe include E10 and E85 [1]. E10 is a blend of petrol that contains up to 10% bioethanol. Diesel in Europe also contains up to 7% FAME (Fatty acid methyl ester) biodiesel content. E85 is an example of a higher blend, which is not widely available in Europe due to the requirement of the development of corresponding fuel standards. E85 consists of 85% ethanol but is only available in a few Member States in the EU [1]. While most vehicles may not be compatible with higher blends, flexible fuel vehicles (FFVs) are able to use both low and high blends. These vehicles contain an internal combustion engine and are compatible with several types of fuels. Global distribution of these vehicles is uneven, with the United States currently having the largest market (as of 2022) with 20.9 million FFVs [10]. To enable widespread commercial use of higher blends, the sales of FFVs in other markets must be increased to ease the large gap in consumption of biofuels globally. This large gap in consumption is especially prevalent within Europe, where the major markets for biofuels include France, Germany, Sweden, Spain, Italy, and the UK [1]. There is a large gap between these markets and other member states within the EU regarding the biofuels market.

Currently, global usage of biofuels is hampered by the lack of information available regarding the lack of information and common technical specifications surrounding biofuels' use in cars [11, 12]. The SUSTAIN Classic range is the UK's first publicly available sustainable petrol, designed specifically for classic vehicles and developed by fuel specialist Coryton. The range went on sale on 13 June 2023 and allows classic cars to run on plant-based petrol. There are three types of fuels included in the classic range, all tailored to allow classic cars to function the same as they would using traditional fuels. The three types of fuels available include the Super 80, Super 33 and Racing 50. The Super 80 is created with 80% renewable content, whereas the Super 33 is created with 33% sustainable content and the Racing 50 is created with 50% renewable content. Overall, the SUSTAIN Classic range promises a reduction of at least 65% in greenhouse gas emissions compared to fossil fuels. These fuels are an example of an advanced second-generation biofuel manufactured from agricultural waste (such as straw and by-products or waste from crops not used for consumption). Instead of decreasing carbon dioxide emissions, the classic fuels utilise and recycle carbon dioxide and are suitable for use all year round. SUSTAIN Classic has been certified by Coryton's laboratory and under the ISCC sustainable protocols, delivered excellent results. SUSTAIN Classic gives the almost half a million classic cars in the UK a more sustainable future and showcases another way to decarbonise the industry through means other than electrification. The Mazda UK Heritage Fleet (a fleet of 15 key cars from 1968 to 2021) has already switched to the SUSTAIN Classic Super 80 supplied by Coryton. The fuels are tailored to suit classic cars, meaning none of the fleet required modification to use the petrol. Despite being designated for use in classic cars, the petrol can be used by standard petrol-fuelled ICE vehicles as well. The SUSTAIN Classic fuels allow for the preservation of classic vehicles in the U.K. beyond the ZEV mandate and have the potential to become even more sustainable as more feedstocks become available, adding even higher levels of traceable sustainable elements to the fuels.

Alternative fuels - Hydrogen

Hydrogen is a promising alternative for the transport sector, due to its general resistance to electrification. Hydrogen fuel cells are especially important for heavy-duty road vehicles where carbon dioxide emissions are generally higher. The production of hydrogen can involve diverse domestic resources. Although hydrogen is abundant in compounds such as hydrocarbons and other organic matter, efficiently isolating hydrogen from these compounds is one of the major challenges of using hydrogen as an alternative fuel. The main processes involved in production are either steam reforming or from water using electrolysis [13]. Steam reforming is where high-temperature steam is reacted with natural gas to extract hydrogen. Electrolysis is more energy intensive, but steam reforming is associated with greenhouse gas and harmful air pollutant emissions. Hydrogen can also contribute to grid stabilisation by being production during periods where there is a surplus of electricity from renewable energy sources that is not utilised elsewhere. Hydrogen has a variety of potential applications in the transport industry, including FCEVs (fuel cell electric vehicles), hydrogen ICE vehicles and through using a hydrogen fuel cell to produce power to charge BEVs. A report from the U.S. Department of Energy's Alternative Fuel Data Centre has demonstrated hydrogen's capabilities as a fuel. FCEVs that utilise hydrogen have a fast-filling time and high efficiency. A fuel cell coupled with an electric motor can be 2 to 3 times more efficient than an internal combustion engine running on gasoline. Despite this, FCEV sales are limited in quantity, as FCEVs require regions where hydrogen stations exist. The European Hydrogen Observatory [14] states that within Europe, there are a total of 187 hydrogen refuelling stations as of 2024. However, they are unevenly distributed throughout Europe, with 86 of these refuelling stations located in Germany. This is followed by France (27) and the Netherlands (24). Nevertheless, the total number of hydrogen refuelling stations in Europe is growing. FCEVs are also able to upcycle hydrogen that is produced as a by-product in many industrial processes. This hydrogen is often wasted [15]. Utilising this hydrogen could reduce the need for electrolysis in producing hydrogen, which contributes to the high cost associated with producing hydrogen for use in FCEVs.

The main challenges to using hydrogen as an alternative fuel are the cost and safety risks. The production of hydrogen cars is generally more expensive due to incomplete industrialisation in production. Furthermore, platinum as a catalyst in electricity generation is in high demand, even though the amount of platinum needed has been reduced through recycling catalytic converters. Despite this, the cost per km of a hydrogen car is approximately the same as combust vehicles. Increasing production volumes for hydrogen cars may reduce the price for hydrogen, introducing the potential for hydrogen cars to be a cheaper alternative when it comes to refuelling. Currently, the price for hydrogen amounts to roughly £15 per kilogram as of February 2025 [16]. A fuel cell car can travel roughly 100km on one kilogram of hydrogen, making it quite efficient. However, whilst the life cycle of FCEVs and BEVs are not too dissimilar, the efficiency of the entire energy chain for a FCEV is only half that of a BEV. The main safety risk associated with hydrogen is how flammable it is. When hydrogen reacts uncontrollably with oxygen, it has the potential to be quite explosive, posing a serious safety risk when driving FCEVs using hydrogen. FCEVs combat this issue with thick-walled tanks (where the hydrogen is stored), which have been validated by numerous safety tests. However, this may extend the development time for future vehicles that utilise this technology, potentially causing the cost to rise, making it less viable for sale to consumers.

BMW have introduced a concept car using hydrogen, demonstrating its potential [17], though not yet available for sale, production should start in the second half of the decade. The BMW iX5 Hydrogen utilises the BMWi Hydrogen Fuel Cell to reduce carbon dioxide emissions and shorten refuelling times when compared to BEVs. The BMW iX5 Hydrogen has a capacity of two hydrogen tanks combined with an electric range of up to 313 miles. The car is similar to a BEV where it has an electric drive and identical electric motor. The main advantage of a BMW iX5 Hydrogen is that it can be completely refuelled in 3 to 4 minutes, making it more efficient than its BEV counterpart. The BMW iX5 Hydrogen also has a minimal environmental impact, being locally emission free. Within the fuel cell, the reactions that produce electricity from hydrogen only produce electrical energy, heat and water as by-products. The water emerges as water vapour. This water vapour often ends up as a waste product, limiting the efficiency of liquid hydrogen as an engine fuel. Despite this, hydrogen is one of the most efficient ways to store and transport renewable energy and the development of infrastructure for hydrogen drives can aid in meeting the increasing demand for electric charging stations for all BEVs, as FCEVs utilise the same electric drive as BEVs. The expansion of infrastructure suitable for BEVs and FCEVs will reduce costs in the long term. BMW have already partnered with various hydrogen producers and filling station operators as part of the Clean Energy Partnership to drive the expansion of infrastructure [17].

Toyota has developed a concept model that could solve the issue of vaporised hydrogen which is produced as a waste product [18]. This vaporised gas is also known as 'boil off gas' and is generated while driving. By harnessing this 'boil-off gas', the efficiency of liquid hydrogen as a fuel would increase. The concept car was showcased in November 2024, where a GR Corolla ran on liquid hydrogen. Liquid hydrogen possesses a higher density than gaseous hydrogen, so a greater volume of liquid hydrogen can be stored in a tank of the same capacity. 'Boil-off gas' is produced when the fuel stored in the tank evaporates due to heat entering from the outside. The gas produced is mainly released into the atmosphere as a waste product. Where Toyota's concept car differs is that it recovers this gas and uses it as an energy to improve the efficiency of the car. The vaporised hydrogen is sent to a self-pressuriser which uses the pressure of the boil-off gas to increase pressure by two to four times. The pressure is increased without the need to supply additional energy. This process allows the gas to be converted back to usable hydrogen fuel for the engine. Within the self-pressuriser, some surplus boil-off gas is released and fed into a small Toyota fuel cell stack. Here, it produces electricity through a chemical reaction, which is then used to power components, such as the liquid hydrogen pump. This supplementary electricity is equivalent to the amount generated by the alternator, allowing for a greater overall energy efficiency that reduces the need for a greater energy input into the car through recycling hydrogen. Any boil-off gas not used in this process is converted into water vapour (through a catalyst) and released outside the vehicle [18].

Electrification is a significant part of the industry's goal to decarbonise, especially considering policies such as the UK's ZEV (zero emissions vehicle) mandate. Despite BEVs' low emissions, the immediate environmental impact of producing these cars is significant, due to the demand for lithium-ion batteries which are notoriously difficult to recycle without sacrificing environmental concerns for higher yields. As such, different fuels must be considered for a transitional phase to develop the technology needed for BEVs and FCEVs and minimise the immediate environmental impact that an increase in production of BEVs would bring. This would also allow ICE vehicles' emissions to decrease locally, as many consumers may still drive ICE vehicles after policies such as the ZEV mandate due to the lack of affordable BEVs and lack of information surrounding alternative options.

Alternative fuels – LPG

One of these alternative options is L**iquefied Petroleum Gas (LPG).** LPG is a by-product of the hydrocarbon fuel chain, produced through the fractional distillation of crude oil. As such, using LPG as a fuel would avoid the problems of resource scarcity and environmental degradation that challenge biofuels or synthetic fuels, increasing the resource efficiency of LPG. Whilst LPG is still produced from crude oil, it is a low carbon alternative that emits 35% less carbon dioxide than coal, 12% less than oil. LPG emits almost no black carbon along with low particle emissions, low NOx emissions and low sulphur content [1]. LPG currently is derived from crude oil and natural gas but has the potential to utilise biomass in its production. LPG infrastructure is already well established in Europe, with the European Alternative Fuels Observatory stating that there are over 32,000 dispensing sites in the EU [1]. This is a result of automotive LPG (Autogas) being Europe's most widely used alternative fuel, with over 15 million vehicles already running on Autogas in the EU alone. Therefore, LPG is an efficient alternative that has the potential to see more widespread use in the transport sector. This is particularly evident in the U.S. market, where LPG accounts for only 2% of the energy used in the U.S., less than 3% of which is used for transportation [19]. Despite this, LPG has a high domestic availability, high-energy density, clean-burning qualities and relatively low cost. For these reasons, LPG is the world's third most common transportation fuel (behind gasoline and diesel). LPG should be used simultaneously with other alternative fuels in the industry, as it is still a form of fossil fuel and therefore only provides an alternative pathway with lower emissions. However, LPG still has environmental benefits when compared to its conventional counterparts. If LPG is spilled, it does not threaten soil, surface water, or groundwater. Despite this, LPG requires more fuel by volume to drive the same distance as a car using gasoline as a fuel. This impacts the efficiency of LPG as a fuel, requiring other alternative fossil fuels to also be considered for a transitional phase.

Alternative fuels- LNG and CNG

Other promising alternative fossil fuels include L**iquefied Natural Gas (LNG)** and **Compressed Natural Gas (CNG).** LNG and CNG both have the potential for higher energy efficiency and lower pollutant emissions when compared to the conventional fossil fuels used in the transport sector. LNG already is a cost-efficient alternative for long-distance road freight transport, and while LNG is used more widely in the USA, development of LNG into a global commodity could improve the security of energy supply and drive the development of fuelling infrastructure and common technical specifications on refuelling equipment and safety regulations, which LNG lacks currently [1]. Shell expects global demand for LNG to rise by around 60% by 2040 [20]. This increase in demand is largely explained by economic growth in Asia, AI impact and efforts to reduce emissions in heavy industries and transportation. The main markets expected to dominate LNG supply by 2035 are the U.S. and Qatar, with infrastructure for LNG expanding in India and China. However, this increase in demand poses a challenge to existing supply, which requires more investment to keep up with the increase. However, LNG's availability as a resource is vulnerable due to declining reserves. This decline has decreased domestic production of LNG in emerging markets (such as Algeria, Egypt and Malaysia) and delayed several LNG products. Current geopolitical tensions, regulatory hurdles and labour shortages are expected to delay availability of around 30 million tonnes of new LNG supply to 2028 [20], potentially threatening the security of the LNG market that perhaps puts its viability as an alternative fuel into question, if the demand for alternative fuels continues to increase. In the long term, current natural gas infrastructure in Europe could be repurposed to deal with the increasing demand by importing bio-LNG or synthetic LNG. Alternatively, this infrastructure could be repurposed for the import of green hydrogen, which can also support the development of hydrogen as an alternative fuel as well, further aiding efforts to decarbonise the industry. Compressed natural gas (CNG) is also a viable alternative fossil fuel already used in the transport industry, with over 1 million vehicles on the road in Europe and approximately 3,000 filling stations [1]. Therefore, there is no need for significant investment into the development of natural gas vehicle technology. If the demand for CNG increases, existing dense natural gas distribution networks in Europe could easily supply additional refuelling stations, perhaps providing a way to combat the insecurity surrounding the demand for LNG. CNG provides similar environmental benefits to LNG, emitting a low amount of pollutants. However, the efficiency of CNG vehicles is limited, with only optimised gas-only vehicles able to have a higher energy efficiency. Nevertheless, CNG vehicles are competitive with conventional vehicles in performance. Natural gas is ultimately cheaper than petrol and diesel, providing a promising future for the widespread use of CNG and LNG. The application of natural gas provides a way to utilise existing fossil fuel infrastructure, which will remain in operation even after the gradual ban on the sale of ICE vehicles. In this way, LNG and CNG enables less energy wastage within the production of fossil fuels, minimising the environmental impact.

Conclusion

The main aspect hindering the implementation of more sustainable alternatives to conventional fuels is the lack of incentives and information regarding these alternative fuels. A survey conducted by SUSTAIN [21] emphasises this issue. 2,000 British people were survey, of which 59% of those who drove a petrol or diesel car planned on keeping it going for as long as possible. This demonstrates the key issue that electrification of the transport sector alone is insufficient to decarbonise the industry. Without alternative fuels, the demand for conventional fuels will still be high, meaning large amounts of pollutants will still be emitted despite mandates against these ICE vehicles. While electrification is a vital solution, 40% still believe that EVs do not suit their needs, meaning that the development of hydrogen and biofuel production is crucial to persuade a wider proportion of the consumer market to switch to more sustainable options that do not include EVs. Many governmental policies portray electrification as the only suitable solution towards sustainable transport, which may deter many people from purchasing BEVs due to the sentiment that they are being forced down one particular path.

Furthermore, another crucial aspect is the lack of awareness for these alternative fuels in the first place. SUSTAIN's survey stated that 34% admitted they had either not heard of sustainable fuel or did not know what it was. If this is not addressed, alternative fuels may struggle to gain access to the market in a way that effectively impacts the sector's carbon footprint. Even if consumers are aware of these alternative options, many may still gravitate towards conventional fuels due to its higher cost and higher availability, as it is accessible at every refuelling station, whereas hydrogen, for example, requires very specific refuelling stations that many consumers will not be able to access. By improving government involvement in the development of these sustainable alternatives. Current political framework is lacking in regard to how environmental solutions are measured and compared. 45% believe that current government environmental policy is flawed due to its failure to include a full Life Cycle Analysis (LCA) for different sustainable alternatives. Through providing an LCA of these fuels, awareness for these fuels will increase, therefore causing the demand to increase. Sustainable fuels are already readily available and will provide a more cost-effective way towards a zero emissions sector by factoring in the 27% of British people who plan to buy an ICE vehicle close to the ZEV mandate [21].

The goal of ACRISS in looking at alternative fuels is not to replace electrification, but to find an additional source to support green environmental initiatives including the Zero mandates and climate goals and its own support for decarbonisation.

ACRISS fully supports electrification however, whilst we are very much in the transition stage from ICE to BEVs, we need to look at other greener sources of fuel for existing ICE cars and future ICE or hybrid cars.

As a travel and transport industry supporting car rental companies and travel partners, ACRISS is looking at alternative fuels to support the transition and legacy ICE models, looking at what is available from biofuels to synthetic fuels, hydrogen fuel cells, ethanol and LPG, some are already adopted in small scale and some in other industries like motorsport but at the moment none of the alternative offer a cost productive solution or able to mass produce enough to be available in the forecourts alongside petrol and diesel.

There is not enough information on what is actually available and the benefits and challenges of each solution as a supplement to electrification. ICE cars are here for many more decades and a greener source of fuel for these ICE models would be an ideal solution. There are some great innovations and new processes out there to support existing and old ICE models but more awareness of the benefits and challenges of each solution and innovation is needed.

Eloise Methven 06 May 2025

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