Zooming in on…

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E-fuels as part of the transformation of the transport sector?

Background

E-fuels are currently a hotly debated topic in Brussels as well as the European capitals. Controversy has arisen, however, between the member states as to whether cars powered by internal combustion engines should generally no longer be registered in the EU after 2035. While some member states were in favor of this, in the interest of openness to technology, other member states and the EU Commission are backing electric cars.

Is it realistic to expect that after 2035 a large proportion of passenger cars could be powered with e-fuels? And what exactly are e-fuels anyway? Where is the world market headed? This briefing will address these issues as well as the question of how the move away from the combustion engine will affect the European automotive industry and what plans it has for the period after 2035.

What exactly are e-fuels?

E-fuels are **synthetic fuels**. They do not exist naturally, but are produced artificially. E-fuels are created by combining hydrogen and CO2. This process is called the **Fischer-Tropsch process**. It was developed back in the 1920s to produce liquid fuel from coal.

The combustion of e-fuels produces greenhouse gases in the same way as the burning of fossil fuels. In order for e-fuels to be climate-neutral, the CO2 required for production must first be extracted from the air. In addition, the hydrogen used must come from **renewable energy sources**. E-fuels are therefore a form of hydrogen converted into fuel. In the future, for example, hydrogen will be used in the steel industry. E-fuels have a **high energy density**. This makes them particularly suitable for areas where electrification is likely to be difficult because of the high levels of energy required.

An indispensable part of a climate-neutral economy

In several sectors of the economy, e-fuels will prove indispensable for achieving climate neutrality. As an example, electrification is not suitable for **shipping and aviation**. The **chemical industry** will also need e-fuels as carbon-based raw materials for the production of plastics. Calculations by the Potsdam Institute for Climate Research (PIK) show that the fuel

demand in Germany for these three application areas alone will be **as great as the total fuel demand for all passenger cars in Germany in 2019**.

Nevertheless, the future use of e-fuels in passenger cars is the main topic of public debate. Just as with trucks, e-fuels in cars represent a possibility for climate-neutral operation. However, there are various competing technologies in the passenger car sector. **Battery-powered electric cars** are refueled directly with electricity that is stored in batteries. A large amount of energy is lost in the conversion of electricity to hydrogen and then to e-fuels. Therefore, battery-powered cars are much more efficient. In fact, compared to cars powered by e-fuels, they consume only one-fifth of the energy.

Fuel cells are another alternative type of drive system for cars. Here, the cars are directly refueled with hydrogen, which is then converted into electricity in the fuel cell. Thus, this is a variant of the electric car. Even though these vehicles are slightly more efficient than those powered by e-fuel, they still consume three times as much energy as battery-powered electric cars.

Vehicles powered by e-fuels, on the other hand, are internal combustion vehicles – to operate the vehicle, the fuel that is burned must first be produced in a costly process. The exhaust gases emit not only CO2, but also harmful emissions such as nitrogen oxide and carbon monoxide.

Existing technology instead of new infrastructure

Proponents of e-fuels argue that they create a possibility to convert passenger cars to a climate-neutral technology without doing away with the internal combustion engine per se. For example, with e-fuels the existing filling station infrastructure could continue to be used; there would be no need for a completely new charging infrastructure for e-cars or hydrogen for fuel cell cars. In addition, e-fuels enable further development of the combustion engine technology used up to now as a drive technology for passenger cars. Therefore there would be no need to switch over to a new technology. Thus, compared to battery-powered electric cars, there is less of a **need for critical raw materials**, which often have to be imported from China.

Another important advantage to using e-fuels to power passenger cars is that they can also be used in **already registered combustion vehicles**. This means that e-fuels could make a decisive contribution to reducing emissions from the existing number of vehicles, and not only in newly registered vehicles. In addition, the use of vehicles powered by e-fuels instead of battery-powered e-cars would ease the burden on the **power grid**. This is because the energy to operate e-cars must be drawn directly from the power grid in addition to the existing electricity demand. In contrast, e-fuels could be imported from energy-rich areas and therefore do not place an additional burden on the power grid.

Availability: a big problem

Despite all of these advantages, the widespread use of e-fuels in passenger cars is not likely. For the foreseeable future, **e-fuels will not be available in quantities that would allow their extensive use in cars**. For one thing, there is currently only one plant in the world that produces e-fuels: it is the "Haru Oni" plant, which was put into operation in Chile in December 2022 and belongs to the HIF Global group, backed by the German car manufacturer Porsche, among others. At present, 60 more projects worldwide are to be commissioned by 2035, although financing for most of these projects is still uncertain. Even if all of these projects were to be financed and even if the industry were to grow to a large extent beyond that, **the global supply of e-fuels would not even begin to be sufficient for the intended purposes described**. And so the maximum global supply would only cover half of German demand alone in those areas where there are no climate-friendly alternatives to e-fuels. In turn, that would constitute only a fraction of global demand in these sectors.

In any case, there is an urgent need to step up the **market launch of e-fuels** in order to sufficiently reduce emissions in the shipping, aviation, and chemical industries. The use of e-fuels in cars would hinder the climate-friendly switch in these other areas. This would **slow down the overall reduction in emissions**, since climate-friendly alternatives to e-fuels are available for cars, while this is not the case in the other industries. Therefore it is much more important to use e-fuels in aviation and the chemical industry than in cars.

The low availability of e-fuels in the face of high demand will also be reflected in **changes in price**. In the short term, e-fuels will remain very expensive. Production costs of **between three and five euros per litre** are expected in the next few years. This means that for economic reasons alone, e-fuels will no longer be used as an alternative to fossil fuels in passenger cars in the foreseeable future. In the long term, however, the price per litre is likely to fall considerably as the market ramps up. According to manufacturers, **by 2050, prices of around one euro per litre** could be possible. For the period prior to that, however, forecasts are difficult because the price depends on technological developments. And therefore there is no guarantee that e-fuels will be available at an affordable price in 2035. But even production costs of one euro per litre would not be comparable to either the cost of fossil fuels or the costs of direct electrification. Accordingly, it will not be worthwhile to produce e-fuels in sufficient quantities to run cars, not even in the medium term. The use of e-fuels in cars would therefore make little sense, **not only from an ecological standpoint but also from an economic perspective**.

Car manufacturers in Europe are planning to switch to electric cars

Against this background, the intensive debate in the EU on the approval of combustion vehicles powered by e-fuels after 2035 is all the more surprising. This discussion has arisen in connection with the plan to permit only zero-emission vehicles in the EU from 2035. Initially, the issue of the extent to which vehicles powered by e-fuels were to be included was to be left

open. However, this was opposed by a group of member states led by Germany. They insisted on binding commitments. The member states and the EU Commission then agreed to a compromise: it provides for the creation of a new category for combustion vehicles to be registered after 2035 that can **only be operated with e-fuels**. This is intended to prevent the use of fossil fuels in these vehicles, which would likely be attempted, since the properties of e-fuels hardly differ from those of fossil fuels. Therefore, **some even question whether it is technically possible to produce such vehicles at all**.

For the most part, car manufacturers in Europe are focusing on electric cars for the period after 2035. Most of the car companies have already named fixed dates after which they want to **offer only electric cars in Europe**. Opel, for example, intends to begin offering only electric cars starting in 2028, while Fiat, Daimler, and Renault want to switch fully to electric cars in 2030, and VW plans to take this step between 2033 and 2035. The Eastern European manufacturers Skoda and Dacia, on the other hand, do not intend to stop selling combustion engines in Europe until the EU regulation comes into force in 2035. Non-European manufacturers such as Ford, General Motors, and Hyundai have already announced their intention to switch fully to electrically powered vehicles in Europe between 2030 and 2035. However, Hyundai, like other manufacturers such as BMW and Toyota, does not want to commit itself entirely to battery-powered vehicles and **is simultaneously developing vehicles that are powered by fuel cell**.

E-cars are also being used in Asia and the USA

The above mentioned exit dates refer only to the European market, which, after China and America, is the world's third largest sales market for new cars. Together, these three markets account for over two-thirds of all new car sales in the world. Accordingly, it is therefore important to look at the Chinese and American markets.

In China, the switch to electromobility has been promoted for a long time now. In 2022, **more electric cars were sold there than in the rest of the world combined**. As a result, the proportion of electrically powered vehicles in the total number of vehicles there is now higher than in the US or in Europe. One of the reasons is that there is already a **well-developed charging infrastructure** for electric cars, with over four million charging points. Chinese suppliers are among the world's leading manufacturers in both the manufacture of e-cars and battery cell production. Five of the world's ten largest manufacturers of e-cars are based in China, and forecasts show that sales of electric cars in China will continue to experience robust growth. In 2030, more e-cars are expected to be sold in China than those powered by combustion, and **in 2040 e-cars will account for almost all new registrations in China**.

The transition to climate-friendly mobility is also underway in the US. Similar to the EU, the state of California has announced that starting 2035, it will allow **only zero-emission vehicles**. Other states are likely to follow suit. Just as in the EU, this does not explicitly exclude climate-friendly technology, including e-fuels. However, both the Biden administration and the manufacturers seem to be clearly backing electric cars when it comes to the future of mobility in the US. For example, in its Inflation Reduction Act (IRA), the American government explicitly

supports only the purchase of electric cars, offering subsidies of 7,500 dollars per vehicle. In addition, according to the US government, **electric cars should achieve a market share of around two-thirds of new registrations by 2032**, which is an ambitious goal given their current market share of 5.8%. Consequently, American manufacturers are orienting themselves strongly towards e-cars and are converting their production accordingly. Adapted to domestic demand, the large American corporations even **already have electrically powered pickups on offer**.

Globally as well, in the long term there does not seem to be a significant market for new vehicles powered by e-fuels. Even in markets where electric cars have not played a role so far, such as India, the expansion of electromobility is being strongly driven forward. For example, the Indian government is planning subsidies for the purchase of e-cars and a massive expansion of the charging infrastructure in the next few years. The aim is for **over 40% of newly registered vehicles in India to be electric cars by 2030**.

E-fuels in order to maintain a status symbol?

In view of this clear initial position, the question actually arises as to why the topic of e-fuels is so hotly contested in European politics. As already mentioned, most car manufacturers have already made a commitment to e-cars. Accordingly, they have positioned themselves against the approval of vehicles powered by e-fuels after 2035. Ultimately, the exclusion of drive technologies means **increased planning certainty for manufacturers and a lower risk when investing in electromobility**.

However, there are two European car manufacturers that are vehemently in favor of e-fuels and are still planning on developing vehicles with internal combustion engines: **Porsche and Ferrari**. The influence of these two sports car manufacturers is likely to have been instrumental in the German and Italian governments in Brussels having spoken out so emphatically in favour of the approval of vehicles powered by e-fuels after 2035. The reason is the manufacturers' concerns about the future of the **sports car as a status symbol**. Battery-powered vehicles are **significantly heavier** than those with internal combustion engines. In the case of sports cars, heavier vehicles would mean a considerable change in the driving experience, especially with regard to road curves and background noise. Both are important for the cultural myth that corporations have built up around the sports car status symbol in recent years.

The example of Porsche well illustrates this myth. The **Porsche 911** is considered the epitome of the brand's sports cars. Its low weight is an important part of this advertising strategy. At the same time, Porsche is largely relying on electromobility with regard to the future of its vehicle fleet. 80% of the cars sold in 2030 are to be electric cars. Porsche is also working quite successfully on **electric alternatives** to its 911 model for sports cars. Last year, for example, the all-electric Taycan model was sold about as often as the 911. The economic significance of the future of the combustion engine for the Group is therefore rather low, and an all-electric future for its automotive business is unlikely to induce a change in the Group's business model.

E-fuels as the final blow to the supplier industry?

In economic terms, the concerns of the supplier industry are much more important than the car manufacturers, since **it employs significantly more people**. Especially in the case of the automotive drivetrain, many production processes are changing as a result of switching over to electric cars, and certain specialised suppliers in particular will be affected. For example, some components that are essential for powering cars with combustion engines will be no longer required, such as tanks, pumps, and multi-speed manual transmissions. Since the drivetrain of electric cars is less complex overall than that of cars with combustion engines, the supplier association CLEPA is forecasting a **significant decline by 2040 in employment** in Europe for suppliers of drivetrain parts. At the same time, the **value added there is expected to increase by more than 40 billion euros per year**. This is also due to the fact that the manufacturing costs for e-car parts are falling more sharply as they reach market maturity.

In addition, the association's study compares two scenarios. While in one scenario, only electric cars will be registered in the EU after 2035, in the other, mixed scenario, vehicles powered by e-fuels would account for 30% of new registrations. The association assumes that in the mixed scenario, **the value added in the drivetrain industry would be EUR 8 billion higher**, with **nearly 400,000 more jobs**. It is therefore not surprising that the supplier industry is strongly committed to e-fuels in this area. Among the trade unions, however, there is no unanimous opinion on e-fuels. Some are pleased that the combustion engine has prospects for the future, while others are calling for a long-term focus on the development of electromobility.

It should be noted that the economic effects of the changeover for the supplier industry are unevenly distributed in Europe. **France and Spain**, for example, will **benefit particularly from the changeover** due to attractive framework conditions such as a low-CO2 power supply or the already existing production of electric cars. This will make these countries **particularly attractive locations for production**. In these countries, employment at suppliers of drive technology will hardly decline, while value creation will increase particularly strongly. Accordingly, these countries have no great incentive to support e-fuels.

On the other hand, Germany, Italy, Poland, the Czech Republic, and Romania will be significantly more affected by the changeover. While the supplier industry in Italy will shrink sharply overall, after 2030 Poland and the Czech Republic in particular will **still be quite dependent on combustion engine technology**. In these countries, the supplier industry will benefit from manufacturers withdrawing from other European countries. In this context, it made sense for Czech auto manufacturer Skoda to announce that it will continue to rely on cars with combustion engines in Europe for as long as possible. It is therefore particularly worthwhile for Poland and the Czech Republic to support e-fuels, as this could be a lucrative business model for domestic suppliers after 2035. However, the CLEPA study also shows that in these two countries, the value added in the supplier industry will **increase in the long term even in the event of a complete switchover to electric cars**.

In the long term, this results in a uniform picture for the supplier industry in Europe with regard to drive technology: the value added is increasing. However, employment is falling due to the

less complex structure of electric cars. However, a study by Agora Verkehrswende shows that this picture does not necessarily apply to the entire supplier industry. For example, overall employment in the German supplier industry is even **forecast to increase slightly**. While the switch to electric cars will result in a loss in jobs for manufacturers and suppliers of drive technology, this is more than offset by increases at other suppliers and by new jobs for the development of the charging infrastructure. However, this will be accompanied by a high need for retraining. Almost half of the employees in the automotive industry are to be affected, although this will mean a complete change of job description for only a small proportion.

E-fuels as a spurious solution – structural change must be actively shaped

Thus, the change in the automotive industry does not necessarily entail resulting job losses. **New jobs** can actually be created if the structural change is actively shaped by retraining programs. It will be particularly important to support those companies and employees who are particularly affected by the shift away from internal combustion engines. This would particularly help countries like Poland or the Czech Republic, whose industries are particularly dependent on combustion engines.

Over the long term, these countries and the automotive industry as a whole would not be helped by permitting cars that are operated exclusively with e-fuels. First of all, it is technically questionable whether such cars can be built at all. Consequently, there exists the threat of a **comeback for fossil fuel burners** through the back door. In addition, e-fuels in sufficient quantities will not be available for cars by 2035, as they are urgently needed for decarbonisation in other areas. Scenarios such as those of the supplier association CLEPA, in which a large proportion of newly registered cars will be operated with e-fuels after 2035, are therefore unrealistic. **The use of e-fuels in cars after 2035 makes no sense either economically or ecologically**.

The major sales markets for cars worldwide will **develop into sales markets for electric cars** in the next few years. Accordingly, most car manufacturers are already preparing intensively for the all-electric future and are investing heavily in it. Discussions about the use of e-fuels are therefore distracting Europe from preparing for this change and jeopardising investment security for car manufacturers and suppliers.

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