A drop of e-fuel in an ocean of oil

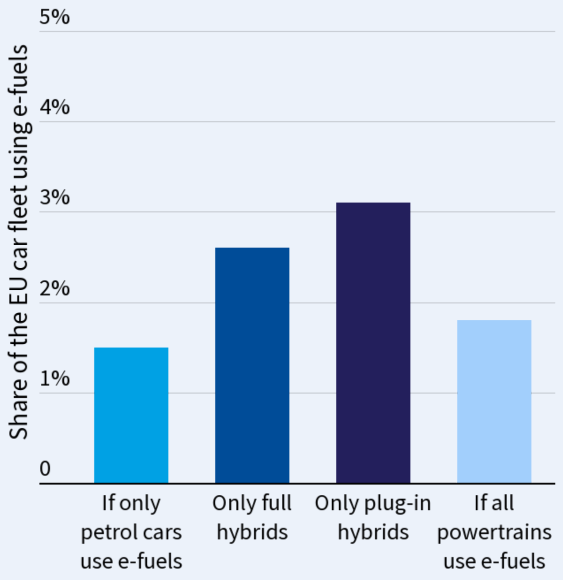
Why carbon neutral fuels will not significantly decarbonise the existing car stock

October 2022

Summary

Battery electric cars (BEVs) are the cleanest, cheapest and best option we have to decarbonise our cars, vans and most trucks, the largest source of carbon emissions in many countries. But Europe is losing ground to global competition: electric cars sales continue surging in China and the US while they have started to stagnate in Europe by the first half of this year. The decision by both the European Parliament and 27 Member States to phase-out all combustion engine models (ICEs) by 2035 is exactly the signal Europe's auto industry needs to ramp-up BEV production and reach affordability in the mass-market as early as possible. Yet the oil and automotive supplier lobbies claim that cars are better decarbonised by so-called "carbon neutral" synthetic fuels, or "e-fuels". This analysis looks at the viability of these neutrality claims and at how many cars can be realistically decarbonised by such fuels.

Only enough e-fuels for tiny fraction of the car fleet in 2035



Source: T&E modelling of the share of the EU fleet that can be driven on e-fuels in 2035. European synthetic fuel production scenario from the oil industry.

E-fuels will be in short supply

E-fuels production will still be in its infancy at the time when Europe plans to phase-out the sales of internal combustion cars. Based on the e-fuels industry forecasts, we estimate that 5 million out of the 287 million cars on the road can fully run on e-fuels in 2035. This is just 2% of the EU car fleet, a drop in the ocean. Even if the existing car fleet shifted to only hybrids, this number would only slightly increase to 3%.

The e-fuels volumes above cannot be certified to be 100% renewable. These would be even lower if only carbon neutral e-fuels - entirely made with additional renewables and CO_2 captured directly from the air - were used.

Plans to import climate neutral e-fuels into Europe in large quantities are also unrealistic as neither the production facilities nor global standards to certify them exist. This would also delay efforts in developing countries to decarbonise their own transport and economies, going against the principles of climate justice. Claims that e-fuels could be a large-scale solution for Europe's existing car stock are therefore not founded in reality.

In addition there are a number of other reasons why e-fuels are not suitable for decarbonising the EU car fleet:

E-fuels will keep damaging health

At a time when over 400 thousand Europeans die prematurely from air pollution and 2 out of 3 citizens of the EU's biggest cities demand cleaner air, Europe needs a credible plan to slash toxic pollution from cars, one of the biggest sources of air pollution. But T&E's tests show that e-petrol is not a clean fuel and, beyond particles, will do little to reduce toxic pollutant emissions of both regulated and unregulated pollutants compared to petrol fuel used today.

E-fuels are not a solution that average EU drivers can afford

Due to their higher prices and limited supply, e-fuels would mainly be used by executive and luxury car owners or wealthier drivers. As such e-fuels would not not benefit the average driver. T&E calculations have already shown that even under the most optimistic assumptions for the price of e-fuel in 2030, a driver with a petrol car running on e-fuel would be €10,000 worse off than a BEV owner on a 5-year usage basis. What European consumers need is not expensive e-petrol but affordable mass market electric models and cheap second hand BEVs alongside better public transport and shared mobility.

Our life cycle analysis show that fully electric cars can become cleaner than car running on the greenest e-fuel

T&E's life cycle analysis results demonstrate the limited CO_2 reduction potential of synthetic fuels. A petrol car running on a blend of e-fuel would only reduce its lifecycle emissions by 5% compared to running on petrol only. And, even if the car runs on 100% e-fuels meeting the EU's sustainability criteria, an average battery electric car bought in 2030 would still be 53% cleaner than e-fuel.

E-fuel production will require huge amounts of electricity

E-fuels in road transport are highly inefficient compared to direct electrification. The low efficiency of e-fuels means that the amount of renewables which would be needed to meet energy demand from road transport compared to direct electrification is huge. Swapping just 10% of cars to e-fuels and another 10% to hydrogen would push up electricity demand by 36%. Therefore, the use of such an inefficient energy source in road transport where more efficient direct electrification is available, will make the decarbonisation efforts unnecessarily costly and less optimal.

Ultimately, EU institutions should not give e-fuels in cars an exemption from the 2035 engine phase-out rules. E-fuels will only suck out renewables from the rest of the EU economy and derail decarbonisation in the sectors where such carbon neutral fuels are the only option, such as aviation and shipping. The use of e-fuels in road transport is only converting green electrons from renewable electricity and transforming them into a polluting hydrocarbon. As such, e-fuels are a Trojan Horse to continue oil's business as usual and delay the transition to true zero emission technologies. T&E calls EU institutions to secure a strong phase-out of combustion engines by 2035 without any inclusion of loopholes for e-fuels in the car CO_2 standards.

1. What are e-fuels?

E-fuels are synthetic hydrocarbons (the same type of chemicals which make up fossil fuels) which are produced from combining hydrogen and CO_2 through a complex chemical reaction known as a power-to-liquid process. As with fossil fuel crude oil, a refinery process is used to split the crude e-fuel into specific fuel fractions for specific uses such as e-kerosene (for aviation) or e-petrol for use in cars. The e-fuel industry states that e-fuels can be used both in new cars and within the existing fleet either as a drop-in fuel, i.e blended into fossil fuels, or used as a stand alone 100% e-fuel. Oil and car companies have been lobbying EU institutions to ensure that the use of e-fuels would be permitted under EU car CO_2 standards that will introduce a 100% CO_2 reduction target for new cars and vans by 2035.

2. How much of the existing cars stock can e-fuels decarbonise?

While recognising that BEVs are key for new sales, the oil and automotive industry argues e-fuels are needed to decarbonise the existing cars stock. T&E has taken assumptions from Concawe - a division of the European Petroleum Refiners Association - to calculate how much of the car fleet can be decarbonised using e-fuels based on the e-fuel industry's assumptions.

European e-fuels production in 2030-2040

This e-fuel production projection is based on Concawe's high end case scenario[1] , or the most optimistic scenario, in which synthetic fuels are deployed across the whole transport sector including road, aviation and maritime transport. E-fuels volumes in this scenario are based on projected installation of new e-fuel production units in Europe. According to Concawe's forecast, first e-fuel industrial size plants are expected after 2025 with an accelerated ramp-up starting around 2030 depending on renewables energy availability and its cost. This means the scenario is a best case scenario for e-fuel production and any issues with the availability of renewables or cost would lead to lower production.

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[1] Scenario 1 from:
https://www.concawe.eu/wp-content/uploads/Rpt_21-7.pdf

Overall, Concawe estimated a total availability volume of e-fuels of 1 Mtoe in 2030, 9 Mtoe in 2035 and 37 Mtoe in 2040. Concawe allocates these volumes between road transport, aviation and shipping. This results in 1 Mtoe in 2030, 6 Mtoe in 2035 and 21 Mtoe for road transport. Based on historical fuel consumption in Europe, 61% of fuel demand (137 Mtoe in 2020[2]) from road transport comes from cars. We assume that the same share (61%) of e-fuels is reserved for cars in Concawe's results for road transport. Therefore, we estimate that 0.6 Mtoe will be available for cars in 2030, 3.6 Mtoe in 2035 and 12.7 Mtoe in 2040. This is a high end estimate as e-fuels might be prioritised for vans and trucks as opposed to cars.

Only 1.8% of the EU's car fleet can be fully fueled by e-fuels in 2035

Based on the quantity of e-fuels available for cars and assuming that a pure blend of e-fuel is used to fuel cars - to meet the carbon neutrality assumption - about 5 million cars in the fleet could use e-fuel in 2035. This corresponds to just 1.8% of the EU fleet of 287 million cars expected in 2035. This shows **that e-fuels will not be able to decarbonise a significant portion of Europe's car fleet.**

This calculation is based on all powertrains using e-fuels but the share of the fleet that can be powered by e-fuels depends on the fleet's fuel consumption. The future fuel consumption forecast is uncertain as it depends on various factors, including but not limited to: the future powertrain split among the car fleet, the share of high-consumption cars such as sport utility vehicles (SUVs) or fuel efficiency improvements of new cars. Assumptions used by T&E for this analysis are included in the Annex.

To present a broader view on the possible outcomes, we defined 4 scenarios:

1. **Only conventional petrol cars use e-fuels:** The fuel consumption[3] assumption is based on a popular conventional petrol model, the VW Golf.
2. **Only full hybrids use e-fuels**: The fuel consumption assumption is based on a popular full hybrid model, the Toyota Prius.
3. **Only plug-in hybrids use e-fuels** : The fuel consumption assumption is based on a popular plug-in hybrid model, the Ford Kuga.
4. **All powertrains use e-fuels**: T&E's best estimate with a more granular forecast including all powertrains, efficiency improvement and increase in the SUV share (overview of assumptions available in Annex).

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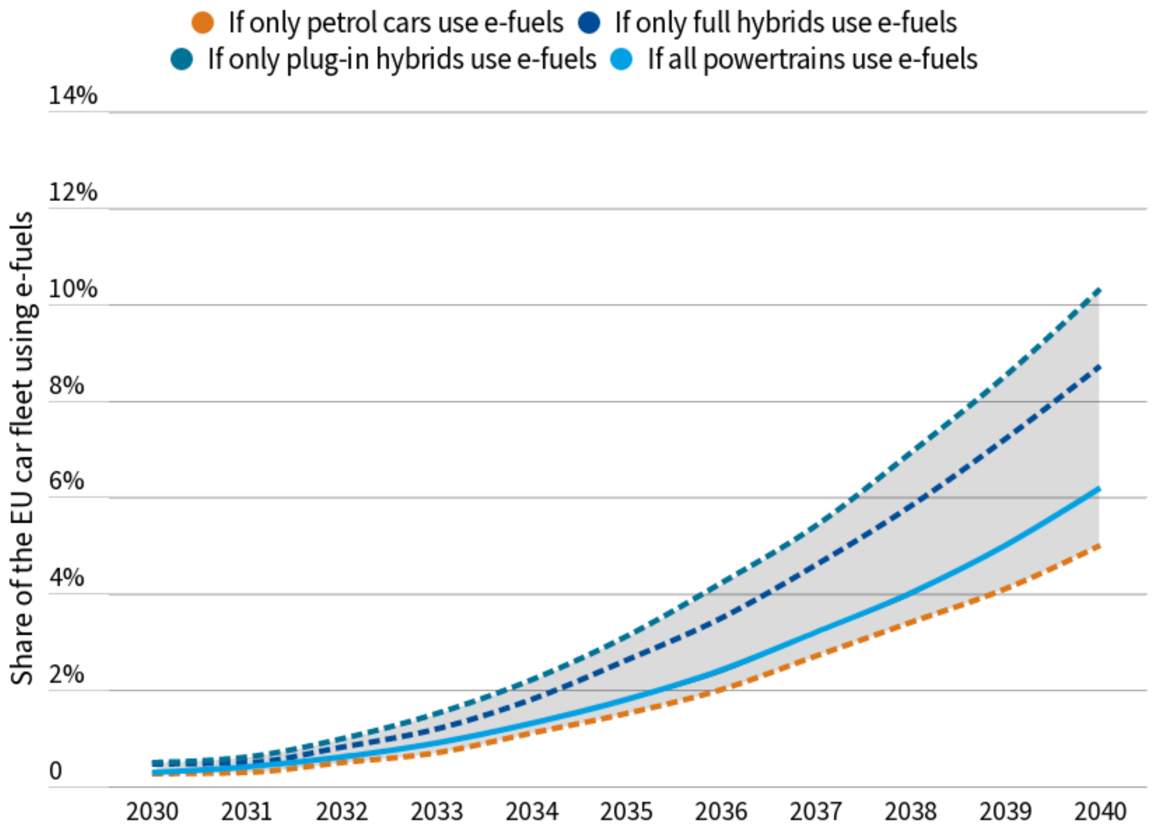
[2] Consumption estimated based on 2020 UNFCCC's annual GHG inventory. Nota: as 2021 data are not available yet, 2020 data is used but car activity was lower than usual during this year due to Covid lockdown.

[3] Fuel consumption data from Spritmonitor detailed in the Annex



Source: T&E modelling of the share of the EU fleet that can be driven on e-fuels. European synthetic fuel production scenario from the oil industry.

Figure 1: Estimated share of the EU car fleet that can be fuelled with synthetic e-fuels

Figure 1 displays the share of cars that can be fueled with e-fuels among the whole EU fleet under the different scenarios. Overall, our scenarios show that e-fuels would cover only between 1.5% to 3% of the EU car fleet's demand. The expected e-fuel production volume could be used to fuel:

- 4.3 million VW petrol Golf (1.5% of the fleet) in 2035,
- 7.5 million Toyota full hybrid Prius (2.6% of the fleet),
- 9 million Ford plug-in hybrid Kuga (3.1% of the fleet),
- 5 million cars on average with all powertrains (1.8% of the fleet).

The spread between a conventional petrol car and the hybrid vehicles highlights possible outcomes depending on fuel consumption. It should be noted that the 3 first scenarios are very optimistic as the vehicles chosen are relatively small and fuel efficient. If the future fleet composition is made up of large or less fuel efficient models the share of the fleet which can be powered by e-fuels will be lower than presented under these scenarios.

In all scenarios, the e-fuel production forecast by the oil industry does not provide a solution to decarbonise a significant portion of the EU car fleet. Concawe's forecast is also based on multiple assumptions that, if not realised, could further decrease the amount of carbon neutral e-fuels available for cars (these are further explored in section 4). One such example is the share allocated to other transport modes, namely shipping and aviation. Concawe's scenario does not allocate any e-fuel for shipping and aviation until 2035, when only a third of the total production volume is allocated to these sectors. This appears to underestimate the volume of e-fuels needed for shipping and aviation.

T&E estimated that 3.7 Mtoe[4] would be needed already in 2030 to start decarbonizing aviation and shipping. In 2035, 7 Mtoe of e-kerosene[5] would be required for aviation and about 12 Mtoe for shipping[6]. This is 6 times higher than assumed by Concawe for these two sectors in 2035 (3 Mtoe).

This means that Concawe e-fuels projections for the whole transport system are not even sufficient to adequately decarbonise aviation and shipping at the necessary pace to meet climate targets. Concawe's allocation of e-fuels mostly for road transport, where other better alternatives exist, therefore risks delaying the decarbonisation of sectors that have no other alternatives. As even the ambitious industry projections of e-fuels production are not enough to meet the needs of hard to abate sectors, no e-fuel should be allocated for inefficient use in cars where sufficient[7], more efficient alternatives exist.

3. Are e-fuels efficient?

The most efficient way to use renewable electricity for road transport is to directly charge electric vehicles as the least losses occur from production to use. For petrol cars running on e-fuels, substantial losses occur due to the energy intensive process of making e-fuels and transportation. The much lower efficiency of the internal combustion engine compared to an electric powertrain results in additional large losses. Today, on average, direct electrification is 77% efficient compared to 16% for petrol cars running on e-fuels[8]. To visualise these differences in efficiency, we compared the distance that two electric vehicles (VW ID.3 and BMW i4) could travel with two equivalent petrol vehicles (VW Golf and BMW 4 series) driven by e-fuel produced from the same amount (100kWh) of renewable energy. Figure 2 shows that the **electric cars could travel 5-6 times farther than their e-petrol counterparts on the same quantity of renewable electricity**.

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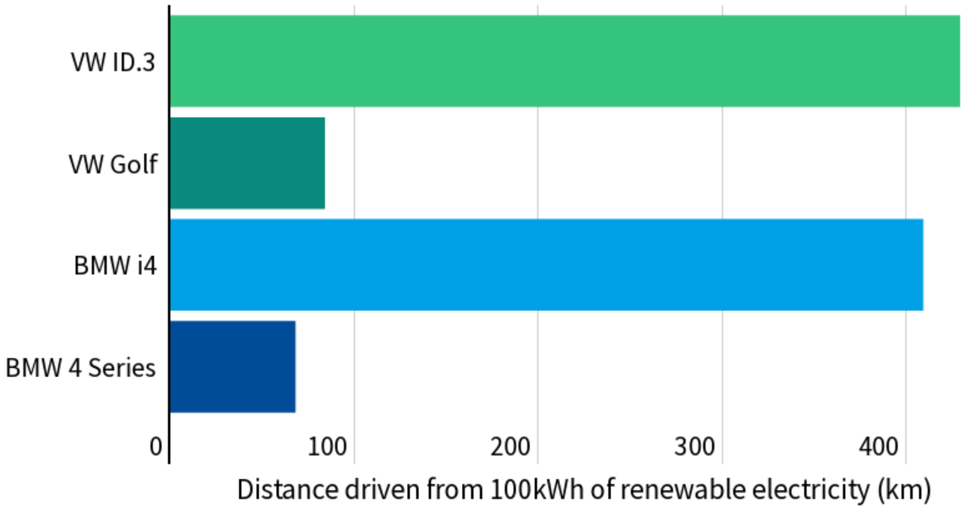
[4] In 2030, 158 PJ are required for shipping (e.g. e-ammonia), aviation (e-kerosene) and e-kerosene by-products in T&E Road2Zero proposal: https://www.transportenvironment.org/wp-content/uploads/2021/11/TE-Briefing-RED-II-review-Autumn-2021-Final-22.11.2021.pdf

[5] https://www.transportenvironment.org/wp-content/uploads/2021/11/ReFuelEU-position-paper-1.pdf

[6] 500 PJ according to T&E analysis: https://www.transportenvironment.org/wp-content/uploads/2022/02/FuelEU-Maritime-TE-Policy-Briefing_240322.pdf

[7] https://www.transportenvironment.org/discover/europe-risks-wasting-e27bn-battery-opportunity-with-weak-co2-targets-study/

[8] https://www.transportenvironment.org/wp-content/uploads/2020/12/2020_12_Briefing_feasibility_study_renewables_decarbonisation.pdf



VW Golf and BMW 4-Series ICE driven with pure e-fuel produced from 100% renewable energy
Source: T&E analysis based on vehicle fuel and electricity consumptions from spritmonitor.de.
For ICEs, a 55% e-fuel production efficiency is applied. For BEVs, additional losses include 7% T&D electricity losses, 5% losses from charger equipment and 5% losses from the battery charging efficiency.

Figure 2: Comparison of electric and e-petrol cars driven using 100kWh of renewable electricity

4. Can we guarantee e-fuel's carbon neutrality?

In theory, as claimed by the e-fuel industry[9], e-fuels could be considered as low carbon if the electricity used to generate the hydrogen used in e-fuel production and to produce the fuel itself comes from additional 100% renewable energy sources, and if the CO_2 is captured directly from the air (direct air capture, DAC). In practice, as all these technologies needed to produce e-fuels sustainably are not yet available commercially, there is a risk that the first e-fuel plants use fossil energy in some part of the production process. This is particularly a risk if a rapid ramp-up of e-fuels for cars is needed due to any incorporation of e-fuels within the car CO_2 standards.

There is no guarantee that e-fuels will be carbon neutral

Firstly, Concawe's forecast of e-fuel production includes both CO2 from DAC and CO2 captured from fossil sources, so the e-fuel produced under Concawe's forecast cannot strictly be considered as renewable. CO_2 could be extracted from facilities that burn fossil fuels instead of capturing it from the air given the early stages and cost of DAC technology. This is a problem because carbon capture from fossil sources will potentially lock-in investment in fossil sources, slow down their decarbonisation and will also result in a delay in DAC investments and developments.

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[9] https://www.efuel-alliance.eu/efuels/what-are-efuels

Secondly, hydrogen could be generated from fossil gas as it is the current most used production process[10]. If so, large amounts of greenhouse gas (GHG) emissions would result from hydrogen production.

Despite assurances by the e-fuels industry that e-fuels for cars will be made from 100% renewable additional electricity, there is no way to guarantee this in practice. While e-fuels will have to meet Renewable Energy Directive (RED II) sustainability criteria[11], there is no requirement for e-fuels to be produced from 100% additional renewable electricity. This becomes even harder to trace if parts of the e-fuel value chain are outside of Europe, in countries without dedicated regulations. In the case of Europe, the RED II criteria requires at least 70% greenhouse gas savings compared to their fossil fuel equivalent. T&E estimates that this would result in 15%-30%[12] of the electricity required for e-fuel production coming from non-renewable sources.

Concawe's scenario assumes that e-fuel production units could be connected to the grid with certification mechanisms used to "claim" that renewable energy is used for production. However, the only schemes which are able to ensure that additional 100% renewable electricity is used are: 1) Direct connection of the renewable source and e-fuel plant. 2) Power Purchase Agreements (PPA) where the renewable electricity is purchased directly from the wind or solar farm constructed specifically for e-fuel production thus guaranteeing additionality[13]. Additionally, to meet this criteria, electricity purchased through a PPA must be generated within the same hour as the e-fuel produced and be located in the same electricity bidding zone as the plant.

Other certification schemes are not able to guarantee additionality or that 100% renewables are used at all times. Guarantee of origin certificates (GO) are one such example of a scheme which cannot guarantee additional 100% renewable electricity use. For instance an e-fuel plant connected to the German grid producing e-fuel during a winter evening - when the grid is most carbon intensive - could purchase a GO from a Spanish solar farm and claim that the e-fuel is produced from solar electricity generated in Spain during the summer. This arises because GOs don't ensure that the location and time of electricity production matches consumption. This allows users to claim 100% renewable electricity use when in fact the electricity used in e-fuel production could be produced in large part using fossil fuels.

By including "other certification mechanisms" and carbon capture "from concentrated sources"[1], Concawe's scenario does not provide sufficient guarantees that the e-fuels produced in its forecast will be carbon neutral.

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[10] https://www.iea.org/reports/global-hydrogen-review-2021

[11] The RED outlines a regulatory framework to ensure the sustainability of so-called renewable fuels of non-biological origin.

[12] https://www.transportenvironment.org/wp-content/uploads/2022/05/TE_LCA_Update-June.pdf

[13] https://www.transportenvironment.org/wp-content/uploads/2021/07/T&E%20Briefing%20sustainability%20RFNBOs_202101.pdf

The large amount of additional renewables needed for e-fuel production may not be deployed quickly enough

Another issue is that additional renewable electricity capacity may not be deployed quickly enough to match demand from hydrogen and e-fuel production. This is particularly a risk due to the low efficiency of e-fuels which require large amounts of renewables to produce. On average, around five times more renewable energy is needed to drive a car the same distance using e-fuel[14] than is needed to directly charge a battery and T&E estimates that a wind farm 3 times larger than Luxemburg would be needed in a scenario that include 10% of the EU car fleet running on e-fuel[15]. The EU aims for a production of 10 million tons of green hydrogen by 2030, but there is already a risk that not enough renewables will be in place in time to hit that target. T&E estimated that this hydrogen targets is equal to 500+ TWh of additional demand, more than the electricity generated by all installed wind power in the EU27+UK in 2021[16].

Large demand for renewables from e-fuels could divert renewable capacity away from existing uses and risks increasing the carbon intensity of the grid if additional fossil fuel based generation capacity is brought online to meet demand, especially if GO are used to certify e-fuel production. The only suitable way to ensure that e-fuels don't divert existing renewables is to ensure all electricity used for their production comes from additional renewable energy sources through direct connection or well-defined PPA. These conditions are also required to ensure the sustainability of the whole automotive industry: any new energy intensive industrial projects from raw material refining, battery and car production to recycling need to ensure that energy is sourced in sustainable ways.

The actual quantity of e-fuel that could be generated economically in a carbon neutral way risks being limited and not enough to meet all sectors' demand, critically shipping and aviation if e-fuels are used in cars. So, instead of inefficiently generating e-fuel for use in cars, the limited supply of these fuels should be prioritised in usages for which no better alternatives can be found such as aviation or shipping.

5. Are e-fuel imports into Europe viable?

Concawe's scenario does not include the potential for e-fuel imports from outside the EU. However, proponents of e-fuels for cars[17] say that e-fuels can be produced outside of Europe - in countries where there is abundant solar or wind - and import them into the EU. In reality, these imports, at least in the medium term, appear unrealistic.

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[14] Based on efficiency calculated in: https://www.transportenvironment.org/discover/electrofuels-yes-we-can-if-were-efficient/

[15] The scenario also includes 10% cars running on hydrogen (which is more efficient than e-fuels by around 50%). More details available in: https://www.transportenvironment.org/discover/magic-green-fuels-why-synthetic-fuels-in-cars-will-not-solve-europes-pollution-problems/

[16] https://www.transportenvironment.org/discover/getting-hydrogen-right-from-the-start/

[17] https://www.efuel-alliance.eu/efuels/global-energy-potentials-efficiency

E-fuels imports in the medium term

In the hypothesis where e-fuel production would be ramped-up outside of the EU, **T&E believes that these imports would not be realistic in the medium term because no certification, standards, or long-term contracts are in place to guarantee the sustainability of these fuels**. Importing e-fuels from outside the EU would add extra cost, emissions and energy losses associated with transportation, thereby increasing their overall inefficiency and only making the use of e-fuels in cars more expensive.

E-fuel costs are sensitive to differences in the cost of capital. Agora Energiewende[18] explained that some e-fuel exporting countries are subject to higher capital costs because of country-specific risks such as political or regulatory instability. They report that studies often assume capital costs of less than 8% but these costs are underestimated for many countries, for intance 11.8 % for Morocco and 10.5% for Algeria are more realistic values. Such premiums could increase the costs of imported synthetic fuels.

E-fuel imports are also highly dependent on the capacity to ramp-up hydrogen production globally. However, global electrolysis ramp-up is challenging. Odenweller et al.[19] showed that the largest planned annual capacity additions of electrolysers are uncertain and unlikely to occur before 2043 globally. They advise to maintain a realistic judgement on long-term hydrogen prospects and to foster available and more efficient alternatives such as direct electrification and energy efficiency. Lack of green hydrogen production capacity could lead exporting countries to favour the use of hydrogen made from or with fossil fuels[20].

An additional technical problem for e-fuels plans in North Africa and the Middle East may be their dry climate. While prototype DAC plants have been successfully operated under a range of climate conditions in Europe and North America, the International Energy Agency[21] mentions that some concerns remain on using DAC in locations characterised by an extremely dry climate. It could prove challenging for some countries to efficiently capture CO_2 from the air and could prevent the efficient use of DAC. Facing these technical challenges, countries with dry climates hoping to export e-fuel may be inclined to use CO_2 captured from fossil sources. This would not produce fuels which are carbon neutral.

Therefore, it is highly uncertain if e-fuels made from CO2 captured using direct air captured and renewable electricity will be produced as widely as hoped by the e-fuels industry. To ensure that e-fuels are made sustainably these imports would need to be subject to standards and emission monitoring schemes to take into account the full environmental consequences of production which are not in place today. Any such certification scheme will require strong international coordination to be implemented.

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[18] https://www.agora-energiewende.de/fileadmin/Projekte/2017/SynKost_2050/Agora_SynKost_Study_EN_WEB.pdf

[19] https://www.nature.com/articles/s41560-022-01097-4

[20] Steam methane reforming or electrolysis with very carbon-intensive electrical systems, such as Morocco or Algeria

[21] https://www.iea.org/reports/direct-air-capture

Importing e-fuels would go against climate justice principles
The decarbonation of all sectors of the economy needs to happen everywhere on the planet, not just in the EU. Many of the places where the e-fuels industry[17] proposes to produce e-fuels (for instance North Africa, Middle East or Chile) for import to the EU are also located in regions where the energy transition is just starting or where many people do not have access to electricity, let alone renewable electricity. It is not socially just or morally acceptable to prioritise renewable electrons for EU e-fuels when the local population do not have access to sufficient renewable electricity for their basic needs.

Renewable energy converted to hydrogen and synthetic fuels in the Global South or other regions outside the EU should instead be used to firstly decarbonize local or regional electricity grids and transport sectors especially since the decarbonisation of car fleets is lagging behind in these regions. When these regions complete their transition, then they can choose to export surplus capacity to other countries. Climate justice principles imply that the decarbonisation of developed countries should not hinder the decarbonisation of developing countries, instead the EU should support them to make their whole economy greener. Prioritising green electrons for EU e-fuels inherently takes renewable capacity away from local use hindering their transition.

Creating a new fuel dependency will not help EU energy sovereignty
Moving from a dependency on oil to a new dependency on e-fuels is not a good solution for the EU's energy sovereignty. Transport is the largest consumer of oil in the EU, and the EU is dependent on imports for 97% of the oil that it uses[22]. This heavy reliance on oil presents a significant geopolitical risk because the EU has no control over supply or pricing leaving the economy exposed to fluctuations driven by external events. For instance, Russia is the second biggest oil exporter in the world and Europe is its biggest customer. The Russian invasion of Ukraine caused a large spike in oil prices driving inflation in the EU, impacting the economy and consumers.

At a time when the EU strives for energy security and resilience to face geopolitical energy risks[23], a new insecure supply chain for e-fuels would lock the EU into a new dependency which would come with similar problems that oil dependency brings today. Instead, energy security needs to be based on renewable and circular solutions available on the continent. Even though battery electric vehicles will initially require imports of minerals from outside the EU, recycling and the creation of a battery ecosystem in Europe will steadily increase the EU's long term material autonomy. The new Critical Raw Materials Act currently under development by the European Commissions will boost strategic domestic projects to guarantee metals supply.

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[22] https://www.transportenvironment.org/discover/how-russian-oil-flows-to-europe/
[23] https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3131

6. Conclusions

The urgency with which we have to decarbonise all sectors of our economy does not allow us to bet on a not yet commercially available technology in a sector where a superior zero emission alternative - battery electric cars - already exists and are sold in their millions. The idea that e-fuels can be anything more than a minor solution for the existing car stock is once again a myth. Based on an already optimistic forecast from the oil industry where synthetic fuels are produced with the EU grid, only 1.8% of the EU car fleet (5 million cars out of 287 million) can fully run on e-fuel in 2035. These already low numbers would be even more limited if only carbon neutral fuels made from 100% additional electricity and CO_2 captured from the air were used.

The truth is that those pushing for e-fuels do not have affordability, decarbonisation or technological openness in mind. What's driving them is short-term economic interest to take advantage of the existing engine-oil business as much as possible, before the inevitable end of the ICE-age.

We cannot ignore the fact that the overall quantity of e-fuels available for cars will be minimal in 2035 and fully renewable e-fuels (i.e. produced using additional renewables and direct air capture of CO_2) will be even scarcer. Ultimately using e-fuels in cars would just delay scaling up of battery electric vehicles, divert renewables from the rest of the EU economy and derail decarbonisation in the sectors where such carbon neutral fuels are the only option, such as aviation and shipping. **Therefore, current considerations in the EU Cars CO_2 review to allow "carbon neutral" e-fuels in diesel and petrol cars beyond the 2035 engine phase-out will not create a large-scale solution to decarbonise cars. Instead, they would delay investments and focus away from the most optimal way to make cars and vans zero emission.**

Further information

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Annex: main assumptions

- Fuel consumption used in Figure 1 scenarios:
    - VW petrol Golf fuel consumption: 7.3 L/100km from spritmonitor.de
    - Toyota HEV Prius fuel consumption: 4.2 L/100km from spritmonitor.de
    - Ford PHEV Kuga fuel consumption: 3.6 L/100km[24] from spritmonitor.de
    - Whole EU fleet[25] fuel consumption: from 6.6 L/100km in 2030 to 5.9 L/100km in 2040 estimated based on T&E modelling with hypotheses detailed below.
- The EU fleet size forecast is based on T&E's in-house transport emission model (EUTRM). From 246 million cars in 2020, the transport model leads to 268 million cars in 2030, 287 million in 2035 and 302 million in 2040.
- The fuel consumption for new car sales is based on a forecast for each powertrain and the change in the sales share of each powertrain from LMC Automotive's Global Hybrid & Electric Vehicle Forecast (Q2 2022 update).
- Reference fuel consumptions in 2021 are based on extracted data from Spritmonitor real-world fuel consumption for a representative number of models. Average by powertrain weighted based on 2021 sales from Dataforce. The extracted data amounts to 74% of petrol car sales and 86% of full hybrid (HEV) sales.
- The methodology to derive the real world consumption of plug-in hybrids (PHEVs) is described in the 2022 update of T&E life-cycle assessment study[26].
- The forecast of average EU fleet fuel consumption is based on new car sales and an average 15 year lifetime with a decrease of activity based on the car age. On average, we assume a car drives 15,000 km/year.
- The fuel efficiency improvements for new sales is based on the following hypotheses:
    - Petrol vehicles fuel consumption decrease by 1.5% every year until 2025
    - Mild and full hybrid vehicles fuel consumption decreases by 1.5% every year until 2025, then by 1% every year until 2030 and by 0.5% every year until 2035.
    - PHEVs utility factor is estimated to increase from 40% in 2022 to 60% in 2035 (based on an increase in electric range and increase in the share of private vehicles compared to company cars)
    - Each powertrain group was splitted between SUVs and non-SUVs in order to take into account the fuel consumption increase due to the SUV sales growth. Based on historical trends, the SUV share of new sales is expected to grow from 50% in 2022 to 84% in 2035.

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[24] This value from Spritmonitor could be conservative as we estimated 3.9 L/100km based on the 2027 update of the PHEV utility factor curve. This implies that the utility factor resulting from Spritmonitor is based on a higher share of EV driving (higher share of private cars vs company cars and Spritmonitor users are probably more conscious about their fuel consumption).

[25] Excluding zero emission vehicles

[26] https://www.transportenvironment.org/wp-content/uploads/2022/05/TE_LCA_Update-June.pdf