E-fuel cars are not zero emission

E-petrol cars under current RED framework would emit 61 gCO2e/km in 2035

October 2023

Summary

In September 2023, the European Commission shared a draft text which defined a new category of vehicles running exclusively on synthetic fuels (or e-fuels). The central point of discussion is around the level of greenhouse gas (GHG) reduction that these e-fuels should achieve. Currently, e-fuels only need to meet a 70% GHG emissions reduction threshold compared to fossil fuels, as per the EU's Renewable Energy Directive methodology (RED).

T&E analysis shows that **e-petrol cars would emit 61 gCO2e/km in 2035 under the existing RED e-fuel system**. This contrasts with EVs, which would only emit 13 gCO2/km when charged with electricity from the EU average grid in 2035. Under such a system, e-petrol cars would be considered CO_2 neutral but would still emit around five times more CO_2 emissions than equivalent EV models. Additionally, e-petrol cars emit air pollutants, including toxic nitrogen oxides (NO_x) and carcinogenic particles.

In short, for the EU to respect the official agreement and decision of co-legislators, it is not possible to allow e-fuels that do not reach a 100% GHG reduction when used in cars. In particular a 70% reduction would disregard the existing agreement to only allow "*vehicles running exclusively on CO_2 neutral fuels*".

T&E recommendations:

- E-fuels allowed in cars should comply with a strict framework to certify and ensure RFNBOs deliver 100% CO_2 reduction. Such rules should ensure that all of the electricity used in the process (production of the e-fuel and DAC) is 100% generated from additional renewable energy sources. The carbon used must also be from 100% direct air capture (DAC) to prevent any additional CO2 being released into the atmosphere. The RED RFNBO methodology also covers emissions from the transport and distribution of RFNBOs, which are a minimal part of total emissions (estimated at maximum 2%-3%). The methodology always ensures the feasibility of the achievement of 100% GHG emissions reduction. The preferred option is to use RFNBOs delivering high GHG savings or even carbon-neutral fuels for the transport of these carbon-neutral fuels (i.e. nearly CO2-neutral ships and electric trucks). It is also legally possible to offset any residual emissions from the transport and distribution of the e-fuel through the purchase of offsets from projects using carbon capture and storage (CCS).
- E-fuel cars should not be designated as zero-emission for the purposes of regulatory compliance given they still emit toxic air pollutants. Otherwise it would undermine efforts to reduce pollution and establish low- and zero-emission zones in European cities.

See T&E's position paper for more.

Introduction

In September 2023, the European Commission shared a draft text which defined a new category of combustion cars powered by renewable fuels of non-biological origin (RFNBOs, or e-fuels) only. This falls under the new car CO_2 regulation agreement, found between co-legislators in March 2023, that requires CO_2 emissions from new cars and vans to be zero in 2035 (0 gCO_2/km). The recital 11[1] of the regulation only allows vehicles running on "CO_2 neutral fuels" to be registered in the EU after 2035. In its statement the Commission clearly states that this recital would be used as "the starting point for legislative initiatives"[2]. To read more on this please see T&E's position paper.

Following the draft text from the European Commission shared in September, subsequent political discussions relate to the greenhouse gas (GHG) reduction criteria for RFNBOs. Under the Renewable Energy Directive (RED), the methodology to certify RFNBOs only ensures that they need to meet a 70% GHG emissions reduction threshold compared to fossil fuels (in a WTW approach, i.e. where renewables are counted as zero emission)[3]. The draft proposed by the European Commission rightly proposes a 100% GHG emission reduction target - in line with the agreement to only allow vehicles powered by "CO_2 neutral" fuels.

T&E analysis presented here, calculates the impact of registering and running cars on e-petrol under the 70% reduction criteria after 2035.

Results: E-petrol cars under current RED RFNBO criteria would emit 61 gCO2e/km

T&E's calculations show that in 2035, a medium size petrol car powered by e-petrol produced under the current RED framework for RFNBO's would emit 61 gCO_2e/km (in well to wheel). For comparison, the emissions of the same car running on fossil petrol are around 200 gCO_2e/km (WTW)[4].

Use of e-fuels also has no effect on the tailpipe CO_2 emissions of cars compared to fossil fuels as they remain the same whether fuelled by regular petrol or e-petrol.

[1] Recital 11 states that, "the Commission will make a proposal for registering after 2035 vehicles running exclusively on CO_2 neutral fuels in conformity with Union law, outside the scope of the fleet standards, and in conformity with the Union's climate-neutrality objective."
[2] https://data.consilium.europa.eu/doc/document/ST-6740-2023-ADD-1-REV-2/en/pdf
[3] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32023R1185&qid=1693820063812
[4] Assumptions: Medium size C segment car in 2035. Real world consumption: 6.8 L/100km for the petrol car. Total lifetime distance traveled is 225,000 km. See T&E EV LCA for more details: transenv.eu/lca

The lower GHG emissions of e-petrol is due to the CO2 emitted at the tailpipe being offset by an equivalent amount of CO2 captured elsewhere as a source of carbon used to make the fuel by combining with hydrogen. While this process could theoretically achieve a 100% reduction in emissions if all energy sources used are additional renewables and all carbon sourced from CO2 from DAC, the RED relaxes these criteria allowing e-fuels to reduce emissions by 70% compared to fossil fuels (resulting in net emissions of 61 gCO2e/km).

For comparison, an equivalent electric car registered in 2035 that is charged with electricity from the EU average grid indirectly emits only 13 gCO_2e/km[5]. These CO_2 emissions are generated from fossil fuels (coal and gas) burnt for the production of electricity[6].

As a result, during the use phase, the **e-petrol car would emit close to 5 times more CO_2 emissions than the electric model**. Over a full year of driving, the emissions from the e-petrol car would result in around 1 tCO_2e emissions (around 0.2 tCO2e for the electric car). In other words, **for every 1 million e-petrol cars placed on the road after 2035 (around a tenth of 2022 car EU car sales)[7], around 1 Mt CO2e emissions per year would be emitted** (or 0.8 Mt CO_2 emissions per year additional compared to a 100% BEV scenario in 2035, i.e. 80% of the total). The annual emissions from this supposedly CO2 neutral technology would thus be equivalent to approximately half of the annual car emissions from a country like Latvia or Estonia for every million e-petrol car placed on the road.

[5] Assumptions: Medium size C segment car in 2035. Energy efficiency: 16.3 kWh/km for the EV. Total lifetime distance traveled is 225,000 km. See T&E EV LCA for more details: transenv.eu/lca

[6] The EU electricity grid is rapidly decarbonising and the average emissions from EV are thus also decreasing and will reach zero once the grid is fully decarbonised (by 2050 at the latest and as soon as 2030 in some countries). In the RED RFNBO methodology, the carbon intensity of renewables is counted as zero emissions.

[7] 9.3 million. ACEA. (2023) New passenger car registrations in the EU.

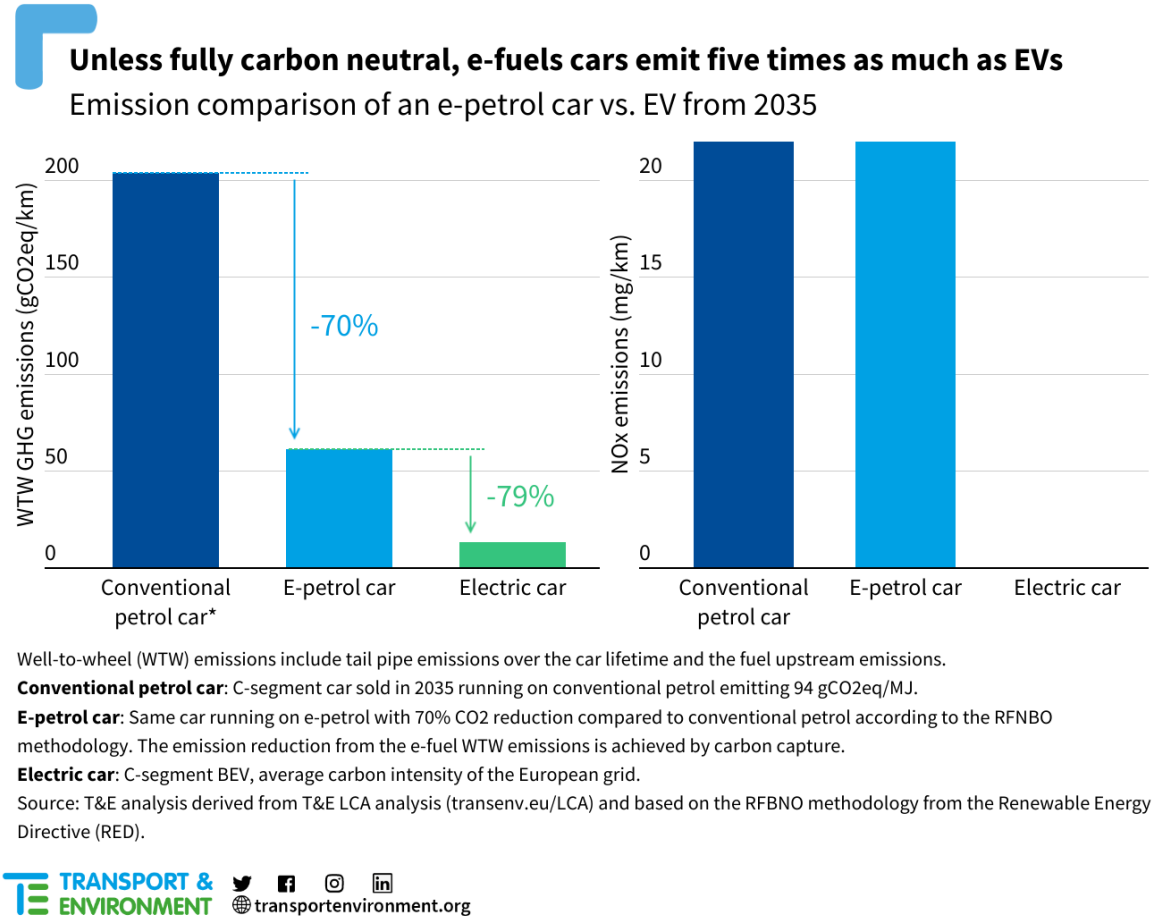


Figure: Emission comparison of an e-petrol car and an EV in 2035

Moreover, in the RED RFNBO framework, there are no requirements to have e-fuels produced with carbon captured directly from the air (Direct Air Capture, or DAC) before 2041[8]. Without further regulatory requirements, CO_2 from industrial sources is expected to be the main source of CO_2 for RFNBO's until the late 2030's as this technique is cheaper and more developed compared to DAC. Unlike DAC, the use of fossil point sources, such as industrial emissions, results in a net increase in atmospheric CO_2. By enabling industries to sell the captured carbon, it also has the unintended effect of weakening the price signal of ETS carbon pricing, and as a result the incentive for industries to move away from fossil fuels. Crucially, the aim is to reduce CO2 emissions at source from all sectors, including industry, in the coming decades - rather than delaying CO_2 emissions - so this cannot be an acceptable pathway.

Key ask: A new framework is needed to certify and ensure RFNBOs deliver 100% CO2 reduction

T&E strongly opposes using e-fuels in road transport (for more details on this please see T&E briefing

[8] Use of industrial emissions is allowed until 2036 for emissions from power generation and 2041 for other ETS covered sources. Biogenic carbon emitted during the combustion and production of biofuels is another eligible source of carbon. However, sustainable biogenic CO2 is limited in supply as about half will be sent to storage. See T&E (2022) Scaling up Direct Air Capture.

from March 2023). However, in the context of the implementing act on e-fuels for cars currently discussed, only e-fuels delivering 100% GHG reduction can be justifiable.

To ensure e-fuels can be certified and guaranteed CO2-neutral, new rules are needed to ensure that all of the electricity used in the full production process is both 100% generated from renewable energy sources and additional. The carbon used must also be from 100% direct air capture (DAC) to prevent any additional CO_2 being released into the atmosphere. This is not currently a requirement for RFNBOs.

See T&E's position paper for more.

In addition to CO_2, e-petrol also emits air pollutants, notably toxic NO_2 and carcinogenic particles. T&E tests[9] have shown that cars powered by e-fuel emit as much nitrogen oxides (NOx) as fossil fuel engines (around 22 mg/km) and much more carbon monoxide and ammonia, doing nothing to alleviate the air quality problems in our cities.

Defining e-fuel vehicles as zero-emission will undermine action to reduce pollution from cars across Europe including by undermining existing and planned low- and zero-emission zones in cities across the EU by potentially allowing e-fuel vehicles to continue to enter and pollute such zones.

Key ask: E-fuel cars should not be designated as zero-emission for the purposes of regulatory compliance

Even if produced according to a CO_2-neutral pathway (100% additional renewable energy and direct air capture), when burned in an combustion engine, e-fuels still emit toxic air pollutants. So e-fuel type approved vehicles should not be allowed to have a zero emission vehicle denomination in certificates of conformity (CoC) for the purposes of EU vehicle standards, local emission rules or national taxation.

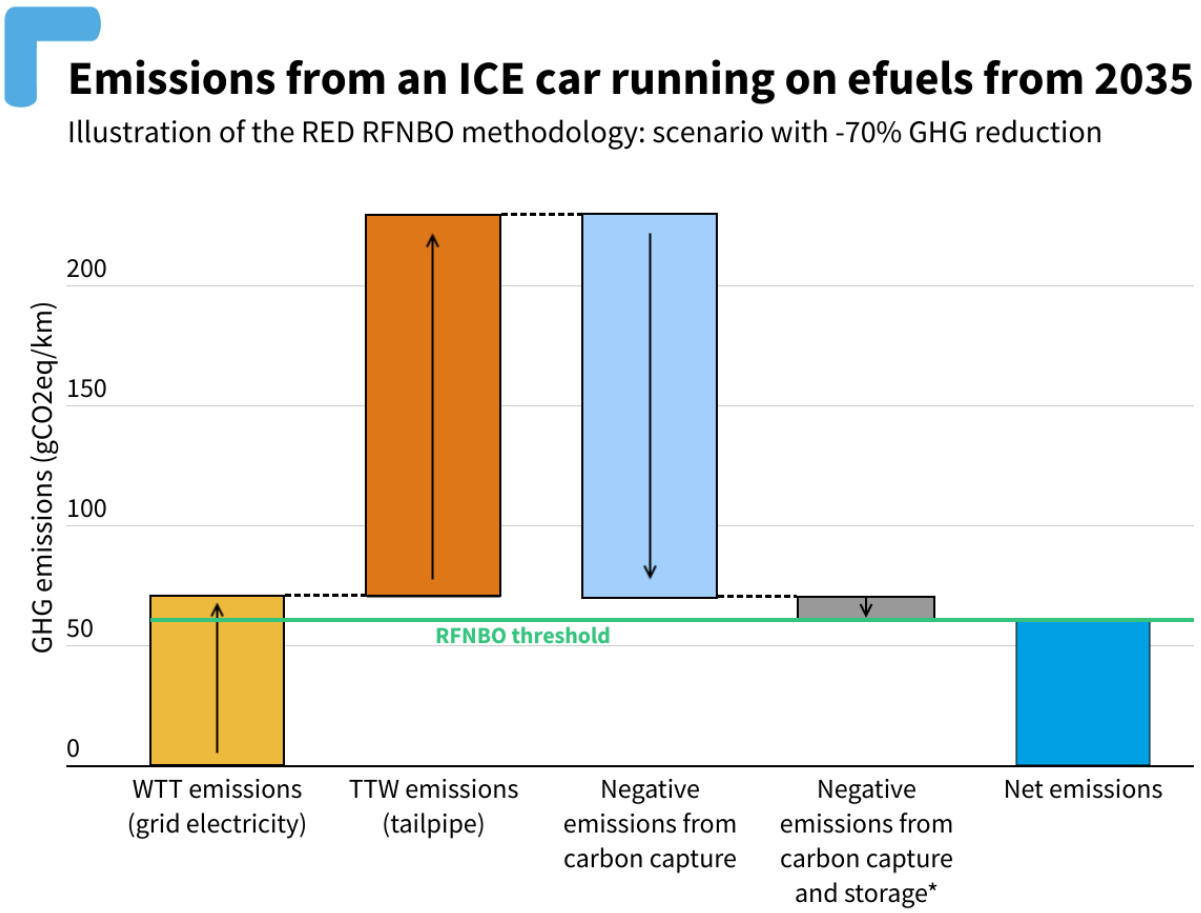
See T&E's position paper for more.

Annex - illustration of an example pathway for e-fuel emissions from e-petrol cars

In the example below we provide an illustrative overview of the positive and negative emissions from the different processes leading to net emissions of 61 gCO_2e/km for e-petrol cars (i.e. in the -70% GHG emission reduction scenario). In this scenario, the e-fuel is produced with electricity from the grid (average grid electricity) over the lifetime of the vehicles (2035-2050). This leads to efuel production emissions (WTT) higher than what is necessary to achieve the 70% emission reduction when accounting

[9] T&E. (2021) Magic green fuels: Why synthetic fuels in cars will not solve Europe's pollution problems.

for the carbon that has to be captured to produce the e-fuel. Hence, to achieve a 70% reduction (or to reduce even further the emissions), there needs to be additional carbon capture and storage leading to higher negative emissions (gray bar). T&E does not support this scenario, as the e-fuel is not produced with 100% renewable and additional electricity along the whole process (including with DAC for carbon capture). It can be noted that in the situation where there are residual transport and distribution emissions, these emissions can be offset by CCS and the e-fuel could thus still reach the 100% GHG reduction[10].



E-fuel well-to-tank (WTT) refers to all positive emissions resulting from e-fuel production from grid electricity.
E-fuel tank-to-wheel (TTW) refers to all positive emissions resulting from the combustion of e-fuel.
Carbon capture is carbon captured from the air or industrial processes which is used for the e-fuel production.
* In this case, to meet the RFNBO 70% emission reduction threshold, more carbon needs to be captured than the carbon tailpipe emissions from burning the fuel. Therefore, this additional carbon will need to be permanently stored geologically. This can be avoided if at least 13% of the electricity used to produce e-fuel comes from a direct connection to renewables or a power purchase agreement (PPA), and the rest from the grid.
Source: T&E analysis based on the RFBNO methodology from the Renewable Energy Directive (RED) applied to a medium car bought in 2035 and driven for 15 years.

Figure: illustrative example for an e-fuels emissions scenario compatible with the RFNBO methodology

[10] Article 10, Annex of the Delegated Regulation (EU) 2023/1185 of 10 February 2023 specifying a methodology for assessing greenhouse gas emissions savings from renewable liquid and gaseous transport fuels of non-biological origin and from recycled carbon fuels.