CLEAN FUELS FOR ALL

- WHAT ARE RENEWABLE FUELS ?
- WHAT ARE E-FUELS?
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WHAT ARE RENEWABLE FUELS?

Liquid fuels have been powering our transportation modes for over 100 years thanks to some unique qualities:

- Unrivalled **energy density**
- Ease of **use and safety**
- **Ease of distribution and storage** for all transport sectors
- **Existence of an extensive and resilient infrastructure** across Europe for their production

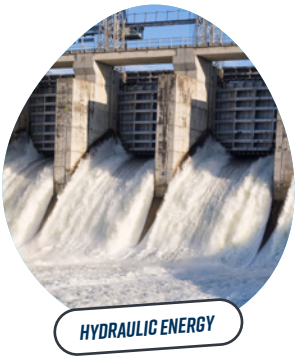
Renewable fuels are of biogenic (biofuels) or synthetic (e-fuels) origin, unlike conventional fuels made from petroleum.

Renewable fuels are produced from waste, sustainable biomass*, renewables and biogenic** or captured CO_2. They emit no or very limited additional CO_2 during their production and use.

*Biomass is organic matter from forestry, agriculture and waste.
**Biogenic CO_2 is CO_2 released as a result of the combustion of biomass.

WHAT ARE E-FUELS?


SOLAR ENERGY


HYDRAULIC ENERGY


WIND ENERGY

What are e-fuels?

E-fuels are produced with electricity from renewable sources such as wind, solar or hydro, water and captured CO_2.

The electrolysis process to make hydrogen is complemented with the help of the Fischer-Tropsch synthesis* adding captured CO_2 and converting it into a liquid fuel.

*Industrial process that transforms hydrogen and carbons into liquid hydrocarbons.

WHAT ARE BIOFUELS?

What are biofuels?

There are two categories of biofuels: 1st generation and advanced biofuels.

The difference between those two is related to the feedstock and to the technological process used in their production. The feedstocks of the 1st generation biofuels can also be used in food production.

As a result, the use of these biofuels is capped by European legislation at 7% of the total energy of fuel.

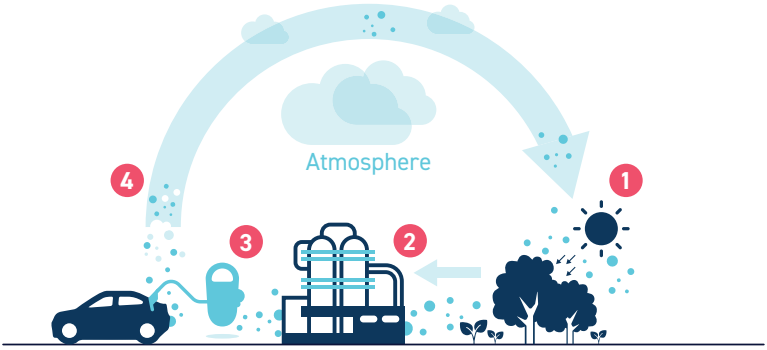
On the contrary, there is no such limit for advanced biofuels.

Advanced biofuels' feedstocks are non-food-crop based and include residues from forestry, agricultural residues (straw and stover) and or waste materials (e.g. waste from industry, waste oil & fats – e. g. waste cooking oils).

THE IMPORTANCE OF CARBON CYCLE

Biogenic CO_2

Biogenic CO_2 biofuels contains CO_2 thanks to the photosynthesis process, therefore no addition of CO_2 is required for these fuels.



Photosynthesis

1. Photosynthesis (capture of the CO_2 by the biomass).
2. Transformation of the biomass to produce biofuels.
3. Use of biofuels in the internal combustion engine.
4. Release of the biogenic CO_2 into the atmosphere.

By using biofuels, we do not increase CO_2 into the atmosphere, making biofuels carbon neutral.

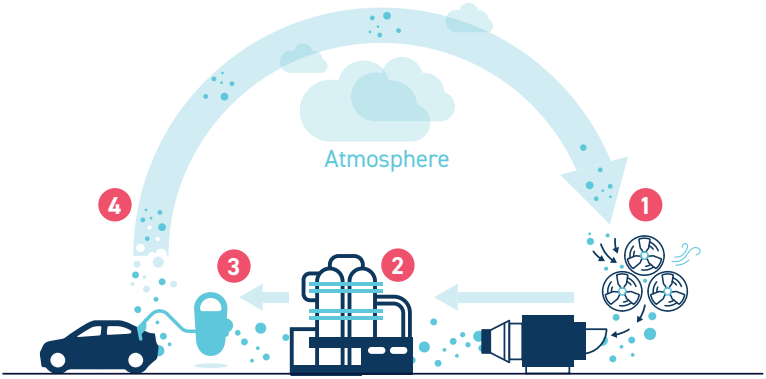
THE IMPORTANCE OF CARBON CYCLE

Carbon is an essential element for all life forms on Earth. Whether to help manufacture goods or release carbon as part of respiration, the intake and output of carbon is a component of all plant and animal life. To allow the phenomenon of combustion to happen, CO_2 is also required.

The carbon cycle can only be carbon neutral if this cycle is circular, which is the case with biogenic and captured CO_2.

Captured CO_2

For e-fuels, the principle is the same but the process is different: e-fuels are made from green electricity and captured CO_2. This CO_2 directly captured from the air thanks to a DAC (Direct Air Capture) is added to the fuel.



Captured CO_2

1. Capture of the CO_2 in the air.
2. Electrolysis of water with green electricity and addition of CO_2.
3. Use of e-fuels in the internal combustion engine.
4. Release of the captured CO_2 into the atmosphere.

By using e-fuels, we do not increase CO_2 into the atmosphere, making e-fuels carbon neutral.

WHAT IS A LIFE-CYCLE ANALYSIS?

What is a life-cycle analysis?

There are several ways to measure the CO_2 emitted by a vehicle: in the EU, emissions are only measured at the tailpipe when using the vehicle.

However, it is also important to measure the CO_2 emitted while producing the energy used to power the vehicle. That production requires energy that also emits CO_2. The amount of CO_2 depends on the type of energy used. For example, emissions will be different for electricity produced from renewables or from coal.

Finally, emissions from the production of the vehicle, its components, such as the battery or fuel cells, and its recycling also need to be measured.

A life-cycle analysis takes into account all these elements: the production of the vehicle; the production of the energy powering the vehicle; its utilisation; and its recycling.

EMISSIONS AT THE TAILPIPE

EMISSIONS FROM THE PRODUCTION OF THE ENERGY

EMISSIONS FROM THE PRODUCTION OF THE VEHICLE, ITS COMPONENTS AND ITS RECYCLING

NO NEED TO CHANGE YOUR CAR: JUST CHANGE YOUR FUEL!

Is it the end of the internal combustion engine?

The internal combustion engine has transformed modern society by enabling a thriving transport sector and by boosting economic activity.

No, it is not the end of the internal combustion engine. By embracing renewable fuels, we can keep the benefits of the internal combustion engine without any impact on climate simply by closing the carbon cycle thanks to the use of recycled carbon.

Powered with renewable fuels, the internal combustion engine also complements the electrification of vehicles, including hybridisation and plug-in hybrids, enabling zero-emission, regardless of the driving mode used.

No need to change your car: just change your fuel!

Today, there are different technologies:

Internal Combustion Engine (ICE) is a vehicle 100% powered by an internal combustion engine.

Battery Electric Vehicle (BEV) is a vehicle which is 100% powered by the electricity stored in its battery through one or several electric motors.

Plug-in Hybrid Electric Vehicle (PHEV) is a hybrid electric vehicle, generally with a bigger battery, which can be recharged on the electricity grid. Its energy comes from the fuel and the electricity stored in the battery.

Hybrid Electric Vehicle (HEV) is a vehicle which contains both an internal combustion engine and a electric motor, both a fuel tank and a (small) battery, but 100% of its energy comes from the fuel tank as the battery cannot be recharged on the electricity grid.

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