The Big Picture

Why a Well-to-Wheels approach is key to meeting GHG reduction targets

The sustainable mobility challenge

GHG

We need to reduce greenhouse gas (GHG) emissions from transport. **Today.**

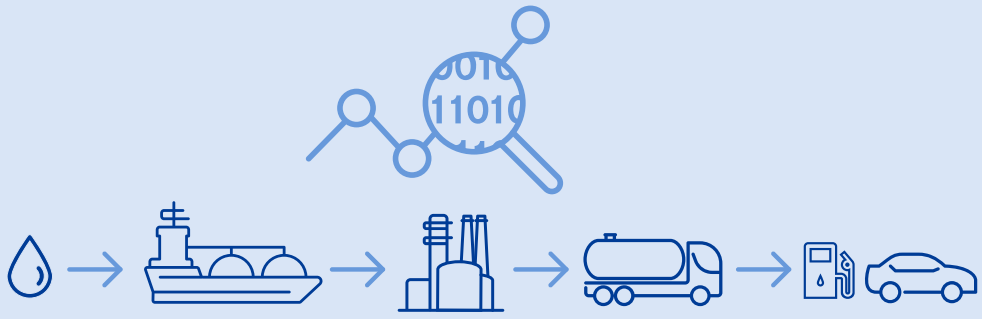
Two different approaches to calculating the emissions from road transport

Tailpipe emissions

Only the emissions **generated by the combustion** of the fuel are counted.

Well-to-Wheels emissions

All emissions over the life cycle of the fuel are counted, **from raw materials to fuel use.**



While a tailpipe approach does not provide the full picture, **a well-to-wheels analysis is based on a holistic assessment of the fuel's entire life cycle: from raw material, fuel production, to fuel use, including all transportation steps.**

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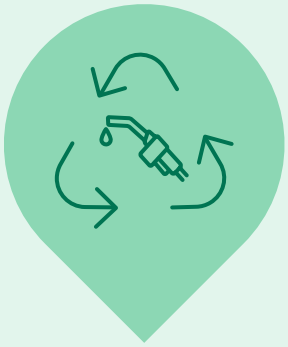
What powers road transports and which emissions should be taken into account?

Fossil fuels

Fossil fuels contain carbon that was stored underground for at least thousands or even millions of years. **When the fuel is burned in the engine, the carbon is released as CO_2 into the atmosphere, subsequently accelerating the climate change**

This, however, is not the fuel's full climate impact, as it leaves out the GHG emissions **from extraction of crude oil, refining, and transportation** of both the fuel and its raw materials.



Renewable fuels

Carbon dioxide emissions from the use-phase of **renewable diesel are considered to amount to zero**, because the CO_2 released upon combustion equals the amount that the renewable raw material absorbed at an earlier stage.

There are also emissions related to the production and treatment of renewable raw materials, as well as fuel refining and all transportation steps.

Electric vehicles

Electric vehicles **do not have tailpipe emissions.** But when the electricity that powers the vehicle is taken into account, **not all electricity is currently produced from renewable sources.** As part of the word's electricity continues being **generated by burning coal or natural gas,** CO_2 from fossil sources is emitted to the atmosphere.

In 2019, the carbon intensity of the European electricity production stood at 255g CO_2e/kWh but **varied substantially between Member States** - with e.g. the Swedish power generation emitting 12g CO_2e/kWh and Poland 751g CO_2e/kWh[1].

Sweden
12g CO_2e/kWh

Poland
751g CO_2e/kWh

[1] https://www.eea.europa.eu/data-and-maps/indicators/overview-of-the-electricity-production-3/assessment-1

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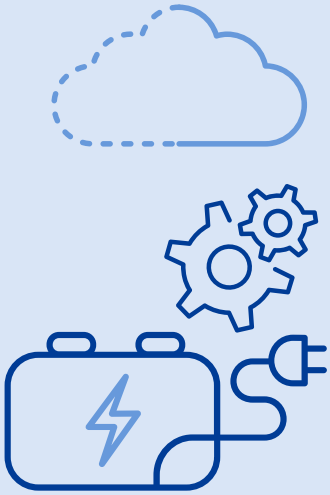
The impact of battery manufacturing



The manufacturing of batteries for electric vehicles is carbon intensive both in terms of raw materials extraction and energy input. The amount of CO_2 emissions from battery manufacturing can vary between 56 and 494 kilograms of CO_2/kWh of battery capacity per kilowatt-hour of battery capacity depending on where and how they are manufactured[2].

What would it take to offset the embodied CO_2 of battery manufacturing ?

- **Assuming a mid-size electric passenger vehicle has a 50 kWh capacity**
- **Assuming 100kg CO_2/kWh**
- **Assuming a comparable diesel-powered vehicle emits 150g of CO_2 per km**

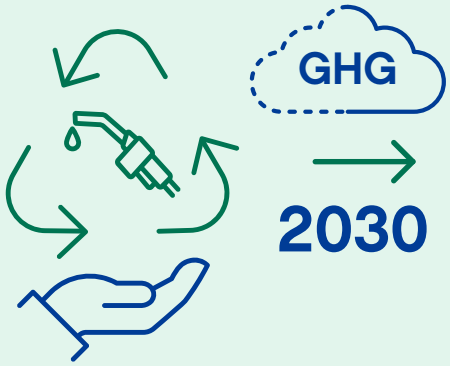
It would take **33,000 km driving on 100% net-zero carbon electricity to offset the embedded CO_2** and over 40,000 km with the current average power mix.

We should also assume that battery manufacturing **will become less carbon intensive** in the years and decades to come.

Change runs on renewables

We need to drive improved sustainability in the transport sector by replacing all fossil fuels with climate-friendlier alternatives. This means replacing liquid fossil fuels as well as all fossil fuels used to generate electricity or produce hydrogen. The Well-to-Wheels approach helps us take all the relevant carbon emissions into account and helps us make more sustainable choices.

We need to base the future of the transport sector on renewables; we need renewable energy to produce electricity, hydrogen and e-fuels, as well as, renewable raw materials to produce liquid or gaseous fuels.



[2] https://theicct.org/sites/default/files/publications/EV-life-cycle-GHG_ICCT-Briefing_09022018_vF.pdf

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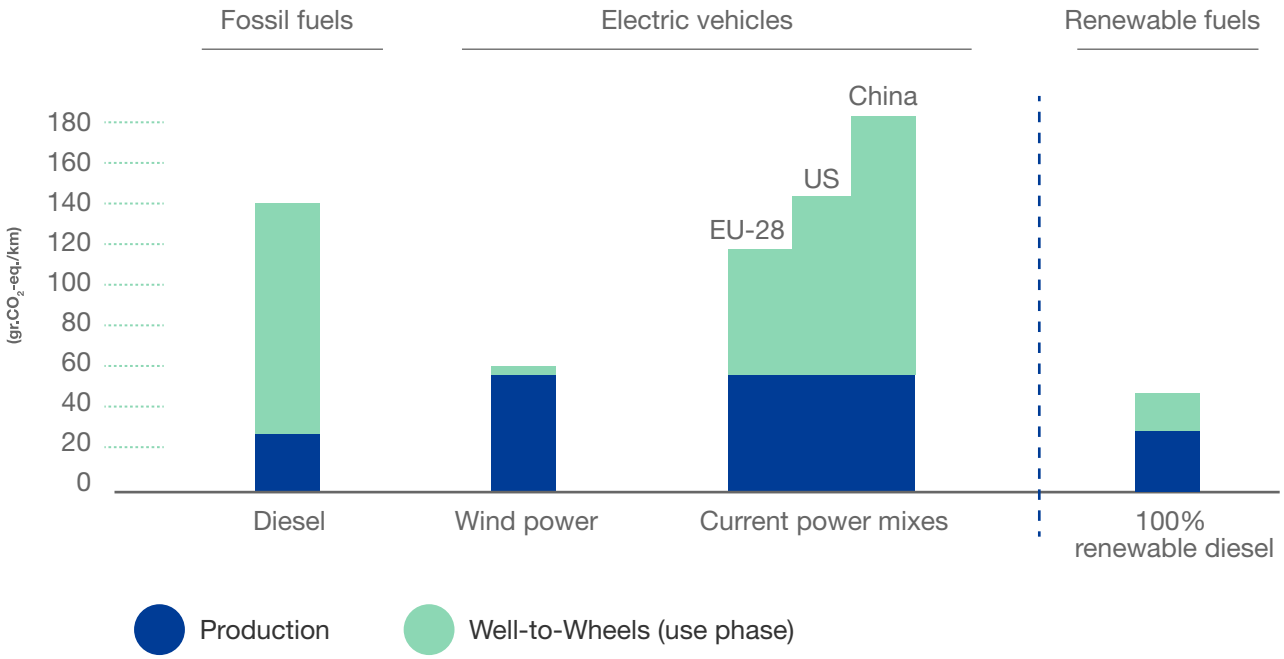
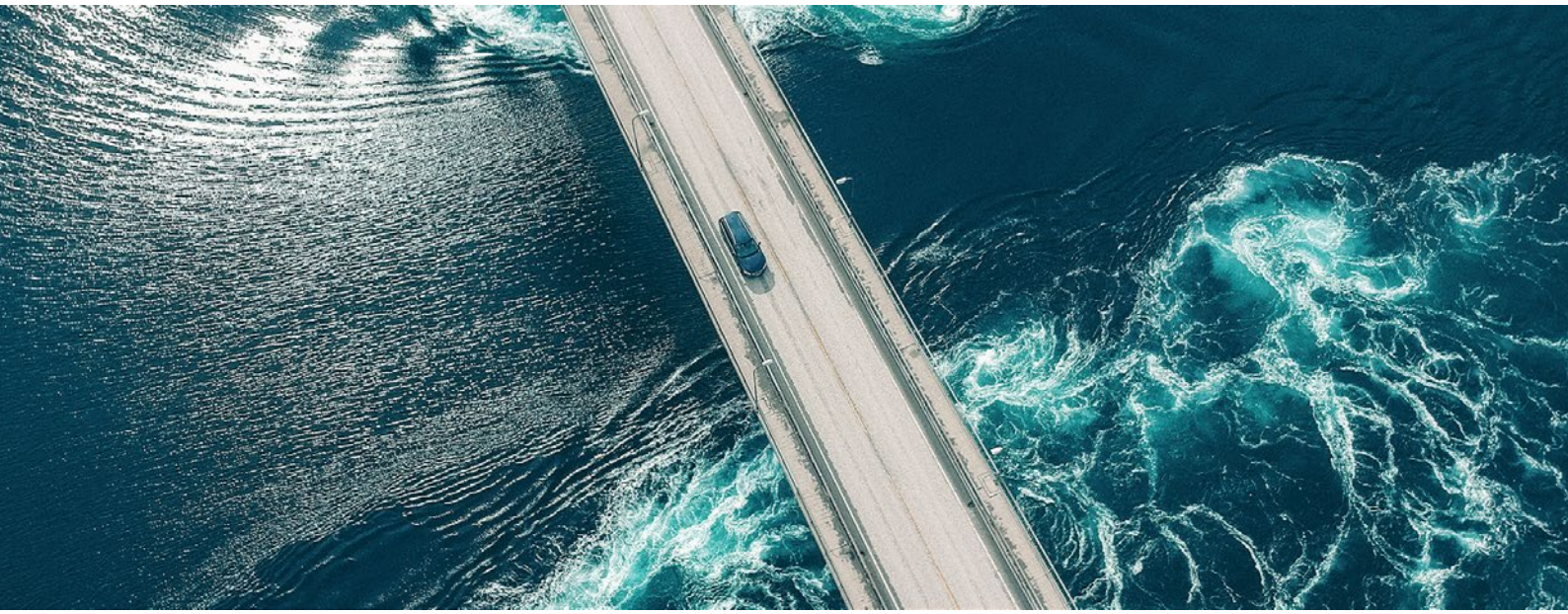
Well-to-Wheels emissions of 100% renewable diesel

The emissions from a diesel-powered vehicle running on 100% renewable diesel are comparable to electric vehicles that use only renewable electricity, when all Well-to-Wheels emissions are taken into account. For electric vehicles, emissions from **the manufacturing of the vehicle and its power generation are included.**



Source: Volkswagen and European Commission JEC 2020 data
Based on a 200,000km use phase.

When compared to the current EU mix for power generation, vehicles running on 100% renewable diesel produce substantially **less emissions than a comparable electric vehicles.**



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Why renewable fuels?

Cost-efficient

Renewable fuels are **the most cost-efficient solution to reduce transport emissions.** Their distribution relies on existing infrastructure, and they can be used in the existing vehicle fleet.

2030 & beyond

The majority of vehicles, especially heavy goods vehicles, **will still rely on internal combustion engines in 2030 and beyond**. We need a solution to reduce the emissions of these vehicles today and in the future.

Time is of the essence

Electrification **will take more time than the climate crisis permits.** Shifting power generation to renewable sources while the demand continues to increase significantly takes too long.

Our commitment

For over a decade, Neste has focused on producing renewable fuels to replace fossil fuel use. **Neste is committed to helping its customers reduce GHG emissions by at least 20 million tons annually by 2030.** This reduction corresponds to the combined annual carbon footprint of more than three million average EU citizens.

What can policymakers do to maximize the potential of renewable fuels?

Recognize that many solutions **can contribute to reducing emissions** from road transport.

Recognize and include renewable and low-carbon fuels in the revision of the CO_2 emissions standard regulations for vehicles.

Consider using the proposed **voluntary crediting system for renewable fuels as an option** to generate significant benefits for the environment, consumers, vehicle manufacturers, and fuel suppliers.

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