

# Ethanol and your engine: What you need to know

**Ethanol is a clean, high-performance renewable fuel that works in today's cars and trucks. Its use boosts engine efficiency, improves urban air quality and mitigates climate change**

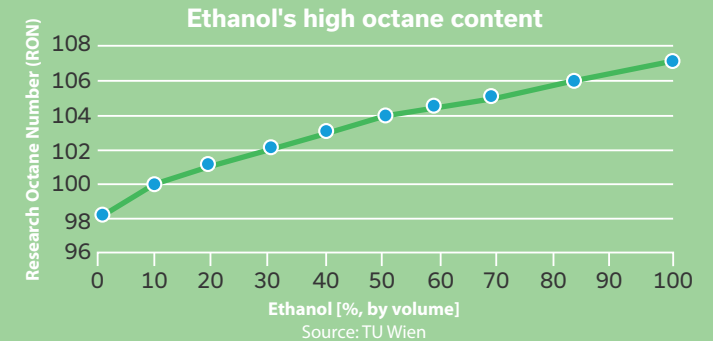
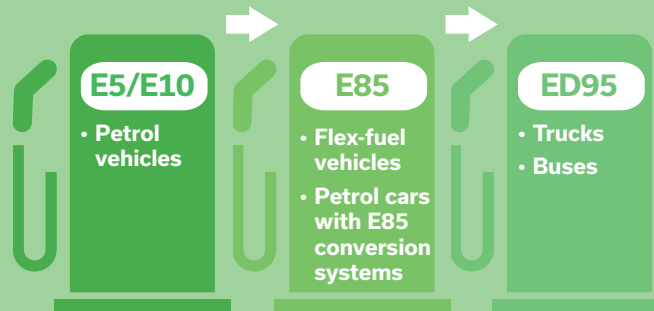


**Renewable ethanol drives EU decarbonisation. Why turn back now?**

## 1.

### A fuel with a long history... and a future

- Ethanol has a long history as a fuel for petrol engines. As far back as 1908, the first mass-produced car, the Ford Model T, ran on petrol, kerosene and ethanol. **Ethanol was the most widely used fuel in cars before it was replaced by cheaper petrol** after World War II.
- Ethanol made a comeback after the oil crisis in the 1970s, when it was used to reduce oil dependency and exposure to price volatility.
- In Europe, ethanol is mainly used to reduce greenhouse gas (GHG) emissions in transport.**
- Ethanol can be used as a stand-alone fuel but is typically mixed with petrol at various levels and then sold as a fuel blend. Fuels containing ethanol include: **E10** (up to 10% ethanol), **E85** (from 65% to 85% ethanol) and **ED95** (95% ethanol).
- Every litre of petrol sold in Europe already contains ethanol:** up to 5% in volume and up to 10% in volume in Belgium, Germany, Finland, France and the Netherlands where E10 is sold. E85 is sold in several countries, including Finland, France, Sweden and the Czech Republic.
- In Europe all petrol vehicles can run on up to 5% ethanol, and **more than 90% of the vehicles produced after 2000 are compatible with E10.** Flex-fuel vehicles can run on higher ethanol blends up to E85.



## 2.

### A fuel more energy-efficient than petrol

- Fuel consumption can increase slightly with higher ethanol blends because ethanol contains less energy per unit of volume than petrol. For example, a switch from petrol containing 5% ethanol to E10 could lead to a maximum 1-2% increase in fuel consumption. However, **any increase in fuel consumption is partially offset by ethanol's greater energy efficiency.**
- Ethanol's efficiency comes from its physical properties. It cools down engines twice as much as petrol when vaporized and provides more octane, which helps improve efficiency, especially in today's downsized petrol engines.
- This boost of efficiency also helps reduce harmful emissions – meaning **the more ethanol that is blended with petrol, the greater the benefits.**
- Ethanol's octane rating is 107, higher than that of regular petrol (95) and premium petrol (98). Beyond improving the resistance of the fuel to damage-causing premature combustion, ethanol can be used in high-performance fuels, to further reduce emission and fuel consumption in optimized engines.

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## 3.

### A fuel with benefits for air quality

- **Less CO:** Carbon monoxide (CO) emissions result from incomplete combustion. By using more ethanol, with its high oxygen content, these harmful CO emissions can be reduced – by more than 70% with E10 and by more than 80% with E85.<sup>2</sup>
- **Less NO<sub>x</sub>:** Polluting nitrogen oxides (NO<sub>x</sub>) emissions have a serious impact on the environment and human health.<sup>3</sup> NO<sub>x</sub> are produced when fuels burn at high temperature. **Higher blends of ethanol can reduce NO<sub>x</sub> emissions because the engine temperature is reduced.**<sup>4</sup>
- **Less HC:** Incomplete engine combustion also emits unburned hydrocarbons (HC). But by using fuel blends containing higher ethanol content, **HC emissions can be reduced.**
- **Less particulate matter:** Fine particulate matter (PM2.5) caused an estimated 200,000 premature deaths in the world in 2014.<sup>5</sup> Road transport is currently responsible for more than 15% of the total particulate matter (PM) emissions in Europe. **Compared to fossil petrol, ethanol reduces particulate emissions by nearly 80% with E10 and more than 90% with E85<sup>2</sup>. Compared to E5, E10 can further reduce particulate emissions by more than 20% and E20 by more than 60%.<sup>6</sup>**

Air pollutants	CO	HC	NO <sub>x</sub>	Particulate
Effect of Ethanol	Greatly reduced	Reduced	Reduced in higher blends	Greatly reduced
	✓	✓	✓	✓

<sup>1</sup>Emissions from Flexible Fuel Vehicles with different ethanol blends, AVL MTC AB (2005).

<sup>2</sup>Bioethanol Blending Reduces Nanoparticle, PAH, and Alkyl- and Nitro-PAH Emissions and the Genotoxic Potential of Exhaust from a Gasoline Direct Injection Flex-Fuel Vehicle. EMPA, USAB (2016).

<sup>3</sup>Valuing impacts on air quality: Updates in valuing changes in emissions of Oxides of Nitrogen (NO<sub>x</sub>) and concentrations of Nitrogen Dioxide (NO<sub>2</sub>). DEFRA (2015).

<sup>4</sup>Meta-analysis for an E20/25 technical development study - Task 2: Meta-analysis of E20/25 trial reports and associated data. TU Wien (2014).

<sup>5</sup>State of Clean Transport Policy. ICCT (2014).

<sup>6</sup>Weniger Feinstaub durch Bio-Ethanol im Tank. TU Wien (2017).

<sup>7</sup>ePURE data, audited by Copartner (2017).

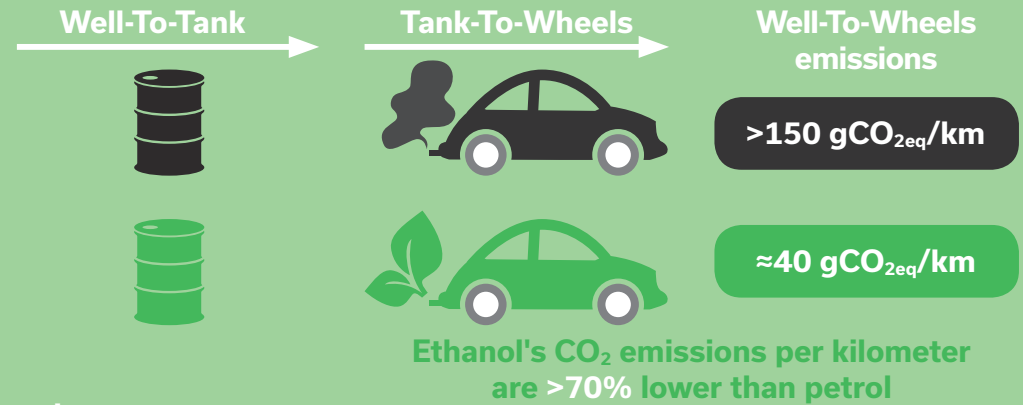
<sup>8</sup>With a petrol car consuming 5.0l/100km of purely fossil petrol. Fossil petrol emitting 94.1gCO<sub>2eq</sub>/MJ (WTW) and 73.4 gCO<sub>2eq</sub>/MJ (TTW).

<sup>9</sup>With a petrol car consuming 5.0l/100km of purely fossil petrol, compared to a theoretical petrol car running solely on ethanol (increase of fuel consumption and efficiency included). Fossil petrol emitting 94.1gCO<sub>2eq</sub>/MJ and renewable ethanol 28.3 gCO<sub>2eq</sub>/MJ.

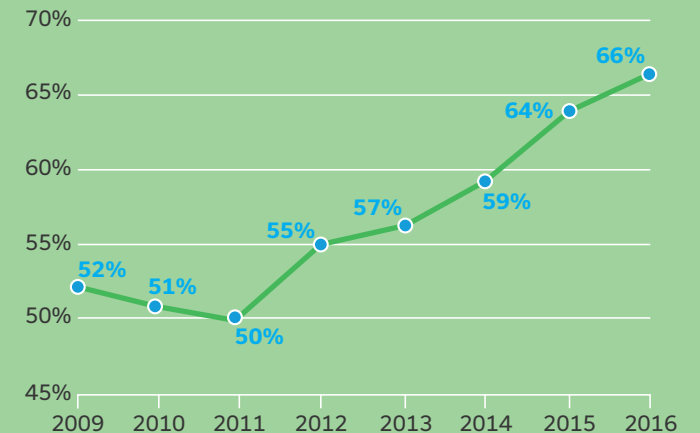
## 4.

### A fuel that fights climate change

- **European ethanol saves 66% GHG emissions compared to petrol<sup>7</sup>.** Its use reduces the European transport sector's total greenhouse gas emissions by at least 6 million tonnes each year, **the equivalent of at least 4 million cars taken off the road.<sup>7</sup>**
- Reducing CO<sub>2</sub> emissions is essential in the fight against climate change. CO<sub>2</sub> emissions from vehicles can be immediately reduced by: decreasing fuel consumption (by engine efficiency improvements or reduction of vehicle weight) or by decreasing the carbon footprint of the fuel.
- **The use of fossil fuels has a much greater impact on the environment than is accounted for in the rules governing tail pipe emissions of new cars.** Emissions that occur during oil extraction, refining and transportation are not taken into account by EU rules. The difference is significant, amounting to more than 30 gCO<sub>2eq</sub>/km<sup>8</sup>, a substantial portion of the average 2020 emissions target of 95 gCO<sub>2eq</sub>/km for light duty vehicles.
- Biofuels must meet higher standards because they have to reduce emissions on a full lifecycle basis (from "Well-To-Wheels"). According to the most recent data, **GHG emissions per kilometer from renewable ethanol produced in the EU are more than 70% lower than petrol.<sup>9</sup>**



### Average GHG emission savings per unit of energy from renewable European ethanol compared to fossil petrol



**ePURE**  
european renewable ethanol

Designed by ACW, London

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