

## Mobility's future must be electric

**There's no place for the internal combustion engine on the road to net zero.**

**W**orldwide, the planes, trains and automobiles we use to get around pumped around 7.7 gigatonnes of carbon dioxide into the atmosphere in 2021, one-fifth of all anthropogenic emissions. Some three-quarters of transport emissions came from just one source – the exhausts of road vehicles.

Converting road transport to run on green energy would be a huge step towards achieving net zero emissions by mid-century, a change needed if we are to limit global warming to 'safe' levels. This is why policymakers have been nudging car makers to accelerate efforts to bring an end to the manufacture of vehicles fitted with an internal combustion engine. It's a no-brainer. In the European Union, at least, it seemed that the two sides were strapped in, ready to reach that destination by 2035.

However, the past few weeks have seen the European Commission embroiled in a row with Germany, Italy and some other EU members over implementation of the 2035 deadline. This has been resolved, but only through a concession to Germany's powerful automotive industry. New cars with internal combustion engines can continue to be sold after 2035, provided the engines use carbon-neutral fuels instead of diesel, petrol or compressed and liquefied gases. These are climate-damaging moves from a region that has so far led the world in policies for decarbonizing transport.

The problem lies in the phrase 'carbon-neutral fuels'. These fuels rely either on inputs such as 'green' hydrogen, which is made by splitting water using renewable electricity, or on feedstocks such as biomass. The technologies used to make these fuels are inefficient, expensive and untested at scale. Moreover, claims of climate neutrality – based on the idea that the CO<sub>2</sub> emitted by their combustion was absorbed relatively recently from the biosphere, or that CO<sub>2</sub> produced during their manufacture was prevented from entering the atmosphere – are questionable.

The capacity to make green hydrogen is severely limited, and any expansion should be used to power sectors such as heavy industry, for which viable decarbonization alternatives are not yet available. Meanwhile, the use of biomass creates incentives to harvest wood and divert agricultural land to grow energy crops, regardless of the consequences for land as a carbon sink or for biodiversity.

It's clear why some in the automotive industry want to keep the internal combustion engine alive. The idea is attractive to short-sighted policymakers, too, because it reduces the need to plan the roll out of charging infrastructure,



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to worry about grid capacity, and to teach people the skills to build and maintain different technologies. The research community must be equally clear in underlining why this is a false economy. There is only one proven viable, scalable and technologically ripe scheme for decarbonizing personal road transport. That is electrification.

Not all car makers want to delay. Many understand that the transition to electric vehicles will take time, and want to get on with transforming their businesses. They want policy certainty and continuity from governments to allow them to get down to business. Last year's COP27 climate conference in Sharm El-Sheikh, Egypt, saw the launch of the Accelerating to Zero Coalition to drive the global transition to new electric cars and vans by 2035 in "leading markets", meaning high-income countries, and globally by 2040. Its more than 200 signatories include 14 car manufacturers, among them household names such as Ford, General Motors, Mercedes-Benz and Volvo Cars, and the governments of more than 40 countries.

But the absentees are also notable. They include some of the world's most prominent motor manufacturers – Toyota, Volkswagen, Honda, Hyundai and Kia. Also absent are the governments of some of the biggest car-producing countries – China, Japan, South Korea and Germany.

If the electric-vehicle transition is further delayed, there are likely to be cascading effects elsewhere that will ultimately put a brake on global decarbonization. The demand for personal powered mobility is increasing in low- and middle-income countries. In Asia alone, cars are projected to account for more than 40% of trips taken in 2050, up from 28% in 2015. On the basis of current trends, there will be three billion cars and vans on the road globally in 2050, up from one billion now – another reason to accelerate the transition to electric vehicles worldwide.

For the decarbonization of road transport to occur, the world will need what the Global Fuel Economy Initiative, a partnership on fuel economy and efficiency, called a "radical policy framework" (see [go.nature.com/4381wvk](https://go.nature.com/4381wvk)). That means the removal of fossil-fuel subsidies and the mobilization of both public and private investment for the development of electric vehicles and their attendant charging infrastructure. It means tying the development of that infrastructure to renewable-energy-generation systems, while ensuring that supply chains are sustainable and providing recycling facilities for battery materials. And it means an international agreement must be reached on standards, so that the introduction of cleaner vehicles in one part of the world doesn't mean old bangers being shipped off to pollute the environment elsewhere.

All of this is doable. But the growing global demand for personal mobility means a truly green transport transition will happen only by addressing another factor. Technological innovation will take us only so far: behavioural change is also needed. Alongside a cogent, evidence-based strategy to develop electric vehicles and displace fossil fuels, we must plan and redesign urban environments around the world to encourage active transport – walking and cycling – rather than driving. That surely is the best route to a cleaner, healthier world.