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E-fuels: A Climate Opportunity for Emerging Economies

Extreme weather events across the globe are turning climate change into a reality for many people and are increasing the need for practical measures that will enable us to achieve our climate targets. One long-running topic for discussion concerns e-fuels. Power-to-Liquid (PtL) is a process that uses electricity to break down water into hydrogen and oxygen by means of electrolysis. In the next step in the process, the hydrogen reacts with CO₂ (from industrial processes or captured from the atmosphere) – following the input of energy – to form methanol (CH₃OH) and other intermediate products containing hydrocarbons. From there, only one more synthesis step is needed to produce raw gasoline.

The electricity mix used in the production process and the source of the CO₂ must be carefully considered to limit the environmental footprint. The process needs between 21 and 27 kWh of electricity to produce one liter of e-diesel (if the CO₂ is extracted from the atmosphere). Assuming a diesel consumption figure of 5 l per 100 km for a compact car, the resulting primary energy requirement is around 105 to 135 kWh per 100 km. A conservative figure for a comparable BEV in normal everyday use is approximately 20 kWh per 100 km. This dramatic difference in efficiency – a factor of 7 is a good approximation – is the main obstacle to the PtL concept. The central problem here is the scarcity of renewable electricity. Because this resource is in short supply, it is essential that it is used efficiently in BEVs. Recent studies on the CO₂ footprint make it entirely clear that there is no alternative to battery electric mobility in industrial countries. The leading car manufacturers have made considerable efforts to develop attractive electric models and competitive charging infrastructure will be established over the next few years.

Although this scenario seems very positive, it is important not to forget that the vehicles with combustion engines which are currently being produced and will continue to be produced in the years to come have a lifetime of several decades. In highly developed countries it is likely that the sale of new gasoline and diesel engine vehicles will be stopped and that existing vehicles will be banned from entering towns and cities in the medium term to limit local emissions. However, developments of this kind cannot be expected in newly industrialized countries of Africa, Latin America and Asia, because they are unlikely to be able to construct the necessary charging infrastructure in the foreseeable future. Against this background, the energy export plans recently discussed in the context of the hydrogen strategy could be part of a global solution. In countries with emerging economies where sunshine is in plentiful supply, there will be extensive opportunities for the large-scale generation of renewable electricity using photovoltaic systems and wind turbines. This amount of green electricity has the potential to turn e-fuels into one of the building blocks of the global climate strategy. As well as allowing car fleets in these countries to be decarbonized, it also represents a profitable export opportunity in the form of e-kerosene for the aviation and petrochemical industries and e-methanol for transport use. The major challenge here will be the production costs, as even the most optimistic forecasts indicate that price parity between e-fuels and fossil fuels is a very long way off. Although e-fuels will be very useful for specific niche applications, they will not change the need for the complete electrification of the automotive industry.