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DESIGN

ELECTRIC OR HYDROGEN POWERED VEHICLES?

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The need for zero emission transport is beyond question, and the drop in air pollution during Covid lockdowns shows us that we can reverse climate change.

Electric and Hydrogen are not the only solutions, but will have a major role to play in decarbonising transportation. Neither electricity or Hydrogen are energy sources, but energy carriers, so in themselves are not 'the' solution. The whole cycle of where the energy comes from, how effectively it can be stored and then used for mobility also needs to be considered.

The vast majority of energy is created from gas, oil and coal, creating 32 gigatonnes of $C0_2$ each year.

The debate for Electric v Hydrogen powered vehicles gets heated, with invested parties on both sides defending their camp and attacking the other, even though both technologies are trying to achieve the same thing. Understandably, both are looking for the attention of investment, but rather than highlight deficiencies, we should be highlighting the advantages as there is no single solution to solve the problem.

The argument is anything but straightforward, as there are so many aspects to consider:

- Political policies, legislation and funding
- The economies of both solutions: TCO, CAPEX, OPEX, efficiency and infrastructure investments
- The practicalities of range, charging time, flexibility of use, where you can refuel, and perceived safety
- Energy and Raw material supply

Both have been around for a while, the fuel cell from 1801, the battery powered electric motor from 1834 and the internal combustion engine from 1806.

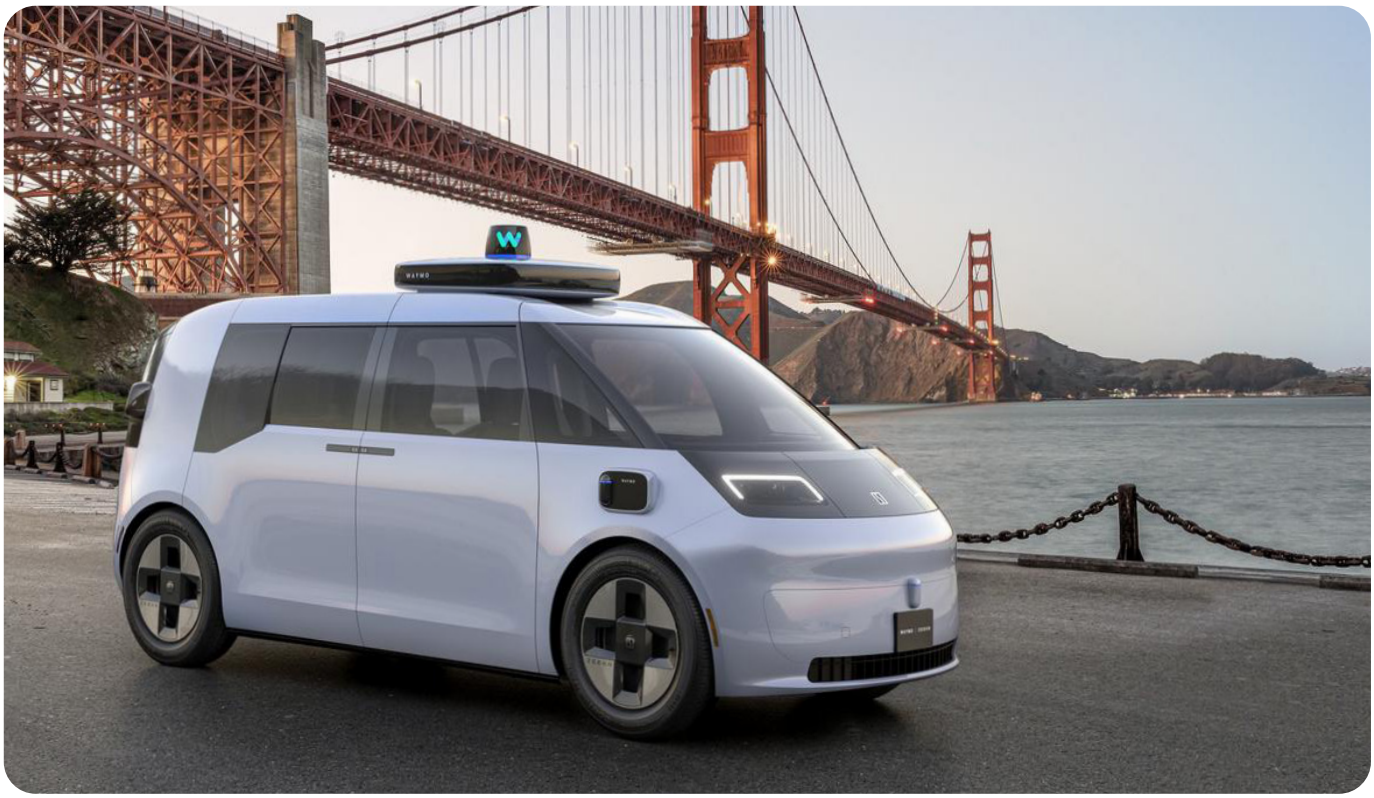
INFLUENCE ON VEHICLE DESIGN

Battery Electric Vehicles (BEVs) allow for completely new vehicle architectures, as the batteries can be placed almost anywhere in the vehicle. In contrast, the Fuel Cell needs significant cooling and so will most logically replace the position of an ICE.

POLITICAL POLICIES AND LEGISLATION

The US Inflation Reduction Act provides $7,500 tax credit for Electric Vehicles beginning in 2023, and as much as $3 a kilogram for clean hydrogen production. The European Union is phasing out the internal combustion engine by 2040. In the UK, there will be no new ICE cars and vans sold from the year 2030. From 2035, only fully zero emission at the tailpipe cars and vans will be made available for sale with the eventual phase out of ICE vehicles by 2040.

Several Western countries have pinned their colours to the mast of BEVs, creating a pathway to transition from the ICE using the existing electricity grid infrastructure. In the UK, there are 11 registered Hydrogen refuelling stations (soon to drop to 8 following Shell's announcement that they are set to decommission their 3 Hydrogen stations due to a lack of interest). Compare that to 29,000 charging points, two-thirds of which are fast-charging, plus the ability to recharge at home, and you can see why BEVs have a big head start on Hydrogen.



ECONOMICS

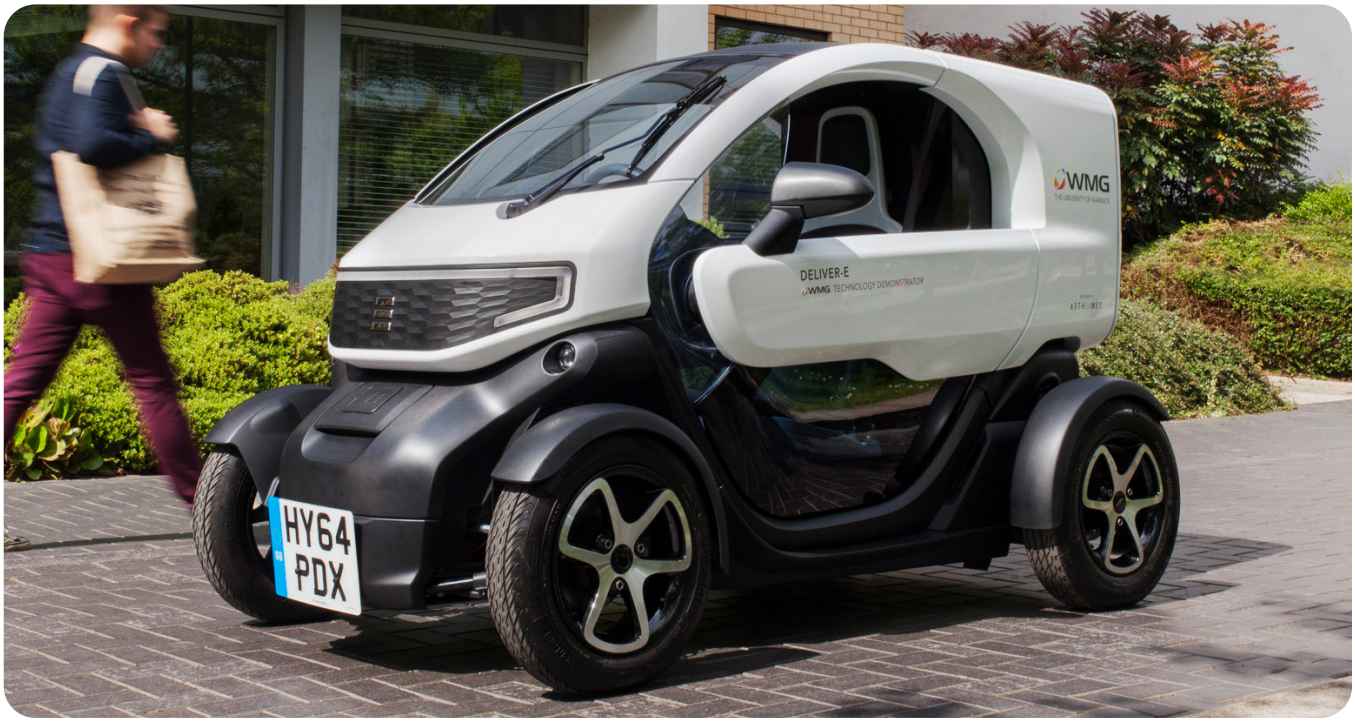
Both technologies are still too expensive. The advisory firm Wood MacKenzie says that electric batteries will hit an inflection point in 2027 — the place where the economies of scale are at the place in which price and quality are getting better at an expedited pace. For Hydrogen to become mainstream by 2030, prices must fall. Central to that is electrolysers — the device that creates an electric current to split apart the hydrogen and oxygen from the water where it is found. Those costs have to drop from $840 per kilowatt to $420 per kilowatt.

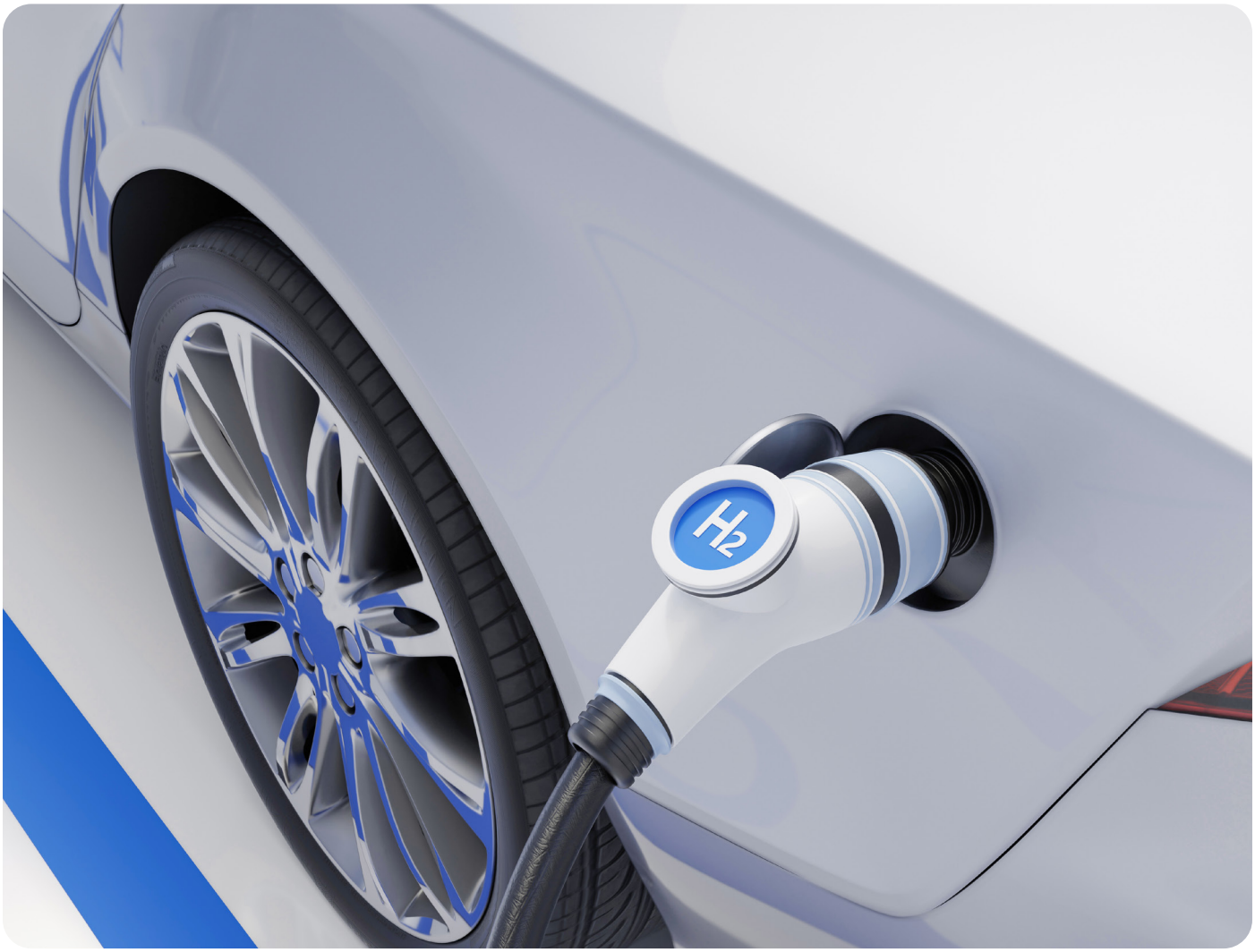
This has not deterred investment however, with Modor Intelligence predicting the global Hydrogen market for HGVs only having a compound annual growth rate of ~40% between 2022-2027.

BEVs are most efficient for small vehicles doing short journeys, and already have a competitive TCO. But as the journeys get longer the battery size needs to increase, increasing weight and decreasing efficiency. This effect increases as the net vehicle weight increases.

Hydrogen loses energy content when it is produced, transported, and converted into electricity. BMW says that it is half the overall efficiency of an average battery-powered vehicle.

However, if the electricity comes from abundant wind and solar, hydrogen inefficiency is less important as Hydrogen works well for energy storage. Clean hydrogen prices will keep falling as the cost of wind and solar energies fall.





PRACTICALITIES

Both technologies suffer at the moment due to a lack of infrastructure. Hydrogen is useful to store and move energy and can be converted into ammonia for a higher energy density.

Hydrogen-fuelled vehicles have a longer range than EVs, they take less time to refuel, and don't lose range in cold weather. Furthermore, Hydrogen avoids the issue of capacity of the electricity grid. A large number of vehicles, fast-charging at one time, has the potential to create too large a strain on current networks.

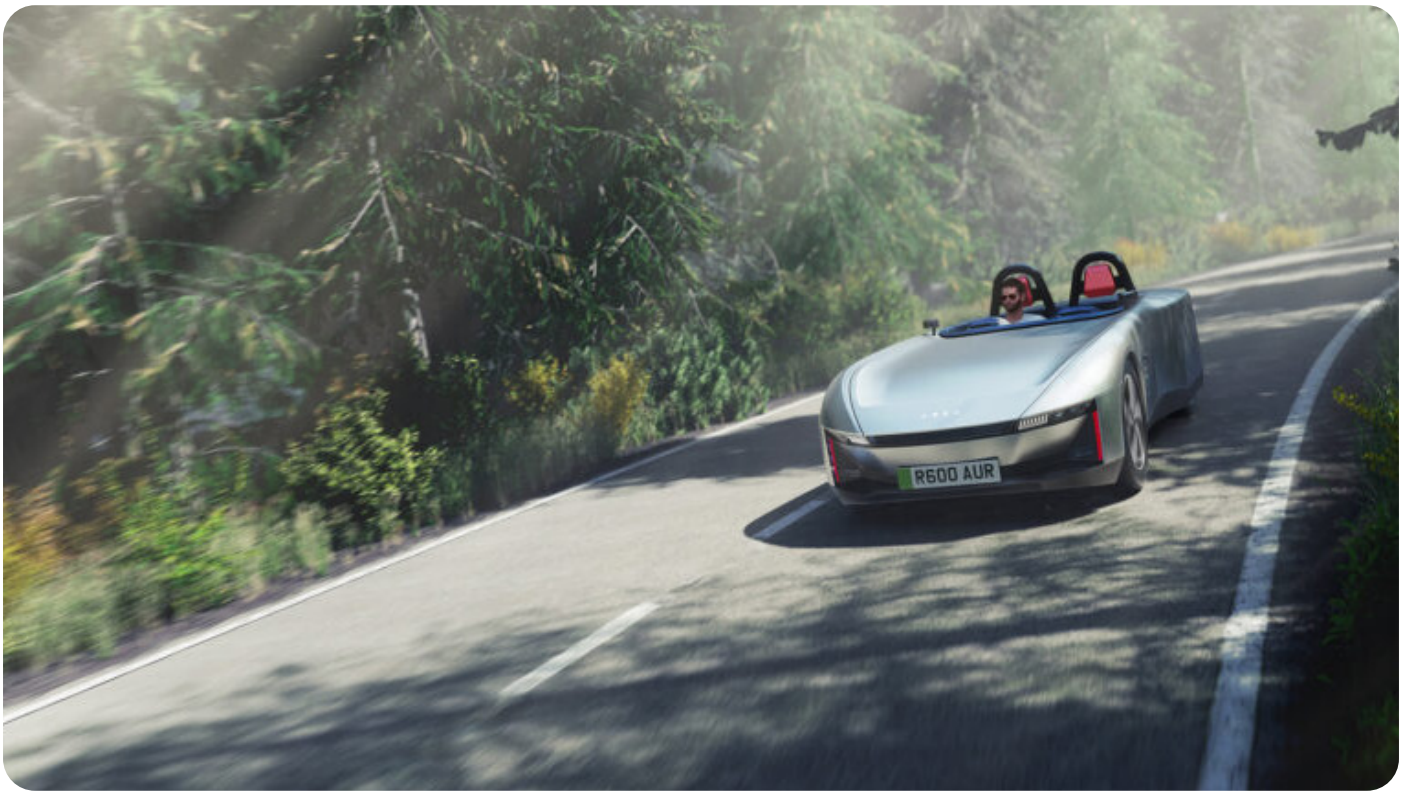
Electric will suit most cars where energy efficiency is the most important factor, whereas Hydrogen will be more effective in the commercial sector, where the practicalities of range and refuelling time are important.

ENERGY AND RAW MATERIAL SUPPLY

We must maximise the use of renewable energy such as wind and solar, as clean energy generation will be our biggest challenge. Furthermore, we must reuse and repurpose the precious metals and other components in batteries, as they are limited resources.

CONCLUSION

For a fast transition to a low-carbon transport system, we need to develop both Electric and Hydrogen where most applicable; developing infrastructures, making them practical to use. Each Department for Transportation needs to create a comprehensive plan for the future transportation system, deciding which technologies should be used for which application based on the country's energy and supply chain resources, and the needs for the transport system. The opportunity is for each global region to develop its own infrastructure and drivetrain platforms to suit their needs, and to let the individual mobility brands develop the different customer experiences needed in moving people and goods around the world.



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