

MARCH 2018

THE FUTURE OF MOBILITY

HYDROGEN OR BATTERY ELECTRIC

REPORT



In association with



INTRODUCTION

Vehicles of the future will move away from fossil fuels – but speed of the transformation will depend on battery and fuel cell development, on the commercialisation of vehicles that use them and on the rollout of charging and fuelling infrastructure.

A Friends of Europe Café Crossfire on 27 March debated this theme, which has enormous stakes for the future of European industry. Vehicle manufacturing is one of the biggest employers in the EU, and changing the industry's core technology has the potential to trigger upheaval. Although the market for vehicles that don't use fossil fuels is still small, it has started to grow fast, and the list of countries planning to ban internal combustion engines is expanding rapidly.

Electric and renewable hydrogen vehicles have yet to take off for at least two main reasons. First, they are seen as too expensive for the average motorist. Second, drivers worry that their lack of range and recharging infrastructure could leave them stranded, without the energy to complete their journey.

The key to overcoming both these barriers is investment – in the technology that powers the cars, and in the recharging infrastructure. In addition, for new types of vehicles to contribute to a reduction in greenhouse gases, cheap renewable energy is needed, so that the ultimate source of the energy in batteries and fuel cells is not fossil fuels.

“The trajectory to the future is clear,” said [Greg Archer](#), Director of Clean Vehicles and Energy at Transport and Environment (T&E). “We believe electro-mobility will predominantly be battery-powered but will also feature hydrogen. The shift is coming because we are producing very cheap renewable energy that will power our vehicles.”

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Director of Clean Vehicles and Energy at Transport and Environment (T&E)

DID YOU KNOW

- [Mobility](#) directly employs **11 million people**, with €651 billion in revenue
 - [Transport](#) sector electrification is essential for meeting the European Union goals of decarbonisation and energy security, as transportation accounts for **25% of all CO2 emissions in Europe**
 - [Transportation](#) accounts for **33% of energy consumption** in the EU and 64.5% of oil consumption
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“Hydrogen can be used to store energy on a large scale and over long periods, which helps manage the intermittency of renewables. We think that renewable hydrogen is the missing link for a 100% decarbonised world”

Michèle Azalbert

CEO of ENGIE's Business Unit
dedicated to renewable hydrogen

BEYOND BATTERIES

Though battery-powered cars have been fastest to market, renewable hydrogen fuel cells have the potential to overcome some of batteries' weaknesses – in particular their limited range. “We think that fuel cells are especially fit for purpose for heavy-duty fleets,” said [Michèle Azalbert](#), CEO of ENGIE's Business Unit dedicated to renewable hydrogen. “With hydrogen, you can fill tank in five minutes for a range of 500 km and you provide the autonomy that vehicles require.” Hydrogen is already powering hundreds of buses worldwide, in particular in Japan. Commercial solutions are also emerging for forklifts and taxis. “It is developing quicker than before,” she said.

Fuel cells could also help overcome a major weakness of renewable energy in general: its dependence on the weather. This makes it necessary to store energy to use when the sun doesn't shine on photo-voltaic cells and the wind doesn't blow on wind turbines. “Hydrogen can be used to store energy on a large scale and over long periods, which helps manage the intermittency of renewables,” she said. “We think that renewable hydrogen is the missing link for a 100% decarbonised world.”

Hydrogen vehicles are still expensive – even compared to battery-powered ones – and they are thus often seen as an option for the future. However, prices could tumble with the right investment and scale. “Take the example of solar panels,” said Azalbert. “At the very beginning, they were quite expensive and they requested support in order to emerge and develop cost-effective solutions. But today it's already available and cheap. So it is time to accelerate the development of hydrogen. We need to invest all along the value chain from production to filling stations.”

IS EUROPE FALLING BEHIND?

However, there are signs that China and Japan could pull ahead in future mobility technology thanks to the investments they are making in vehicles, batteries, renewable hydrogen fuel cells and recharging infrastructure. In February 2018, Vice-President for Energy Union Maroš Šefčovič said that the European battery market could be worth around €250 bn per year by 2025. “Do we want to leave this to our global competitors?” he asked at the time.

Ten years ago, the European Commission decided to invest in vehicle power sources of the future. “Electric batteries and fuel cells and hydrogen are two different paths with different difficulties,” said [Jean-François Aguinaga](#), Head of Unit for Surface Transport at the European Commission Directorate-General for Research and Innovation. “At that time, we decided to invest in research and innovation because there were a number of technology challenges. We have invested a lot in hydrogen fuel cells.” In this sector alone, the European Commission has invested roughly €2 bn over the last 10 years.

However, the European Union needs to invest more, and Šefčovič previously called for €20 bn in investment in battery factories. The technology has evolved far enough now that battery-powered cars have a certain momentum, he said at the time. “Manufacturers are putting models on the market with significant autonomy,” he said. “400 km for example, even for a small car. Fuel cells and hydrogen for me are maybe a longer-term challenge. But we need to continue investing there in order to avoid a situation such as electric batteries where we are lagging behind Asian competitors.”

Charging infrastructure especially needs more investment – about four times current levels, said moderator [Dharmendra Kanani](#), Director of Strategy at Friends of Europe. There are currently fewer than 200,000 chargers in the EU, but close to one million will be needed in the next 10 years.

“Already the EU is investing in our charging infrastructure – for both hydrogen and electric batteries,” said Aguinaga. “It is not enough. It is a way of starting to create momentum. At the end of the day, this should be taken up by the private sector as a business.” To encourage the private sector, said Aguinaga, “The answer is the EIB (European Investment Bank). If we think just about grants given by the EU, we will not make it. We need some sort of banking intervention with money captured by economic operators and investments that are real investments.”

CLIMATE CHANGE IS ADVANCING

Concern over global warming means these solutions need to come more quickly, said Kanani. “We had the hottest year last year and things are not accelerating in the way that we might wish,” he said. “Levels of anxiety are increasing around the globe. Some years ago, there was a nirvana moment about diesel. We thought we had achieved something that was going to be sustainable and green. But then ‘dieselgate’ happened and we still have millions of cars in Europe that haven’t been taken off the roads by manufacturers despite what we know. So how do we know that discussion of hydrogen and electricity is not simply a response the opportunity we have now? Are we really thinking ahead to the future? Are we really thinking about alternative forms and pathways that will achieve those Sustainable Development Goals? Or are we simply thinking that hydrogen and electricity are the new winners for today without thinking about tomorrow?”

Progress is being made – but it could and should be faster, said Archer. “Automakers are not moving fast enough. Cost is often cited as an issue – but it is being solved. The shift is coming about because we are now producing very cheap and plentiful renewable energy that will power our vehicles and we are seeing a transformation in battery technology and battery prices. Between around 2012 and 2022 it is forecast that the cost-performance of batteries will improve by around 100 times. That is utterly transformational. That will start to feed through very quickly into the price of the vehicles, particularly when we start to see vehicles being manufactured on the same production lines and therefore produced in volume.”

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ALTERNATIVE CARS ARE BECOMING AFFORDABLE

Some products are already beginning to look like reasonable buys for average drivers. “We are seeing the range of those vehicles increasing,” said Archer. “The Nissan Leaf has gone from 24 kW to 30 – and the new one will be 40 kW. That’s taking the range from under 150 to over 300 km. Suddenly the range anxiety starts to go away, and people no longer even need to charge their car every day. People start to charge their car twice a week.”

Moreover, he said, charging speeds are improving. “Once everybody needed eight hours. Now the car industry is investing in solutions that charge to 80% or 90% in 10 or 15 minutes. Why do you need a plug-in hybrid vehicle if you drive 400 or 500 km and recharge in 10 minutes? I need longer than that to have a cup of coffee. We have a massive change going on.”

To accelerate progress, more regulatory drivers are needed, he said. So far, the industry is largely unenthusiastic about electric vehicles, because it makes thin profits. There are relatively few electric models on the market; they are relatively pricey; and they are not pushed by automakers’ marketing divisions: currently just 1% to 2% marketing spend goes on electric, plug-in and hybrid vehicles, said Archer. “We do not have an industry that wants to invest in electric vehicles at this moment in time in Europe,” he noted. “There are only 20 battery models on the market in Europe at the moment. No one’s going to want to buy these cars until the industry turns its immense talents to actually starting to promote them.”

CONCLUSION

For renewable hydrogen- and battery-based vehicles to take off, Europe needs more investment in vehicle technology and the charging infrastructure. However, automakers appear to be moving slowly. Regulation and public funds should be used to encourage them away from the internal combustion engine and to help them achieve the United Nations’ Sustainable Development Goals.

DID YOU KNOW

- Bloomberg New Energy Finance forecasts investment in zero carbon energy [at \\$8.7 trillion by 2040](#), with an estimated 530 million vehicles on the road
 - There are more than [3 million electric vehicles on the road worldwide](#), 1.3 billion vehicles globally. By 2040, 54% of new car sales and 33% of the global car fleet will be electric
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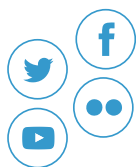
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