Is the sun shining on new energy sources?

The future of solar-powered and hydrogen-powered mobility

WHAT'S NEXT

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The future of solar-powered and hydrogen-powered mobility

Although the European Union (EU) seems to be on track to meet this year's greenhouse gas (GHG) emission reduction target of 20% compared to 1990 levels, it is currently not projected to achieve the 2030 targets. In line with the Paris Climate Agreement of 2015, these targets relate to domestic GHG emissions, the share of renewable energy sources and energy efficiency[i]. Hence, radical change is required and we all need to do our bit. With road transport accounting for approximately 20% of carbon dioxide (CO_2) emissions in the EU alone, the mobility sector can play an important role in helping to accomplish the environmental targets. Electric vehicles (EVs) are catching on rapidly and are certainly a big step in the right direction. However, other innovative sustainability-related advancements are already starting to reshape the future of driving. Here, we provide some early insights into two emerging renewable fuels – solar power and hydrogen – and explore their potential relevance for fleet management.

The 2030 targets are: at least 40% reduction in domestic greenhouse gas emissions (compared with 1990 levels); an increase of at least 32% share of renewable energy sources in the EU; and at least 32.5% improvement in energy efficiency at EU level.

BACKGROUND

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Climate Action Summit

The EU is striving to become the world's first climate-neutral economy. One key step in achieving this is to accelerate the shift away from fossil fuels in favour of renewable energy (the 'share of renewable energy' target is 10% for 2020 and 32% by 2030), as well as making significant gains in energy efficiency. New technologies and engineering solutions are already delivering energy at a lower cost than the fossil-fuel-driven approach. Solar energy and onshore wind are now the cheapest sources of new bulk power in virtually all major economies[ii].

CO_2 emissions rise in Europe overall, but fall in Norway, Finland and the Netherlands

The electric vehicle (EV) plays an important role in the evolving renewable energy system. In Europe overall, the CO_2 emissions of passenger cars have actually risen again over the past two years following several years of decline[iii]. In contrast, emissions fell in Norway, Finland and the Netherlands Norway and the Netherlands are leading the way in the adoption of EVs, and electric passenger cars are an increasingly common sight on the roads in those countries. However, other innovative sustainability-related advancements are already starting to reshape the future of driving, including the emergence of two renewable fuels: solar power and hydrogen.

IMPORTANT

Important role for passenger cars

According to scientists, CO_2 is the biggest contributor to climate change

In the EU, CO_2 emissions of cars and light commercial vehicles (LCVs) actually rose by an average of 2 g/km per vehicle in 2018 (taking emissions of new passenger cars to 120.5 g/km and LCV emissions to 158.1 g/km) following years of decline and stabilisation.

This increase is partly caused by the shift from diesel to petrol engines, which emit more CO_2 than diesels. Another factor is the growing popularity of SUVs, which have an average emission level of 133 g/km; one in three cars sold in Europe is an SUV nowadays. Meanwhile, new LCVs are now larger on average and have more mass and engine power, plus petrol engines have gained ground, all of which is contributing to higher CO_2 emissions. At just 1.7% of the total, low-emission or emission-free cars are barely a drop in the ocean.

If the EU is to achieve its average CO_2 emissions targets of 95 g/km for new passenger cars and 147 g/km for LCVs by 2021, more EVs will need to be sold. Automotive manufacturers will be launching more and more electric models in the years to come, and risk fines if the targets are not met.

The countries with the highest average CO_2 emissions are Switzerland with 137.3 g/km, Germany with 129.1 g/km and Poland with 128.3 g/km. The countries that have achieved the biggest reductions in CO_2 emissions are Norway with -11.4 g/km, the Netherlands with -2.9 g/km and Finland with -0.6 g/km. In Norway, the average CO_2 emission level stands at 72.4 g/km, which is significantly lower than the EU average of 120.5 g/km[iv]. Parking and driving-related incentives undoubtedly play a role in Norway, as do tax breaks; cars with high CO_2 emissions are subject to more tax, whereas low-emission or emission-free vehicles are subject to less or no purchase tax and are taxed at a lower rate in the case of leasing.

New energy sources for vehicles

Solar energy

The Dutch manufacturer Lightyear has developed a fully electric vehicle with solar cells integrated into the roof and bonnet, which charges from the sun's energy at a rate of 12 km per hour. This means the car has sufficient charge for the average European commuting distance of 28 kilometres[v] after around two hours. Lightyear is an initiative by former members of the Solar Team Eindhoven (Eindhoven University of Technology). The lightweight, aerodynamic Lightyear One vehicle which has been designed to be as safe as possible will cost around € 150,000. It is scheduled for market launch in spring 2020 and will be exclusively available for lease through LeasePlan.

The Lightyear One, developed by Solar Team Eindhoven, is scheduled for market launch in 2020.

Vehicle to grid

A sustainable energy system includes so-called 'prosumers': consumers who produce renewable energy. One example of that is vehicle to grid (V2G): a system in which cars can be used to store any excess energy generated and release it back to the grid during peaks in demand. This can be included in energy contracts, resulting in user discounts. The energy sector sees potential in this system, because it offers benefits to both grid operators and EV users.

NEW ENERGY SOURCES FOR VEHICLES

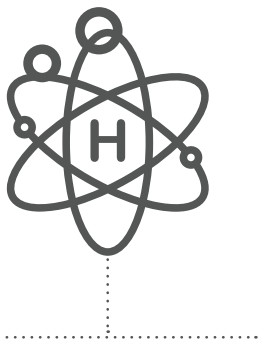
Hydrogen

Hydrogen is a hot topic at almost every conference and report about the energy transition or the Paris Climate Agreement

The colourless, odourless, non-toxic gas is regarded by many as the missing link in the switch from fossil fuels to renewable energy sources because it has the potential to replace fossil fuels such as natural gas for industrial and consumer purposes. Furthermore, it is suitable for storing green energy generated by wind farms, for example, as a way of safeguarding the supply of clean energy even during longer periods without wind. In other words, hydrogen is becoming a key sustainable energy carrier. The process of powering cars by hydrogen is less efficient than using electricity, because a certain amount of energy is required to convert hydrogen back into energy.

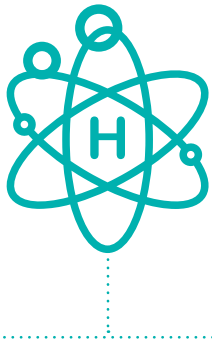
There are three ways to produce hydrogen. The most sustainable method is the electrolysis of water using wind or solar power, but there is not yet enough renewable energy for all cars to run on sustainably produced hydrogen.

Three methods for hydrogen production



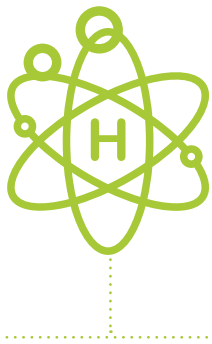
Grey Hydrogen

Steam is used to split natural gas into hydrogen and CO_2. CO_2 emissions are 20% to 30% lower than diesel and petrol, and there are zero emissions of NO_x and fine particulate matter.



Blue Hydrogen

The same process as for grey hydrogen. The CO_2 is collected and stored, e.g. at the bottom of the sea.



Green Hydrogen

Hydrogen produced by electrolysis using solar or wind power as the energy source. This achieves the biggest environmental gains.

NEW ENERGY SOURCES FOR VEHICLES

Hydrogen

Although green hydrogen is the best method from an environmental perspective, it is also more costly than producing grey or blue hydrogen. When the price of natural gas is low, it is difficult for green hydrogen to compete with the other two methods.

Hydrogen still has a very limited market share when viewed as a percentage of the total number of refuelling stations. According to the latest figures, hydrogen is currently available at just 152 refuelling stations in the whole of Europe, with Germany out in front. There are 136 in Asia and 78 in North America. Out of those 366 hydrogen refuelling points, 273 are open to the public. On a global level, Japan tops the list with 96 public hydrogen stations.

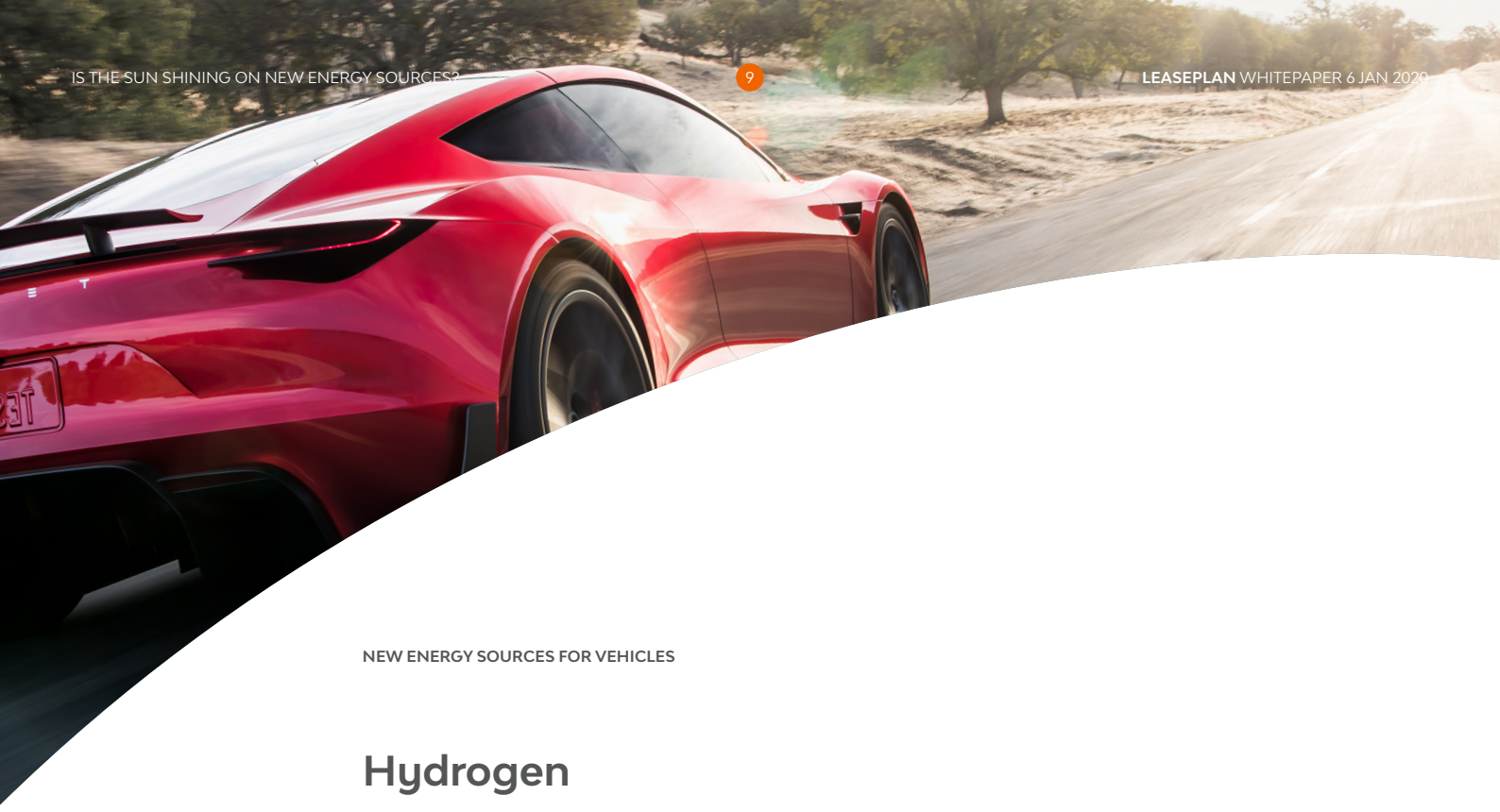
Opportunities in the mobility sector

The International Energy Agency (IEA)[vii] is keen to see hydrogen play a bigger role in the renewable energy landscape. As the basis for achieving that, the IEA makes seven recommendations, including extending the use of hydrogen in the mobility sector. Thanks to its unique properties, hydrogen is ideal in the transition to clean fuel for cars – combustion emits just pure water rather than CO_2 and other harmful substances. In fact, hydrogen cars are electrically powered. They include a small battery which is charged by a hydrogen fuel cell during driving. Hence, they are also referred to as fuel cell electric vehicles (FCEVs).

Existing use cases in the mobility sector

In terms of road transport, the use of hydrogen and fuel cells has been most extensively tested with buses in public transport networks. Since the early 1990s, the number of buses running on hydrogen has grown to several hundred worldwide – predominantly in North America and Europe, but increasingly in Asia too[viii].

Heavy freight transport in particular offers more opportunities for hydrogen than for electric vehicles. The main advantage of hydrogen as a fuel is the larger range.



Hydrogen

LEZ schemes boost demand for hydrogen

Following on from the Climate Agreement, more and more larger towns and cities are choosing to restrict pollution-causing vehicles in their urban centres. The implementation of a low-emission zone (LEZ) to regulate the volume of high-emission vehicles in a specific geographical area is often considered the most effective measure that towns and cities can take to improve air quality. This usually means that vehicles with high emission levels may not enter the area at all, or in some cases that drivers of such vehicles must pay a fee/ toll in order to enter the LEZ. The concept of 'environmental zones' originated in Sweden in 1996, and there are now many similar schemes in numerous countries around the world. LEZ requirements are not harmonised across countries, however, but are instead subject to the various local and/or national regulations. The continued growth of LEZ schemes is expected to further drive the demand for hydrogen.

Hydrogen-powered passenger cars

The Toyota Mirai and Hyundai Nexo are two examples of existing hydrogen-powered passenger cars, and the launch of more new models could provide much-needed help in bringing prices down. Lower prices will stimulate demand and encourage investment in the further development of hydrogen-based vehicles and hydrogen refuelling stations.

Hydrogen is gradually attracting increased attention in the LCV segment too. Hyundai has developed a concept version of its H350, for example, and Volkswagen is working on the Crafter HyMotion, which will result in a range of 500 kilometres and a refuelling time of just four minutes. These models have not yet gone into production due to the lack of hydrogen refuelling infrastructure.

NEW ENERGY SOURCES FOR VEHICLES

Hydrogen

Time to scale up technologies

Clean hydrogen is currently gathering unprecedented political and economic momentum, with the number of policies and projects around the world expanding rapidly. It is now time to scale up technologies and expand the use of hydrogen in mobility through fleets, freight and transport corridors in order to bring down costs and stimulate wider adoption of hydrogen.[ix]

> *"Following on from the Climate Agreement, more and more larger towns and cities are choosing to restrict pollution-causing vehicles in their urban centres."*

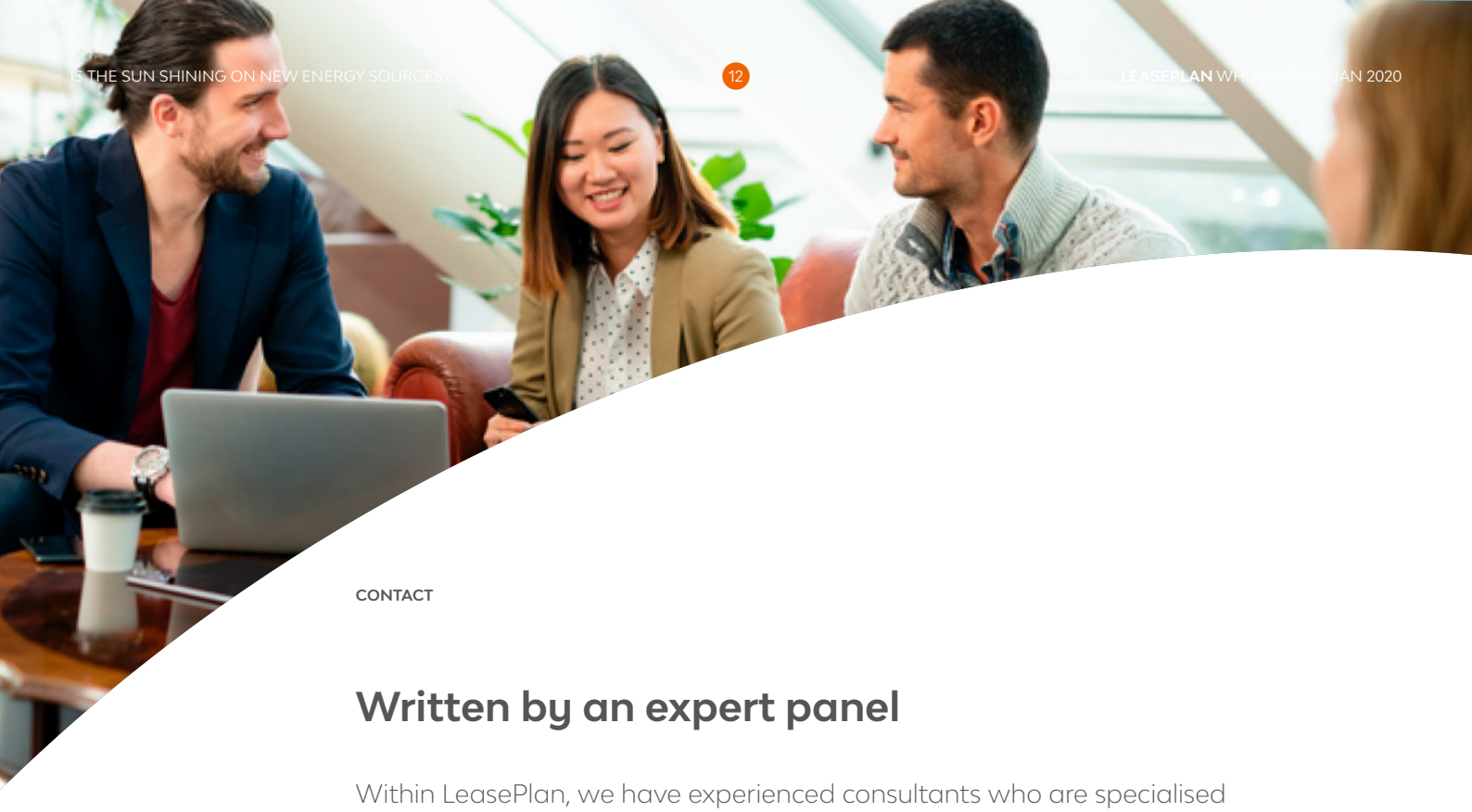
CONCLUSION

Electricity or hydrogen – what will it be?

The core target in the Climate Agreement is to reduce greenhouse-gas emissions by 40% by 2030 compared with 1990 levels. Employers must do their bit to help achieve this goal. The biggest gains are to be made by switching to EVs – especially solar-powered ones – and vehicles running on sustainably produced hydrogen.

So will it be electricity (rechargeable batteries) or hydrogen? The signs seem to indicate it will mainly become a combination of hydrogen for heavy freight transport and EVs for general mobility and LCVs, not least because there is simply not yet enough renewable energy available to produce sufficient green hydrogen for everyone's needs.

> *"The signs seem to indicate it will mainly become a combination of hydrogen for heavy freight transport and EVs for general mobility and LCVs"*



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Written by an expert panel

Within LeasePlan, we have experienced consultants who are specialised in the complex dynamics of today's – and tomorrow's – mobility market. They can provide tailor-made advice and training and offer solutions for your specific mobility needs. Ask your LeasePlan contact person for more information or support.

Our new energy team

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