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The Case for Hydrogen

Why Critics Get it Very Wrong

The goal is clear: Europe's economy is to become CO_2-neutral by 2050. But the way to get there is still less clear. One decisive and controversial topic is hydrogen. This article looks at popular arguments against hydrogen and unmasks them as mere myths.

“That hydrogen is the champagne of the energy transition and an unnecessary luxury – a statement which critics like to spread – therefore turns out to be a myth. Hydrogen is much more like water: absolutely necessary to enable an era of renewable energies.”

The facts are clearly in favor of hydrogen: It is key for sustainable transportation. That’s why we at Daimler Truck are pursuing a dual strategy based not only on batteries, but also on fuel cells.

Myth #1: Hydrogen is the champagne of energy transformation

Fact: Hydrogen is like water – absolutely essential

Today, the world meets a large part of its energy needs from fossil fuels. And the regions where oil, gas and coal are mainly produced are often many thousands of kilometers away from North America, Europe or Asian countries like China and Japan where they are mainly consumed. Europe, for example, is a net importer of energy.

In the future, the world will increasingly meet its energy needs via renewable energies. Especially via solar energy. So that’s changing. But one thing remains unchanged: Also in the future origin and consumption of energy will often be far apart. Solar energy is best harvested in sunny regions such as North Africa, the Middle East and Australia. However, it will continue to be used primarily in regions that already account for the majority of energy consumption today.

This means that even in the age of renewable energies, Europe will remain an energy importer. And above all: renewable energies will also be traded and transported internationally.

The question now is: How can this trade and transport become possible? The answer: Not via power lines and electrons, but only via a molecule-bound, non-carbon energy carrier – namely hydrogen.

Hydrogen is therefore urgently needed for a sustainable, international energy market. That hydrogen is the champagne of the energy transition and an unnecessary luxury – a statement which critics like to spread – therefore turns out to be a myth. Hydrogen is much more like water: absolutely necessary to enable an era of renewable energies.

Myth #2: Hydrogen is energy inefficient

Fact: Hydrogen is “sun-to-wheel”-efficient

It is said that hydrogen is too energy inefficient – especially compared to batteries. If a hydrogen-based fuel cell powers a truck, the argument goes, a much smaller portion of the solar energy that was originally put in is used for propulsion than with a battery. The ratio is about 30 percent vs 70 percent. The so-called “well-to-wheel” efficiency of fuel cells is therefore lower than that of batteries by a factor of two to two and a half. The reason for this is that a significant portion of the usable energy is lost when hydrogen is generated in the electrolyzer and later converted into electricity in the fuel cell.

This ratio seems to speak a clear language – for batteries and against hydrogen. Yet it is not that simple. Because we need to consider the following: The solar energy used to charge a battery truck in Europe must also be harvested in Europe. The solar energy used to generate hydrogen for a fuel cell truck, on the other hand, can be harvested in much sunnier regions. There, each solar panel square meter delivers two to two and a half times as much electricity as in Europe.

If we now combine both facts – the lower energy efficiency of fuel cells and the higher efficiency in harvesting solar power – it comes down to this: With a solar installation in the sunny south, it is possible to move a fuel cell truck the same distance as a battery truck for which the energy is generated with a solar installation of the same size in Europe. Experts therefore speak of a balanced “sun-to-wheel” efficiency for fuel cells and batteries.

Moreover, energy efficiency is not a decisive criterion. That would only be the case if renewable energies were in short supply. But they are not. Every day, 15 times as much energy hits the earth’s land surface as we currently consume worldwide in an entire year. So there is plenty of energy available. We just need to capture it and make it available in the right place.

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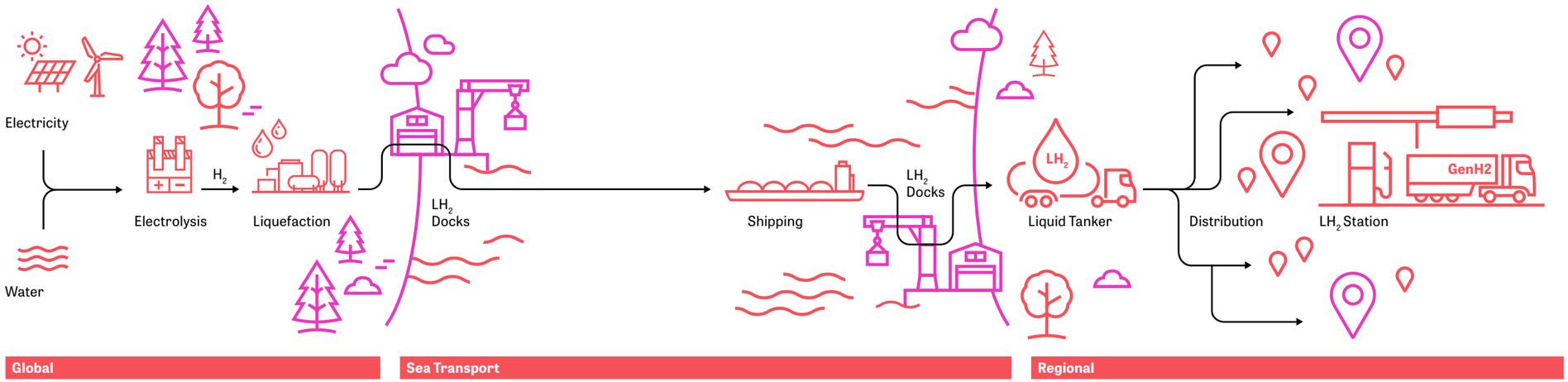
Myth #3: Hydrogen is too expensive

Fact: Cheap solar power makes hydrogen competitive

Critics like to point out that hydrogen currently costs more than ten euros per kilogram and is therefore not competitive. And at first glance, they are right.

Yet a high price today does not mean the price will also be high tomorrow – for two reasons. First, the electrolyzers still have a very low capacity, so we do not yet see any economies of scale.

And second, the energy used in electrolyzers is very expensive in Europe. The calculation looks very different if – see Myth #2 – the solar energy is harvested in sunny regions. There, solar energy is cheaper by a factor of two to two and a half – and because the energy used in electrolyzers is the largest cost block at about two-thirds, this immediately makes hydrogen competitive.



Myth #4: Hydrogen infrastructure is too expensive

Fact: Two infrastructures are cheaper than one

An electricity grid is already in place, so it requires relatively little investment to charge the first battery-powered cars and trucks with it.

It's a different story with hydrogen. There is almost no infrastructure yet, and so considerable initial investment is needed to build up an initial supply.

Yet it would be fundamentally wrong to conclude from this that the costs for a hydrogen infrastructure are too high and that hydrogen therefore is out of the question.

Because after this first phase with an initial small number of zero-emission vehicles comes the decisive next phase: the ramp-up with a rapidly increasing number of vehicles.

If we then continue to rely exclusively on batteries, it will be very expensive to scale up the power grid further and further. Just one example: Once battery-electric trucks hit the road in large scale, a highway charging station will require 20 to 50 charging bays on average. Each of which should be equipped with megawatt charging – an energy load comparable to a city of 15,000 inhabitants.

In a study, the consulting firm McKinsey examined how infrastructure costs would develop if zero-emission vehicles were powered a) exclusively by batteries or b) exclusively by hydrogen-based fuel cells. Or if c) both technologies are used. The result was clear: c) is the most advantageous scenario. Building two infrastructures is cheaper than one.

Intuitively, one might have expected a different outcome. But: scaling the infrastructure for one technology to an extreme volume is more expensive than scaling two infrastructures to a medium volume.

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Myth #5: Hydrogen is just a pet project of the big industry

Fact: We invest in a big way

We as Daimler Truck have committed ourselves to invest in hydrogen technology on a grand scale. By 2026, our joint venture with Volvo Group called cellcentric will put in operation one of Europe's largest production facilities for fuel cells.

Moreover, in the second half of this decade our Mercedes-Benz GenH2 Truck will hit the road, undergoing rigorous testing already. All of this clearly shows: We are very serious about hydrogen and make it an integral part of sustainable transportation.