

## My Vision for Green Hydrogen

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Hydrogen production around the world continues to grow rapidly.

Analyzing some hundred projects already active or under construction across the planet, in the United States, Europe and China, even though in very distinct ways and with different targets, we are searching all the reasons, numbers and goals in details, to understand how our world could benefit from it, in the field of e-mobility, but also of heating and industrial applications.

To fully understand where the energy sector is heading with this new “water-based fuel”, or even “valuable alternative to natural gas”, it is important to place it briefly within the world economy.

Imagine a substance largely present in the universe, with good energy efficiency which, if produced correctly, can be 100% sustainable and useful for powering all those machineries and systems that cannot be equipped with a battery pack or with a traditional engine, and therefore do not depend exclusively on electricity from the public grid or renewable, or even from fossil.

The hydrogen production capacity in North America, Europe and China recently increased exponentially, at different speeds, but it is still in an early and insufficient stage.

The United States have invested more than anybody else in this technology, with a total of around 10 billion dollars, financed for the development of a widespread network of production plants, which are now constantly growing. After the USA comes Europe, with 7 billion dollars, and finally China, with 5 billion dollars. This latter, however and despite having fewer funds dedicated to hydrogen, has been the one that has recorded the largest year-on-year growth, at around 200%, approximately.

It is clear that the world is moving to make hydrogen a strategic field, but not fast enough.

To meet the zero emissions targets set for 2050, it is first of all necessary to increase the production capacity again more than 200 times. And to do so the Governments need to understand the importance of funding this sector and making it rich and attractive for private investors.

As per my vision, indeed, the world is going towards a future of multiple jeopardized micro producers, connected in a sort of global network, let us call it “hydrogenet”, a bit like the internet. But we need to make a statement: not all hydrogen is good enough. Green hydrogen is classified as green if produced through an electrolysis process, only using the energy produced by renewable sources, such as solar, wind, waste or hydroelectric energy. My idea is to build a multiple network of scalable and modular systems, compact enough to be placed in all houses, such as in storage parks, micro private power plants or even in containers and easily moved, on trains, trucks, and so on, being able to produce and store green hydrogen in the most flexible way. Stored hydrogen can then be utilized when and where needed, in a number of situations. The goal is indeed to create a worldwide network of small and medium producers and users, which can be auto producing and sharing small quantities of hydrogen, in the most flexible way. But we need to speed up and the Governments need to put a much bigger investment target on this field. As we are now, this will not be enough to start with a real business, as today a business plan takes too long to be affordable. We need a huge starting sparkle.

And this will have two main positive effects, one on the economy, creating business, and the other on the environment, as ensuring clean hydrogen and universal access to integrated energy systems is defined as the new key vector for achieving climate neutrality goals. Green hydrogen represents the most important green solution and the most affordable path, at the moment. We need to speed up in the direction of a sustainable energy carrier, providing the perfect solution for energy production. In fact, if produced cleanly, hydrogen can be a viable sustainable alternative for energy production at the expense of energy sources that have a greater impact on the environment, such as fossil fuels or even batteries.

An electrolyzer also uses electricity to split water into hydrogen and oxygen, but this electricity is specifically produces in a totally clean way. The excess oxygen should not be discharged into the environment, but also used to provide medical tanks, or to clean water in public pools or for other industrial operations.

Since hydrogen is an energy carrier, it can be used to power any hydrogen fuel cell electric application, including trucks, tramways, buses, trains and even cars of elevators, and data centers.

The hydrogen gas can be either compressed or liquefied for storage.

The four primary types of electrolyzers are based on Solid Oxide Electrolyzer Cell, Anion Exchange Membrane Electrolysis (AEMEL), Proton Exchange Membrane (PEM) and Alkaline Electrolyzer.

We need to improve the efficiency of this process. The more efficient the electrolyzer is, the less electricity is wasted, and the lower is the cost of the green hydrogen. So we are also studying new types of electrolyzers. This is the main R&D goal, today.

The hydrogen produced is regarded as renewable and CO<sub>2</sub>-free from well to wheel when the electrolyzer system is driven by a renewable energy source.

And furthermore, a lot of companies are working on the transition from natural gas to hydrogen in the boilers. The goal is to get to a 100% hydrogen boiler. Today the state of the art is the so called "H<sub>2</sub> Ready" boiler, commercialized by different companies, which can work with a maximum 20% hydrogen blend, but many companies seem to be ready for a stunning increase of this percentage.

In order to overcome these grid-related difficulties, hydrogen can also serve as an energy storage medium, making it simpler to use renewable energy off the electric power grid or can be used immediately after its production.

In conclusion, considering the geopolitical situation, the macro-economic framework, along with all the changes that are happening in the world, such as wars and a large number of human movements, gas and energy increasingly in trouble, it is considered necessary to accelerate the transition to renewable technologies, especially hydrogen. We have a niche project to develop hydrogen on small and medium-small customers and therefore very widespread in the area. So, the goal is to create a capillary structure where those customers install these highly profitable experimental systems in a relatively short time, without big investments and therefore without big risks.

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