magility

POSITION PAPER

Hydrogen – just one part of the big picture
Energy transition, companies and „Climate Action Failure“

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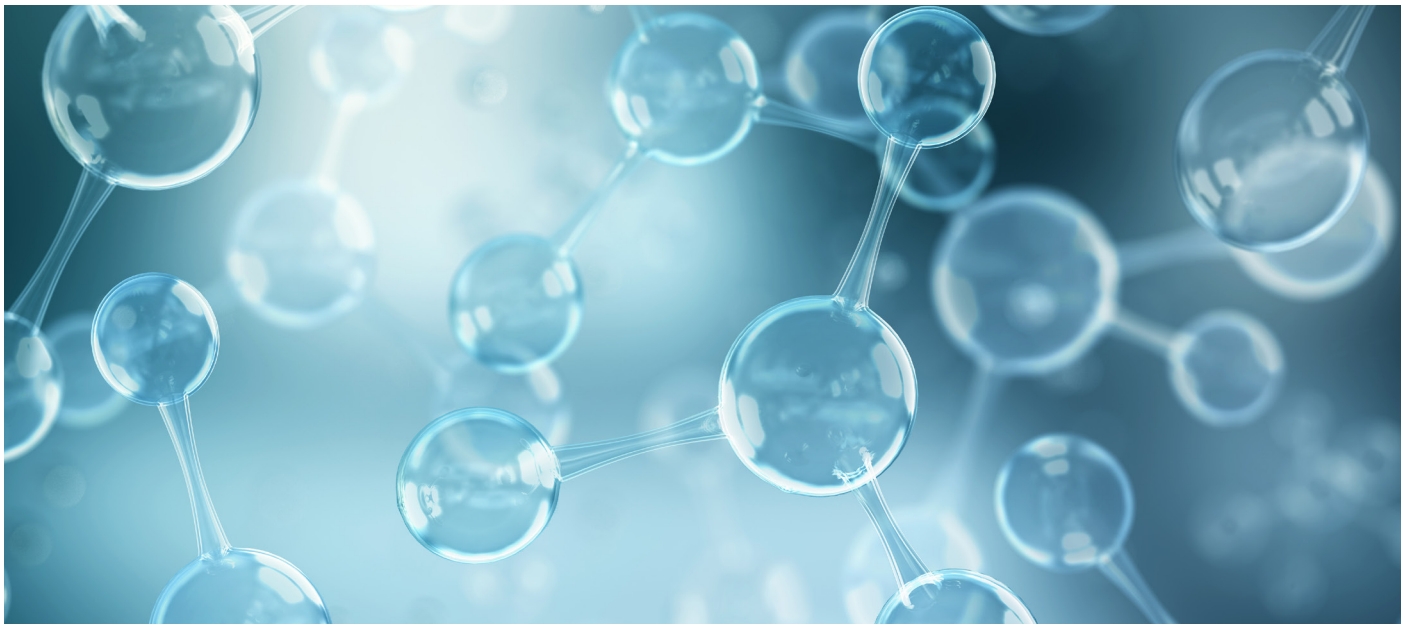


Foreword

„Climate Action Failure“ will become one of the biggest risk factors for companies in the future: companies are meanwhile no longer merely required, but rather forced by political framework conditions, to actively participate in the energy turnaround. Germany and the whole of Europe are to be greenhouse gas neutral by 2050; this is what the German government and the European Union have stipulated. The primary goal is to replace conventional energy resources and fossil fuels with CO2-neutral resources. The energy supply in the areas of transport and buildings, in industry and in production processes will change fundamentally and with it the entire economy itself. Sustainable structures will therefore become the new formative economic factor of our time. The megatrend neoecology will shape the future and will especially affect the thinking and acting of companies. The economic system as well as the market will change permanently. As a result, companies are not only faced with the challenge of aligning themselves with the future through digital transformation and the associated innovations and new business areas, but the 2020s will also be decisively shaped by sustainability issues that concern every entrepreneur.

Jules Verne wrote in the book „The mysterious Island“ as early as 1874: „Water is the coal of the future. The energy of tomorrow is water which has been decomposed by electric current. The elements of water thus decomposed, hydrogen and oxygen, will secure the earth‘s energy supply for the unforeseeable future.“ H2 is one of the options for phasing out fossil fuels quickly and sustainably. H2, especially in its green variant, offers considerable potential for climate protection targets. In order for hydrogen to establish itself as a sustainable and easily accessible energy carrier, it is necessary to consider various fields: From production, logistics and distribution to applications. At magility, we focus on the applications and new business models that can be created by H2. What potential does hydrogen have for new business models, and what innovative technologies do we need for this? In which H2-business models do we see short-term and long-term potential for our customers, which are efficient and also economically worthwhile for the companies? We at Magility GmbH have taken a close look at the market and H2-technologies as well as the framework conditions over the last few years, and we are taking a stand in this paper.

Hydrogen and its possible applications

Applications for hydrogen (H2)

Hydrogen is seen as a promising alternative to fossil fuels. Due to its many possible applications, it can play a key role in achieving climate targets, provided that it is green hydrogen.

Energy storage systems that can guarantee a continuous supply of electricity despite the strong fluctuations in the amount of energy generated from wind and sun will therefore be very popular in the future. This is where hydrogen enters the stage. Hydrogen, used as an energy storage medium, can compensate for fluctuations in the energy grid through power-to-gas applications and thus cushion energy demand fluctuations and usage peaks, and this in a wide variety of industrial sectors. If hydrogen is used as an energy storage medium, wind turbines will be able to run continuously, as the electricity produced can always be used for hydrogen production. Wind turbines that stand still despite the wind will soon be a thing of the past.

Hydrogen is multifunctional and can be used in many industrial areas, e.g. in the energy industry, in chemical production for steel or fertilizer, or even in transport. Where these considerable quantities of hydrogen come from and how it will be possible to provide them from climate-friendly and, not least, renewable sources is a matter of concern for players at all political levels. Electricity is needed to produce hydrogen. It is clear that the demand for electricity will increase massively by 2030 and that Germany – like other countries – cannot currently meet its own energy needs sustainably.

However, it must also be assumed that the green hydrogen required in Germany cannot be produced entirely locally. This means that we will in any case have to talk about hydrogen cooperations with countries where the possibilities for regenerative hydrogen production will be significantly higher than their needs. With regard to solar energy production within the EU, the favourites are Spain, Portugal, France, Bulgaria, Romania, Italy and Greece. For the use of wind and water energy, the northern countries such as Denmark, Ireland and Sweden and additionally Norway are potential candidates for cooperation.

The **automotive industry** is currently evaluating the use of hydrogen in freight transport with different results. In passenger cars, the race is clearly decided in favour of the battery-electric variant. H2 is used for quasi-stationary alternative drives and e-fuels. In **space travel**, hydrogen has been used as an energy carrier since the US moon missions. Apollo space ships had the first modern fuel cells on board to ensure power supply. Fuel cells are also used in **intralogistics**, e.g. in forklift trucks. In the **energy industry**, hydrogen is used as an intermediate storage medium for renewable energies from wind or solar energy and is either fed into the gas grid or converted into electricity as required. Hydrogen technology is also used in **real estate**, e.g. in the form of fuel cell heating appliances that reform hydrogen from natural gas. The resulting hydrogen is used to produce electricity with the aid of a fuel cell. The heat released by this reaction can be used for **space heating** or **drinking water heating**. Hydrogen can also be used as **seasonal storage** for self-produced solar energy. In this case, an electrolyser is used to produce hydrogen from solar power. The hydrogen is then stored and, for example, converted back into electricity in a fuel cell in winter. Surplus energy is thus not lost and can be retrieved later at a convenient time.

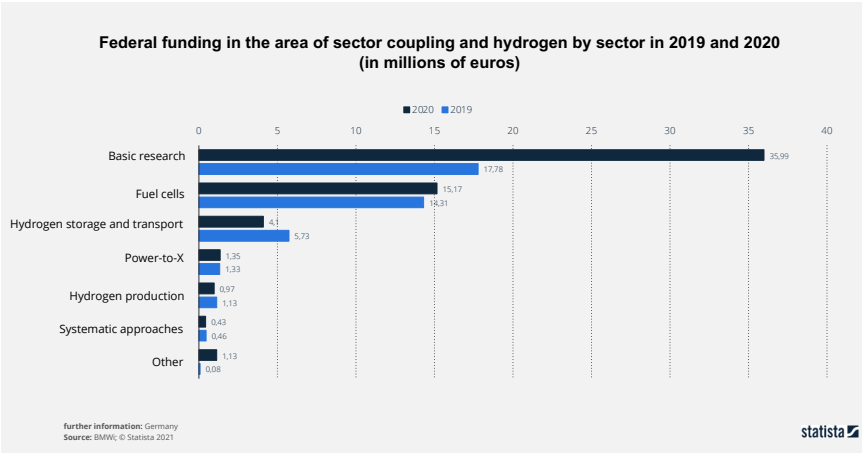
H2 can also be used in **rail transport**, e.g. in the form of hydrogen-powered trains that act as alternatives to diesel-powered train carriages on non-electrified routes. **Military shipping** is already using fuel cells and electric motors as silent propulsion for submarines. **Civilian shipping**, on the other hand, is only just starting with the first pilot projects on the subject of hydrogen. Under the leadership of Meyer Werft and its project partners, a new generation of PEM (fuel cell systems) for use on ocean-going passenger ships is being investigated in the course of the Pa-X-ell2 demonstration project through the test operation of test systems with fuel cell technology, which are being developed as part of a decentralised energy network and hybrid energy system.

Due to the climate discussions, cruise lines have become the focus of criticism and are reacting: After Aida Cruises sent the first liquefied natural gas-powered cruise ship to sea in 2018, MSC Group's cruise division, Fincantieri and Snam, signed a declaration of intent in July 2021 to jointly build the first hydrogen-powered cruise ship. It was not until September 2021 that the International Maritime Organization (IMO) adopted the „Guidelines for the safety of ships using fuel cell power installations". After approval by the Maritime Safety Committee, they will come into force in May 2022. This will enable the market ramp-up of fuel cell systems in the maritime sector and the construction of emission-free ships.

Framework conditions for H2 application scenario

Subsidies

The funding landscape for hydrogen projects is highly developed. More than 300 million euros are available until 2023 from the climate fund alone. **Funding quotas of 40-50 %** are granted. Funding is available for fuel cell vehicles in local public transport,trains and ships powered by fuel cells, publicly accessible hydrogen filling stations in road transport, fuel cell systems for the self-sufficient energy supply of critical or off-grid infrastructures, and fleets of fuel cell-powered ground transport vehicles.



The **German government** is funding hydrogen projects to the tune of billions of euros as part of the National Hydrogen Strategy, which is intended to dovetail climate, energy, industry and innovation policy. Since 2020, the German government has made more than 8 billion euros available for 62 selected projects. Around 2 billion of this has been allocated to the steel industry. According to the German Ministery of Transport, 1.3 billion euros have been earmarked for research and development and market activation measures as part of the National Hydrogen and Fuel Cell Innovation Programme. Funding is provided for hydrogen-based energy solutions in H2-research, H2-production, H2-storage and H2-use.

With the funding call **„Future Programme Hydrogen BW“** of April 1, 2021, the Ministry of the Environment of Baden-Württemberg started the implementation of measures in the most important thematic fields of the Hydrogen Roadmap BW introduced by the state government in 2020. The aim of the Hydrogen Roadmap BW (ZPH2) is to support companies in establishing a future-proof and competitive hydrogen economy in Baden-Württemberg. The state is providing a total of 26.4 million euros for this purpose until 2024. More than 20 project outlines were received by the deadline at the end of May 2021. Following a meeting of the jury with experts, the decision on project applications to be funded is now being prepared. Approval is planned before the end of 2021.
If one takes a closer look at the funding jungle, one finds many more offers to promote the realization of hydrogen projects on the state, federal and international level.

magility view on H2-promotion

The many funding opportunities lead to a correspondingly large number of funded pilot projects. These pilot projects primarily serve to build up competence and the necessary H2-supply chain. The cost efficiency apart from the funding sum is often pushed into the background and thus also the direct comparison with another, perhaps more sensible solution for the climate overall. We at magility also see the danger that successful pilot projects do not become mainstream projects as soon as the funding ends, and that many of the hyped hydrogen projects suddenly disappear again because they prove to be economically unsustainable compared to other solutions. The use of these subsidies is very well suited to providing an initial spark for H2-business models, but as magility we always make sure that our customers have a sustainable business model that is commercially viable in the long term even after the subsidy period has expired. We support our customers in finding the right funding sources for their company and business model and also in placing orders.

Rules and regulations

In order to create viable and functioning H2-business models for economic operation that promise profitable investments, regulatory framework conditions must be adapted. Now and even more so in the future, the rules and regulations must also create a secure framework for companies when comparing H2-business models with alternative business models, so that their decisions do not only have to be oriented one-dimensionally to economic efficiency.

Among other regulatory areas, regulations on the pricing of fossil energy use, on emission limits in local and global markets, and on the use of green hydrogen must form the core of the regulations.

magility view of the H2-rules and regulations

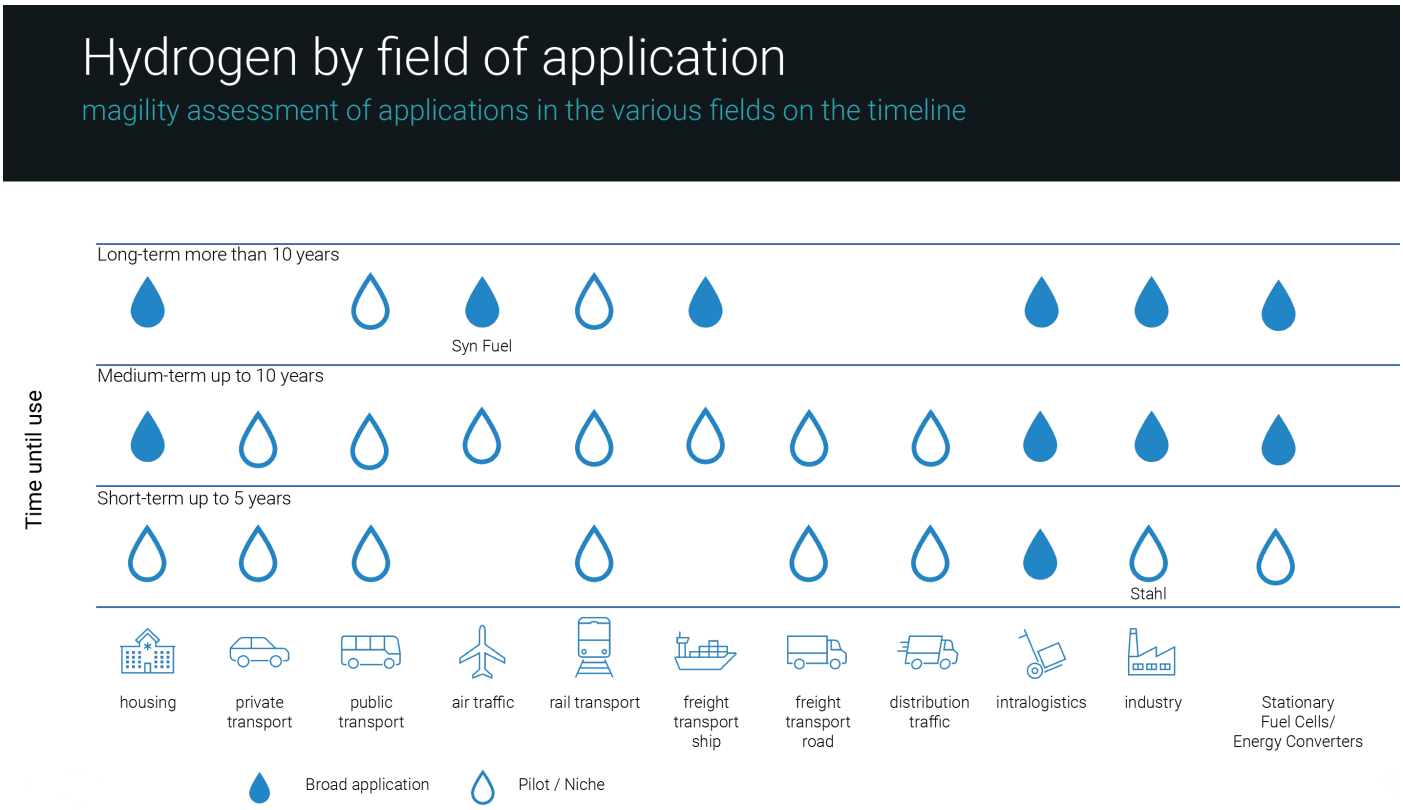
Only with the right regulations it is possible to build a new infrastructure that forms the basis for new business models. In particular, sustainable mobility, the expansion of renewable energies and efforts to reduce greenhouse gas emissions will be key factors influencing the implementation of hydrogen projects. Political decision-makers must create the necessary regulations for hydrogen production, infrastructure and applications so that the desired H2-business models can be successful. Without these regulations, the H2-initiative will fail.

Changes in the market, infrastructure and society

The energy transition not only brings with it new forms of organisation and business models. The process of change induced by the energy transition also requires new ways of behaving and living and creates entirely new responsibilities, also with regard to social interaction. The energy transition also has a political, social and institutional dimension that must not be neglected. The social requirements and thus also the requirements of the customers or buyers change with the awareness of the critical climatic situation, which will have massive effects already now and at the latest with the next generation. This fact is leading to a steadily increasing sensitivity towards sustainability issues and consequently the number of companies imposing corresponding self-imposed obligations on themselves, e.g. with regard to emission standards, is rising.

In addition, the new requirements are changing the systems and products for energy, mobility, heating and transport. In order to achieve the targeted hydrogen goals, a massive growth of the H2-infrastructure in the areas of production, pipelines, refuelling, storage and use is necessary.

magility's assessment of the future of hydrogen according to fields of application

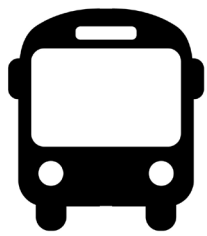


Housing – Combined Heat and Power

In the residential sector, we see long-term H2-applications for emission-free buildings and neighbourhoods. Decentralised fuel cell applications, which are particularly suitable for stationary applications, will be used there.

Private transport (car)

A car powered by fuel cells offers no advantages over a purely battery-powered vehicle. We do not see any viable business models here in the long term, at the latest when the subsidies come to an end.

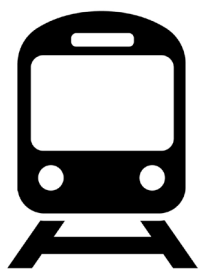


Public transport (buses)

A bus powered by fuel cells only offers advantages over a purely battery-powered vehicle in very specific applications and routes. In the long term, we do not see any widespread applications here, but there will probably also be pilot projects or niche applications in which the H2-drive is used.

Air traffic

In order to achieve the goal of „emission-free flying“ in the long term, aircraft engines will be fired with H2-based synthetic fuels in the future and will gradually replace fossil kerosene.



Rail transport

A train powered by fuel cells offers no advantages over a purely battery-powered train with an overhead line. In the long term, we do not see any widespread applications here, but there will probably also be pilot projects or niche applications in the long term in which H2-propulsion is used, especially if the line is not already electrified.

Freight transport – ship

In order to enable emission-free marine logistics in the long term, ship propulsion systems will be fired with H2-based synthetic fuels in the future and will gradually replace fossil heavy fuel oil.

Freight transport – road and distribution

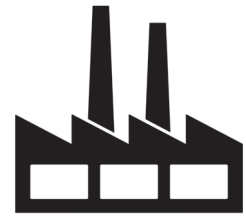
A truck powered by fuel cells offers no advantages over a purely battery-powered vehicle. We do not see any viable business models here in the long term, at the latest when the subsidies come to an end.

Intralogistics

Emission-free intralogistics using hydrogen can very well substitute the current gas-powered (CH4 and other) logistics vehicles.

Industry

As an energy carrier, hydrogen will enable emission-free production in industry in the long term and replace fossil energy carriers.



Stationary fuel cells/energy converters

Fuel cell applications, which are particularly suitable for stationary applications, will also become established in the long term and will be used in various branches of industry.

Opportunities for industry and SMEs

	Industry heat	Industry cement	Industry steel	Intralogistics small	Intralogistics big	staionary enegry converters	power & heat generators	Syn Fuel for airplanes	Syn Fuel for ships
Production	Components & Pipes	Components & Pipes	Components & Pipes	Components & Pipes	Components & Pipes	Components & Pipes	Components & Pipes	Components & Pipes	Components & Pipes
Storage	Tanks	Tanks	Tanks	Tanks	Tanks	Tanks	Tanks	Tanks	Tanks
Power to Liquid								Tech	Tech
Distribution	Pipelines	Pipelines	Pipelines	Pipelines	Pipelines		Pipelines	Pipelines	Pipelines
Energy conversion				Components & Pipes	Components & Pipes	Components & Pipes	Components & Pipes	Components & Pipes	Components & Pipes
Burner	Components & Pipes	Components & Pipes	Components & Pipes						
Project-management Planning	Planning Support Maintanance			Planning Support Maintanance	Planning Support Maintanance	Planning Support Maintanance	Planning Support Maintanance		
HUB planning and development	Planning Support Maintanance			Planning Support Maintanance		Planning Support Maintanance	Planning Support Maintanance		
Area planning and development						Planning Support Maintanance	Planning Support Maintanance		
Public management and marketing	Concept Realisation Feedback			Concept Realisation Feedback		Concept Realisation Feedback	Concept Realisation Feedback		

Summary

Among the different types of applications for hydrogen as an energy carrier, the long-term applications with high potentials in CO2-reduction are the steel and cement industries. This is followed by other heat-based industries that can use hydrogen as a substitute for gas and oil burners. For electrical power generation in larger building complexes, hydrogen can be used as a base energy for combined heat and power plants. In the long term, shipping and aviation can also be decarbonised on the basis of hydrogen-based energy sources.

Regard to the significantly poorer overall efficiency of road-based drive technologies, battery-electric variants are highly likely to prevail in car and truck transport. Niche and special applications can also be developed on the basis of hydrogen for special usage profiles.

magility as a hydrogen expert

The use of hydrogen technology is not always the best solution. At magility, we view hydrogen as part of the bigger picture and analyse in detail whether the use of a hydrogen technology is really worthwhile in terms of sustainability, economic efficiency and functionality. Only when the strength of hydrogen is considered across all sectors for transport, electricity generation, heat and industry green hydrogen can develop its full potential in a sustainable energy system and a viable concept emerge. Magility helps to identify the opportunities and potential risks arising from the topic of hydrogen and the reorganising energy industry, and works with companies to find suitable business models. Hydrogen is currently the best energy storage medium for long-term large-volume energy storage. However, the conversion losses are very high and hydrogen will be at a disadvantage compared to an electric battery by a factor of 2.5. If the direct use of renewable energies is only possible with difficulty or not at all, the use of H2 and its downstream products only makes sense in our view. Hydrogen is an answer to the decentralization of the energy economy. Hydrogen forces our society to develop networked concepts that can be implemented with local partners and companies from various industries. We see ourselves as a system integrator for hydrogen projects especially in the fields of industry, real estate, individual mobility, transportation and energy supply for the German market. We model the individual environment of our customers and can calculate individual optimizations from the available energy balances and applications. From this, we create suitable and scalable solutions that can also be expanded and adapted over time.

As soon as a company or a municipality uses fossil fuels or manufactures products that are used in systems with fossil fuels, those responsible should also deal with the topic of hydrogen. The modification of conventional to climate-neutral business models requires a high degree of competence and experience. The greatest challenge for companies is to find the optimal mix between climate neutrality and business success.

At magility, we have a network that has been built up over decades, in particular with the important players in the energy and mobility industry as well as the international high-tech start-up scene, and we bring the right people together at the right time. In this way, we help our customers with capacity and competence to equip their companies for the current challenges. International networks, also with high-tech start-ups, are gaining with regard to entrepreneur relevance. We see ourselves in the best position to advise our customers on strategy and action planning and to accompany the implementation process of a hydrogen project in the company.

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