

Emerging hydrogen industry can help tackle climate change, but complex risks need managing

Hydrogen is predicted to play a leading role in the energy transition towards a low-carbon economy. As an alternative to fossil fuels like oil and coal, it could be key for tackling climate change in future, helping many industries to reduce their carbon emissions.



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While hydrogen technology has been in use for decades, currently planned mega projects require a scaling up of risk management around production, storage and transportation of hydrogen.

"Hydrogen (produced from low-carbon or even renewable energies) is of growing importance for the substitution of fossil fuels in the fields of energy, supply, mobility and industry. It has the potential to morph from a niche power source into big business, with countries committing billions to scale up their infrastructure and with projects being introduced around the globe. Despite these successes, there are challenges to overcome for hydrogen to become a major part of the energy transition, such as the cost of production, supply chain complexity and a need for new safety standards," says Chris van Gend, global head of energy and construction at Allianz Group Corporate & Specialty (AGCS).

Over 30 countries have produced hydrogen roadmaps

Hydrogen offers several options for the transition towards a low-carbon economy: as an energy carrier and storage medium for conversion back to electricity, as a fuel for all means of transport and mobility and as a potential substitute for fossil hydrocarbons in industries such as steel production or petrochemicals.

Around the world, there is strong governmental commitment for hydrogen initiatives, backed by financial support and regulation: As of the beginning of 2021, over 30 countries have produced hydrogen roadmaps and governments worldwide have committed more than \$70bn in public funding, according to McKinsey. There are more than 200 large-scale production projects in the pipeline. One of the most significant announcements has been the European Commission's [Hydrogen strategy for a climate-neutral Europe](#), released in July 2020, which includes an ambitious target of 40GW of European electrolyser capacity to produce green hydrogen by 2030. Africa established the [African Hydrogen Partnership \(AHP\)](#), which advocates for the establishment of renewable hydrogen economies to offer solutions to many of the social, economic and environmental issues faced by African nations. It has laid out a framework for its vision of the hydrogen economy in Africa, beginning with the construction of power-to-gas renewable energy hubs in large metropolitan areas,

ports and mining centres along important trans-African highways

Assessing the risk environment

Many of the technologies used for the generation of hydrogen or energy from hydrogen are well known in principle. "Today the vast majority of hydrogen is produced and used on site in industry. What is new is that the type and scale of its adaptation is changing fundamentally, with the expected rapid growth of plants in future. We see the advent of giga-scale projects in many countries with various new players entering the market and established players sizing up – and risk management has to keep pace," says Thomas Gellermann, an AGCS risk consultant and expert at Allianz Centre for Technology.

- **Fire and explosion hazards**

The main risk when handling hydrogen is of explosion when mixed with air. In addition, leaks are hard to identify without dedicated detectors since hydrogen is colorless and odorless. A hydrogen flame is almost invisible in daylight. Industry loss investigation statistics show approximately one in four hydrogen fires can be attributed to leaks, with around 40% being undetected prior to the loss.

"Fire and explosion protection needs to be considered on three different levels. Preventing the escape of flammable gases as much as possible. Ensuring safe design of electrical and other installations in areas where ignition sources cannot be excluded and constructing buildings and facilities to withstand an explosion with limited damage. Proper handling of hydrogen gas is critical, and any emergency situation requires appropriate fire safety equipment," says Gellermann.

An AGCS analysis of more than 470,000 claims across all industry sectors over five years shows how costly the risk of fire and explosion can be. Fire and explosions caused considerable damage and destroyed values of more than €14bn (\$16.7bn) over the period under review. Excluding natural disasters, more than half (11) of the 20 largest insurance losses analyzed were due to this cause, making it the number one cause of loss for businesses worldwide.

- **Material embrittlement**

Diffusion of hydrogen can cause metal and steel (especially high-yield steels) to become brittle and a wide range of components could be affected, for example, piping, containers or machinery components. In conjunction with embrittlement, hydrogen-assisted cracking (HAC) can occur. For the safety of hydrogen systems, it is important that problems such as the risk of embrittlement and HAC are taken into account in the design phase. This is ensured by selecting materials that are suitable under the expected loads as well as considering appropriate operating conditions (gas pressure, temperature, mechanical loading). High-yield strength steels are particularly at risk of hydrogen-related damage.

- **Business interruption exposures**

Hydrogen production or transport typically involves high-tech equipment and failure to critical parts could result in severe business interruption and significant financial losses. For example, in case of damage to electrolysis cells (used in water electrolysis) or heat exchangers in liquefaction plants it could take weeks, if not months to replace such essential equipment, resulting in production delays. In addition, business interruption costs following a fire can significantly add to the final loss total. For example, AGCS analysis shows that across all industry sectors, the average BI loss from a fire incident is around 45% higher than the average direct property loss.

Significant increase in demand for insurance expected

Given the numerous projects planned around the world, insurers can expect to see a significant increase in demand for coverage in future to construct and operate electrolysis plants or pipelines for hydrogen transportation.

“As with any energy risk, fire and explosion is a key peril. Business interruption and liability exposures are also key as are transit, installation and mechanical failure risks,” Van Gend says.

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