



Add value.
Inspire trust.

Hydrogen Services

A potential energy carrier for
achieving your decarbonisation goals



Your challenges

The fight against global warming and climate change is a challenge that affects everyone – in all countries and industries. Numerous nations are already committed to reducing energy consumption and have agreed to ambitious goals to minimise carbon emission-related effects. However, the transition from conventional to renewable energy such as wind and solar power is just a first step in achieving these goals.

As the current renewable energy production is based on climate variation, we need to move towards more consistent and reliable renewable source energy like Hydrogen. But there are many challenges with the nature of gas and the production of Hydrogen to make it safe and efficient for mass scale development and distribution. Until now, hydrogen has been produced mainly via steam reformation and used within industrial applications – a process that creates an abundance of damaging CO₂ emissions and therefore decreasing importance. In the future, the demand for hydrogen will grow due to additional consumers from sectors such as mobility seeking its benefits. However, in order to keep it sustainable and to reach climate goals in all

application areas, the CO₂ footprint of hydrogen needs to be reduced.

Hydrogen has a significant potential to decarbonise energy consumption. However, to achieve this potential, several obstacles around hydrogen production, storage, transportation and distribution must be overcome. Perhaps, the biggest challenge for developing hydrogen as an energy carrier is that the gas has an extremely low volumetric density – at 3.2 times lower than natural gas and 2,700 times lower than gasoline. Hydrogen must therefore be compressed or liquified to be cost-competitive with other forms of energy. However, achieving this presents a number of technical challenges and difficulties:

- Hazards – compressed hydrogen can be explosive
- Hydrogen liquifies at -253°C, making this an energy intensive form of storage
- Regulations for hydrogen storage vary significantly around the world
- Mixing hydrogen safely with natural gas in pipelines is a challenge
- Damage – hydrogen can embrittle components and storage materials

SERVICES			GREEN PRODUCTION (Renewables + Electrolysers)	TRANSMISSION / DISTRIBUTION / STORAGE (Pipeline, Tank)	CONSUMPTION (Mobile, Stationery, Applications)
FEASIBILITY			Technical Due Diligence and Project Risk Rating		
			HAZOP Analysis		
			Feasibility Studies		
MANUFACTURING	Staff Training/Personal Certification QA/QC Services		Evaluation of safety concepts		
			Component, System Testing and Certification		
					Fuel cells testing and certification
		Material compatibility assessment, testing and qualification		Assembly and stationary	
CONSTRUCTION		Assembly group certification (NoBo)		Rail assembly certification	
		Global market access		Global market access	
OPERATION			Pre-commissioning testing, test concept for operation		
			Risk-based inspection	Conformity evaluation pipelines	
			Green Hydrogen Certification		
			Damage Analysis		
			Staff Training / Personnel Certification		
		Project management in large H2 infrastructure projects			

To become a truly competitive source of green energy, the cost of storing and transporting hydrogen must be reduced. Green hydrogen is expected to play a major role in the renewable energy revolution. However, before hydrogen usage becomes more widespread, several key challenges related to consumption must first be addressed. As the usage of green hydrogen increases, it will be essential for companies operating in this sector to ensure it can be safely used by consumers and business customers.

Why is Hydrogen important?

Hydrogen as an energy carrier offers the extensive potential to support decarbonisation efforts. Hydrogen can be used as a storage medium to further advance the integration and use of energy from renewable sources. It can also be used as a sector coupling technology to decarbonise all energy sectors. This has been recognised by governments and industry leaders worldwide. In principle, all industry-driven countries have not only understood the role of hydrogen to reach climate goals but have started to support the introduction of hydrogen in projects reaching from the generation of green hydrogen over transportation to hydrogen usage in widespread applications.

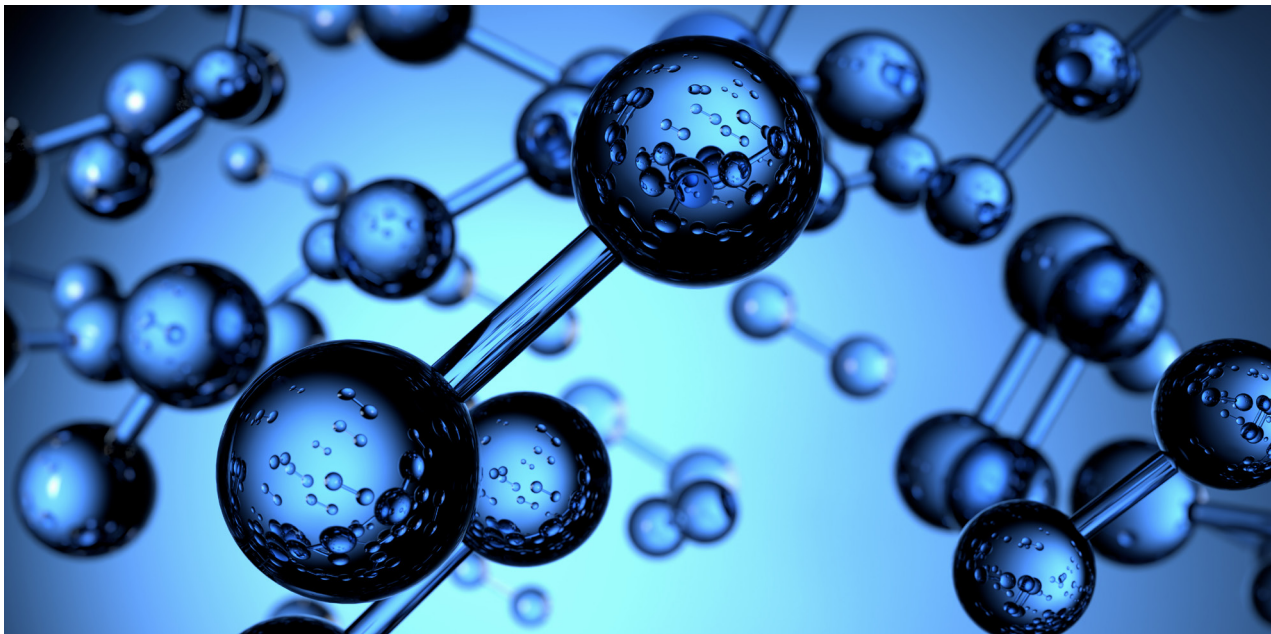
How can we help you?

At TÜV SÜD, we are committed to applying our vast expertise and experience with hydrogen and related technologies to support the development of safe, secure and reliable hydrogen energy solutions. TÜV SÜD has experience over the whole value chain of hydrogen and life cycle of hydrogen technologies. Our experts have accompanied numerous successful and innovative projects over the past decades.

Our services

Our solutions in hydrogen technology are divided into four segments:

- **Strategy, realisation and integration:** We support you throughout the entire process by offering comprehensive technical capabilities with a strong network of experts from a wide range of different areas. Our conviction that hydrogen is the energy source of the future for your organisation is a key driving force for us. And we can be your energy transformation partner from strategy to integration.
- **Production of Green Hydrogen:** Electrolyzers and Powergas facilities use renewable energy from sources such as wind turbines and solar panels to create hydrogen or, in a separate step, even methane, known as the important molecule within natural gas. TÜV SÜD offers a comprehensive service portfolio for investors, manufacturers and operators of such facilities. Our services include, but are not limited to, project due diligence and risk assessment to support investment decisions, Notified Body certification as well as initial and regular inspections during operation as an Authorized Inspection Body to ensure regulatory compliance or assessment of safety concepts to meet HSE requirements.
- **Transmission, storage and distribution:** Under standard conditions, hydrogen is a combustible, colorless, odorless, tasteless, non-toxic, non-corrosive, non-metallic, two-atomic gas. It can be stored and distributed



in a similar way as other gaseous fuels (e.g. natural gas), typically by being compressed or even liquefied. Common hydrogen storage and transmission technologies include pipelines, tanks and trucks. TÜV SÜD offers operators and manufacturers of hydrogen equipment extensive support with our services, including flow metering, feasibility, due diligence, material compatibility testing, pipeline integrity testing, and infrastructure safety concepts.

- **Consumption or usage of Hydrogen:** Hydrogen can be used in different segments and helps to reduce carbon emissions in mobility applications, industrial production processes and residential applications for heating and power supply. This flexibility makes hydrogen the ideal fuel for climate neutral technologies. In addition, hydrogen can be used as industrial feedstock to power fuel cells or within turbines and motors. At TÜV SÜD, we provide services for all segments in which hydrogen is used, like fuel cell certification, car/rail homologation and fueling stations testing. With TÜV SÜD's interdisciplinary teams of experts, we provide individual services for all segments in which hydrogen is used. This covers services for manufacturers interested in testing and certification of fuel cells for vehicle homologation, HydRails or stationary application with CE marking. This also includes services to realize safe hydrogen installations like Hydrogen Refueling Stations (HRS) with accredited inspectors, for example, health and safety workers or an environmental protection base on local national requirements.

Your business benefits

- **Work with an expert partner** – having an experience over the whole value chain of hydrogen and life cycle of hydrogen technologies
- **Gain competitive edge** – with TÜV SÜD's safe, secure and reliable hydrogen energy solutions
- **Enhance your commitment towards sustainability goals** – through an expert partner having accompanied numerous successful and innovative projects over the past decades

Add value. Inspire trust

TÜV SÜD is a trusted partner of choice for safety, security and sustainability solutions. It specialises in testing, certification and auditing services. Since 1866, the company has remained committed to its purpose of enabling progress by protecting people, the environment and assets from technology related risks. Through more than 25,000 employees across over 1,000 locations, it adds value to customers and partners by enabling market access and managing risks. By anticipating technological developments and facilitating change, TÜV SÜD inspires trust in a physical and digital world to create a safer and more sustainable future.



Transform your business today with TÜV SÜD

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