Services along the hydrogen value chain

H_2 generation:

Electrolysis

HydroHub

H_2 competence @ HydroHub

Our services run along the entire value chain in the hydrogen industry – from generation through transport and storage to use in various fields of application.

Energy generation

Renewables (e.g. wind, solar)

Conventional power plants

Geothermal

H_2 generation

Electrolysis

Seawater desalination plants

Reforming processes

Methane pyrolysis

Distribution/transport

Electrical grid

Pipelines

District heating

Intelligent networks

Refuelling stations/ filling systems

Tankers (lorry, train, ship)

Storage

Battery storage

Gas tanks

Cavern storage (H_2 and CO_2)

Pressure vessels

H_2 hydride storage

Consumption/use

Fuel cell system

Methanol synthesis unit

Carbon capture and utilisation

Mobility (e.g. e-fuels)

Reconversion to electricity

Power to gas (gas, heat, liquid)

Industrial applications (e.g. refinery)

H_2 competence @ HydroHub

We give comprehensive support to hydrogen projects and offer a broad spectrum of services in the concept/planning, production, operation and decommissioning/disposal phases.

Concept/planning

We support you from the start with research and project planning measures and specific tasks. Already at the conception phase, we are there at your side with feasibility studies, strategic and financial consultation and a broad range of organisational and technical services. Alongside concept creation with consideration for legal, technical and economic conditions, we take on the task of analysing the requirements and support you in the process of determining feasibility through basic and design planning all the way to the approval process.

Production

For over 150 years, it has been one of our tasks to analyse and manage technical sources of risk. With our wide range of specific services, we are thus able to offer you competent help in the integration of hydrogen technologies into the industrial value chain. Our range of services runs from fact-finding and construction through project management, administering documentation and operator's obligations, basic and detailed process engineering all the way to project support through geological, environmental and engineering services during the production process.

Operation

We support frictionless operation with our extensive range of services and our primary goal of optimising operational reliability and preventing damage. Our services support you in the implementation of your operating strategies and in the accompanying optimisation, maintenance and upkeep concepts. Our safety-oriented process with operational monitoring and the creation of damage-limitation concepts contributes, in the final account, to establishing hydrogen in the popular conception as a safe and controllable technology.

Decommissioning/disposal

Just as we are there for you in the first concept phase, we are also at your side at the decommissioning phase, providing all the required services for dismantling and disposal – including project management and comprehensive services to handle your operational obligations. We create concepts to the current legal requirements, standards and regulations and support you in identifying, analysing and avoiding the potential risks of your intervention.

Electrolysers – the technology of hydrogen generation

For the electrolysis of water, various processes are used, achieving various levels of energy efficiency based on the specific technologies, materials, current densities, temperatures and other factors. What links all these techniques is the principle of splitting water into hydrogen and oxygen using an electrical current. Here, two water molecules ($2H_2O$) can be converted into two hydrogen molecules ($2H_2$) and one oxygen molecule (O_2). By using electricity from renewables, so-called “green hydrogen” results.

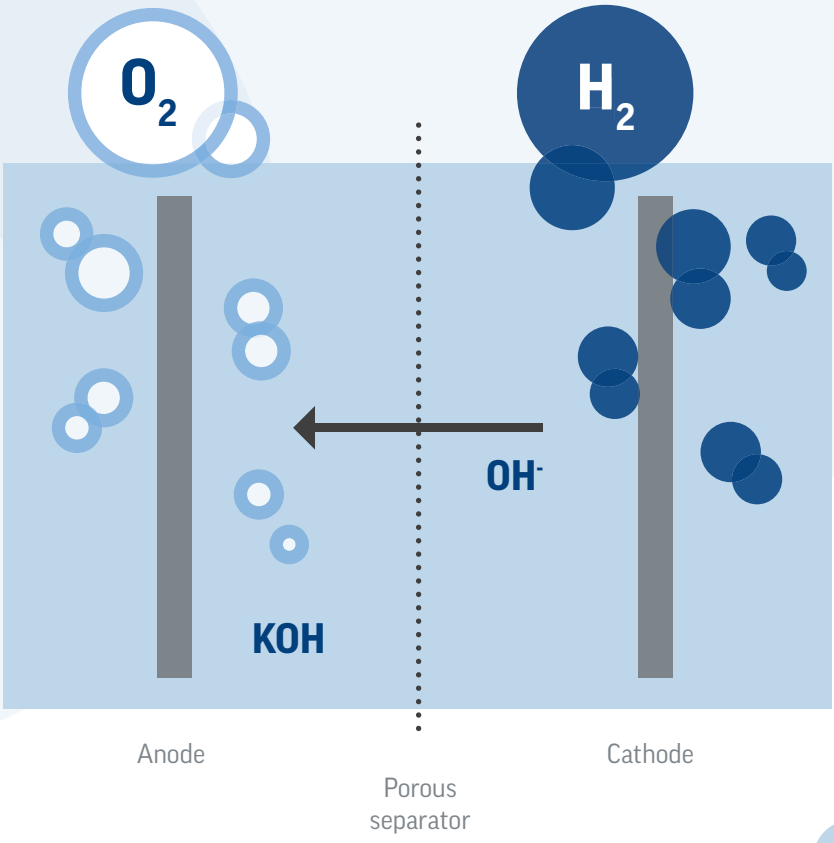
We are your partner for the development, assessment and integration of powerful electrolysers in your process chains – from the use of smaller systems in research institutes or the mobility sector all the way to larger plants for energy-intensive industries. With the most modern analytical methods, measurement processes and competent specialists, we are at your side to carry out your project safely and successfully, and to help you benefit from subsidies as available. Do get in touch.

Overview of the processes of water electrolysis

AWE (ALKALINE WATER ELECTROLYSIS)

Alkaline water electrolysers are used worldwide on an industrial scale, as they work with comparatively cheap materials. The electrolyte is a potassium hydroxide solution (KOH) with a concentration of 20–40 %. Under a direct current of at least 1.5 volts, hydrogen is formed at the cathode and oxygen at the cathode. The electrodes are nickel-based or made of ruthenium oxide or iridium oxide-coated titanium.

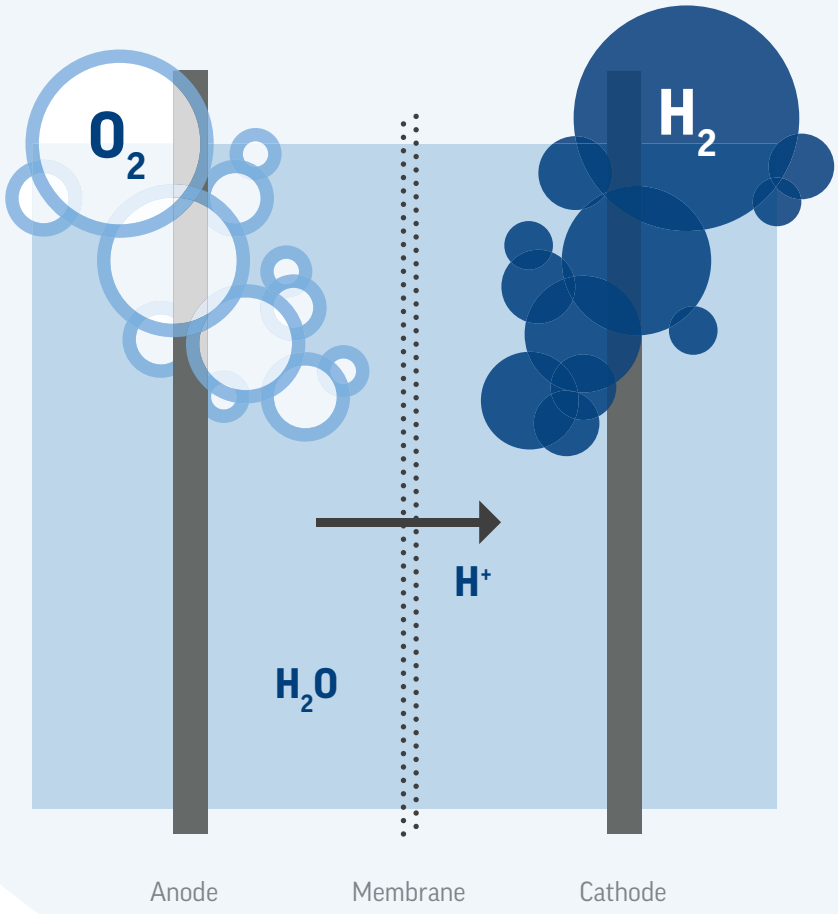
Limited efficiency: the anode and cathode are separated, in alkaline water electrolysis, by a porous, semi-permeable Zirfon membrane which only resists a limited level of pressure and can only be operated at low current densities (max. 600 milliampere per square centimetre of membrane area). The hydrogen must then be compressed at great energy cost so it can be stored and transported.



PEM ELECTROLYSIS (ACID ELECTROLYSIS)

In PEM electrolysers, instead of a liquid electrolyte, a solid polymer is used (proton exchange membrane). The membrane is suspended in distilled water or drinking water. The aggressive, acidic environment places a great burden on the materials, for which reason the polymer membrane is fitted on the cathode side with a porous, platinum-coated carbon electrode and, on the anode side, with a ruthenium or iridium oxide-coated one.

High efficiency: With 2,000 milliamperes per square centimetre of membrane, the solid, semi-permeable polymer membrane achieves three times the current density of the Zirfon membrane in AWE plants. In addition, it can withstand greater load fluctuations. As PEM electrolysers can be operated under high pressure, they also reduce the energy needed for subsequent hydrogen compression for storage and transport. The higher efficiency of PEM electrolysis makes it possible to use smaller electrolysers to generate the same quantity of hydrogen as with larger AWE units. Replacing the expensive platinum catalyst with molybdenum sulphite also allows investment costs for production to be reduced.



HTE (HIGH-TEMPERATURE OR STEAM ELECTROLYSIS)

A high temperature electrolyser works in the range between 100 °C and 900 °C, where efficiency increases in line with temperature. Unlike AWE and PEM electrolysers, they do not need noble metal components. The steam enters a solid oxide electrolysis cell, in which the water molecules are split between nickel cermet steam electrodes, for hydrogen, and electrodes consisting of mixed oxides of lanthanum, strontium and cobalt, for oxygen.

Top efficiency: With efficiency rates up to 90 %, high-temperature electrolysis is a particularly effective way of generating industrial hydrogen. It offers its advantages to energy-intensive sectors such as the steel industry, where great quantities of waste heat are available for use in high-temperature electrolysis.

Our services

In the development and operation of electrolysers, we are there for you to provide all the required services. From creating concepts in compliance with the standards and drawing up specifications to creating specific risk analyses and handling the complete project management, we offer you comprehensive provision in the fields of consulting, engineering and training – in all phases of the project in question:

	Concept/ Planning	Production	Operation	Decommissioning/ Disposal
Creation of concepts to current legal requirements, standards and regulations	●			●
Creating requirements specifications	●			●
Creating technical specifications	●			●
Creating commissioning and periodic inspection concepts	●			
Weak-point analysis, identification and analysis of potential risks	●			●
Creation, consultation on staggered power system protection plans, protection tests	●			●
Conception and consultation (commissioning, periodic inspection) of isolated networks including the incorporation of e.g. decentralised generator units, electrolysers and any necessary storage facilities (on and offshore)	●			
Creation of risk analyses to determine the potential risk of intervention	●			●
Creation of risk analysis and hazard assessments	●			●
Creation of safeguarding concepts	●			●
Consultation, evaluation of electrical and mechanical safeguarding systems	●			●
Consultation, evaluation on installation and operation of alarm receiving stations	●			●
Consultation, evaluation on determination of intervention measures by guarding/security company or police	●			●

	Concept/ Planning	Production	Operation	Decommissioning/ Disposal
Consultation, evaluation on determination of administrative security measures	●			●
Technical advisory services	●			
Project management and document administration	●	●	●	●
Creation of safety shut-down matrices for the safety chain	●			
Creation of fire and explosion protection concepts	●			
Calculation of pressure waves (explosion or bursting)	●			
Flow optimisation of components	●			
Dimensioning of safety valves	●			
Damage assessments and analyses of the causes of damage, creation of avoidance concepts			●	
Analysis and evaluation of damages and measures to prevent comparable faults			●	
Maintenance of breakdown statistics to assess operational reliability in comparable plants/components			●	
Analysis of electrical grids: e.g. short circuit, load flow calculations, efficiency and optimisation assessments			●	

HydroHub

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