



**BECOME A
WATER
EXPERT!**

**Pioneering technology
hydrogen production**

grünbeck

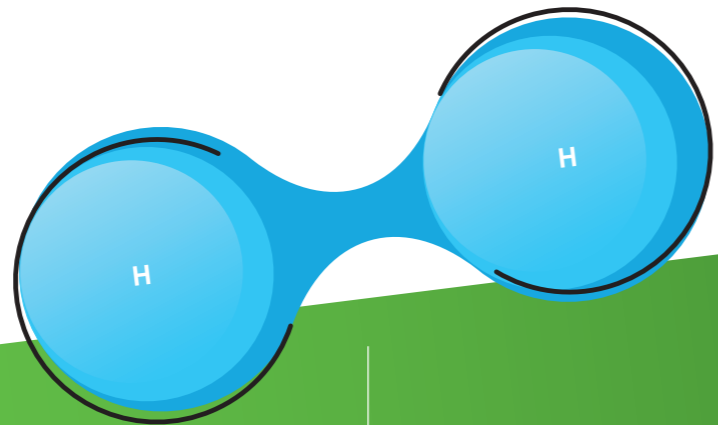
The element of the future!

Climate-neutral with H₂ effect

Whenever there is talk of sustainable energy storage or Co₂-neutral mobility, one element is usually not far away. With the atomic number 1, it is the lightest element we know and yet it has huge potential: hydrogen. As the energy source of the future, it is of paramount importance for achieving the objectives set as part of the energy revolution. Without this colourless gas, no green electricity will be stored, nor will there be any fuel cell-powered vehicles on our roads in the foreseeable future. For technology corporations, carmakers and the steel and chemical industries, hydrogen is currently the key technology for future developments.

Grünbeck is your partner during the transition

Water is a precious resource. This is precisely why at Grünbeck we have made it our business to provide it with its optimum quality and state. With our water treatment processes, we contribute to addressing unanswered questions, including those on the use of hydrogen. "Understanding water" together for a sustainable future.



Appearance: colourless gas (H₂)

Element category: Non-metal

Discoverer: Henry Cavendish

Atom radius: 25 pm

Melting point: - 259.14 °C



Reference Project

Demineralisation system for hydrogen production

✓ Make-up water feed of demineralised water with conductivity of < 0.2 µS/cm

Capacity: 360 l/h

System components: Supply tank, pressure booster system, softening system, activated carbon filter, residual hardness monitoring, reverse osmosis system, membrane degassing, electrodeionisation, pure water tank

✓ Circulation water treatment to the residual demineralisation system at < 0.1 µS/cm for water temperatures up to 60 °C (up to 70 °C for short periods)

Capacity: 4 m³/h

System components: UV system to the TOC reduction system, mixed bed ion exchanger cartridges, sterile filter

Material: Stainless steel 1.4404

The application of hydrogen

Power production: Stationary power supply with minimum performance losses

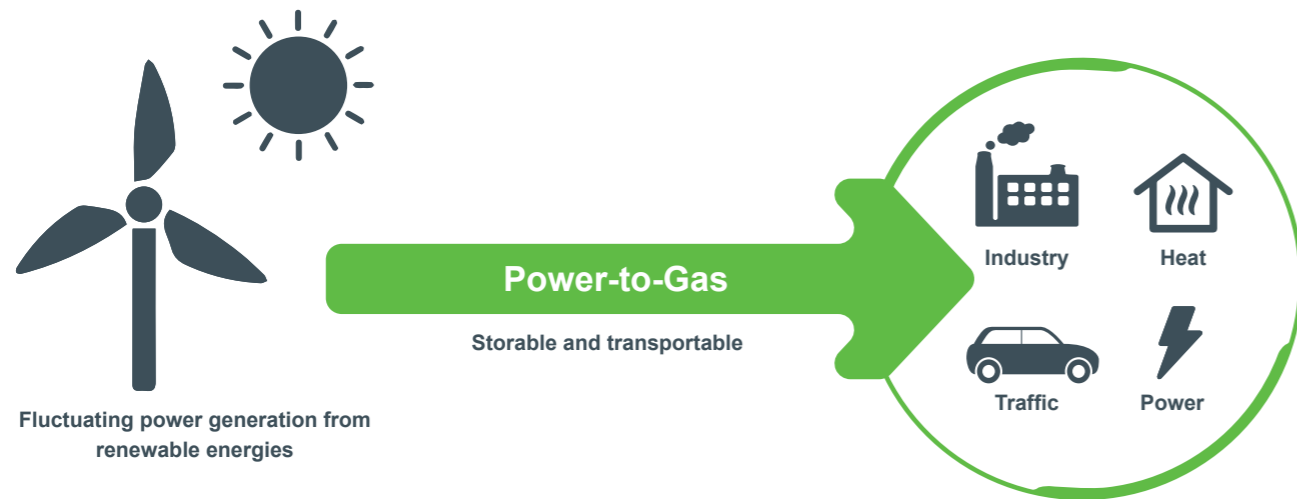
→ Regeneratively reproducible and flexibly applicable

Heat: making optimum use of renewable energies and cogeneration

→ 40 % of German CO₂ emissions currently results from heat generation!

Mobility: sustainable means of transport in all fields

→ Individual transport, public passenger transport, industrial trucks, road and rail freight transport etc.



Did you know?

Electrolysis is the separation of water (H₂O) into hydrogen (H₂) and oxygen (O₂) with the help of an electric current. The most important application of electrolysis is for hydrogen production.

Plain facts.

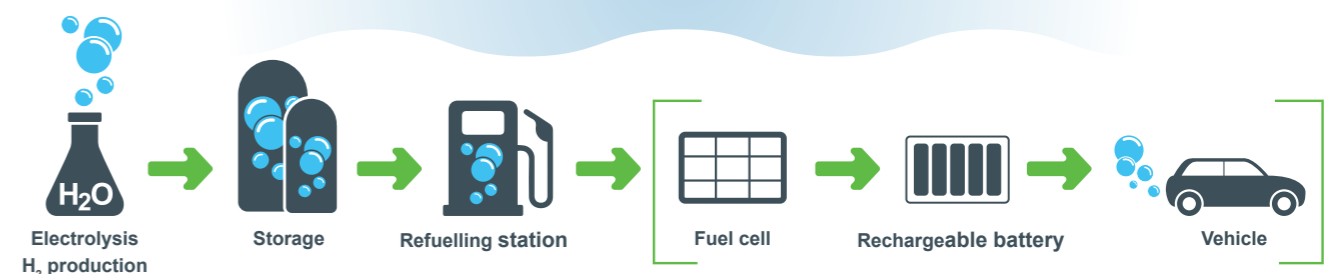
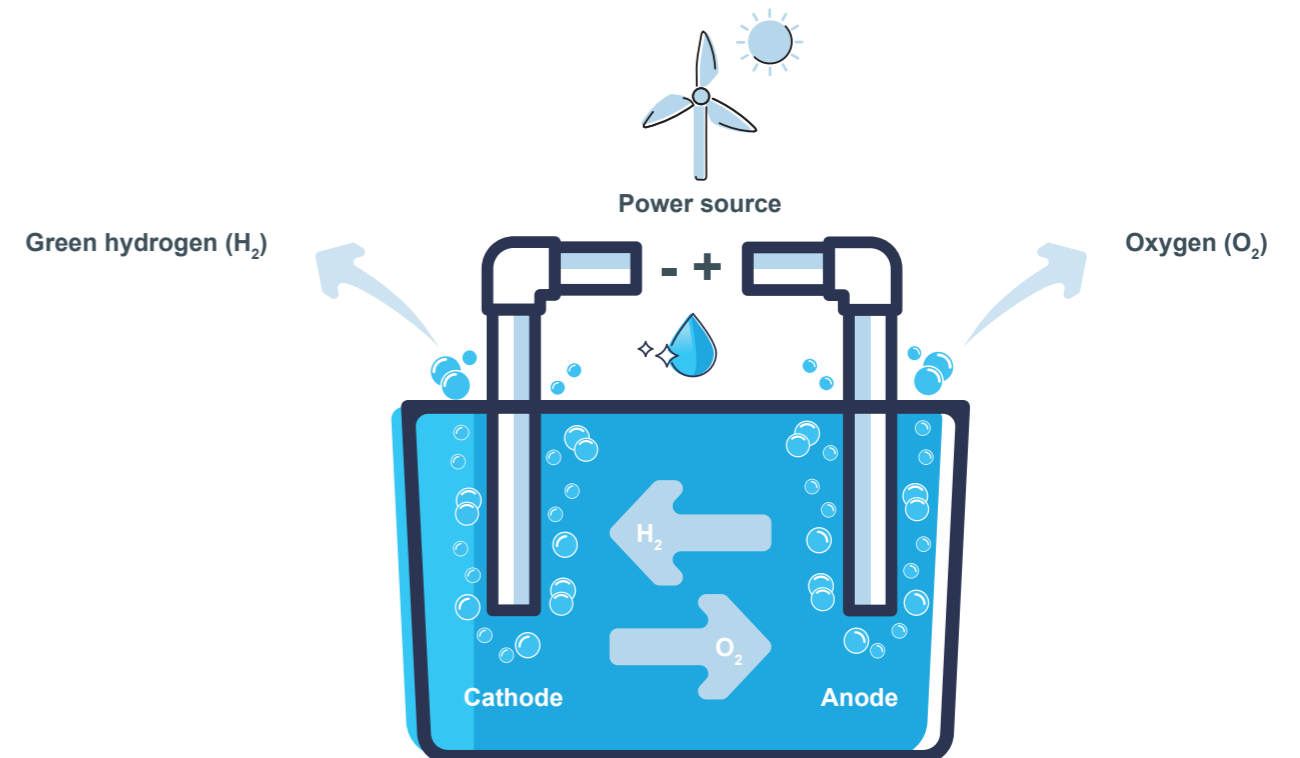
Hydrogen as an energy source

Advantages and opportunities

- High energy content
 - Combustion of 1 kg H₂ ≙ Combustion of approximately 2.75 kg petrol
- Hydrogen H₂ is available in virtually endless quantities
- H₂ is technically easy to produce from H₂O
- Storage and transport possible
- Power-to-gas: Making power storable by means of hydrogen
- Environmentally friendly: no CO₂ is produced when burning H₂
- Hydrogen refuelling stations and H₂ generation containers are not dependent on existing infrastructure

Grünbeck's role

Only the purest water is required for the electrolysis process. Other water-borne substances can lead to problems with the redox reaction. As a rule, water with electrical conductivity of < 0.1 µS/cm is required (fully demineralised water). Different methods are used depending on the manufacturer, which means, for example, that water treatment systems are required for additional fresh water feed or circulation treatment.



Optimum water by means of demineralisation

Water treatment according to nature's paradigm:

Grünbeck's reverse osmosis systems demineralise drinking water. The systems generate permeate for technical processes. In order to achieve higher permeate quality, with the GENO-OSMO-X the permeate can be demineralised even further by applying a second reverse osmosis stage (= permeate stage).

The principle of reverse osmosis

A fantastic idea of nature is implemented technically in the form of reverse osmosis. In the membrane process, water is pressed through a semi-permeable membrane by means of pressure. While the material is being transported through the membranes, dissolved minerals are retained and only the water molecules may pass through the membranes. The cleaned water is called permeate.

Reverse osmosis system GENO-OSMO-X



Product advantages

- System recovery up to 80 % → little waste water
- Energy saving up to 30 % → high-efficiency engine
- Link to conventional BUS systems optional
- Web link and emailing for 24-hour overview
- Integrated data logging
- Smart metering
- Automatic, self-regulating system operation
→ maximum process safety
- Touch display with an operating option for the entire system line
- Online operation optional
- High-pressure pump (stainless steel 1.4401)
→ long service life

Rack-mounted modular system GENO-OSMO-X p

Convenient rack-mounted modular system for individual requirements

The GENO p rack-mounted modular systems are pre-assembled on a system rack made of anodised aluminium. They represent the pretested plug-and-play solution for fast water treatment on your premises. Easy installation and the individual combination options do indeed highlight the advantages of Grünbeck's innovative, rack-mounted modular systems.



Product advantages:

- Individually customisable
- Completely pre-assembled
- Workshop-tested
- Plug-and-play

GENO-EDI-X Electrodeionisation system

Extraordinary technology for perfect water

With the electrodeionisation system GENO-EDI-X, Grünbeck offers you economic, continuous electrochemical deionisation by means of a combined electro dialysis and ion exchange process. It represents an optimum alternative to conventional ion exchanger systems. This environmentally friendly technology removes virtually all anions and cations. The EDI process is a highly efficient demineralisation process. With a Grünbeck reverse osmosis system installed upstream, the permeate produced in this process is also subjected to electrochemical residual demineralisation by the GENO-EDI system. The electric current ensures that the resin is regenerated continuously.



Product advantages:

- No downtimes thanks to electrochemical regeneration
- Designed for continuous operation
- No twin systems required to bridge the regeneration periods
- No storage and application of chemicals required
- Maintenance-free operation
- No waste water treatment required

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