Hydrogen facts

What are the benefits of hydrogen?

Safe transport and reliable storage

The safe handling of hydrogen has long been state-of-the-art in industrial applications. Transport by road, rail and water, transport through pipelines, temporary storage in pressurised or liquefied gas storage facilities – none of the above pose any fundamental problems. In order to set up an infrastructure, it is important to develop devices and systems suitable for everyday use and to further develop existing systems, such as making the current, conventional gas pipelines suitable for hydrogen, i.e. H_2-ready.

Unlimited availability and generation

When it comes to renewable energies in particular, we are often faced with the following fundamental challenge: in principle, they are abundant, but are not always available in places where they are needed – or in other cases renewable energy is generated in excess but cannot all be used.
With hydrogen as an energy source, we can bridge these local and temporal gaps between supply and demand. The electrolysis process in particular makes it possible to produce (green) hydrogen exactly where there is a lot of renewable energy available. This can then (liquefied under pressure) be transported to exactly where it is needed.

Diverse uses and applications

Reduction of emissions and environmental degradation

Sustainable systems are needed to replace fossil fuels, the extraction and combustion of which are harmful to the environment. With the use of hydrogen, we are giving the process of decarbonisation a considerable boost. It is an important alternative that brings us closer to the goal of achieving climate targets and preserving our world.

Sector coupling: Connect everything with everything

On the right track: Within the framework of sector coupling, we link various areas that were previously considered separately, such as electricity, heat, E-Mobility and industry. For example, power from wind energy is used to generate hydrogen which in turn is used in fuel cell cars or in industry. The benefits: synergies and efficiency are increased and power from renewable energies can be used in areas that were previously difficult to electrify.

colours mean?

Green, grey, blue and turquoise – there is a “colourful” mixture of types of hydrogen, even when in reality they are all colourless. We explain what it all means:

Green hydrogen

As a truly climate-neutral hydrogen, the “model student”, so to speak, of all the hydrogen variants. It is produced using electricity from renewable sources or by reforming biogas.

Blue hydrogen

This hydrogen is climate-neutral at least in terms of its climate footprint as the CO_2 produced during reformation of natural gas is separated and stored using CCS (carbon capture storage).

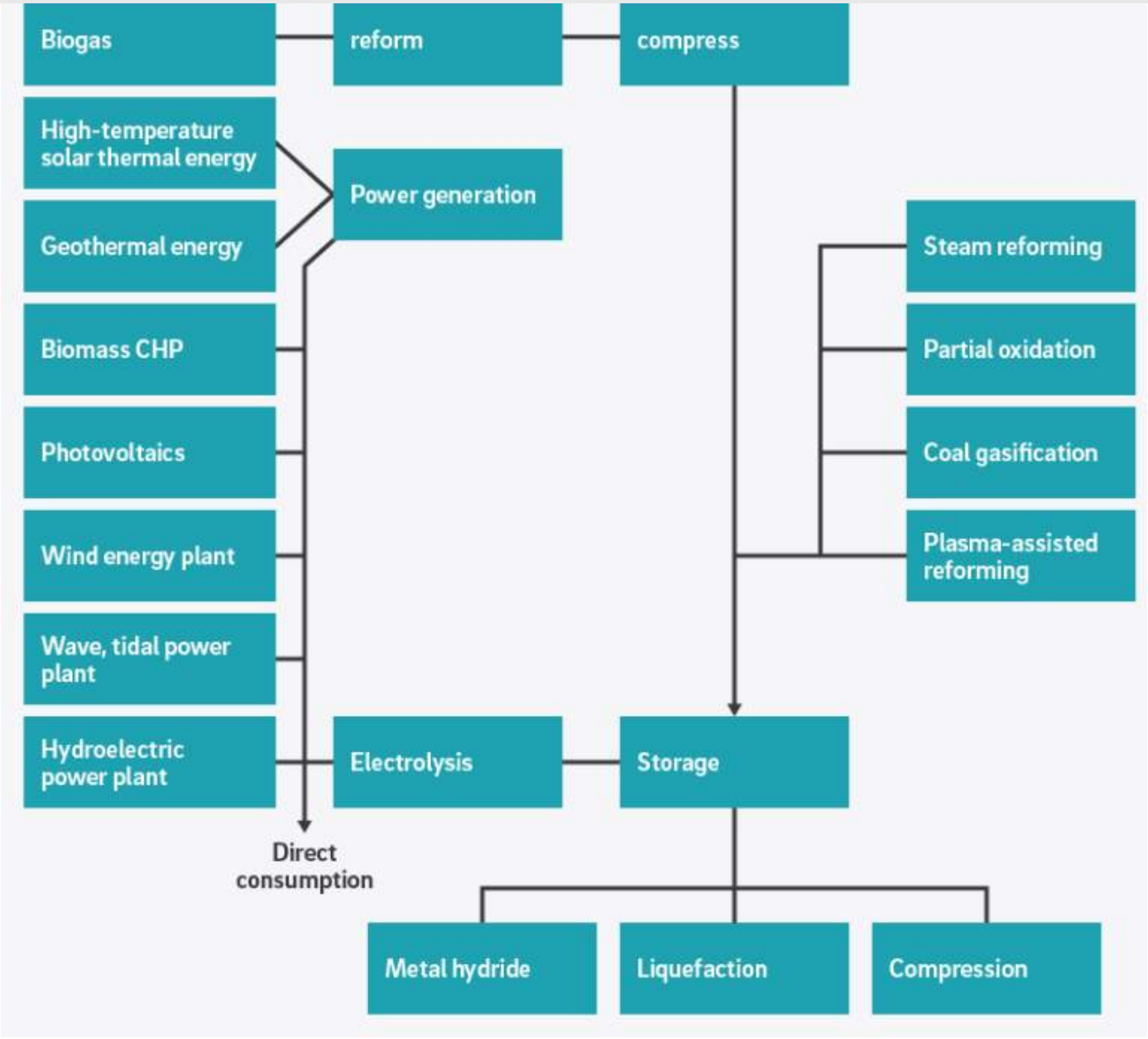
Turquoise hydrogen

If methane is split into hydrogen and carbon in a chemical process under intense heat (around 1,200° C), hydrogen is also produced. The process is called methane pyrolysis.

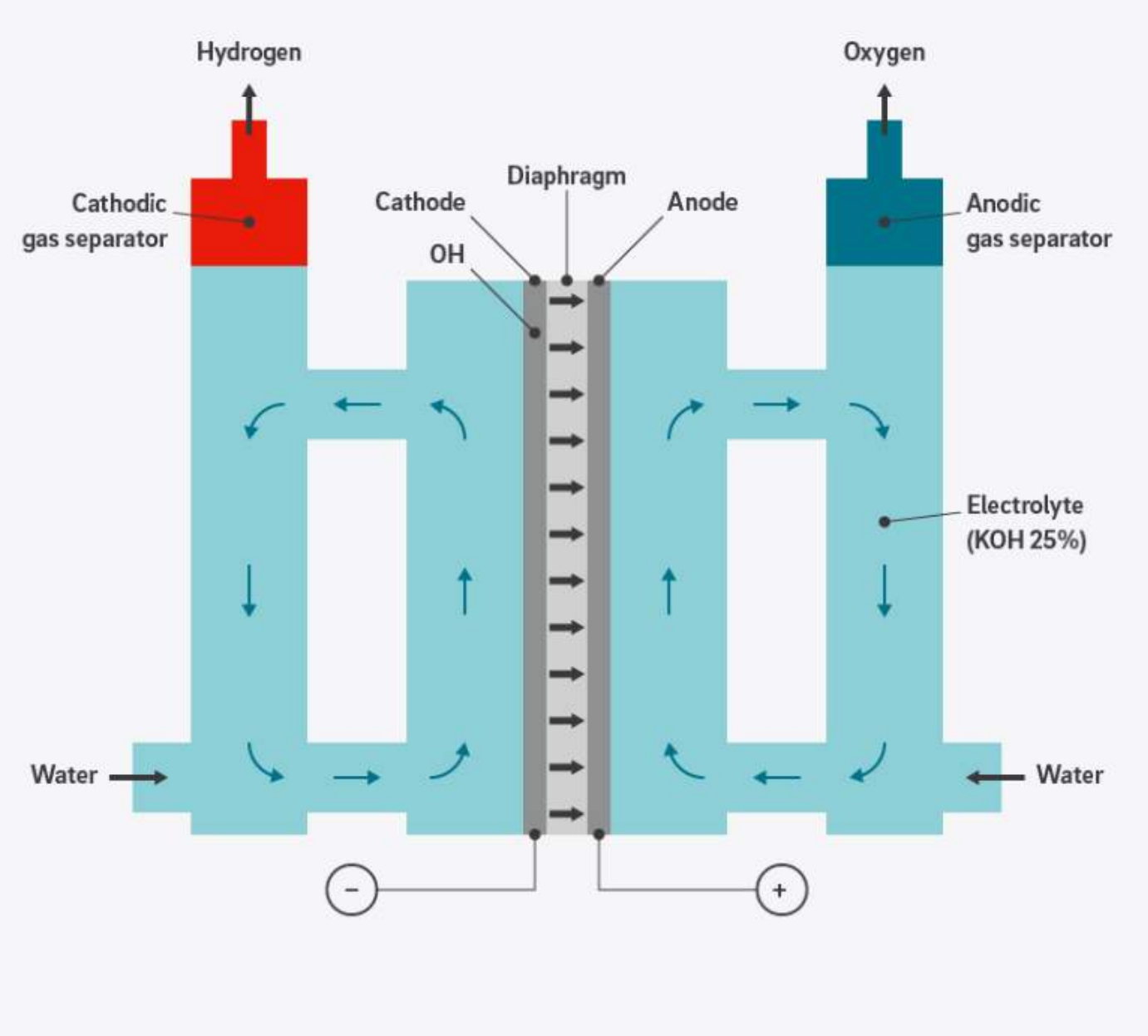
Grey hydrogen

How is hydrogen obtained?

Hydrogen is present in almost unlimited amounts in the universe and on Earth, but unfortunately almost exclusively in chemical compounds, such as in water, acids, hydrocarbons and other organic compounds. Therefore, hydrogen that can be used as a gas has to be specially produced. The following procedures are mainly used for this purpose:

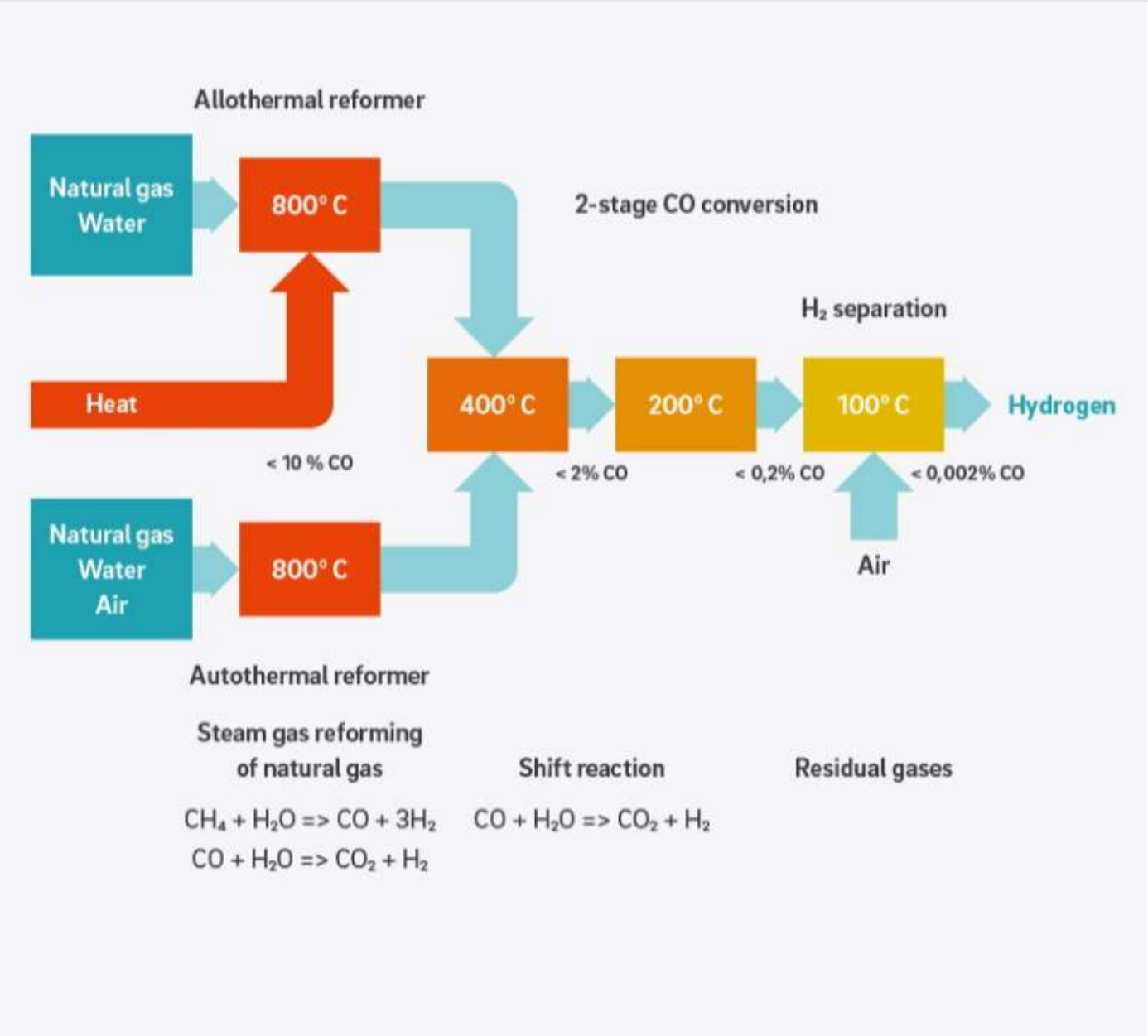


Elektrolysis

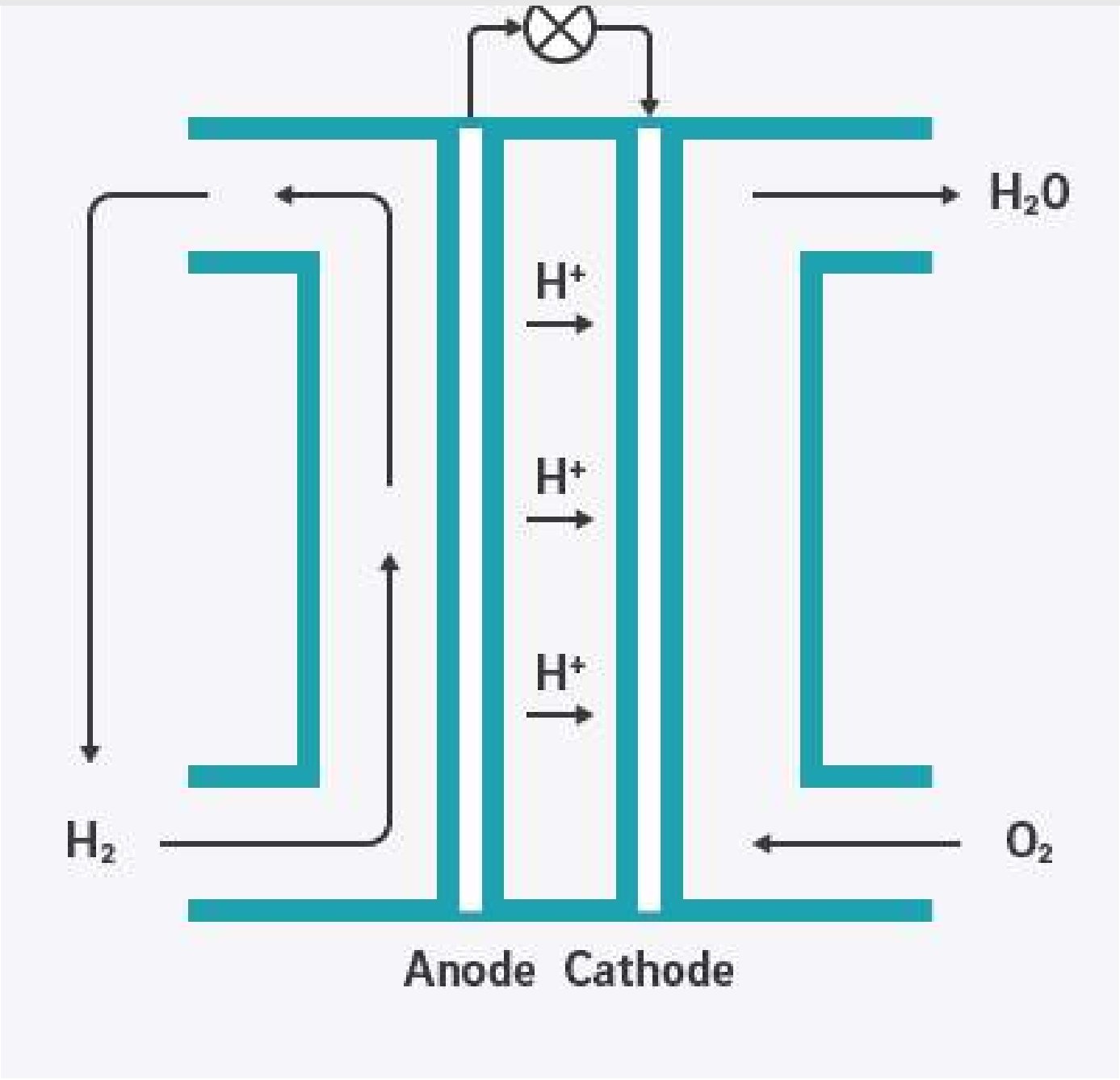


Reforming process

Electrolysis is essential for the CO_2-neutral production of hydrogen that is variable in terms of location and time. Here, water (H_2O) is mixed with a liquid that enables ion transport. Using electricity, water is broken down into its components hydrogen (H_2) and oxygen (O_2) in a redox reaction. The electrical energy is converted into chemical energy and stored in the hydrogen. In a fuel cell, the reverse principle can be used to convert the energy previously chemically stored in hydrogen back into electrical energy.



Most of today's hydrogen production occurs as a by-product of processes in the chemical industry and is also used again by other chemical industry processes, especially in the petrochemicals industry. If hydrogen is specifically generated on an industrial scale, this is currently done mainly by reforming natural gas. However, this process is based on a fossil and raw material that is not always available and is also associated with considerable CO_2 emissions.


H2O
H+
H+
H+
H2
O2
Anode
Cathode

Put simply, the electrolysis process is reversed when operating a fuel cell. This means that electricity and water are not converted into hydrogen, but rather the fuel hydrogen reacts with the oxidising agent oxygen. The resulting reaction energy is converted into electrical energy. In addition to electricity, this reaction also releases heat.

How can hydrogen be used as an energy source?

PtG plant in Brunsbüttel, Schleswig-Holstein: Feeding hydrogen into the natural gas network

energy supply in the long term. The main usage scenario will be the chemical storage of large amounts of excess power in conjunction with renewable energies such as the sun and wind using electrolysis. Hydrogen can then be used as follows:

- With decentralised reconversion into electricity in fuel cells or gas engines
- For feeding into the gas network (directly or after methanation) or as a pure substance
- For high-quality applications in industry
- As a fuel in vehicles with fuel cell drives

Fuel cell vehicles: E-Mobility without a battery

vehicle floor. Instead, the energy required is carried with you in the form of hydrogen, which is first converted in the fuel cell – with the addition of abundant oxygen – from chemical energy to electrical energy: hydrogen is fed into the fuel cell, where it reacts with the oxygen that enters the compressor through the large air inlets. This chemical reaction creates the electricity that powers the electric motor. In addition, the braking energy is stored in a high-voltage battery and can be used to assist with overtaking manoeuvres for example. Everything a fuel cell car emits is pure water vapour. And another unexpected aspect of E-Mobility: filling up at a hydrogen filling station only takes a few minutes and a full tank allows for up to 500 km of travel.

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