



FACT SHEET N°2

PRODUCING HYDROGEN USING AN ELECTROLYSER

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by :

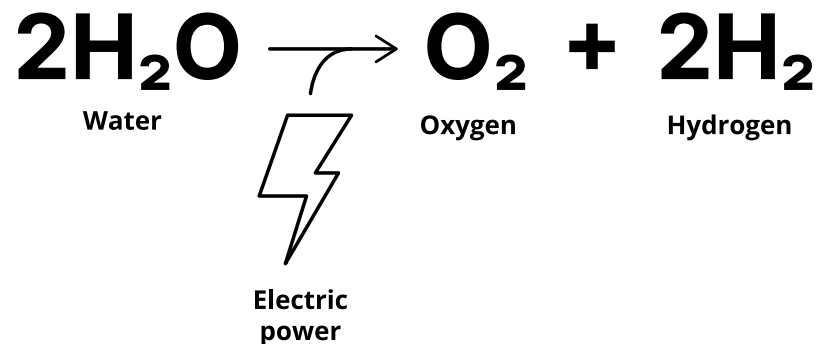


As of today, **hydrogen** is mostly produced from natural gas which leads to tremendous CO2 emissions. Another way of producing **hydrogen** is coming into being, that is electrolysis. A process through which **hydrogen** can be produced from decarbonised or renewable electricity. But...

WHAT IS ELECTROLYSIS?



The principle of **electrolysis** is quite simple. A direct current is injected into an electrolytic solution, to separate the water molecules into **hydrogen** and **oxygen**.

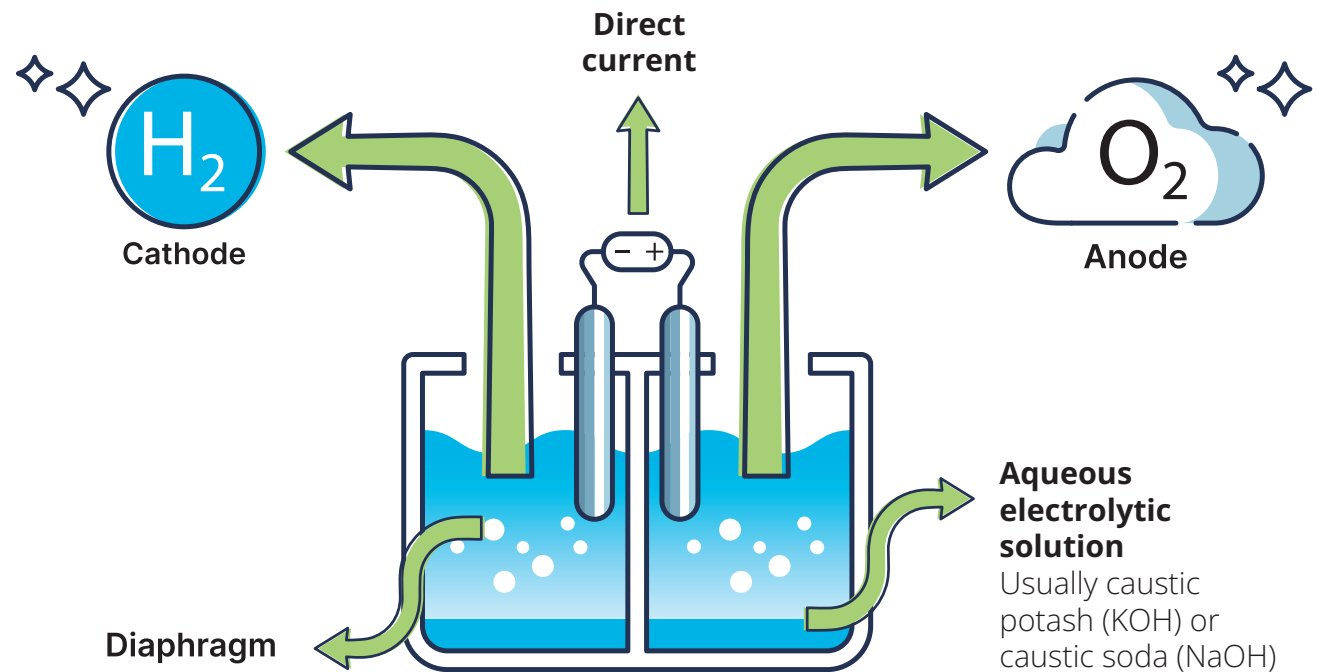


LET'S SEE HOW AN ALKALINE ELECTROLYSER WORKS

An **alkaline electrolyser cell** consists of two electrodes immersed in a bath of electrolytic solution. Strong direct currents are injected, and that's it!

Hydrogen will appear at the cathode and **oxygen** will appear at the anode.

The **electrolyser** is made up of hundreds of cells stacked one on top of the other, and the whole thing is commonly known as a **stack**.



HOWEVER ALKALINE ELECTROLYSIS IS NOT THE ONLY TECHNOLOGY USED. THE MAJOR FAMILIES ARE:

PEM

Proton Exchange Membrane electrolyzers

Alkaline

Alkaline electrolyzers





AEM

Anion Exchange Membrane electrolyzers

SOEC

Solid Oxide Electrolyser Cell electrolyzers

Operating temperature - efficiency - maturity - deployment:

	PEM	Alcalin	AEM	SOEC
	60-80°C	60-80°C	70°C	500-1000°C
	70% HHV (High Heating Value)	67% HHV (High Heating Value)	85% HHV (High Heating Value)	Up to 97% HHV (High Heating Value)
	★★★☆☆	★★★★★	★★★☆☆	★☆☆☆☆
	★★★☆☆	★★★★★	★☆☆☆☆	★☆☆☆☆

The general principle is the same: breaking up water molecules with electricity using different techniques:

PEM

The electrolyte solution is replaced by a **solid polymer membrane**.

The protons (**H⁺**) pass through it and form **H₂** at the cathode.

Alkaline

These are the electrolyzers described above.

The electrolyte is an **aqueous liquid solution**. The hydroxide ions (**OH⁻**) flow through the membrane to form **O₂** at the anode.

AEM

Unlike **PEM** electrolyzers, here it is the anions (**H⁻**) that pass through and form the **H₂** at the anode.

SOEC

Here the electrolyte is in the form of a **solid ceramic**.

At the cathode, the **hydrogen** is separated from the **oxygen** ions (**O₂⁻**), which pass through the ceramic membrane and form **O₂** at the anode.

THE MAIN DIFFERENCES:

Each technique has its advantages and disadvantages.

PEM:

- Advantages: compact size, high current density, rapid production time
- Disadvantages: Use of Rare materials, high production cost, sensitive to bivalent ions (calcium and iron)

Alkaline:

- Advantages: reliability, low production costs, not sensitive to bivalent ions
- Disadvantages: low efficiency, operation at low current density, bulky, long start-up time

AEM:

- Advantages: compact size, high current density, rapid production time, reliability, low production costs, not sensitive to bivalent ions
- Disadvantages: less mature than other conventional techniques

SOEC:

- Advantages: high efficiency
- Disadvantages: requires high temperatures, low maturity level



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