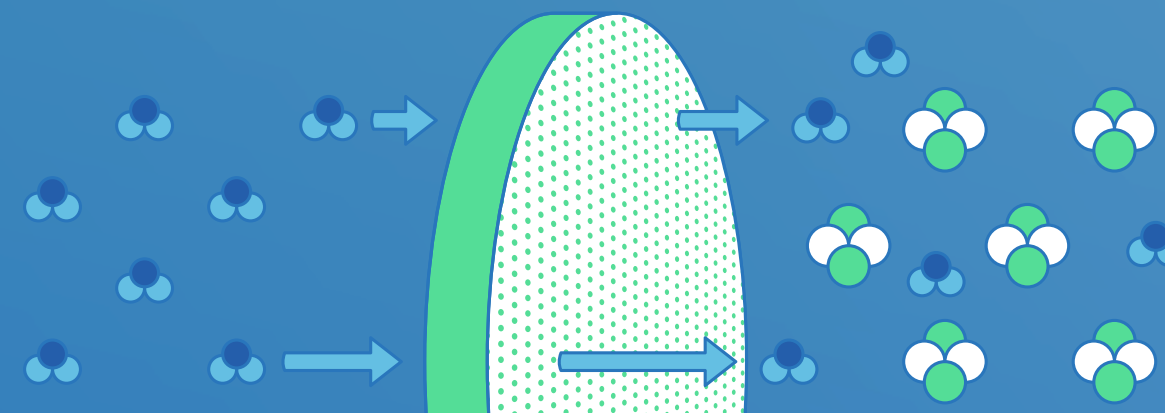




Understanding Proton Exchange Membrane (PEM): The Basics

The PEM membrane acts like a filter that divides water under electric current into Hydrogen and Oxygen. The membrane is a kind of solid electrolyte that leads the protons all the way through from anode side to cathode side while the electrons travel aside the cell. On the cathode side the electrons recombine with protons and form a hydrogen atom. The hydrogen atoms again react to bound as a hydrogen molecule.

To make this work the PEM membrane has catalysts like Iridium and Platinum on it's surface to speed up the reaction.

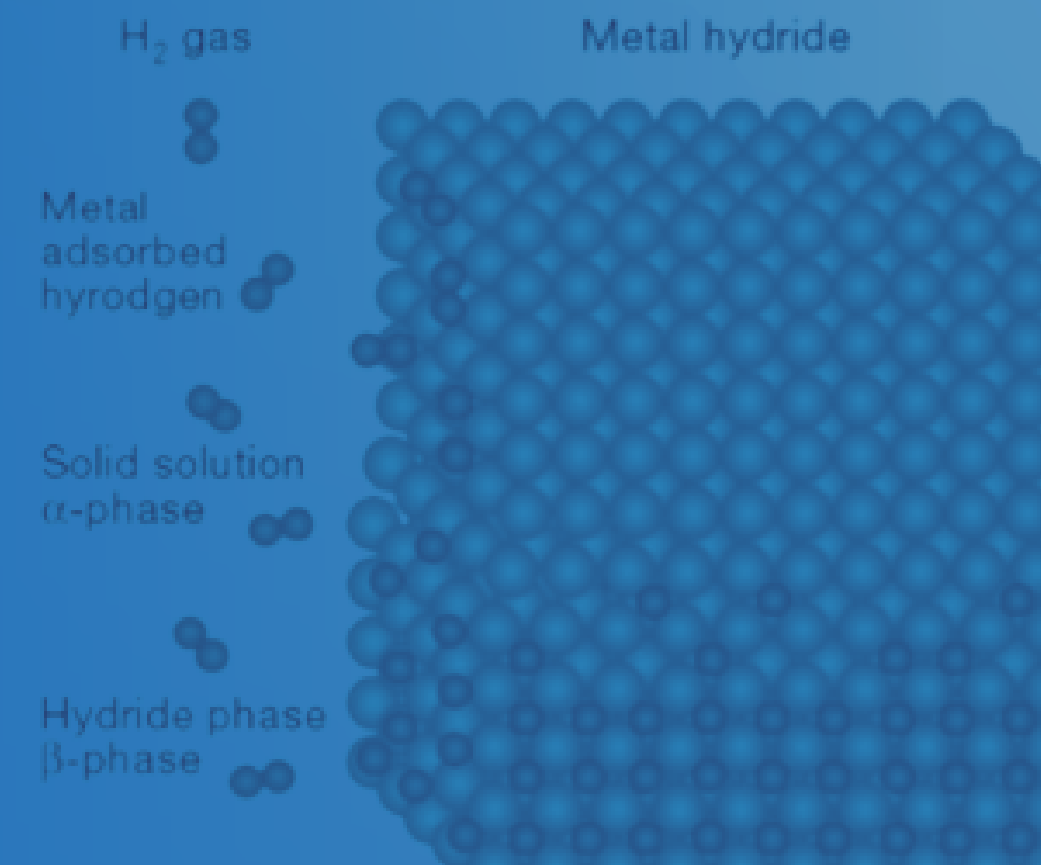




Why PEM is Important: The Big Picture

PEM Stacks can ramp up the hydrogen production within seconds up to several MW's of power. The amount of power that can be stored via hydrogen per kg is 100x higher than in battery packs. Even though batteries need up to 5x less space per kWh than hydrogen storages, an extraordinary lot of resources are necessary for them to be fabricated.

Recent developments in hydrogen storage such as metal hydride and nano-polymer powder beds are a smart solution as they multiplied the energy content in comparison to conventional hydrogen gas vessels.

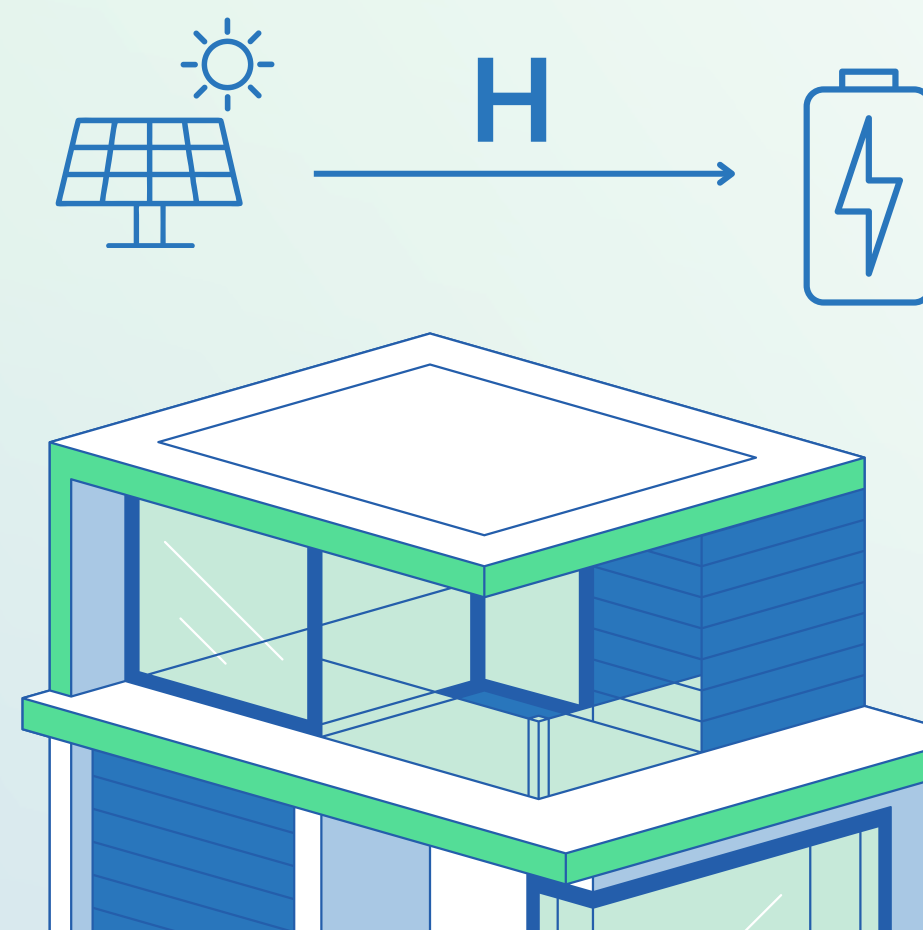




PEM in Our Daily Lives: Practical Impact

Recent product developments have shown that a full self-sufficient energy source for private households and SME'S is possible. **The main idea is to store energy from photovoltaic in summer days in the form of hydrogen and use it via fuel cells and/or heating in autumn and winter.**

Batteries usually store up to 15kWh in a 4-person household whereas the **nanopolymer solutions can store up to 1500kWh**. Additionally, you can share your energy within your quarter for example to charge your neighbor's electric car after work.





The Crucial Difference: Why innovation is needed?



For the hydrogen reaction on the PEM membrane catalysts like Iridium and Platinum are mandatory. The price for Iridium and Platinum is 5000\$/oz and 1500\$/oz respectively (as of now, 07/2026).

Thus, it's highly necessary to save on these materials for a successful market development of PEM Electrolysis.



H2GREEN PLANET's Role: Addressing PEM Challenges

Within the Cleanhypro project our partners TNO and VSP could provide high tech coatings using sALD and Spark Ablation respectively. These techniques made it possible to apply the catalysts on the cell parts in very precise, thin and homogenous layers. Therefore e.g. the amount of Platinum could be reduced from 0.5 mg/cm^2 to 0.1 mg/cm^2 with almost persistent electrolysis performance.

Additionally in case of the sALD process the coating was accelerated up to 100x times in comparison to conventional ALD techniques which makes the fabrication a lot more cost effective.

