Making an impact on the clean energy transition

ENERGY

GAME-CHANGING COMPONENTS FOR NEXT-GENERATION ELECTROLYSERS

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Higher pressure and current densities

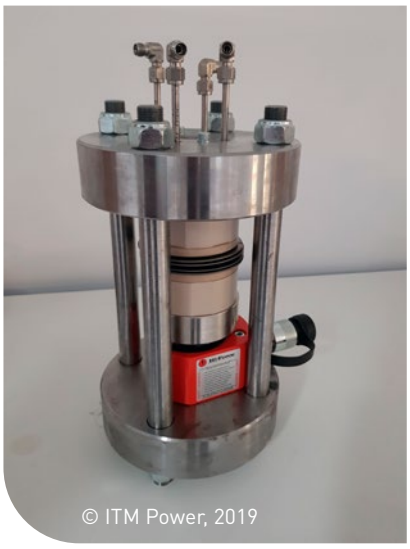
Existing high-pressure proton exchange membrane (PEM) electrolysers produce hydrogen at 20-30 bar, which requires operators to use a mechanical compressor to store and transport the gas efficiently. As industrial electrolyser current density is only 2-3 A/cm^2, the footprint of electrolysers is high, taking up large areas of valuable space.

Technology for compact PEM electrolysers that operate at 100 bar and higher current densities is being developed in the FCH JU projects NEPTUNE and PRETZEL. NEPTUNE will use novel polymers, along with thin membranes that withstand large pressure differentials and a safety recombination catalyst, enabling stacks to operate at a base load of 4 A/cm^2 at nominal power and 8 A/cm^2 at high power. Meanwhile, PRETZEL is placing stacks inside a high-pressure chamber and improving membrane electrode assemblies, the porous current distributor and bipolar plates, among other components. The project has also used low-cost coatings to optimise current collectors and has designed innovative pressurising and cooling for durable operation at 4-6 A/cm^2.

Efficiency for industry

Both projects pave the way for electrolysers that deliver hydrogen at high pressures for industry applications and injection without further compression to natural gas (NG) transmission grids. Once these concepts have been proven at a scale of 10-100 kW, the next step is to scale up the electrolysers. NEPTUNE and PRETZEL will also compare the investment and operating costs of the new 100-bar electrolysers with those of existing lower-pressure electrolysers operating with a compressor, strengthening the case for industry investment.

Two FCH JU projects are pushing the limits of PEM electrolyser performance, aiming at a current density of 6-8 A/cm2 and operating pressure of 100 bar. The lower footprint and energy consumption for commercial-level output make the technology cheaper to install and operate, increasing its appeal to industry.



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INCREASING ELECTROLYSER ATTRACTION

For electrolysers to be attractive to industry, they must produce hydrogen at a higher rate relative to their footprint and at pressures that allow for direct transport and storage.

A COST-EFFECTIVE CASE FOR HYDROGEN

Collaborations between energy and specialist manufacturing and research organisations are improving electrolyser components. **The goal?** To make electrolysers more efficient and the resulting hydrogen easier and more cost-effective for industries and gas distributors to integrate into their operations. **Key results?** Electrolysers that produce hydrogen at a ready-to-store 100 bar and with higher current densities that increase their productivity, enhancing the business case for industry to adopt green hydrogen.

KEY ACHIEVEMENTS

NEPTUNE

< 50 kWh/kg H_2
target nominal energy consumption

< 1.75 V AND < 2.0 V
cell voltages at 90 °C, at 4 A/cm² and 8 A/cm², respectively

100 bar
output pressure for current densities ranging from 0.2 to 8.0 A/cm²

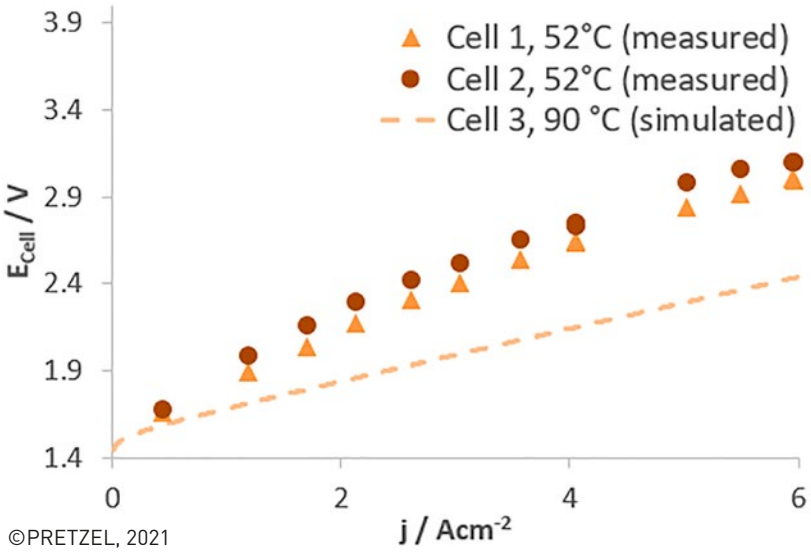
50 %
of beneficiaries are SMEs and received > 50 % of project funding

PRETZEL

500 cm²
membranes developed and ready to test in stacks

4.5 m³/h HYDROGEN EXPECTED
at target electrical power consumption of 25 kW

90 °C
maximum feedwater temperature



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IMPACT

INCREASES PRODUCTION RATE
for a higher return on investment

REMOVES NEED FOR COMPRESSORS
thanks to higher output pressure

SAVES VALUABLE MATERIALS
through innovative component solutions

SHRINKS FOOTPRINT
of electrolysers for more efficient use of floor space

STRENGTHENS BUSINESS CASE FOR GREEN HYDROGEN
to promote carbon savings in industry

SUPPORTS RENEWABLE ENERGY
with production pressures suitable for injection into the NG grid

EXPANDS MARKET FOR ELECTROLYSERS
for new opportunities for manufacturers

SHOWCASES EUROPEAN INNOVATION
in commercially attractive green technology

FIND OUT MORE

www.fch.europa.eu/page/fch-ju-projects
https://neptune-pem.eu/en/activities-en
http://pretzel-electrolyzer.eu/

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FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

A partnership dedicated to clean energy and transport in Europe

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