



Making an impact on the clean energy transition

ENERGY

# RESOURCEFUL WAYS WITH WASTE HYDROGEN



## Home thoughts from abroad

Although fuel-cell applications have the potential to transform by-product hydrogen from some industry processes into energy that can replace fossil fuels, the cost of electricity in Europe is still too low to incentivise the implementation of this practice. The FCH JU is bypassing this by funding EU-led projects in regions with more favourable market conditions and supporting research leading to the next generation of fuel-cell power plants.

Located in a chlor-alkali factory in China, the DEMCOPEM-2MW project has helped European industry players to develop and demonstrate a successful system for converting industrial by-product hydrogen into electricity, heat and water for use in the production process. Similarly, the ClearGenDemo project is demonstrating a 1 MWe fuel cell at a refinery in the French overseas territory of Martinique using spare hydrogen in a refinery. With these flagship projects, the FCH JU intends to demonstrate large stationary fuel-cell systems for clean and efficient power and heat production in industry applications.

## Greener prospects

By demonstrating the successful use of waste hydrogen and developing lower-cost technologies, these overseas projects are helping fuel cells to become cost-effective choices in European industry. The technology developed by DEMCOPEM-2MW has been advanced by European companies. The 2 MWe fuel-cell system demonstrated in China has provided experience and know-how to support other applications in the maritime sector, for example. The Martinique refinery project has led to follow-up projects in other territories. To reduce costs further to make the technology commercially feasible in Europe, the FCH JU-funded Grasshopper project is developing the next generation of cost-effective multi-MW fuel-cell power plants.

**Some chemical and petroleum industries produce significant quantities of by-product hydrogen which could be transformed into energy using fuel-cell technology. By creating reference sites and developing increasingly efficient and cost-effective European technologies, the FCH JU is making energy from redundant hydrogen, that would otherwise have no value, a feasible solution for European and worldwide industry.**



KEY ACHIEVEMENTS

DEMOCOPEM-2MW

**MULTI-MWE FUEL CELL SUCCESSFULLY INSTALLED IN A CHLOR-ALKALI PRODUCTION PLANT**  
 first-of-its kind installation in a successful partnership with Chinese industry

**2 MWe FUEL CELL RECOVERING BY-PRODUCT HYDROGEN DEMONSTRATED OVER 2 YEARS**

870 tons hydrogen recovered  
 13+ GWh electricity,  
 7 GWh heat produced  
 15000 tCO<sub>2</sub> emissions avoided  
 50% net electrical conversion efficiencies and 85% overall net conversion efficiencies  
 availability of 95%+ for over 16 000 hours

**27 000 NEW MEAS**  
 designed and produced by European manufacturer

**TARGETED EXCHANGES WITH DECISION-MAKERS**  
 replication potential of 1+GWe in the chlor-alkali sector in China; viable business in other French overseas territories identified

**OPEN-SOURCE CALCULATION TOOL**  
 preliminary economical assessment of using by-product hydrogen with fuel cells

IMPACT

**INCREASED COMPETITIVENESS OF EUROPEAN INDUSTRY**

new and improved MEA manufacturing process with lower platinum demands and longer lifetimes; stack platform developed also suitable for transport applications

**POTENTIAL TO ACHIEVE POWER PRODUCTION OF ~0.04 €/kWh**  
 at CAPEX <2 500/kWe

**OPENING-UP NEW MARKETS FOR HEAT AND POWER PRODUCTION WITH FUEL CELLS**

maritime, district heating and chemical industry; today, H<sub>2</sub> produced by chlor-alkali plants worldwide would be sufficient to produce about 3 GWe with fuel cells

**REPLICATIONS ALREADY STARTED AND PARTNERSHIPS SET UP**

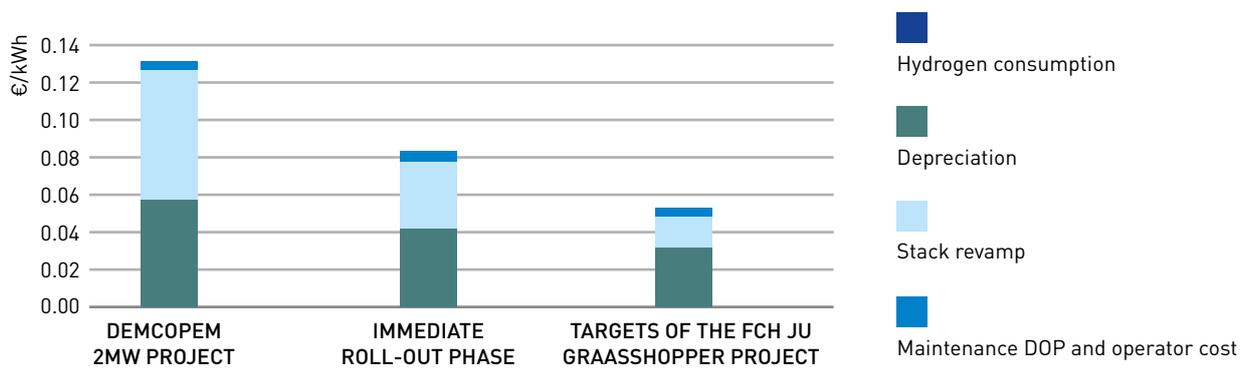
General Electric with Nedstack and Ballard Power with ABB to develop hydrogen fuel-cell power systems for cruise vessels; 100 % renewable power for plant generating green H<sub>2</sub> planned in French Guiana with zero subsidies and private financing

WASTE NOT WANT NOT

Harnessing redundant hydrogen as a resource for heat and power at large scale has yet to become cost-effective for industry in Europe.

GETTING MARKET READY

The FCH JU is implementing projects in suitable markets, developing lower-cost technologies and demonstrating how waste hydrogen can be fed back into production as electricity, water and heat. **The goal?** To bring European manufacturers, operators, engineers and project developers together to develop and showcase fuel-cell technologies fit to enter the European market. **Key results?** The first multi-MW-scale combined heat and power PEM fuel cell has been demonstrated using recuperated hydrogen to generate power and heat for two years. Market prospects: applications abroad are already viable and replication of similar concepts have been planned.



[www.fch.europa.eu/page/fch-ju-projects](http://www.fch.europa.eu/page/fch-ju-projects)  
[www.demcopem-2mw.eu/](http://www.demcopem-2mw.eu/)  
[www.cleargen.eu](http://www.cleargen.eu)  
[www.grasshopperproject.eu](http://www.grasshopperproject.eu)



FUEL CELLS AND HYDROGEN  
 JOINT UNDERTAKING

A partnership dedicated to clean energy and transport in Europe