Making an impact on the clean energy transition

ENERGY

RELIABLE GREEN POWER FOR OFF-GRID COMMUNITIES

Overcoming variability

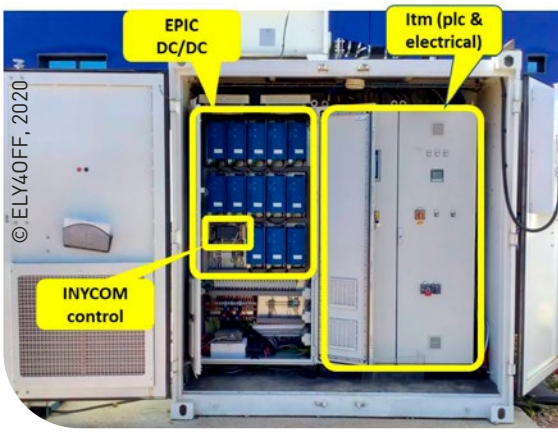
Solar panels and wind turbines are emblems of the clean energy transition, although they themselves cannot provide a stable energy supply. In locations where grid power is unavailable or unreliable, stand-alone systems producing green hydrogen could help to compensate for the variability of these renewable energies and phase out fossil fuels as a fallback solution. They could also boost the uptake of wind and solar energy in general.

Proton exchange membrane water electrolysis (PEMWE) has shown particular promise for use in the type of dynamic, adaptable operation required for hydrogen production powered by variable renewable energy. The Fuel Cells and Hydrogen Joint Undertaking (FCH JU) project ELY4OFF focused on developing this technology into a more competitive proposition.

What happens when the sun does not shine? Hydrogen holds promise even in remote locations: autonomous electrolyser systems could help to reduce the reliance on diesel generators which are widely used as back-ups. Research funded by the FCH JU has produced an innovative prototype.

A system for all seasons

The solar-powered autonomous 50-kW system devised and demonstrated by ELY4OFF produces more than 1.5 tonnes of hydrogen per year. Key features include a robust, innovative control system designed to ensure safe, efficient operation under varying environmental conditions. A back-up component combining batteries and a fuel cell maintains the electrolyser system when solar power is unavailable. The project also innovated by connecting the photovoltaic power source and the electrolyser through a DC bus, achieving higher conversion efficiencies. In addition, the partners explored a wide variety of potential business cases.



FCH JU Success Stories >

RELIABLE GREEN POWER FOR OFF-GRID COMMUNITIES

STRINGENT REQUIREMENTS

Green hydrogen can be generated without grid power, for uses as varied as remote electrification, mobility and the production of fertiliser – but a system designed to do so autonomously using variable renewable energy must be particularly flexible and robust.

PROMISING STAND-ALONE TECHNOLOGY

Self-sufficient off-grid systems transforming intermittent renewable energy into a versatile, storable, sustainable energy carrier could help to phase out fossil fuels – and revolutionise the lives of communities worldwide that currently cannot access electricity. **The goal?** To improve the case for stand-alone PEMWE technology as a way of tapping this potential. **Key results?** The ELY4OFF project developed a prototype of a highly efficient system powered by a photovoltaic (PV) field, paving the way for scale-up to the megawatt range.

IMPACT

62 % REDUCTION IN GREENHOUSE GAS EMISSIONS
achievable compared to hydrogen from steam methane reforming

530 kg OF GREEN HYDROGEN
produced in the project, during one year of intermittent operation

GREEN HYDROGEN SUPPLIED TO OTHER PROJECTS
e.g. for research on hydrogen refuelling stations and hydrogen drones

IMPROVED UNDERSTANDING
of the economic aspects and potential business cases

LEADS FOR FURTHER ADVANCES
such as development of a hydrogen-producing wind turbine involving direct connection of an electrolyser located inside the tower, potentially offshore

KEY ACHIEVEMENTS

AUTONOMOUS 50-kW PEM ELECTROLYSER

MORE THAN 1.5 TONNES OF HYDROGEN PER YEAR
(potential output capacity)

FUEL-CELL GRADE HYDROGEN PURITY

DIRECT DC CONNECTION TO A PV POWER SOURCE

97.4 % AVERAGE EFFICIENCY
achieved for the power supply unit

56.33 kWh/kg EFFICIENCY AT SYSTEM LEVEL*

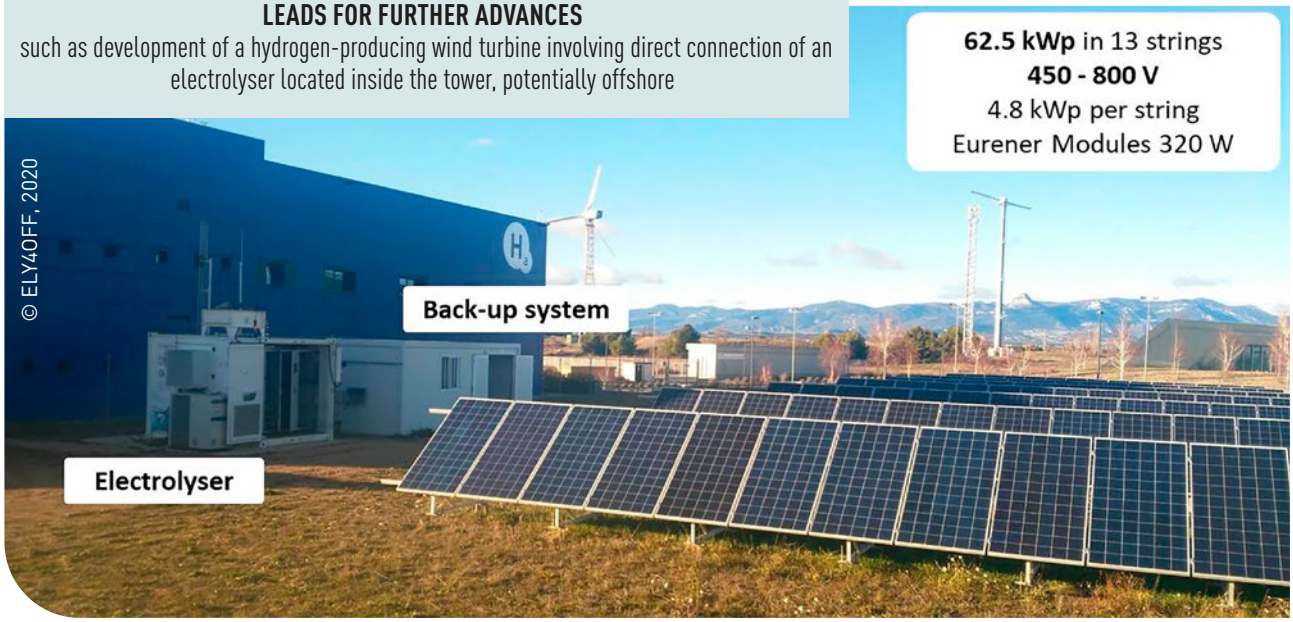
46.3 kWh/kg EFFICIENCY AT STACK LEVEL*

150 % MAXIMUM OVERLOAD CAPACITY

210 S COLD START RAMP TIME
(from idle)

0.2 S RAMP-UP
(to full load)

* at 77.48 % load



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FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

A partnership dedicated to clean energy and transport in Europe

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