

RUBY

ROBUST AND RELIABLE GENERAL MANAGEMENT TOOL FOR PERFORMANCE AND DURABILITY IMPROVEMENT OF FUEL CELL STATIONARY UNITS



Project ID:	875047
PRD 2023:	Panel 4 – H2 end uses – stationary applications
Call topic:	FCH-02-8-2019: Enhancement of durability and reliability of stationary PEM and SOFC systems by implementation and integration of advanced diagnostic and control tools
Project total costs:	EUR 3 037 430.00
Clean H₂ JU max. contribution:	EUR 2 999 715.00
Project period:	1.1.2020–31.12.2024
Coordinator:	Università degli Studi di Salerno, Italy
Beneficiaries:	Ballard Power Systems Europe AS, Bitron SpA, Commissariat à l'énergie atomique et aux énergies alternatives, Communauté d'universités et d'établissements université Bourgogne-Franche-Comté, École Polytechnique Fédérale de Lausanne, Europäisches Institut für Energieforschung EDF Kit EWIV, Fondazione Bruno Kessler, Institut Jožef Stefan, SOLIDpower SpA, Sunfire Fuel Cells GmbH, Teknologian tutkimuskeskus VTT Oy, Université de Franche-Comté

<https://www.rubyproject.eu/>

PROJECT AND OBJECTIVES

RUBY aims to exploit electrochemical impedance spectroscopy (EIS) for developing, integrating, engineering and testing a comprehensive and generalised monitoring, diagnostic, prognostic and control (MDPC) tool. Thanks to the features of EIS, RUBY will improve the efficiency, reliability and durability of solid oxide fuel cell (SOFC) and proton-exchange membrane fuel cell (PEMFC) systems for stationary applications. The tool relies on advanced techniques and dedicated hardware, and will be embedded in the fuel cell systems for online validation in the relevant operational environment.

NON-QUANTITATIVE OBJECTIVES

The MDPC tool performs monitoring, diagnosis, prognosis and control and mitigation of the stack and balance of plant (BoP) for PEMFC in back-up applications and for SOFC for micro combined heat and power (micro-CHP) applications.

PROGRESS AND MAIN ACHIEVEMENTS

- Tests on the proton-exchange membrane (PEM) stack and system have been performed in nominal conditions.

- Tests on the SOFC stack have been commissioned.
- Preliminary tests on the SOFC system have been performed in nominal conditions.
- Preliminary versions of monitoring, diagnostics and prognostics algorithms have been developed and tested.
- The MDPC tool's hardware has been designed, manufactured and tested.
- The concept and preliminary design of the hardware for EIS perturbation stimuli have been produced.

FUTURE STEPS AND PLANS

- Tests on PEM stack and system in faulty conditions.
- Tests on the SOFC stack in nominal and faulty conditions.
- Tests on the SOFC system in faulty conditions.
- Integration of the MDPC tool algorithms into the hardware.
- Commissioning of hardware for EIS perturbation stimuli.
- Implementation and testing of the MDPC tool.

QUANTITATIVE TARGETS AND STATUS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?	SoA result achieved to date (by others)	Year of SoA target
Project's own objectives	Lifetime of micro-CHP applications (SOFC)	years	15	10	⚙️	10	2020
	% of the appliance		98.5	97.5	⚙️	97.5	
	Lifetime of backup applications (PEMFC)	years	15	12	⚙️	12	
	% of the appliance		99.99	99.99	✓	99.99	