RUBY

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

Project ID	875047
PRR 2025	Pillar 4 - H_2 End Uses - Stationary Applications
Call Topic	FCH-02-8-2019
Project Total Costs	3 024 715.00
Clean H_2 JU Max. Contribution	2 999 715.00
Project Period	01-01-2020 - 31-08-2025
Coordinator Beneficiary	UNIVERSITA DEGLI STUDI DI SALERNO, IT
Beneficiaries	NEW ENERDAY GMBH, BITRON ELECTRONICS SPA, MINERVAS SRL, COMMUNAUTE D' UNIVERSITES ET ETABLISSEMENTS UNIVERSITE BOURGOGNE - FRANCHE - COMTE, NEW ENERDAY GMBH, TEKNOLOGIAN TUTKIMUSKESKUS VTT OY, SOLIDPOWER SPA, BITRON SPA, BALLARD POWER SYSTEMS EUROPE AS, EIFER EUROPAISCHES INSTITUT FUR ENERGIEFORSCHUNG EDF KIT EWIV, FONDAZIONE BRUNO KESSLER, UNIVERSITE DE FRANCHE-COMTE, INSTITUT JOZEF STEFAN, ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE, COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES

http://www.rubyproject.eu

PROJECT AND GENERAL 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 EIS features, RUBY will improve the efficiency, reliability and durability of solid oxide fuel cell (SOFC) and polymer electrolyte 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 environments.

NON-QUANTITATIVE OBJECTIVES

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

PROGRESS, MAIN ACHIEVEMENTS AND RESULTS

- Tests on proton exchange membrane stacks and systems have been performed in nominal conditions.
- Tests on SOFC stacks have been commissioned.
- Preliminary tests on SOFC system have been performed in nominal conditions.
- Preliminary versions of monitoring, diagnostics and prognostics algorithms have been developed and tested.
- Hardware of the MDPC tool has been designed, manufactured and tested.
- Concept and preliminary design of hardware for EIS perturbation stimuli have been determined.

FUTURE STEPS AND PLANS

- RUBY will acquire conventional and advanced signals. The tool measures conventional signals from the balance of plant and stack (voltage, current, temperature, etc.) and the EIS for the stack.
- RUBY will advance the monitoring, diagnostic, prognostic and control (MDPC) activities. The tool monitors the state of health of the stacks and the systems, detects faults at stack and balance-of-plant levels, estimates the stacks lifetimes, applies advanced control actions and proposes mitigation strategies at system level.
- Tests will be performed on proton exchange membrane stacks and systems in faulty conditions
- Tests will be performed on SOFC stacks in nominal and faulty conditions.
- Tests will be carried out on the SOFC system in faulty conditions.
- MDPC tool algorithms will be integrated into the hardware.
- Hardware will be commissioned for EIS perturbation stimuli.
- The MDPC tool will be implemented and tested.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Achieved to date by the project	Target achieved?	SoA result achieved to date (by others)	Year for reported SoA result
Project's own objectives	Lifetime of back-up applications (PEM)	years	15	12		12	2020
	Electrical efficiency of back-up applications (PEM)	% LHV	45	45		45	
	Reliability of back-up applications (PEM)	BX-Y	B10-15	B25-12		B25-12	
	Lifetime of micro-CHP applications (SOFC)	years	12	10		10	
	Maintenance costs of back-up applications (PEM)	€/year	452	617		617	
	Availability of micro-CHP applications (SOFC)	%	99	97		97	
	Availability of back-up applications (PEM)	%	99.99	99.99		99.99	
	Electrical efficiency of micro-CHP applications (SOFC)	% LHV	39	35		35	

Clean Hydrogen Partnership
Co-funded by the European Union