



DIAMOND

Diagnosis-aided control for SOFC power systems

PANEL 4

Research activities for stationary applications

ACRONYM	DIAMOND
CALL TOPIC	SP1-JTI-FCH.2013.3.3: Stationary Power and CHP Fuel Cell System Improvement Using Improved Balance of Plant Components/ Sub-Systems and/or Advanced Control and Diagnostics Systems
START DATE	1/04/2014
END DATE	31/03/2017
PROJECT TOTAL COST	€3,6 million
FCH JU MAXIMUM CONTRIBUTION	€2,1 million
WEBSITE	http://www.diamond-sofc-project.eu/about/

PARTNERSHIP/CONSORTIUM LIST

HyGear B.V., COMMISSARIAT À L'ÉNERGIE ATOMIQUE ET AUX ÉNERGIES ALTERNATIVES, Teknologian tutkimuskeskus VTT Oy, UNIVERSITÀ DEGLI STUDI DI SALERNO, HTceramix SA, INEA INFORMATIZACIJA ENERGETIKA AVTOMATIZACIJA DOO, INSTITUT JOZEF STEFAN

MAIN OBJECTIVES OF THE PROJECT

The DIAMOND project aims at improving the performance of solid oxide fuel cells (SOFCs) for CHP applications by implementing innovative strategies for on-board diagnosis and control. Advanced monitoring models will be developed to integrate diagnosis and control functions with the objective of having meaningful information on the actual state-of-the-health of the entire system. The new concepts will be validated using two different SOFC systems.

PROGRESS/RESULTS TO-DATE

- List of faults and failures of SOFC CHP systems.
- Fault signature matrices for FDI (fault detection and isolation) developed; low level control schemes for both systems developed and analysed and soft sensors developed.
- System models for both systems developed.
- First sets of experimental data for both systems sent to partners for use of control, model, and diagnosis development.
- Applicability of THDA (total harmonic distortion analysis) for SOFC systems shown.

FUTURE STEPS

- Implement improved low level control in both DIAMOND A and C system.
- Implement supervisory control.

- Implementation of signal- and model-based diagnosis schemes in the advanced system control.
- Experimentally validate control and diagnosis schemes.

CONCLUSIONS, MAJOR FINDINGS AND PERSPECTIVES

- Applicability of THDA for SOFC systems shown.
- Low-level control was designed and verified on a stack model. It provides better temperature control and system efficiency.
- A supervisory controller has been developed able to monitor and control the overall SOFC system performance.
- The system models have been verified using experimental data. The modelling approach is validated.

CONTRIBUTION TO THE PROGRAMME OBJECTIVES

PROJECT OBJECTIVES / TARGETS	CORRESPONDING PROGRAMME OBJECTIVE / QUANTITATIVE TARGET (SPECIFY TARGET YEAR)	CURRENT PROJECT STATUS	PROBABILITY OF REACHING INITIAL TARGET	COMMENTS ON PROJECT PROGRESS / STATUS
(a) Project objectives relevant to multi-annual objectives (from MAIP/MAWP) – indicate relevant multi-annual plan:				MAIP 2008-2013
Electric efficiency 50 %	2013	The systems are being tested using standard control. In the final stage of the project advanced control and diagnostic tools will be implemented. These will aid in achieving the target.	100 %	Developments are delayed due to experimental problems
Durability, 10 years, >85,000 hrs.	2013	The systems are being tested using standard control. In the final stage of the project advanced control and diagnostic tools will be implemented. These will aid in achieving the target.	100 %	Developments are delayed due to experimental problems
(b) Project objectives relevant to annual objectives (from AIP/AWP) if different than above – indicate relevant annual plan:				AIP 2013-1
To develop advanced diagnostic and innovative control strategies	SP1-JTI-FCH.2013.3.3; 2013	Dynamic models of both power systems have been developed and validated.		
To develop advanced diagnostic and innovative control strategies	SP1-JTI-FCH.2013.3.3; 2013	Control and diagnostic strategies are being designed using the models		
To develop advanced diagnostic and innovative control strategies	SP1-JTI-FCH.2013.3.3; 2013	Low-level controls were developed and tested using a stack model		
To develop advanced diagnostic and innovative control strategies	SP1-JTI-FCH.2013.3.3; 2013	Soft sensors have been designed and validated with the real SOFC system data		
System life 10 years for smaller-scale applications	SP1-JTI-FCH.2013.3.3; 2013	In the final stage of the project advanced control and diagnostic tools will be implemented.		