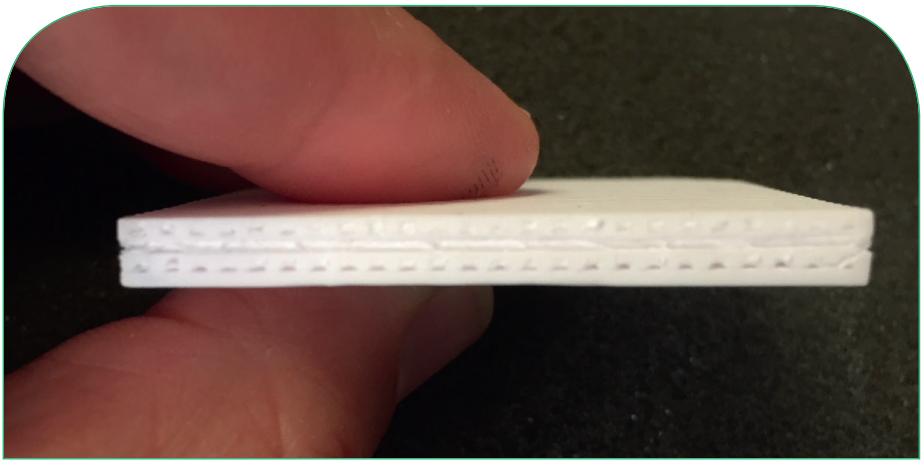
Cell3Ditor

COST-EFFECTIVE AND FLEXIBLE 3D PRINTED SOFC STACKS FOR COMMERCIAL APPLICATIONS

Project ID:	**700266**
Call topic:	**FCH-02.6-2015** - Development of cost-effective manufacturing technologies for key components or fuel cell systems
Project total costs:	**€ 2,191,133.75**
FCH JU max. Contribution:	**€ 2,180,662.5**
Project start - end:	01/07/2016- 31/12/2019
Coordinator:	**FUNDACIO INSTITUT DE RECERCA DE L'ENERGIA DE CATALUNYA, ES**
Website:	**www.cell3ditor.eu**



BENEFICIARIES: 3DCERAM, DANMARKS TEKNISKE UNIVERSITET, FRANCISCO ALBERO SA, HYGEAR FUEL CELL SYSTEMS B.V., PROMETHEAN PARTICLES LTD, SAAN ENERGI AB, UNIVERSIDAD DE LA LAGUNA

PROJECT AND OBJECTIVES

The main goal of the Cell3Ditor project is to develop a 3D printing technology for the industrial production of SOFC stacks by covering research and innovation in all the stages of the industrial value chain (inks formulation, 3D printer development, ceramics consolidation and system integration).
At this stage, inks and slurries of SOFC materials have been formulated and tested for printing, a multi-material 3D printer for ceramics has been developed and patented and fabrication of SOFC cells and parts has been achieved while single-step sintering of multilayer system is being optimized.

NON QUANTITATIVE OBJECTIVES

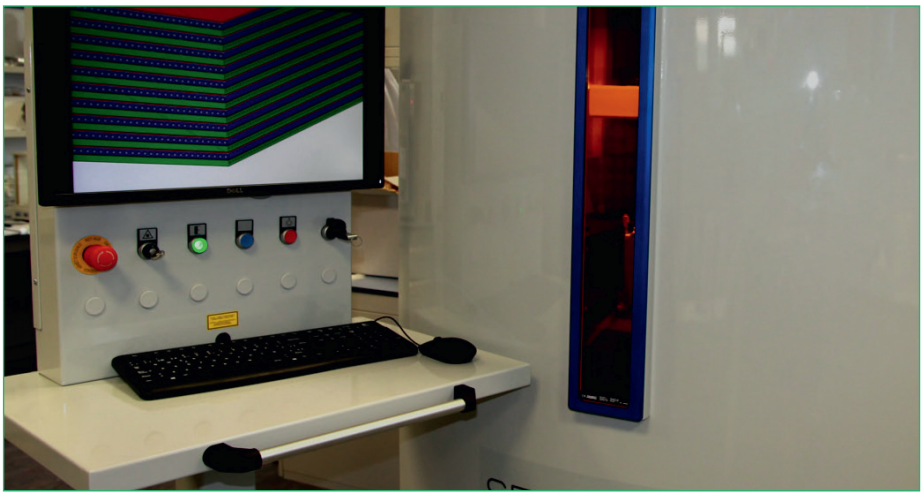
- Analysis of the exposure to nanoparticles has been completed
- Scientific papers and articles in industrial magazines published. Conferences, fairs and expositions attended. Two workshops are being organised (one in Denmark and another one in Naples) and profiles in scientific/social networks updated
- Business plan looking for the commercialisation of two outcomes of the project, already a primary market analysis and a business plan performed
- Creation of an Industry Advisory Board focused on deployment and scalability of technology
- Evaluation of the investment and running costs of the technologies developed.

PROGRESS & MAIN ACHIEVEMENTS

- A multi-material hybrid (additive and subtracting manufacturing) 3D printer for ceramic materials has been developed, patented and commercialized
- Formulation of printable inks and slurries of technical ceramic materials
- Fabrication of SOFC components and fully printed SOFC button cells.

FUTURE STEPS & PLANS

- Fabrication of complex design multi-material parts
- Fabrication of multi-material SOFC components
- Fabrication of SOFC stacks.

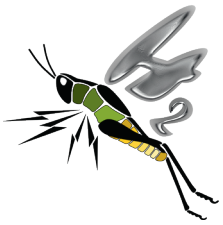


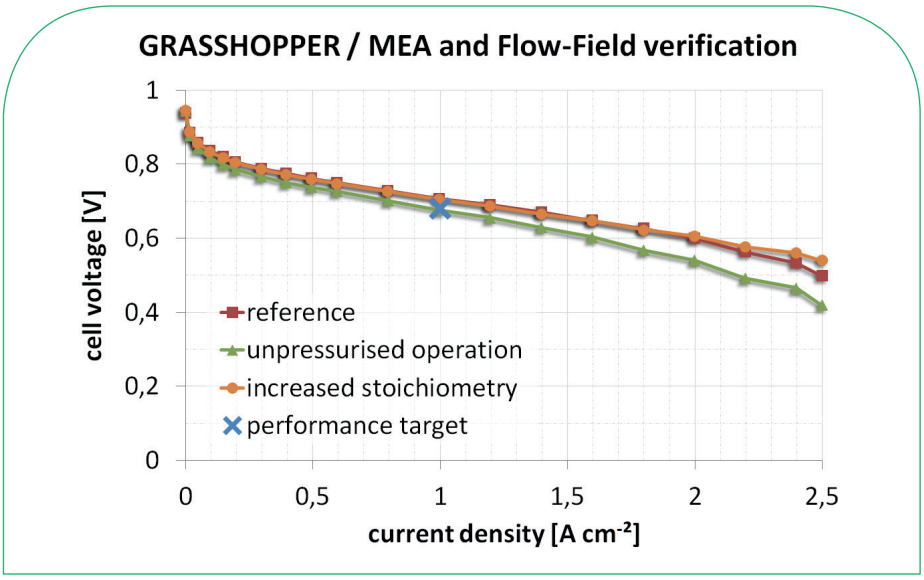
QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	UNIT	TARGET	ACHIEVED TO DATE BY THE PROJECT	TARGET ACHIEVED?	SOA RESULT ACHIEVED TO DATE (BY OTHERS)	YEAR FOR SOA TARGET
Project's own objective	Area-specific resistance of electrolyte	Ohm*cm2	<0.15	0.31		0.15	2003
	Area-specific resistance of electrodes	Ohm*cm2	<0.75	Not assessed yet		0.7	1997
	Area-specific resistance of interconnect	Ohm*cm2	<0.2			0.013	2013
	Power density of single repetition unit	mW/cm2	ca. 250			280	2016

GRASSHOPPER

GRID ASSISTING MODULAR HYDROGEN PEM POWER PLANT





Project ID:	**779430**
Call topic:	**FCH-02-7-2017** - Development of flexible large fuel cell power plants for grid support
Project total costs:	**€ 4,387,063.75**
FCH JU max. Contribution:	**€ 4,387,063.75**
Project start - end:	01/01/2018 - 31/12/2020
Coordinator:	**INEA INFORMATIZACIJA ENERGETIKA AVTOMATIZACIJA DOO, SI**
Website:	**www.grasshopperproject.eu**

BENEFICIARIES: POLITECNICO DI MILANO, NEDSTACK FUEL CELL TECHNOLOGY BV, ABENGOA INNOVACION SOCIEDAD ANONIMA, ZENTRUM FUR BRENNSTOFFZELLEN-TECHNIK GMBH, JOHNSON MATTHEY FUEL CELLS LIMITED

PROJECT AND OBJECTIVES

The GRASSHOPPER project aims to create a next-generation MW-size Fuel Cell Power Plant (FCPP), which is more cost-effective and flexible in power output. The FCPP will be demonstrated in the field as a 100 kW sub-module pilot plant, implementing newly developed stacks with improved MEAs and BoP system components.
Large area bipolar plate development is ready to start. Operating conditions of stacks & systems have been fixed and the new cell plate design finalised. The detailed design of the 100 kW FCPP is almost completed with the main components selected and ordered.

NON QUANTITATIVE OBJECTIVES

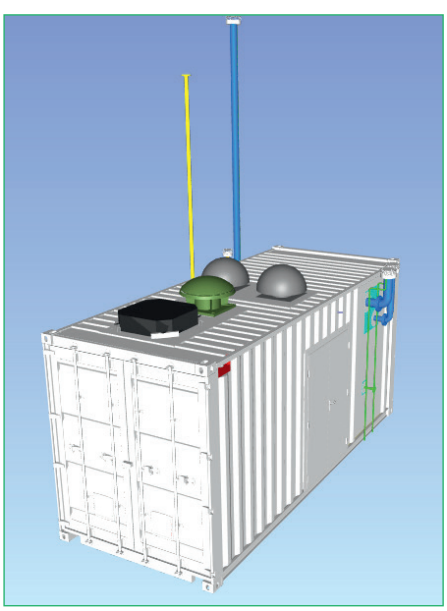
- Operation flexibility and grid stabilisation capability via fast response
- Safe plant operation. European Hydrogen Safety Panel (EHSP) contacted. An intro-session scheduled in May 2019.

PROGRESS & MAIN ACHIEVEMENTS

- Power density targets on 25 cm2 area are met as a combination of newly developed MEAs and the GRASSHOPPER flow fields
- New design of the stack without housing is completed
- Design of a flexible pilot power plant based on simulations is completed.

FUTURE STEPS & PLANS

- Verification of new design
- Power plant construction finish
- Factory acceptance tests
- Site acceptance tests and operation start
- Plant validation.

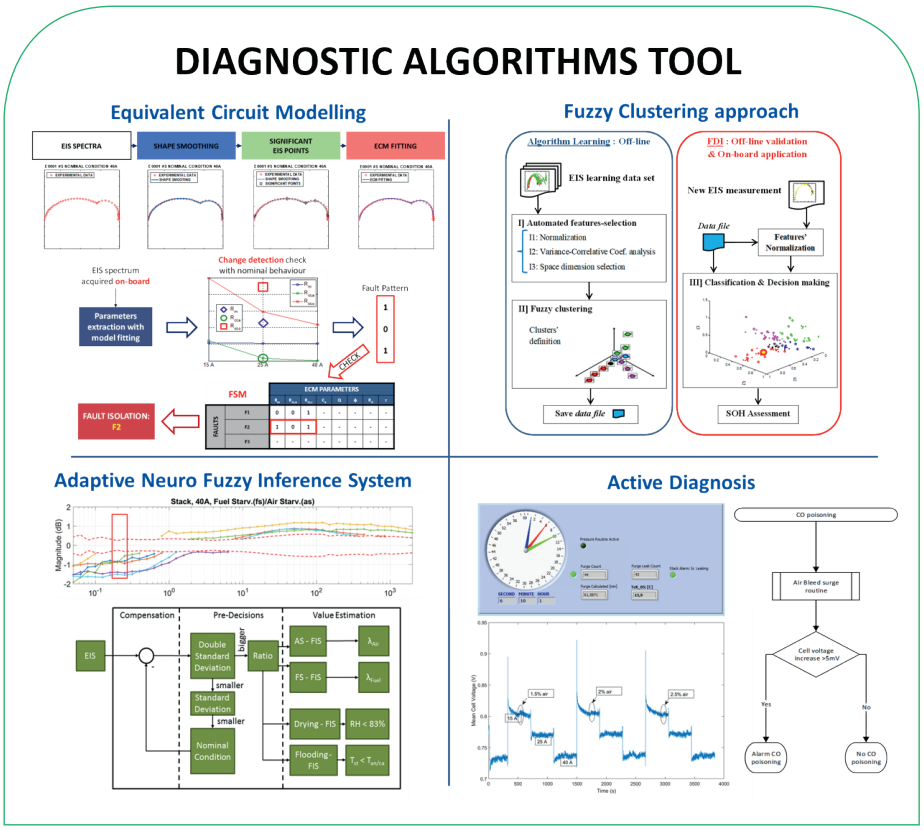


QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	UNIT	TARGET	TARGET ACHIEVED?	SOA RESULT ACHIEVED TO DATE (BY OTHERS)	YEAR FOR SOA TARGET
Project's own objective	MEA cost reduction	%	65	(demonstration hasn't started yet)	MEA cost price of electricity 0.04 €/kWh	2018
	Stack efficiency	%	55		55	
MAWP Addendum (2018-2020)	System electrical efficiency	%	50		50	
	CAPEX	€/kWe	1,500		3,000	
AWP 2017	Stack lifetime	hours	20,000		16,000	

HEALTH-CODE

REAL OPERATION PEM FUEL CELLS HEALTH-STATE MONITORING AND DIAGNOSIS BASED ON DC-DC CONVERTER EMBEDDED EIS



Project ID:	**671486**
Call topic:	**FCH-02.3-2014** - Stationary fuel cell system diagnostics: development of online monitoring and diagnostics systems for reliable and durable fuel cell system operation
Project total costs:	**€ 2,358,736.25**
FCH JU max. Contribution:	**€ 2,358,736.25**
Project start - end:	01/09/2015 - 31/12/2018
Coordinator:	**UNIVERSITÀ DEGLI STUDI DI SALERNO, IT**
Website:	**pemfc.health-code.eu**

BENEFICIARIES: AALBORG UNIVERSITET, UNIVERSITÉ DE FRANCHE-COMTE, ABSISKEY CP, UNIVERSITÉ DE TECHNOLOGIE DE BELFORT - MONTBELIARD, EIFER EUROPAISCHES INSTITUT FUR ENERGIEFORSCHUNG EDF KIT EWIV, ELECTRO POWER SYSTEMS MANUFACTURINGSRL, BALLARD POWER SYSTEMS EUROPE AS, BITRON SPA, TORINO E-DISTRICT CONSORZIO, EPS ELVI ENERGY SRL, ABSISKEY

PROJECT AND OBJECTIVES

HEALTH-CODE implemented an advanced monitoring and diagnostic tool (MDT) for µ-CHP and backup PEMFC systems, to determine FC status (condition monitoring) and infer on residual useful lifetime. Six faults are detected: fuel and oxidant starvation; flooding and drying; CO contamination and Sulphur poisoning. The main objectives dealt with the enhancement of EIS-based diagnosis; the development of monitoring and diagnostic tool for state-of-health assessment. The reduction of experimental campaign time and costs was addressed through a scaling-up algorithm.

NON QUANTITATIVE OBJECTIVES

- Database of EIS spectra. +2,300 EIS spectra in nominal and faulty condition for 2 PEMFC technologies
- Know-how for the design of the future converters of PEMFC.
- Developed EIS-board able to acquire high quality EIS spectra and to isolate faults while the system runs, once interfaced with system' converters
- 3 diagnostic algorithms designed and tested on-board along with 1 active diagnosis approach. 1 scaling-up algorithm developed.

PROGRESS & MAIN ACHIEVEMENTS

- More than 2,300 EIS spectra acquired on two different PEMFC technologies for either single cells or short/full stacks, in nominal and faulty states

FUTURE STEPS & PLANS

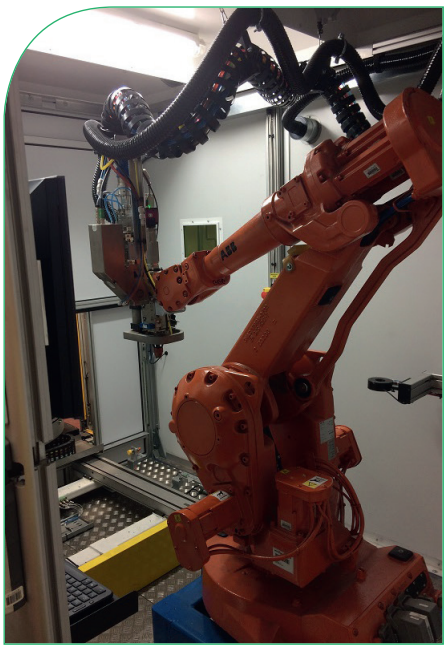
Project finished.

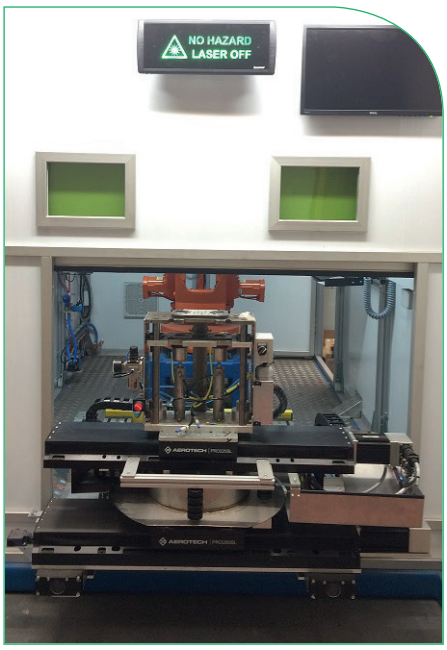
QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	TARGET	ACHIEVED TO DATE BY THE PROJECT	TARGET ACHIEVED?
AWP 2014	n. of stacks	2	6	✓
	n. failure modes	5	5	
	n. tested systems	2	2	
	n. methodology	1	1	
	Cost (%)	<3 %	<3 %	

HEATSTACK

PRODUCTION READY HEAT EXCHANGERS AND FUEL CELL STACKS FOR FUEL CELL M-CHP





Project ID:	**700564**
Call topic:	**FCH-02.6-2015** - Development of cost-effective manufacturing technologies for key components or fuel cell systems
Project total costs:	**€ 2,899,760**
FCH JU max. Contribution:	**€ 2,899,760**
Project start - end:	01/04/2016 - 30/09/2019
Coordinator:	**SENIOR UK LTD, UK**
Website:	**www.heatstack.eu**

BENEFICIARIES: THE UNIVERSITY OF BIRMINGHAM, I.C.I CALDAIE SPA, PNO CONSULTANTS LIMITED, VAILLANT GMBH, SUNFIRE GMBH, SENIOR FLEXONICS CZECH S.R.O.

PROJECT AND OBJECTIVES

The project focuses on the industrialisation of manufacturing the Cathode Air Preheater (CAPH) and Full Cell stack to realise a 50% cost saving once in volume production of these two most expensive components of microCHP systems. Currently, system cost is the biggest hurdle to wide scale adoption of this technology in the domestic market. Research is also being undertaken into the benefits of using AluChrom in the CAPH to extend the longevity of the CAPH, further enhancing the overall lifetime cost of microCHP. The project is currently 36 months into a proposed 42-month duration.

NON QUANTITATIVE OBJECTIVES

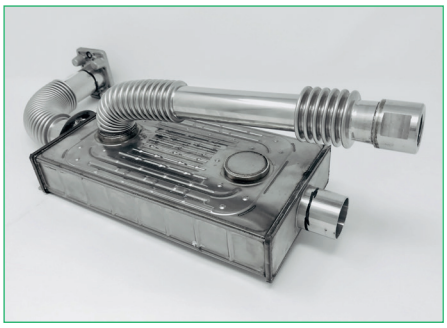
Change to MicroTIG welding from laser to reduce operator Health and Safety risk- but to overcome the material cracking and reduced precision.

PROGRESS & MAIN ACHIEVEMENTS

- Research results showing a x10 reduction of Cr evaporation using AluChrom318 in CAPH compared to the current standard of Inconel 625, SS309, Al SS309
- Redesigned CAPH that resists deformation under rigorous testing, tooling/equipment validated for automated welding of CAPH cells & plates above target
- Process development: printing for seal glass established, tailored glass paste characterised, stencil printing setup, automated line concept created.

FUTURE STEPS & PLANS

- Transfer of CAPH automated production equipment/ tooling from SFC (Wales) to SFO (Czech Republic)
- Sunfire to continue testing their first 5 prototype units
- Sunfire to continue developing their prototype system units post-HEATSTACK, under the PACE project, expecting to manufacture 500 systems in 2020/21
- Delivery of techno-economic assessment of the improved processes compared to the pre-project approaches (including LCA analysis)
- Compilation and finalisation of business/exploitation plans based on final project results and market assessment.

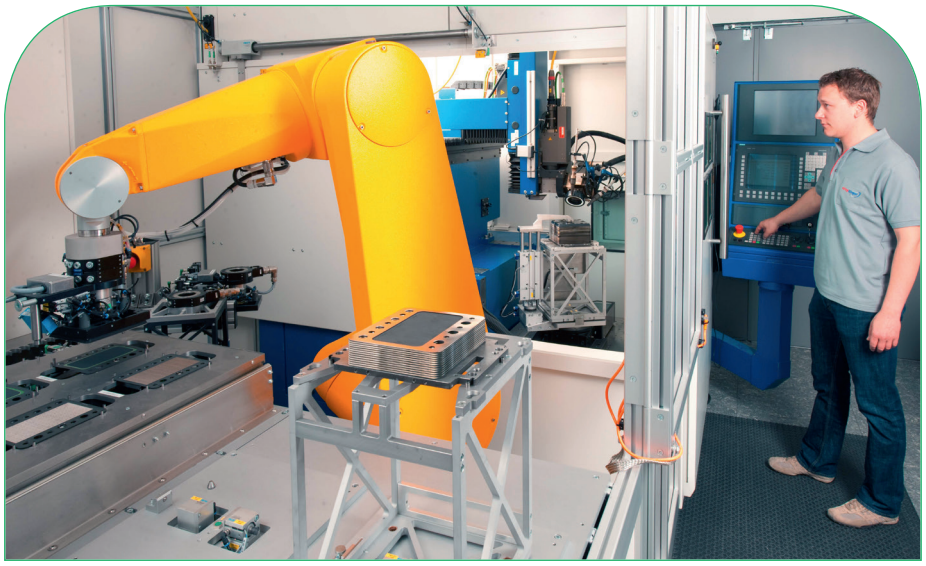


QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	UNIT	TARGET	ACHIEVED TO DATE BY THE PROJECT	TARGET ACHIEVED?
Project's own objective	CAPH cost (sale) from 2000	%	60	Not able to confirm until high volume production (10,000+ per annum) has been realised.	✗
	CAPH manufacture time reduction from 8.83 hours	hours	1.32	The target will be achieved once in production	
	Reduction of process time for glass sealant from 200 minutes	minutes	100	The target will be exceeded in due course but depends on the final automated process	
	Reduction of glass needed for Stack	%	50	Process development completed and the target has been achieved.	✓

INNO-SOFC

DEVELOPMENT OF INNOVATIVE 50 KW SOFC SYSTEM AND RELATED VALUE CHAIN



Project ID:	**671403**
Call topic:	**FCH-02.5-2014** - Innovative fuel cell systems at intermediate power range for distributed combined heat and power generation
Project total costs:	**€ 3,998,081.25**
FCH JU max. Contribution:	**€ 3,998,081.25**
Project start - end:	01/09/2015 - 31/10/2019
Coordinator:	**TEKNOLOGIAN TUTKIMUSKESKUS VTT OY, FI**
Website:	**www.innosofc.eu**

BENEFICIARIES: AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L´ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE, FORSCHUNGSZENTRUM JULICH GMBH, ELRINGKLINGER AG, ELCOGEN OY, CONVION OY, ENERGY MATTERS BV

PROJECT AND OBJECTIVES

INNO-SOFC project combines leading European SOFC technology companies and research centres to collaborate and form required phases in the SOFC value chain. Within this project a next generation 60 kW SOFC system together with its key components will be developed, manufactured, and validated. This system will be demonstrated in Lempäälä industrial park as a key part of their smart-grid. System is estimated to be up and running in the autumn 2019.

NON QUANTITATIVE OBJECTIVES

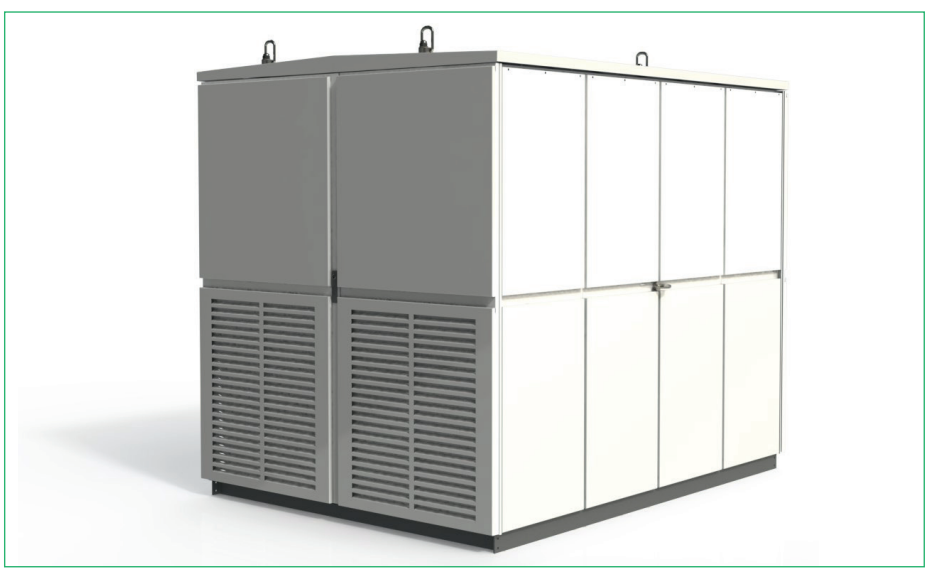
Identification of most promising applications and end-users for SOFC CHP - finalized and publicly presented e.g. in EFCF2018.

PROGRESS & MAIN ACHIEVEMENTS

- System design ready
- Stacks manufactured, QA passed and delivered for system assembly.

FUTURE STEPS & PLANS

3,000 hours system demonstration.

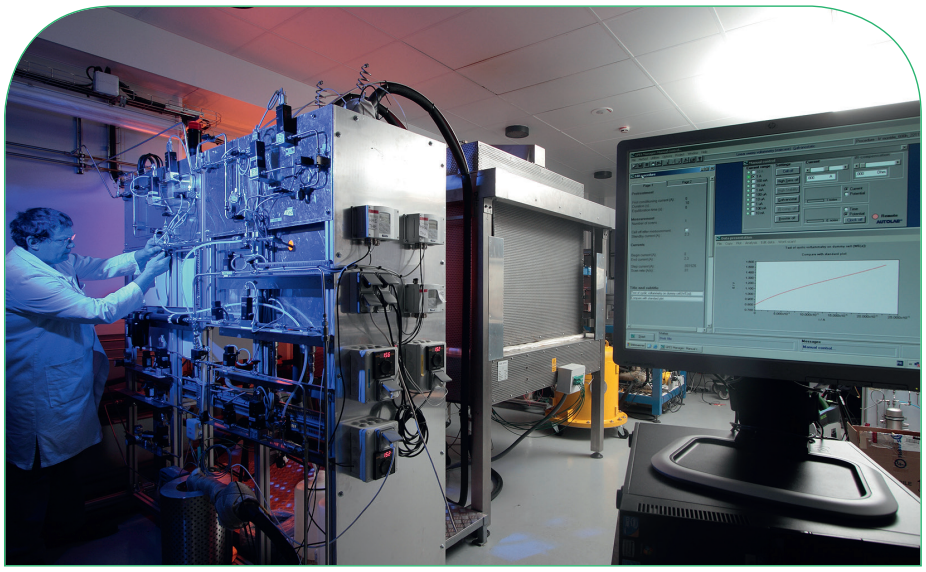


QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	UNIT	TARGET	ACHIEVED TO DATE BY THE PROJECT	TARGET ACHIEVED?	SOA RESULT ACHIEVED TO DATE (BY OTHERS)	YEAR FOR SOA TARGET
Project's own objective	System CAPEX	€/kW	4,000	N/A	✗	9,000	2018
	System life-time	hours	30,000	N/A	✗	N/A	N/A
	electrical efficiency	%	60	>60% based on system modelling	✓	60%	2017
	total efficiency	%	85	>85 based on system modelling	✓	82%	2017

INSIGHT

IMPLEMENTATION IN REAL SOFC SYSTEMS OF MONITORING AND DIAGNOSTIC TOOLS USING SIGNAL ANALYSIS TO INCREASE THEIR LIFETIME



Project ID:	**735918**
Call topic:	**FCH-02-5-2016** - Advanced monitoring, diagnostics and lifetime estimation for stationary SOFC stacks and modules
Project total costs:	**€ 3,146,056.25**
FCH JU max. Contribution:	**€ 2,498,948.75**
Project start - end:	01/01/2017- 31/12/2019
Coordinator:	**COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES, FR**
Website:	**insight-project.eu**

BENEFICIARIES: DANMARKS TEKNISKE UNIVERSITET, ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE, INSTITUT JOZEF STEFAN, AVL LIST GMBH, UNIVERSITÀ DEGLI STUDI DI SALERNO, ABSISKEY CP, SOLIDPOWER SA, BITRON SPA, SOLIDPOWER SPA, TEKNOLOGIAN TUTKIMUSKESKUS VTT OY, ABSISKEY

PROJECT AND OBJECTIVES

The INSIGHT project aims at developing a Monitoring, Diagnostic and Lifetime Tool for SOFC stacks. Monitoring is based on 2 advanced techniques (EIS and THD) in addition to conventional stack signal. Durability tests with faults added on purpose generate the data required to develop and validate the algorithms. Fault mitigation logics will be developed to avoid stack failures and slow down their degradation. A specific low-cost hardware, consisting in a single board able to embed the tool will be developed and integrated in a commercial microCHP, which will be tested on field.

NON QUANTITATIVE OBJECTIVES

- A mitigation matrix has been designed. The severity of each main fault selected has been defined. It correlates the 3 faults with detection and mitigation variables
- The DC/DC converter of the EnGen 2500 micro-CHP system has been modified, and the Bitron Box developed.

PROGRESS & MAIN ACHIEVEMENTS

- Non-linear perturbations techniques (THD & PRBS) have been found as quick analysis tools, with an answer consistent with conventional EIS measurements
- DC/DC converter of the EnGen 2,500, Bitron Box (developed to embed the monitoring, diagnostic and lifetime tools) have been developed and manufactured
- A mitigation matrix & the severity of each main fault selected have been designed. It correlates the 3 faults with detection and mitigation variables.

FUTURE STEPS & PLANS

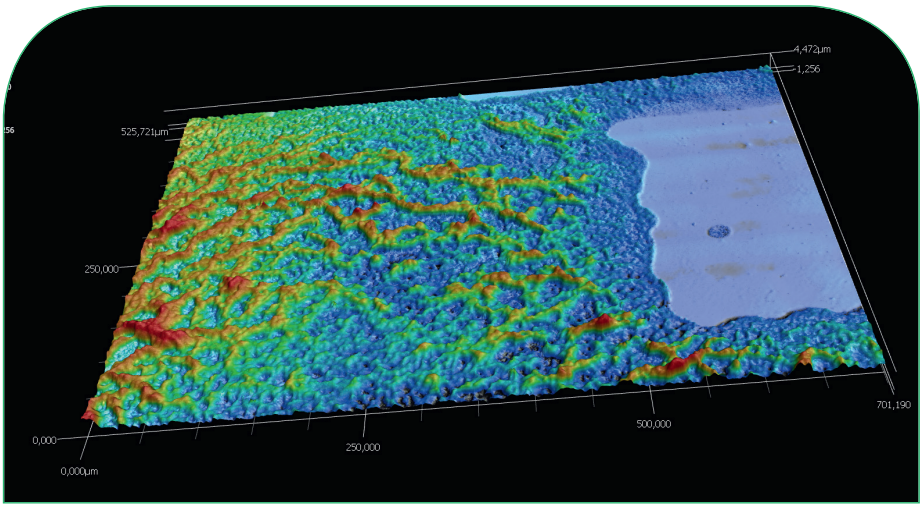
- Being able to isolate faults on a full scale stack where the instrumentation is less, due to averaging effect
- Finalize the installation of the Bitron Box and MDLT tools on the Engen system
- Perform the in-field test
- Continuation of data exchange between WP2 testing & WP4/5 MDLT to fine tune algorithms.

QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	TARGET	ACHIEVED TO DATE BY THE PROJECT	TARGET ACHIEVED?	SOA RESULT ACHIEVED TO DATE (BY OTHERS)	YEAR FOR SOA TARGET
Project's own objective	Perform test with faults added on purpose	Test 3 faults	3 planned fault tested, plus two additional reported	✓	Evaluation of C deposition	2016
	Develop monitoring, diagnostic and lifetime tool (MDLT)	Tool developed	in progress	✂	No other similar tool for SOFC, as far as open literature is concerned	NA
	Implement the MDLT on board	Implementation done	in progress	✂	NA	NA
AWP 2016	Lifetime	Prolong lifetime by 5%	Quantification will be done in 2019	✂	Degradation rates < 1%/1000h	NA
	Cost	System cost increase due to addition hardware for MDLT less than 3%	Evaluation in 2019	✂	NA	NA

MAMA-MEA

MASS MANUFACTURE OF MEAS USING HIGH SPEED DEPOSITION PROCESSES



Project ID:	**779591**
Call topic:	**FCH-02-8-2017** - Step-change in manufacturing of Fuel Cell Stack Components
Project total costs:	**€ 3,189,816**
FCH JU max. Contribution:	**€ 3,189,816**
Project start - end:	01/01/2018 - 31/12/2020
Coordinator:	**TECHNISCHE UNIVERSITAET CHEMNITZ, DE**
Website:	**mama-mea.eu**

BENEFICIARIES: FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V., UNIVERSITÀ DEGLI STUDI DI MODENA E REGGIO EMILIA, NEDSTACK FUEL CELL TECHNOLOGY BV, INEA INFORMATIZACIJA ENERGETIKA AVTOMATIZACIJA DOO, JOHNSON MATTHEY FUEL CELLS LIMITED, SYSTEM SPA

PROJECT AND OBJECTIVES

The task of the MAMA-MEA project is to develop an innovative additive layer deposition process integrating all main CCM components (membrane, catalyst layers, sealing) using a single, continuous roll-to-roll manufacturing process for the PEM fuel cell industry, thus enabling an increase in the volume manufacturing rate of over 10 times compared to state of the art processes, whilst also increasing key material utilisation and reducing materials and costs. Currently, a multi-layer deposition process is being developed and multilayer structures have been prepared.

NON QUANTITATIVE OBJECTIVES

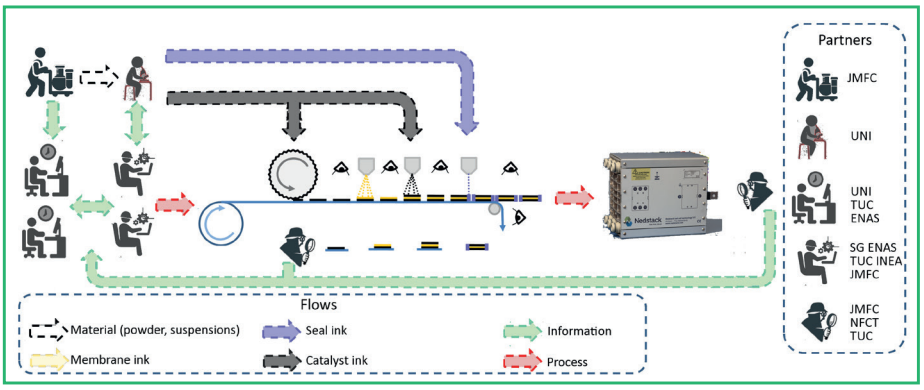
- Workshop on ionomer ink preparation in preparation for end of May
- INSPIRE workshop in Marseille, integration of several FCHJU projects (MAMA-MEA, INSPIRE, Fit-4-AMandA, etc.).

PROGRESS & MAIN ACHIEVEMENTS

- Ink optimisation for chosen deposition techniques based on state of the art catalysts. Multi-layer deposition with gradients attempted
- Down-selection of mature production techniques from other industries including an assessment of their suitability for the deposition of each layer
- Project performance parity achieved on test cell level (50 cm^2) with the baseline deposited using the most promising down selected technique.

FUTURE STEPS & PLANS

- Characterisation and selection of additive manufactured MEAs
- Adapting and showing the possibility for scaling up the laboratory results to mass-manufacturing-ready equipment
- Low batch production of sufficient amount of full size MEAs for stacks
- Stack assembly and test preparation with chosen MEAs
- Further future improvement of the selected processes and corresponding inks.



QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	UNIT	TARGET	TARGET ACHIEVED?	SOA RESULT ACHIEVE TO DATE (BY OTHERS)	YEAR FOR SOA TARGET
AWP 2017	CAPEX	€/kW	12,000		N/A	N/A
	Lifetime	hours	20,000		23,000	2017
	Degradation	% / 1,000 hour	0.25	✗	3 µVh	2017
Project's own objective	Material utilisation	%	95		N/A	N/A
	Production/web speed	m/s	1		N/A	N/A

qSOFC

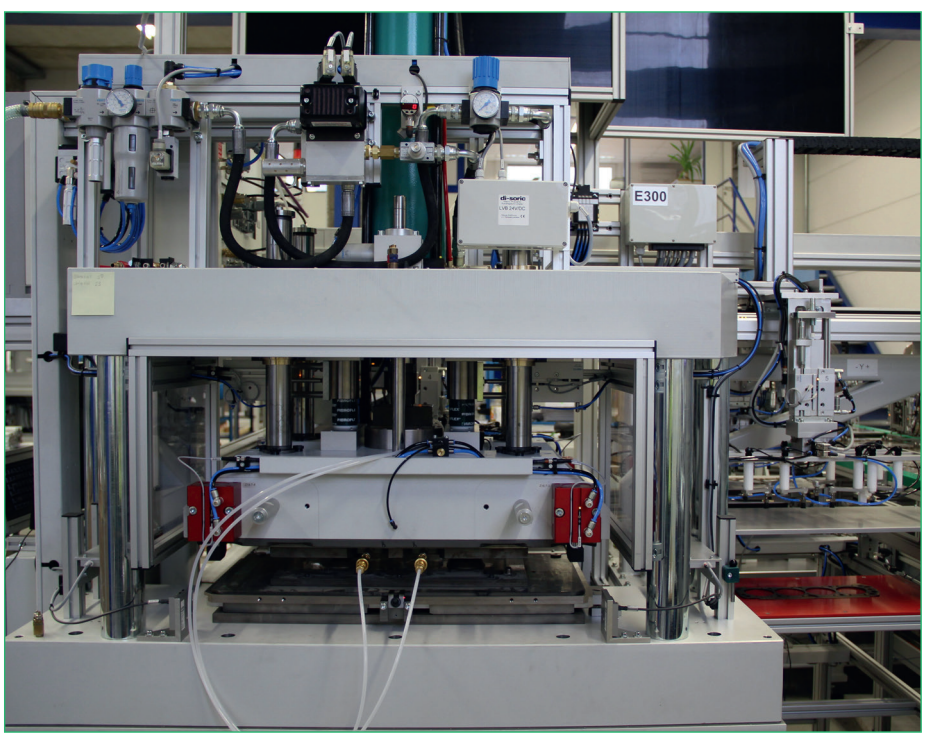
AUTOMATED MASS-MANUFACTURING AND QUALITY ASSURANCE OF SOLID OXIDE FUEL CELL STACKS

Project ID:	**735160**
Call topic:	**FCH-02-6-2016** -Development of cost-effective manufacturing technologies for key components or fuel cell systems
Project total costs:	**€ 2,110,015**
FCH JU max. Contribution:	**€ 2,110,015**
Project start - end:	01/02/2017 - 31/01/2020
Coordinator:	**TEKNOLOGIAN TUTKIMUSKESKUS VTT OY, FI**
Website:	**www.qsofc.eu**

BENEFICIARIES: AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE, AKTIEBOLAGET SANDVIK MATERIALSTECHONOLOGY, AKTSIASELTS ELCOGEN, ELRINGKLINGER AG, ELCOGEN OY, HAIKU TECH EUROPE BV, MUKO MASCHINENBAU GMBH

PROJECT AND OBJECTIVES

qSOFC focuses on SOFC stack cost reduction and quality improvement by replacing manual labour in all key parts of the stack manufacturing process with automated manufacturing and quality control. This will lead to stack cost of 1000 €/kW and create a further cost reduction potential down to 500 €/kW at mass production (2000 MW/year). During the qSOFC project, key steps in cell and interconnect manufacturing and quality assurance will be optimized to enable mass-manufacturing. The project is currently in a phase in which the developed methods, materials, and procedures are validated.



PROGRESS & MAIN ACHIEVEMENTS

- Automated machine vision inspection system for cell manufacturing quality assurance
- Novel stack manufacturing/conditioning procedures have been developed, leading to significant reduction of CAPEX needed to upscale the production
- Cell manufacturing process has been modified to allow high-speed manufacturing necessary for mass-production.

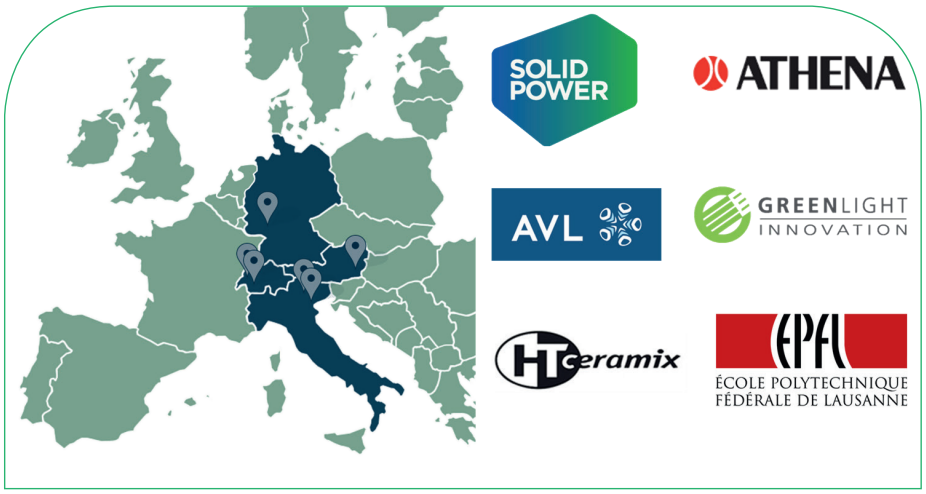
FUTURE STEPS & PLANS

- Validation of novel stack conditioning processes to reduce manufacturing time & cost
- Validation of interconnect assembly manufacturing QA procedures
- Long-term test of final validation stack.

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 FOR SOA TARGET
Project's own objective	Cell layer QC time	second/cell layer	10	11	✗	N/A	N/A
	Stack cost at 50 MW/year production volume	€/kW	1,000	N/A	✗	$6,500 for full system	2018
	Electrical efficiency	%	74	74	✓	N/A	N/A

SOSLeM
SOLID OXIDE STACK LEAN MANUFACTURING



Project ID:	**700667**
Call topic:	**FCH-02.6-2015** - Development of cost-effective manufacturing technologies for key components or fuel cell systems
Project total costs:	**€ 2,944,176.25**
FCH JU max. Contribution:	**€ 1,994,301.25**
Project start - end:	01/04/2016 - 31/03/2019
Coordinator:	**SOLIDPOWER SPA, IT**
Website:	**www.soslem.eu**

BENEFICIARIES: ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE, AVL LIST GMBH, SOLIDPOWER SA, ATHENA S.P.A, GREENLIGHT INNOVATION GMBH

PROJECT AND OBJECTIVES

The SOSLeM project aimed at reducing manufacturing costs for solid oxide fuel cell (SOFC) stacks while at the same time making production more resource efficient and realising environmental benefits.

NON QUANTITATIVE OBJECTIVES

Reduce environmental impact of SOFC manufacturing. New coatings of stack parts were developed and tested and reduced the amount of volatile Chromium in the stack exhaust.

PROGRESS & MAIN ACHIEVEMENTS

- The project resulted in a significant reduction of SOFC manufacturing costs and time
- The project led to an increase in SOFC lifetime and reliability
- The project developed and investigated novel technologies for end-of-line monitoring.

FUTURE STEPS & PLANS

Project finished.

QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	UNIT	TARGET	ACHIEVED TO DATE BY THE PROJECT	TARGET ACHIEVED?
Project's own objective	Reduction in stack manufacturing costs	€/kW	3,519	5,779	✓
	Nr. staff per MW	Nr. staff / MW	54.2	49.2	