



FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING

**Workshop on PEMFC
Stack and MEA
manufacturing: Is the
EU industry ready for
the challenges?**

Pietro Caloprisco

11 October 2018



Agenda Event

PEMFC stack and MEA manufacturing workshop; volume & quality challenges workshop, 11 October 2018, Brussels



08:30 - 09:00 Welcome coffee

09:00 - 10.40 INTRODUCTION

Welcome & introductory remarks, Mrs. Mirela Atanasiu, Head of Operation and Communication

- Overview of the FCH JU manufacturing activities, Pietro Caloprisco, Project officer, FCH JU
- Victoria Petrova, adviser DG GROW, directorate Industrial Transformation and Advanced Value Chains
- Overview of the European FC supply chain, David Hart, director, E4tech
- Optimisation of the manufacturing value chain, Alicia Arce Rubio, Head of Control Systems Lab-R&D Project Manager, AYESA

10:40 - 11:10 Coffee break

11:10 - 12.30 SESSION I - OEMs vision & requirements

- Toyota Europe, Isotta Cerri, General Manager
- BMW, Thomas Mertens, Head of Technology Development and Prototyping Battery and Fuel Cell
- Viessmann, Volker Nerlich, Project manager PACE in the Viessmann Group
- OEM tbc

12:30 - 13:30 Lunch break



13:30 - 15.10 SESSION II - Stack; manufacturing processes & quality techniques - presentations and panel discussion

- Elringklinger, Jurgen Kraft, Head of PEM Fuel Cell Development (presentation and moderation of the panel)
- Panel discussion
 - PowerCell, Thomas Tingelöf, CTO
 - Proton Motor, Thomas Wannemacher, Team Leader Mgt & Doc
 - Intelligent Energy, Peart Richard, Head of Manufacturing Development
 - Borit, Joachim Kroemer, Manager Marketing and Sales
- Open discussion

15:00 - 15:20 Coffee break

15:20 - 17.00 SESSION III - MEA; manufacturing processes & quality techniques - presentations and panel discussion

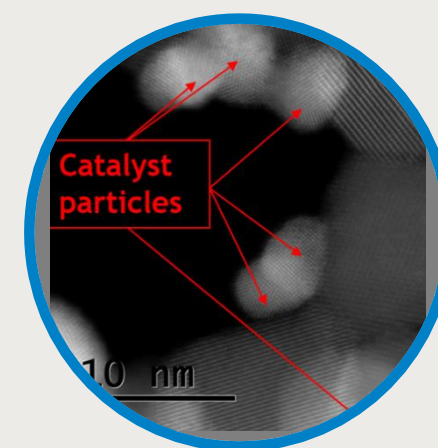
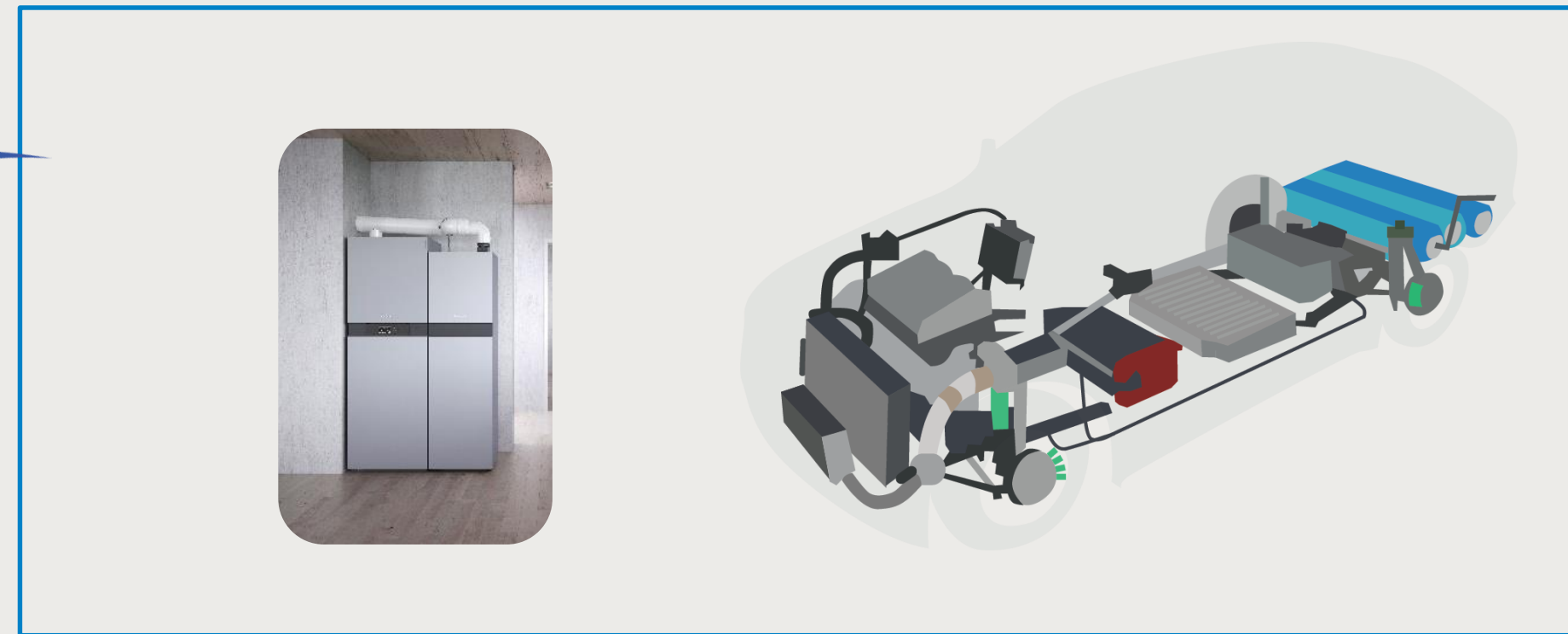
- Johnson Matthey Fuel Cells, Silvain Buche, Technology Projects and Test Facility Manager (presentation and moderation of the panel)
- Panel discussion
 - 3M, Mark Muggli, Senior Specialist Application Engineering
 - CEA, Pierre-André Jacques, Project Manager
 - CNRS, Deborah Jones, Director of Research
 - SGL Carbon, Ruediger Schweiss, Manager R&D GDL
- Open discussion

Concluding remarks, FCH JU, Pietro Caloprisco, project officer

17:00 Networking cocktail

The FCH JU strategy for manufacturing

Unlocking the potentials of PEM fuel cells



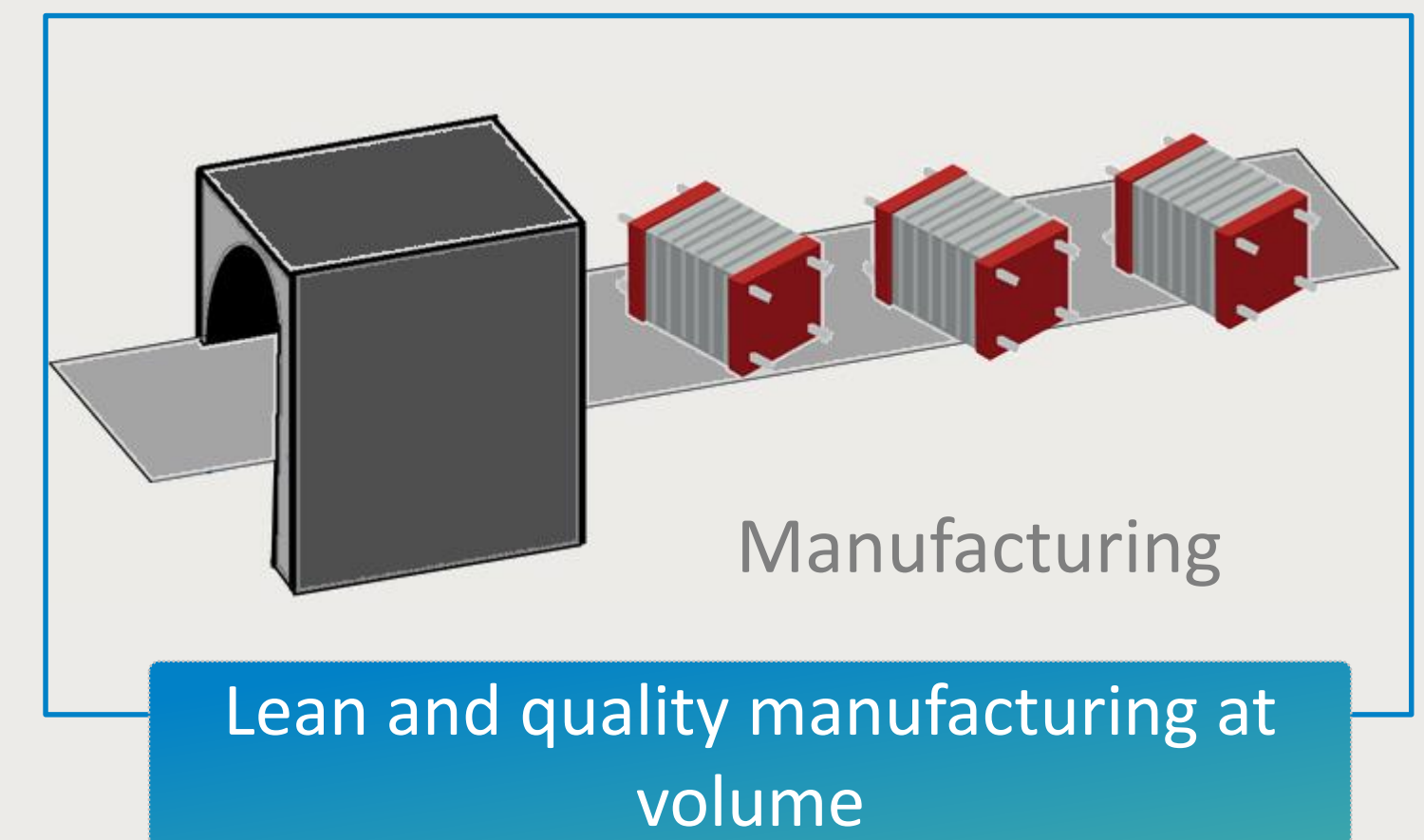
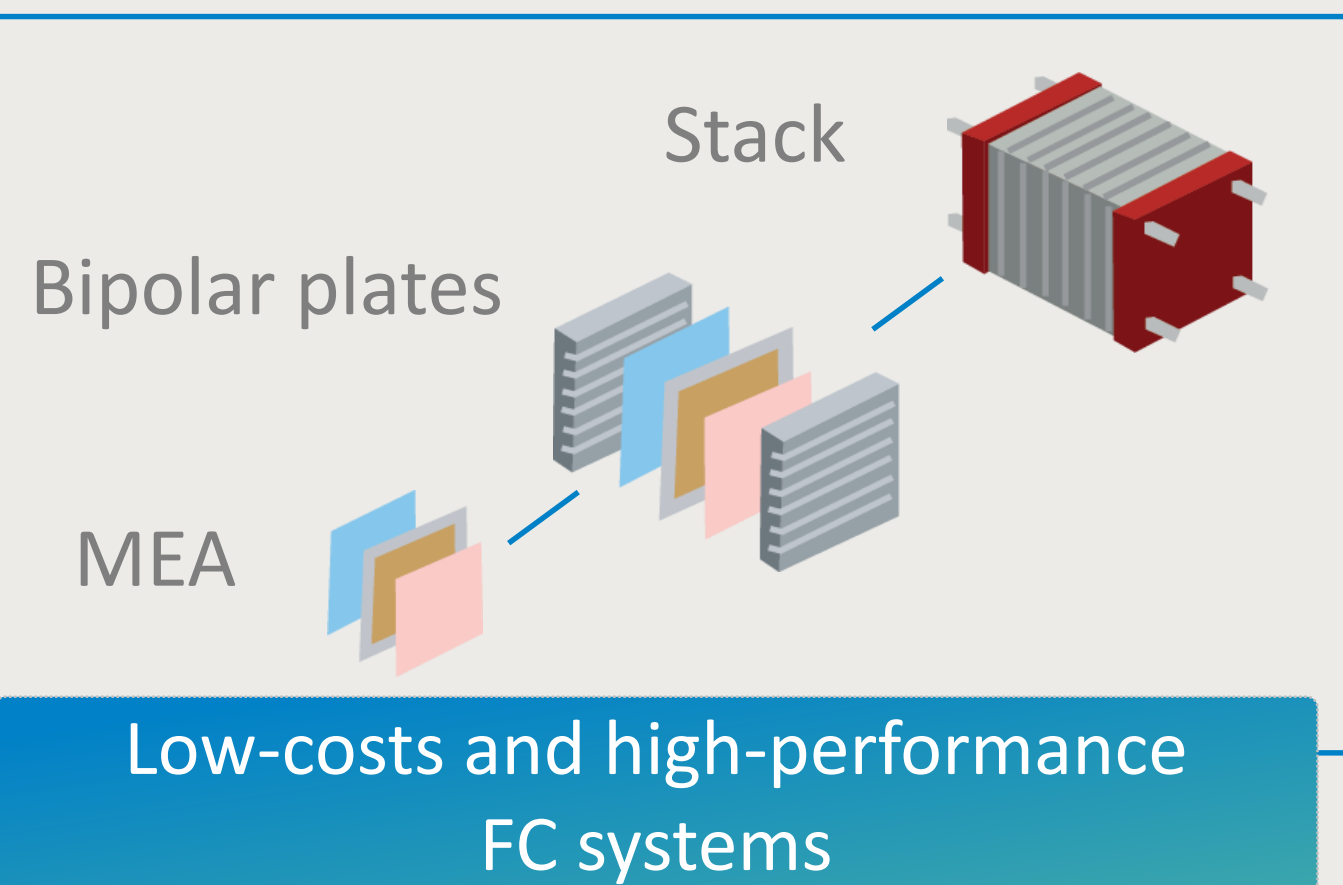
LAB-FAB



50 %



56 %



Policy drivers

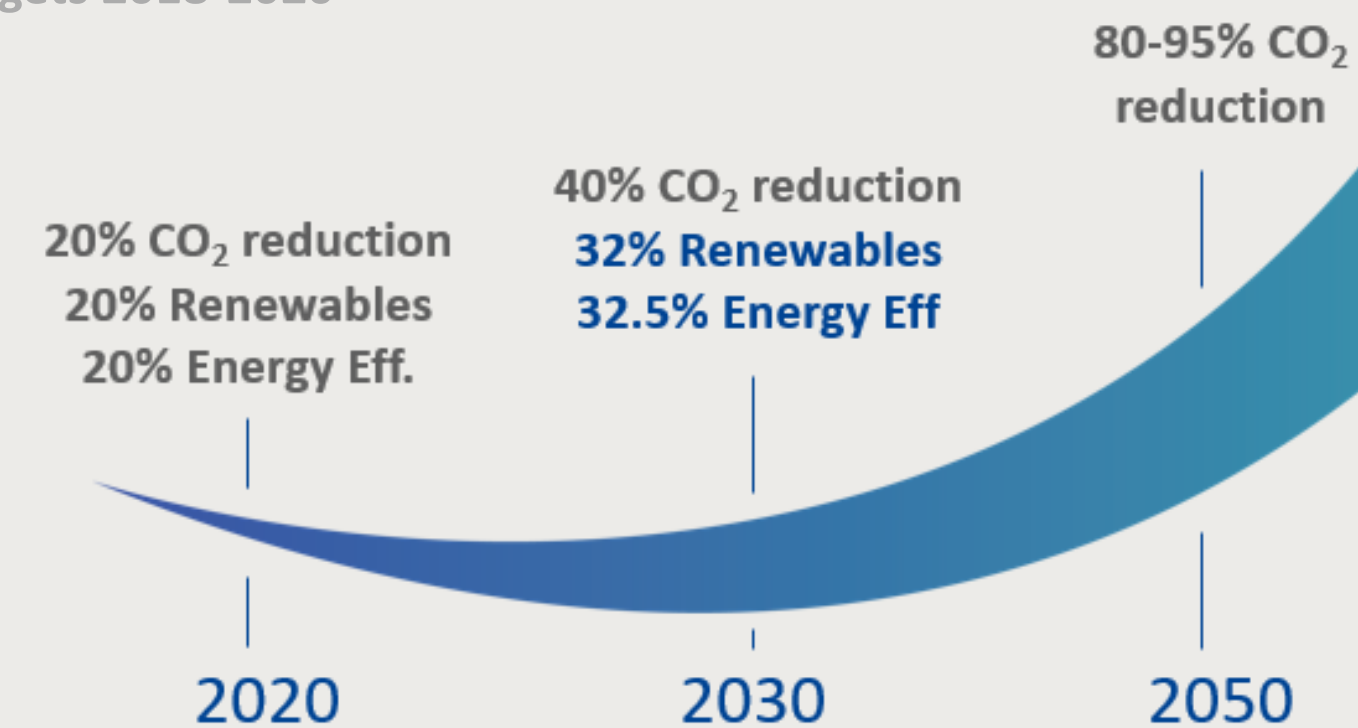
Energy efficiency, renewables and air quality



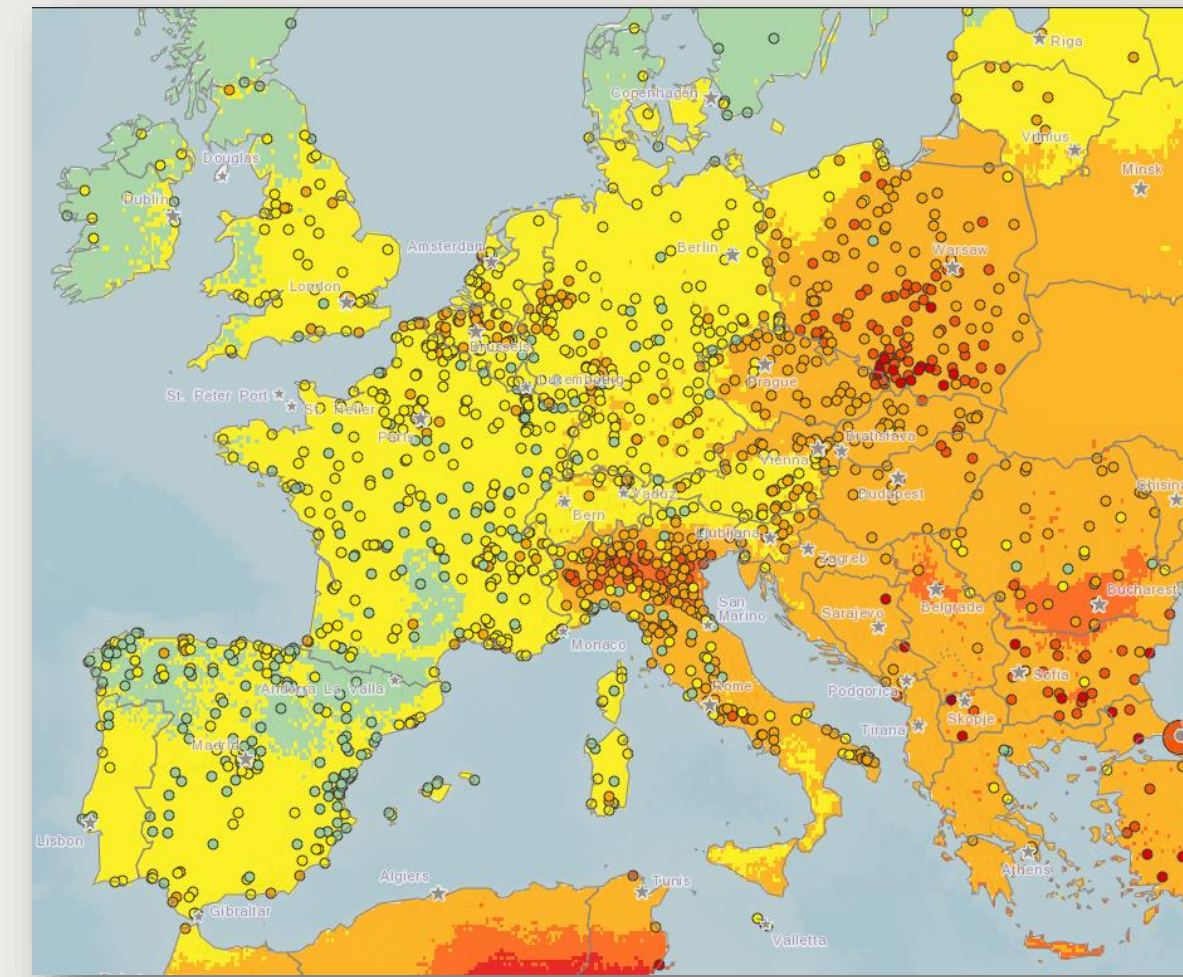
CO₂ reduction (Energy Efficiency / Renewables)

Roadmap to a highly efficient and decarbonised building stock

NZEB targets 2018-2020



Air quality



More than 467.000 premature deaths were attributed to exposure to high concentrations of particulate matter in 2013







Source: Air quality in Europe — 2016 report. [Link](#)

The opportunities

Demand for PEMFC applications ramping up



Region	2018	2025
	190 MW	1,1 GW
	573 MW	7,4 GW
	258 MW	20 GW
	15 MW	5 GW



1.2*GW



43** GW



*Cumulative
**Aspirational targets



Ready to seize the opportunity ?



- FC industry has little experience in scale manufacturing
- Key components of a PMEFC system: complex niche products
- Considerable manual input leading to:
 - Low yields & high production costs
 - Quality issues
- Enough confidence to make the needed investments ?

Manufacturing cost

Capacity

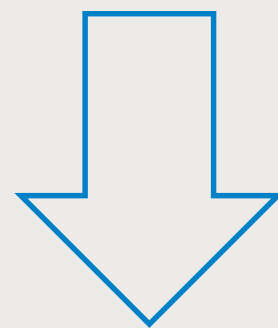
Quality



The challenges

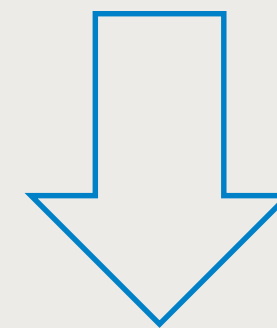


Manufacturing cost



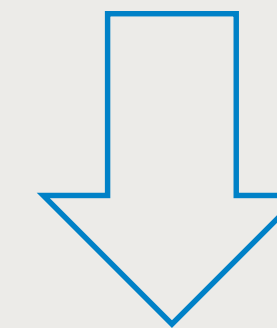
- Use engineering analysis to identify cost reduction potential throughout the overall process chain
- Design for manufacturability of components & simplification of the FC system architecture
- Development of production lines

Increased capacity



- Innovate: Improving manufacturing, tooling, equipment and manufacturing processes specific to the PEMFC system
- Disrupt: Explore benefits of serial production and automated lines and other techniques coming from other more mature

Quality

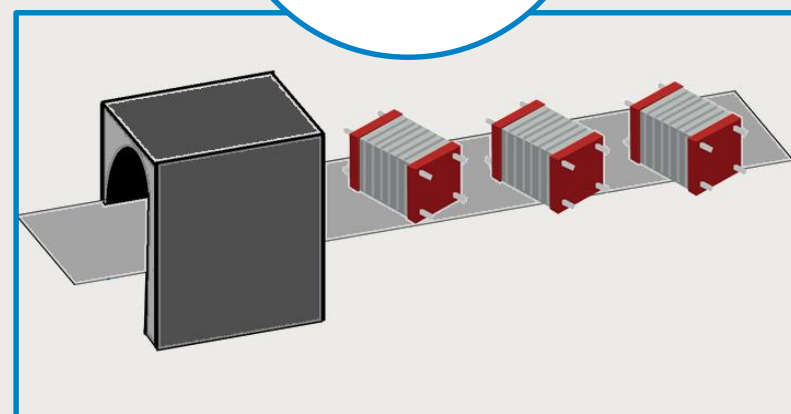


- Developing inline non-destructive control tools to reduce the number of defective components
- Increase MRL across the board

...while accommodating continuous innovation and ensuring increased performances



The targets



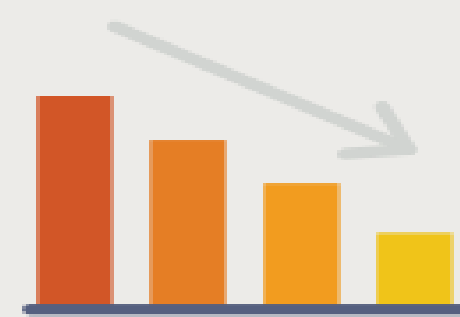
**Yield:
Innovation**

5 MW/y



**Yield :
Disruption**

50 MW/y



**Cost
FC system**

100€/kW



Quality

Scrap rate 5%



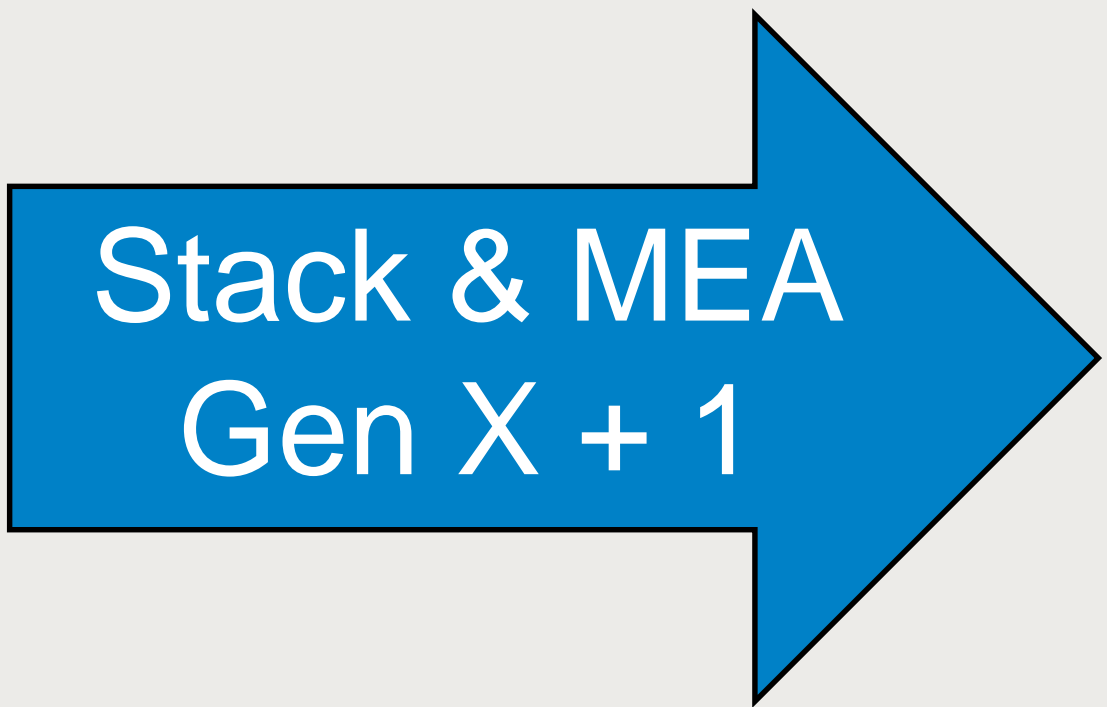
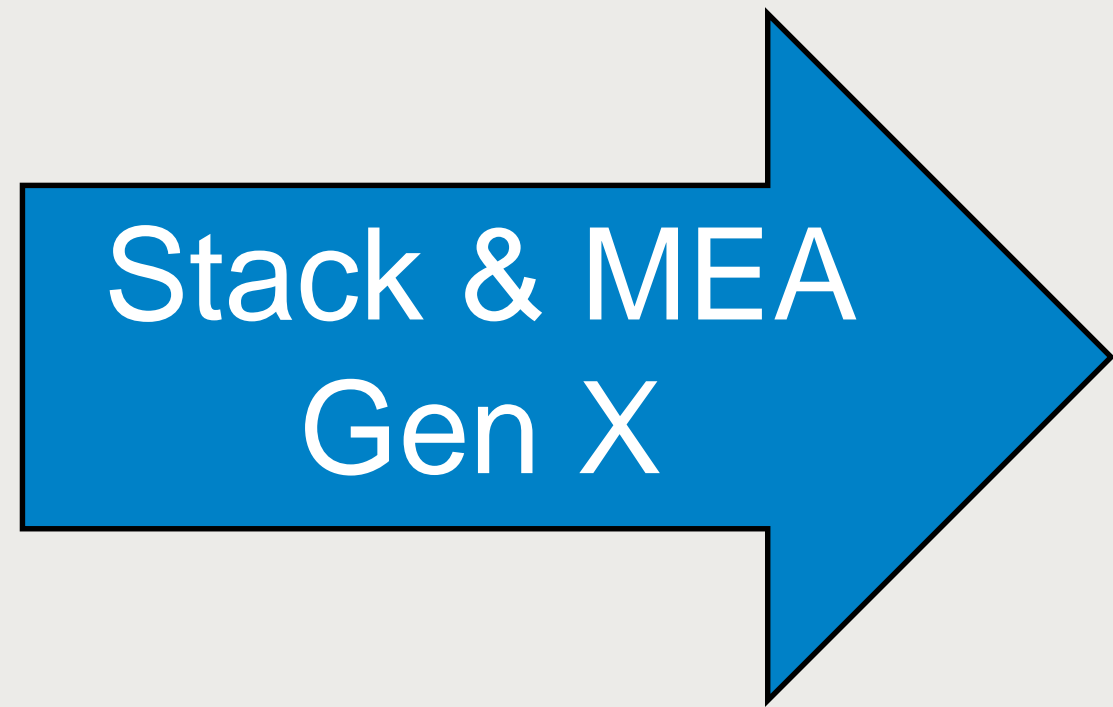
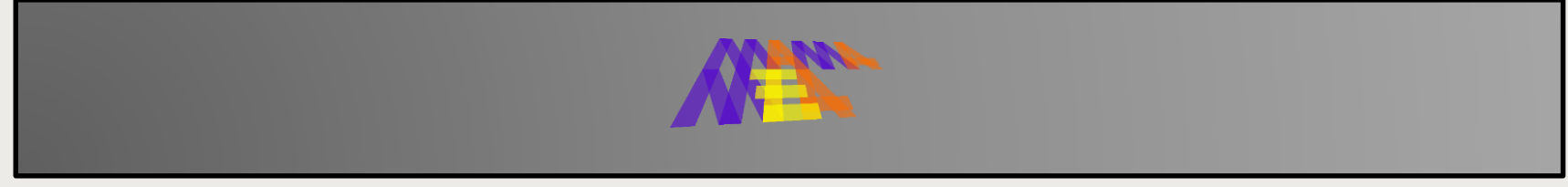
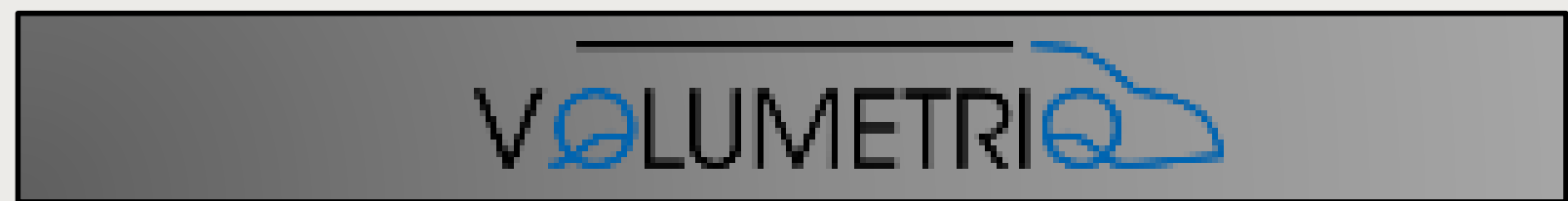
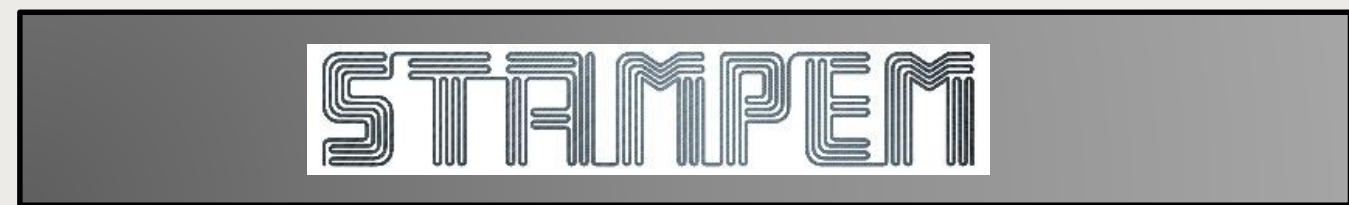
Performance

- Lifetime expectation: > 20.000 h
- Max degradation 10% @ 6.000 h
- Power density > 0.67 W/cm²
- Minimize packaging

The solutions



2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
------	------	------	------	------	------	------	------	------	------



8 projects total: € 31 M

Other activities

Harmonisation of testing procedures



JRC SCIENCE FOR POLICY REPORT

EU HARMONISED TEST PROTOCOLS
FOR PEMFC MEA TESTING IN
SINGLE CELL CONFIGURATION FOR
AUTOMOTIVE APPLICATIONS

Georgios Tsotridis, Alberto Pilenga, Giancarlo De...

2015

	Automotive Fuel Cell Cooperation	Robert Boulianne
	Bayerische MotorenWerke Aktiengesellschaft	Johannes Schmid Zacharias Veziridis Peter Wilde
	CEA Commissariat à l'énergie atomique et aux énergies alternatives	Pierre-André Jacques
	Daimler Aktiengesellschaft	Georg Frank Martin Heinen
	Deutsches Zentrum für Luft- und Raumfahrt e. V.	Andreas Friedrich Jens Mitzel Mathias Schulze
	Fraunhofer ISE	Ulf Groos
	FuMA-Tech Gesellschaft für funktionelle Membranen und Anlagentechnologie mbH	Tomasz Klicpera
	IRD fuel cell A/S	Madeleine Odgaard
	Johnson Matthey Fuel Cells Ltd	Silvain Buche
	Technische Universität München	Oliver Schneider
	Toyota Motor Europe	Isotta Cerri
	Université de Montpellier	Deborah Jones
	Volkswagen Aktiengesellschaft	Gerold Hübner Miriam Stiefel
	Zentrum für Sonnenenergie- und Wasserstoff-Forschung BW	Ludwig Jörissen Alexander Kabza

EU HARMONISED
SINGLE PEM FUEL CELL
TESTING HARDWARE

Georgios Tsotridis; Tomasz Bednarek

European Commission
Joint Research Centre
Directorate C – Transport
Petten, The Netherlands



Supply & value chain studies



Supply chain

- Better understanding of the supply chain;
- Identification gaps;
- Comparison with other regions of the world;

Value chain

- FCH technologies as a decarbonisation solution;
- 2050 penetration scenario;



Agenda Event

PEMFC stack and MEA manufacturing workshop; volume & quality challenges workshop, 11 October 2018, Brussels



08:30 - 09:00	Welcome coffee
09:00 - 10.40	INTRODUCTION
Welcome & introductory remarks, Mrs. Mirela Atanasiu, Head of Operation and Communication	
<ul style="list-style-type: none">- Overview of the FCH JU manufacturing activities, Pietro Caloprisco, Project officer, FCH JU- Victoria Petrova, adviser DG GROW, directorate Industrial Transformation and Advanced Value Chains- Overview of the European FC supply chain, David Hart, director, E4tech- Optimisation of the manufacturing value chain, Alicia Arce Rubio, Head of Control Systems Lab-R&D Project Manager, AYESA	
10:40 - 11:10	Coffee break
11:10 - 12.30	SESSION I - OEMs vision & requirements
<ul style="list-style-type: none">- Toyota Europe, Isotta Cerri, General Manager- BMW, Thomas Mertens, Head of Technology Development and Prototyping Battery and Fuel Cell- Viessmann, Volker Nerlich, Project manager PACE in the Viessmann Group- OEM tbc	
12:30 - 13:30	Lunch break

13:30 - 15.10	SESSION II - Stack; manufacturing processes & quality techniques - presentations and panel discussion
<ul style="list-style-type: none">- Elringklinger, Jurgen Kraft, Head of PEM Fuel Cell Development (presentation and moderation of the panel)- Panel discussion<ul style="list-style-type: none">• PowerCell, Thomas Tingelöf, CTO• Proton Motor, Thomas Wannemacher, Team Leader Mgt & Doc• Intelligent Energy, Peart Richard, Head of Manufacturing Development• Borit, Joachim Kroemer, Manager Marketing and Sales- Open discussion	
15:00 - 15:20	Coffee break
15:20 - 17.00	SESSION III - MEA; manufacturing processes & quality techniques - presentations and panel discussion
<ul style="list-style-type: none">- Johnson Matthey Fuel Cells, Silvain Buche, Technology Projects and Test Facility Manager (presentation and moderation of the panel)- Panel discussion<ul style="list-style-type: none">○ 3M, Mark Muggli, Senior Specialist Application Engineering○ CEA, Pierre-André Jacques, Project Manager○ CNRS, Deborah Jones, Director of Research○ SGL Carbon, Ruediger Schweiss, Manager R&D GDL- Open discussion	
Concluding remarks, FCH JU, Pietro Caloprisco, project officer	
17:00	Networking cocktail

