FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING

Research activities for stationary applications

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PRD 2017

23 November 2017

Agenda

PROGRAMME REVIEW DAYS 2017
FUEL CELLS AND HYDROGEN: FROM TECHNOLOGY TO MARKET
23-24 NOVEMBER, BRUSSELS

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FUEL CELLS AND HYDROGEN: FROM TECHNOLOGY TO MARKET
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PANEL 4

RESEARCH ACTIVITIES FOR STATIONARY APPLICATIONS: Materials, components, diagnosis, performance phenomena, subsystem design and production

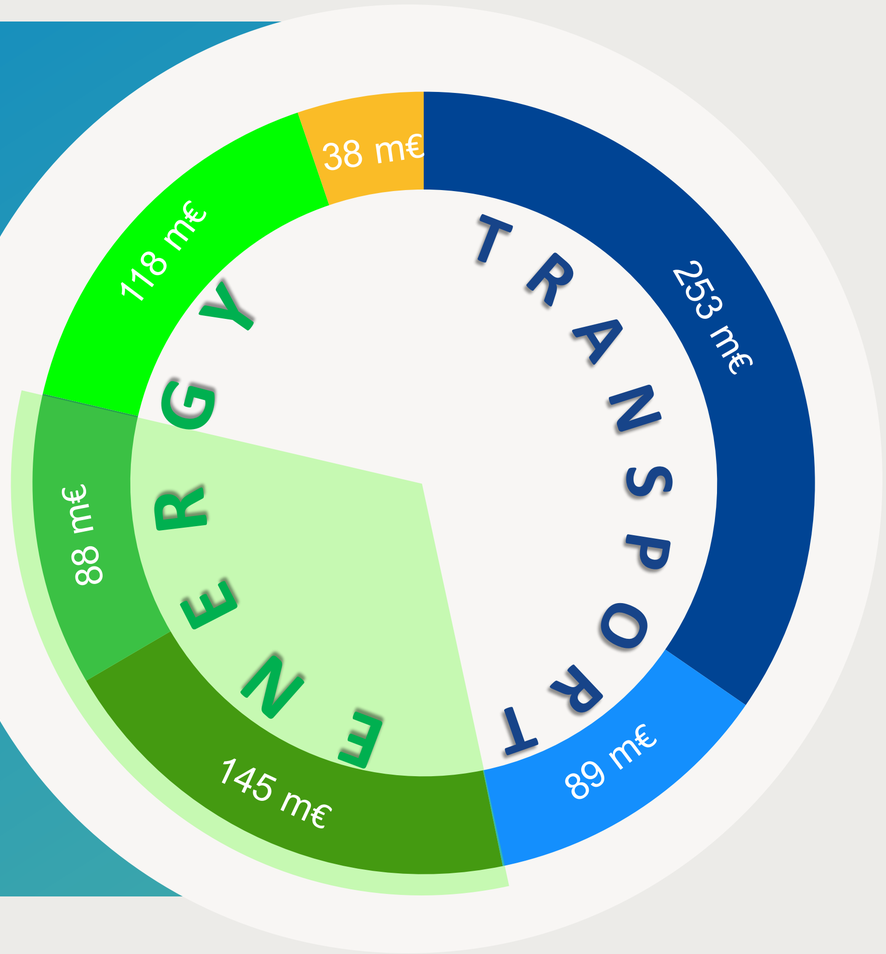
09:00 - 09:20	Portfolio overview by **Tsimis Dionisis**, FCH JU
09:20 - 09:40	ENDURANCE: Enhanced durability materials for advanced stacks of new solid oxide fuel cells
09:40 - 10:00	SECOND ACT: Simulation, statistics and experiments coupled to develop optimized and durable µCHP systems using accelerated tests
10:00 - 10:20	SOSLeM: Solid Oxide Stack Lean Manufacturing
10:20 - 10:40	NELLHI: New all-European high-performance stack: design for mass production
10:40 - 11:00	MATISSE: Manufacturing improved stack with textured surface electrodes for stationary and CHP applications

STATIONARY APPLICATIONS

Fuel cells for combined heat and power

Related FCH JU objectives

Increase the efficiency and the durability of fuel cells for power production, while reducing costs



Stationary

32 %

233 Mill Euros

70 Projects

Research

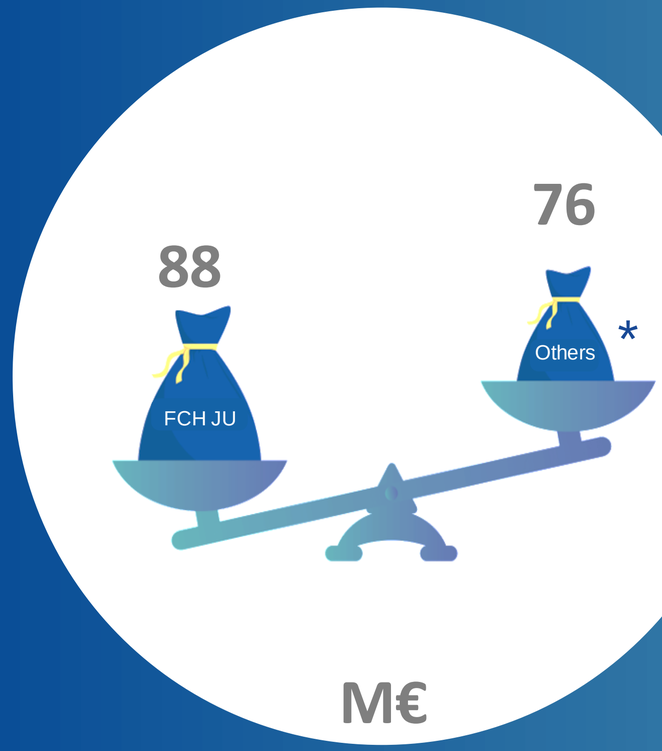
12 %

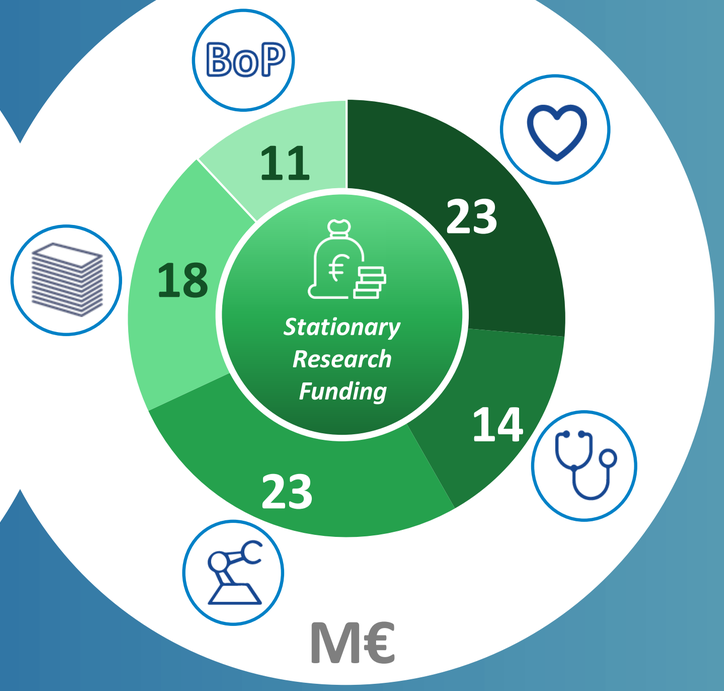
88 M€

42 Projects

Research portfolio

42 projects – 165 M€



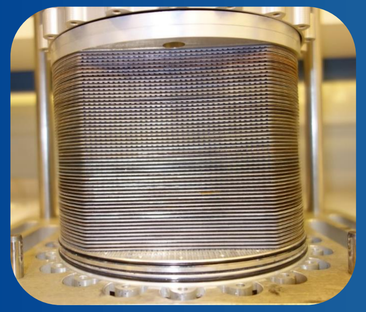


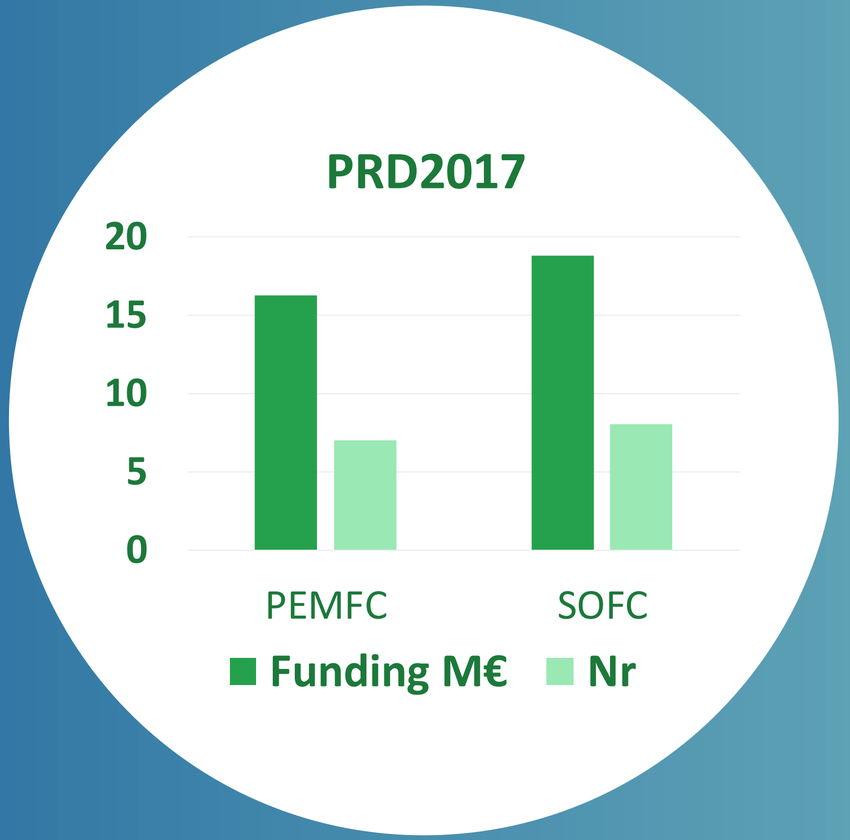
- Degradation and Lifetime
- Diagnostics, Monitoring and Control
- Next generation stack and cell design
- Balance of Plant
- Manufacturing

* *Other resources including private and national/regional funding*

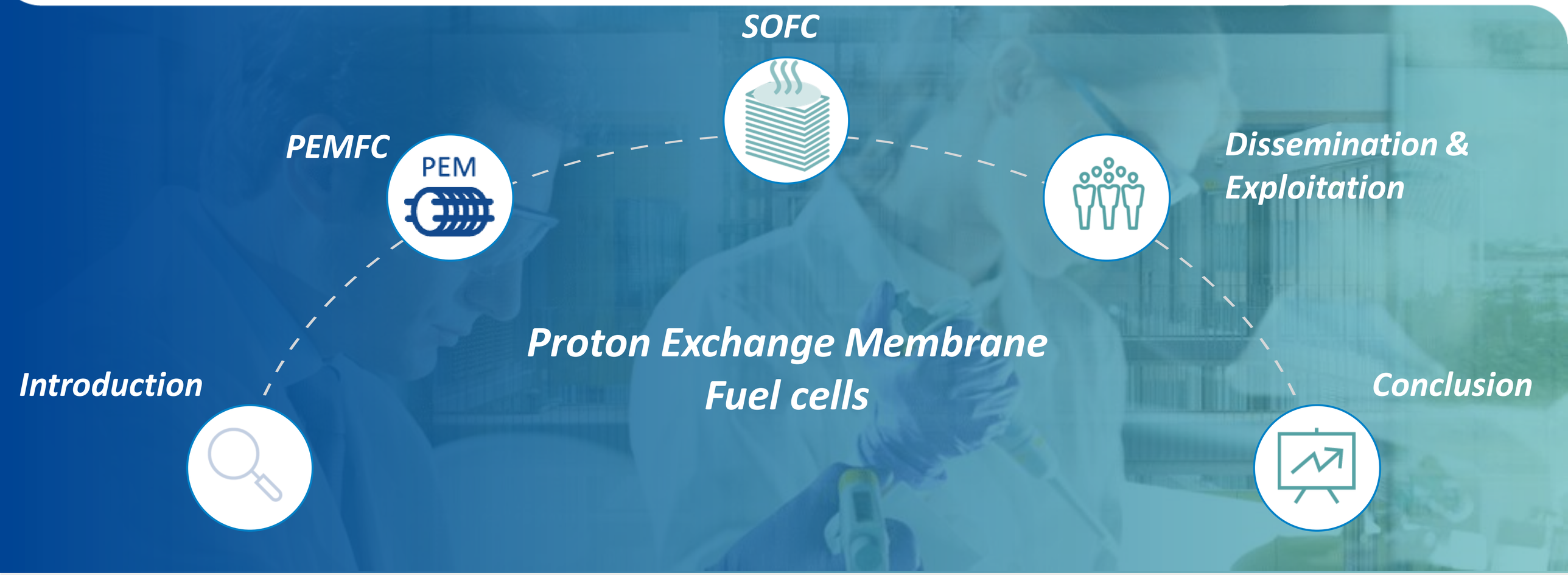
From lab scale to mass manufacturing

Technology neutral approach – Wide research scope





Research Portfolio



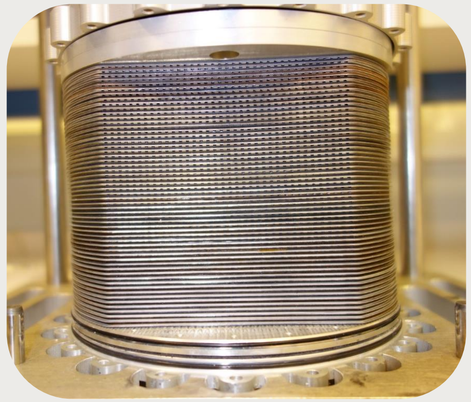
PEMFC – Improvements on MEAs lead to increased lifetimes

Both Low and High temperature PEMFC projects show strong focus on improving MEAs

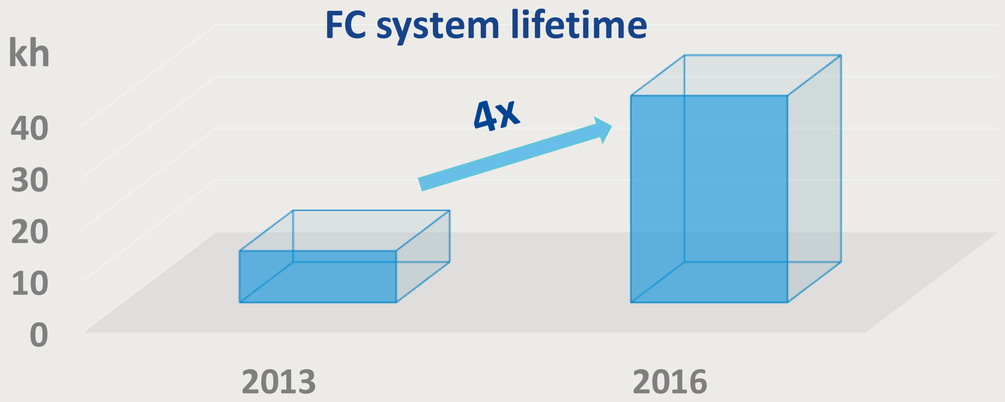
- Degradation mechanisms
- Improving Modelling accuracy
- Validation of improved components

- On-board EIS
- Fault Detection/Prevention
- Aims at 30% lifetime increase

- Improved current distribution
- Stable HT-PEM membranes



Breakthrough lifetimes



Tackling degradation

At MEA level	At system level	Start/Stop Cycles
3µV/h	0.5%/1000h	46 with no deg.

Based on 2016 project data gathered in the FCH2 JU 2017 data collection exercise

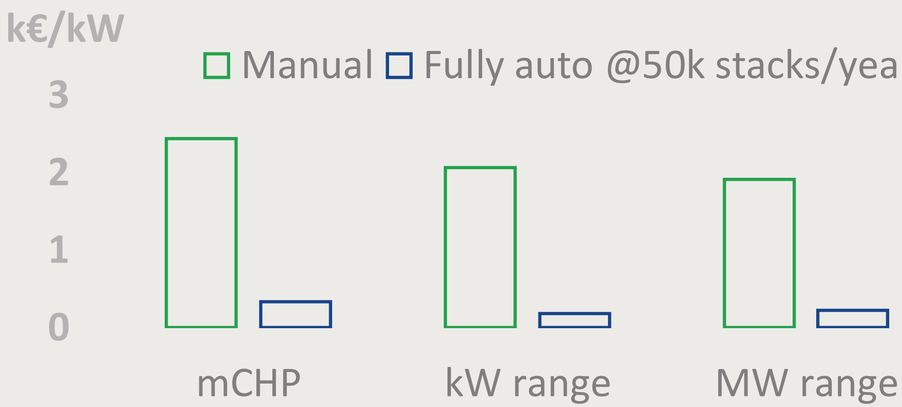
Automation reducing costs even at low production volumes

Minimising use of critical raw materials

- Validation of screen printing pilot line
- Validation of automated assembly of MEAs

- Flexible reformers for mCHP
- Bio-ethanol reformer
- BoP target of €2,300/kW

- Low platinum MEAs
- CO tolerance increase

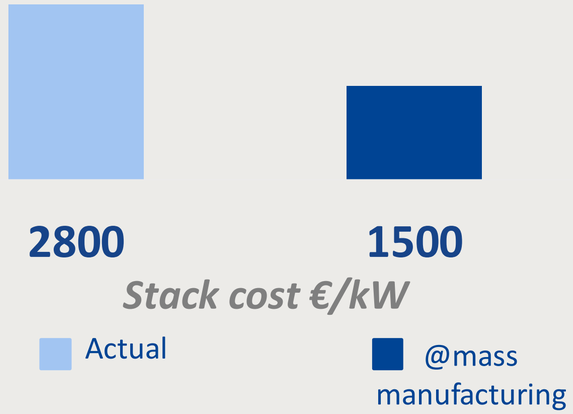


80% future reduction of cost

Minimising the use of critical raw materials

40% reduction of platinum loading recorded

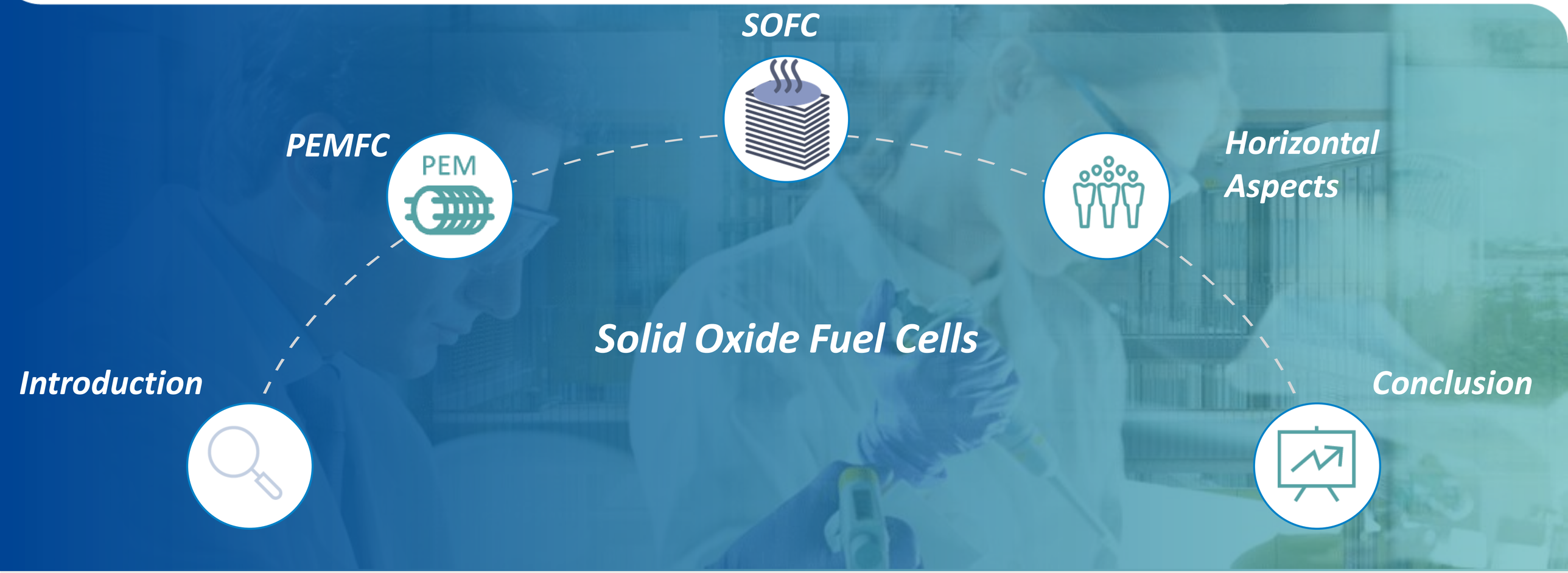
Reported Costs



47% reduction

Based on 2016 project data gathered in the FCH2 JU 2017 data collection exercise

Research Portfolio



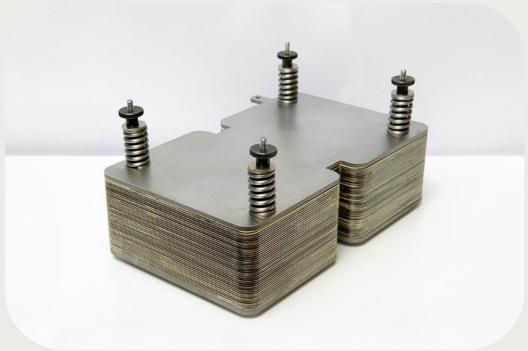
SOFC – Stack durability pushed beyond state of the art

Ambitious target set for 2020 : 90,000h of stack lifetime

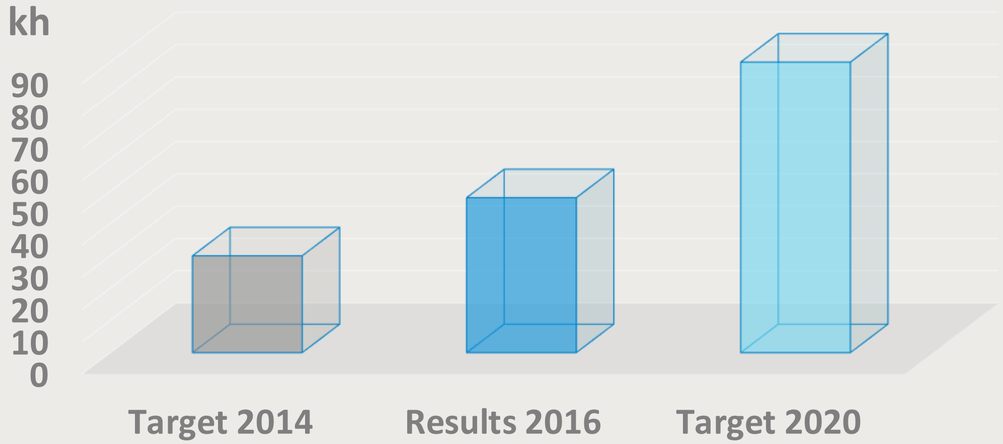
- Degradation mechanisms
- Improving Modelling Accuracy
- Validation of Improved components

- Total harmonic distortion analysis
- Fault Detection/Prevention

- Sealants for higher thermal cycling
- Innovative Interconnect designs
- Coatings limiting Cr evaporation



Lifetimes projections for 80kh



Electrical Efficiencies exceeding targets

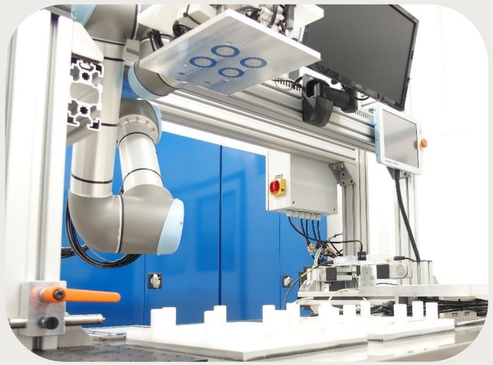
Efficiency @Stack level	Voltage degradation @stack level	Efficiency @system level
η_{el} = 74%	0.2%/1000h	η_{el} = 60%

Based on 2016 project data gathered in the FCH2 JU 2017 data collection exercise

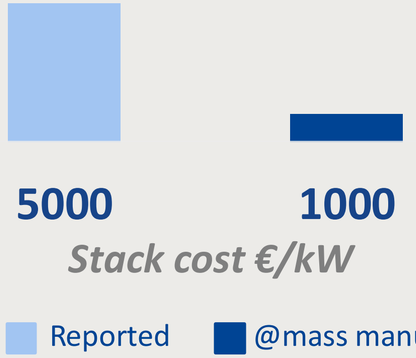
SOFC – Manufacturing picking up leading to cost reductions

Half of the projects had manufacturing as their central theme

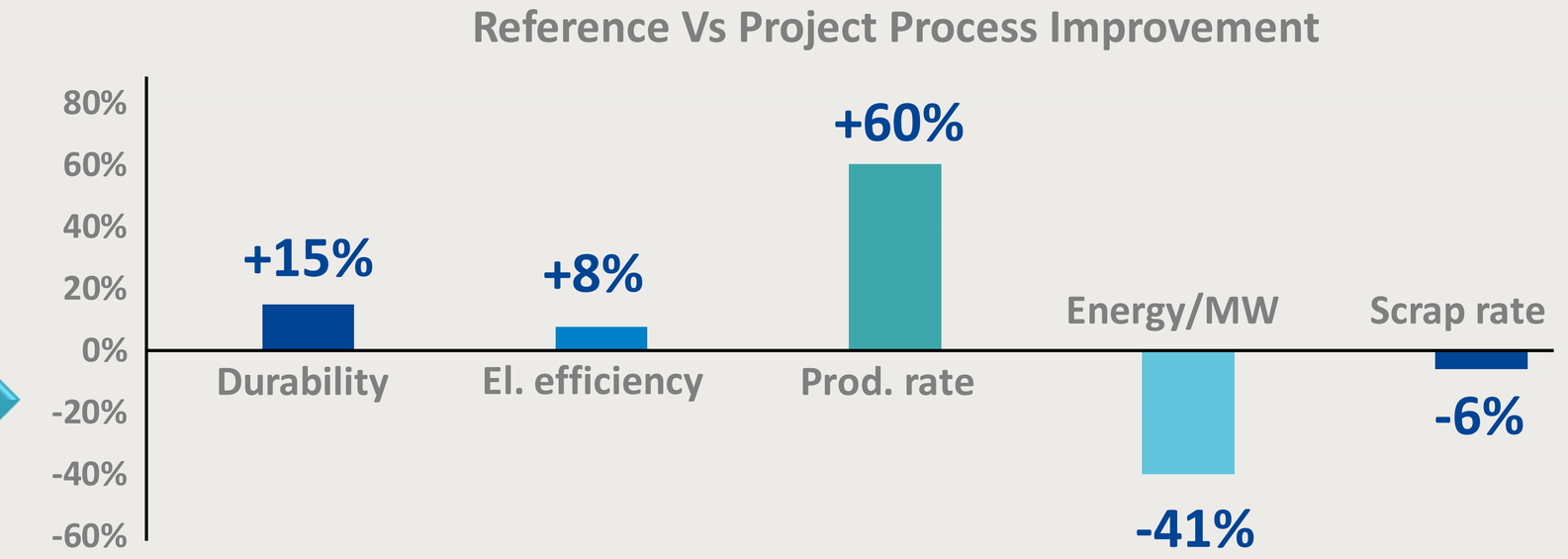
- Stack conditioning
- Lean Manufacturing
- 3D printing
- Interconnect manufacturing



Manufacturing focus already delivering results



80% reduction



Based on 2016 project data gathered in the FCH2 JU 2017 data collection exercise

Research Portfolio

Dissemination contributing to open science

Widening the audience for dissemination from scientists and academia to high school students

49 Publications

41 Conference Presentations

4 Patents

13 Workshops

1 Game
www.durablepower.eu

Research Portfolio

Research providing the foundations for next generation systems

- Pushing stack durabilities beyond the state of the art
- Improved stack designs lead to increased electrical efficiencies
- Manufacturing taking a central role

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FCH JU

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PANEL 4

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