Impact of Research Activities on FCH Technologies and Policy Development

for NERGHY – Research Grouping

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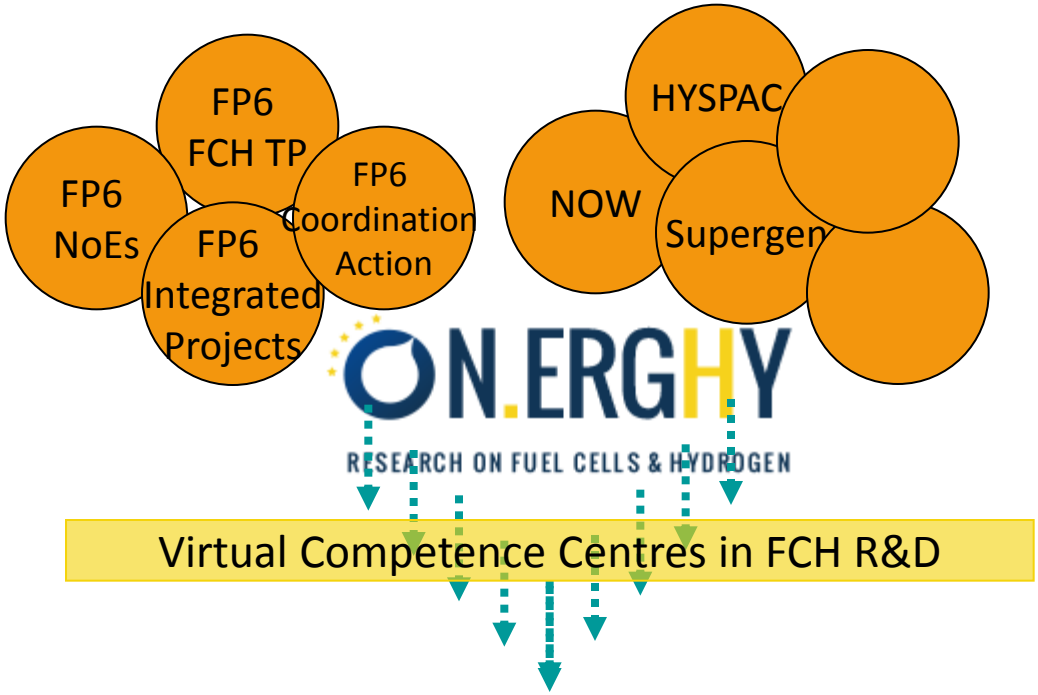
European Research Community in FCH technologies

- European FCH research community is exceptionally well-structured, a result of efforts in previous FPs as well as nationally

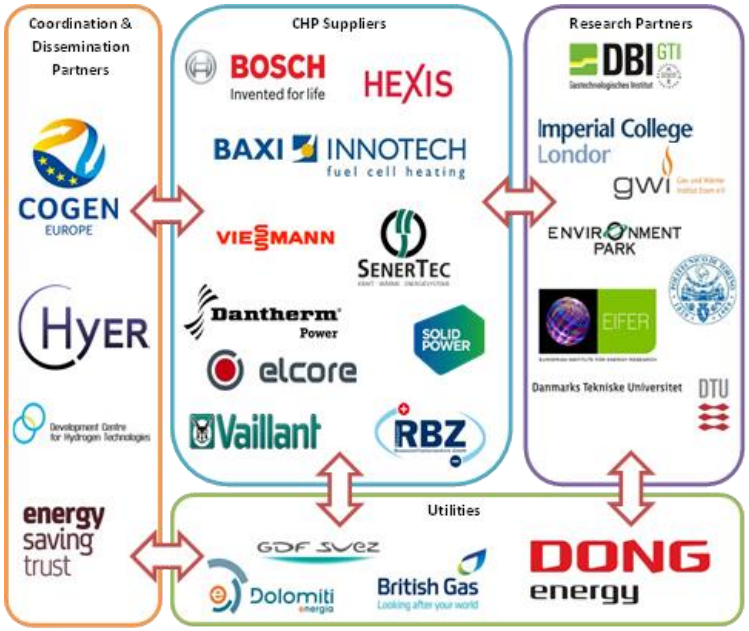


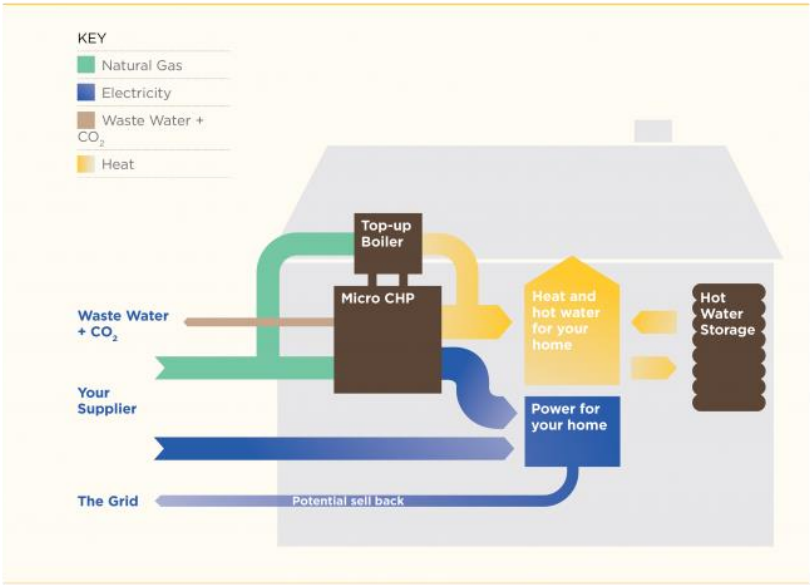
- Competence, capacity, capability, continuity
- Pluriannuality of FPs and programme vision in FCH JU are key
- Virtual competence centres in European FCH R&D

RG-IG collaboration leading to a competitive Europe in FCH technologies

- Joint efforts between IG and RG members to forward European FCH technologies to commercialisation are central and crucial. Most effectively:
  - *Clear and detailed industrial guidance*
  - *Research challenges clearly defined*
  - *Complementary capabilities, no overlap or gaps*
- Knowledge gaps and bottlenecks require RG research
- Current position of FCH technologies is a legacy of high level R&D (RG, IG) - *two examples where research partners have pivotal role*

Demonstration project example of RG-IG collaboration: ene.field





- Research partners > 25%, lead role in 3 of 6 WPs
- Research partners' contributions to data collection, analysis and developing commercialisation pathways for fuel cell µ-CHP, producing reports based on their findings, are key to delivering ene.field project objectives

Collaborative research project examples of RG-IG collaboration: automotive transport

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Towards common stack specifications and unified testing protocols

autostack moves

- Establishment of a technology roadmap,
- Definition of a business concept for a European stack industry

2010

autostack core

- Common OEM specification and stack platform concept
- Agreed Component and stack design
- Study cost engineering and volume production processes

2013

3 projects
Budget: 23.2M€
EC Funding: 11.9 M€

- 12 test programs on performance, endurance and safety related issues agreed in EU
- 3 International Workshops on PEM Fuel Cell Stack Testing

2013

Better technical cooperation between OEMs and suppliers

Accelerated learning curves

Reduced market introduction cost

- 9 industry
- 3 research (coord)

- 1 industry
- 9 research (coord)

- **Jointly developed stack platform specifications**
- **Harmonised test format**
- **Validated new components undergoing scale-up**
- **Automotive stack with planned specs achieving programme targets**

From lab to production

Maestro

2011

Improved membranes

- Development of mechanically robust membranes by research
- Validation in accelerated ageing short-stack testing by industry
  - 2 research (coord)
  - 2 industry

VOLUMETRIQ

- Optimise existing fuel cell component detail designs to achieve 2.5 A/cm^2 at 0.6 V
- Develop volume manufacturing capability and in-process quality controls
- 90 kW automotive stack

2015

European automotive stack product

- 5 industry (coord)
- 1 research

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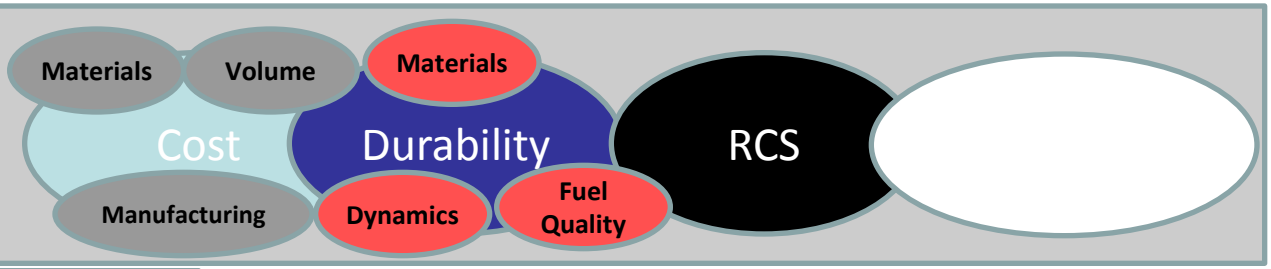
Fuel Cells and Hydrogen – the time is now

Improvement of AWP Preparation

- **RG initiative to streamline/ structure the FCH JU prioritisation process - AWP and MAWP revision**

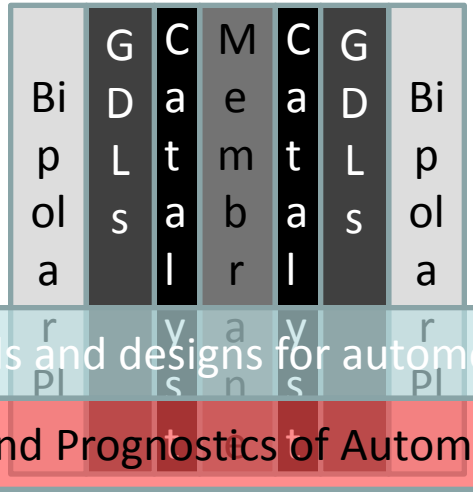
Fuel Cells for
Road vehicles propulsion
(Passenger cars, buses, vans, two wheelers)

1) Start by agreeing on Key Challenges



2) Which KPI must be met to become competitive, when?

3) Which Topics are required in call to reach those KPIs?



Exemplified for R&D activities on

"Next generation FC components"

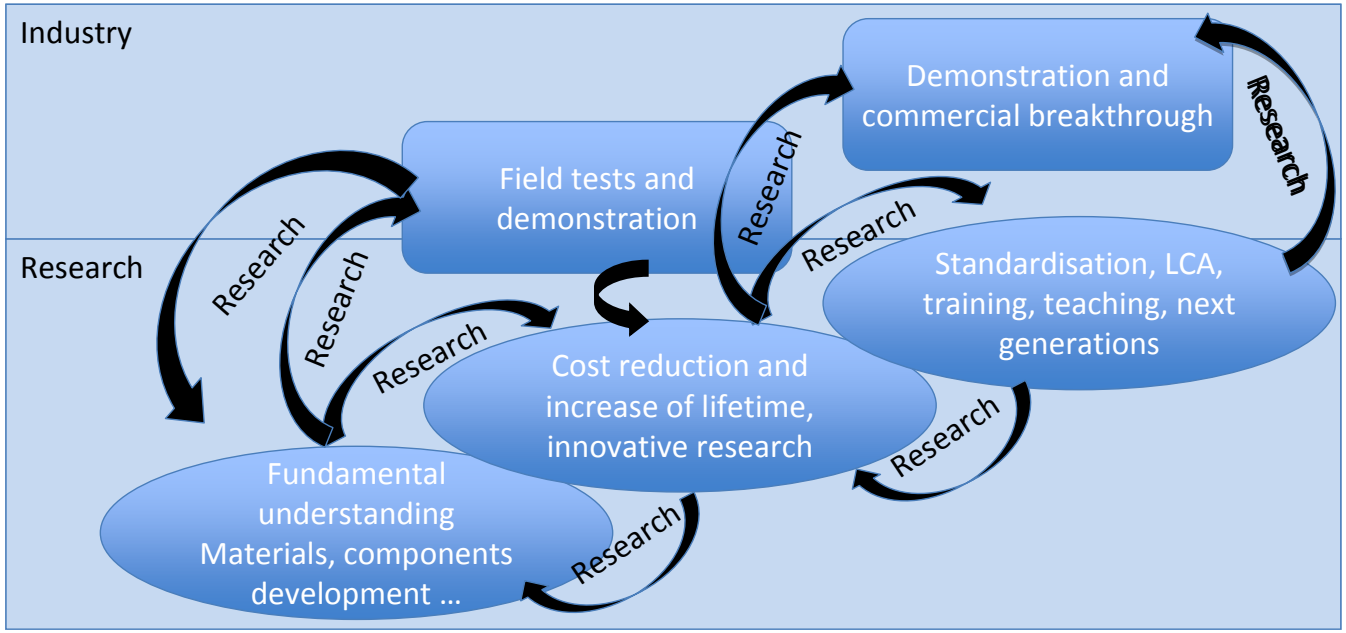
"Tools to identify State of Health" - remaining lifetime, mitigation

New materials and designs for automotive PEMFCs

Diagnostics and Prognostics of Automotive PEMFCs

Intensifying RG-IG collaboration

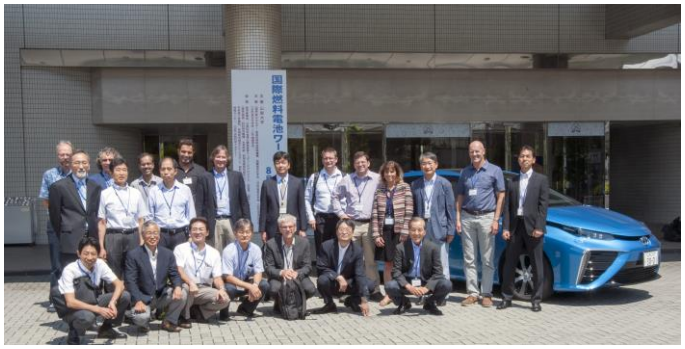
- **Better alignment of RG efforts with industry needs**
- Facilitate pursuit of successful project outcomes advancing to higher TRLs for more "lab to product"



- Increase focus in AWP topics commensurate with the urgency in reaching programme targets

Lower TRL research is crucial for a next generation FC technology

- Shift towards higher TRL and more demo activities in FCH 2 JU
- The current generation of FCH technologies is not the final answer - costly – Toyota continues research on new fuel cell catalyst concepts despite its Mirai



Pt/Catalyst issues

- PEMFC reliance on Pt catalysts: cost, resource limits
  - *Catalyst concepts to increase Pt utilisation (g/kW) – core shell, de-alloy, non-PGM*
  - *Better realising the intrinsic kinetic benefits of novel catalysts in catalyst layer design*

- Lower TRL research still required for competitive European FCH technology would be identifiable with intermediate KPIs
- Gathering all focussed research on FCH technologies, under the FCH 2 JU, provides the greatest opportunities for synergy

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Cross-cutting Impacts of Research Activities

- Research results provide support to policy decisions – COP21
- Unique facilities and platforms: from large science facilities and unique test platforms, to pilot lines and simulation
- Research support to SMEs
- Increasing involvement of EU12 countries in FCH 2 JU
- Safety, education and training, role of hydrogen in overall energy mix, climate change, public information

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Conclusions

- RG is a structured, well-identified community assembling world level competence
- RG is supporting and facilitating IG in reaching H2020 targets and succeeding in transition to commercialisation. There is overall greater capacity and potential of the RG contribution than is being used currently by IG
- Research at lower, intermediate and higher TRLs for a next generation lower cost FCH technology is essential to avoid technology stagnation, with loss of impact and competitiveness
- Improved coordination with national programmes is required to add value and avoid duplication

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Final Remarks

- RG-IG taskforces are a coordinated approach towards optimisation of JU funding and platform usage
- Intermediate technical milestones (KPIs) would facilitate project and programme monitoring
- Feedback from demonstration projects can be improved: feed technical issues into research topics
- Linking potential breakthrough discoveries from other areas or programmes (FET, graphene flagship) to industry will reinforce competitivity
- Increased prioritisation and focus are required to push European FCH technology to commercial readiness
- Joint roadmap and involvement of public research in technological market introduction, product improvement, codes and standards definition, quality assessment