



European-wide deployment of residential fuel cell micro-CHP

Fuel Cells for Stationary Power Applications

27, September 2016



The research leading to these results has received funding from the European Union's 7th Framework Programme (FP7/2007-2013) for the Fuel Cells and Hydrogen Joint Undertaking Technology Initiative under Grant Agreement Number 303462.



- 1. Introduction to the ene.field project**
2. Lessons learned to-date
3. Forthcoming research and analysis
4. PACE – the bridge to large scale market uptake

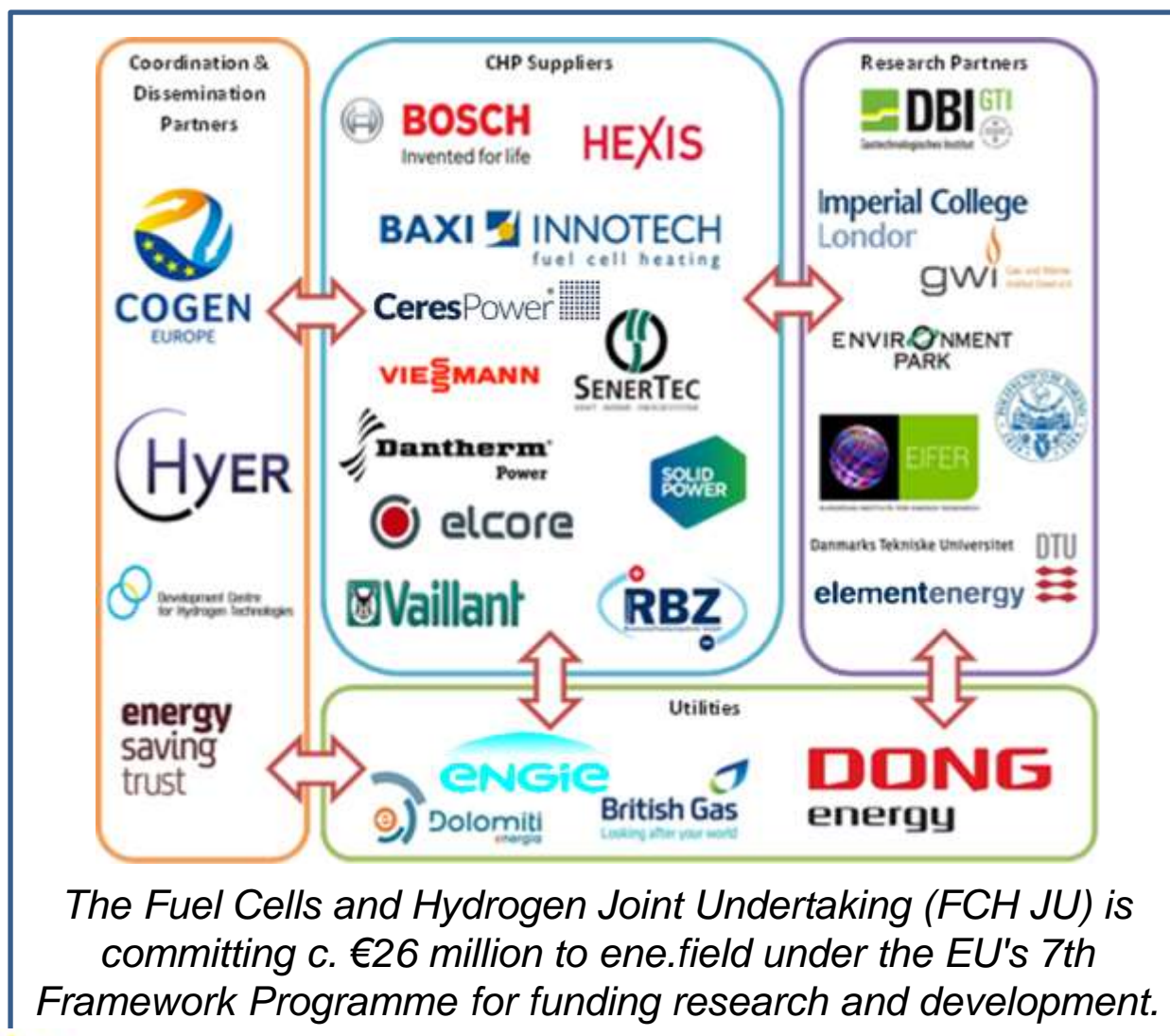
- ene.field is the **largest European demonstration** of the latest smart energy solution for private homes, fuel cell micro-CHP.
- Up to **1,000 Fuel Cell micro-CHP systems** are being deployed across 11 key European countries.
- Project duration of **5 years** (end: September 2017). Systems to be demonstrated for 2 to 3 years.
- Outputs of the project include: Detailed performance data, lifecycle cost and environmental assessments, market analysis, commercialisation strategy.

Where can I get my fuel cell?



Countries where units are being installed

ene.field is a European platform for FC Mchp



The consortium brings together 26 partners including:

- the leading European FC micro-CHP developers,
- leading European utilities,
- leading research institutes,
- partners in charge of dissemination and coordination of the project.



Field trials overview

Dachs InnoGen	Cerapower FC10 Logapower FC10	PEMmCHP G5	Elcore 2400	Galileo 1000 N	Inhouse 5000+	ENGEN 2500	BLUEGEN	Vaillant G5+	Vitovalor	SteelGen
										
LT PEM 700W	SOFC 700W	LT PEM 2kW	HT PEM 300W	SOFC 1kW	LT PEM 5kW	SOFC 2.5kW	SOFC 2kW	SOFC 1kW	PEM 700W	LT-SOFC 700W
Natural Gas	Natural Gas, Gas	Natural Gas + Biogas	Natural Gas	Natural gas+ Biogas	Natural gas + Biogas + H2	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Floor	Floor	Floor	Wall	Floor	Floor	Floor	Floor	Wall	Floor	Wall
SenerTec	Bosch Thermotechnik	Dantherm Power	Elcore	Hexis	RBZ	Solid power	Solid power	Vaillant	Viessmann	Ceres Power

Fue cell micro-CHP has potential to play a key role in decarbonisation of heat in buildings

Solution to efficient heat supply in buildings

- Highly electrical and overall CHP efficiency
- Significant primary energy saving and reduction of CO₂ emissions compared to incumbent technologies
- Very low local pollutants and noise

Large market potential across Europe

- Potential to compete in the large gas boiler market
- Suitable for existing buildings and particularly well-matched to modern low heat demand housing
- Straightforward integration with existing gas and electrical supplies

Complementary with national energy system transition

- Consistent with continued utilisation of Europe's well-developed natural gas infrastructure
- Long-term decarbonisation possible with clean gas sources, such as biomethane and hydrogen
- Complementary with increasing renewable generation penetration

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- **ene.field has successfully installed > 650 FC mCHP** in a range of house types across 10 European markets – performance data is being collected and analysed at this stage of the project
- **Germany is the strongest early market**, this is due to regional funding opportunities, tolerance of higher cost heating systems and a more developed manufacturer and installer base, among other factors
- **Route to market via utilities has proven very difficult**; less finance available for demonstration projects – interest in only small numbers of units and limited co-financing
- **System capital costs are the major challenge for growth of the market** (running costs are competitive with incumbents).
- **Increased manufacturing volumes is expected to be the biggest driver of capital cost reductions**, which will require continued public funding support

Main drivers of cost reduction identified in the ene.field supply chain study

- Reduce system complexity and component count
- Standardisation of component lines
- Automation of manufacturing
- Increasing volumes
- Greater supply chain competition

Supply chain report – Recommendations

- On-going field trial collaboration and standardisation where appropriate
- Define level and nature of subsidies required for successful roll-out (e.g. Roland Berger study for JU FCH)
- Form European industry group to support collaboration, lobby and secure additional funding
- Develop strategic partnerships – component suppliers, utilities etc.

Regulations, Codes and Standards

- **Non-homogeneity in Europe:** countries use international and European standards, but supplemented by own versions
- **Mix of standards** lead to problem for OEMs that want to commercialise products throughout Europe
- European Regulations: **labelling of FC mCHP found to be unfair** compared to other energy systems
 - Current methodologies used to calculate the seasonal space heating energy efficiency found to poorly represent the performance of FC mCHP – this determines the energy label
 - The study compared alternative methodologies and found that EN 50465 gave the most accurate reflection of FC mCHP performance

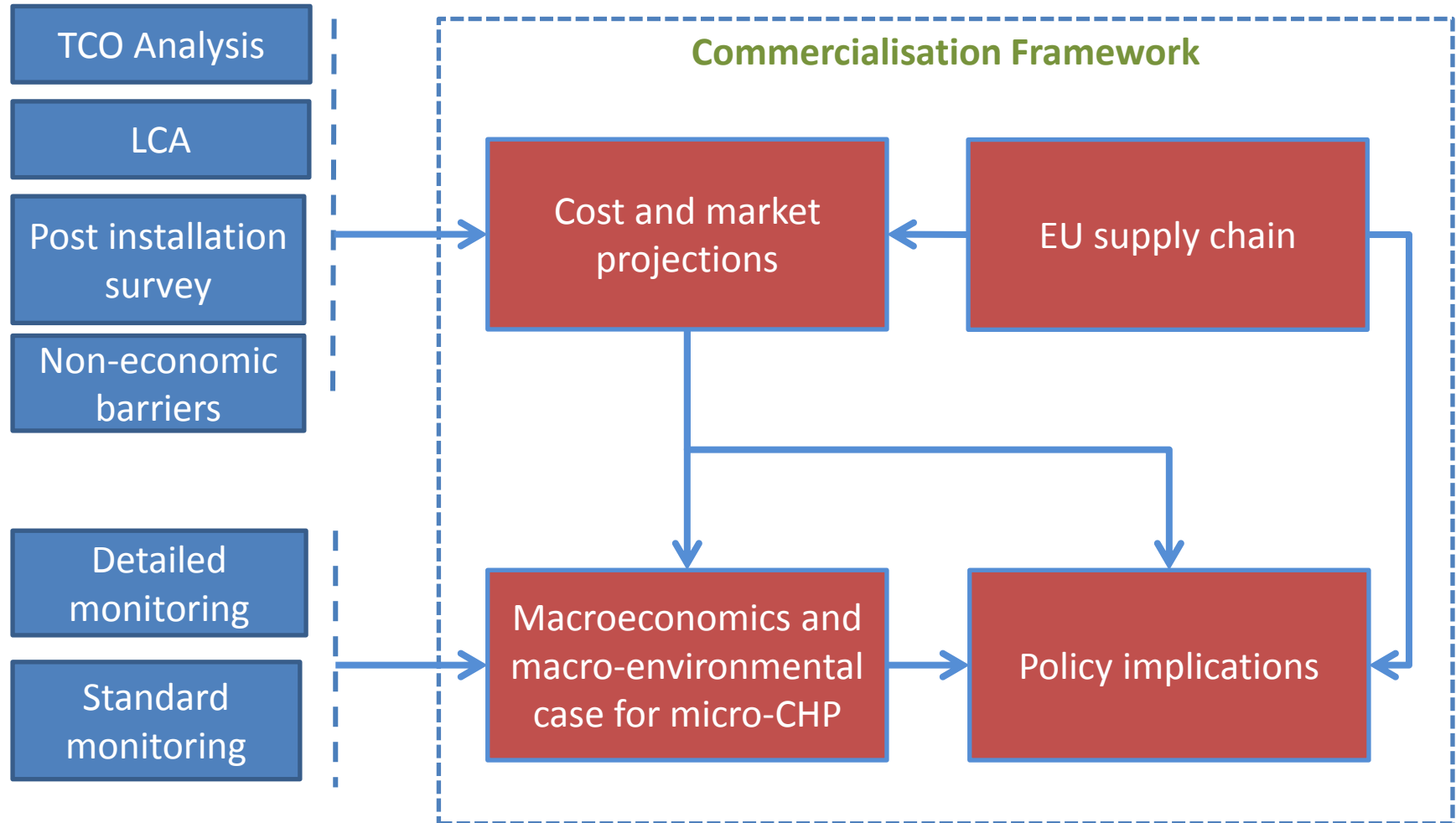
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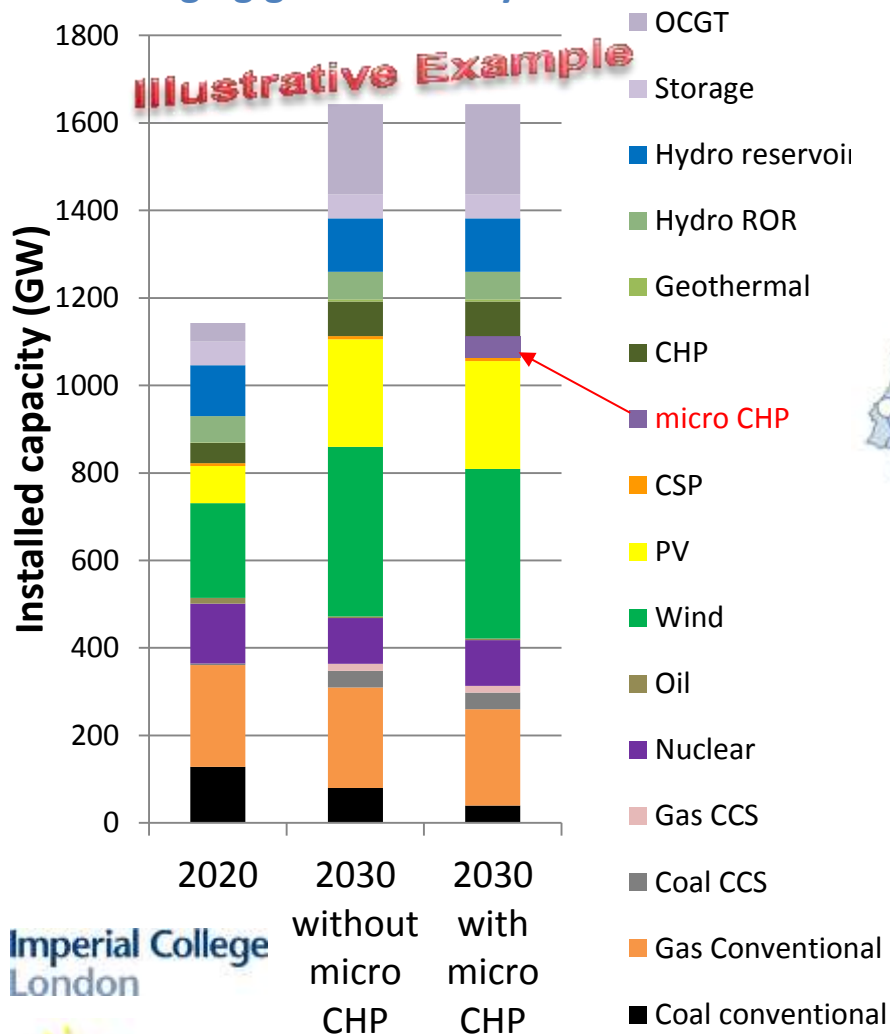
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Assessment of market potential and policy requirements will be a focus in the next phase

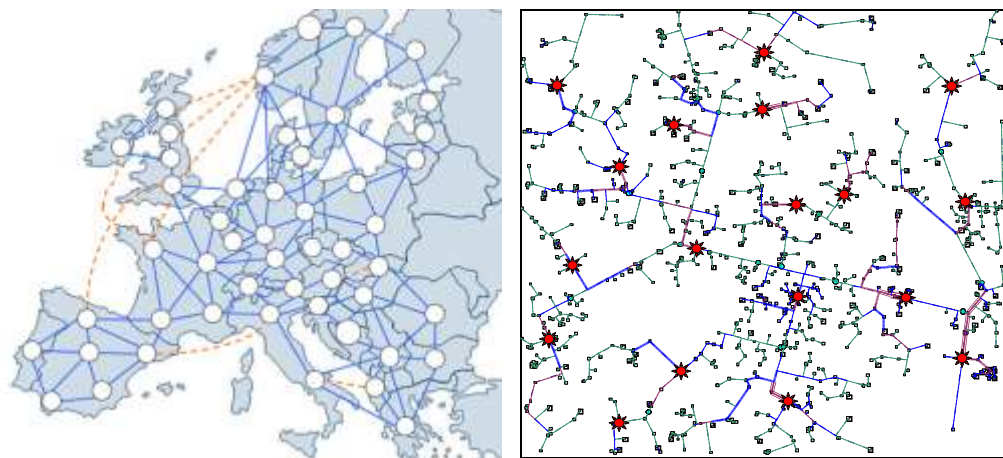


Detailed modelling of the impact of FCmCHP on Europe's electricity system will be performed

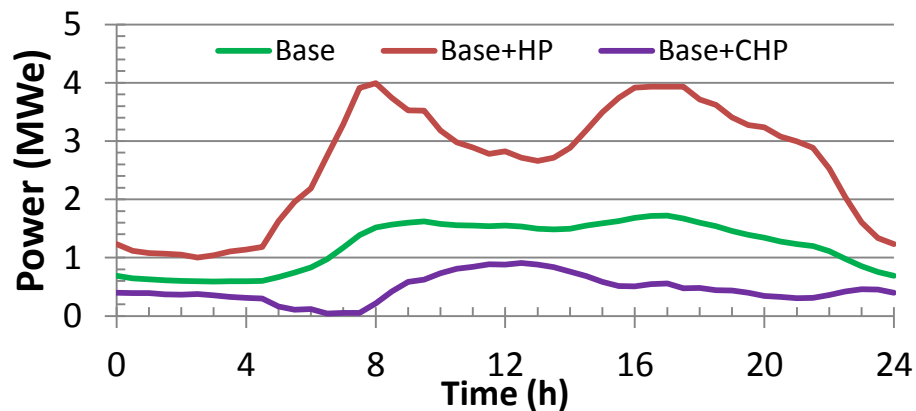
Changing grid electricity mix



Representative models of electricity transmission and distribution networks



Impact of FCmCHP deployment on network loads



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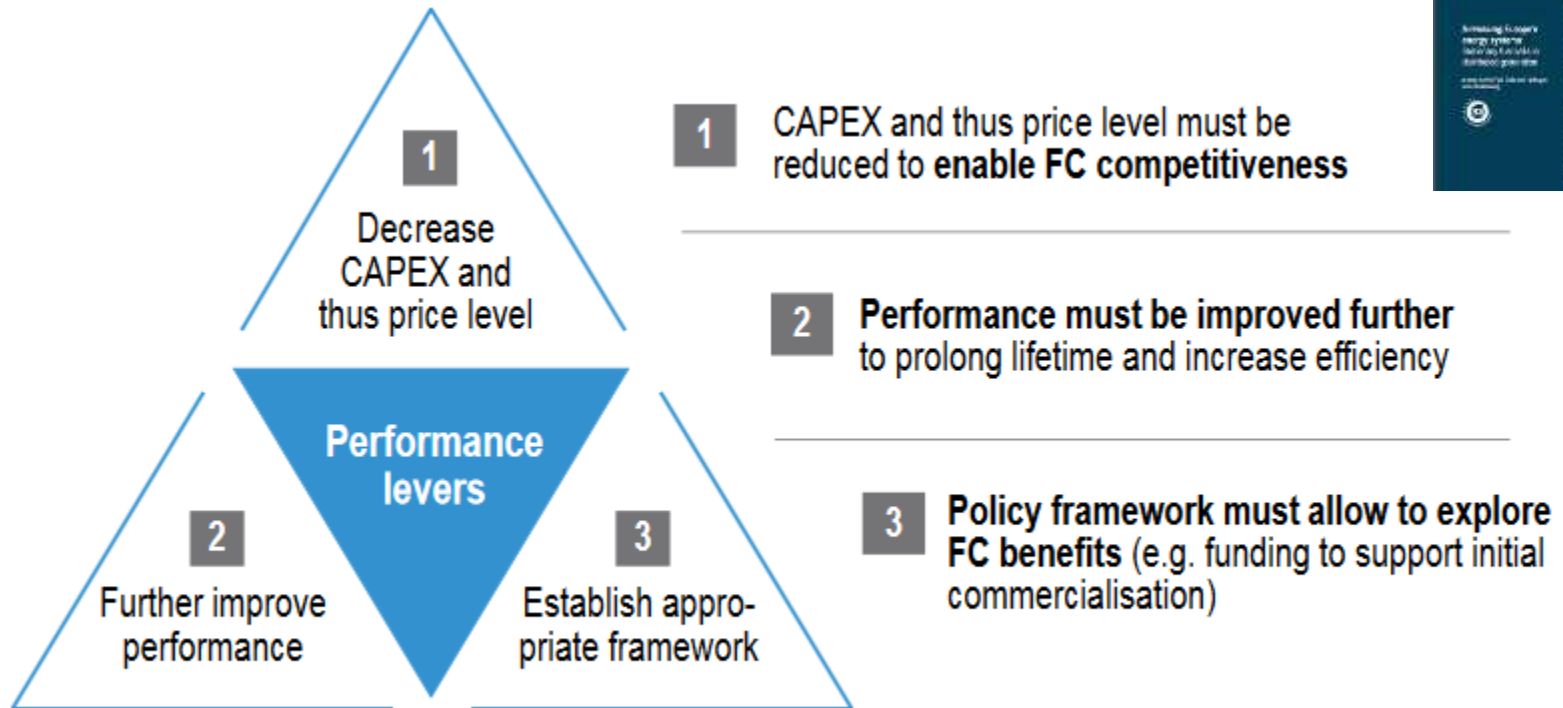
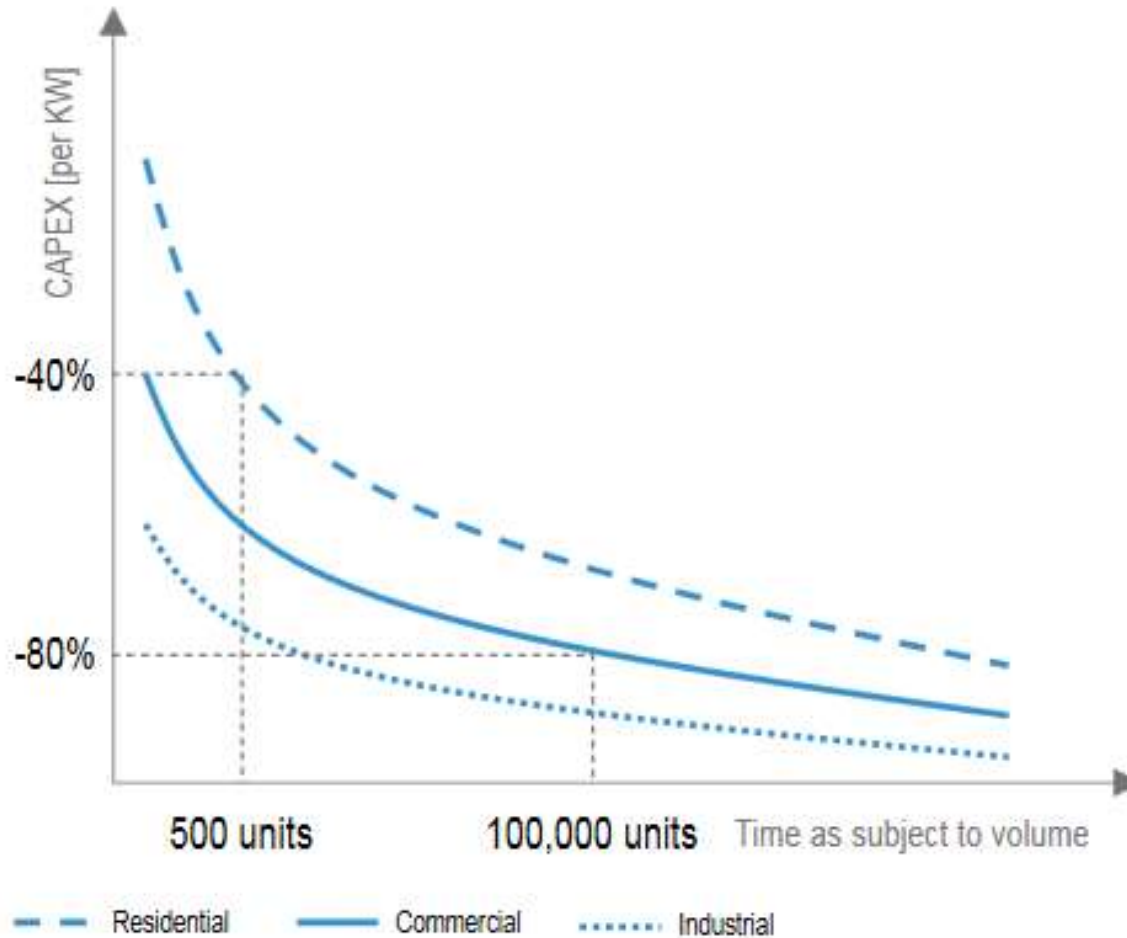


Figure 9: Three main levers to unlock the benefits of stationary fuel cells

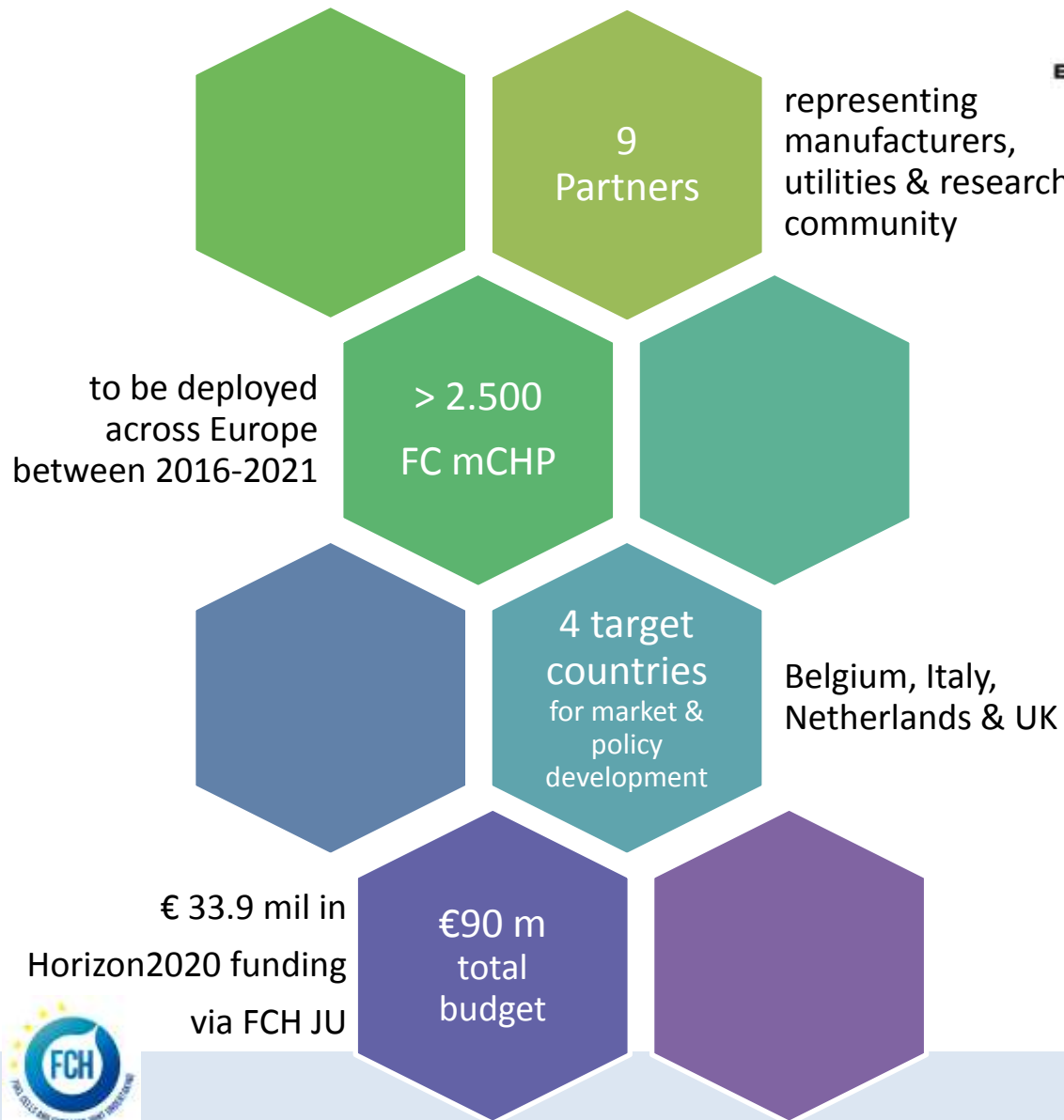
Source: [Roland Berger Study commissioned by FCH JU](#), 2015

Achieving CAPEX reductions



Source: [Roland Berger Study commissioned by FCH JU, 2015](#)

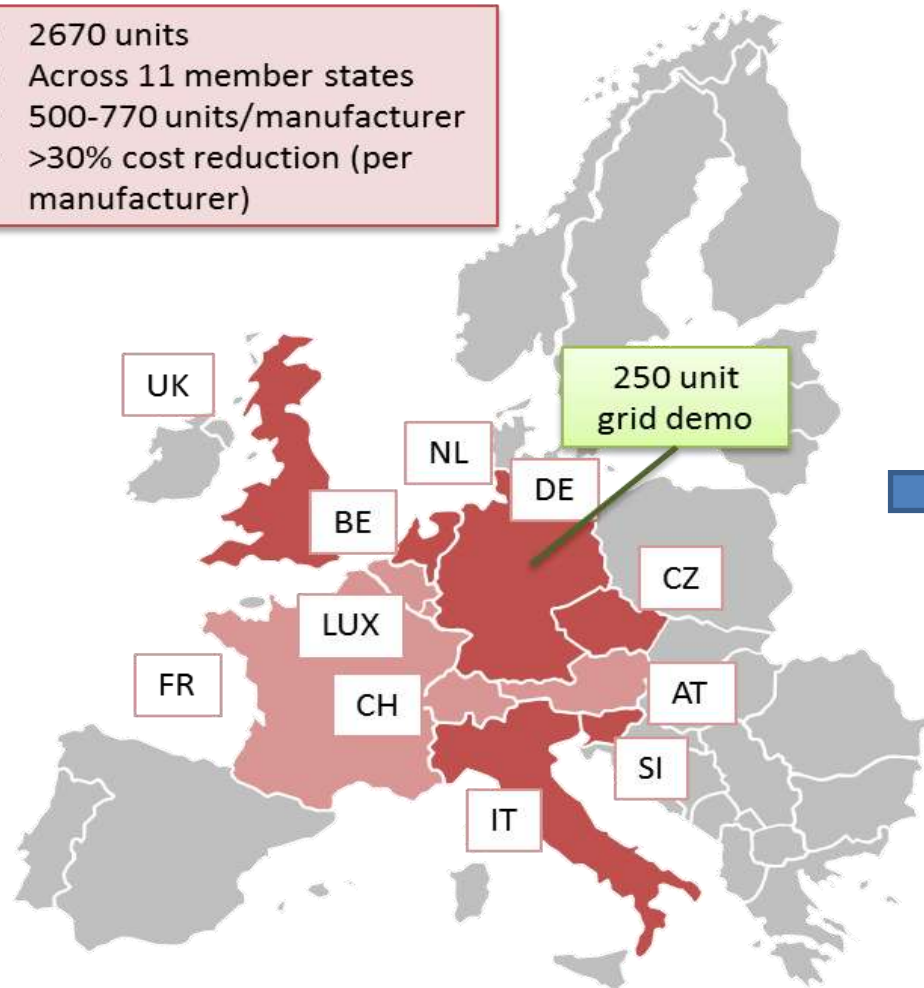
PACE – Pathway to a Competitive European FC mCHP Market



Objectives:

- **Product innovation and cost reduction** – constructing and demonstrating next generation FC mCHP units, designed for cost reduction, increased performance and mass manufacture.
- **Supply chain development** – working to build a more competitive EU component supply chain.
- **Policy collaboration** – working collaboratively with member states to develop policy to enable the transition to wider roll-out.
- **Demonstrating and verifying primary energy savings, and testing grid benefits** – for innovative business model application.

- 2670 units
- Across 11 member states
- 500-770 units/manufacturer
- >30% cost reduction (per manufacturer)



Setting the ground for the large scale uptake of **10,000 FC mCHPs/year post 2020**

- Field trial + component supply or system integration + installer training
- Field trial + local support and installer training

- Continuation and **acceleration of deployment of units across the field trials**
- **Technical performance monitoring across all field trials**, including 10% of units with detailed monitoring. First monitoring data to pass through the clean room and made available to analysis partners and the FCH JU
- Further analysis of **customer perception** through pre- and post-installation surveys
- **Lifecycle analysis (LCA)** and **lifecycle cost analysis (LCC)**
- **Market growth projections** and detailed modelling of FC mCHP **impacts on European electricity systems**
- Development of **policy recommendations reflecting the lessons learned from the project** and the requirements for commercialisation of FC mCHP across Europe
- **PACE to build on ene.field** to generate **new findings &** develop the markets for **the mass commercialisation phase.**

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www.enefield.eu



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