



EU policy & micro-CHP

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Background: The Energy Union

(European Commission Communication Feb.2015)



“I want to reform and reorganise Europe’s energy policy in a new European Energy Union.”

Jean-Claude Juncker
(President European Commission)

The 5 Pillars of the Energy Union:

1. Security of supply
2. Integrated European energy market
3. Energy efficiency
4. Decarbonisation
5. Research and Innovation => H2020

Security of Supply Package (Feb 2016)

Security of Gas Supply Regulation

- gas will be an important part of our energy system as we make the transition to a low-carbon future by 2030
- its about using more intelligently and efficiently, in line with our targets on renewables and energy efficiency

Heating and Cooling Strategy

- stationary fuel cells is an emerging CHP application that...
- in some use segments is ready for commercialisation and can achieve attractive prices



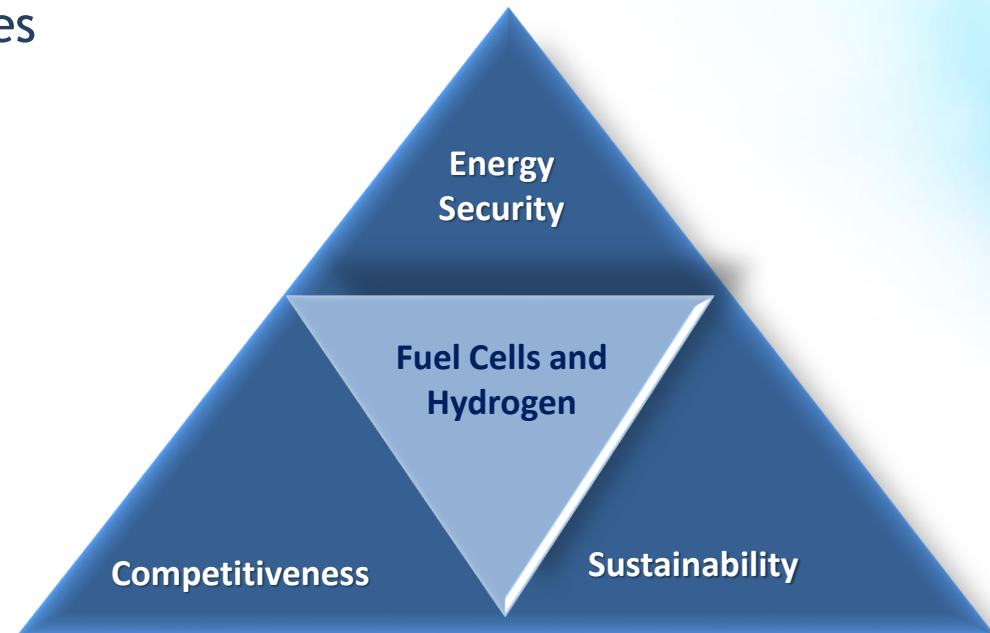
Clean Energy Package (Nov 2016)

- proposals by the European Commission to review key legislation in the energy field, including the EED and the EPBD
- the Market Design Initiative provides a framework for a level playing field for all flexibility solutions in the electricity grid.

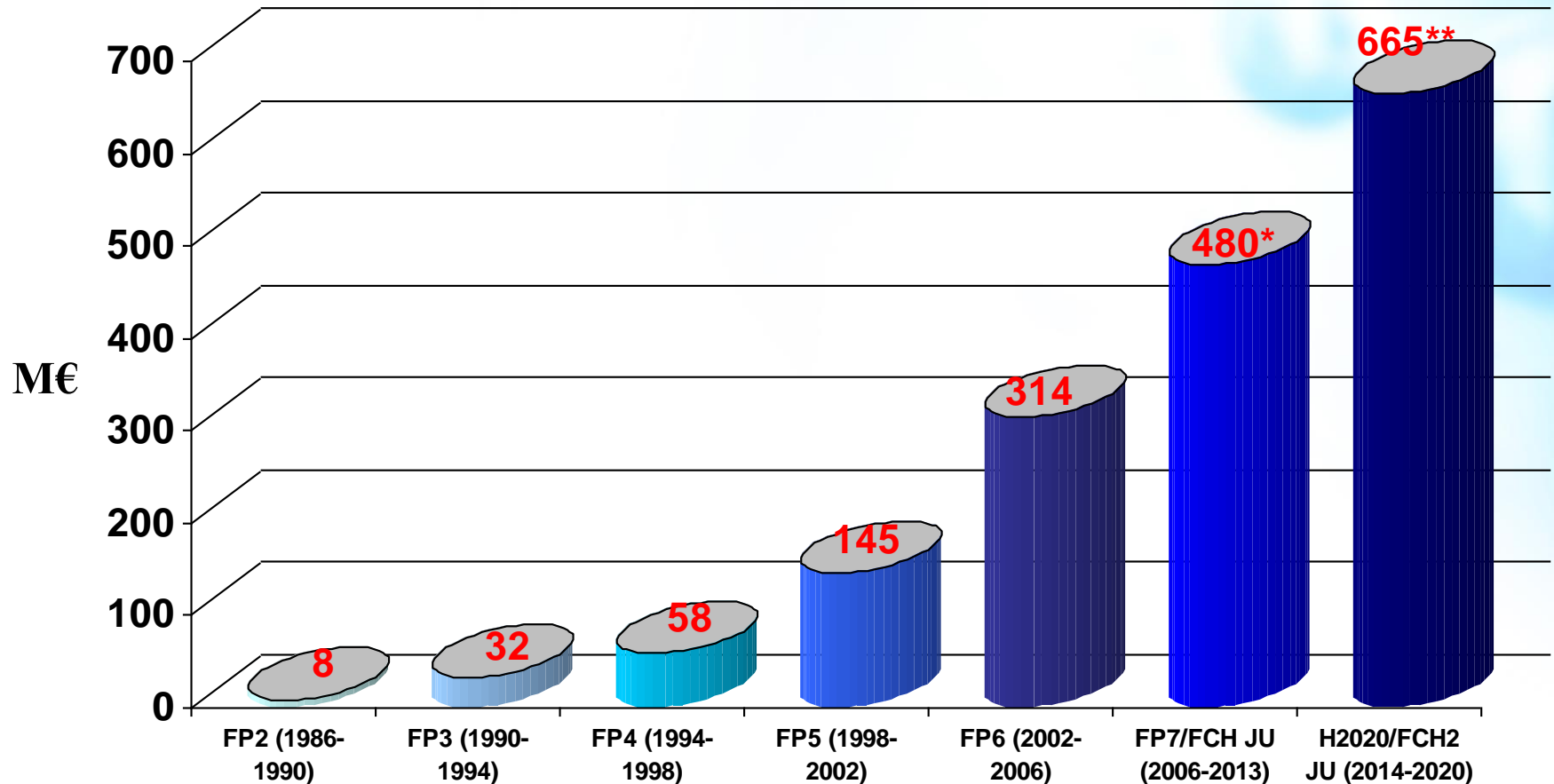


Second Report on the State of the Energy Union (Feb 2017)

- energy storage, including hydrogen-storage-based solutions, has yet to develop its full potential in the energy markets
- developing affordable and integrated energy-storage solutions is highlighted as a priority to facilitate and enable the transition to a low-carbon energy system based largely on renewables



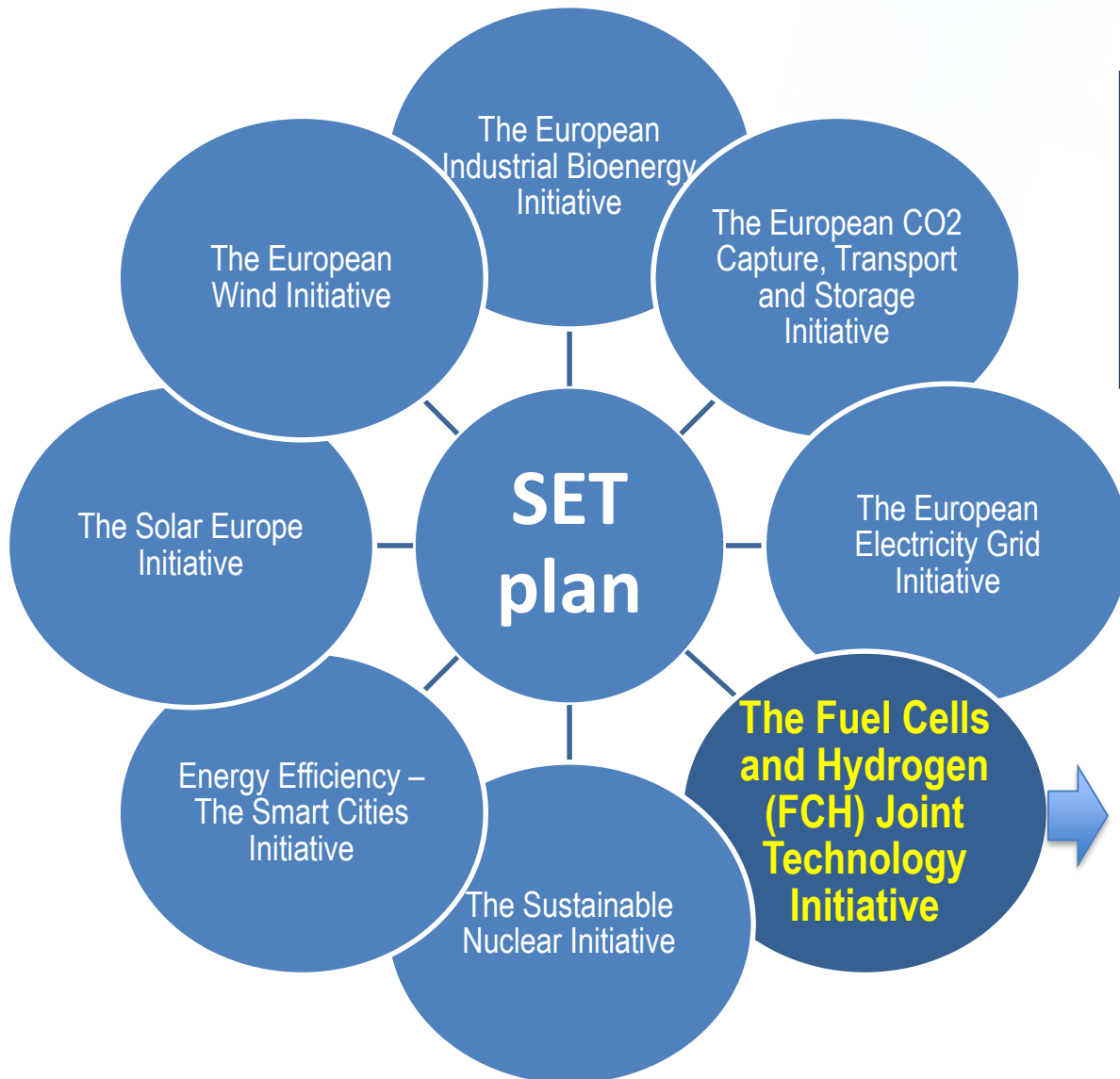
Continuous Support in the EU Framework Programmes



* 470 mill EUR implemented by FCH JU + about 10 mill EUR already spent from EU 2007 budget, before FCH JU in place

** 665 mill EUR only to be implemented by the FCH2 JU + additional budget from EU programmes for low TRL (basic research) and structural funds/smart specialisation

The FCH 2 JU in the SET plan to realize EU 2030 targets



EU 2030 targets*:

- 27 % increase in renewables
- 27 % increase in efficiency
- 40 % decrease in emissions

Fuel Cells and Hydrogen Joint Undertaking

- FCH JU - EU body
- Budget: 1.4 bill.€ (2014-2020)**
- FCH JU Programme Office

*European Council, October 2014

** continuation of previous program for 2008-2013 with a budget of approx. 1 bill.€

Strong Public-Private Partnership with a focused objective

Fuel Cells & Hydrogen Joint Undertaking (FCH2 JU)



Industry Grouping
Close to 100 members
~ 50% SME



RESEARCH ON FUEL CELLS & HYDROGEN

Research Grouping
Over 60 members



To accelerate the development of technology base towards **market deployment** of FCH technologies from 2015 onwards

The Joint Undertaking is managed by a Governing Board composed of representatives of all three partners and lead by Industry.



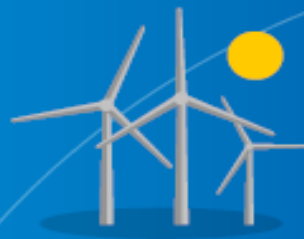
H₂ STORAGE FOR GRID BALANCING

Demonstrate on a large-scale hydrogen's capacity to harness power from renewables and support its integration into the energy system



HEAT & ELECTRICITY PRODUCTION

Increase fuel cell efficiency and lifetime



GREEN HYDROGEN PRODUCTION

Increase efficiency and reduce costs of hydrogen production, mainly from water electrolysis and renewables



MINIMAL USE OF CRITICAL RAW MATERIALS

Reduce platinum loading



CLEAN TRANSPORT

Reduce fuel cell system costs for transport applications

2030 Energy Goals and FC potential contribution

Energy Goals 2030*

- 27 % energy savings
- 40 % less greenhouse gas
- 27 % renewable energy
- Strong European economy
- Energy security
- Lower energy cos

Stationary fuel cells

- ~25 % less primary energy
- Up to 80 % less CO₂, no NO_x, SO_x etc.
- Storage (H₂), grid support (flex base load)
- Technology driver, job creator
- Decentralized, grid support, lower import
- Up to 60 % el. efficiency, lower grid loss

Higher chance to reach goals with stationary Fuel Cells

Benefits of μ CHP to be suitably accounted for specially with increasing renewables: CO₂ of Marginal vs. Average Generation and grid balancing services



FCH2 JU Goals and Objectives

on Stationary Fuel cells

Demonstration

- By 2015, demonstrate at least 1,000 m-CHP units and 5 MW large CHP

CAPEX

- By 2020, decrease to 12,000 €/kWe (micro-CHP), and 3,000-4,000 €/kWe (large CHP)

Durability

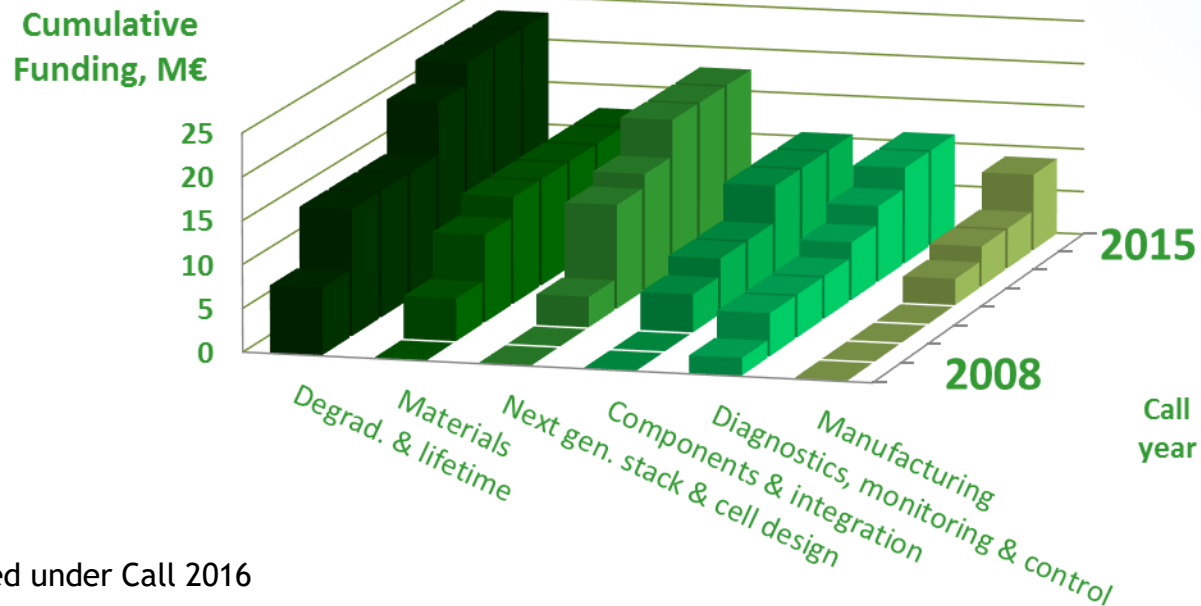
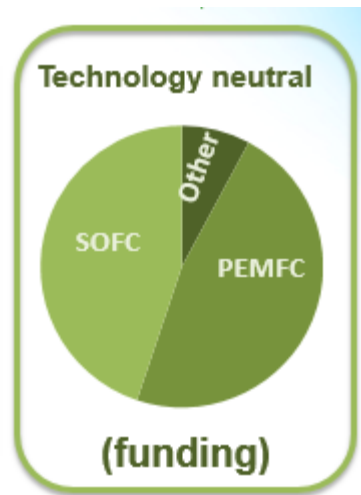
- By 2020, increase to 40,000 h (12 years of operation for micro-CHP) or even 20 years for large CHP), at 97% availability

Efficiency

- Electrical efficiencies >45% for power only units (towards 60% for SOFC systems), while total efficiency > 80%

Research and innovation: covering all technologies at all stages of development

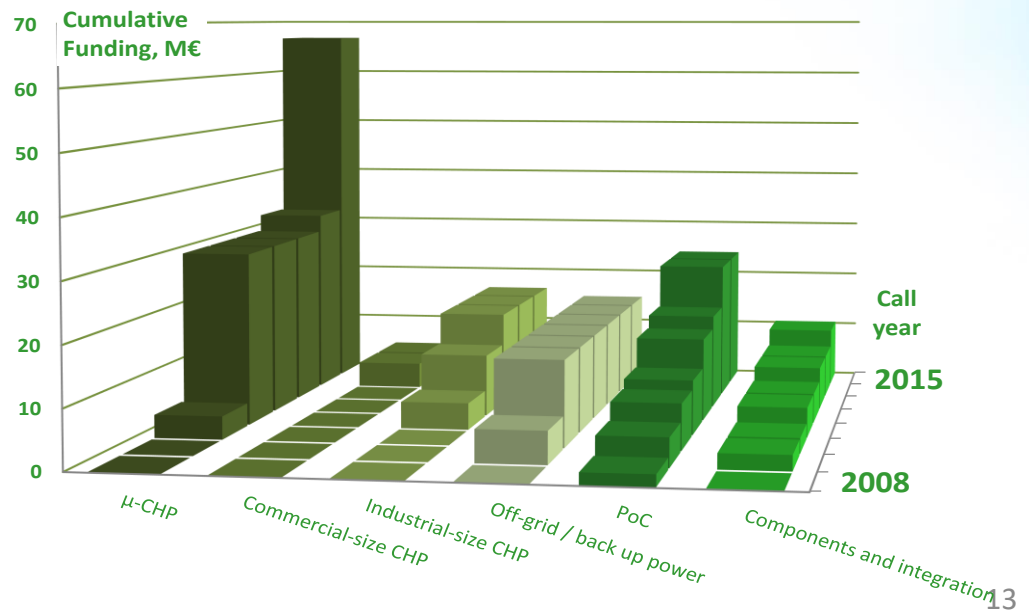
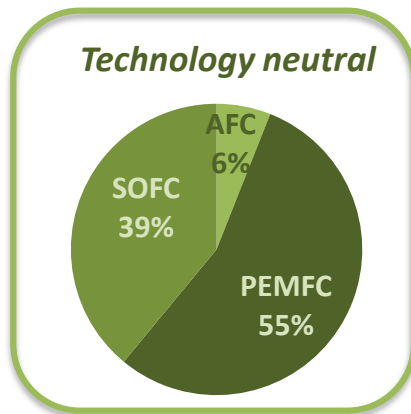
- Extending fuel cell stack lifetime
- Shifting the focus to manufacturing
- Enabling cost reductions for demo projects
- European leadership in SOFC



*Excluding projects supported under Call 2016

Increased support to field demonstration





- Pathway to a Competitive European FC mCHP market (over 3000 units)
- 170 kW on biogas from waste-water treatment plant
- tens off-grid and back-up power for remote areas/ emerging economies
- 2 MW using waste H₂ from chlor-alkali plant in China
- EU supply chain for components



*Excluding projects supported under Call 2016

m-CHP: from National to EU initiative and back to roll-up

initial volume uptake, market readiness

| | FCH JU project results 2015 | Objectives 2017 | Non-European SoA |
|--------------------------------|---|-------------------|------------------|
| CAPEX, €/kW |  | < 14,000 | 6,100-7,200 |
| Durability, y |  | > 12 | 10-20 |
| Electrical efficiency, % |  | 33-60 | 39-52 |
| Thermal efficiency, % |  | 25-55 | 35-56 |
| LCOE, €/kWh | - | < 2.5*grid parity | 0.62-0.90 |
| NO _x emissions, ppm | - | < 2 | |

European Regulations:
labelling of FC mCHP found to be unfair compared to other energy systems !



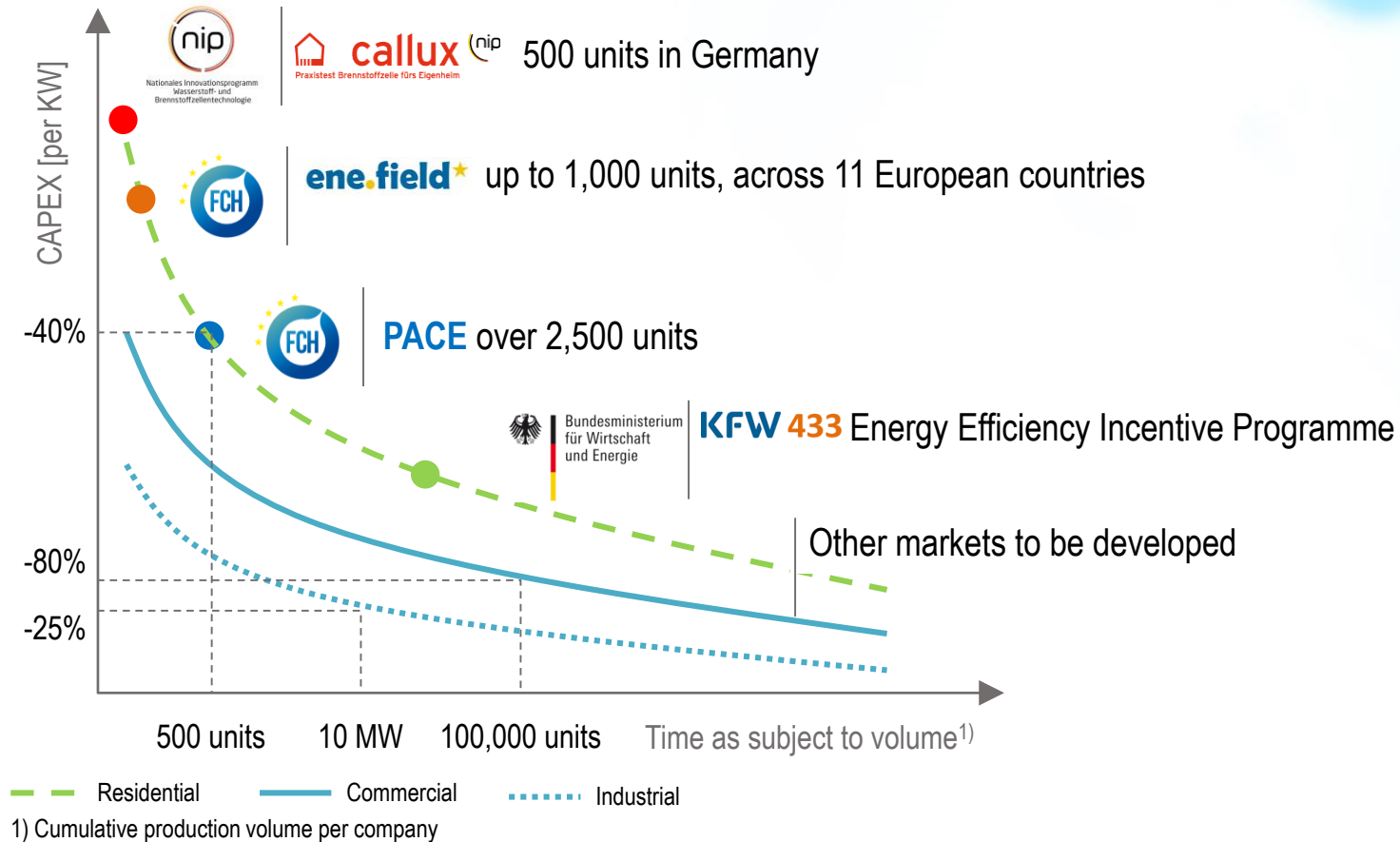
Over 800 m-CHP systems installed so far in 11 countries across the field trials (by 11 active manufacturers)

Main drivers of cost reduction: Reduce system complexity, Standardisation of component lines, Automation of manufacturing, Increasing volumes

Generating their own electricity allows home owners to cut energy costs by EUR 800 -1,300 per year and reduces exposure to rising electricity prices

Achievements through the various demonstrations

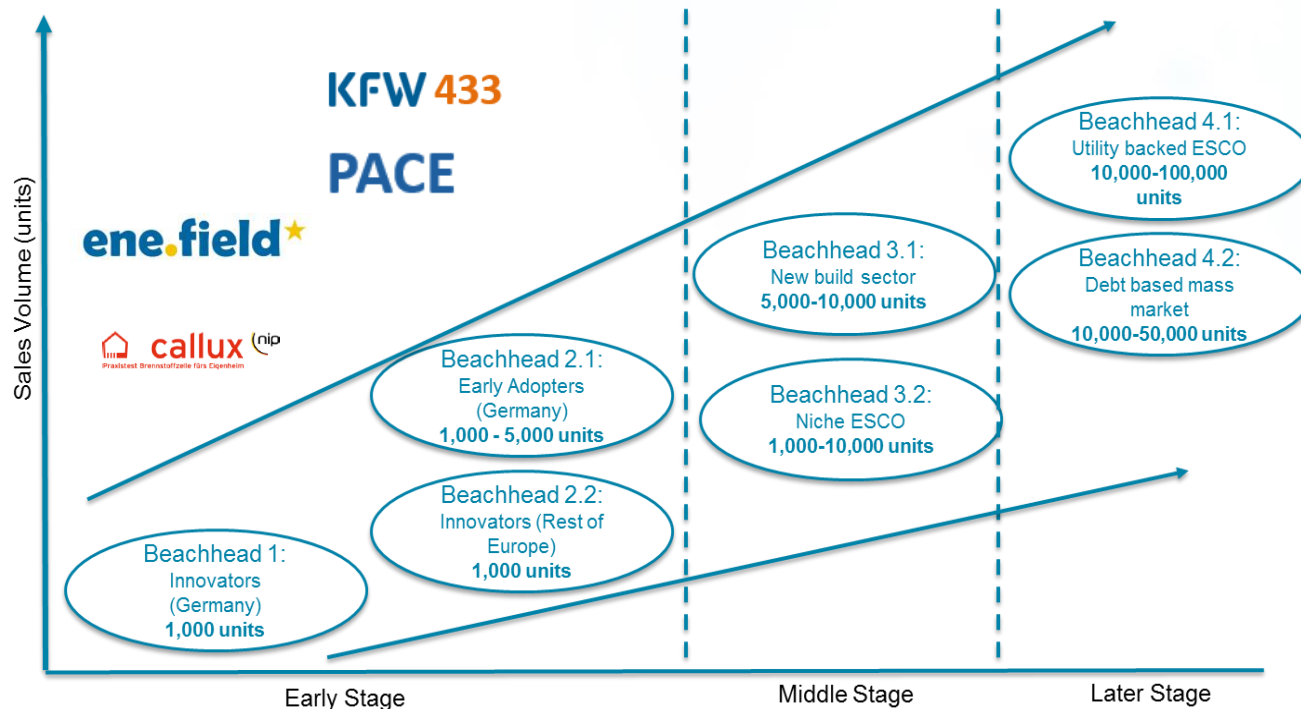
Micro CHP Fuel Cell demonstration and industrialisation pathway



Source: FCH JU Coalition, Roland Berger, Initiative Brennstoffzelle, NIP Germany, BMWi, KfW

Development Pathways - Residential Fuel Cell

Early support programmes to achieve cost reduction, demonstrate and promote the technology and set the basis for new models and routes to market



Market uptake and mass market will require industry to adopt alternative business models and financial packages as well as commercial and marketing proposals

Thank you for your attention



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Further info :

- FCH JU : <http://www.fch.europa.eu/>
- HYDROGEN EUROPE : <http://hydrogeneurope.eu/>
- N.ERGHY : <http://www.nerghy.eu>