Introduction to portfolio of Energy Programme Review Days 2015

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Energy Union

(European Commission Communication Feb.2015)

"I want to reform and reorganise Europe's energy policy in a new European Energy Union."

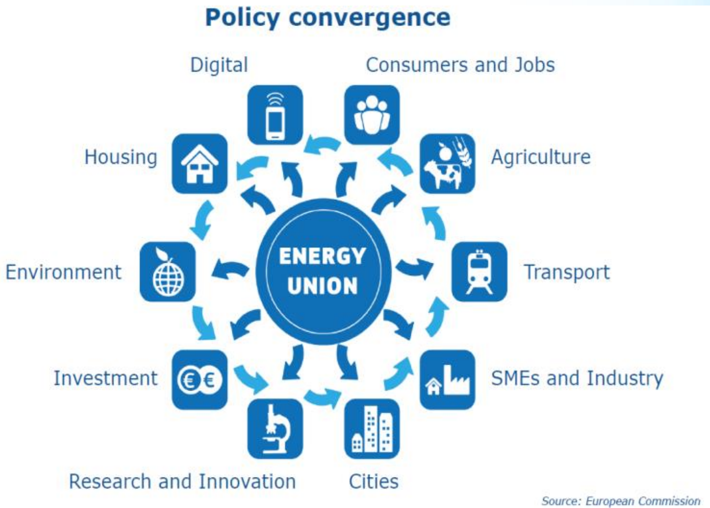
Jean-Claude Juncker (President of the European Commission)

The vision of the Energy Union:

- a sustainable, low-carbon and climate-friendly economy that is designed to last;
- strong, innovative and competitive European companies that develop the industrial products and technology needed to deliver energy efficiency and low carbon technologies inside and outside Europe;
- with citizens at its core, where citizens take ownership of the energy transition, benefit from new technologies to reduce their bills, participate actively in the market, and where vulnerable consumers are protected.

The Energy Union strategy has five mutually-reinforcing and closely interrelated dimensions:

- Energy security, solidarity and trust;
- A fully integrated European energy market;
- Energy efficiency contributing to moderation of demand;
- Decarbonising the economy, and
- Research, Innovation and Competitiveness.



2030 Energy Goals and FC potential contribution

Energy Goals by 2030*:

27 % energy savings
40 % less greenhouse gas
27 % renewable energy

Strong European economy
Energy security
Lower energy cost

Stationary Fuel Cells:

~25 % less primary energy
Up to 80 % less CO_2, no NO_x, SO_x etc.
Storage (H_2), 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

**European Council, October 2014*

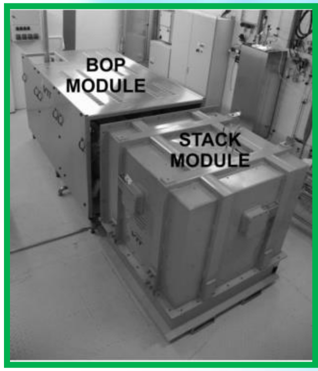
FCH JU Goals and Objectives
on Stationary Fuel cells

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

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

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

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

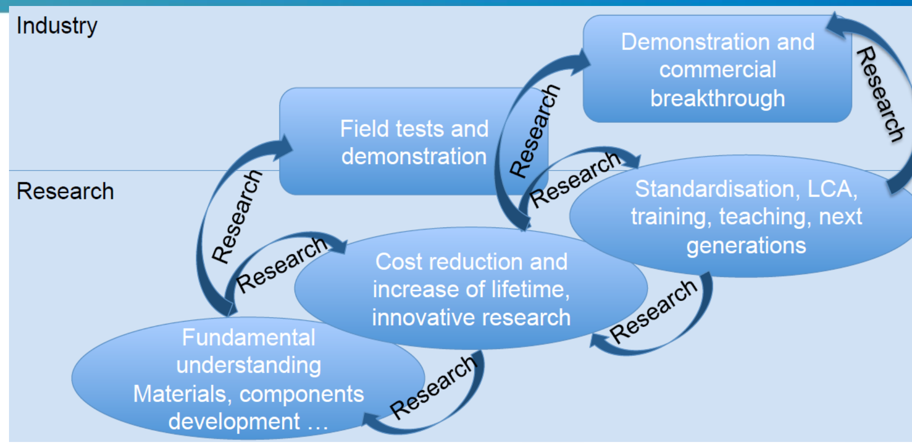


Improve the technology for fuel cell stack and balance of plant components by bridging the gap between laboratory prototypes and pre-commercial systems

Challenges and Strategy

CHALLENGES

Cost
Durability
Performance

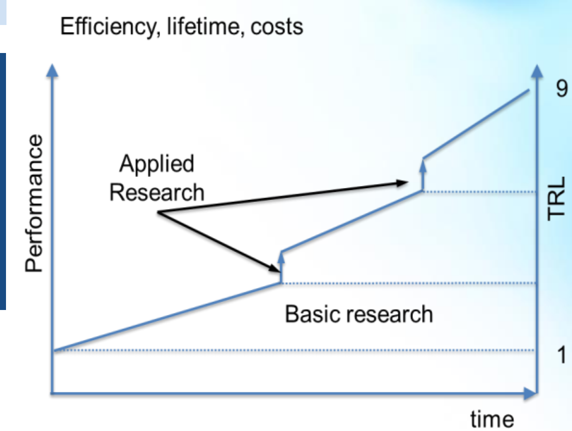


STRATEGY

Technology neutral RTD, system integration and technology validation

Basic Research: **Cost** (materials - electrodes, catalysts, electrolytes, stacks), weight, **lifetime**, new architecture & design, thermal cycling & stress, transients, new components, robustness.

Applied Research: **Cost** (manufacturing process & lines, maintenance), monitoring, State-of-Health & control, new components; **Methodologies**, benchmark, protocols & standards, safety, LCA, training, teaching; **New plants**, integration with renewables.



Degradation and lifetime fundamentals

New/improved materials for cells, stacks, BoP

Control and diagnostics tools at component and system levels

Novel architectures for cell and stacks

Components Improvement

Proof-of-concept/Full system integration

Validation of integrated systems readiness

Field demonstration

Technology Readiness Level (TRL)

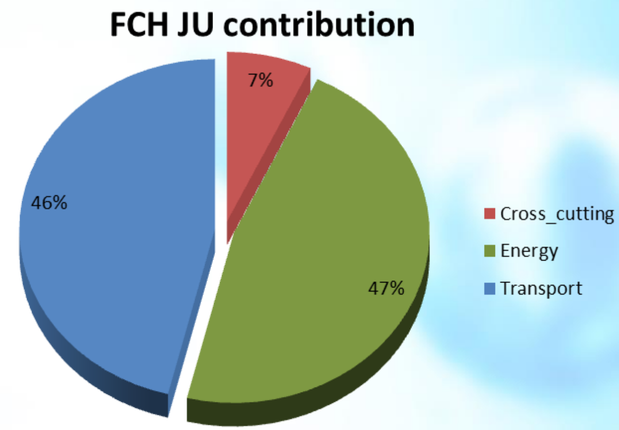
FCH JU supports in a public-private partnership the entire development chain of fuel cells for different energy applications (CHP, back-up power etc)

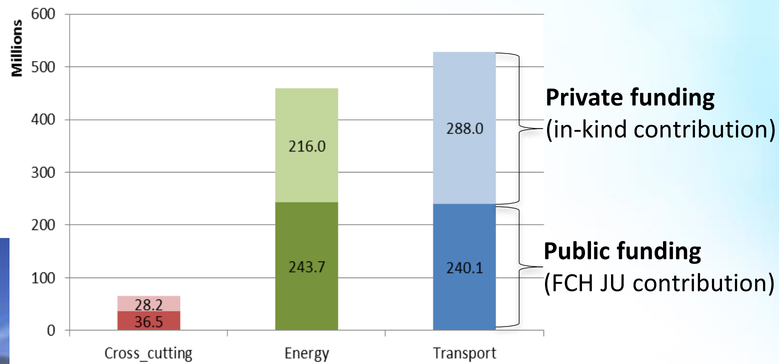
FCH JU portfolio of projects

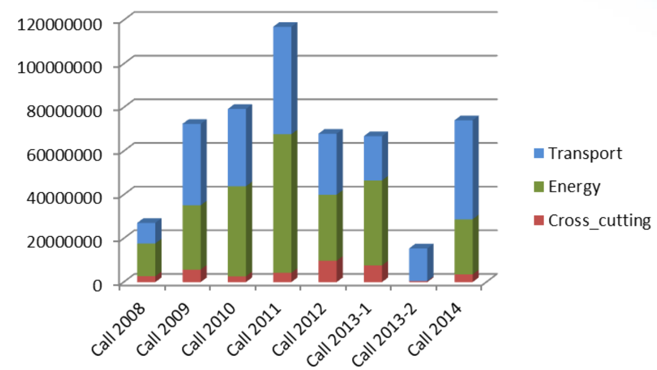
169 projects supported for about 520 mill €

(of which FP7: 155 projects for 446 mill €)

50/50 distribution betwen Energy and Transport pillars





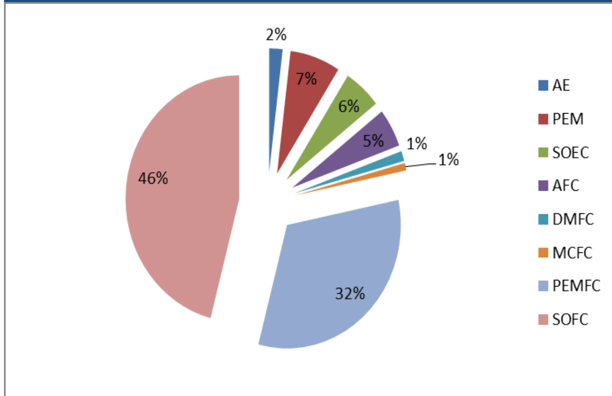


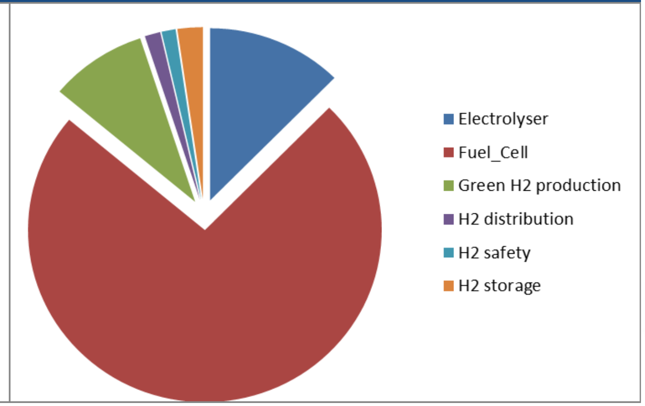
Similar leverage of private funding: 532 mill €

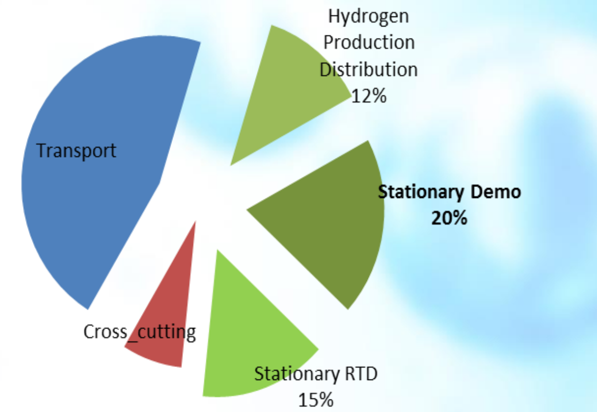
Continous/constant annual support (through annual calls for proposals)

ENERGY portfolio

96 projects under Energy pillar, for more than 240 mill €

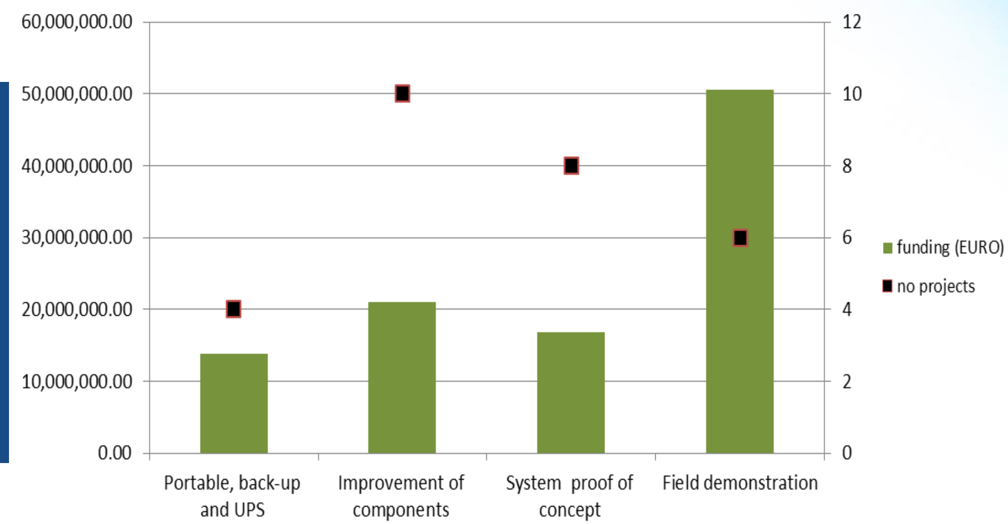






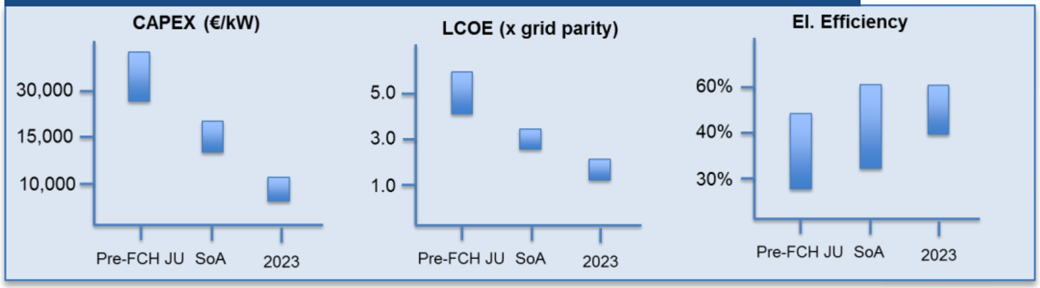
<u>Technology neutral</u> approach, however most support to Solide Oxide and PEM for both fuel cells and electrolyser applications

<u>28 projects at TRL ≥ 3 for about 100 mill €</u> **('Stationary Demo' type), mainly focusing on system integration and field demonstration (e.g. components development, including control systems; proof-of-concept; field demonstration of CHP and back-up power units)**



Accomplishments
(examples of projects achievements)

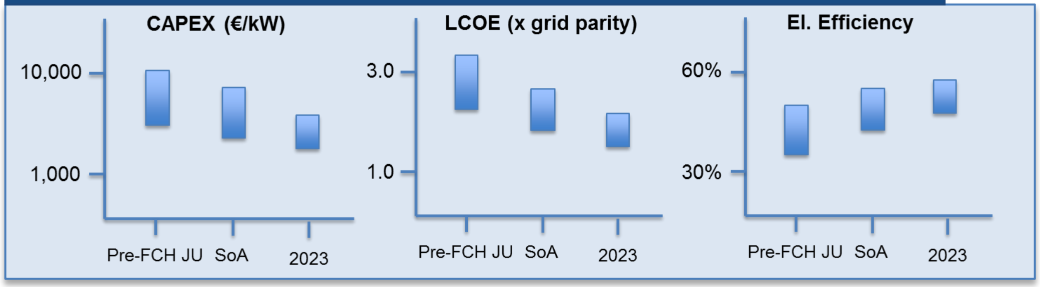
Residential Market Segment (< 5 kW)



ene.field project: more than 300 units installed in 10 countries of Europe, reliabilities confirmed, very good customer satisfaction (70% positive feedback),

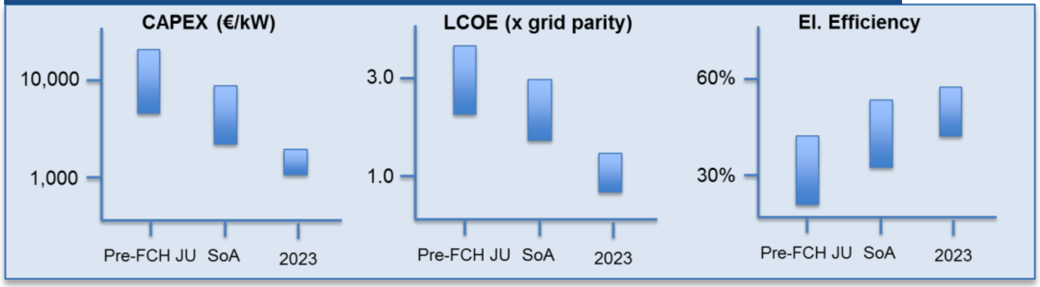
SOFT-PACT project: 65 fuel cell systems, electrical efficiency higher than 42 % over lifetime (total efficency higher than 78%), 25% cost reduction

Commercial Market Segment (5-400 kW)



SOFCOM project: proof-of-concept poly-generation SOFC systems fed by biogenous primary fuels (biogas and bio-syngas, locally produced), modular concept, cost driver identified → next step: upscaling to hundreds kW size (DEMOSOFC project)

Industrial Market Segment (0.3-XX MW)



POWER-UP project: first module of 40kW (out of 240 kW) in the field, 61% electrical efficiency (started Oct2015)

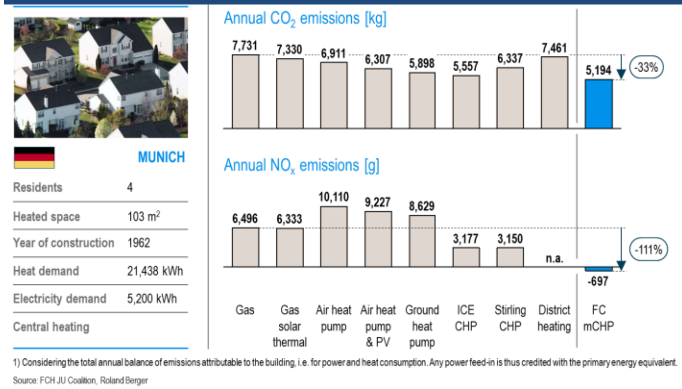
ClearGenDemo project: 1 MW PEM to be installed near Bordeaux, FR on by-product H2 from clori-alkali plant

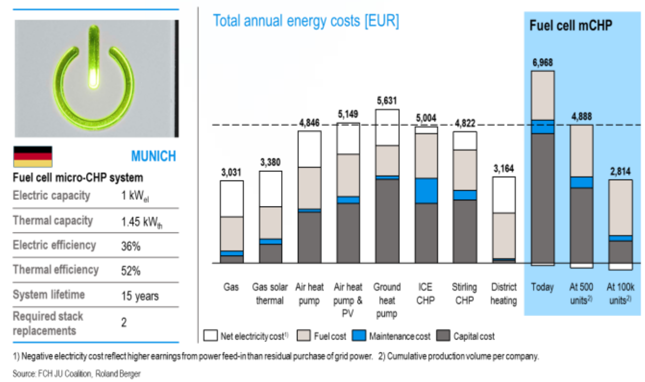
DEMCOPEM-2MW project: 2 MW PEM (European technology) to be demonstrated in China

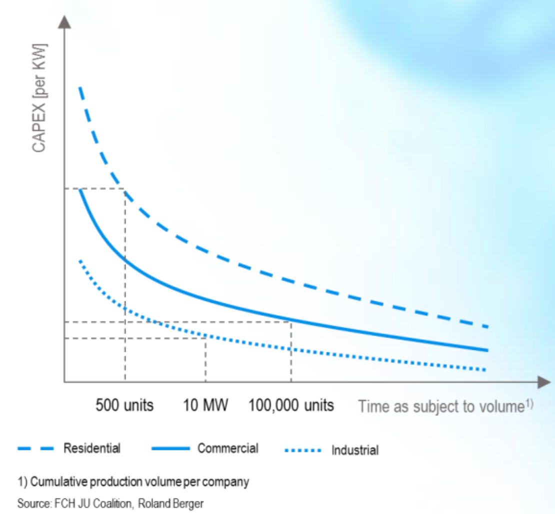
Sources: MAWP, Roland Berger Study, IBZ/Callux

Roland Berger Study: ***Advancing Europe's energy systems: Stationary fuel cells in distributed generation***

- Industry coalition composed of more than 30 stakeholders – Results reflect common understanding
- The most comprehensive assessment of the commercialisation potential of stationary fuel cells in Europe (4 focus markets, 6 generic fuel cells, 35 years time horizon, 45 different use cases, >30 benchmark technologies, >3 energy scenarios, >34,000 resulting data points)

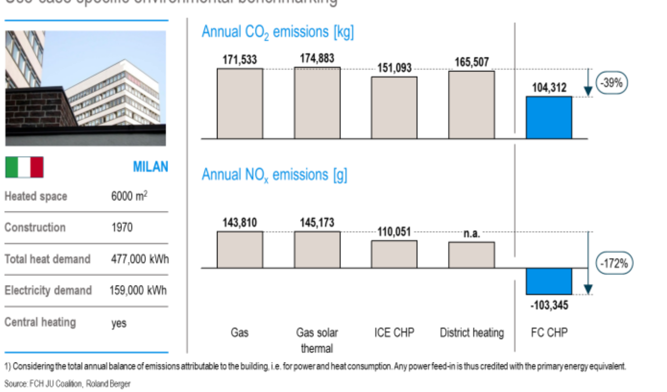




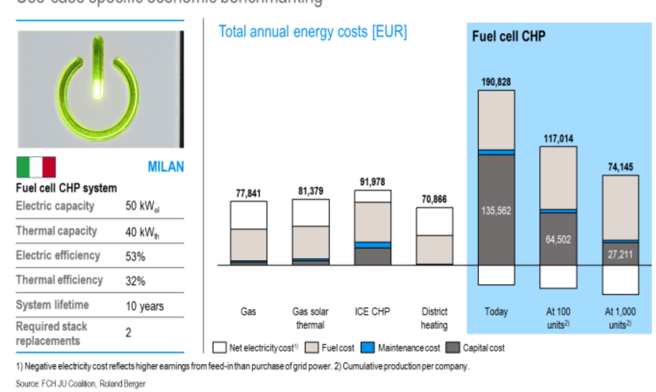


Today FC can reduce CO_2 emissions by more than 30%, while No_x emissions can be eliminated entirely; however, to become economically competitive, capital costs must be reduced substantially by increasing production volumes

Use-case specific environmental benchmarking[1)]



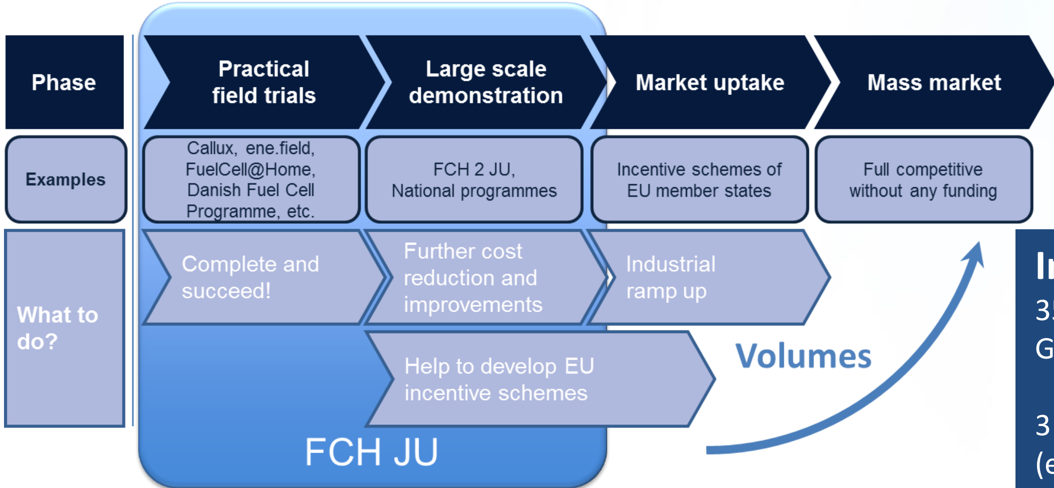
Use-case specific economic benchmarking[1)]



Industry sees ambitious potential (larger volumes allow for automation and bundled sourcing strategies, standardisation must increase within and across technology lines)

Industry is fully committed to decreasing cost with sufficient installation volumes !

Road-Map for 2020/2023



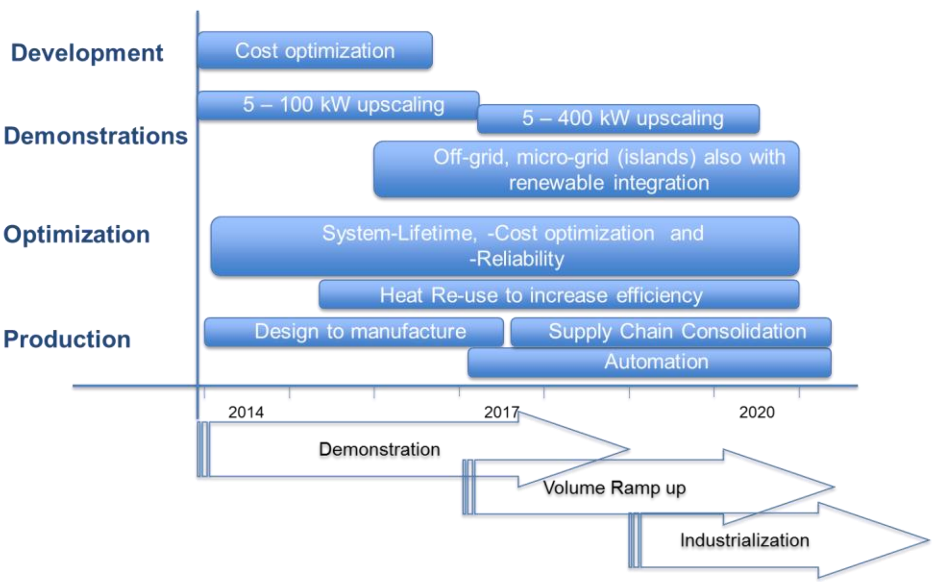
Market uptake needs to develop incentive schemes in parallel to large scale demonstration. This ensures a final and sustained take-up of initial funding.

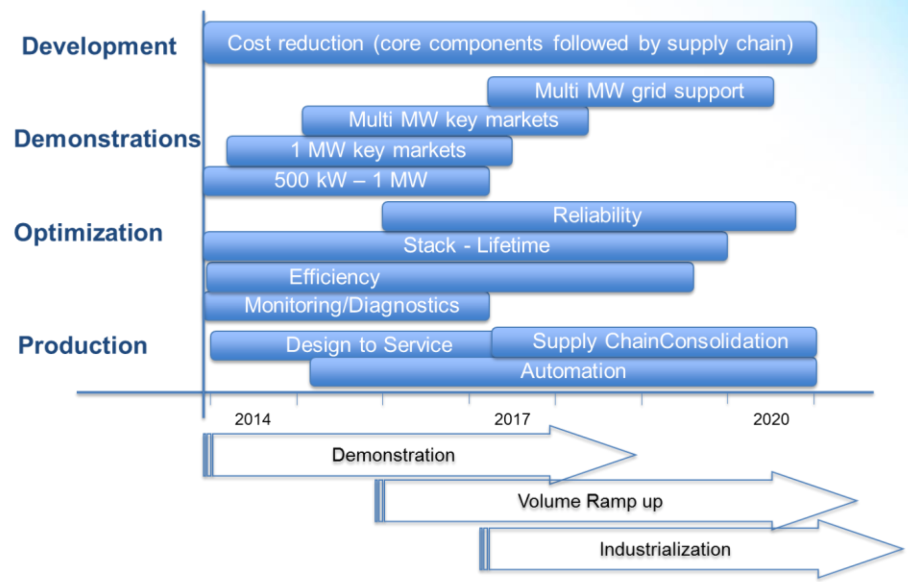
Industry Vision for Stationary Fuel Cells in 2023

350 MW – 2 GW installed capacity
Grid parity price of generated electricity

3 – 17 Mt/a less CO_2 emissions
(equal to 1.6 - 8 million avoided car emissions)
0.8 – 4.6 Mt/a NOx emissions nearly eliminated

10,000 sustainable, green jobs created





Panel 3 overview
Stationary Demo flagship projects

Tuesday 17 November

13:30 – 14:30	Registration	
14:30 – 14:45	Opening and Welcome Address (Alcide de Gasperi Room, 2nd floor)	
	Jean-Luc Delplancke, Head of FCH 2 JU Programme Unit	
	PARALLEL SESSIONS ON TECHNOLOGY DEMONSTRATION PROJECTS	
14:45 - 15:00	Introduction to Transport portfolio: Enrique Girón (Lord Jenkins Room, ground floor)	Introduction to Energy portfolio: Mirela Atanasiu (Alcide de Gasperi Room, 2nd floor)
15:00 - 15:05	Q&A	Q&A
	PANEL 1 - Transport demonstration and proof of concept: light-duty vehicles, buses, forklifts, APU.	PANEL 3 - Energy demonstration and proof of concept: μ and industrial CHP, back-up power and components.
	Panel - Cars	
	Moderators: Carlos Navas and Eden Mamut	Moderators: Mirela Atanasiu and Deborah Jones
15:05 – 15:20	HYTEC	ENE.FIELD
15:20 – 15:35	HYFIVE	SOFT-PACT
15:35 – 15:50	H2ME	FLUMABACK
15:50 – 16:00	Q&A	Q&A
16:00 – 16:30	Coffee Break and Networking	
	Panel - Buses	
	Moderators: Enrique Girón and Eden Mamut	Moderators: Mirela Atanasiu and Deborah Jones
16:30 – 16:45	CHIC	SOFCOM
16:45 – 17:00	HIGH VLO CITY/HYTRANSIT	POWER-UP
17:00 – 17:20	Bus Study	REFORCELL/FLUIDCELL/FERRET
17:20 – 17:30	Q&A	Q&A
	Panel - Forklifts and APUs	
	Moderators: Enrique Girón and Eden Mamut	Moderators: Mirela Atanasiu and Deborah Jones
17:30 – 17:45	HAWL	FCPOWEREDRBS
17:45 – 18:00	DESTA	DIAMOND
18:00 – 18:15	FCGEN	SAPPHIRE
18:15 – 18:25	Q&A	Q&A
18:25 – 19:10	Poster Session - Panels 1 and 3 Manned (2nd floor)	
19:10 – 21:00	Networking Dinner	