



ene.field★



Pathway to a Competitive European
Fuel Cell micro-CHP Market

European-wide field trials for residential Fuel Cell micro-Cogeneration

Overview of ene.field and PACE projects

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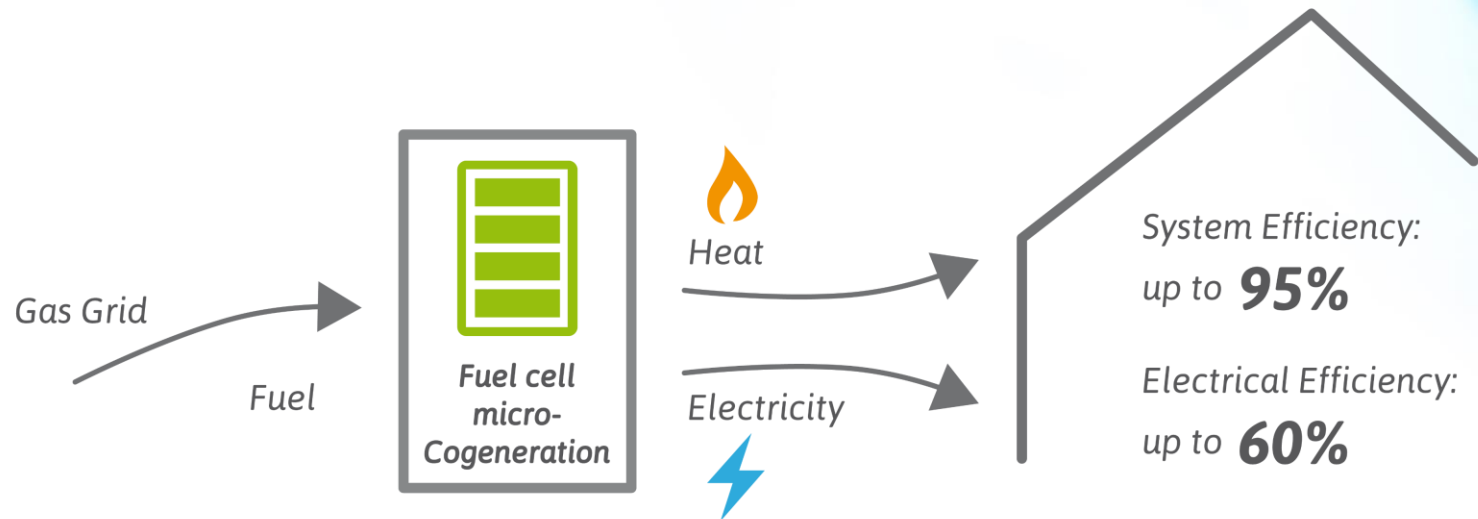
***Programme Review Days 2017
Brussels, 23-24 November***

CONTENT

1. Fuel cell micro-CHP - What and Why
2. ene.field project - paving the way to early commercialisation
3. PACE project - the bridge to large scale market uptake

What is Fuel Cell micro-Cogeneration?

Fuel Cell micro-Cogeneration is a highly efficient home energy system that simultaneously produces heat and electricity



Why Fuel Cell micro-Cogeneration?

Heating and Powering your Home



Empowers consumers



Supports the European
energy transition



Provides greater flexibility
for the energy system



Fosters innovation
and high-value jobs

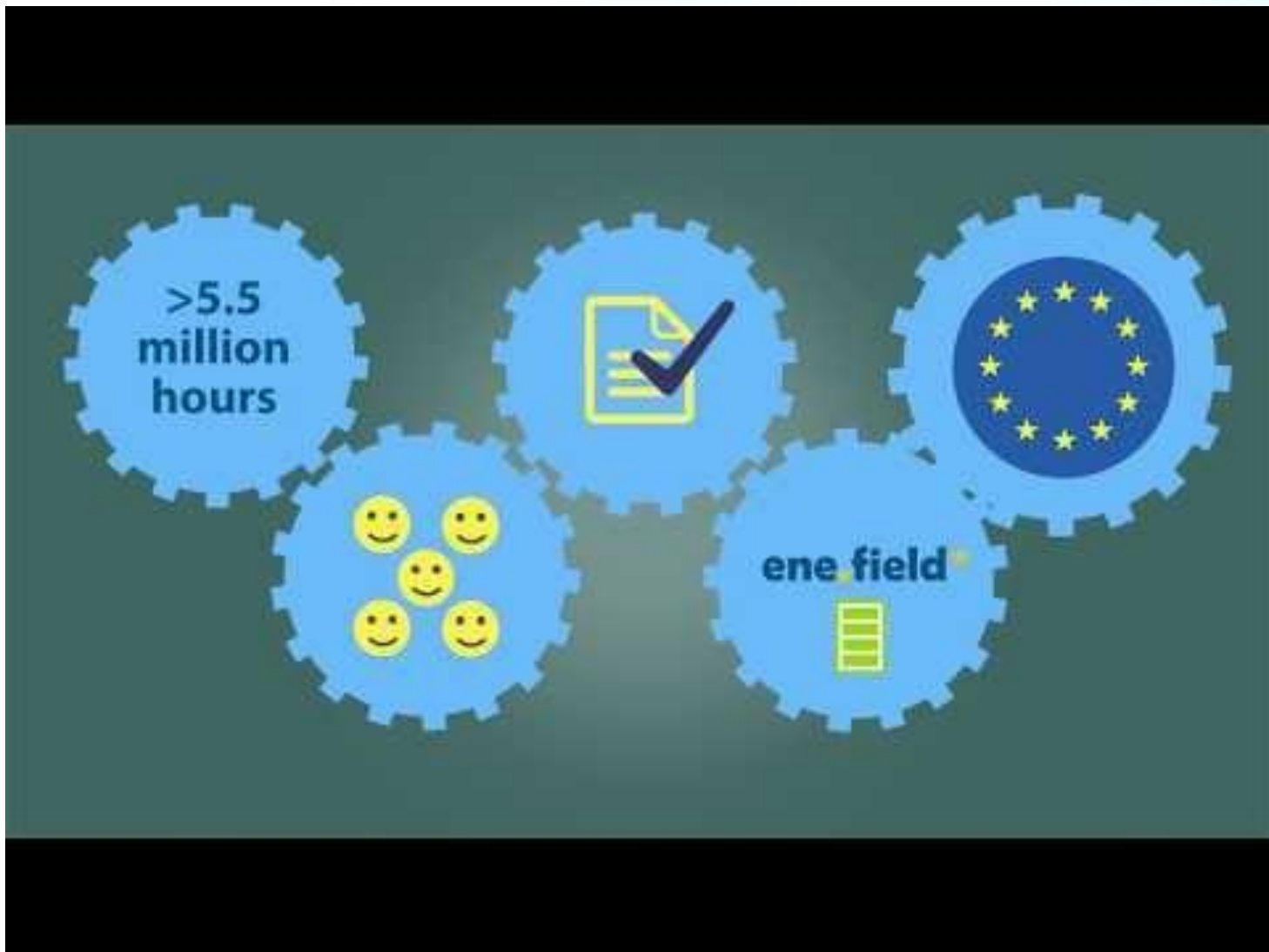
1. Fuel cell micro-CHP - What and Why
2. **ene.field project - paving the way to early commercialisation**
3. PACE project - the bridge to large scale market uptake

PROJECT OVERVIEW

ene.field project

Call year	2012
Call topic	Field demonstration of small stationary fuel cell systems for residential and commercial applications
Project dates	01/09/2012 - 31/10/2017
% stage of implementation	100% as of 01/11/2017
Total project budget	EUR 52,487,443.06
FCH JU max. contribution	EUR 25,907,168.77
Other financial contribution:	EUR 26,580,274.29
Partners:	Ballard, Baxi Innotech, Bosch, British Gas, Ceres Power, COGEN Europe, DBI, DCHT, Dolomiti Energia, DONG Energy Power, DTU, EIFER, Elcore, Element Energy, Engie, Environment Park, Energy Saving Trust, GWI, Hexis, HyER, Imperial College London, Politecnico di Torino, RBZ, SenerTec, SOLIDpower, Vaillant, Viessmann.

ene.field is a European platform for Fuel Cell micro-Cogeneration



Introduction to ene.field project

- ene.field is the **largest European demonstration** of the latest home energy solution for private homes, fuel cell micro-CHP.
- Project duration of **5 years** (2012-2017).
- **1,046 Fuel Cell micro-CHP systems have been deployed** across 10 key European countries.
- More than **5.5 million hours of operation & 4.5 GWh of power produced**
- Outputs of the project include: Detailed performance data, lifecycle cost and environmental assessments, market analysis, commercialisation strategy.



Overview of systems in ene.field

- **10 active suppliers** directly involved in the project and in direct interaction with their customers
- Applications suitable for both **residential use and small commercial buildings**

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

ene.field findings I: customer satisfaction

Surveys show that more than 90% of end users are pleased with the environmental performance, the comfort and warmth, reliability and running costs of their fuel cell micro-cogeneration unit

Environmental performance



Comfort and warmth



Reliability



Running costs

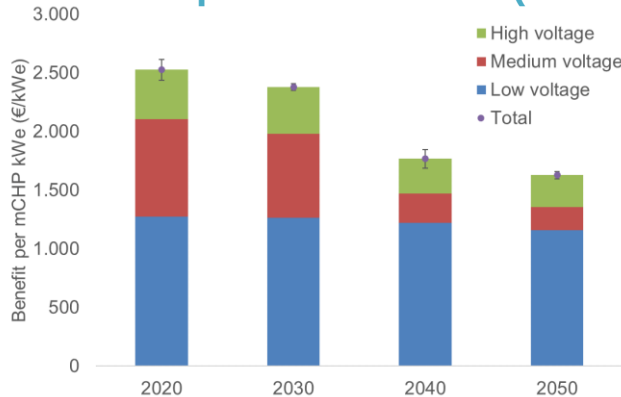


“With FC m-CHP we are less dependent on rising energy costs. We are excited about having our own power plant, which saves us around €700 annually on our energy bills and 2 tonnes of CO2 per year”, Mr Dilger, Germany

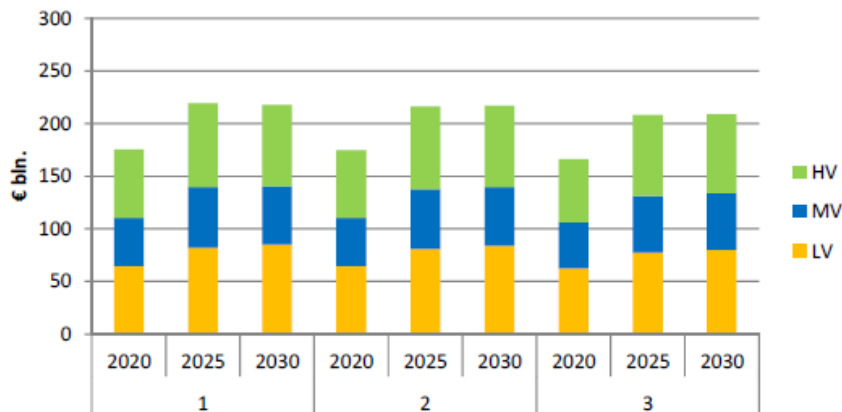


ene.field findings II: micro-CHP delivers important distribution network cost reductions

Micro-CHP distribution network cost reductions per kW installed (2020-2050)



Cumulative distribution network reinforcement costs in EU-28 up to 2030



Up to 31 GW

micro-CHP potential
in 2030

€ 62 bn

in avoided grid
investments associated
with micro-CHP

Up to 28%

of EU's projected grid
reinforcements needs
potentially delivered
by micro-CHP

Upper graph source: For the full report "Benefits of Widespread Deployment of Fuel Cell micro-CHP in Securing and Decarbonising the Future European Electricity System" authored by Imperial College London [click here](#).

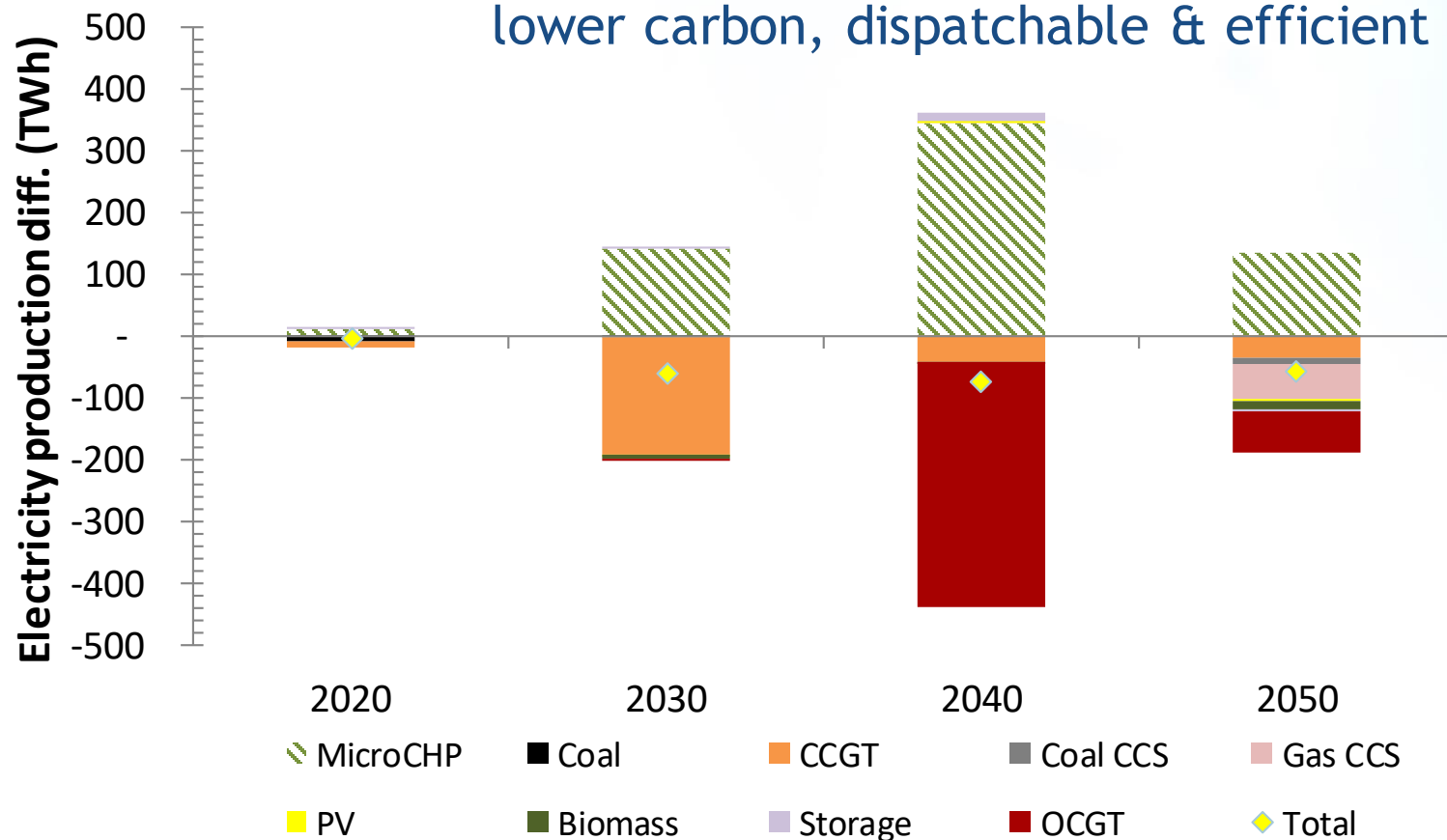
Lower graph source: Imperial College London, NERA Economic Consulting, DNVGL, «Integration of Renewable Energy in Europe», June 2014. [Full report is available here](#).

ene.field findings III: micro-CHP displaces more carbon intensive power, while reducing grid losses

Electricity from micro-CHP vs. centralised generation



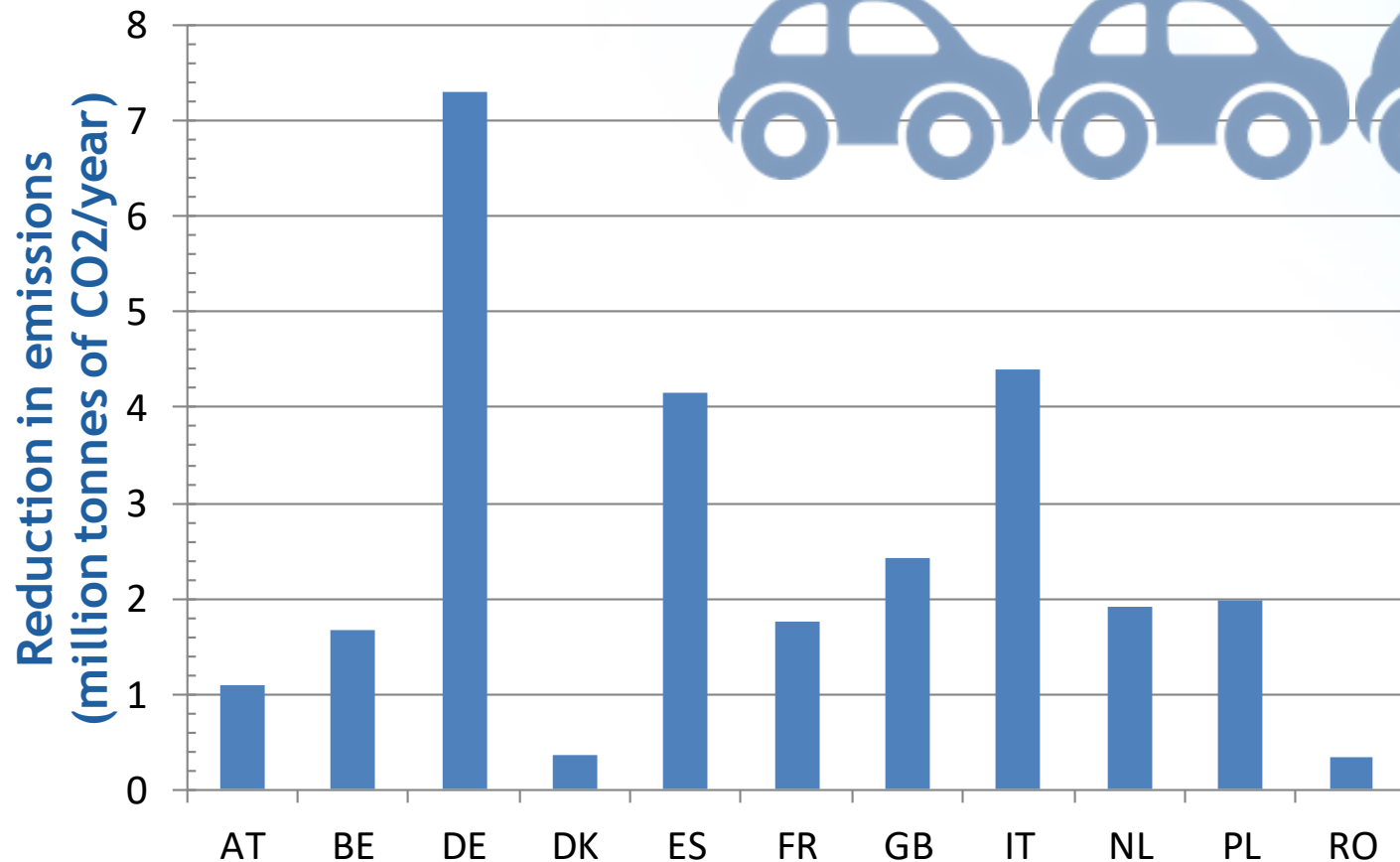
lower carbon, dispatchable & efficient



ene.field findings IV: CO2 emission reductions

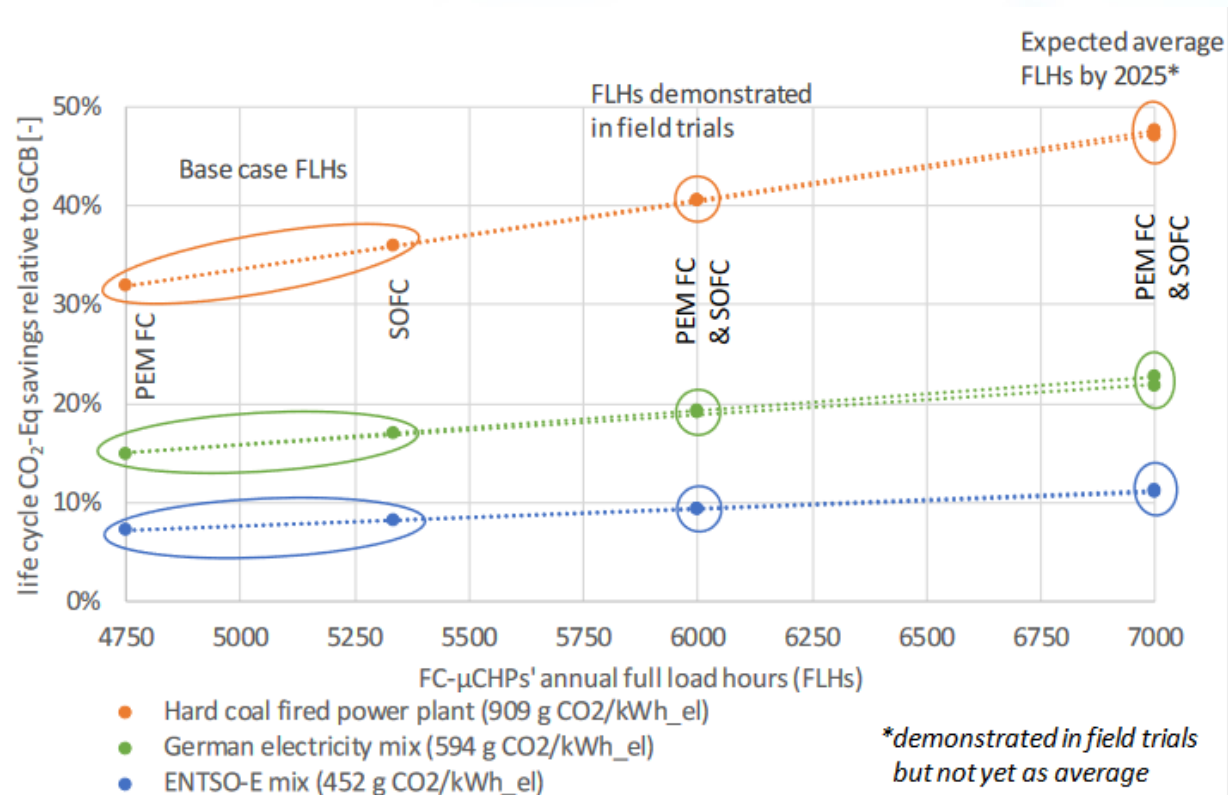
Decarbonisation benefits of more than 32 mil tonnes of CO2 emissions across Europe in 2030 :

- equivalent to 25% of Belgium's emissions in 2015
- equivalent total yearly emissions of more than 5,3 million cars



ene.field findings V: environmental life cycle assessment

- LCA GHG generally lower for fuel cell micro-CHP than alternative home energy solutions considered (i.e. gas condensing boiler, heat pump)
- Higher benefits for higher utilisation of the fuel cell & for more carbon intensive power mixes



To read the Executive Summary of the “Environmental Life Cycle Assessment” [click here](#).
Case: “Not well-insulated” “single family-home” in “Central Europe”

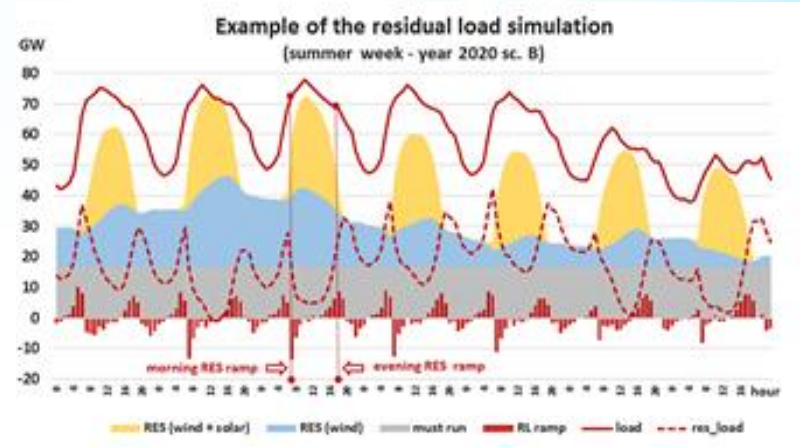
The flexibility challenge



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For our transition to a complex energy system, with increasing penetration of intermittent renewables, Fuel Cell micro-CHP:

- is a valuable demand-side measure for managing grid stability
- overcomes the challenge of increasing penetration of electric heating
- is low carbon and renewable when utilising bio-gas and H2
- in an existing, extensive natural gas network
- contributes towards a cleaner, healthier environment

The renewables challenge

Heat Roadmap Europe: “*Electrifying heating & cooling with heat pumps could double the electricity demand (in Europe)*”

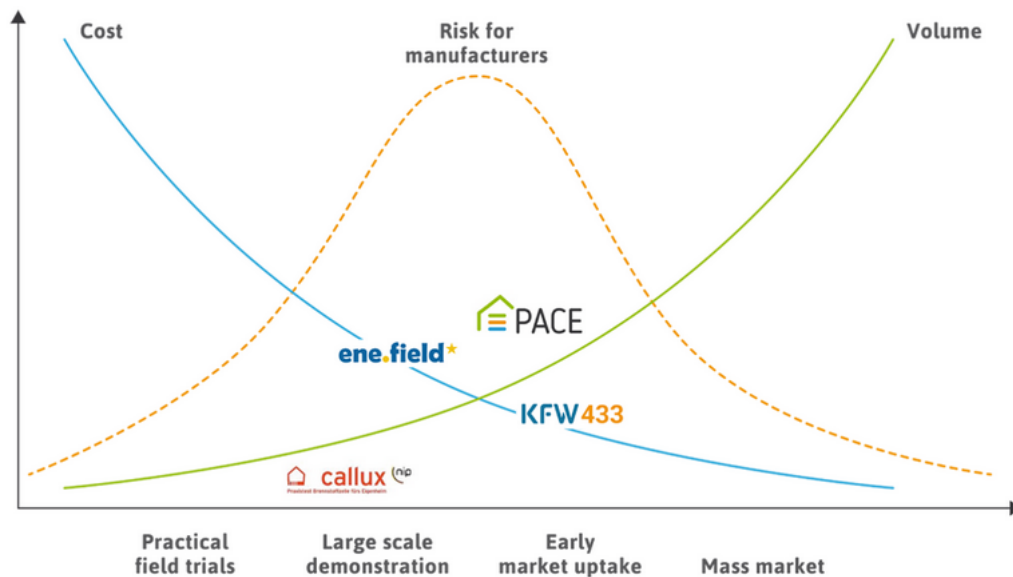
UK Policy Exchange: “*Switching 80% of homes to heat pumps would require an additional **105GWs** of electricity generation capacity (an increase of 175% above current peak power demand) as well as significant investment to reinforce the power distribution network.*”

Fuel Cell microCHP can help offset the additional **generation** and **network capacity** requirements if electric heat pump penetration is to significantly increase



Fuel Cell mCHP can be a tool to optimise an energy system with a much higher penetration of renewables coupled with new electrical demand

Driving the Fuel Cell micro-Cogeneration sector closer to mass market uptake



Reduce costs and improve competitiveness

Improve products' performance

Establish Fuel-Cell micro-Cogeneration as a standard technology

Raise awareness on Fuel-Cell micro-Cogeneration

Demonstrate product readiness as a key component in the delivery of EU's energy goals



Callux

- Period: **2008 – 2015**
- Total budget: **€75 million**
- German NIP co-financing: 50%
- **500 systems installed in Germany**
- **> 5 million operating hours**
- **CO₂ reduction by 30% on average per year**



ene.field

- Period: **2012 – 2017**
- Total budget: **€52 million**
- EU co-financing (FCH JU/FP7): 50%
- **> 1,000 systems installed in 11 European countries**
- **> 3 million operating hours so far**



PACE

- Period: **2016 – 2021**
- Total budget: **€90 million**
- EU co-financing (FCH JU/Horizon 2020): 37%
- **> 2,500 systems to be installed in 11 European countries**
- **500 units/manufacture**



KFW433

- Period: **started in 2016**
- **German NOW NIP grant scheme** administered by KfW bank
- Beneficiaries: **End customers**
- Eligible size: 0.25 kWe – 5 kWe
- Grant value per system: **€5,700 – €28,000**

Fuel Cell micro-Cogeneration units have demonstrated initial technology readiness in previous European and national demonstration projects

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3. **PACE project - the bridge to large scale market uptake**

PROJECT OVERVIEW

PACE project

Call year	2016
Call topic	Large scale demonstration of μ CHP fuel cells
Project dates	01/06/2016 - 28/02/2021
% stage of implementation	30% as of 01/11/2017
Total project budget	EUR 90,307,094.50
FCH JU max. contribution	EUR 33,932,752.75
Other financial contribution:	EUR 56,374,341.75
Partners:	BDR Thermea, Bosch, COGEN Europe, DTU, Element Energy, EWE, SOLIDpower, Viessmann

PACE at a glance

Promoting a successful transition to the large scale uptake of Fuel Cell micro-Cogeneration across Europe



Pathway to a Competitive European
Fuel Cell micro-CHP Market



- Field trial + installer training + targeted market & policy development activities
- Field trial + local installer training

8
Partners

Representing
manufacturers,
utilities & research
community

> 2,500
Fuel Cell micro-
Cogeneration
units

To be deployed
across Europe
between 2016-
2021

>500
Systems per
manufacturer

Established
production
capacity per
manufacturer

10
Countries

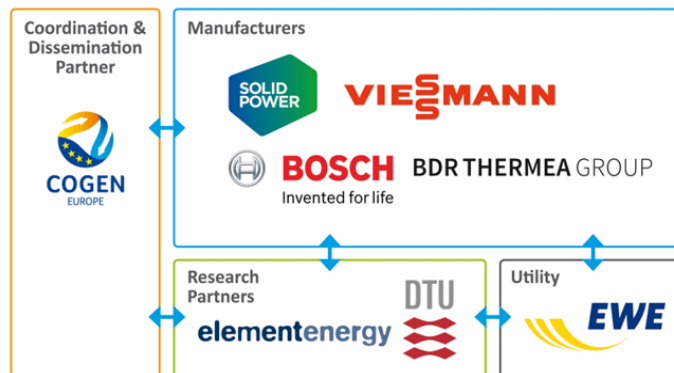
Where the units
will be installed

4
Countries

Selected for policy
& market
development
(Belgium, Italy,
Netherlands and
UK)

€90m
Total budget

Including €33.9m
Horizon 2020
funding via FCH JU



>10,000
FC micro-
cogeneration
units/year post 2020

Policy recommendations for FC m-CHP

- Consumer and energy system benefits of micro-CHP systems should be fully recognised and rewarded by policy at the EU and national levels
- Methodologies in key policy mechanisms (energy labelling, building codes, Covenant of Mayors) should fully reflect the benefits of FC micro-CHP
- Electricity market design should fairly allocate grid charges to micro-CHP, while not forgetting its benefits in terms of reduced grid and generation costs.
- Simplified administrative procedures to access the grid or different support scheme should be introduced for the potential users or FC micro-CHP
- The decarbonisation and flexibility potential of gas networks (renewable gas) with fuel cell micro-CHP should be taken into account, as part of a comprehensive energy and climate strategy

The market uptake of Fuel Cell micro-CHP requires a coherent, steady and predictable policy framework in recognition of the benefits for energy transition

To read all the policy recommendations from the ene.field Final Policy Report, please click on this link: [Fuel Cell micro - CHP in the Context of EU Energy Transition - Policy Analysis & Recommendations](#)

ene.field & PACE take-home messages

- Fuel cell micro-Cogeneration is **reliable**, it works and is now available in key European markets.
- Major European manufacturers, supported by the Fuel Cell & Hydrogen Joint Undertaking at the EU level and key European national governments, are now committed to **bringing the technology closer to mass market by increasing scale and achieving further product cost reductions**.
- Experience from **Japan**, i.e. Ene-Farm programme, shows that significant cost reduction of fuel cell micro-CHP is possible, as over 7 years (2009-2016) the **Ene-Farm project triggered fuel cell micro-CHP cost reduction by more than 50%**.
- ene.field environmental and economic assessments have highlighted **clear benefits of fuel cell micro-Cogeneration for EU climate and energy objectives**.
- It is key to put in place the **right policy framework** to encourage wide deployment of this technology in Europe.

Thank You!

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