COGEN EUROPE

Towards an efficient, integrated and cost-effective net-zero energy system in 2050



Journée micro et mini cogénérations 01 January 2023



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New Programmer Strength and Str

Our Mission

Cross-sectoral voice of the cogeneration industry

Work with EU Institutions and stakeholders to shape better policies by:



Building a robust evidence-base demonstrating the benefits of cogeneration.



Using the expertise of our membership. Establishing strong coalitions and partnerships.



MEMBERS

National Associations





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Buildings are "Hard to Decarbonise"

Challenges

- 40% of energy consumption & 36% of GHG emissions;
- 80% of buildings demand comes from heating and hot water & 75% of heat demand is based on inefficient natural gas and oil boilers;
- Electrifying heat could increase peak demand by 200-300%; and
- PV and Wind are intermittent and insufficient to cover demand at all times cost-effectively.

Opportunities

- Improve efficiency of buildings where cost-effective;
- PV & wind seasonal storage as RES H2;
- Smartly electrify by requiring **heat pumps** to consume electricity off peak and in high-RES periods; and
- Enable **efficient & flexible micro-CHP** to produce heat and electricity during peak demand, simultaneously reducing peak demand and balancing the grids.





Expert contributions from **15** CHP national experts...

2022 Cogeneration National Snapshot Survey

...representing 82% of installed capacity in EU27 & Turkey

...capturing the European CHP industry sentiment



CHP Market Developments in Europe (2020-2021)



- > CHP stable in ~50% of markets
- Growth segments included natural gas & RES CHP



* Percentages on all slides represent the aggregated answers weighted by the installed capacity in each country.

5-year CHP Outlook

Growth expected in 60% of the CHP markets in Europe, in the next 5 years.





CHP growth trends by segment





Micro-CHP legislation - EU

EU Taxonomy (in force): Micro-CHP recognised as climate mitigation buildings solution, along PV, heat pumps, wind

Energy efficiency directive (under revision): Micro-CHP recognised as highly efficient; micro-CHP complement to heat pumps to ensure EE1st

Energy performance of buildings directive (under revision):

- positive impact of CHP electricity to be taken into account
- micro-CHP potentially included as a "demand-side flexibility" solution
- micro-CHP recognised in buildings Smart Readiness Indicator (SRI)
- !!role of gas in zero-emissions buildings challenged!!

Energy label (under revision): Micro-CHP, especially fuel cells, labelled in top two labelling classes

Electricity market reform (upcoming): Ensure flexibility markets reward demand-side flexibility





Micro-CHP Legislation - National

Efficient buildings funding (new): Fuel cell micro-CHP support up to 35% of CAPEX, provided they run on 100% biomethane or RES H2

Buildings law (upcoming): requirement for 65% RES share in heating for new heating appliances

Energy efficiency tax credit: Tax deduction up to 50% of investment cost for energy efficiency solutions, including micro-CHP







PACE at a Glance

Pathway to a Competitive European Fuel Cell micro-CHP Market

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

	10	> 2,800	>500	10	4	€90m
	Partners	Fuel Cell micro- Cogeneration units	Systems per manufacturer	Countries	Countries	Total budget
	Representing manufacturers, utilities & research community	To be deployed across Europe between 2016- 2023	Established production capacity per manufacturer	Where the units will be installed	Selected for policy & market development (Belgium, Italy, Netherlands and	Including €33.9m Horizon 2020 funding via FCH JU
Field trial + installer training +	Coordination & Dissemination Partner	Manufacturers VIESMANN BDR TH BOSCH Invented for life	ermea group Solydera Unfire HEXIS		UK)	000
targeted market & policy development activities Field trial + local installer training	EUROPE	Research Partners elementenergy an ERM Group company	Applied Sciences and Arts HOCHSCHULE LUZERN Engineering and Architecture		cogene units/year	eration post 2020



Overview of FC mirco-CHP System in PACE





Why Fuel Cell micro-Cogeneration?

Pathway to a Competitive European Fuel Cell micro-CHP Market

Heating and Powering your home

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





Fosters innovation and high-value jobs



Project Progress & Performance of Units Installed

Number of Units	Total Operating	Total kWh	Efficiency**	Availability**
Commissioned*	Hours**	Produced**	(gas to power utilisation)	
2,356 (85% of overall objective)	23,390,524	23,991,535	35-57%	94.8 -100%



Source: **PACE D2.9.** – 3rd **Report on Performance Validation of Units Installed** *as of September 2022. ** as of end March 2022.





2016-Dec

PACE Units Installed Across Europe (2016-2022)





Why Fuel Cell micro-Cogeneration?

Heating and Powering your home

Supports the European Energy Transition

With total efficiencies of more than 90%, including electrical efficiencies of up to 60%, this technology can achieve significant energy savings and CO_2 emission reductions. On average in Europe it would save around 1 tonne of CO_2/kW every year, thus delivering more than 32 million tonnes of CO_2 emission reductions across Europe in 2030.

This "fuel flexible" technology will be progressively fuelled by renewable energy sources, such as hydrogen and renewable gas.





Why Fuel Cell micro-Cogeneration?

Heating and Powering your home

Empower Consumers

It transforms Europeans into active energy 'prosumers' (producer-consumers), creating a decentralised energy system with a reduced carbon footprint and lower energy bills. 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



"With the fuel cell micro-CHP system, I was able to cover 72% of my electricity use by producing power myself. Compared to before, I save around €1,000 a year", Mr. Boel, Hamburg



Trial Participants Survey 1/4

Overall how would you describe your experience with your mCHP?

Nearly 80% of respondents reported having a positive overall experience with their FC mCHP unit and just 8% described their experience as negative or very negative.







Trial Participants Survey 2/4

Overall how would you describe your experience with your mCHP?

100% 90% 80% 70% 60% 50% 40% 30% 20% 10% 0% UK Non-residential Austria Belgium Germany France

■ Very negative ■ Negative ■ Neutral ■ Positive ■ Very positive

No negative responses were reported by any nonresidential respondents.

100%

90%

80%

70%

60%

50%

40%

30%

20%

10%

0%

Residential

Fuel Cell micro-CHP Market

Austria reported the highest number of "very positive" responses, and only Belgium and Germany were the only two countries to report any "very negative" experiences.

As the two countries with the most installations, it would be expected that Germany and Belgium would have a broader range of responses.



Fuel cell micro-CHP significantly reduced consumer energy bills compared to standard heating solutions & grid electricity in 2020-2021*.

Self-consumption Benefits of Fuel Cell micro-CHP



* The analysis assumes stable energy prices, based on 2020-2021 trends. Between 2021 – 2022 energy price volatility and emergency government interventions make it difficult to predict fuel cell energy bill savings. Since the ratio between electricity and gas prices have remained high in many countries, we expect that field trial participants have experienced lower energy bills than other consumers, due to both higher efficiency and self-generation of power.

Source: PACE project (HSLU), 2021. Economic value of mCHP's participating in power and grid service markets.



MICROCHP HYBRID HEATING AND COOLING SYSTEM RUNNING ON SUSTAINABLE LIQUID BIOFUELS

The Fit4Micro solution aims at increasing environmental sustainability of the building sector



optionally combined with solar PV, heat pump and/or adsorption cooling Fit4Micro **technology** is based on a microCHP hybrid heating system running on biofuels, able to provide renewable **heating**, **cooling** and **power** production.









Objectives

- Reaching higher levels of socioeconomic and environmental sustainability in the household sector
- Implementing a Micro Turbine with a design efficiency up to 40%
- Increasing the availability of renewable fuels for domestic usage
- Integrating the Micro Turbine with solar-PV to allow a flexible power operation





22

CHP's Multiple Benefits in 2050



- * excluding off-grid RES for P2X generation.
- ** excluding furnaces.

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*** excluding furnaces; DHC for industry is 100% CHP.

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Focus on Heat: CHP Key for all Sectors



** excluding furnaces; DHC for industry is 100% CHP.

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User focus: Modelling approach (2/2)





SOLUTIONS EN OPTIMISATION

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Cost Savings for CHP Users



*Based on retail power prices including taxes, levies and grid costs, self-consumed electricity and hydrogen retail price of 80-100 €/MWh. All other user cases assume cogenerated electricity is sold to market at wholesale electricity prices, excluding taxes. **Based on biomass price of 40-60 €/MWh.





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CHP: Beneficial to Consumers in All Sectors

CHP enables the **most energy-efficient** & **cost-effective** pathways to decarbonisation in a **consumer-empowering** way.



220 TWH OF PRIMARY ENERGY SAVINGS

OR 2.5 x annual electricity consumption of Belgium*



5.5 MT

OF REMAINING CO₂ EMISSIONS AVOIDED OR Annual CO₂ emissions of 3 million petrol cars

8.2 BN € SAVED YEARLY OR 9.5 x of LIFE Climate Action funding



* IEA 2019



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