



Pathway to a Competitive European
Fuel Cell micro-CHP Market

Fuel cells in micro-cogeneration mode: the technology explained

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



PACE project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 700339.

This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme and Hydrogen Europe and Hydrogen Research.

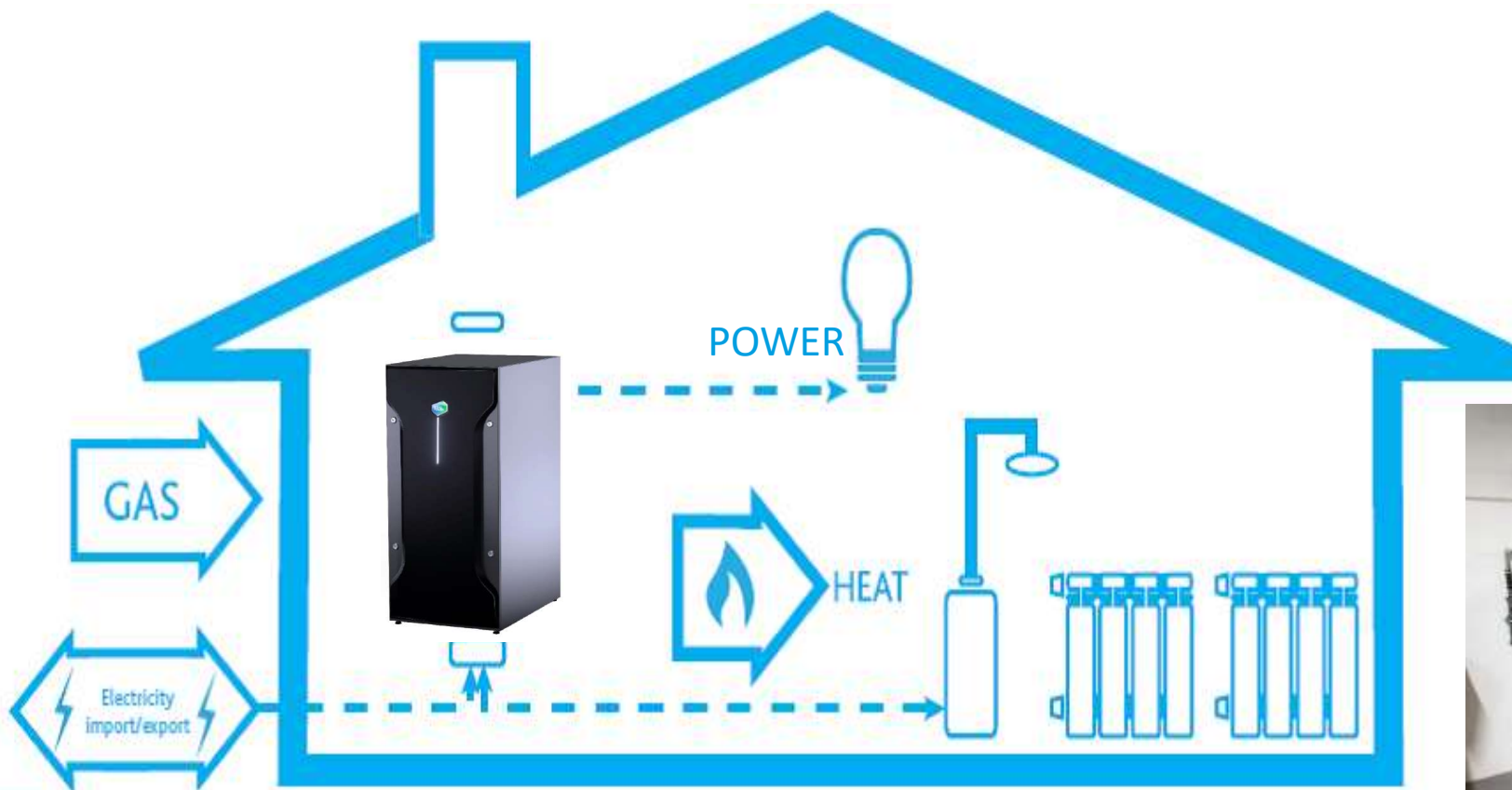
What is Fuel Cell micro-CHP ?

Combined Heat and Power generation

- **Fuel cells can be used as Energy plants for Buildings**
 - On-site energy solution to produce both electricity and heat.
 - Easy to install, silent, no rotating parts and little maintenance.
 - Flexible & modular with easy cascading for higher power demand
 - Cuts energy costs: High energy bill savings. As electricity prices rise, savings will increase.
 - Eligible for green subsidies in many EU countries.
- Reducing environmental footprint **potentially to zero Carbon**: much more efficient than power from the grid + a condensing boiler, it reduces CO₂ and eliminates local air pollution: no combustion so no NO_x, SO_x and particle emissions.
- **Future proof**: Gas from the grid (either conventional or renewable) is converted into **Hydrogen** and then used to produce **electricity and heat** inside the **Fuel Cell**



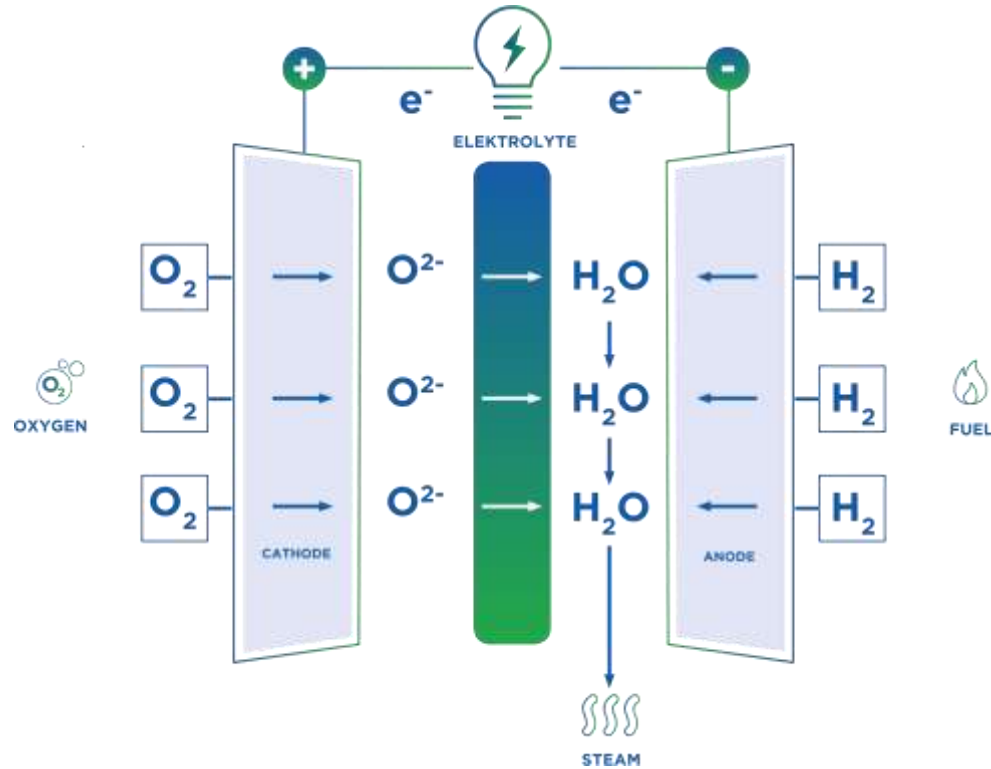
What is Fuel Cell micro-CHP ?



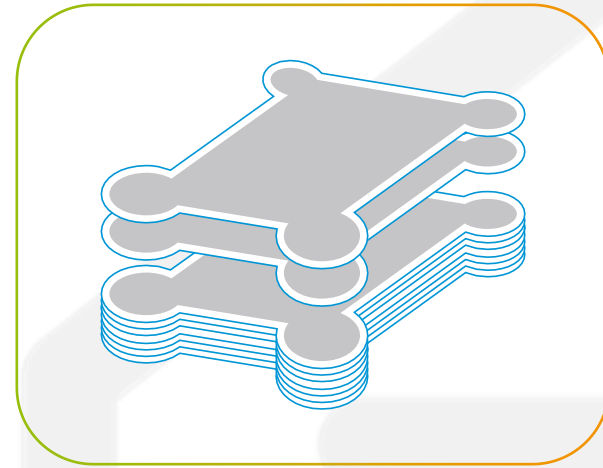
Easy cascading for
higher SME demand



Principle of a Fuel Cell



FUEL CELL STACK





SILENT OPERATION
(NO MOVING PARTS)

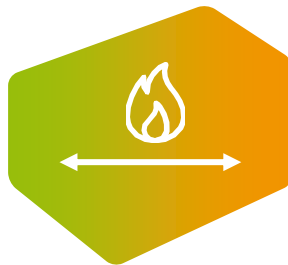


HIGHER EFFICIENCY
THAN COMBINED CYCLE
GAS TURBINES (> 60% AC DELIVERED)

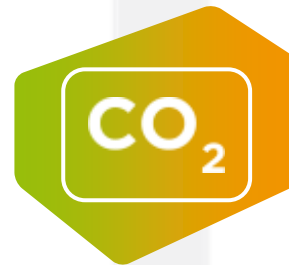


CLEAN EMISSIONS
NO SO_x OR NO_x

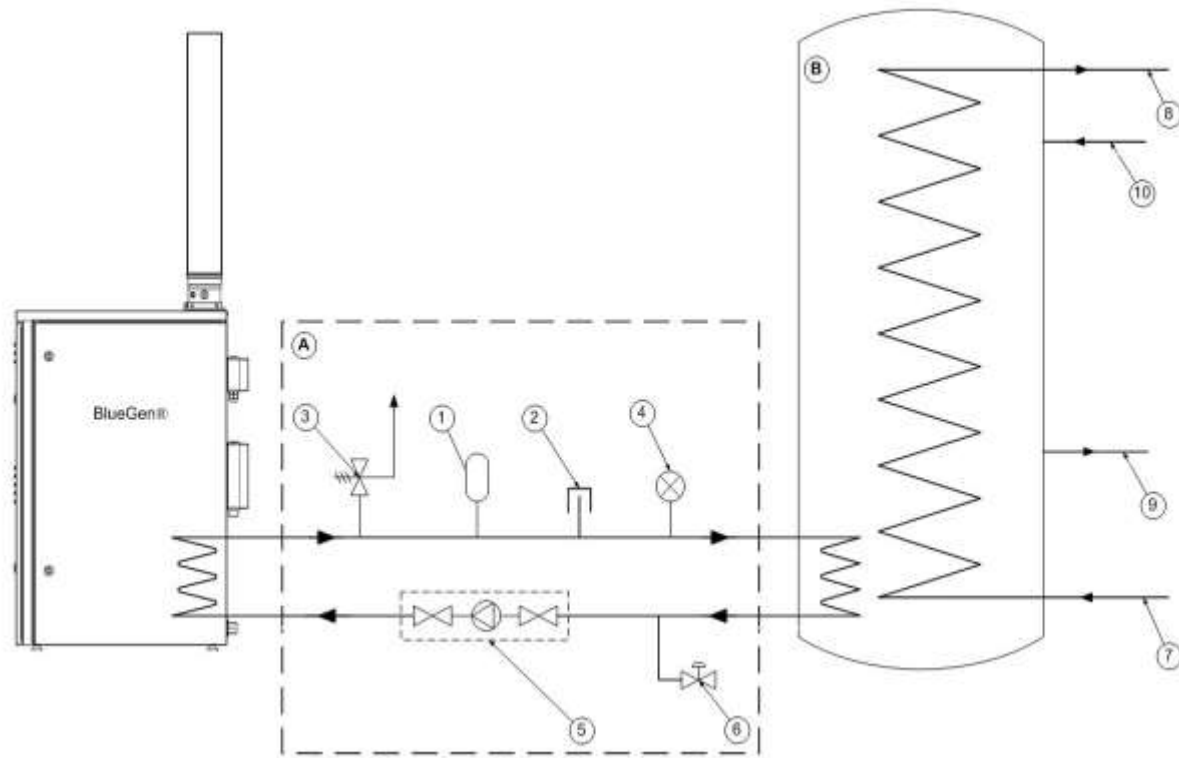
Other unique features:



WIDE RANGE OF FUELS
(Hydrogen, GAS, BIOGAS, etc.)
FUTURE PROOF, NO REGRET SOLUTION



CO₂ CAPTURE "BUILT-IN"
WITHOUT LARGE INVESTMENT
OR EFFICIENCY PENALTY





Pathway to a Competitive European
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Easy monitoring and control

Control and full access to the extensive data:

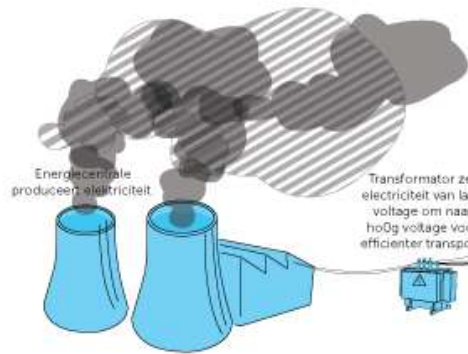
- ✓ Electricity you are producing
- ✓ CO₂ emissions you have saved

- ✓ For iOS and Android
- ✓ HTML₅ responsive
- ✓ Security compliance (GDPR)
- ✓ Monitoring / power profiling

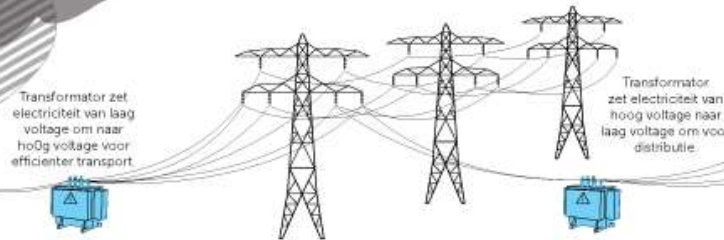


Current average situation in Europe: Centralized power production

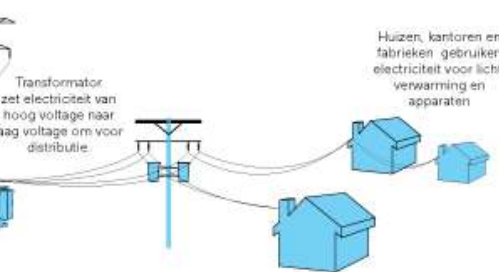
45-70% waste-heat



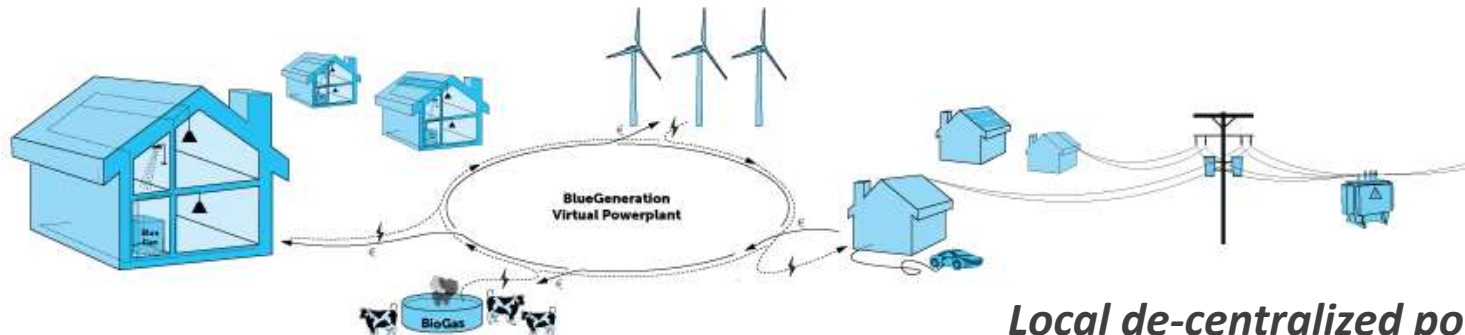
5-8% transportation losses



Only 25- 40% energy left for the building!



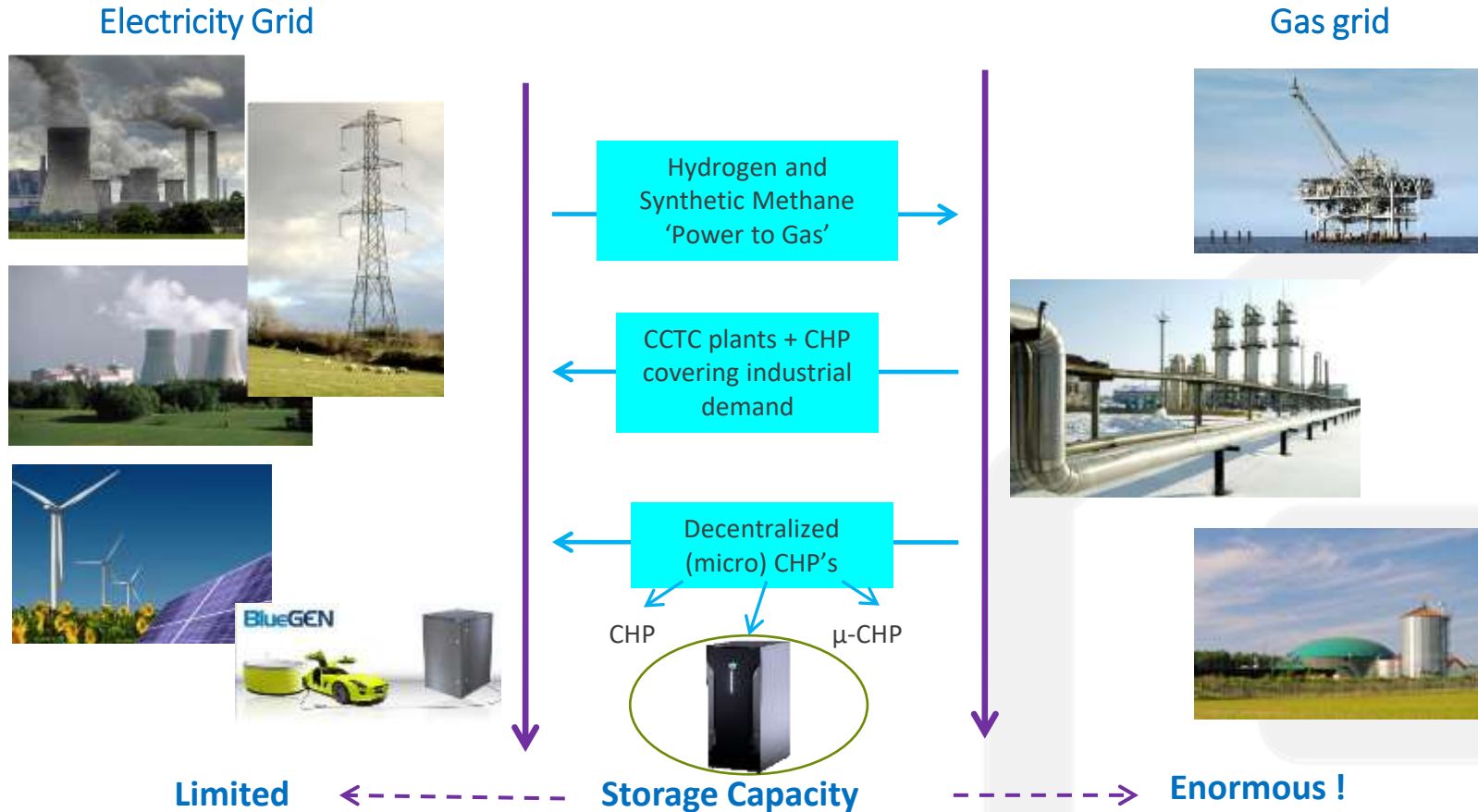
> 90% Energy @home with Fuel Cell mCHP = up to 3 times more efficient!



Local de-centralized power production

The future: Smart-grids and energy-storage in Hydrogen

Storage of renewable energy with – “Power to Gas”



Why Fuel Cell micro-CHP? Example Belgium

Electricity and heat for your building



Example 'Foets Restaurant' Mol

- Yearly power demand 71 MWh
- Yearly power bill (2018): € 16.920,-
- Yearly power generation 65 MWh
- Yearly waste heat recovery 25 MWh
- 5 BlueGEN 1.5 kW units cascaded
- Total investment € 107.000,-
- Savings year one: € 2.770,-
- Savings after 15 years: € 128.955,-
- Carbon savings: 17.5 Tons per year



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

Environmental performance



Comfort and warmth



Running costs



Source: ene.field
project report
“Learning points from
demonstration of
1000 fuel cell based
micro-CHP units”

90% of the FC micro-CHP systems were
available for at least 95% of the time

Customer satisfaction

From ‘consumer’ to ‘prosumer’

“After the installation of the Fuel Cell micro-Cogeneration unit in my car dealership, my demand of energy decreased by 10.000 kWh per year and I save €2 ,200 Euro in electricity cost every year.”

Yakup Ak, managing director at Autoport
Cologne



“With Fuel Cell micro-CHP we have many advantages in one single compact unit. To install a unit, households need nothing more than a gas connection and an electricity connection.”

André Bartels, CEO, Carl Cordes GmbH

