Capabilities, potentials and barriers – Lessons learnt

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The ene.field project has received funding from the European Union´s 7th Framework Programme (FP7/2007-2013) for the Fuel Cells and Hydrogen Joint Undertaking Technology Initiative under Grant Agreement Number 303462.

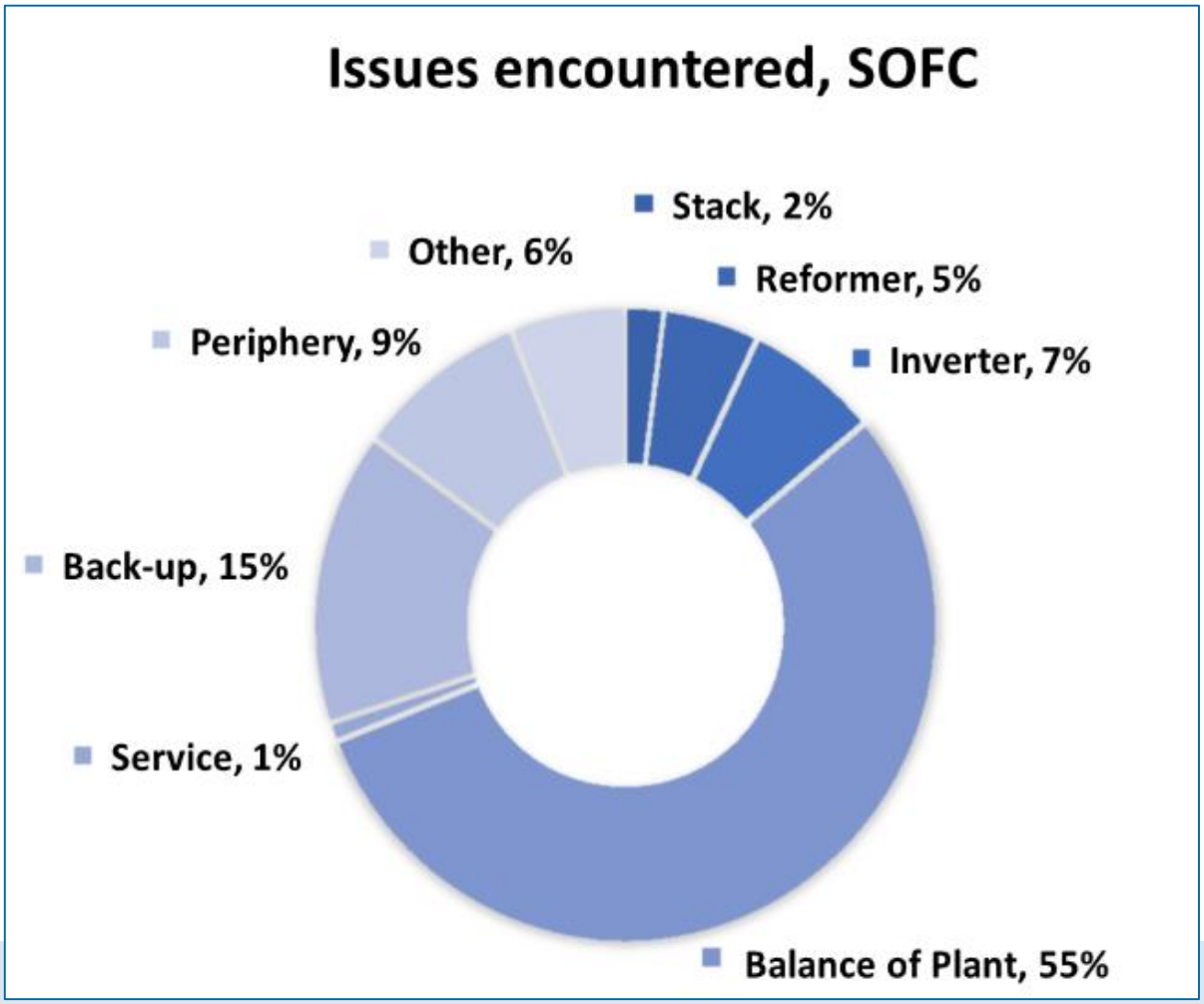
Top 5 messages

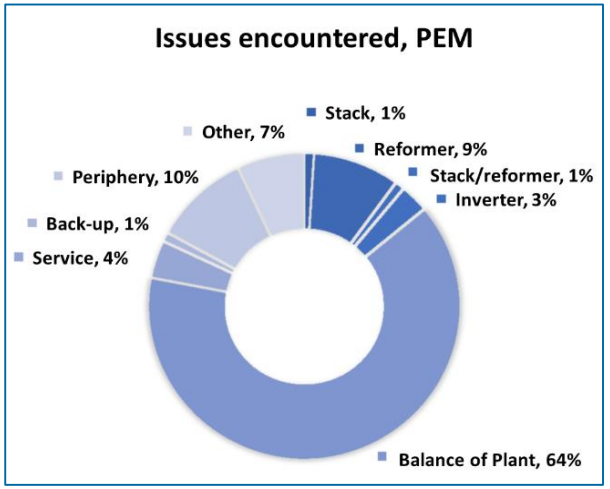
- The technology works - robust and reliable
- End-users are satisfied
- Environmental benefits
- Barriers: Paper work and Costs
- More analysis results available

Reliability

Reliability

Units available to end-users 96-99% of the time (average)



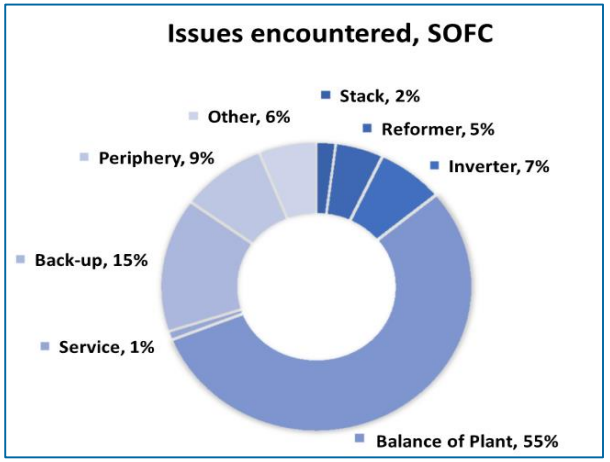


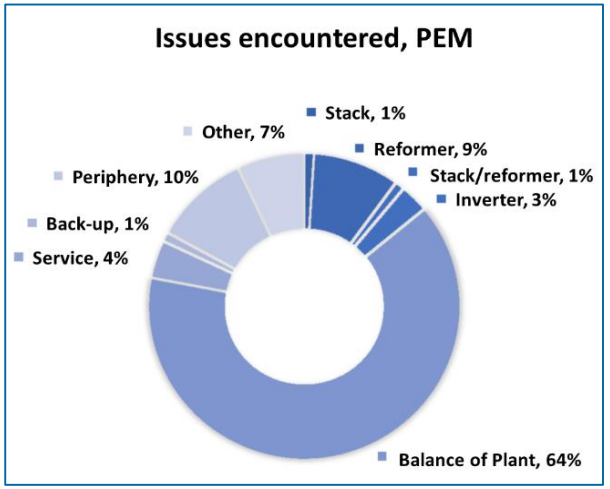
Reliability

Units available to end-users 96-99% of the time (average)

14% of issues relate to FC appliance

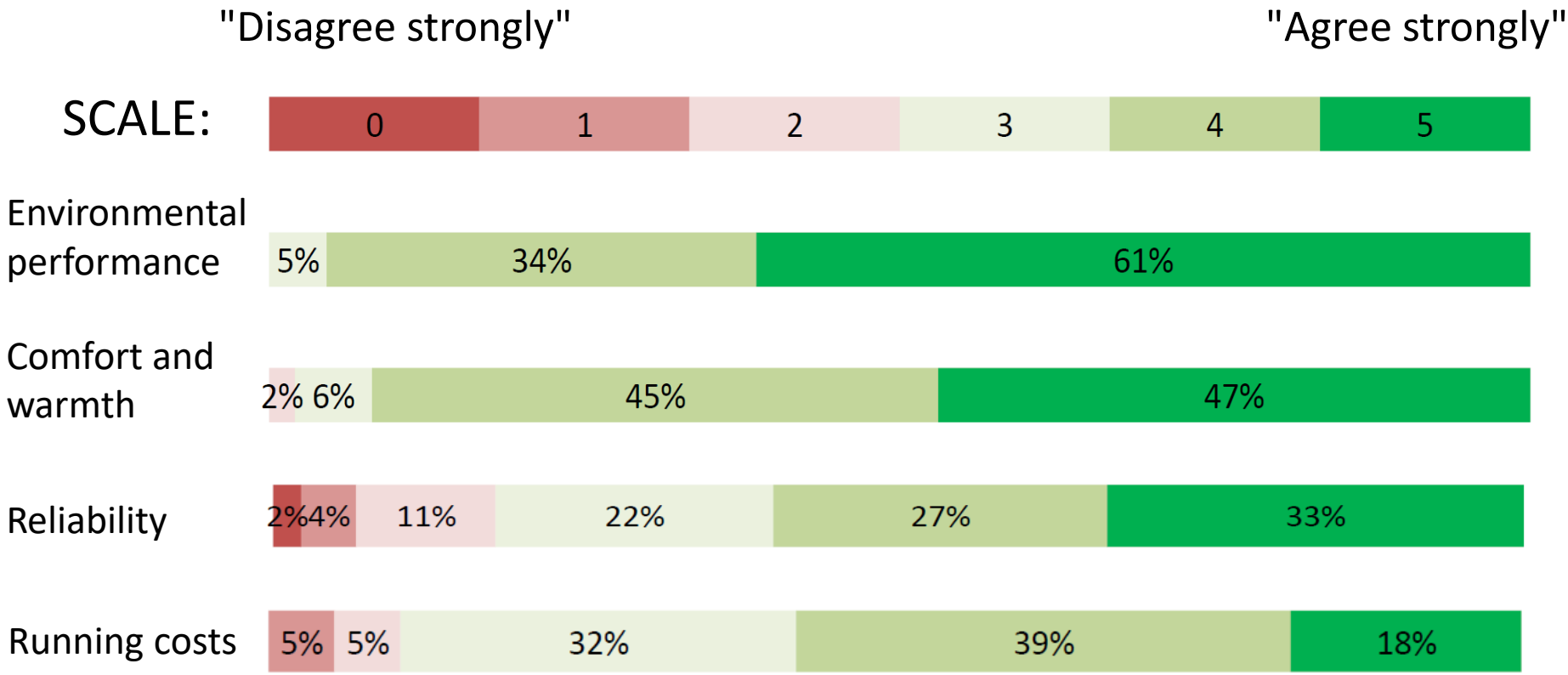
Only 2% of issues relate to FC stack





End-user satisfaction

Perception: "I am satisfied with the...



... of my FC micro-CHP.

Environmental benefits

LCA

Environmental life cycle assessment

Environmental life cycle assessment (LCA)

Environmental impact taking "everything" into account.

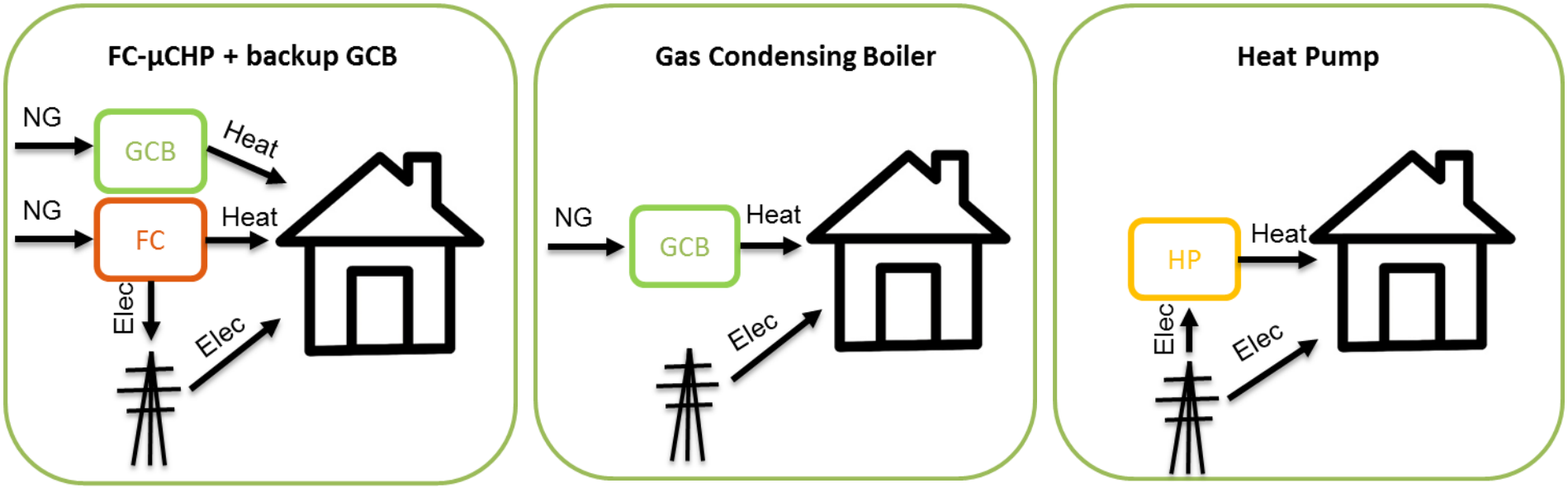
Product life stages:

- Raw materials, production, **operation**, maintenance, disposal

Impact categories:

- climate change; GreenHouse Gases, CO_2-equivalents
- respiratory effects, inorganics; air pollutant emissions, particles
- acidification;
- mineral, fossils and renewables depletion

Technologies compared:

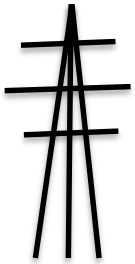


LCA scenarios analysed:

Different house types (with different demands):
- Southern, Central, Northern Europe
- New or existing building
- Single or multi family home

FC

- **Different FC types**, size and operation mode.
- Fixed number of full load hours (utilization of unit) for each case.



Electricity mix:
"ENTSO-E" mix

LCA conclusion

In all the investigated scenarios

- **Greenhouse gas emissions are lower** than for gas condensing boiler and heat pump
- **Lower air pollutant emissions** in general

The environmental benefits are highest:

- When there is **high utilization of the FC** micro-CHP
- When there is **low utilization of the back-up boiler**

... which is when the capacity of the FC micro-CHP unit **fits the building's needs** for heat and power.

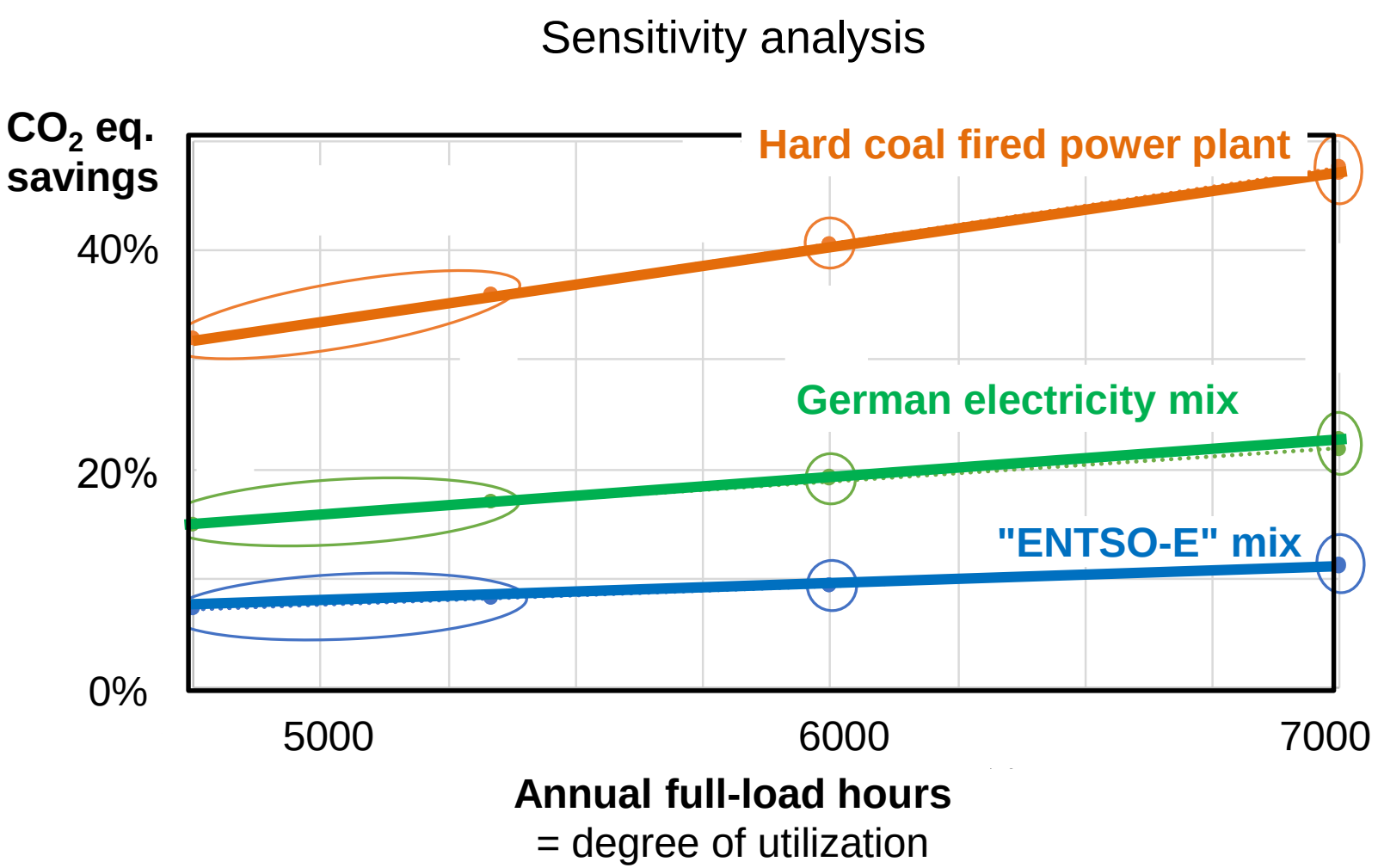
LCA - sensitivity analysis

CO_2 eq. savings compared to GCB.

- What if FC is more utilized (higher full-load hours), running more hours and on with higher capacity?

- What if the electricity replacement has higher carbon intensity?

CO_2 eq. savings compared to Gas Condensing Boiler



Case: "Not well insulated" "single family home" in "Central Europe"

[T.M. Bachmann, F. Carnicelli, P. Preiss, 2017]

More LCA conclusions

CO2 eq. savings:

- Higher full-load hours => higher CO_2 savings
- Higher carbon intensity of the electricity "replacement mix" => higher CO_2 savings

...relative to the GCB.

Future work – LCA

More analyses should be made, including:

- Specific FC micro-CHP systems - not a generic system (diversity in type, size and operation)
- Impact of future fuel types (biogas, green natural gas and green hydrogen)

Barriers

- Permissions and approvals. Simple registration is needed.
- Environmental and system benefits are not rewarded by policy.
- Capital and maintenance costs. Need for larger production volume.
- Complexity of systems and components.
- Lack of trained installers in new markets – 600 trained during ene.field.

More analysis results

available at enefield.eu

Reports available

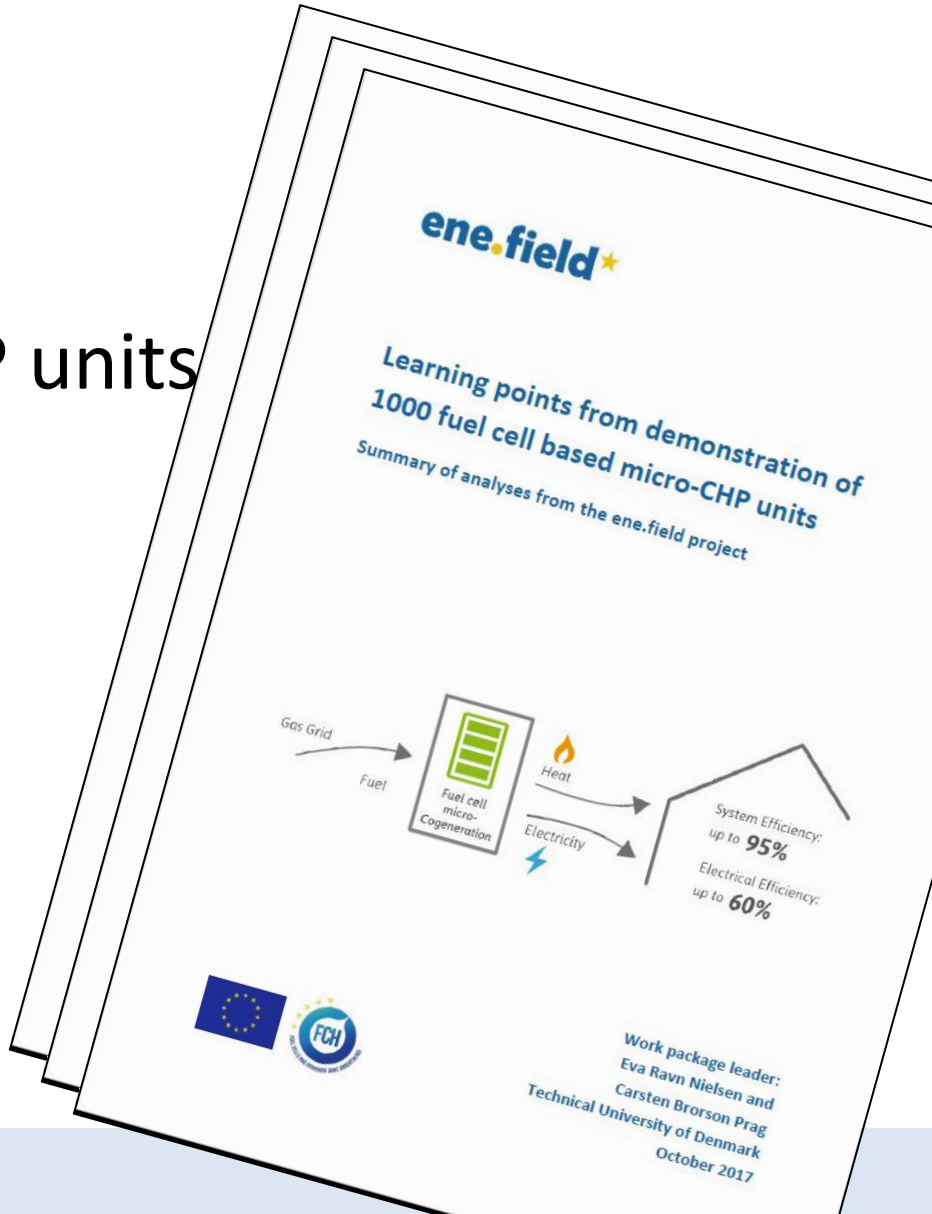
- Regulations, Codes and Standards
- Smart Grid
- Grid connection
- Training - "field support"
- Non-economic barriers to large-scale market uptake
- Supply chain analysis
- Policy report
- Environmental Life Cycle Assessment
- Life Cycle Cost Analysis
- Cost and market projections
- Macro-Economic and Macro-Environmental Impact

Summary Report

Learning points from demonstration of 1000 fuel cell based micro-CHP units

Grab a copy!

enefield.eu



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Thank you for your attention!

www.enefield.eu

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