

Programme Review Day
Brussels, 28/29 November 2012

**Evaluating the Performance of Fuel
Cells in European Energy Supply
Grids**

FC-EuroGrid

Contract number FCH JU 256810

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Project description

- duration 01.10.2010 – 30.09.2012
- total budget 805.931 €, funding 588.982 € (73%)
- addresses the development of benchmarks and indicators to assess the impact of employing fuel cells for stationary applications in various European electricity grid environments

The consortium consists of 9 partners:

University of Birmingham (coordinator)

Forschungszentrum Jülich

European Institute for Energy Research Eifer

Teknologian tutkimuskeskus VTT

Institute of Power Engineering IEn

Grontmij AB

E.ON Ruhrgas

ENEA

EBZ GmbH

Problem addressed

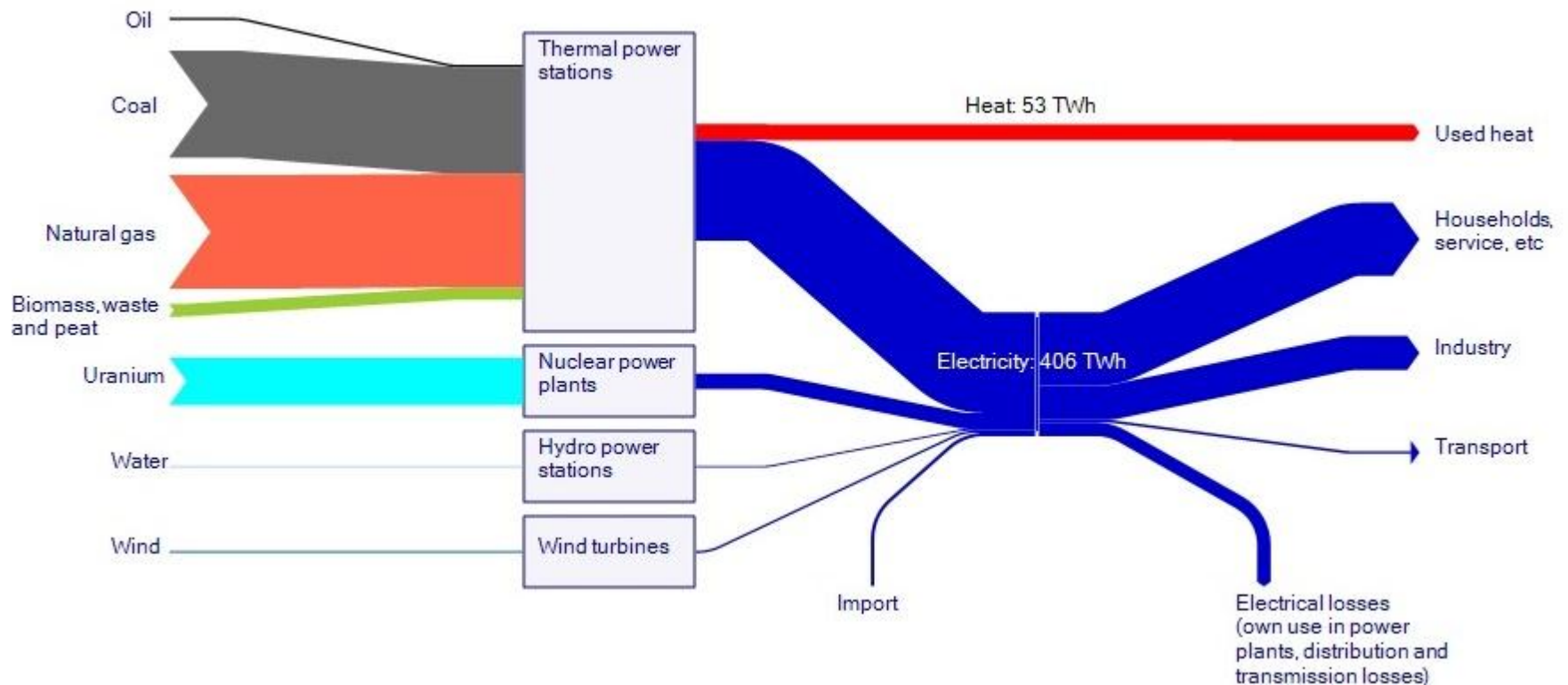
- MAIP / AIP include no clear indications as to the desired minimum performance stationary fuel cells have to deliver in order to contribute to the EU goals of increasing energy efficiency and reducing GHG emissions and thus achieve funding
- stationary fuel cell performance has to match and surpass CHP requirements
- useful indicators are
 - amount of CO₂ avoided
 - amount of fossil energy avoided or substituted
 - total and electrical efficiency
- the environmental benefits will vary according to the electricity grid the installation is situated in
- methodology of assessment has been established

Project goals

- map European electricity grids with respect to performance indicators
- identify the most meaningful indicators
- develop a methodology for assessing the resources and environmental advantage delivered by fuel cells in the electricity market(s)
- derive actual performance figures in given scenarios (SFH and MFH) via simulation models using static performance figures (efficiency, turn-down ratio, etc.)
- run assessment exercises for various FC technologies in different European grids
- evaluate results and methodology
- discuss results with stakeholders in Europe in order to find a common agreement on methodology
- discuss results with US and Japanese institutions

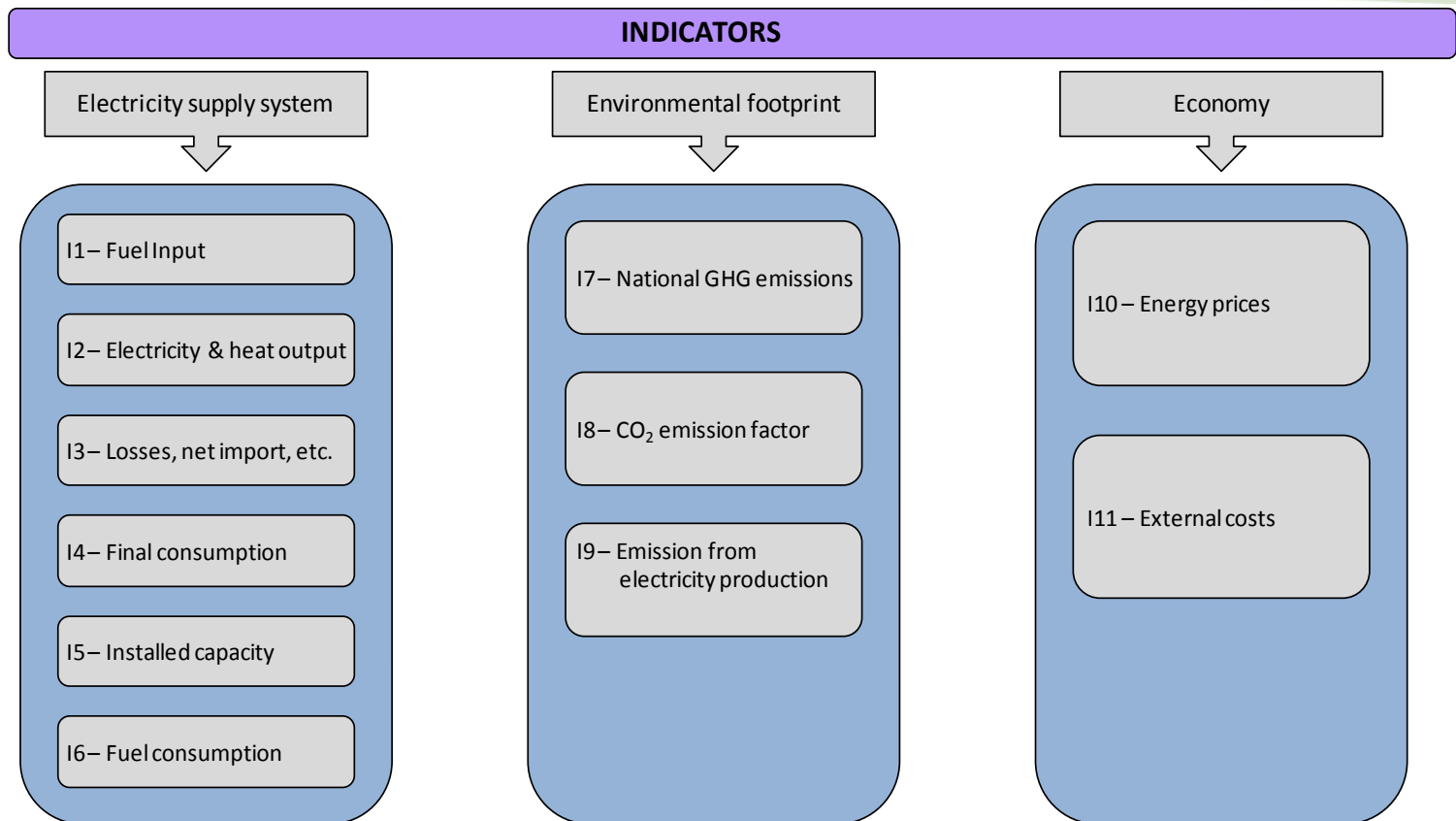
Input Data: Power Generation

- Database of system data



Input Data: Indicators

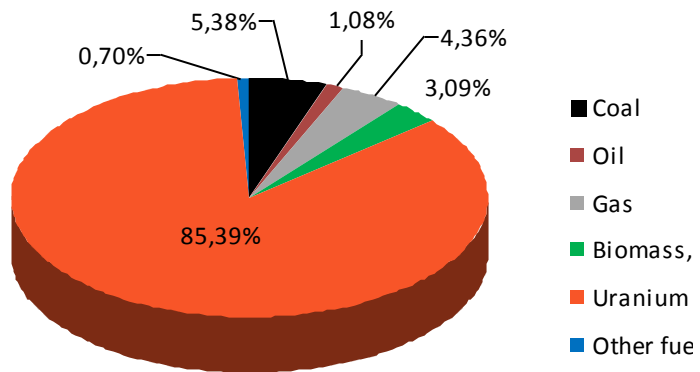
- Database of indicators: Structure



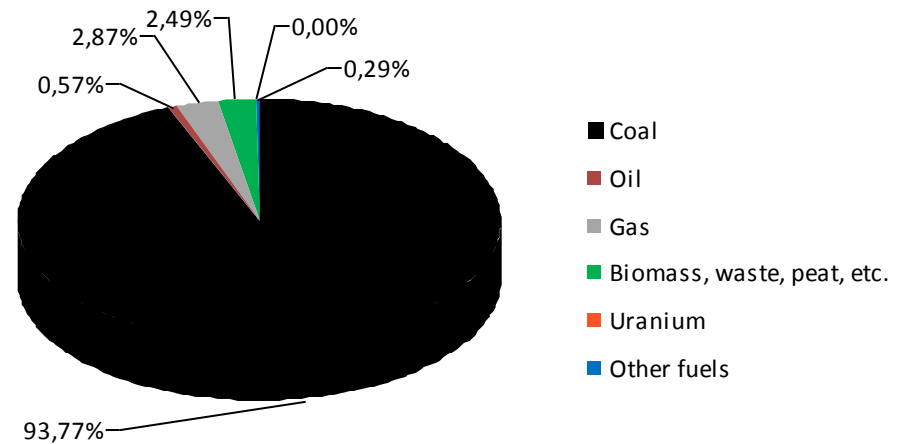
Input Data: Fuel Use in Power Generation

- Database of indicators: fuels in electricity generation

France-Total fuel input share [%]

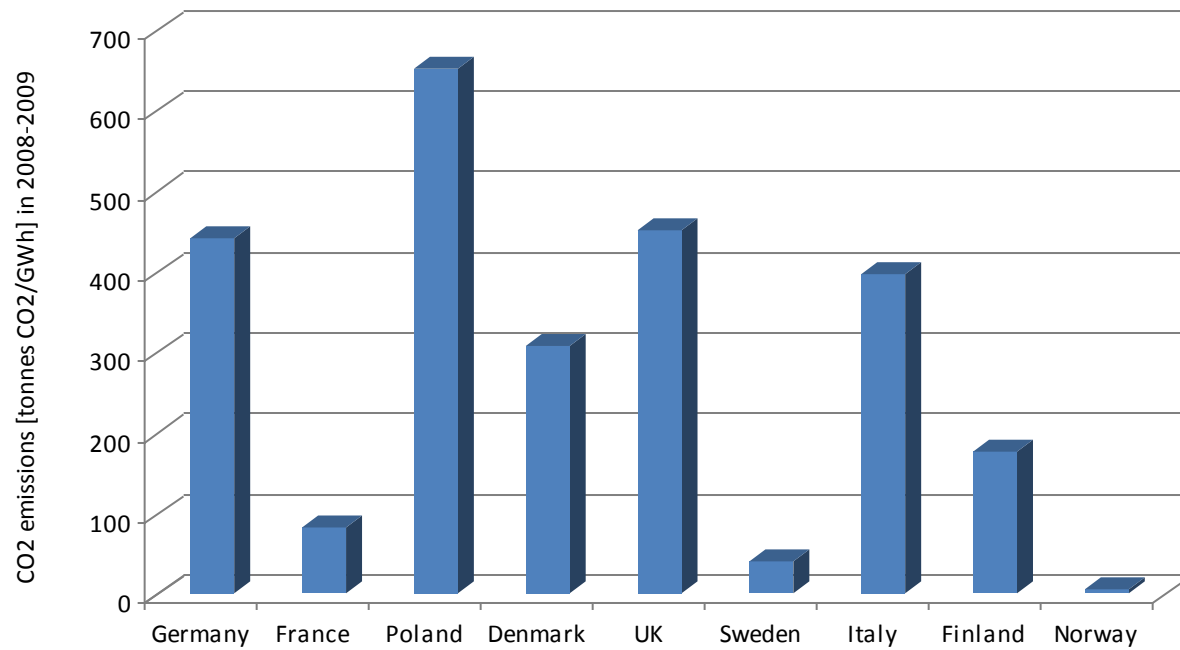


Poland-Total fuel input share [%]



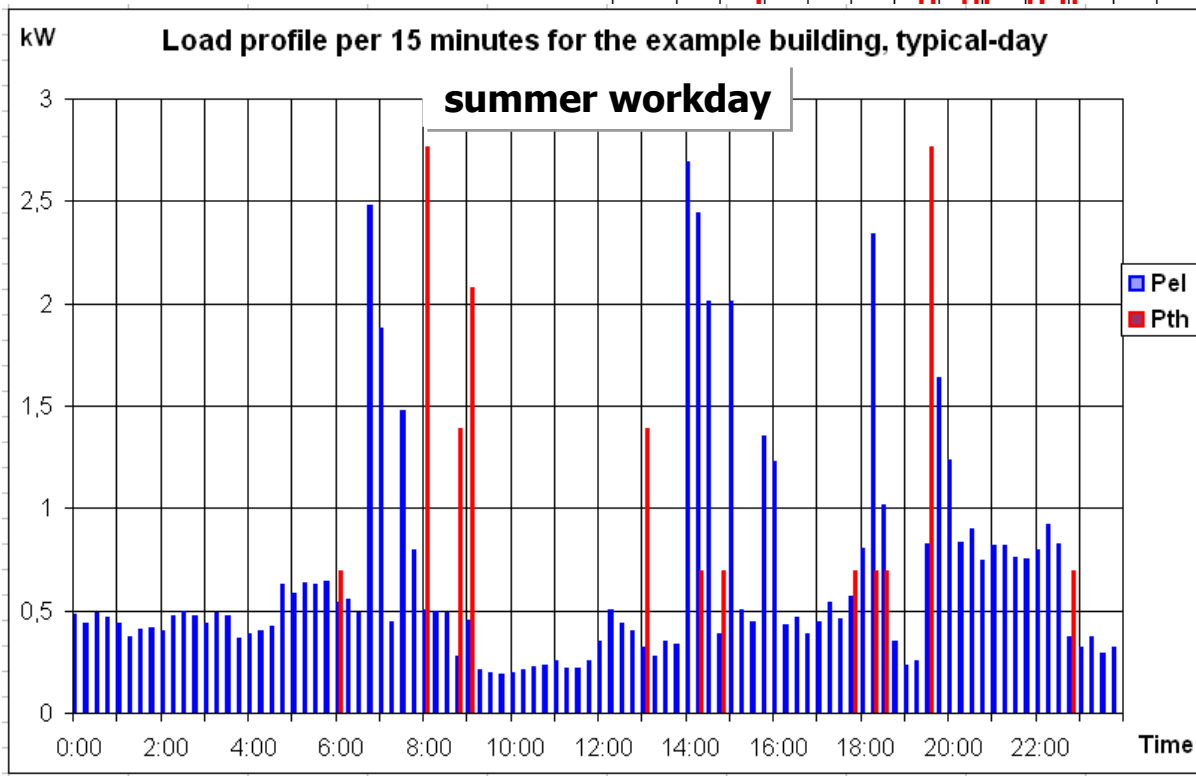
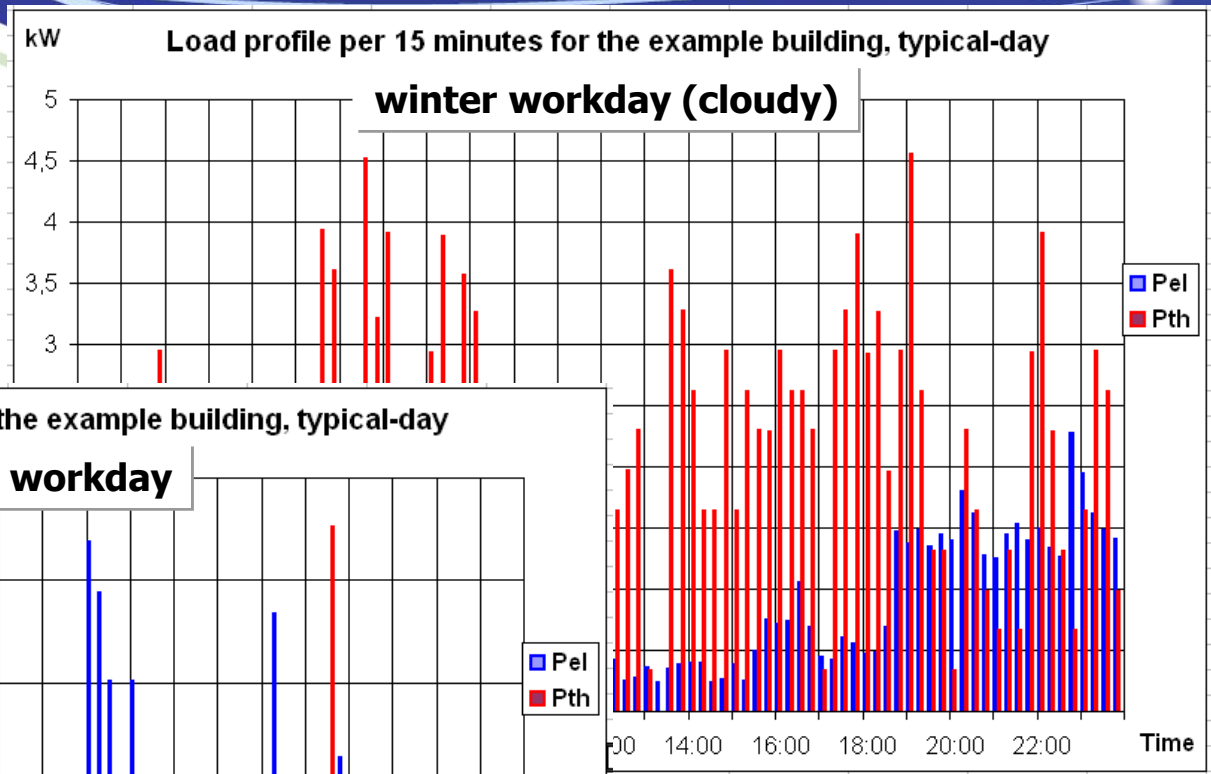
Input Data: CO₂ Emissions

- Database of indicators:
CO₂ emissions



Simulation Calculations

- calculation of FC performance under 'real' operating conditions



Time

Benchmarking Approach

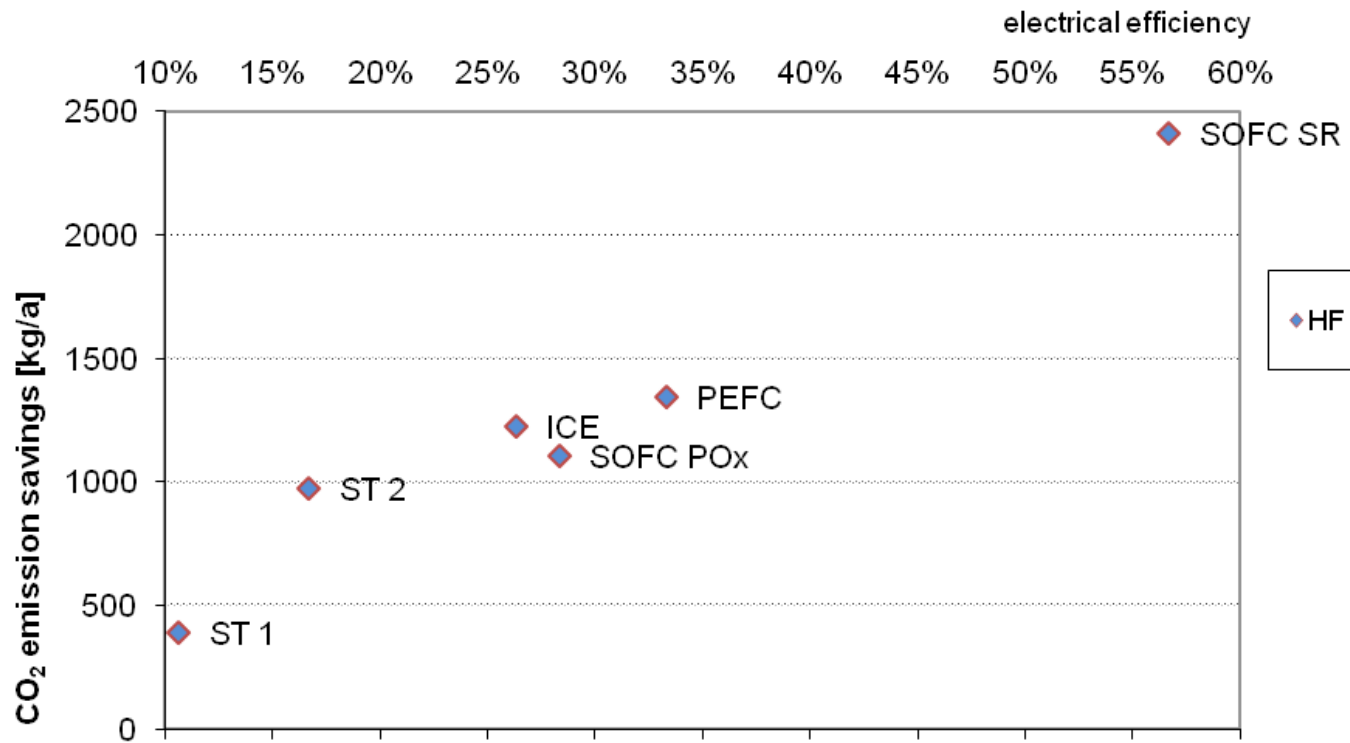
reference systems:

1. Single Family Home (SFH)
 2. Multi Family Home (MFH)
- Calculation of system performance with 1-hour time steps
 - Comparison of key figures of merit
 - * system CO₂ emission
 - * primary energy use
 - * electrical and total efficiency
 - different operating strategies: (1) heat & (2) electricity following, (3) economic optimisation
 - different CHP technologies: Stirling, ICE, PEFC, SOFC

Technology Choice

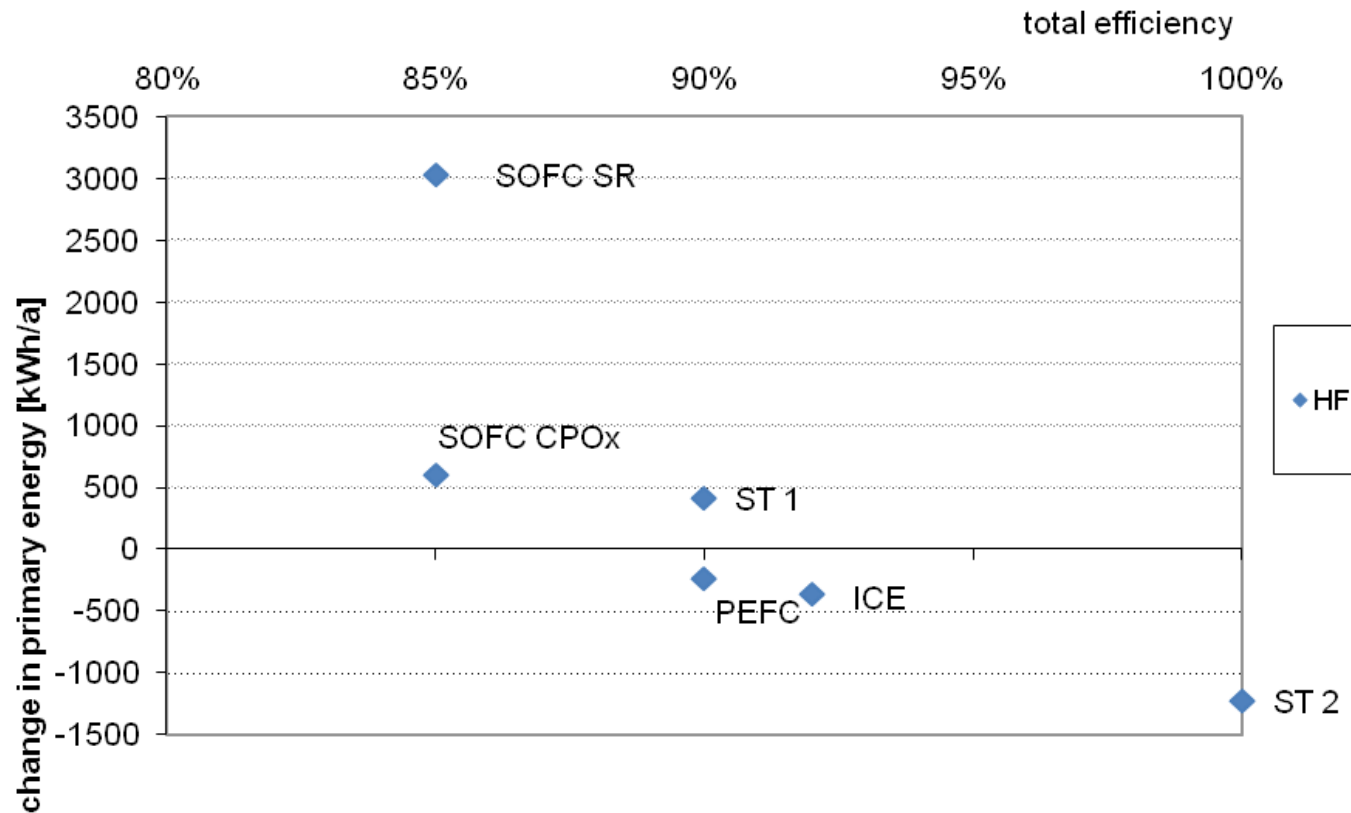
	Company	Name	Capacity		Efficiency el	Peak boiler	Total efficiency
			[kW _{el}]	[kW _{th}]	[%]	[kW _{th}]	
mCHP for residential applications							
Gas engine	SenerTec	Dachs	5.5	12.5	27		93
	ecoPOWER	ecoPower 4.7	1.3 - 4.7	4 - 12.5	24		96
	Vaillant/Honda	ecoPower 1.0	1	2,8	22,5	12 - 30	90
Stirling engine	EHE	Wispergen	1	5.5 - 7.5	11	14.5	90
	BDR	eVita	0.9	7	13	18	105
Fuel Cell	Baxi Innotec	Gamma 1.0	0.3 - 1	0.5 - 1.7	32	15	85
	Hexis	Galileo N	1	2	30	20	90
	CFCL	Blue Gen	0 - 2	0.3 - 1	60 (at 1.5kW)	20	85

Comparable System Emission Savings vs. eta el. German single family home, CHP different operation modes



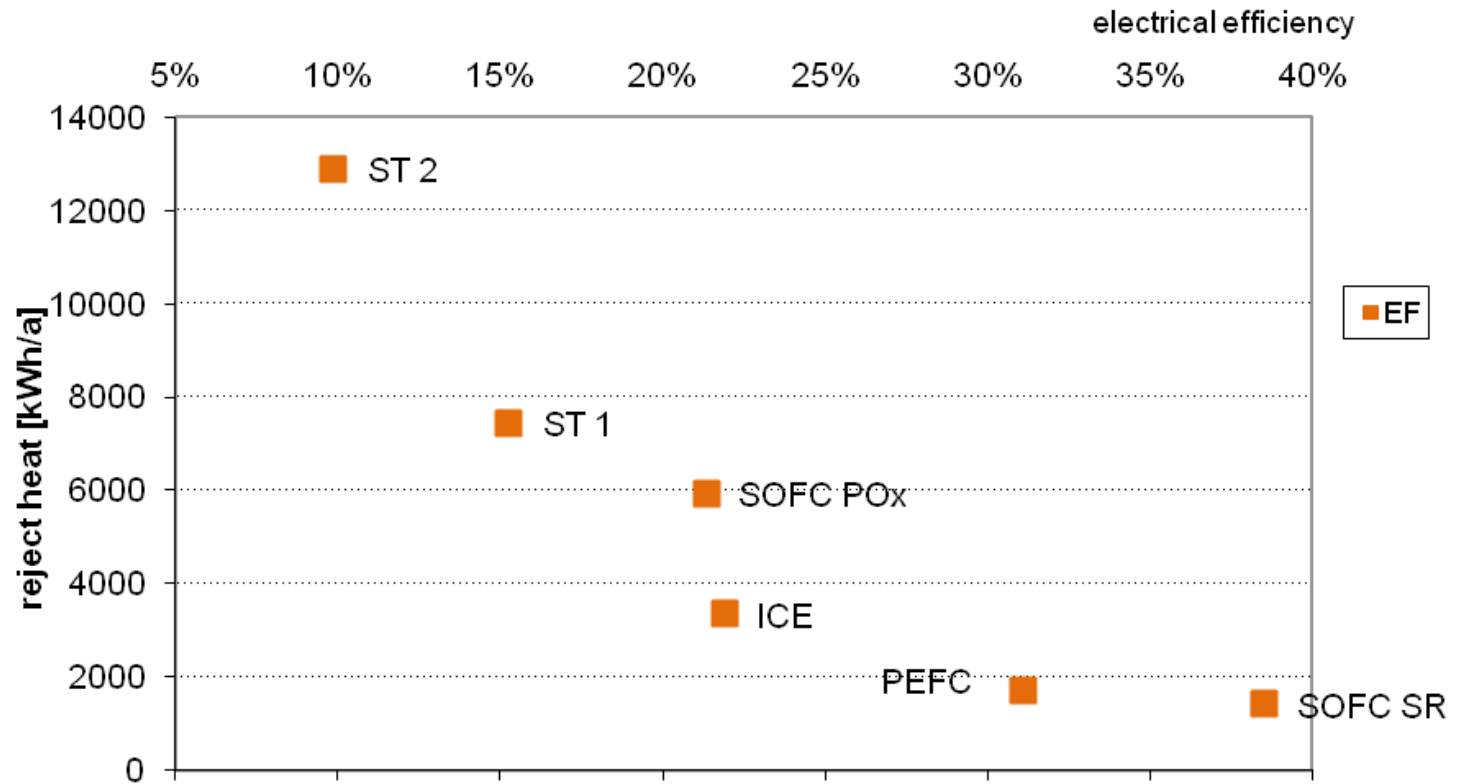
Project results (2)

Change in primary energy use vs. eta total
German single family home, CHP different operation modes

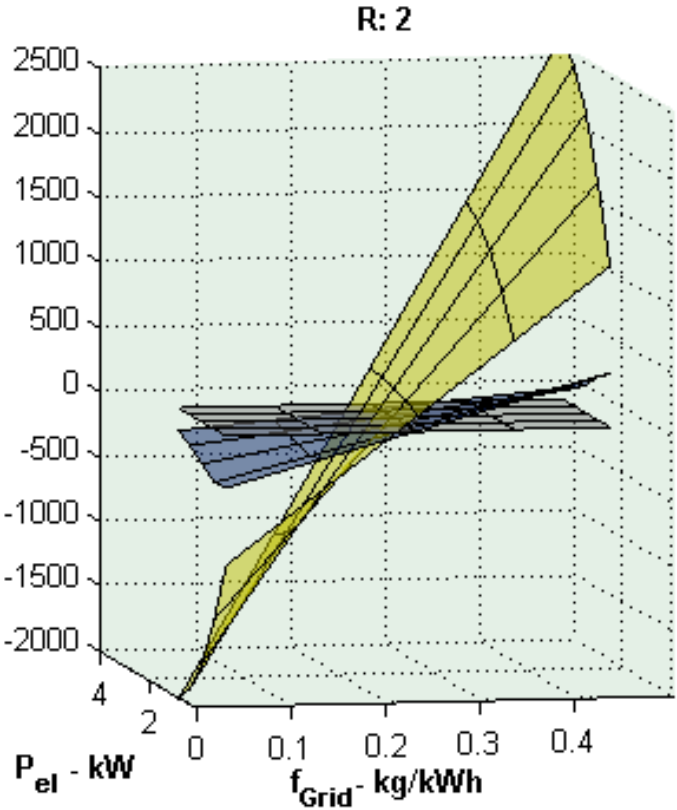
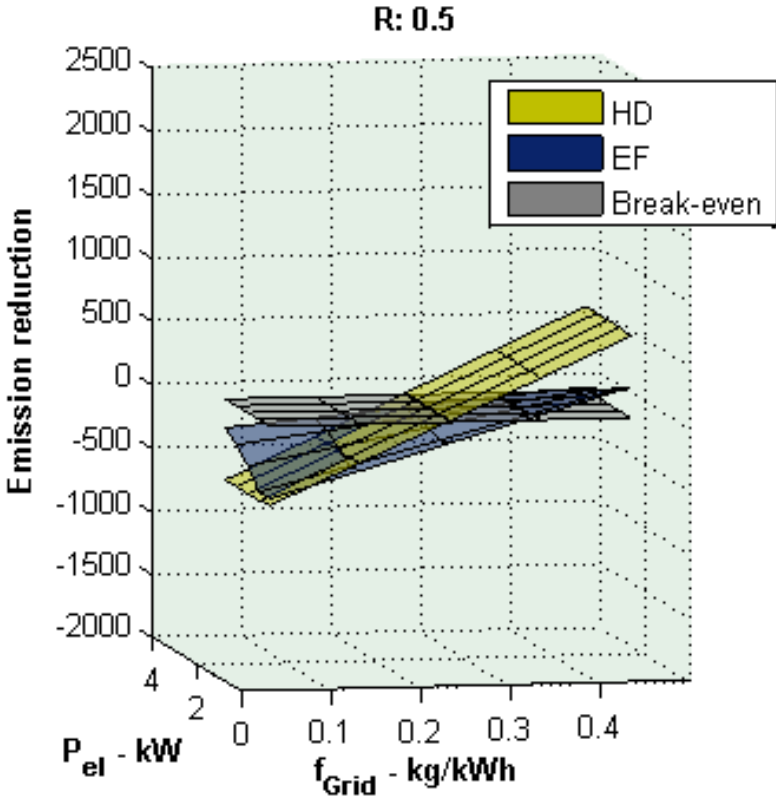


Reject Heat vs. eta el.

German single family home, CHP different operation modes



Sensitivity Analysis



Enhancing cooperation

- discussion of preliminary results with Advisory Committee (of power industry, manufacturers, stakeholder groupings etc.) in order to achieve agreements on approach and results validity and on industry approach to figures of merit
- contacts with US and Japanese institutions to exchange information on assessment approaches appears to be difficult
- Public Workshop in second half of January 2013 in Brussels

- “Notably specific technical and economic targets are to be developed and a technology benchmarking, based on a pan-European assessment, is to be performed for residential, commercial and industrial applications..”
- contribution to target-setting for AIP and MAIP and the technology assessment activities in evaluating programme progress

- report on energy efficiency and GHG impact assessment of stationary fuel cell technologies under various operating and grid constraints will be prepared for FCH JU and general public
- input to development of MAIP 2.0
- influence on current MAIP was not possible due to complexity of MAIP development process



Thank You for your Attention !