

IRD Fuel Cells A/S

- providing sustainable power and heat in Denmark and beyond



IRD in short



- Founded in 1995 in Svendborg, Denmark, as a fuelcell R&D company
- Focusing mainly on PEMFC, DMFC and PEMEC technology
- Close collaboration with a broad range of research groups locally and worldwide
- Commercial production of MEAs, flow plates, PEMFC systems and DMFC systems
- Headquarter, R&D and production in Denmark plus MEA production line in New Mexico, USA
- 30 employees



Our products



PEMFC µCHP plant

 $1.5 \text{ kW}_{AC} + 1.5 \text{ kW}_{th}$

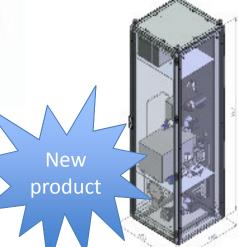


Flow plates

Any size and design



DMFC generators 500 W or 800 W



PEMEC μ-electrolyser

4.5 kW / 1 Nm³/h H₂ @ 100 bar



MEAs

Various types, applications and customised designs

Our competences



- Long-time experience and record within electrochemical devices
- Broad and extensive knowledge through a highly skilled team of scientists, chemical engineers, electronic and software engineers, mechanical engineers, production professionals, etc.
- Product and process development through ingenuity
- Flexibility adaptation to requirements from customers and public demand
- Availability of specialised facilities and a unique selection of equipment for R&D, production and testing of fuel-cell products



Product development



National and international RD&D projects with partners:

- Universities, institutions, companies
- Co-funding from government, regional and EU programmes
- Comprising all levels:
 Sub-components, components, cells, stacks, systems
- Focusing on: New materials, concepts and processes, and improvements of existing ones
- Activities including: Integration, manufacturing processes, testing, field demonstration, documentation, dissemination

Tailoring of products for customers

- Utilising knowledge to respond to user's specific needs
- Evaluating and improving



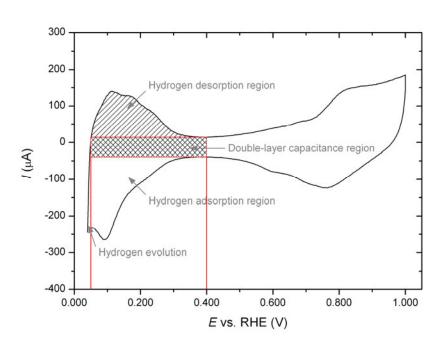
Materials R&D

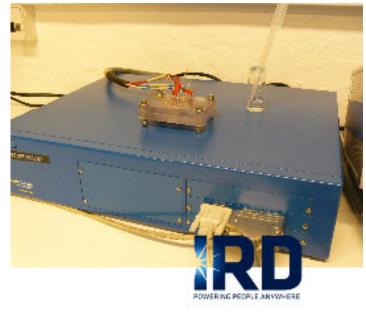


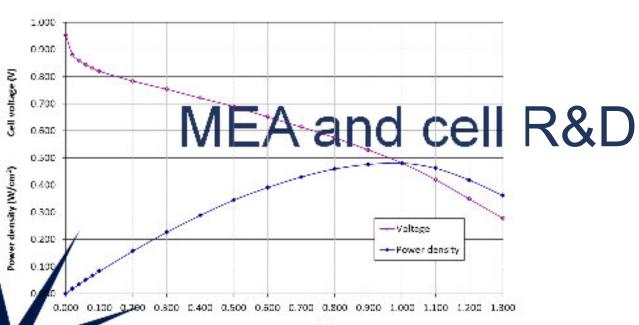
- Catalysts
- Membranes
- Ionomers
- Inks
- Backings, supports, sealing etc.



Gas Atmosphere N ₂ s	deg. C
Rotating Speed (M HCIO ₄
ш † 1s1s 1.5 V	atureted
III † ++++ 1.0 Y) rpm
- oc	OC OC

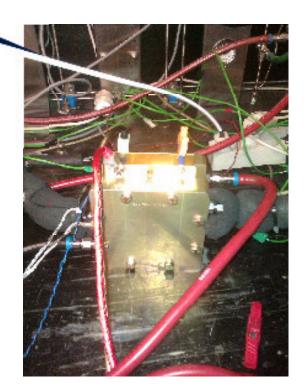








Current density (A/cm²)





Production





- Production sites in Denmark and the USA
- We manufacture, supply and market MEA and flow plate components to fuel-cell developers, manufacturers and OEMs. Customers in the USA, Europe and Asia including Japan
- We build PEMFC, DMFC and PEMEC systems for sale
- The MEA production is suitable for customised prototype manufacturing
 for customers who require pre-commercial volumes, as well as for reliable
 supply within a large-scale manufacturing framework. We work closely
 with key OEMs on advanced materials and designs and develop solutions –
 materials and fabrication methods. We offer comprehensive technical
 support and fast prototyping
- The flow-plate production is based on low-cost press moulding for high-volume serial production and on CNC machining for small-series/prototype plates.
 We focus on high quality and supply reliability within a large-scale manufacturing framework.





μCHP system



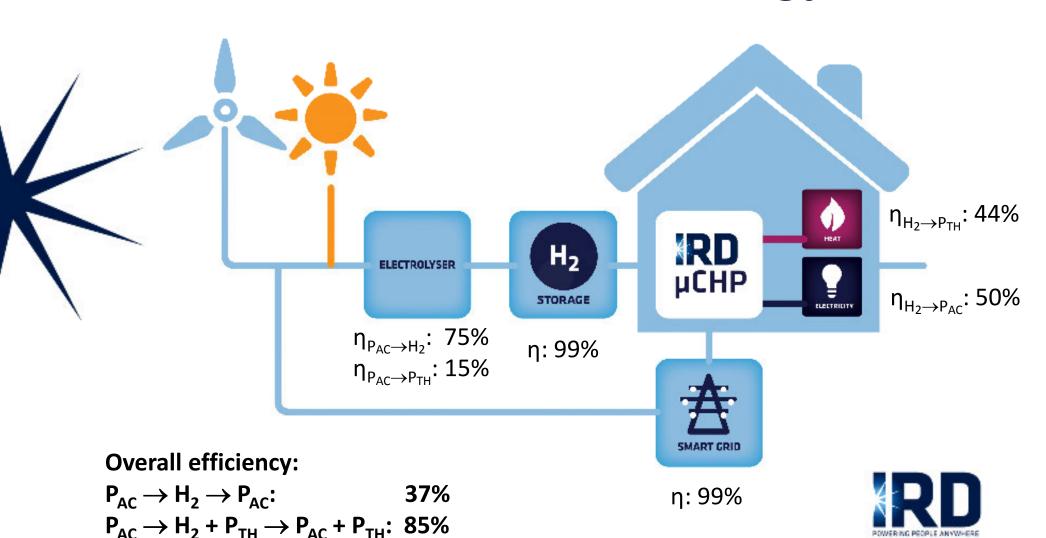


Product facts:

Nominal Power	1	.5 kW _{AC}
Power range	0.9 - 2	.0 kW _{AC}
Nominal Heat	1	I.5 kW _{th}
Heat range	0.8 - 2	$2.0~\mathrm{kW_{th}}$
Electrical efficiency (H	$H_2 - P_{AC}$	47 %
Heat efficiency (H ₂ - I	P_{th})	47 %
Combined efficiency		94 %
Ready-mode Power		15 W _{AC}



H₂-based renewable energy vision



H₂-based renewable energy vision









Hydrogen roll-out in Denmark



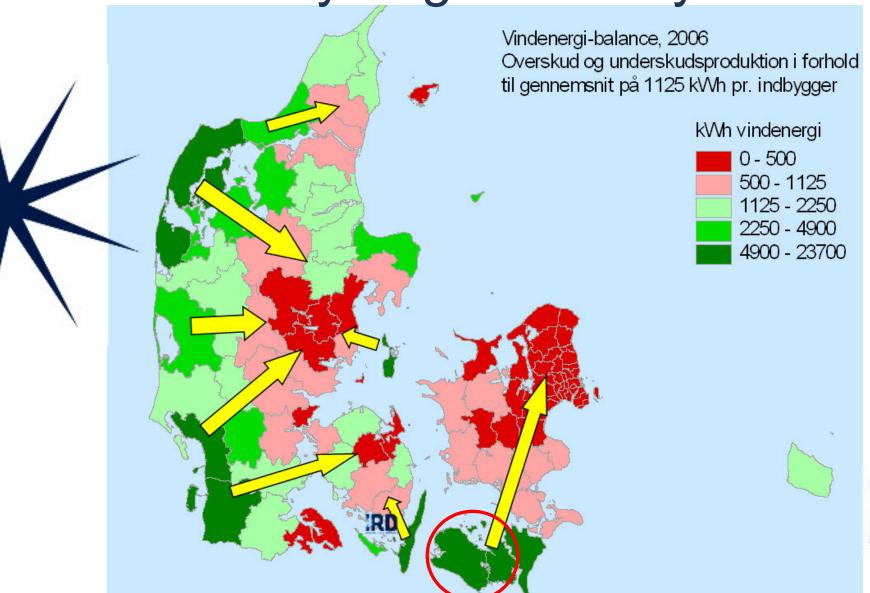
Large Danish fuel-cell µCHP demonstration project 2006–2014

- Installation of fuel-cell units in houses to provide electricity and heat
- The target houses are outside the district-heating and natural-gas grids
- The fuel-cell units replace oil boilers
- Partners: Fuel-cell manufacturers, utility companies, municipalities and others
- Co-funded by the Danish authorities





The hydrogen society





The hydrogen society

Case 1: Vestenskov – 200 inhabitants The issue:

- The island of Lolland produces 5 times more wind power than it consumes.
- No storage still dependent on fossil fuels.

The solution:

- Excess wind power produces hydrogen in an electrolysis plant
- Stored in a central tank.
- Supplying household µCHP systems with hydrogen when needed.

Case 2: Danish outskirts (Lolland Falster, ...)

- Oil burners to be replaced according to new energy law
- Potential in the region: at least 10.000 units (households)
- IRD can deliver from 2014

Case 3: Export

Scotland, Japan, Korea, Norway, Belgium, France, ...











- Pioneers in a new world



2008: Installation and opening

IRD's first combined heat and power plants were installed in Vestenskov, where a groundbreaking hydrogen community is being developed.

2012: Hydrogen village version 2.0

Vestenskov increases the number of participating households from 5 to 32. The host families are pioneers in the future power system.















Building a hydrogen village







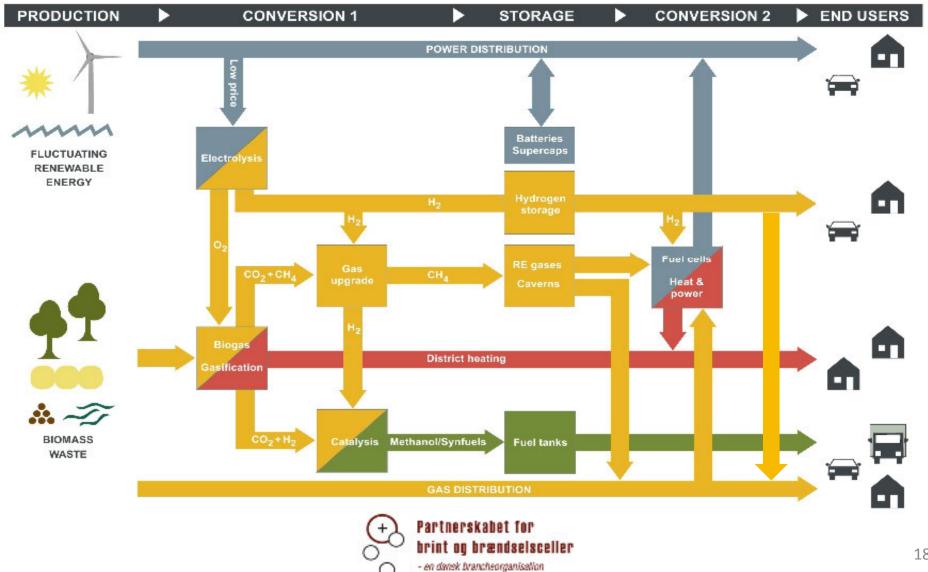


100 m

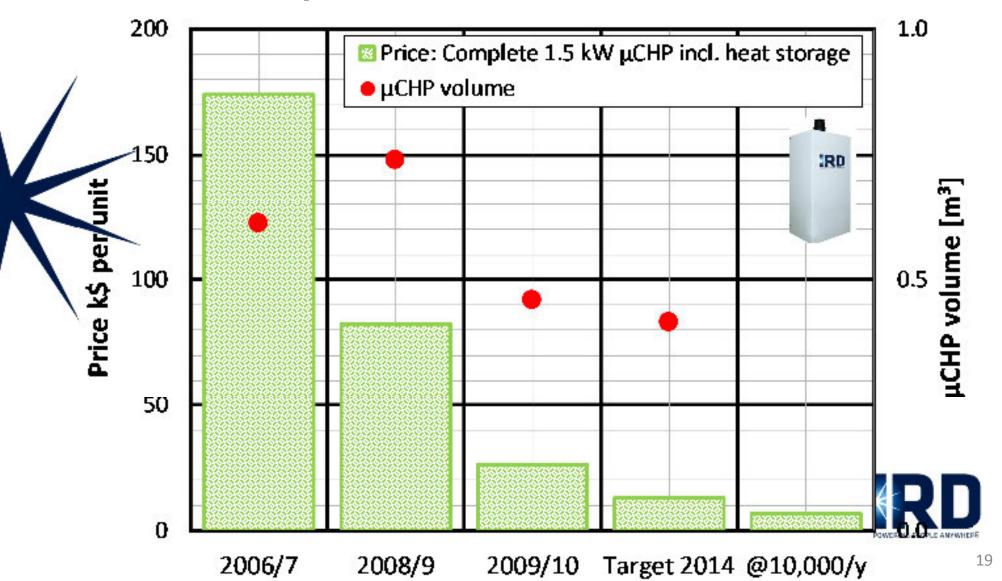




Hydrogen society – the vision



The price





We provide sustainable power to people – anywhere

We acknowledge co-funding of the μ CHP development:

Danish µCHP project, 2006-2014:

Phase 1: Danish Public Service Obligations, Energinet.dk (contract no. 2006-1-6295)

Phase 2: Danish Energy Agency (EFP-Akt.167 j.no. 033001/33033-0151

Phase 3: Danish Energy Agency (EFP-Akt.167 j.no. 033001/33033-0333)

The CanDan HUX, 2009-2014:

Danish Public Service Obligations, Energinet.dk (contract no 2009) 10245

KeePEMAlive, 2010-2013:

EU (FCH-JU-2008-1 GA 245113) & Energia - 4 - 10444

Competitive µCHP for H2omes_2021

Danish Energy Agency (ECO) 1-1.no. 64011-0051

