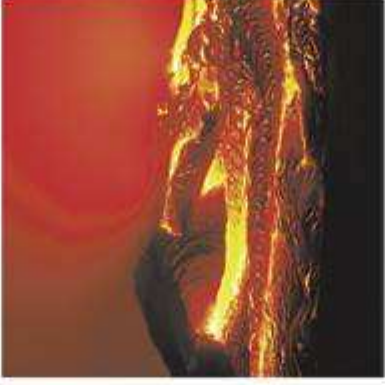


 - Caring for the energy of tomorrow



Focus. Trust. Initiative.

Dantherm Power at HTAC, DOE

Dr. Per Balslev
February 17th 2011

Dantherm Power at HTAC

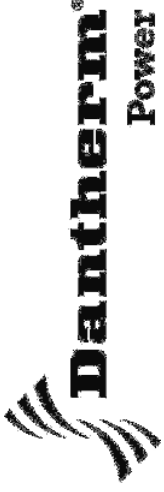


Outline

1. Dantherm Power A/S
2. Telecom back up power
3. Micro CHP
4. Wind and fuel cells
5. Cross Atlantic activities



Dantherm Power A/S



January 2007 (Dantherm Air Handling A/S Spin off)

Location: Hobro, Denmark

Employees: 43

CEO: Per Albæk

Business focus: R&D, Engineering, Sales and Service

Manufacturing: Dantherm Air Handling A/S facility in DK

Dantherm Power Inc.

Co-located at: Dantherm Air Handling Inc.

Spartanburg, South Carolina

Established Sept. 2008

Sales and service

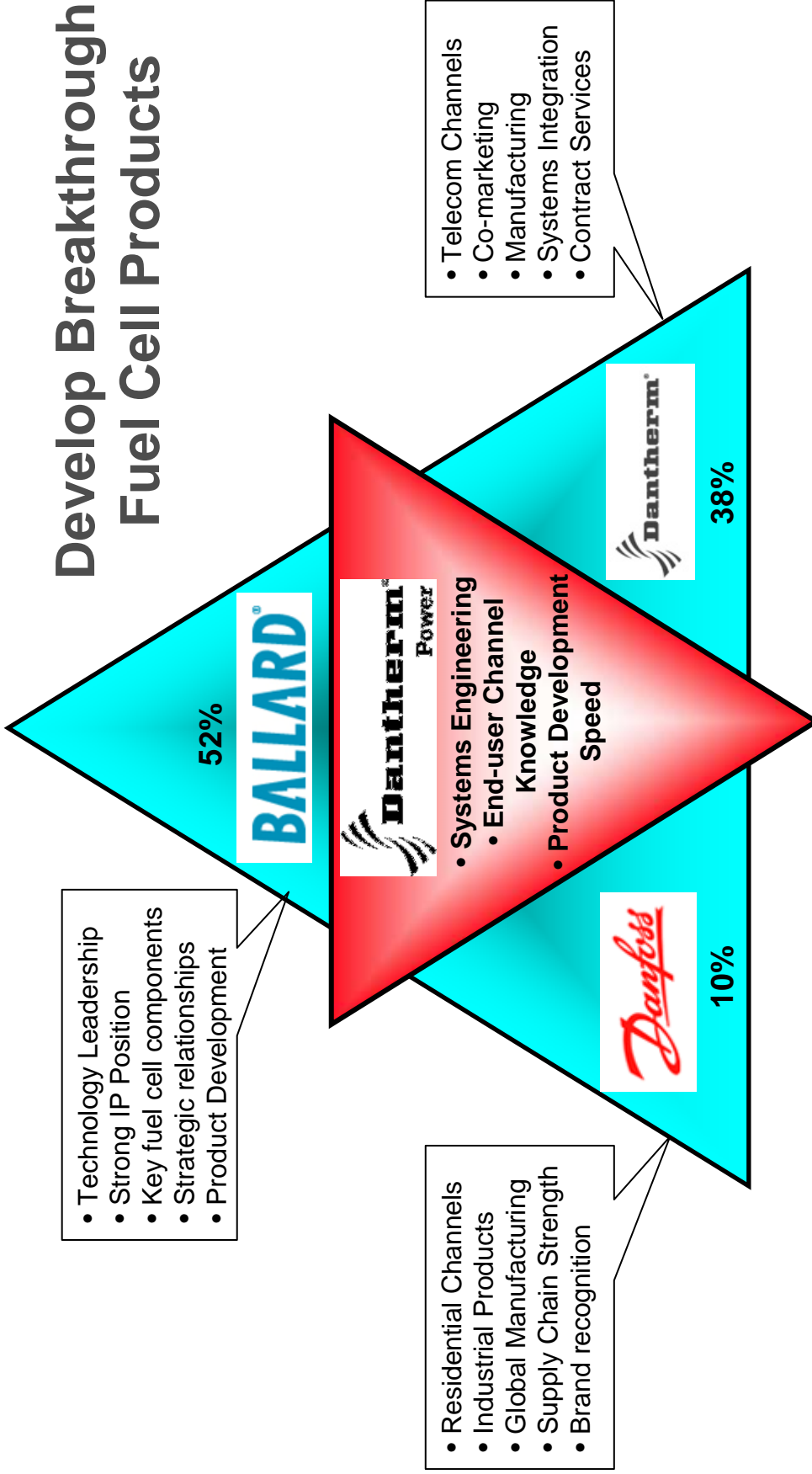
Offices: Toronto, Canada; New York, US



Dantherm Power at HTAC



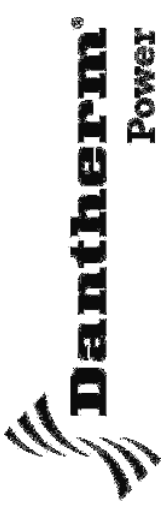
Develop Breakthrough Fuel Cell Products



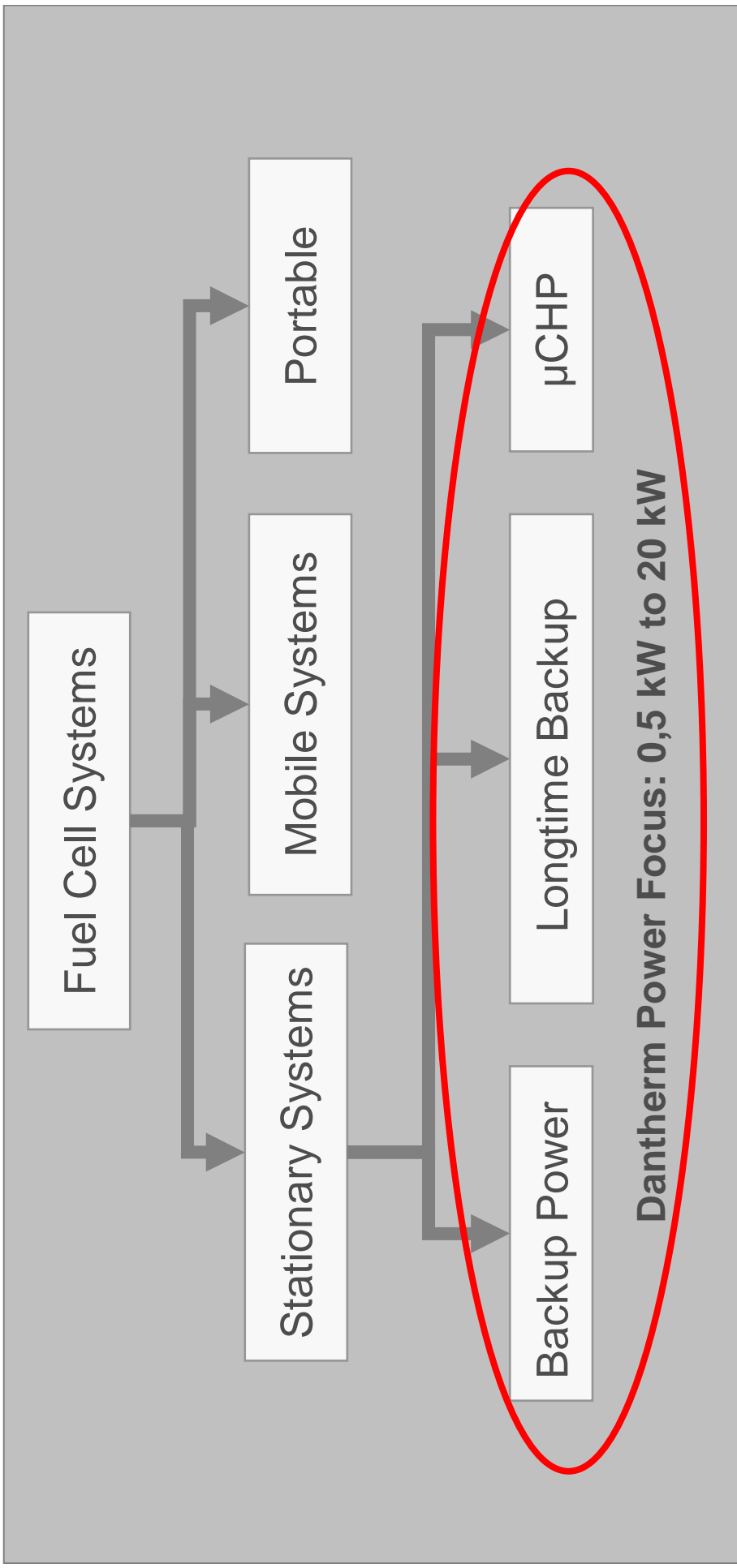
Small, focused company with partners bringing significant value



Dantherm Power at HTAC



Dantherm Powers Markets for Fuel Cell System



Dantherm Power at HTAC

Status

- **Commercial power backup system:**
 - To date around 1 MW shipped in units primarily in 2 kW systems.
 - Fully commercial line production of fuel cell systems with our sister company, Dantherm Air Handling.
 - Largest commercial project to date is the Danish Emergency Network (Tetra) where 125 fuel cell systems are installed.
- **Field test of mCHP systems:**
 - Delivered 9 units. SOFC system running on natural gas. Next generation SOFC system under development, 2 units expected deployed March 2011.
 - 5 units HT-PEM systems installed. 11 units waiting for installation.
 - 3 LT-PEM on natural gas ready to be installed February 2011
- **Power Plant**
 - 100 kW power plant for grid balancing delivered to BC Hydro. After 4 months of successful testing at Powertech Labs the system is now being installed in Bella Coola - a small remote community north of Vancouver.



Line production of DIB 2000.



Power Backup Module DIB 2000.



SOFC mCHP system.



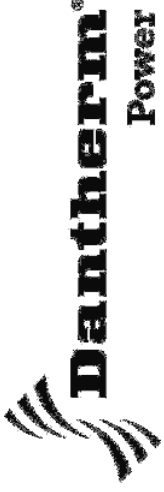
100 kW installation in Bella Coola.



100 kW testing at Powertech.



Production of backup power modules



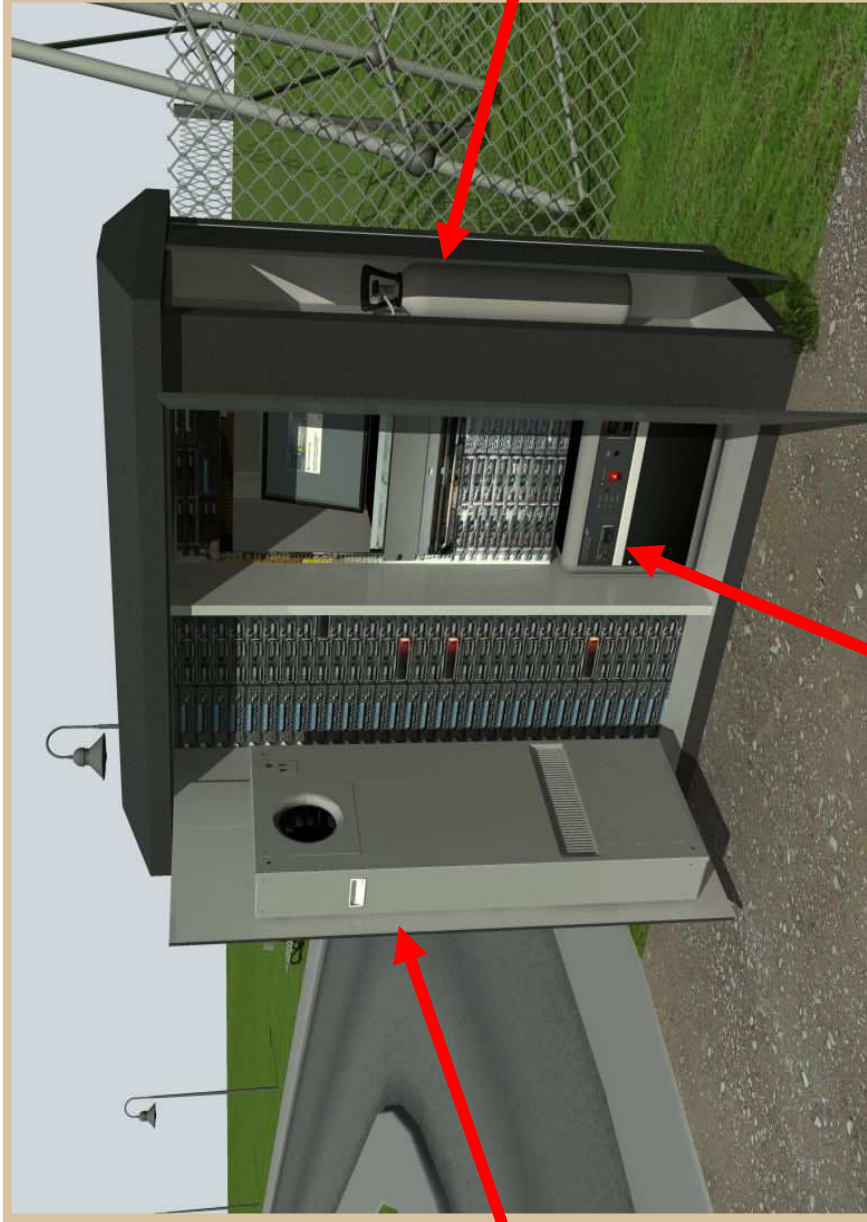
- Serial production of the backup systems take place at Dantherm Air Handling in Skive
- Assembly line production with several stations ensures high quality and repeatability
- Full traceability on all major components within the unit
- All units are tested by use of PC-tester.
- All test records are stored at Dantherm Power linked to its serial number
- Packing takes place at the last station at the line



Dantherm Power at HTAC



The integrated solutions



Optional climate control solution for cabinets and shelters

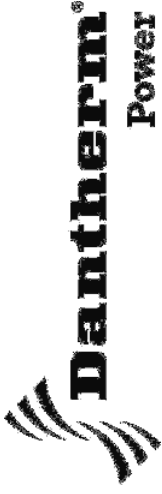
- Hydrogen storage using compressed hydrogen in cylinders including hydrogen monitoring equipment

- Methanol tank with monitoring equipment in combination with a methanol reformer

Power Supply module with integrated UPS or power backup and reformer integrated when running on methanol



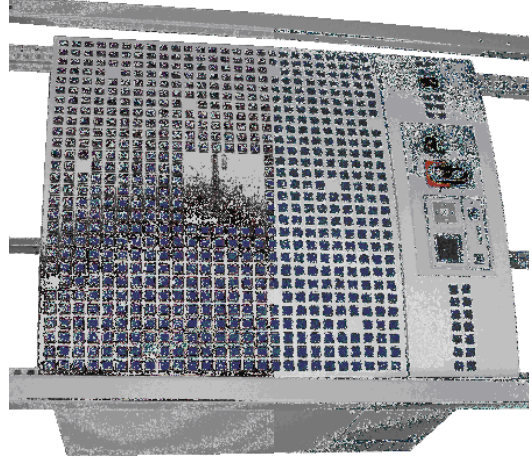
Dantherm Power at HTAC



Power Generator/Backup Solutions
development since 2003



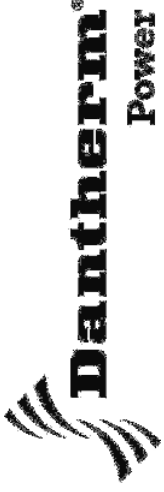
DBX2000: 1.7 kW backup power



DBX5000: 5 kW backup power



Dantherm Power at HTAC

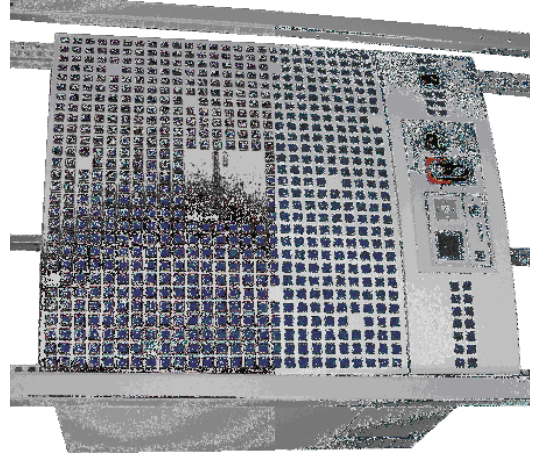


Products available now

DBX2000	
Important Note	DBX requires fresh air supply and ducting of exhaust air to outside ambient. DBX can only work when equipped with Dantherm Power Valve Block and a fuel regulator supplied by or approved by Dantherm Power
System capacity	
Power output	W _e 1676
Voltage output	VDC 45 - 57
Voltage input	VAC For Standby operation 90 - 264 / 50-60 Hz
Fuel	
Hydrogen purity (H ₂)	% Min. 99,95
Inlet Pressure	Barg Nominal to Valve Block 5
Consumption	Nm ³ /kWh Average at max. load 0,87
Physical	
Ambient Temperature	°C Operational (optional) -20 (-40) - +40 (+45)
Internal Temperature	°C Operational 0 - +60
Storage Temperature	°C Weather protected -45 - +70
Unit dimensions	mm H x W x D 355 x 446 x 628
Weight	kg Each module 40
DBX5000	
Important Note	DBX requires fresh air supply and ducting of exhaust air to outside ambient. DBX can only work when equipped with Dantherm Power Valve Block and a fuel regulator supplied by or approved by Dantherm Power
System capacity	
Power output	W _e 5000
Voltage output	VDC 47 to -57
Voltage input	VAC For standby operation 90 - 264 / 50-60 Hz
Fuel	
Hydrogen purity (H ₂)	% Min. 99,95
Inlet Pressure	Barg Nominal to Valve Block 5
Consumption	Nm ³ /kWh Average at max. load 0,95
Physical	
Ambient Temperature	°C Operational (optional) -20 (-40) to +40 (-55)
Integration cabinet Temperature	°C Operational 0 to +60
Storage Temperature	°C Weather protected -45 - +70
Cabinet dimensions	mm H x W x D 611 x 500 (450) x 555
Weight	Kg Stand alone module 75 Kg
Ingress Protection	IP-class External to internal 55
Air flow	m ³ /h Exhaust to outside 200-1600



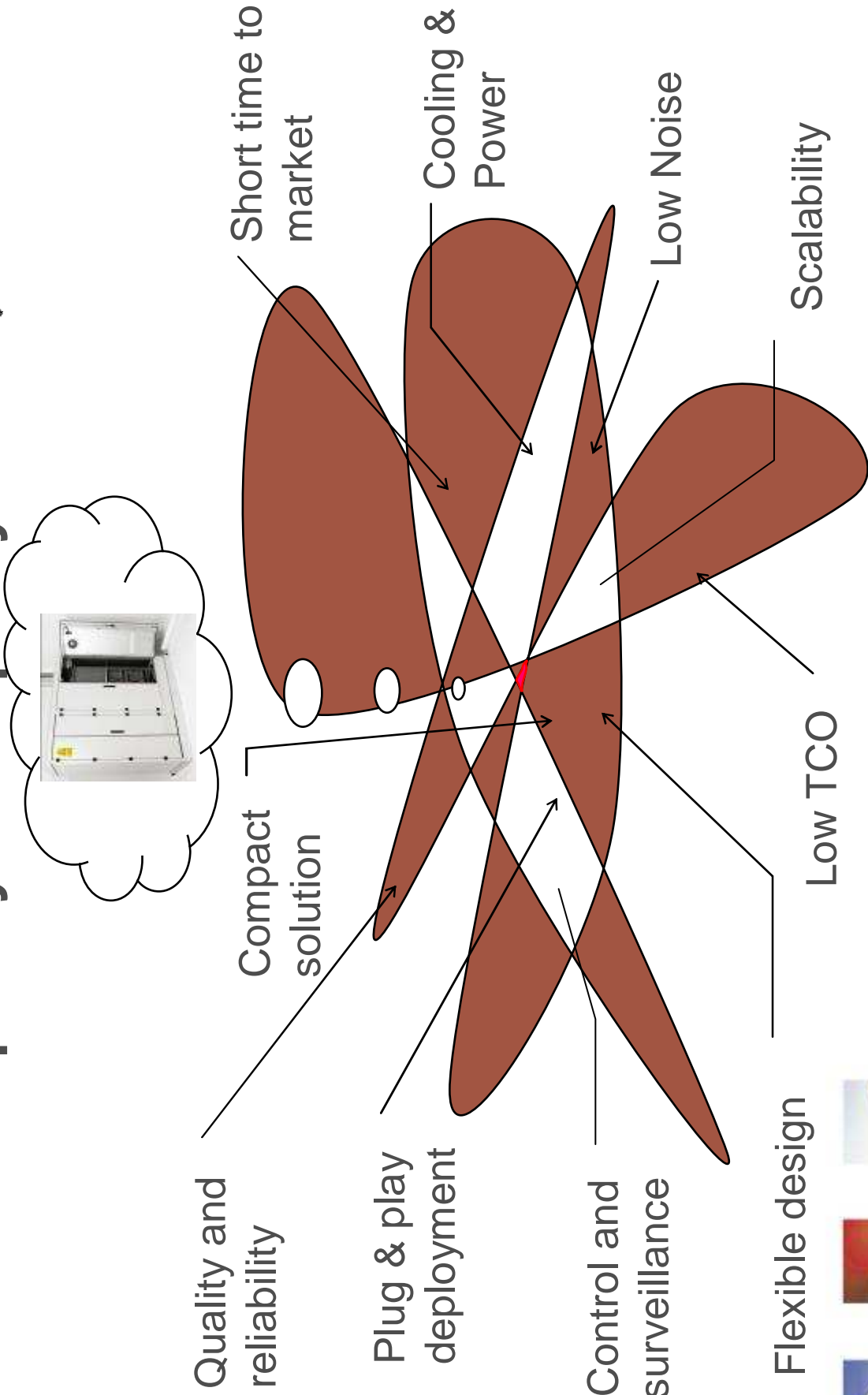
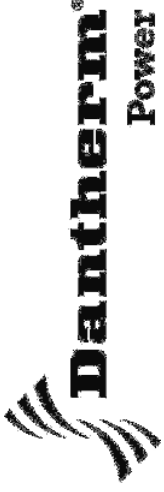
DBX2000: 1.7 kW backup power



DBX5000: 5 kW backup power



We take Fuel cell based systems from complexity to simplicity...



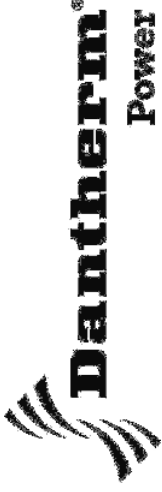


Emergency network - TETRA

- Tetra is used by firefighters, police, ambulances, defense,.... in a closed encrypted network.
- Tetra is a digital radio communication system
 - substituting existing talkie talkie systems
- Tetra has many advantages:
 - enabling joint operations
 - enabling text messages
 - enabling central coordination



Dantherm Power Application



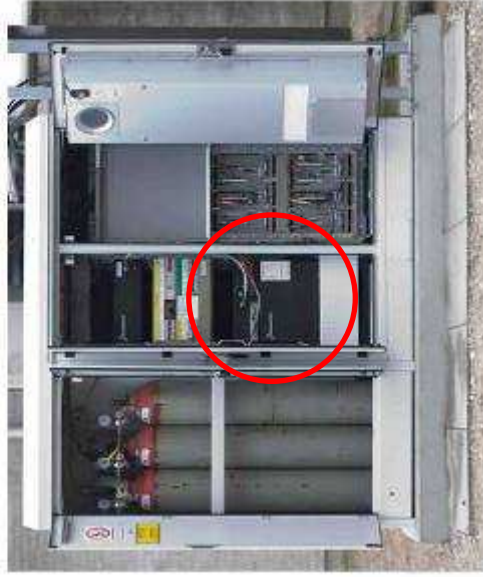
Motorola Delivers TETRA Solution with Innovative Fuel Cell Backup Power to Denmark's SINE Network

Robust, environmentally-friendly TETRA solution backed up by fuel cell technology

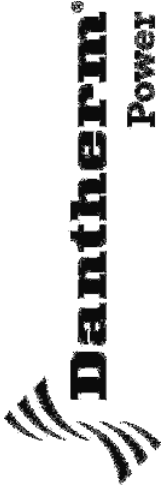
***GLOSTRUP, Denmark – 30 June, 2009 -** Motorola, Inc. (NYSE: MOT) today announced that a total of forty Motorola TETRA Base Stations with fuel cell back-up are now live across Denmark's SINE public safety network, with approximately 50 planned and commissioned for installation throughout the remainder of the year.

The environmentally friendly, fuel cell-based back-up solution, which was developed with Dantherm Power, was installed to provide mission-critical operations with continuous secure communication across the nationwide SINE network in Denmark. It is the first network of its kind in the world.

"The use of our hydrogen fuel cell technology in mission-critical environments provides public safety networks across the country with uninterrupted network access," says Per Albæk, CEO for Dantherm Power. "Our partnership with Motorola is a world's first and we hope to continue developing innovative technology that helps professionals do their jobs more effectively."



Dantherm Power at HTAC



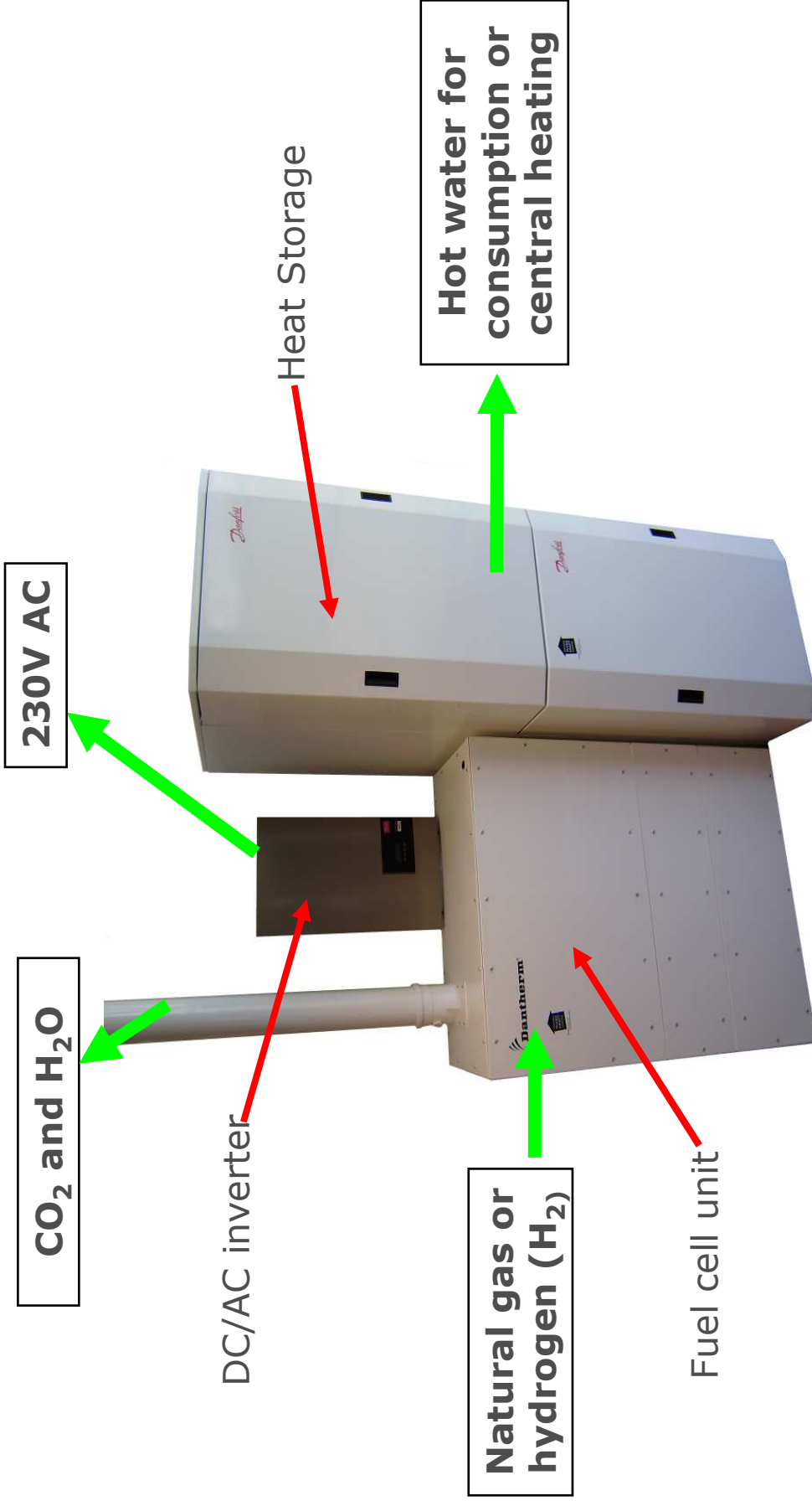
Fuel cell backup power in the DK SINE Network



Due to security reasons the specific locations are not correct in this map



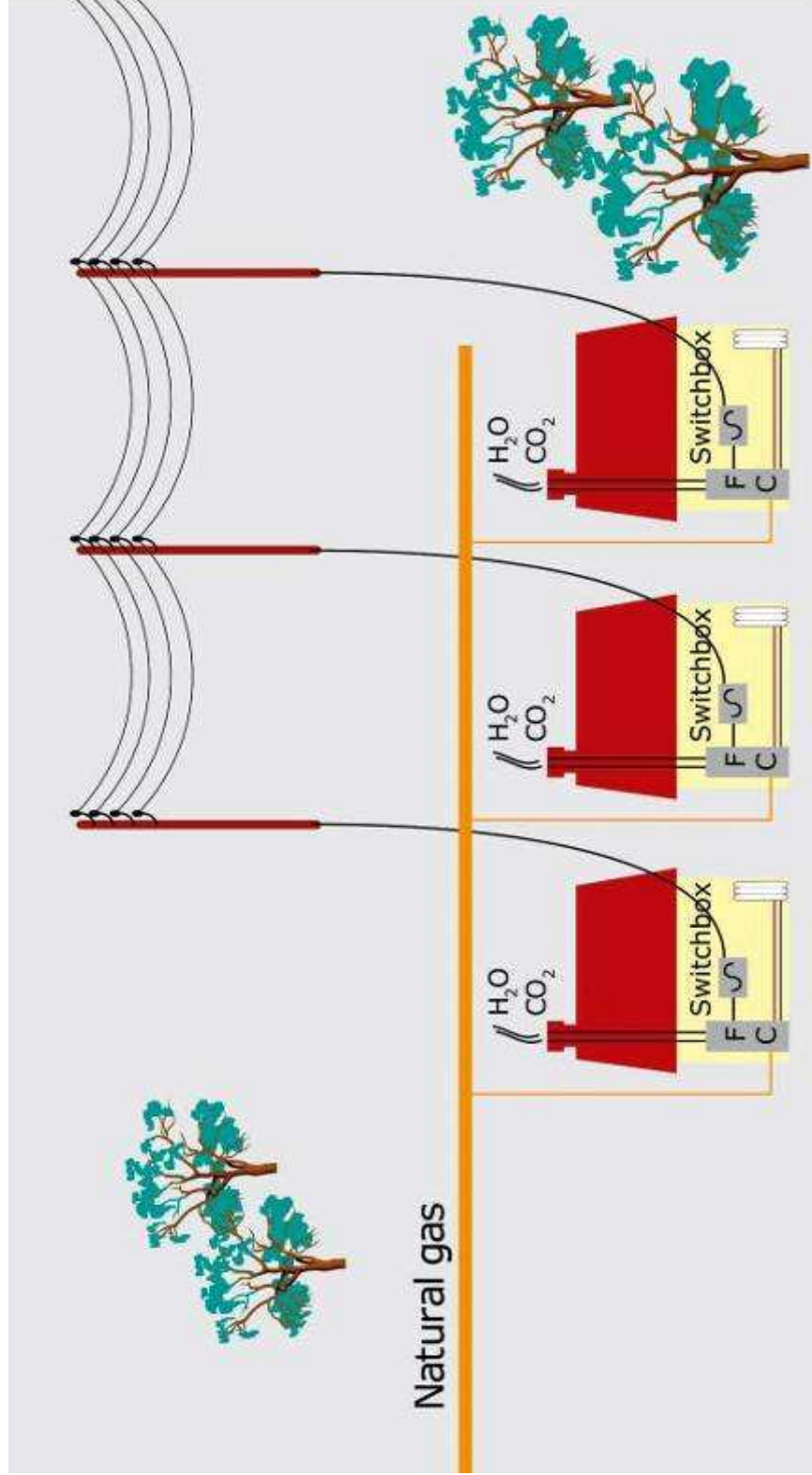
A Danish demonstrations project on fuel cell based micro CHP



A Danish demonstration project on fuel cell based micro CHP



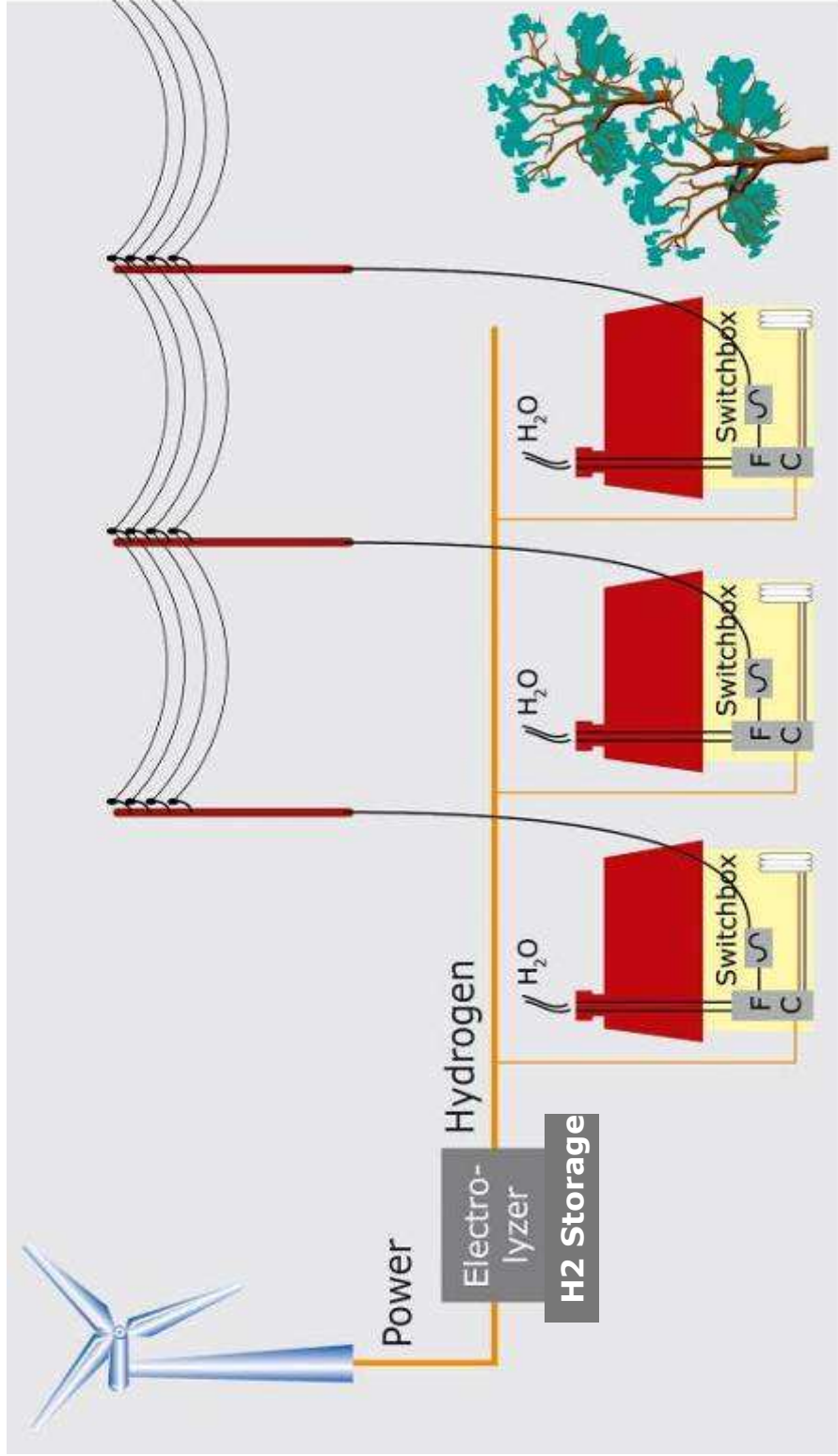
Demonstration of Fuel cell micro CHP fueled by natural gas based on LT-PEM and SOFC



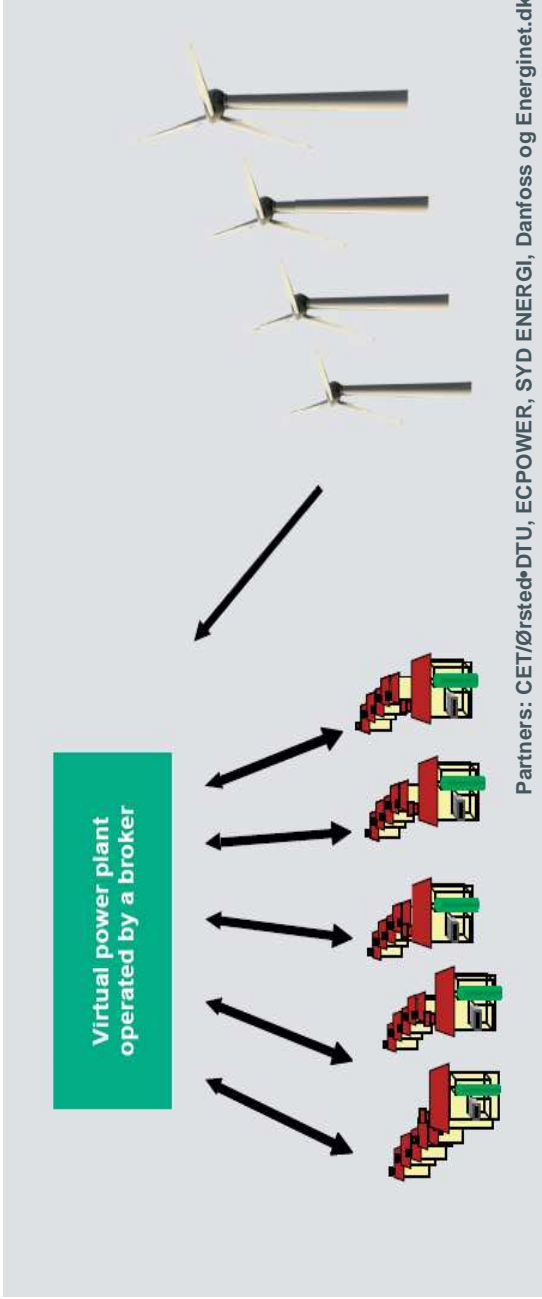
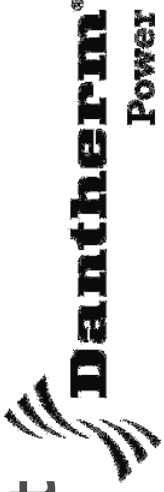
A Danish demonstration project on fuel cell based micro CHP



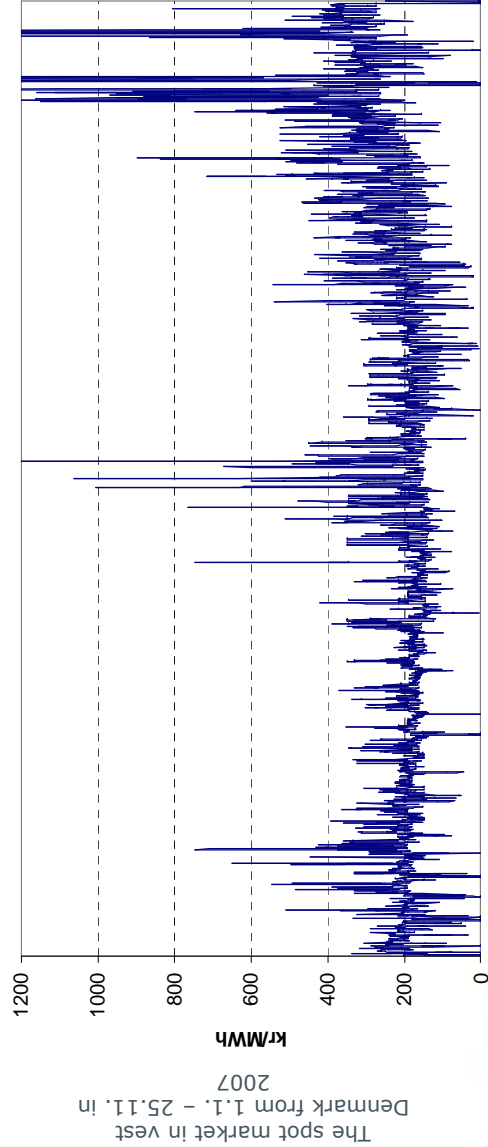
Demonstration of Fuel cell micro CHP fueled by hydrogen based on LT-PEM



A Danish demonstrations project on fuel cell based micro CHP



Virtual Power Plant: Power from μ CHP can supplement wind turbines in periods with little wind.



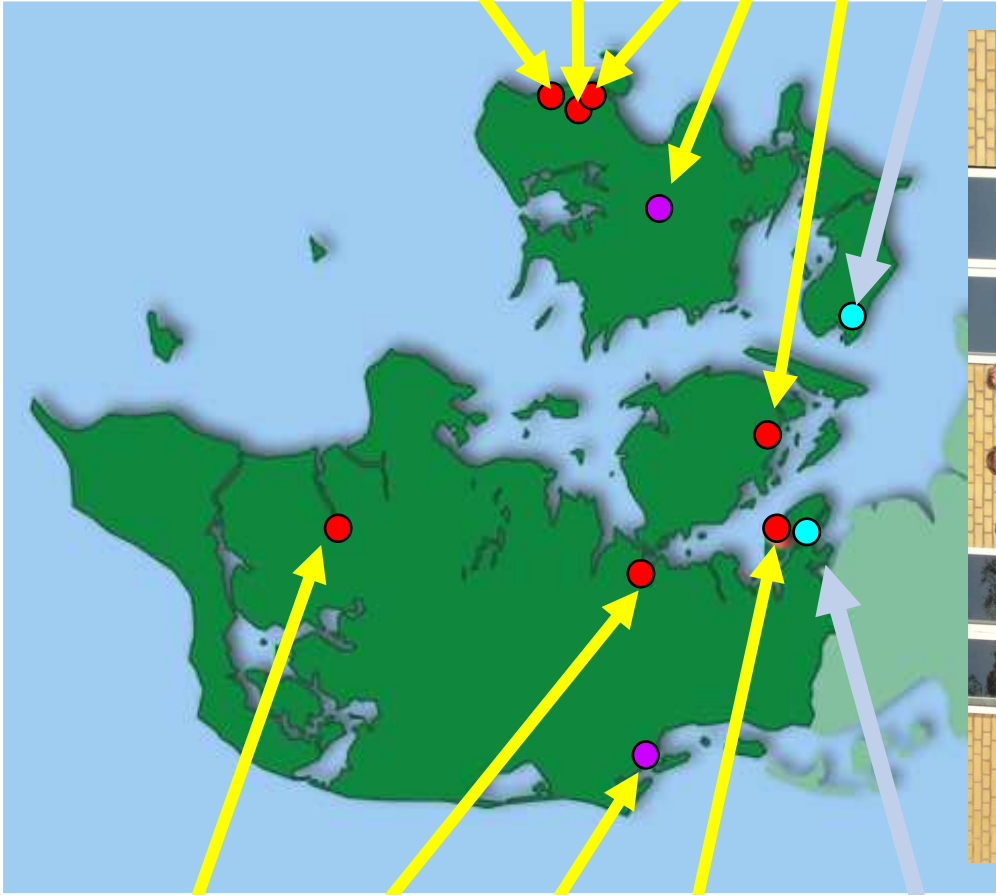
A Danish demonstrations project on fuel cell based micro CHP



Project sponsors:
ENERGINET/DK



Sønderborg



TOPSOE FUEL CELL

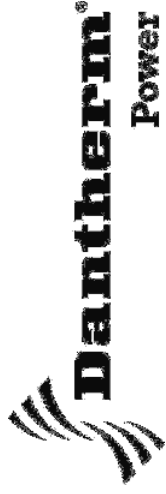


Lolland



Heat & Power from Fuel Cells

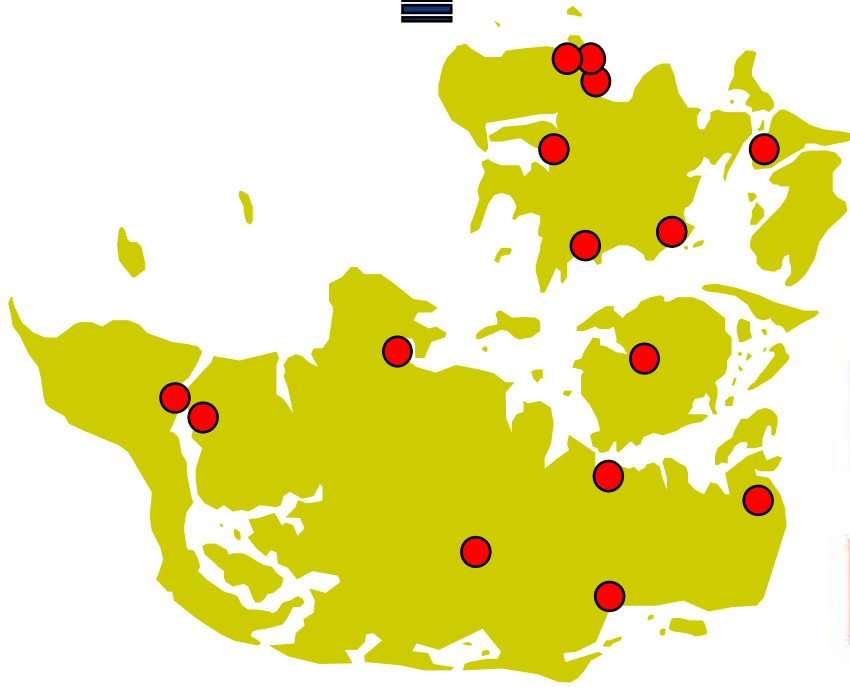
Distributed production of electricity in DK



Development since the 1980s

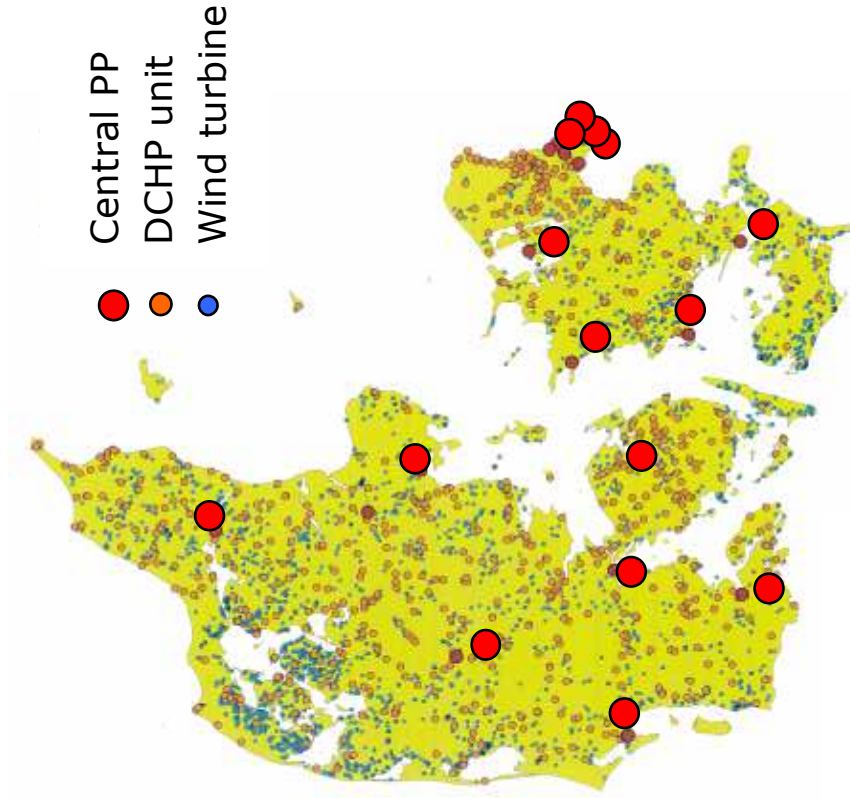
1980

Central Power Plants



2010

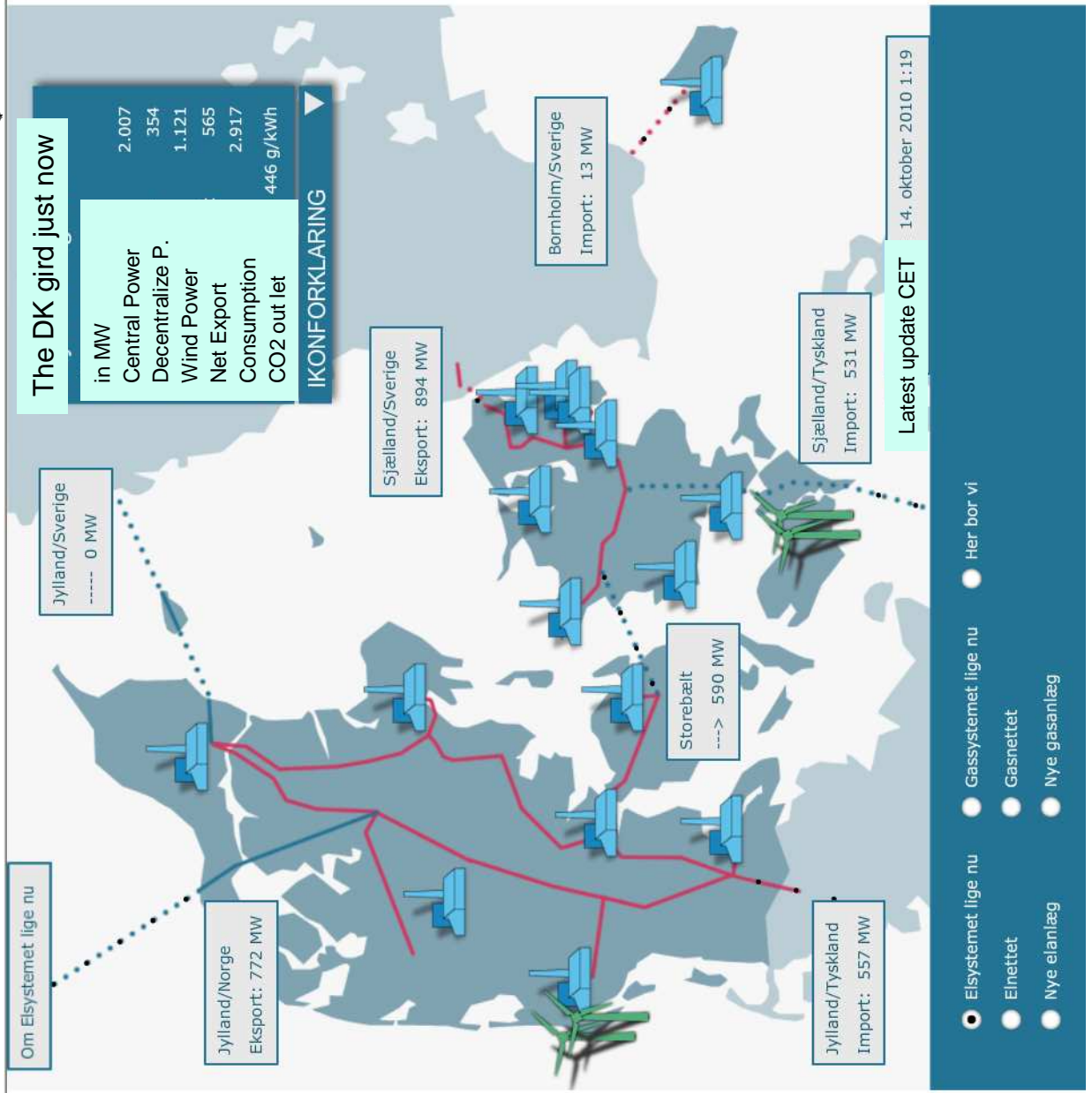
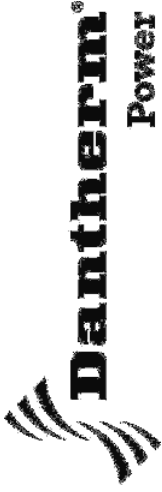
Locale Power Plants



- Central PP
- DCHP unit
- Wind turbine



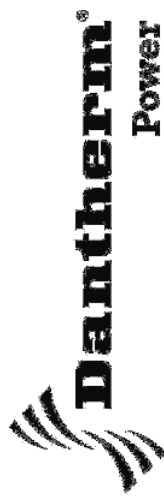
The electrical grid in Denmark



Copy right ENERGINET/DK



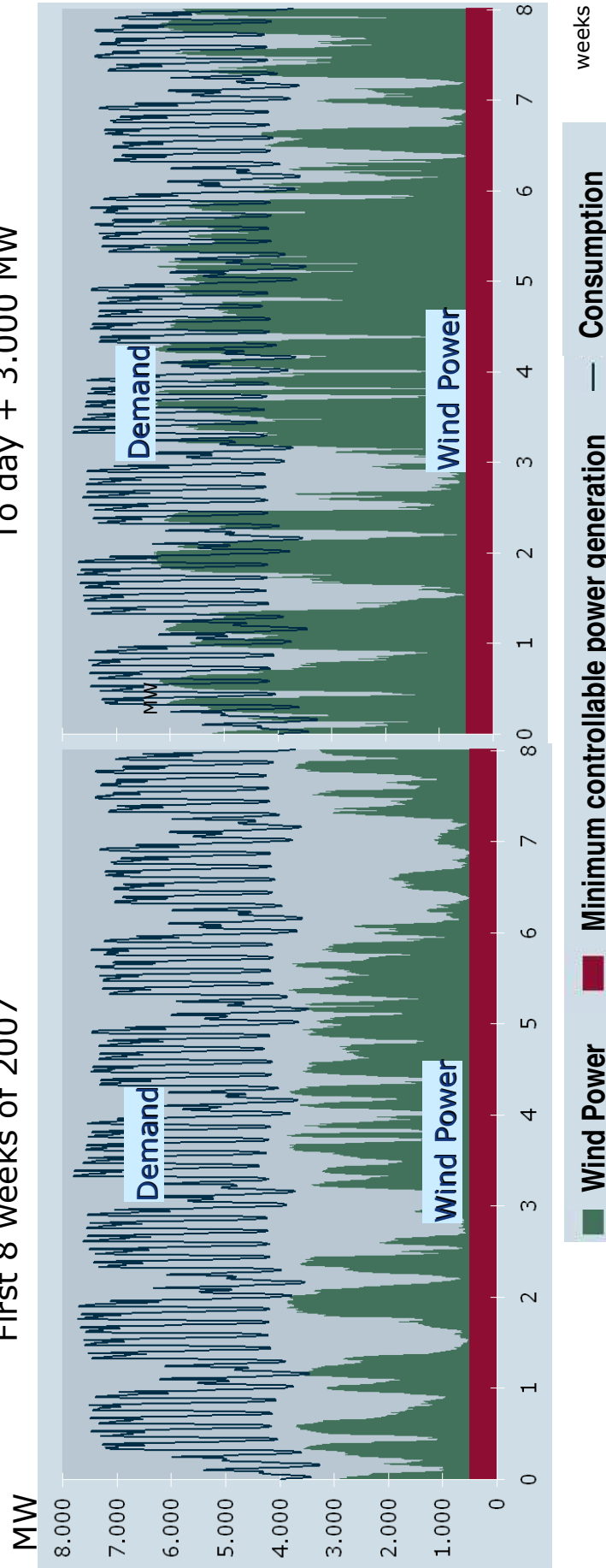
Wind Power in Denmark



Integration of extra 3,000 MW wind power?

First 8 weeks of 2007

To day + 3.000 MW



© Dantherm Power A/S

20110217

Per Balslev

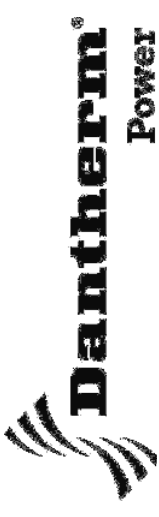
Denmark must utilize **domestic resources** and **trade with neighbors**.

Security of supply must be maintained and the value of wind power should be maximized ecological and economical

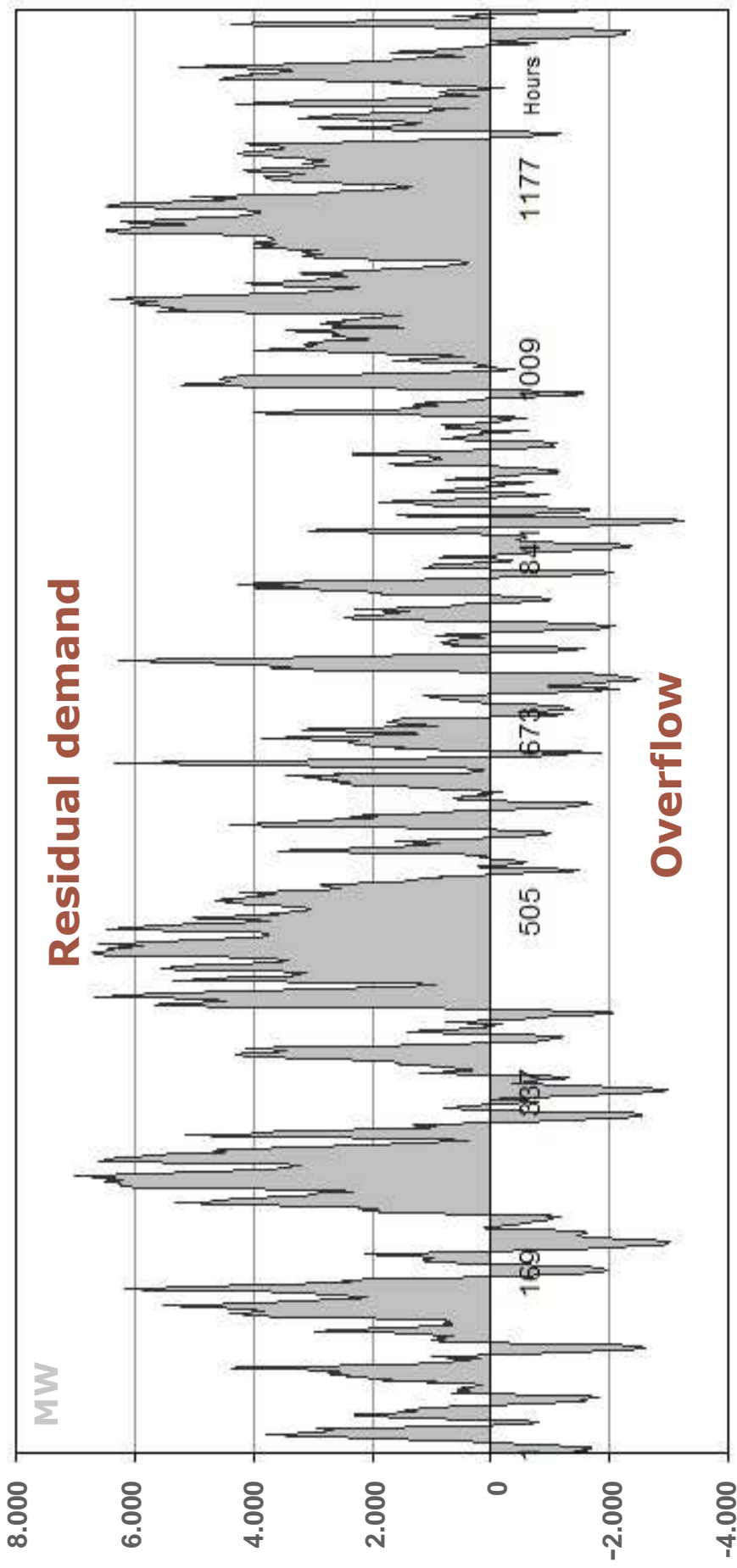


Copy right **ENERGINET/DK**

Wind Power in Denmark



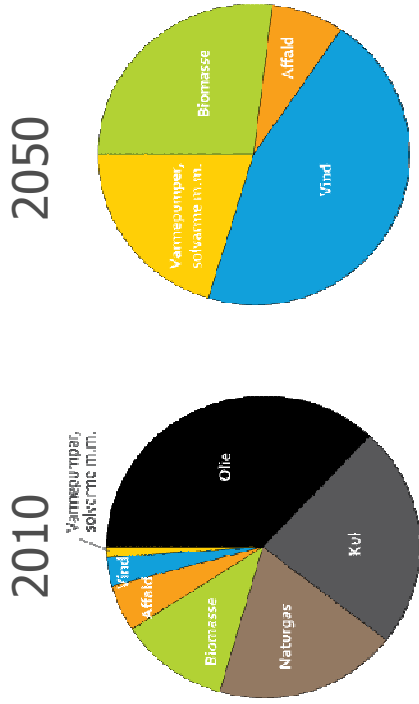
Residual market first 8 weeks 2007



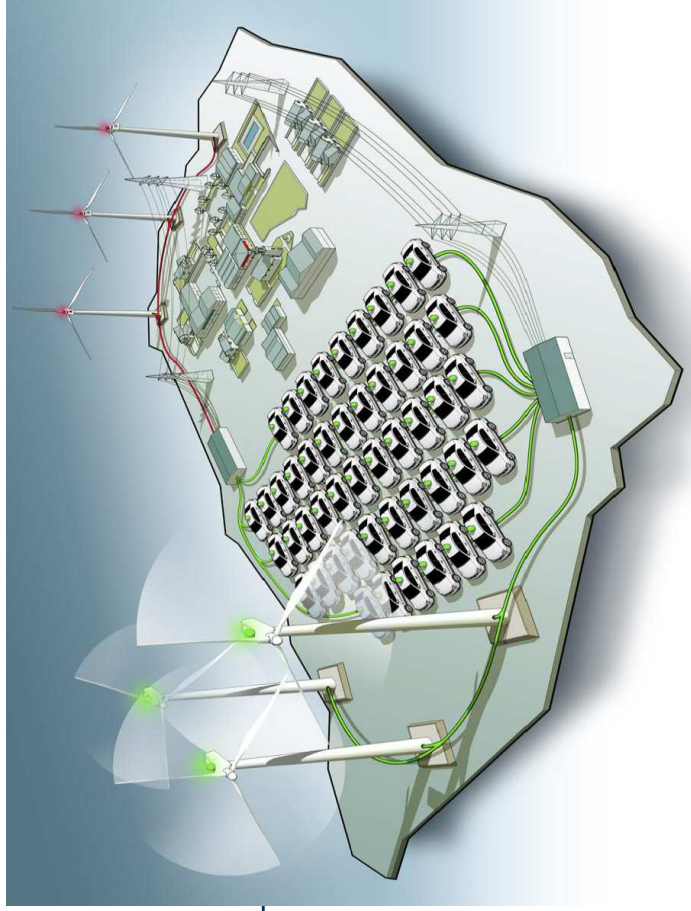
This profile needs a lot of expensive regulating power



The Danish climate commission: "The future is renewable energy"



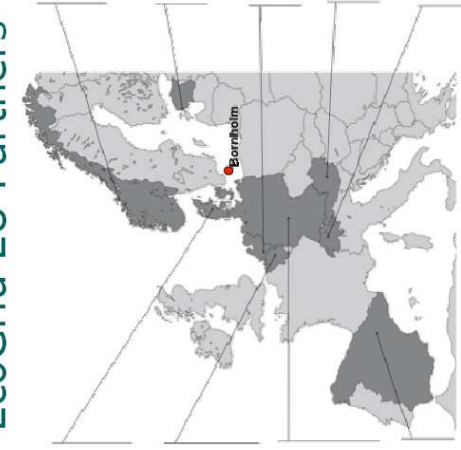
EcoGrid EU A Prototype for European Smart Grids



EcoGrid EU
www.eu-ecogrid.net

EcoGrid EU Partners

- DENMARK:** Energinet.dk, Østkraft, DTU-CET
- BELGIUM:** ELIA
- FRANCE:** EDF
- GERMANY:** Siemens, ENCT
- SPAIN:** Laben



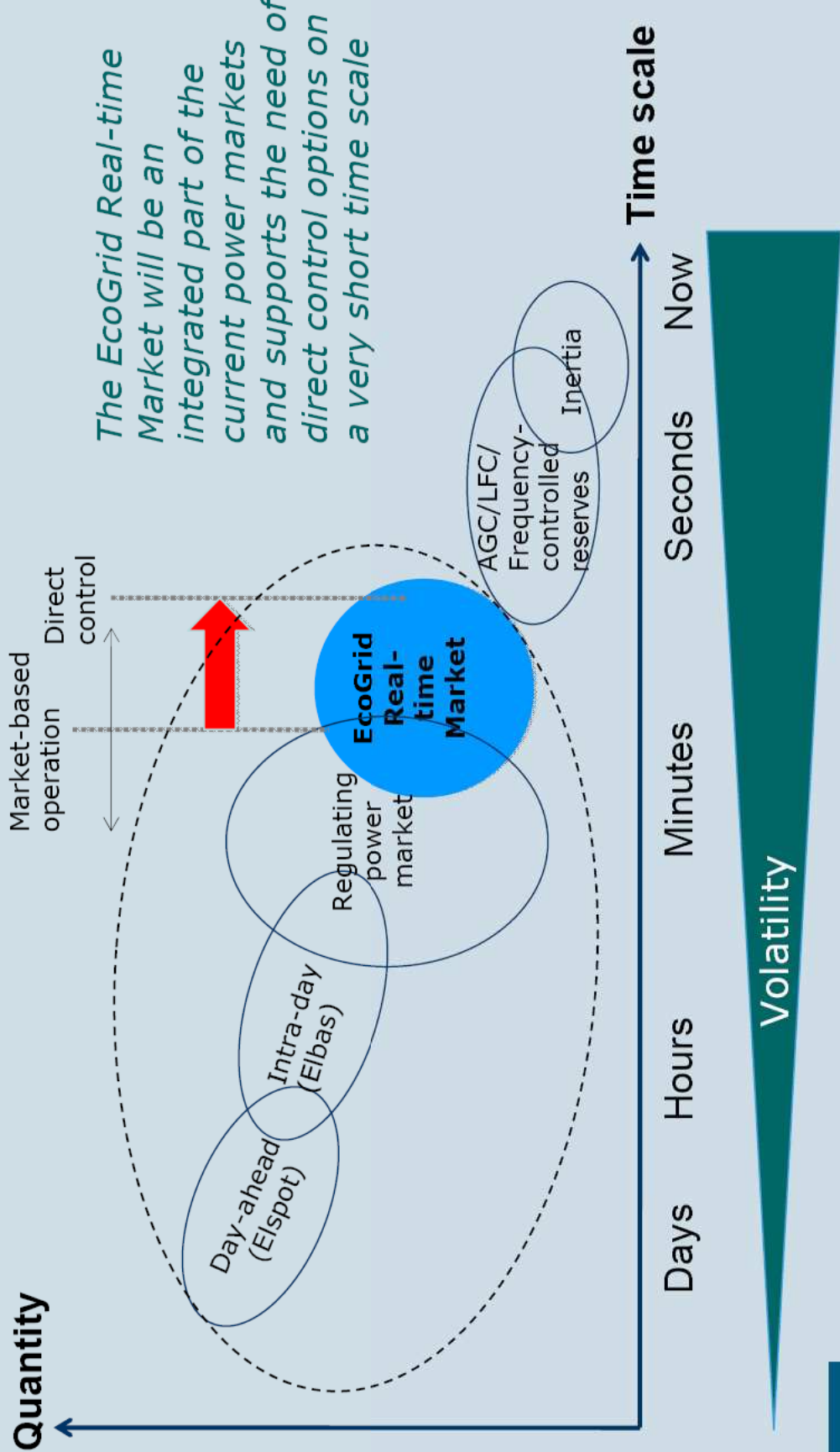
- NORWAY:** SINTEF ER (Coordinator)
- ESTONIA:** Tallin University of Technology (TUT)
- THE NETHERLANDS:** ECN, IBN Benelux
- AUSTRIA:** Austrian Institute of Technology (AIT)
- SWITZERLAND:** IBM Research

Executive Subcontractors

- Sweden:** Landis + Gyr
- Denmark:** Forbrugerrådet
- Norway:** Maj Dang Trong analyse

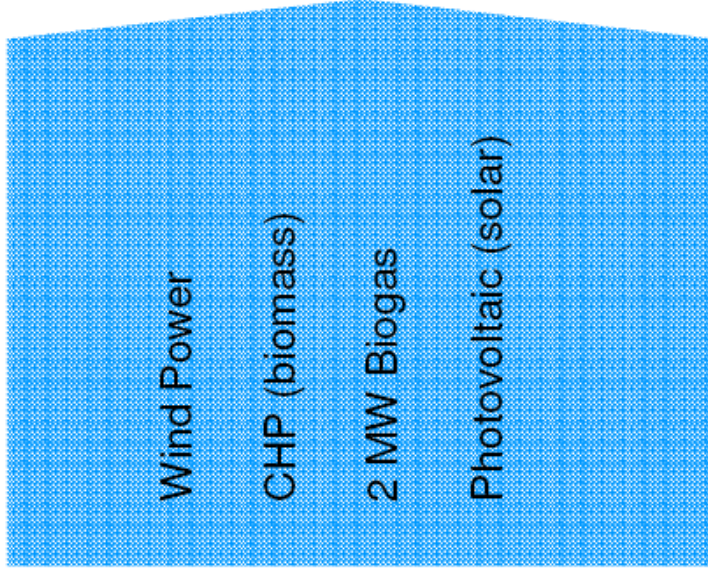


The Scope of a Real-time Market



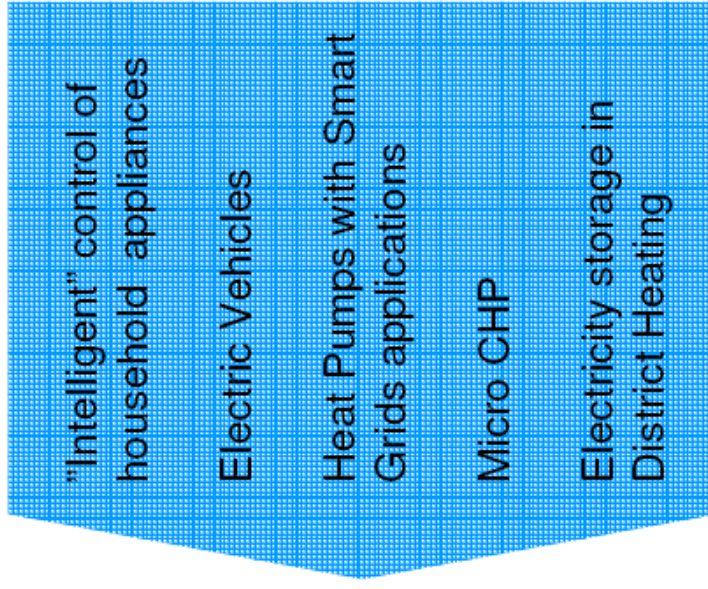
What to be Demonstrated on Bornholm?

Power Generation



EcoGrid EU is a full scale demonstration of a real-time market place including a very broad mix of distributed energy resources

Demand side/Storage options

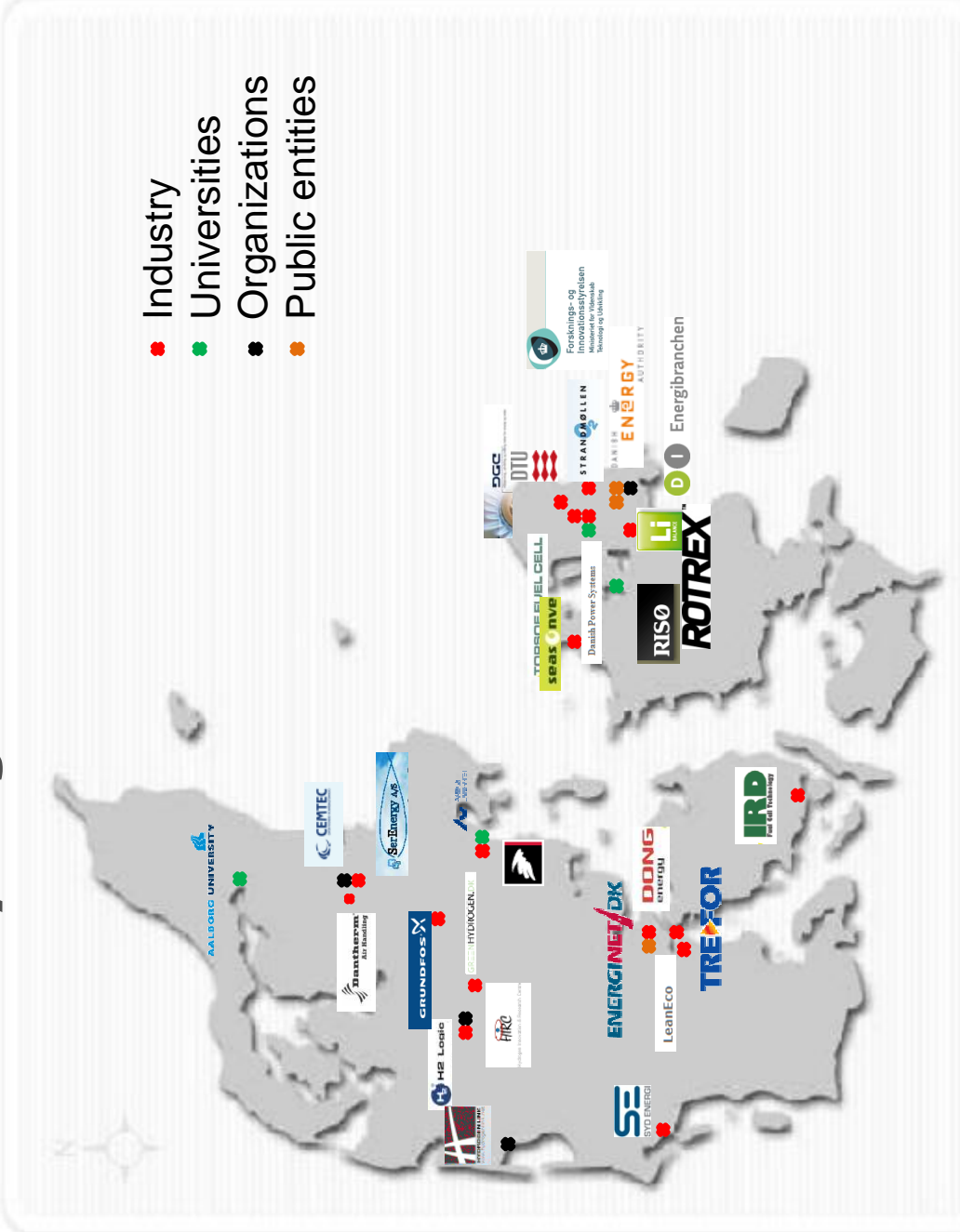
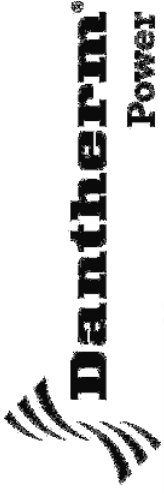


Budget 24 M€

Synergies with other Bornholm activities, e.g. EV roll-out and infrastructure demonstration (EDISON), heat pump roll-out program, PV roll-out, 200 smart heating/coolers controllers demonstration



The Danish Partnership for Hydrogen & Fuel Cells



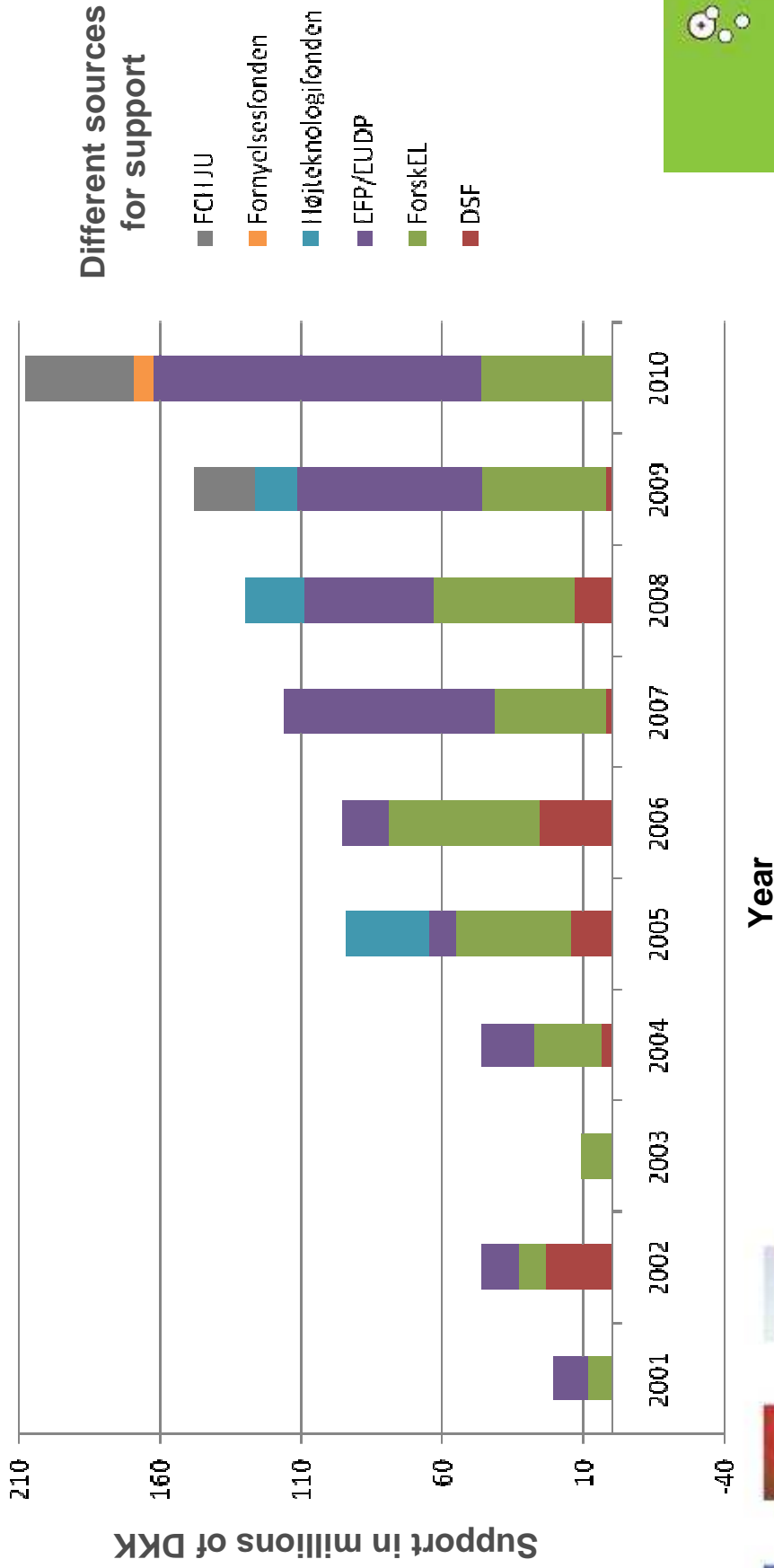
- Industry
- Universities
- Organizations
- Public entities



www.hydrogennet.dk



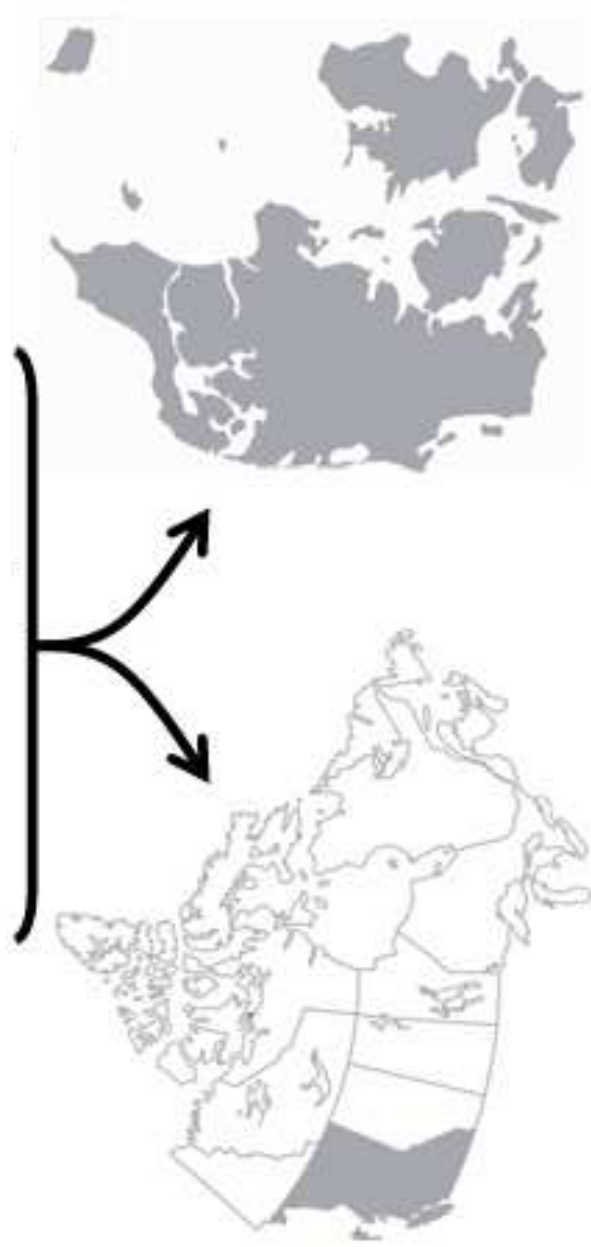
Public support for hydrogen and fuel cells granted from 2001 till 2010





Canadian/Danish Joint Fuel Cell Initiative

UPS and power backup Niche transport and H₂ fuelling



Pilot testing and large scale demonstration in Canada and Denmark



Project sponsor:  **eUDP**

CanDan – History and Purpose

History

Established between Canadian and Danish leading fuel cell universities and companies in September 2006 based on existing collaboration relations

Purpose

CanDan is combining Canadian Fuel Cell knowledge with Danish System knowledge in joint fuel cell system R&D, pilot and demonstration projects with the purpose of commercializing fuel cell systems for early markets such as Power Backup and Industrial Electric vehicles.

Actions so far

CanDan 1 – 1.5 – 2: A joint \$15 million research, development and pilot testing project on fuel cell systems. Focus on early transport and backup power applications in Denmark and Canada supported by the Danish Energy Authority and Canadian Government.

CanDan 1&2 – Funding structure

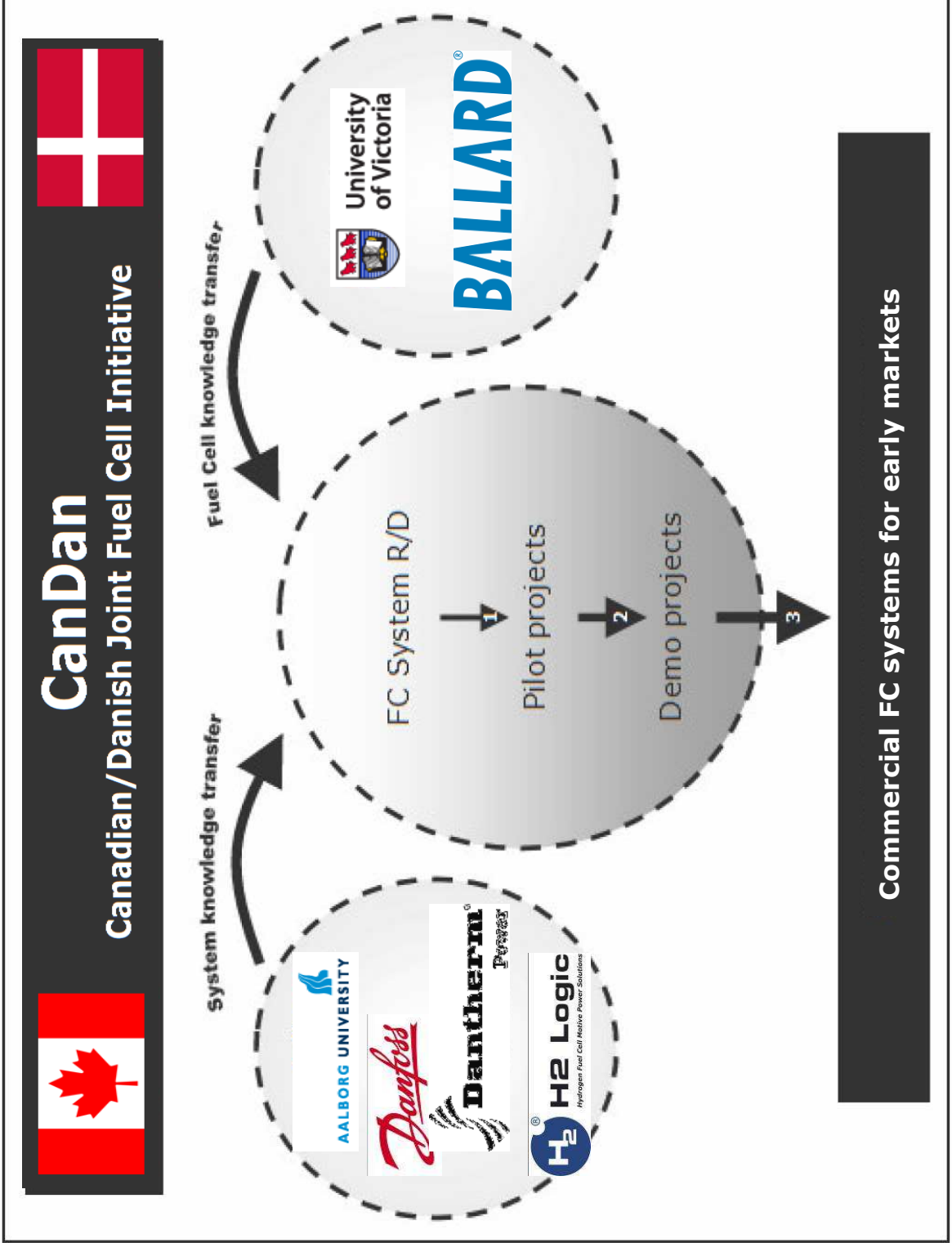


- End-user product purchases
- Company development costs
- End-user development costs

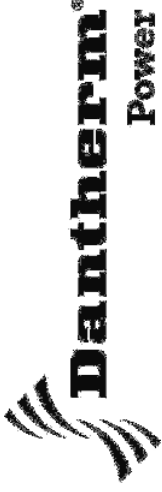
- Danish Federal funding
- Canadian Federal funding
- Province of British Columbia



CanDan – principle



CanDan Power Backup demo examples 1.



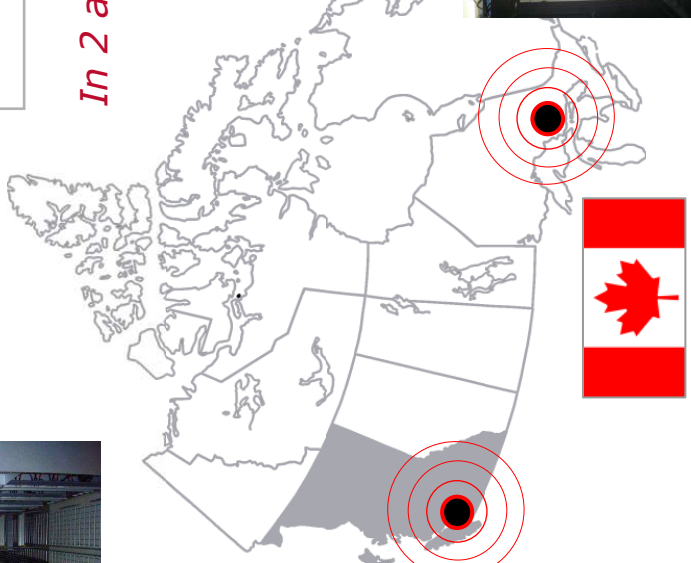
100 kWe fuel cell power solution for BC Hydro's Hydrogen-Assisted Renewable Power (HARP) initiative in Bella Coola



⚡ ~300kWe installed

In 2 areas

In 1 network

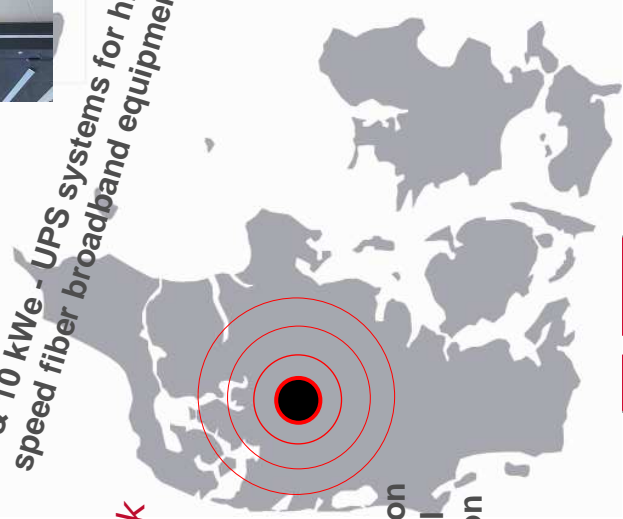


McKesson

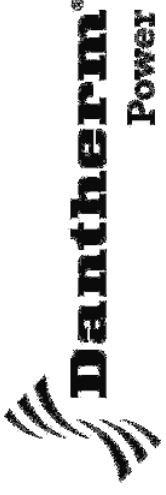
A 6 kW fuel cell power solution with electrolyzers and metal hydride storage at McKesson



5 & 10 kWe - UPS systems for high-speed fiber broadband equipment.



CanDan Power Backup demo examples 2.



Telecom shelter installations

Operator 1.

Supply of 15 temporary power sites in Ontario and Quebec. Temporary power is defined as power for the temporary period of time from installation of base station until connection to the electrical grid is established. Usually 3 – 6 months.

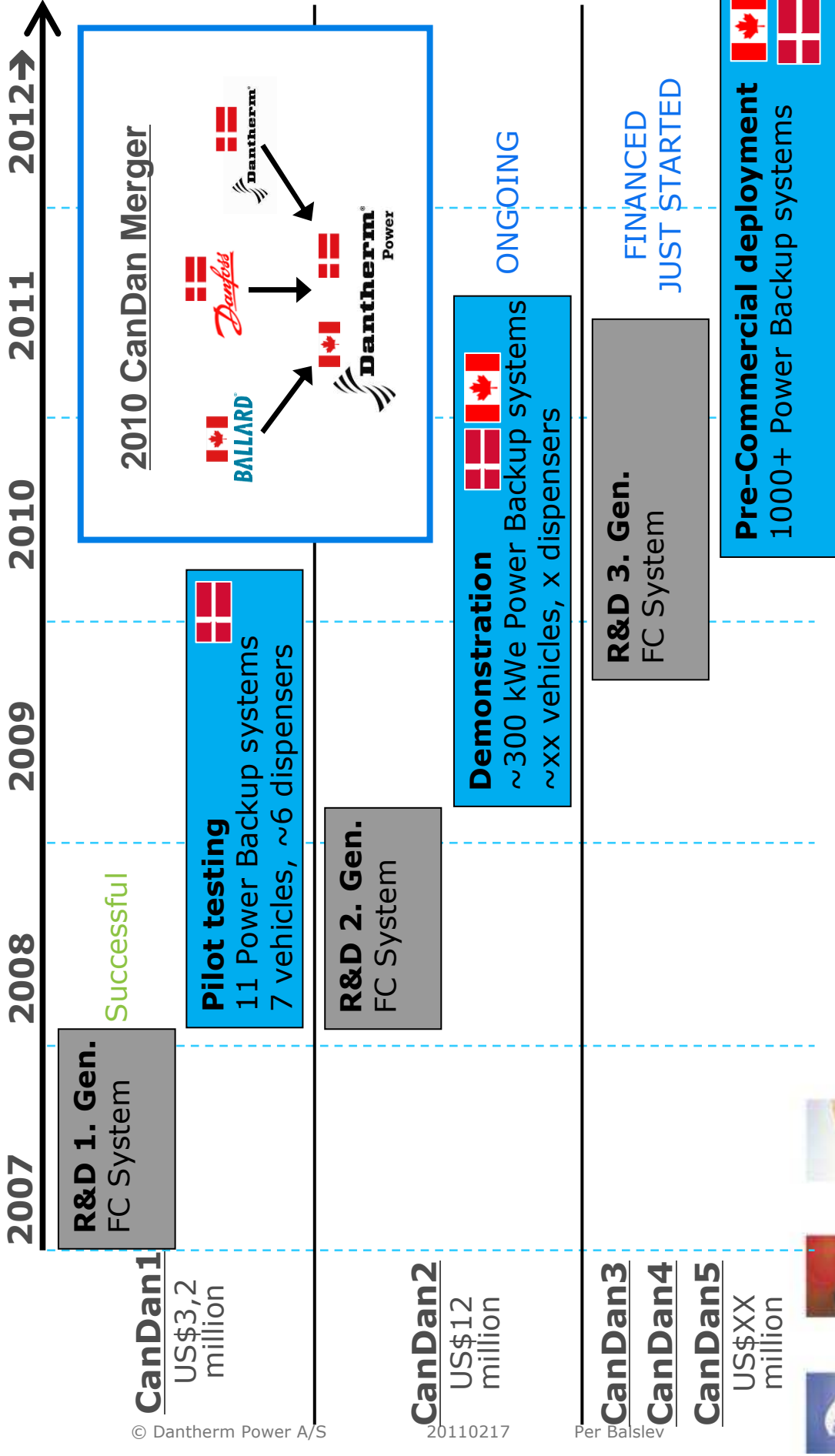
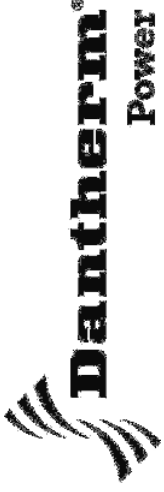


Operator 2.

16 kW installed for large operator in Canada. Battery free backup power system for use in big telecom shelters. 3 racks with each 3 pcs 1,7 kW standard units. Works as free cooling ventilation system also in stand by mode



CanDan – step overview



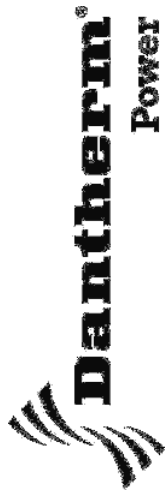
© Dantherm Power A/S

20110217

Per Balslev



Dantherm Power at HTAC



Proposal for DOE:

Join a

USA – Danish RD&D program! [USDan]

Why:

- An international approach are needed to create the paradigm shift to fuel cells and hydrogen
- Promote the development of the fuel cell industry
- Develop the global fuel cell technology and market
- The Canadian - Danish example has proven the concept



Dantherm Power at HTAC



Thank you for your attention!

Questions?



Dr. Per Balslev

peb@dantherm.com

www.dantherm-power.com