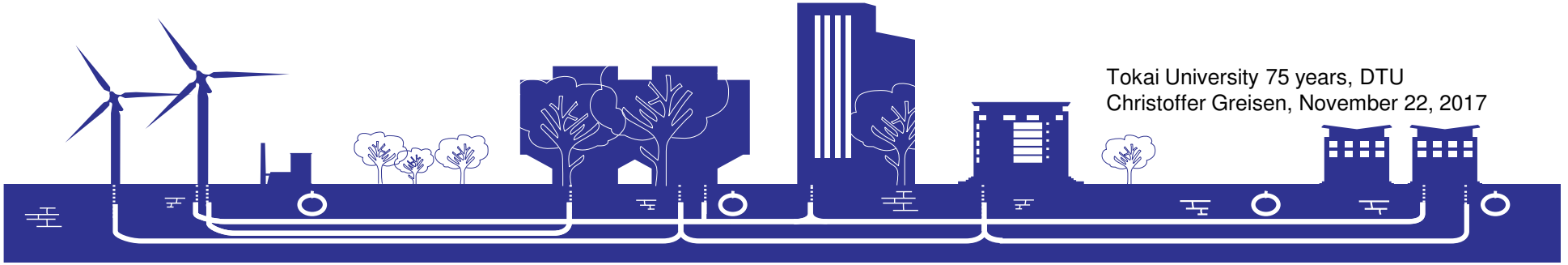
EnergyLab Nordhavn

New Energy Infrastructures and Smart Components in Cities



Tokai University 75 years, DTU
Christoffer Greisen, November 22, 2017

Inspiration

[From www.tvindkraft.dk]

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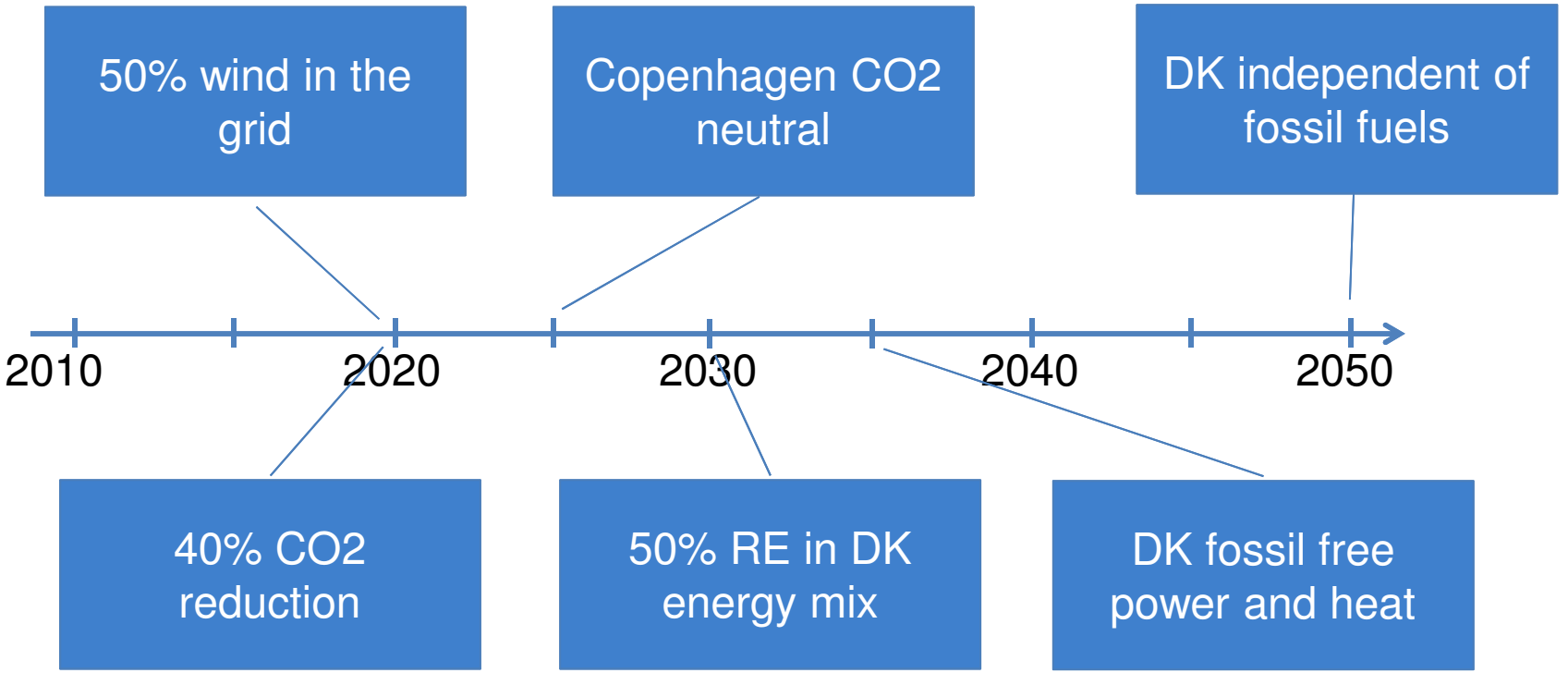
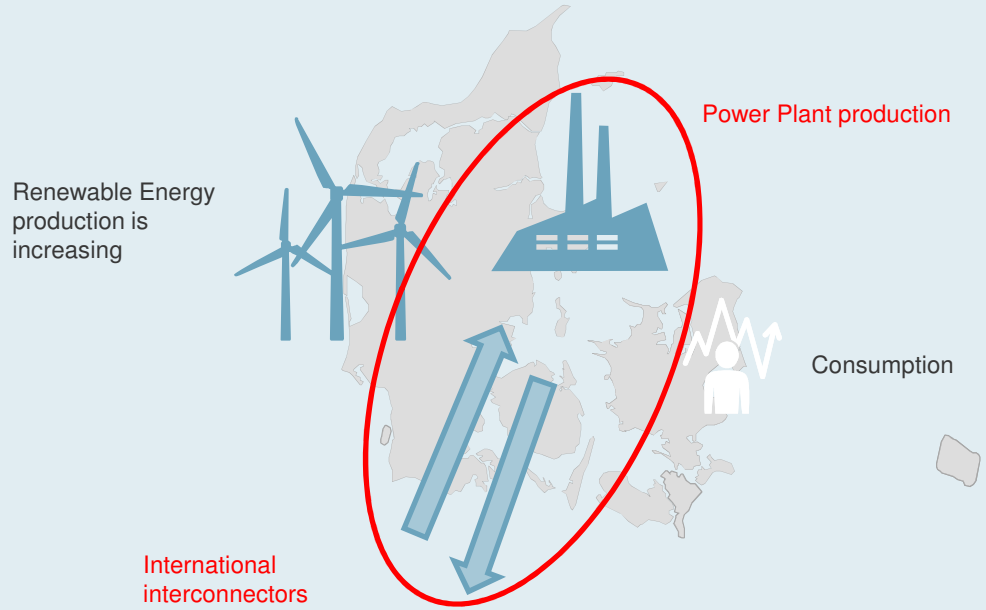
Long term goals supported



One of two major challenges:
Increasing renewable energy in the electricity system



Production and consumption have to be in balance every second

Low price Renewable energy means less operation time for power plants = close down of many power plants

This means

heavy reliability on flexible assets in the grid

This means market development

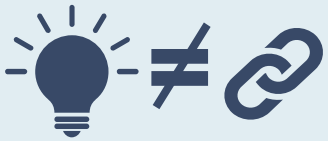
Radius

The major challenges and possibilities for the DSOs are driven by market developments

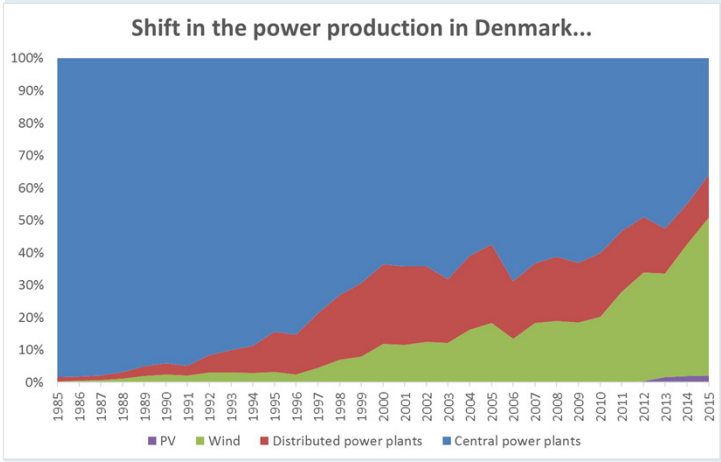
Market trends

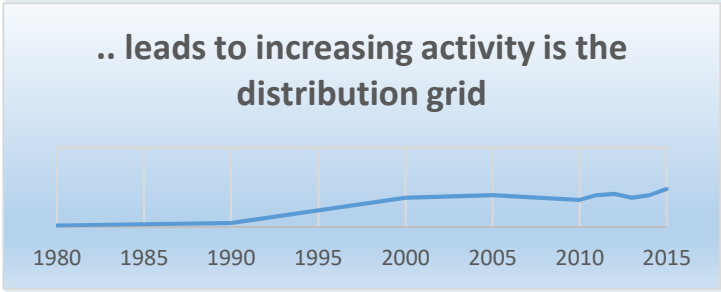
DERs, micro grids and new players challenge the collective idea and a common grid

Increased and volatile loads challenge quality of supply



Continued demand for cost reductions in the sector





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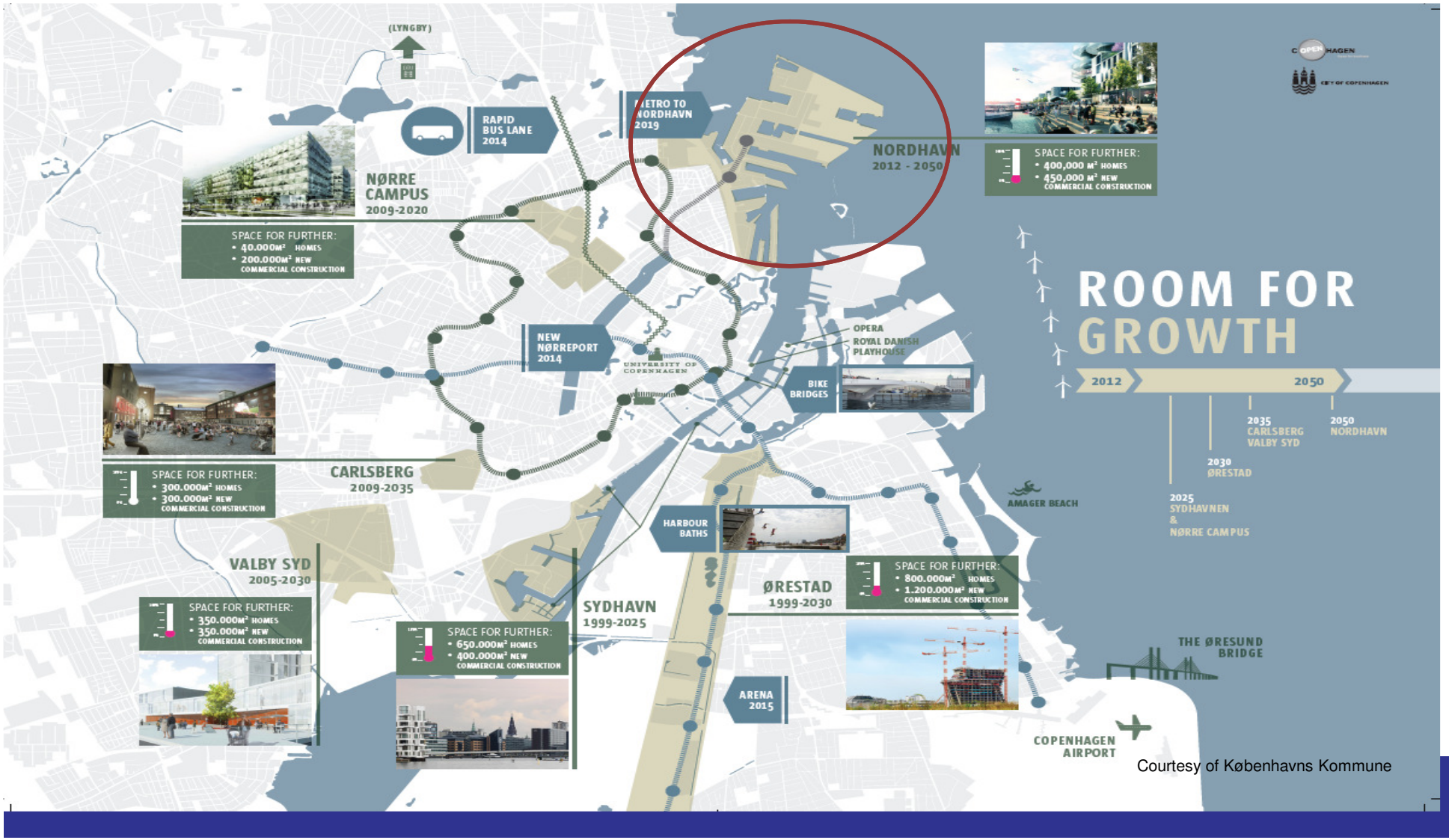

Courtesy of Københavns Kommune

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Objective

To develop

new methods and solutions

for design and operation of the future

cost-effective integrated energy system

based on Nordhavn as a

globally visible real-life laboratory.

Photo: Kontraframe

Partners from multiple sectors

Authority and city development

Energy Infrastructure

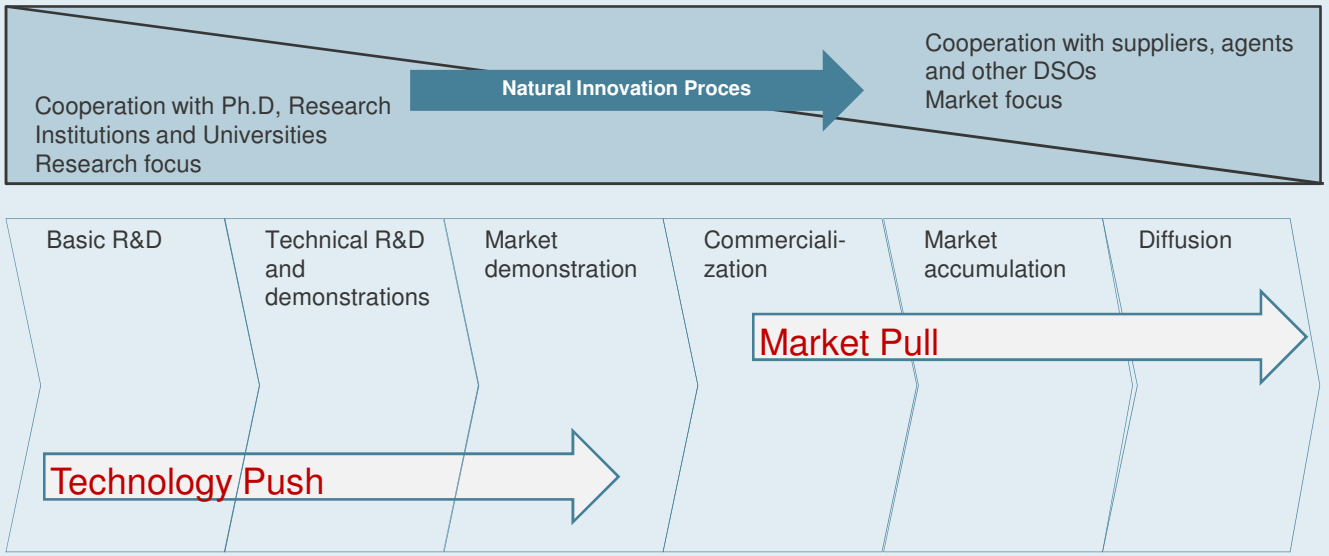
Industry and consulting engineers

University and data infrastructure

2015-2019, Budget 19 M€, Public funding 11 M€ from EUDP

Classic Innovation Process

Good practice in innovation:
- Involve (external) partners
- Projects on all levels in 'Push'. Especially Basic R&D
- Remember internal marketing
- Safe space for Innovation. Ultilize disagreements
- More than one R&D project within each focus area (seen form various angels)



Radius

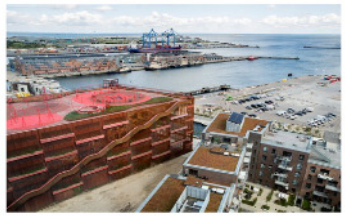

Showroom and visualisation
Power grid operation
Flexibility from heat and cooling grids
Integrated markets and control centers
Storage flexibility
Smart network services
Smart charging infrastructure
Measurements and data warehouse
Flexible buildings and users
PowerLabDK
Photo: By & Havn/Ole Malling

Frihavnstårnet

- 12 appartments with building automation
- Q4 2016

P-hus Lüders

- Grid connected Li-ion battery
- 460 kWh (60 homes for one day)
- Integrated with 10 kV grid
- Technology: ABB
- Operation: Radius
- Q1 2017



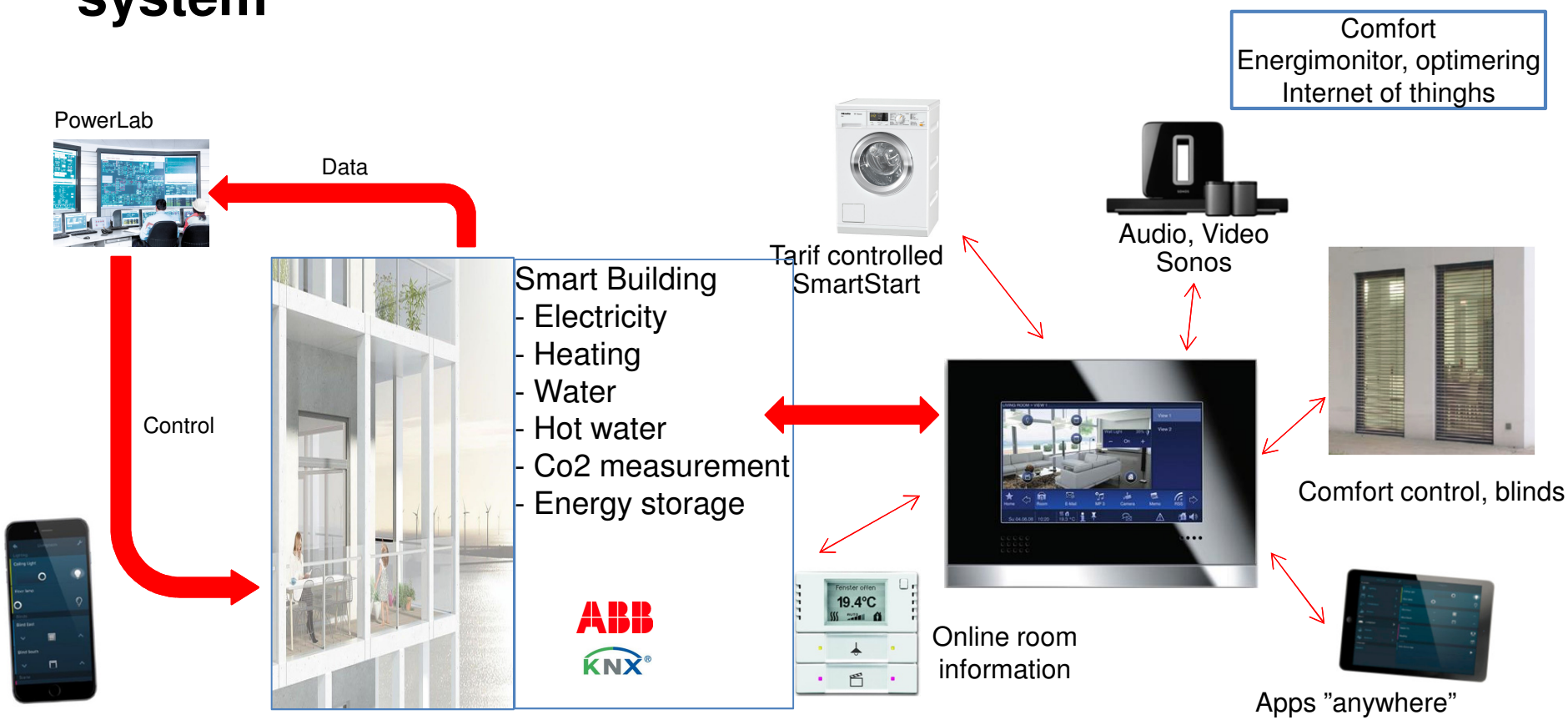
Havnehuset

- Demonstration of flexible district heating and low temperature district heating
- Q4 2016

Terra Nova

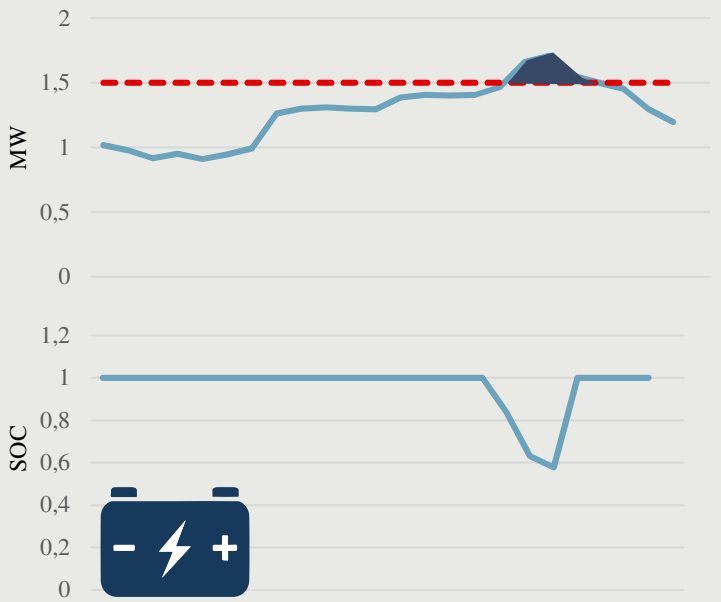
- 10 appartments with smart control of heating systems
- Measuring of thermal capacity in four apparments
- Q4 2016

Homes will play an active role in our energy system

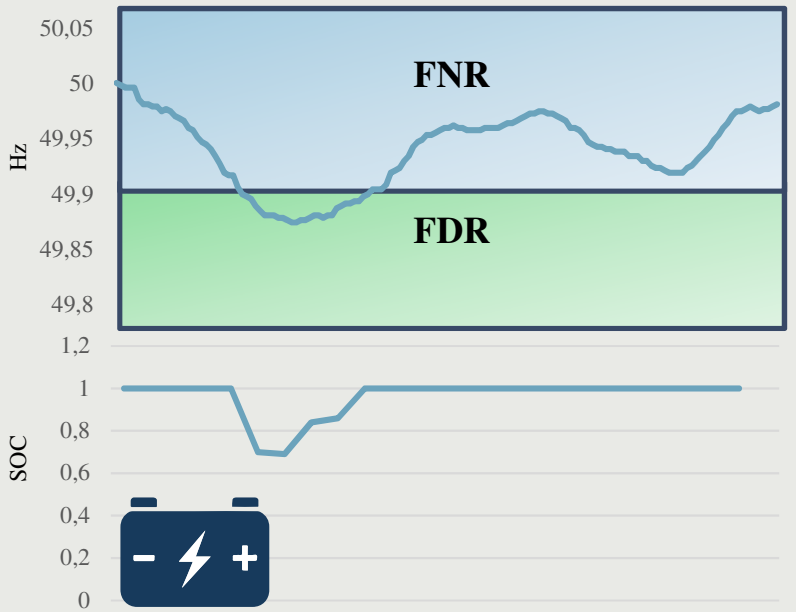


Radius use of the battery – Overview

Grid upgrade deferral



Frequency support



Frekvensstyret driftsforstyrrelsesreserve (FDR)

Frekvensstyret normaldriftsreserve (FNR)

Tests in Nordhavn – Peak-shaving + FDR (+FNR)






Production (PBA)	Renewables (CO_2 reduction)	Power markets (FBA, Retailers)	TSO	DSO	End-User
ELBAS (intraday-trading for balancing production-plans)	Curtailment minimization	ELBAS (intraday-trading for balancing plans)	FNR (Frequency continuous reserve)	Peak-shaving (Distribution grid upgrade deferral)	Retail electric energy time-shift (Local arbitrage)
	Renewable generation flexibility	ELSPOT (Day-ahead trading – Arbitrage)	FDR (Frequency interruptions reserve)	Voltage quality support	Power reliability (geographically firm interruption reserves)
		…	Regulating Power Market	SAIDI (geographically firm interruption reserves)	End-user peak shaving (Reduceret tilslutningsbidrag)
			Transmission grid upgrade deferral	SAIDI (mobile interruption reserves)	Power quality
			Black start support		

Commercial activity

Monopoly activity

Source: Based on data from EPRI, IRENA, DOE, and IEA

In practice in Nordhavn

Do we have an energy (and transport, and...) community?

We may think of alternative scenarios for community-driven management:

[At the building level?]

[Collaborating with local PV generation from CIS building?]

[And then with the battery, EVs, and other assets?]

[Adapted from Pierre Pinson et al, 2017]

Selected learnings

- Power sector is unbundled – Heat sector is not > conflict of interests and concepts
- Very different interpretation of personal data legislation amongst partners
- Learning about opportunities and limitations for various actors in a flexibility market
- Landscaping of optimal business models
- Demonstration is necessary – also for finding regulatory barriers
- Outlook > Collaboration projects demonstrating and piloting in multiple environments
- Open co-creation methods

Christoffer Greisen
cgre@elektro.dtu.dk
+4541390347

Funded by