



Co-funded by  
the Intelligent Energy Europe Programme  
of the European Union



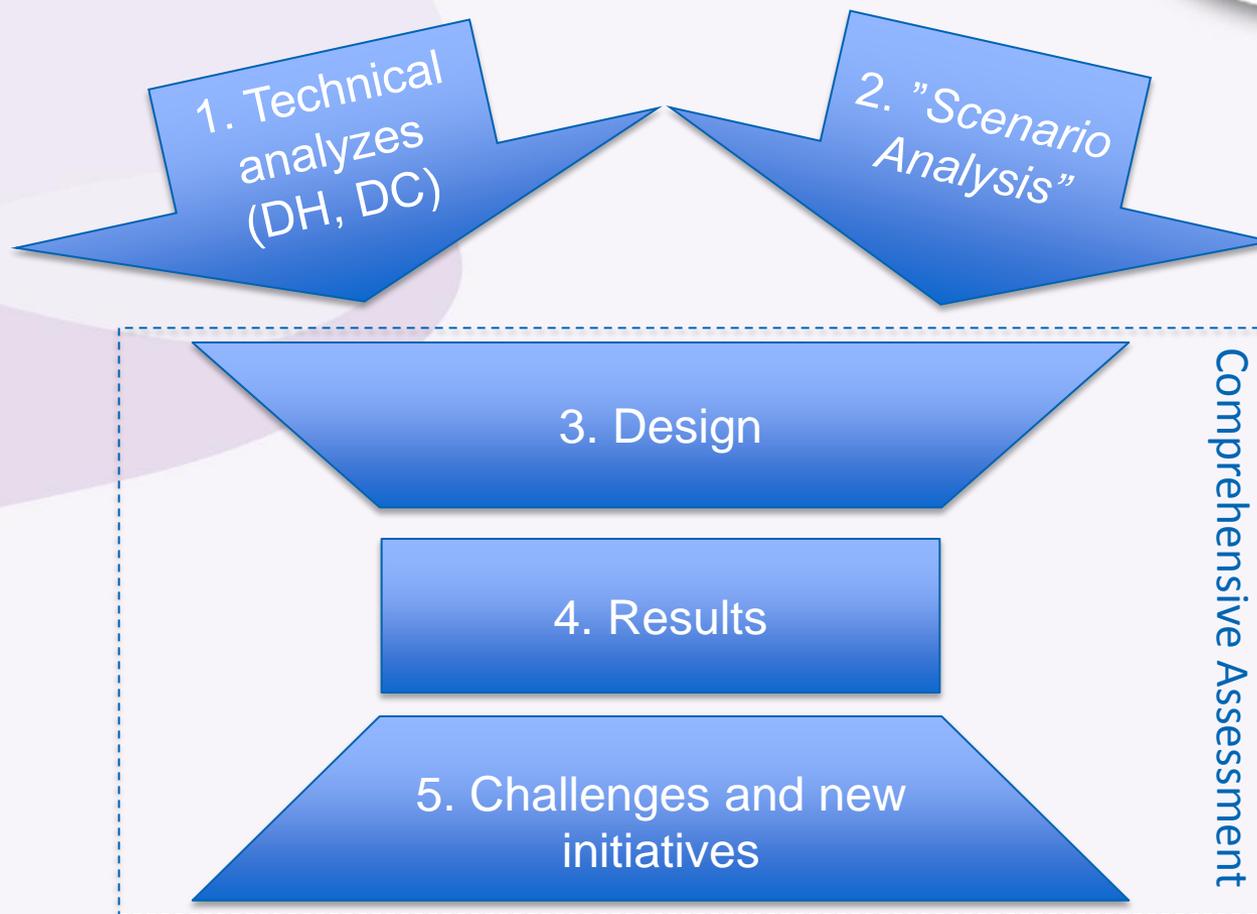
CONCERTED ACTION  
ENERGY EFFICIENCY  
DIRECTIVE

# Comprehensive Assessment, efficient DHC, Denmark

Bjarne Juul-Kristensen  
Danish Energy Agency  
Concerted Action, Luxembourg  
21 October 2015

- Promotion of efficiency in heating and cooling
  1. By 31 December 2015, Member States shall carry out and notify to the Commission a comprehensive assessment of the potential for the application of high-efficiency cogeneration and efficient district heating and cooling, containing the information set out in Annex VIII. (...)

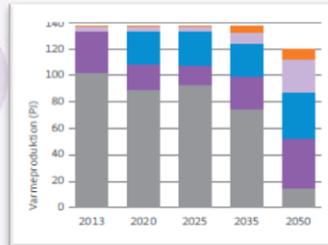
# 0. Content of the presentation



# 1. The technical analyzes

## The District Heating Analysis

- ≈ 50% (199 PJ) of demand covered with DH (2013)
- Potential for up to 70% (189 PJ) by 2020
  - Socio-economic potential mainly in densification of current DH net
- Production:



Solar  
Surplus heat  
Heat pumps/electric boiler  
Boilers  
\*CHP

## The District Cooling Analysis

- Large untapped potential
  - Economically competitive and technically feasible
  - Smart grid advantages
  - Possible synergy with DH
- Main barriers: Knowledge, organization and regulation

\* CHP was not analyzed separately, but is an integrated part of several studies, including the District Heating Analysis and Scenario Analysis



## 2. Scenario Analysis



### A cross sectoral scenario analysis

- Aims to present possible technical paths to a fossil-free energy system by 2050
- Scenarios: Wind, biomass, hydrogen, Bio+ and “Reference”
- Method: For each scenario, the most cost-efficient energy system in 2050 is constructed, hereafter back-casting to 2035 and 2020

## 2. Scenario Analysis

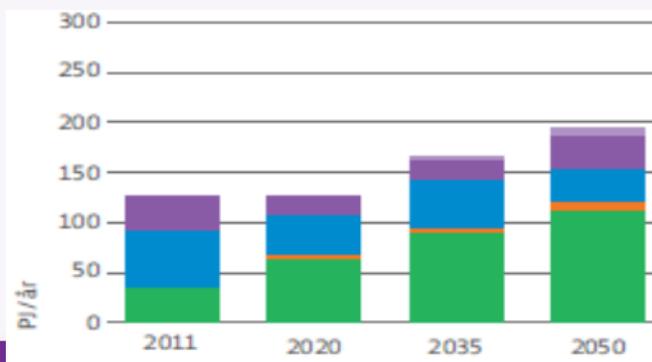
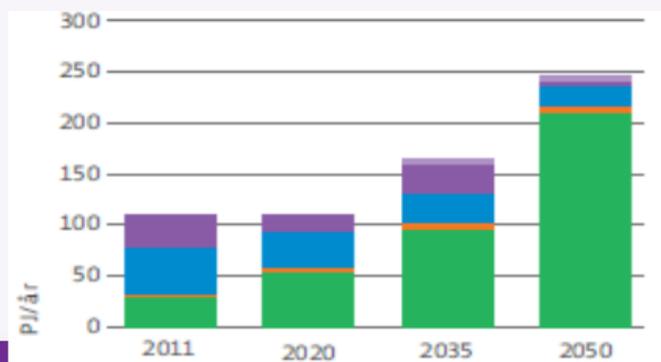


### Findings

- Main direction wind vs. biomass to be decided post 2020 (current energy agreement in Parliament expires in 2020)
- DH will play a crucial role
  - Large variations in, how DH is produced acc. to overall scenario
  - The role of CHP is as well dependent on the scenario in play
- DH-supply is expected to decrease (energy savings - despite more cons.)
- *Power production in scenarios:*

Wind scenario

Biomass scenario



Biofuel production  
Power plant  
CHP  
Solar  
Wind

# 3. CA design acc. to Annex VIII



CONCERTED ACTION  
ENERGY EFFICIENCY  
DIRECTIVE

The Danish  
energy system

- Current situation and general trends of relevance to CHP, DH and DC
- Scenario walk-through

Technical  
assessment

- Separate: DH, DC and CHP
- Relation to overall system and the different scenarios
- Demand, forecast, GIS maps, energy efficiency, etc.

Strategies,  
policies and  
measures

- Separate: CHP, DH, DC, Land use planning
- Current and considered initiatives

# 4. Results



- CHP
  - The roll of CHP will decrease in all circumstances
  - Many plants have already few full-load hours
    - Operation acc. to financial viability – capacity maintained
  - Current support schemes for CHP production (natural gas) expires by 2018
- DH
  - Ongoing assessment and decision of heat supply method:
    - This is regulated by the Heat Supply Act and socio economic criteria (CBA)
    - Close “race” between ind. NG-supply areas and DH – areas,
    - Individual solutions (e.g. bio-boilers and heat pumps) are becoming more competitive – especially for new dwellings
- DC
  - Large untapped potential
  - New regulation put in place June 2014
  - Development is monitored and further initiatives are considered **by Gov.**

# 5. Main challenges and new initiatives



## Challenges

- Current and expected developments in the Danish system leaves reduced room for high-efficiency cogeneration.
  - What's the most cost-efficient way of maintaining security of supply?
- How is DC best promoted?

## Current and new initiatives (under development)

- Energy agreement for March 2012
- Ongoing analysis of energy taxation and support schemes to support green transition
- Geothermal potential being identified in 28 DH-markets
- Demonstration program and task force unit for large heat pumps in DH
- Enhanced economic efficiency in district heating (benchmarking etc.)

*(Will be reported as part of "policies and strategies for implementation")*

# What has been achieved?



CONCERTED ACTION  
ENERGY EFFICIENCY  
DIRECTIVE

Better documentation and new knowledge:

- Economic / financial viability of extension of DH-distribution (competition with indiv. NG and indiv. HP)
- Economic optimised DH-production depends of overall development of Danish energy system
- Opportunities and barriers regarding development of DC

# Thank you for your attention...



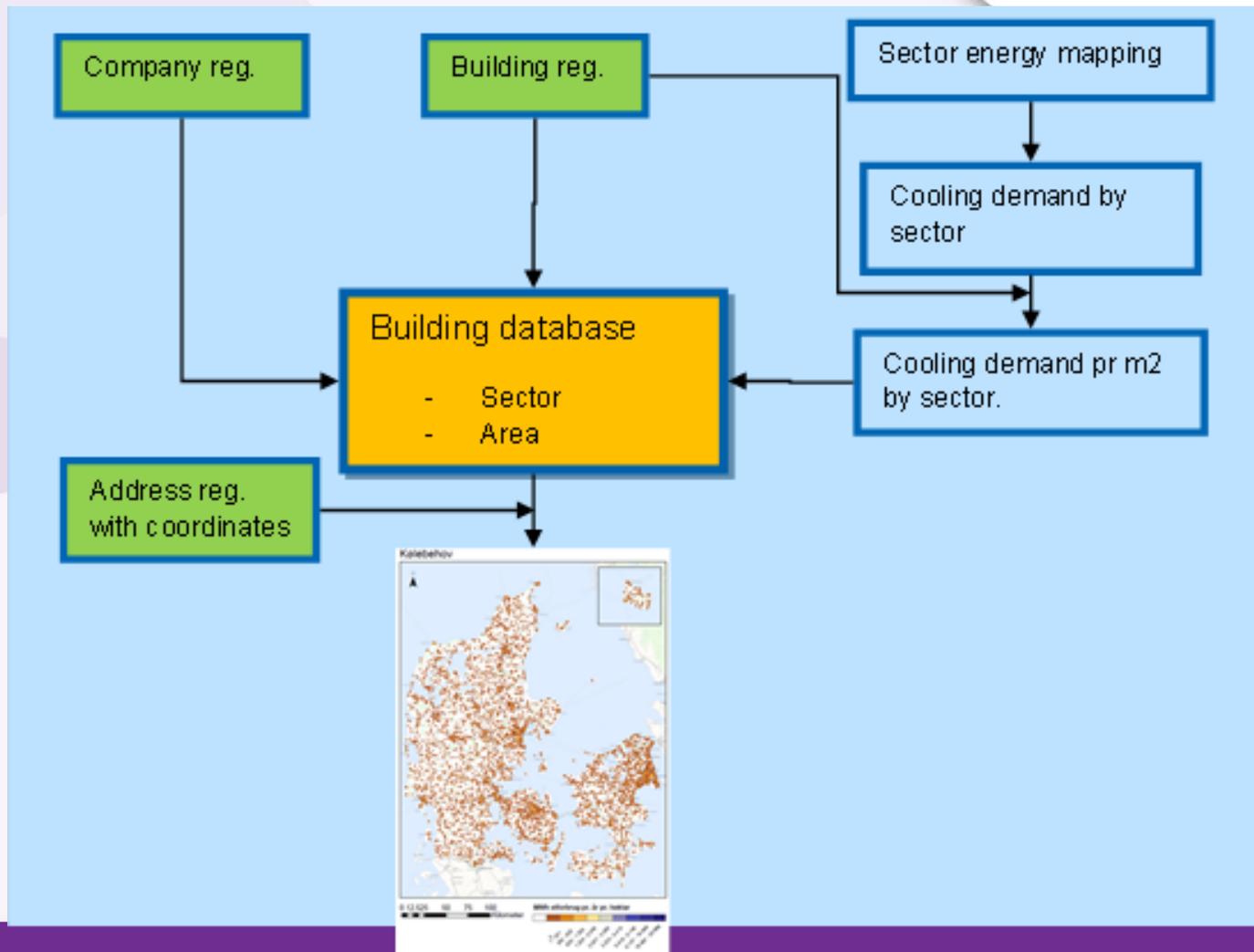
CONCERTED ACTION  
ENERGY EFFICIENCY  
DIRECTIVE

- Contact information  
Bjarne Juul-Kristensen, Danish Energy Agency  
[bjk@ens.dk](mailto:bjk@ens.dk)



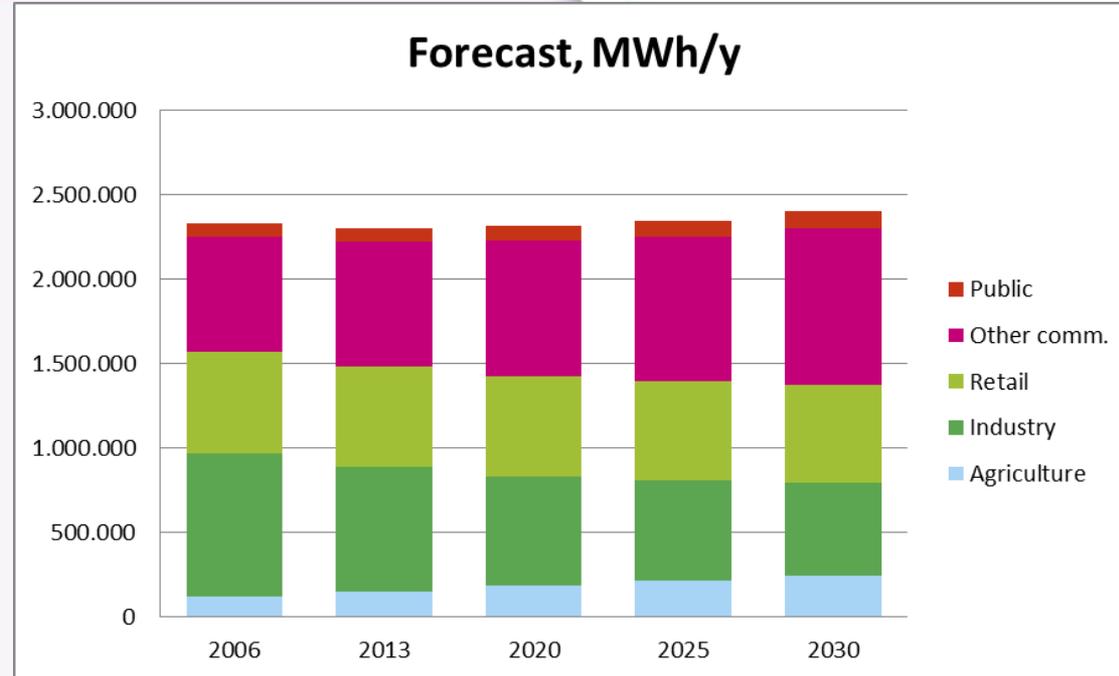
## ■ District Cooling Analysis

# Combining databases



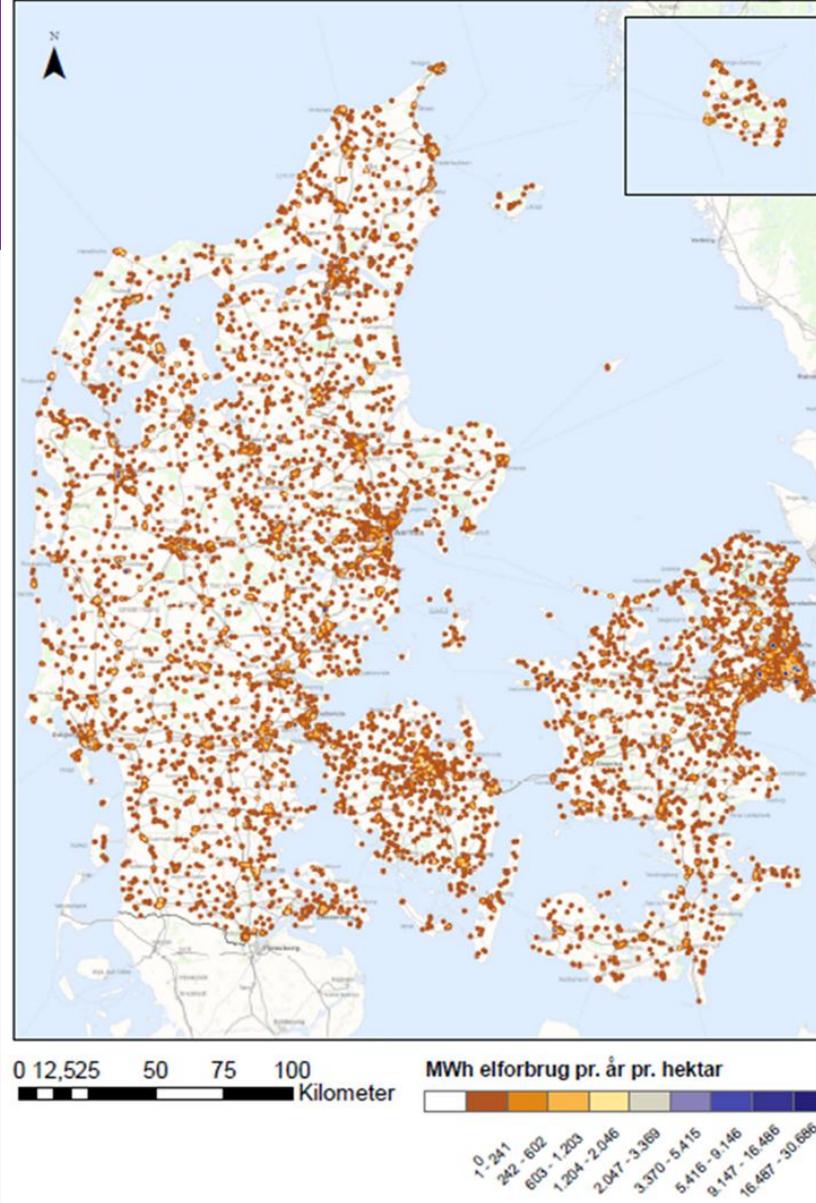
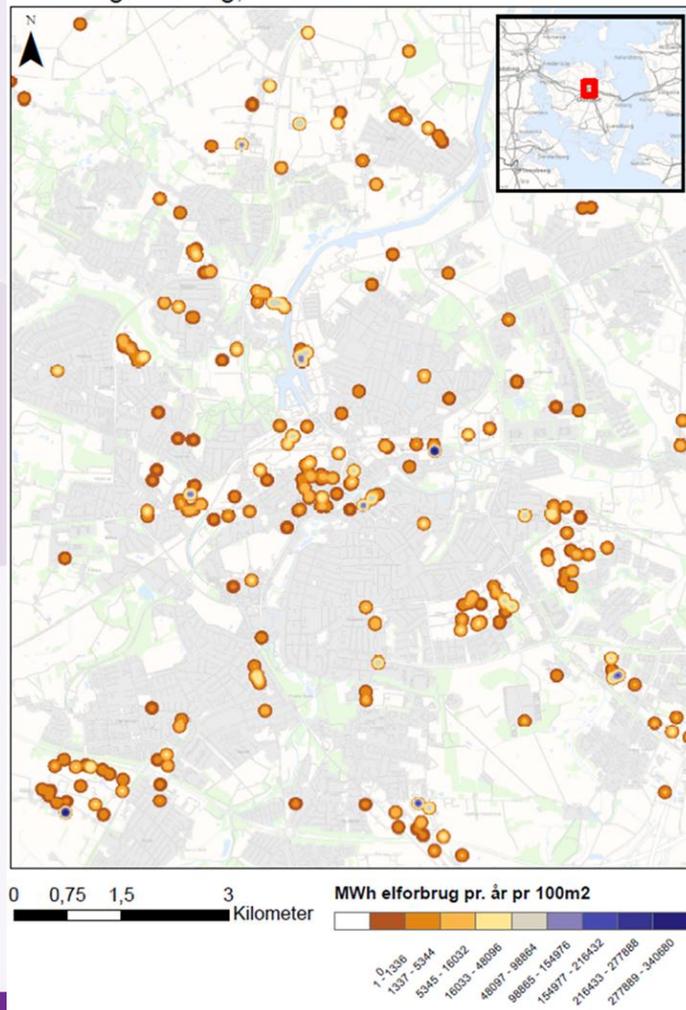
# Forecast of cooling energy demand

- Commercial and public sector demand projected on basis of m<sup>2</sup>
- Industrial and agriculture demand projected on the basis of value-added projection
- Extrapolation from 2006-2012 – figures.



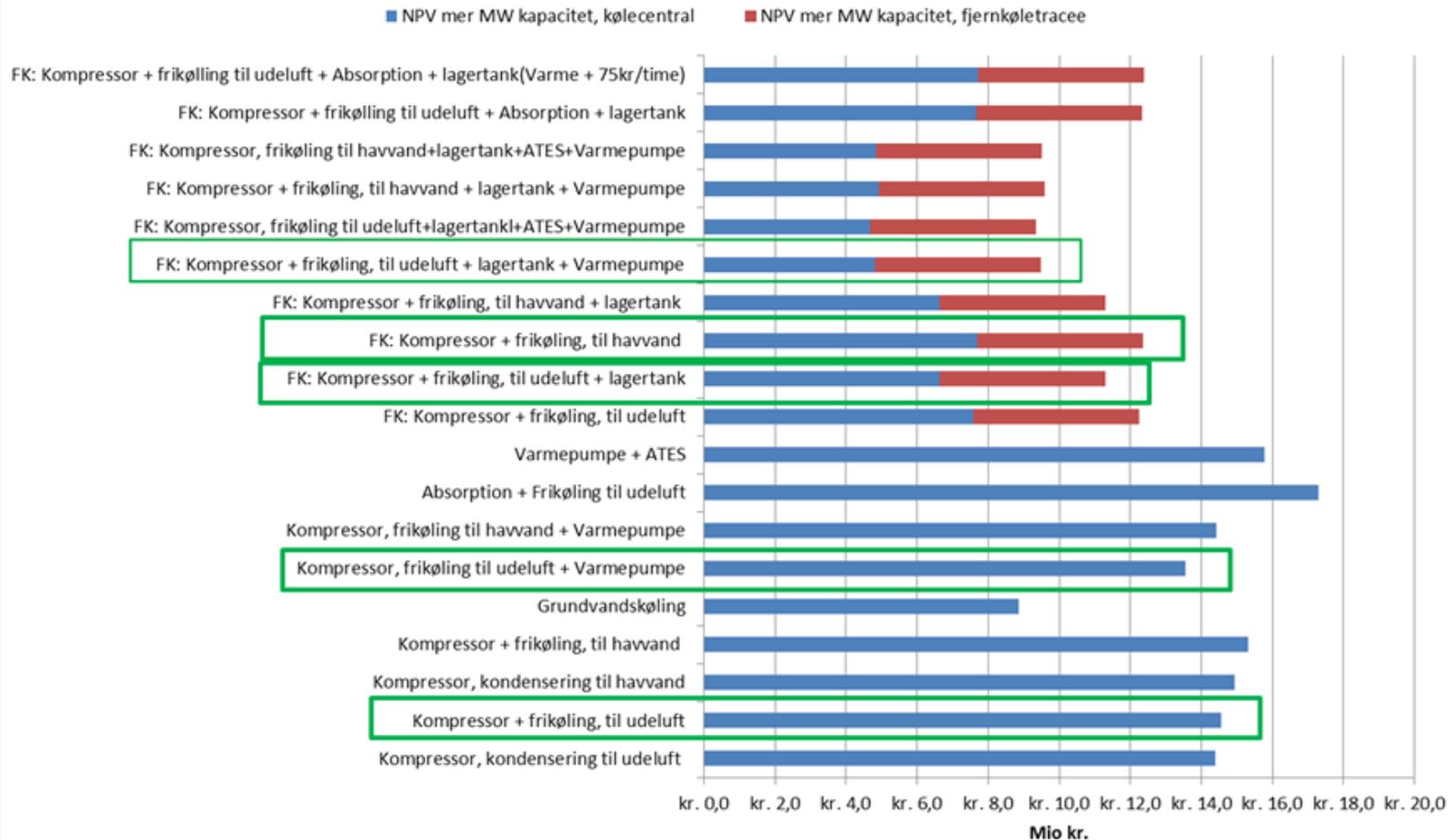
# GIS maps of cooling demand

Elforbrug til køling, Odense



# Cooling production cost analysis

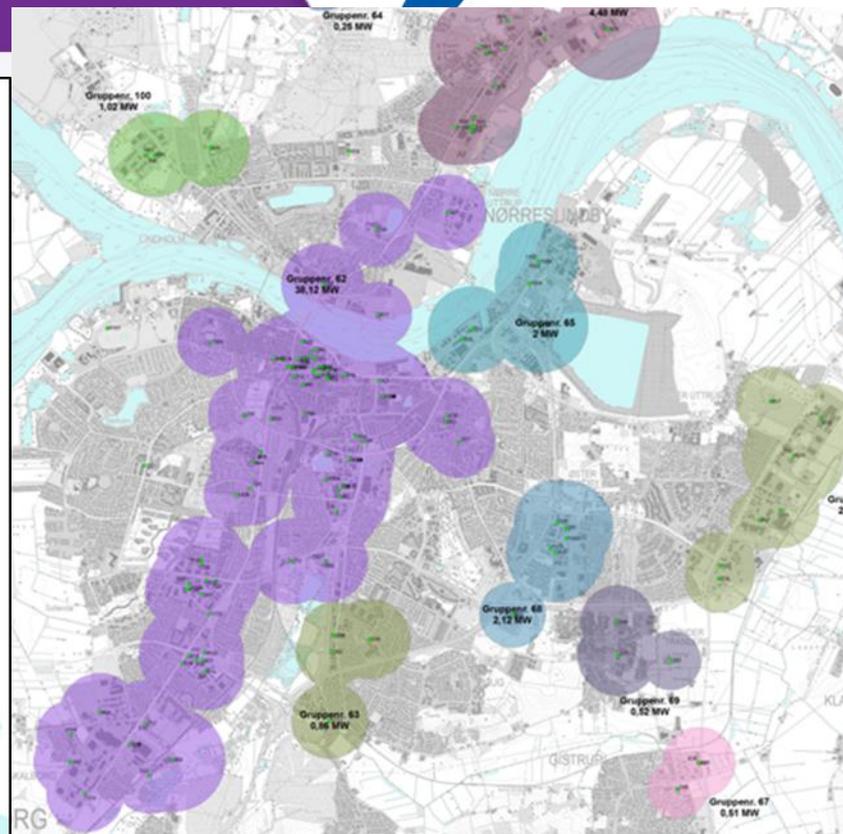
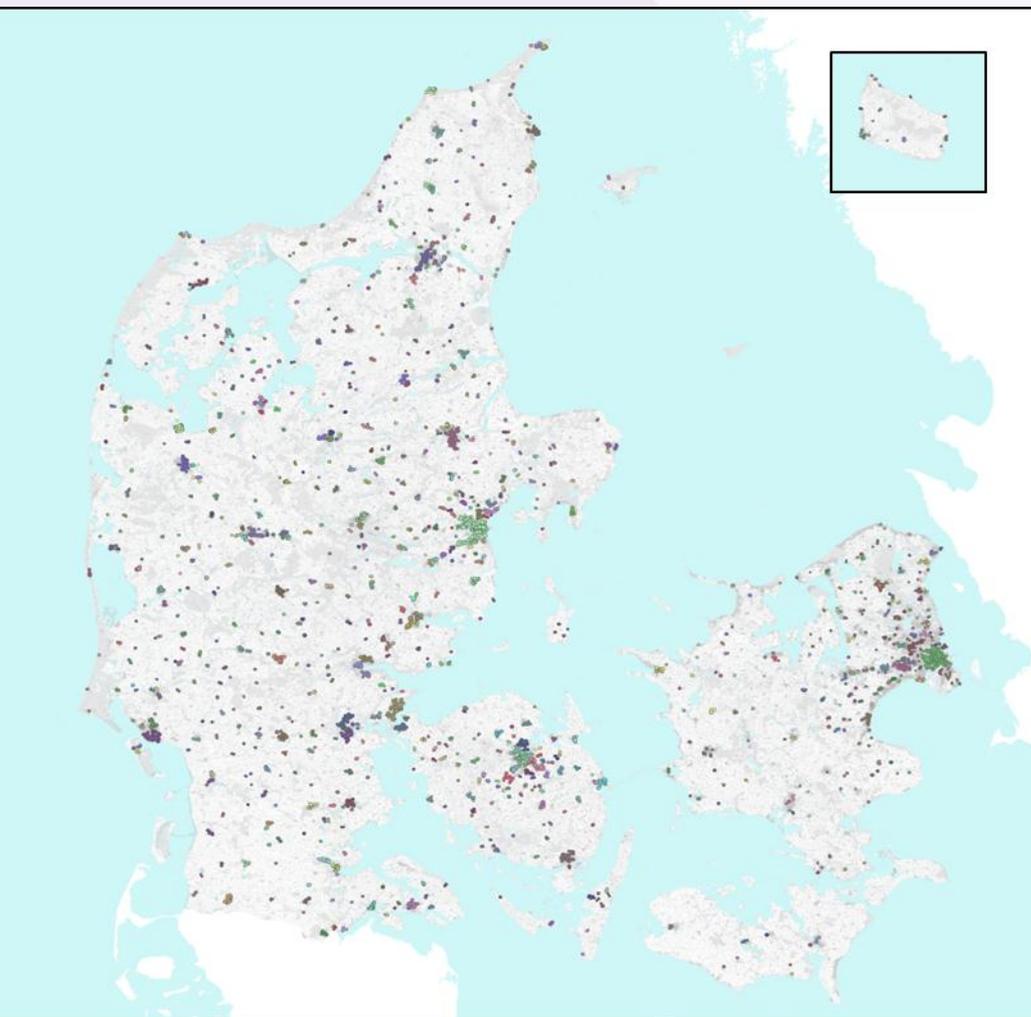
## Life cycle costs of selected cooling systems, MDKK NPV



# Technical potential assessment



CONCERTED ACTION  
ENERGY EFFICIENCY  
DIRECTIVE



Total cooling [MW]	Technical potential [MW]	Share of technical potential
5.142	2.866	56 %



## ■ Danish Energy Strategy

# Milestones up to 2050



CONCERTED ACTION  
ENERGY EFFICIENCY  
DIRECTIVE

## The government's energy policy milestones up to 2050

In order to secure 100 pct. renewable energy in 2050 the government has several energy policy milestones in the years 2020, 2030 and 2035. These milestones are each a step in the right direction, securing progress towards 2050.

### 2020

Half of the traditional consumptions of electricity is covered by wind power

### 2030

Coal is phased out from Danish power plants  
Oil burners phased out

### 2035

The electricity and heat supply covered by renewable energy

### 2050

All energy supply – electricity, heat, industry and transport – is covered by renewable energy

The initiatives up to 2020 will result in a greenhouse gas reduction by 35 pct. in relation to 1990.

# Energy agreement, March 2012



These are the headline results for 2020:

2020

More than 35% renewable energy  
in final energy consumption

Approximately 50% of electricity  
consumption to be supplied by wind power

7.6% reduction in gross energy  
consumption in relation to 2010

34% reduction in greenhouse  
gas emissions in relation to 1990

# Main initiatives in the Energy Agreement, March 2012



1. A more energy efficient society
2. Wind power and new RES-technologies
3. RES in industry, buildings and transport
4. Bioenergy in Danish energy supply
5. Smart grids
6. Financing the initiatives

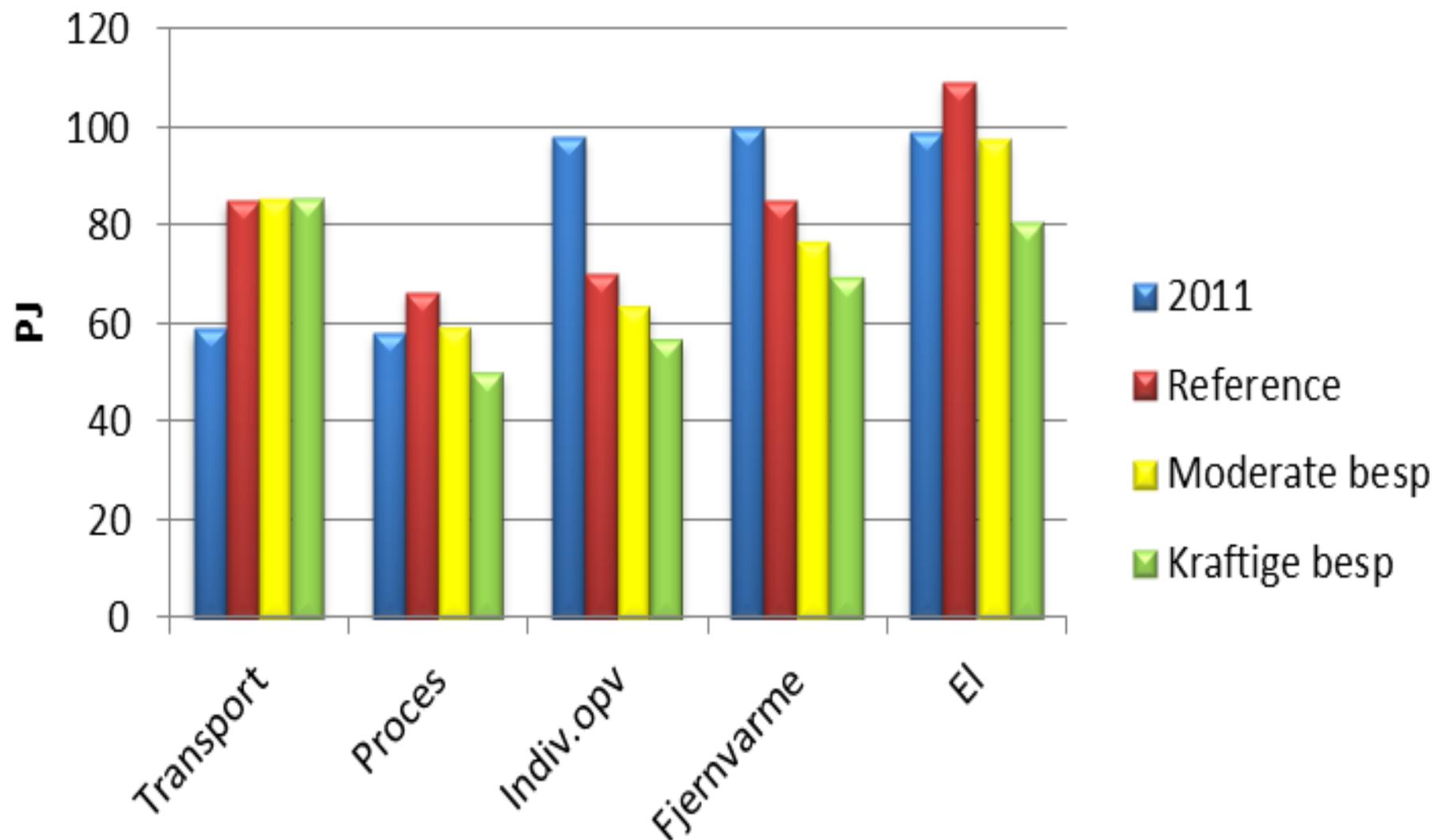
\*\*\*\*\*

Besides a large number of sub sector analyses are being carried out, managed by Danish Energy Agency

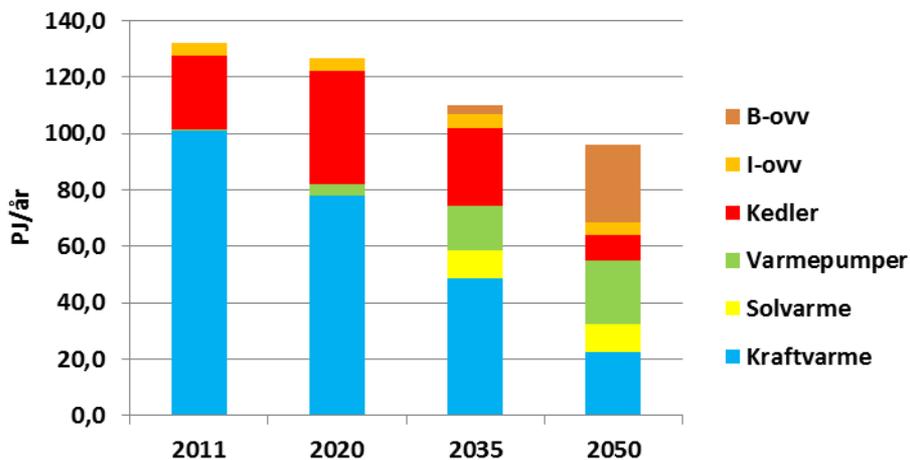


## ■ Scenario Analysis

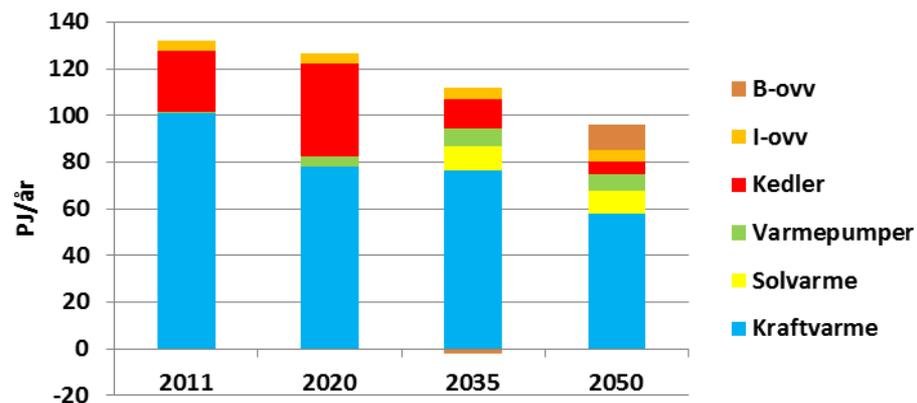
# Nettoenergiforbrug 2011 og 2050



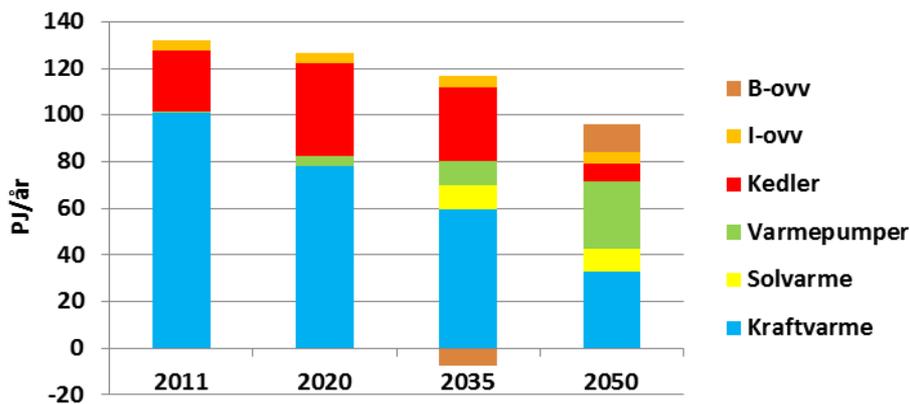
## Fjernvarmeproduktion i vindscenariet



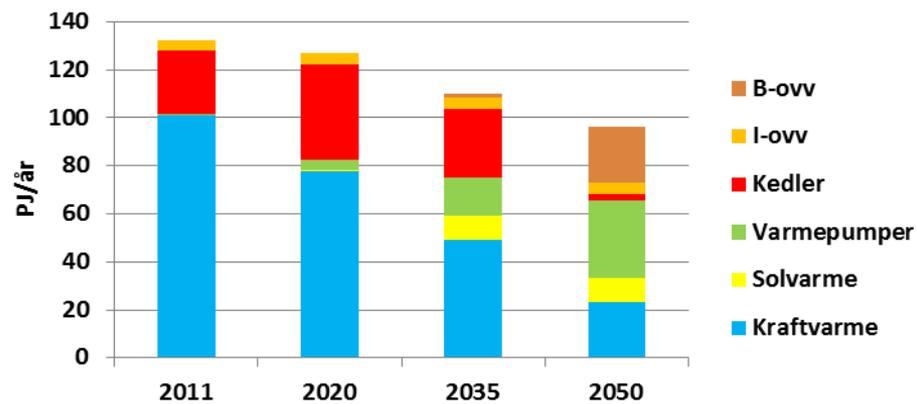
## Fjernvarmeproduktion i bioscenariet



## Fjernvarmeproduktion i biomassescenariet



## Fjernvarmeproduktion i brintscenariet





## Udvikling i bruttoenergiforbrug

