The influence of low-energy buildings on the future Danish energy system

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Outline of the presentation

- Overview of the study
- The methodology of the study
- Analysis
- Results
- Main points
- Future work
- Questions and comments

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Overview of the study

✓I assessed the **impacts** of new low-energy buildings (nZEBs) in a **future highly-renewable energy system in 2050**

- I did not investigate the impacts in a **shorter time span**, i.e. in the next 10-15 years

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Method

Defining the projected changes

1. The Danish **building stock** from today to 2050

2. The potential **future highly-renewable energy system** of Denmark in 2050

Analysis procedure

3. I tested different **heat demand levels** in the new buildings to understand their impact in the highly-renewable energy system in the year 2050

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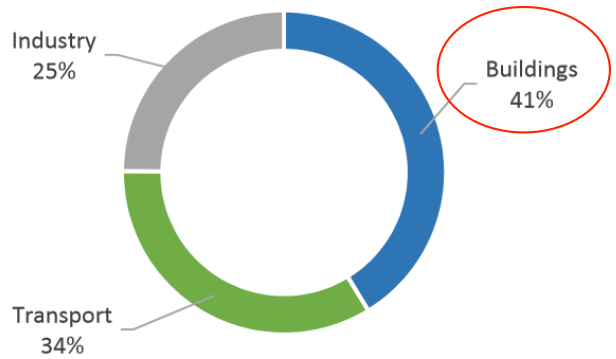
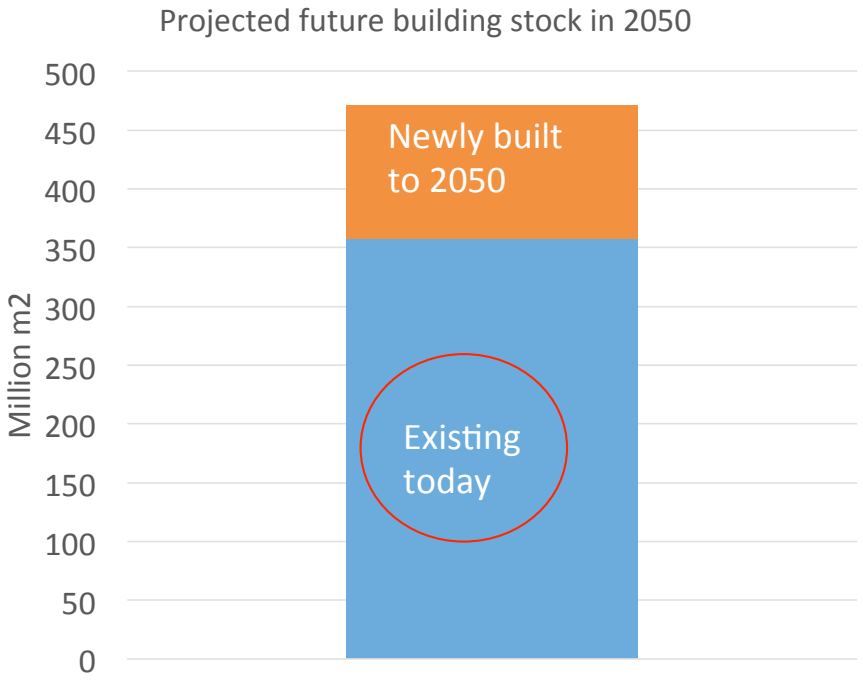
1) Projected changes in the **building stock** from today to 2050

Primary energy demand today (2015)





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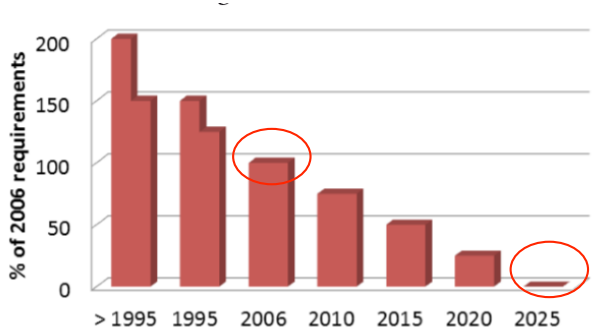
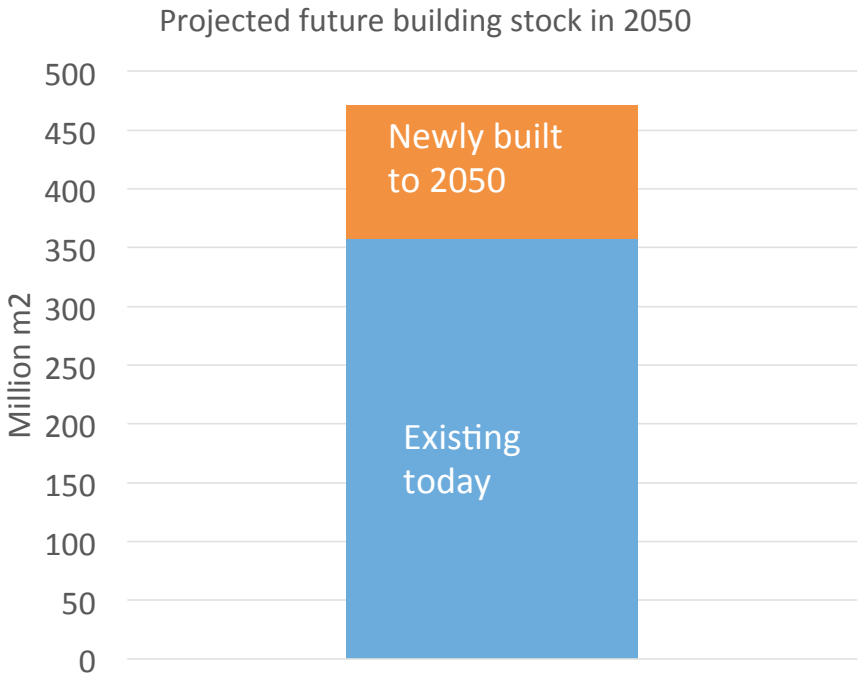
Danish new building requirements



	New residential buildings (kWh/m²y)	New non-residential buildings (kWh/m²y)
2015	30 + 1000 / (heated gross floor area)	41+1000 / (heated gross floor area)
2020	20	25
2025	0	0



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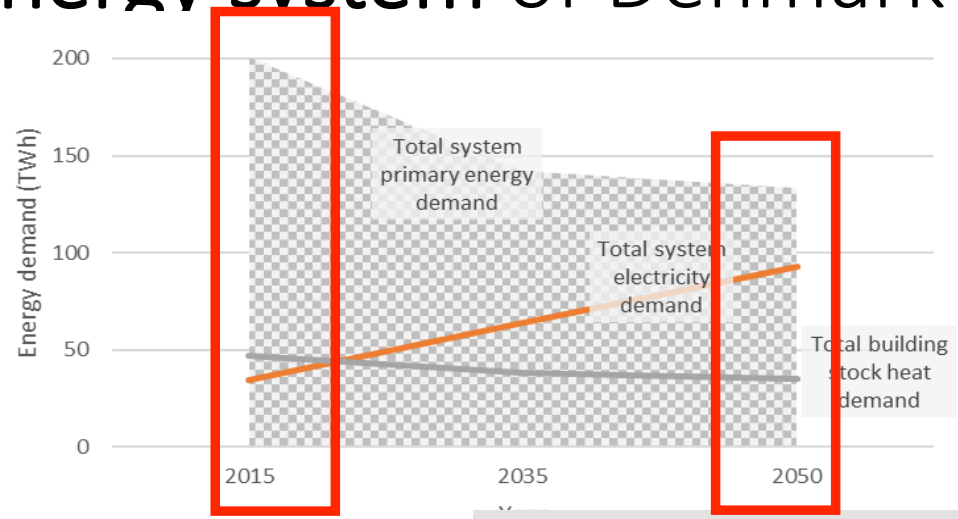
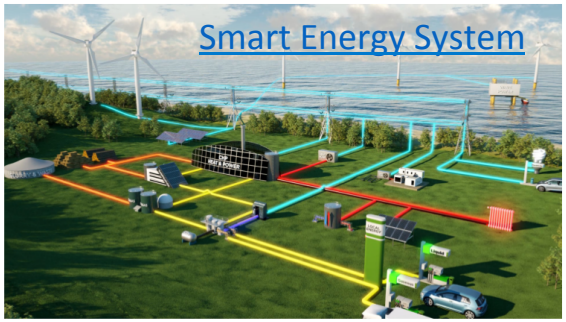
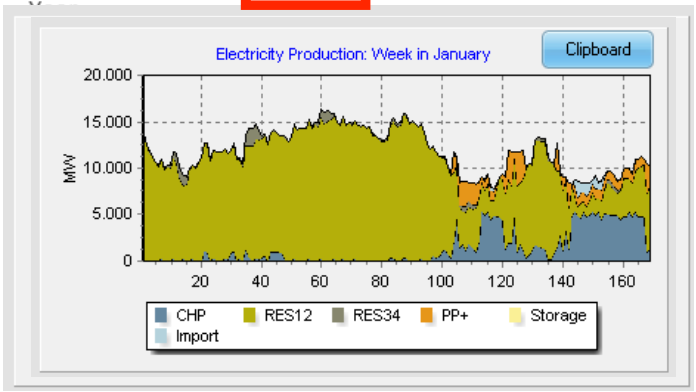
2) Projected changes in the potential **future highly-renewable energy system** of Denmark

- Today (2015)
  - 70% fossil fuels
  - Over 50% heat supplied by district heating
- Future (2050)
  - 0% fossil fuels
  - Large amount of offshore wind
  - Sector-sector integration to reduce biomass demand & cost
  - End-use demand has a lower primary energy demand



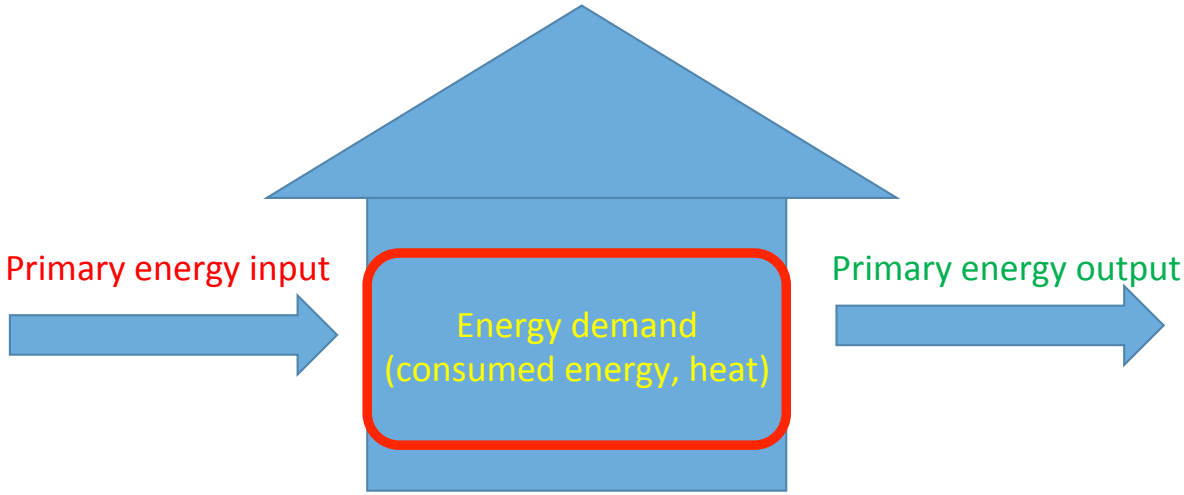




3) Analysis of different **heat demand levels** in the new buildings

nZEB

Net primary energy demand = Primary energy in – Primary energy out



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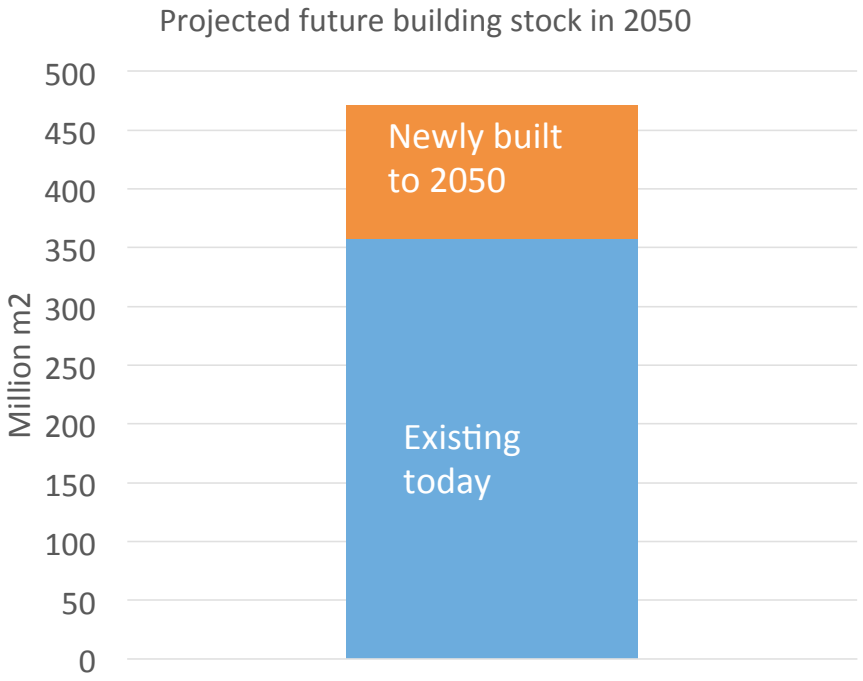
3) Analysis of different **heat demand levels** in the new buildings

- New buildings
  - 56 kWh/m2
  - 44 kWh/m2
  - 36 kWh/m2

- Existing buildings
  - 132 kWh/m2 (same as today)
  - 80 kWh/m2 (retrofitting)

- Six scenarios
- E.g. 132 & 56 kWh/m2
- E.g. 44 & 80 kWh/m2



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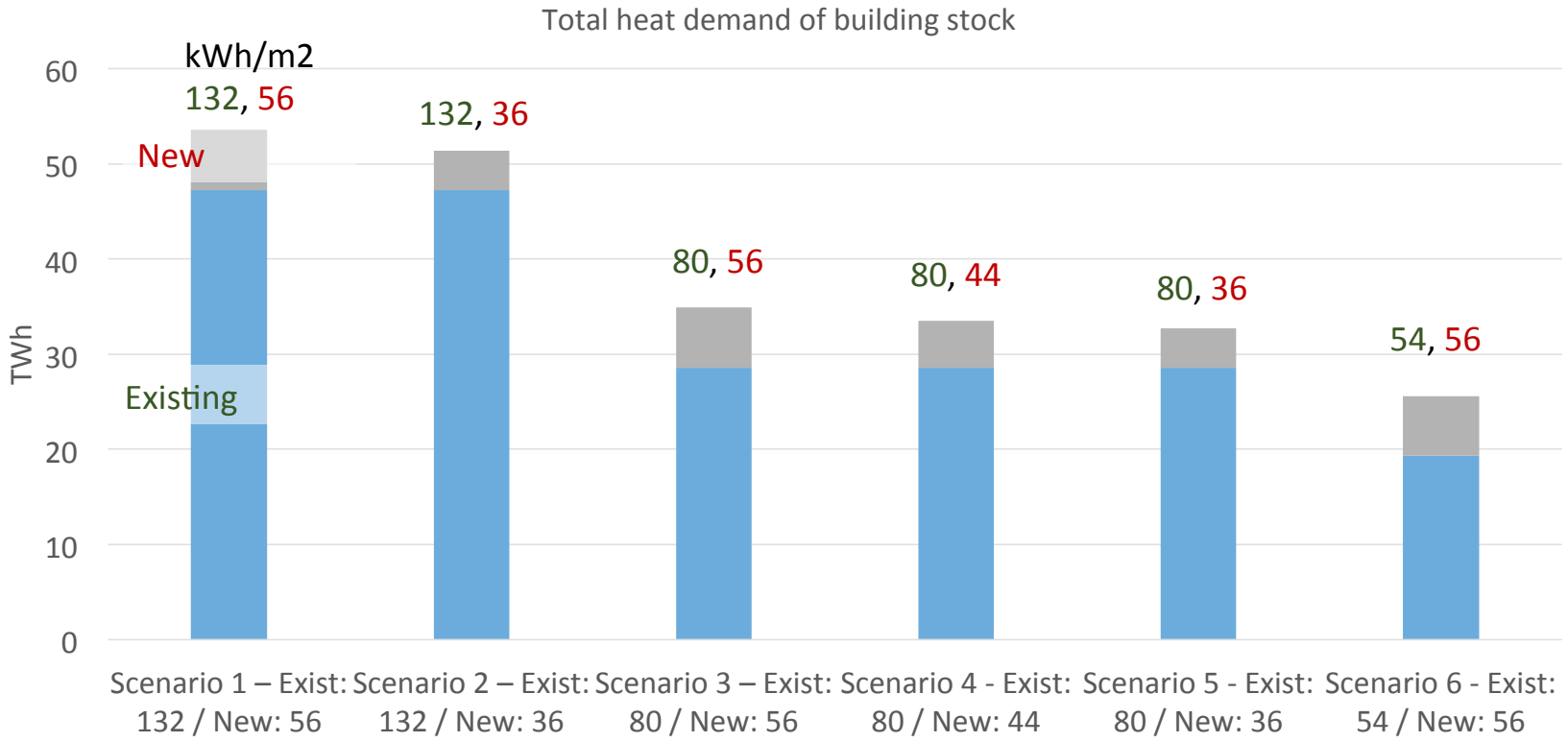
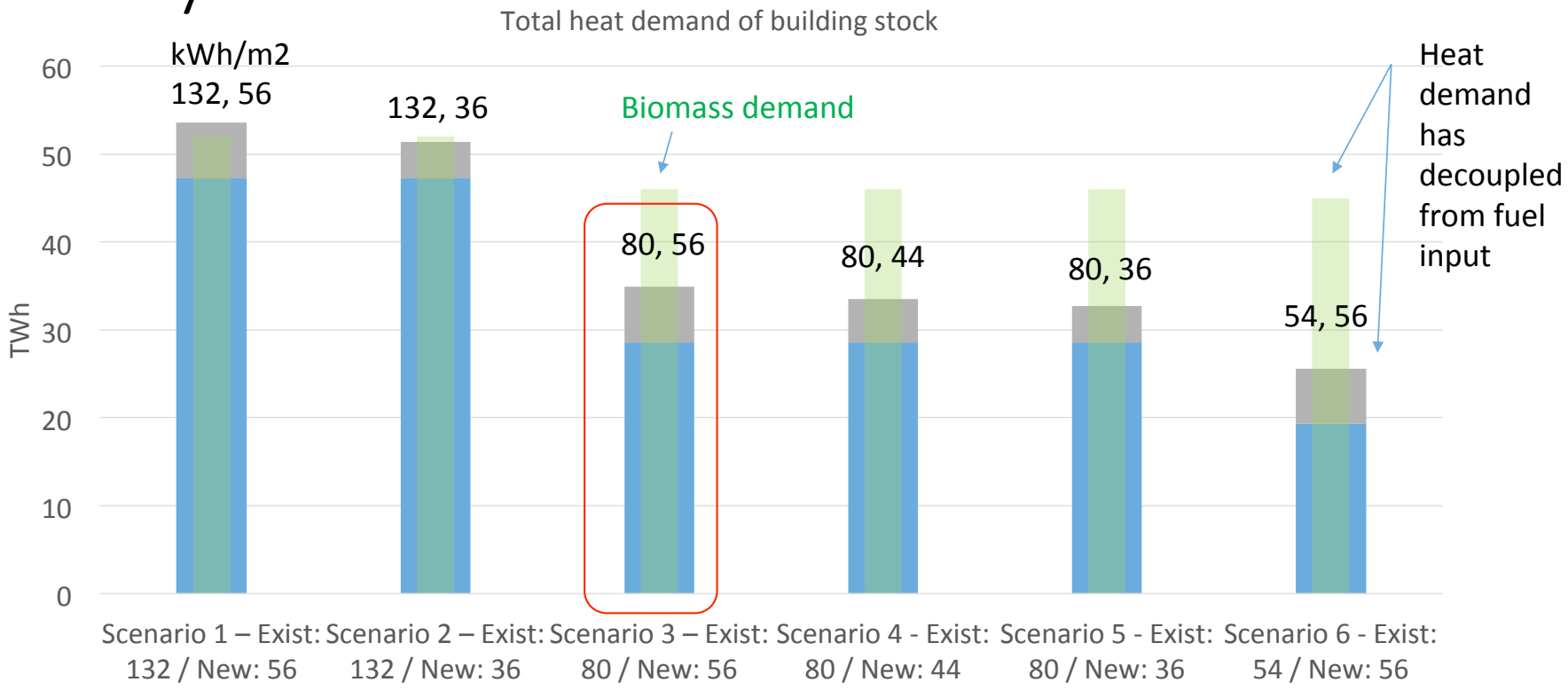
Results - Total heat demand in a 2050 system



Results – Biomass is the limiting factor in a 2050 system



Main points

- Existing building stock in Denmark is large and will remain large in the future
- Energy demand of new buildings will not be too problematic in the future energy system
- The district heating system provides an opportunity to decarbonise the energy system
- Energy can be reduced significantly with system level solutions, i.e. district heating
- European countries should understand their balance between individual and system level solutions, e.g. district heating

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Further research

- Include all the energy production units of nZEBs
- Investigate the benefits of low-energy nZEBs in the short term to e.g. 2030
- Investigate the total private costs of nZEBs versus cost of energy supply, e.g. district heat supply
- Investigate the change and influence of primary energy factors on the nZEB calculation

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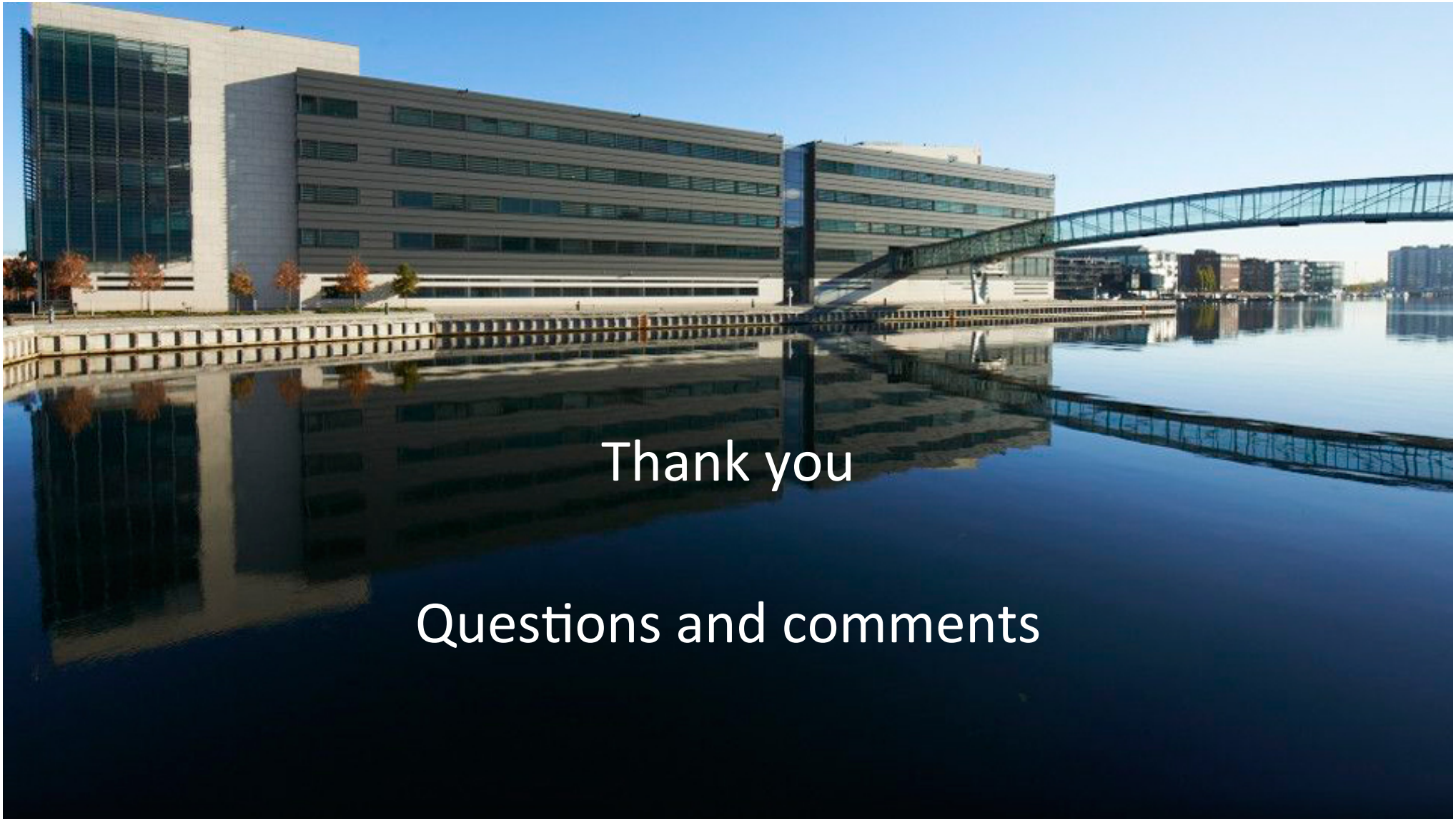
Thank you
Questions and comments