Clarifying the role of the Danish building stock in the future 100% renewable energy system

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4DH
4th Generation District Heating Technologies and Systems

What is the Danish building stock?

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Existing buildings in 2015

358 million m2

- **40%** of total **primary energy consumption** in Denmark (mostly for heat)
- Over **90%** of **existing building stock** is expected to exist in 2050 (many inefficient)

+

New buildings added to 2050

113 million m2

- Around **30% additional heated floor space** added to 2050

What does role mean?

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- Role refers to the amount heat that should be consumed in the existing and new buildings in the 100% renewable energy system

- Is it best to:

1. **Do nothing** to existing buildings and cease improving new buildings?
2. Reduce heat demand in only the **existing building** stock?
3. Reduce heat demand in **existing building stock and build new buildings** with low heat demand (nZEBs)?
4. **Build only new buildings** with low heat demand (nZEBs)?

How do compare these options?

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- Socio-economic cost of the whole energy system (annualised)
- Resource demand (biomass)
- **”IDA’s Energy Vision 2050”**

Option 1. Do nothing

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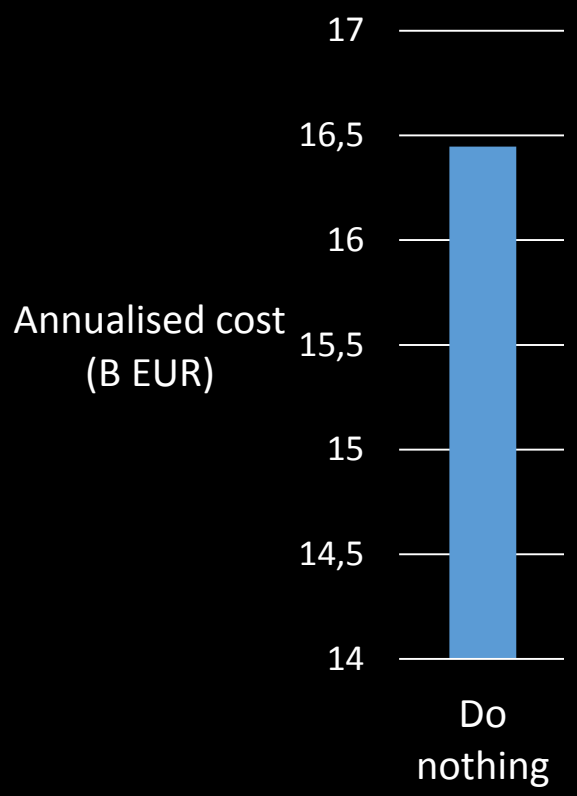
	2015	2050
Existing buildings (kWh/m2)	132	132
New buildings (kWh/m2)	56	56
Heated floor space (Mm2)	358	471
Heat demand (TWh)	47	53



Option 2a. Reduce heat demand in existing stock

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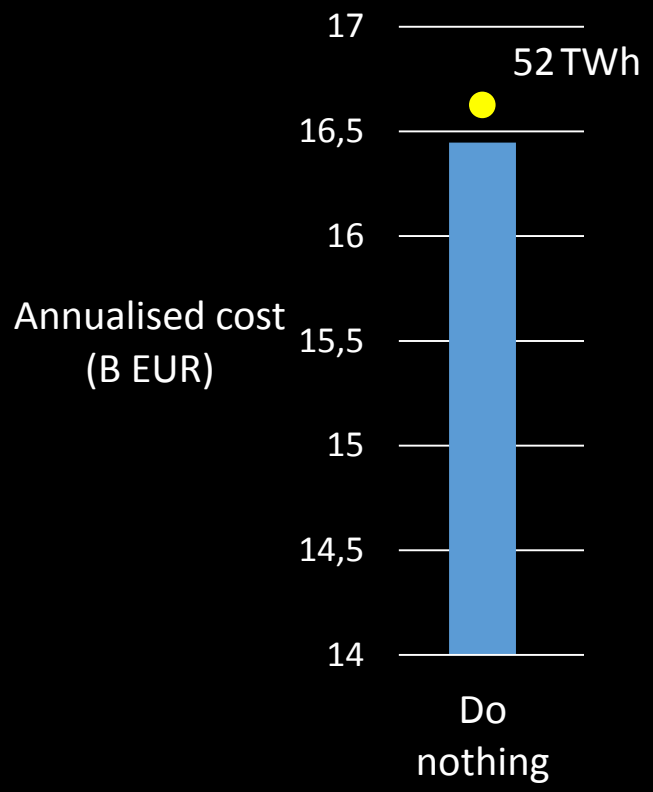
	2015	2050
Existing buildings (kWh/m2)	132	80
New buildings (kWh/m2)	56	56
Heated floor space (Mm2)	358	471
Heat demand (TWh)	47	35



Option 2b. Reduce heat demand (even more) in existing stock

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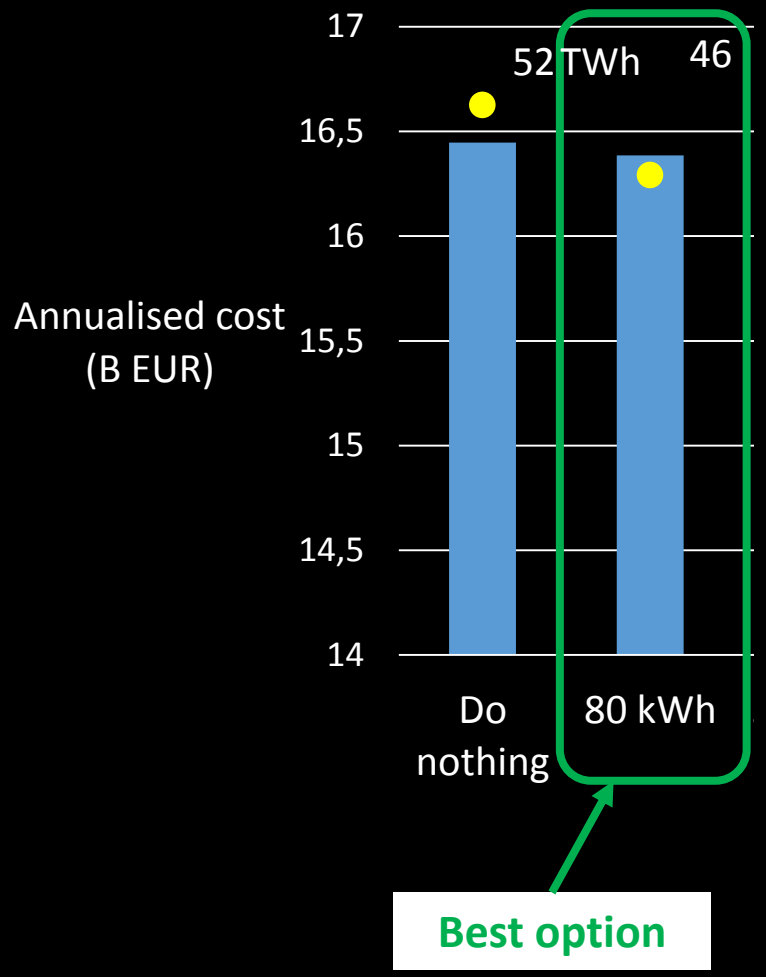
	2015	2050
Existing buildings (kWh/m2)	132	54
New buildings (kWh/m2)	56	56
Heated floor space (Mm2)	358	471
Heat demand (TWh)	47	26



Option 3a. Reduce heat demand in new buildings to 44 kWh/m2

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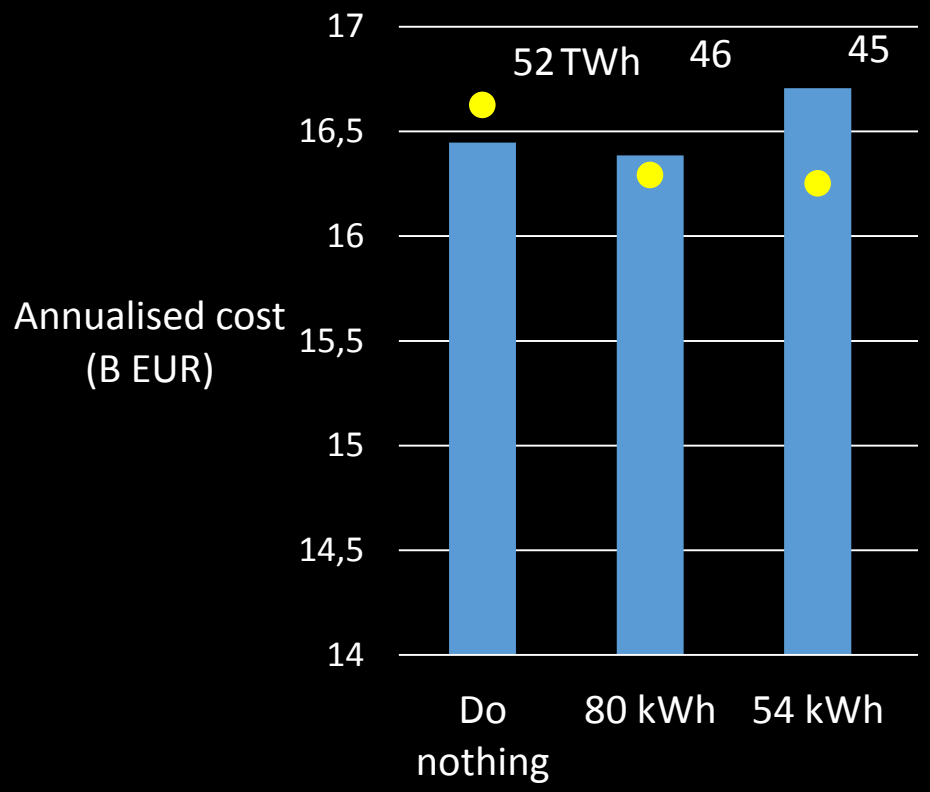
	2015	2050
Existing buildings (kWh/m2)	132	80
New buildings (kWh/m2)	56	44
Heated floor space (Mm2)	358	471
Heat demand (TWh)	47	34



Option 3b. Reduce heat demand in new buildings to 36 kWh/m2

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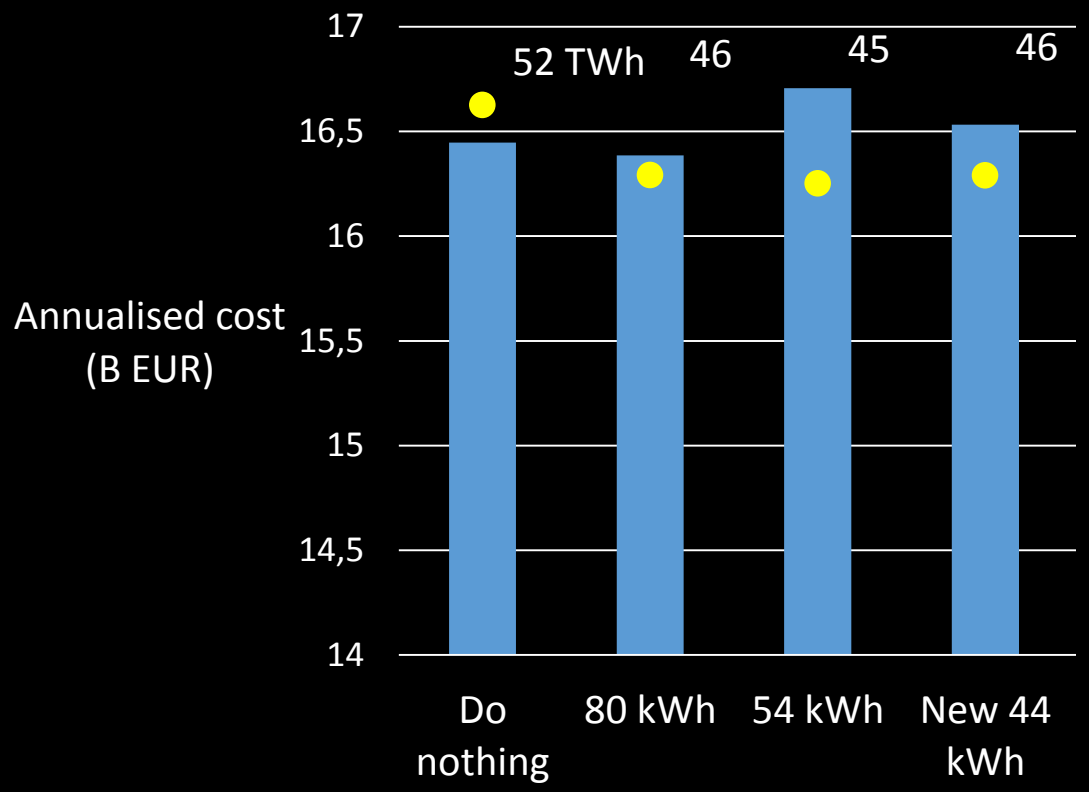
	2015	2050
Existing buildings (kWh/m2)	132	80
New buildings (kWh/m2)	56	36
Heated floor space (Mm2)	358	471
Heat demand (TWh)	47	33



Option 4. Reduce heat demand only in new buildings

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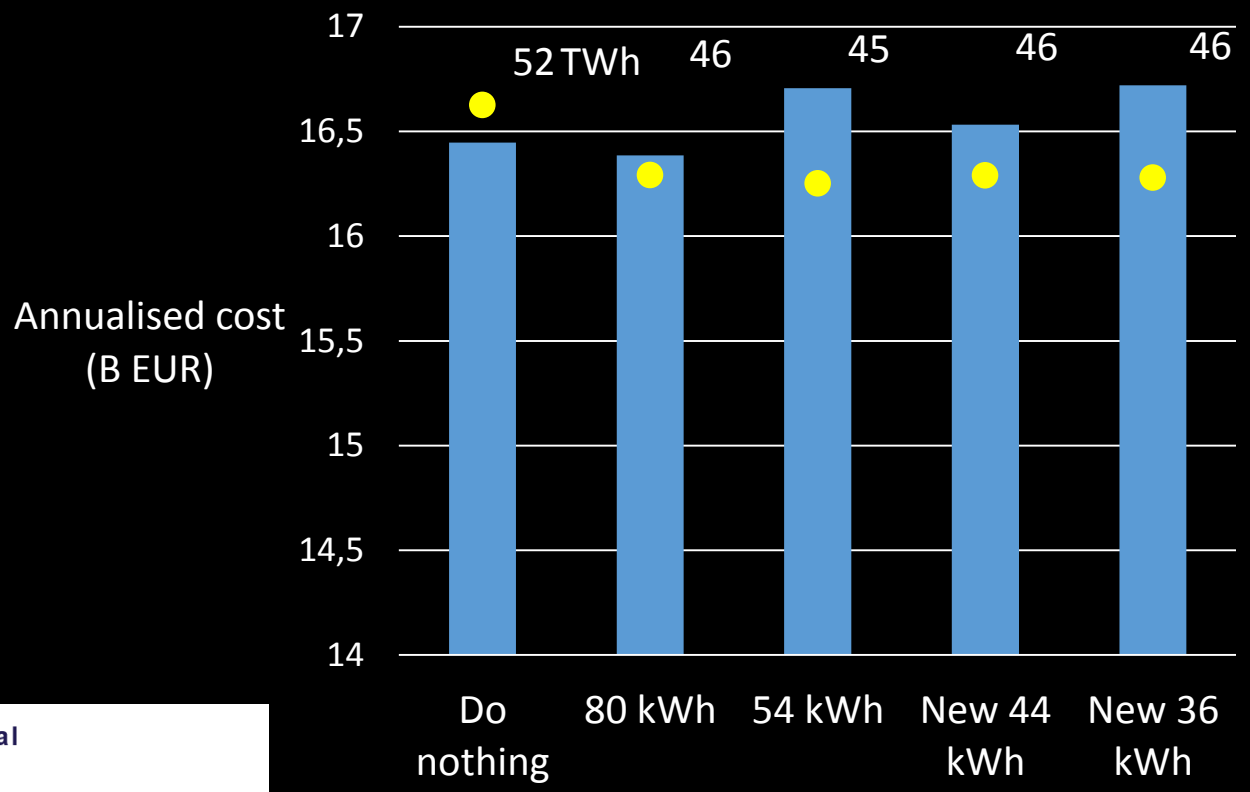
	2015	2050
Existing buildings (kWh/m2)	132	132
New buildings (kWh/m2)	56	36
Heated floor space (Mm2)	358	471
Heat demand (TWh)	47	51



Residential

2010
52.5 + 1650/A kWh/m² year

2015
30 + 1000/A kWh/m² year

2020
20 kWh/m² year

Key points

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- In the Danish 100% renewable energy scenario:
  - Heat savings are important in the building stock in order to reduce biomass consumption
  - Emphasis needs to be placed on retrofitting existing buildings first
  - We need to understand the role of new highly energy efficient buildings

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Thank you