District heating network savings from building retrofit

Building retrofit to capacity problems

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- District heating company of Aarhus, Denmark
- Part of Varmeplan Aarhus
- 130 km of transmission network
- 50 area substations
- 55,000 customers
- 3,000,000 MWh/year
- 1,000 MW peak load
Why use District Heating?

- District heating is essential in the future energy system [1]
- Sharing excess heat
- Renewable heat sources
- Cheapest in dense areas [2]
- Already functioning in many locations

What is 4GDH\[^3\]?

- Holistic
- Low temperature
- Old buildings and low energy buildings

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How do we get there?

- What is the best operational strategy, using the existing network setup?

- Investment costs in DH are more than half the total distribution costs\[^4\]
  - Investment could also be placed in building renovations

Network or building renovation

What should we do first?
eg. Capacity problems

Networks
- Capacity design
- Common practis
- Better pipes

Buildings
- Capacity limits
- Building renovation also works as low temperature preparation [5]
- Better design of the network

Example: Aarhus City center

- 50 km DH network
- 2,500,000 m² buildings
- Energy consumption at area substation: 260,000 MWh
- Total energy consumption in buildings: 230,000 MWh

12% grid loss
19 GJ/m linear heat density
92 kWh/m² (BR15 = 30–41)
Example: Aarhus City center

- Capacity issues due to urban densification
  - Action is needed

Network renovation
- At least 1,000 mio DKK
- Up to 75 %\(^\text{[6]}\) (~6 mio DKK) saved from grid losses

Building renovation
- 2,500 – ? mio DKK
- Lower energy use
  - Direct benefits
  - Indirect benefits
- Peak load reduction \([5]\)

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Benefits of building renovation

Direct

- Lower energy demand
- Aarhus City
- Direct saving: 150,000 MWh (30 mio DKK)

Indirect

- Grid losses due to temperature reduction
- Peak shaving
- Postponing renovation
- Extension planning

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Future work

- Using all 50 networks in Aarhus
- Considering
  - Energy
  - Economy
  - CO₂
  - Security of supply
- Building changes
  - Retrofit
  - Demand Side Management

Thank you!
Questions?