Low-temperature district heating grids
A study of the feasibility of low-temperature district heating solutions for Aarup, comparing booster heat pumps and electrical cartridges for preparing domestic hot water

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Agenda

• Introduction and Framework conditions
• Scenarios
• Methods
• Results
• Conclusions
• Questions
Introduction and framework conditions

• Background:
  – Long-term climate goals
  – Interest in expanding district heating areas

• Investigating two things
  – Is low-temperature (40 °C) district heating a feasible alternative to individual, or 60 °C district heating in Aarup
  – What kind of booster unit should provide domestic hot water in a low temperature scenario
Introduction and framework conditions

Heat demand: 30,800 MWh
90/10 split between space heating and hot water
Scenarios

• References
  – Existing system with primarily natural gas boilers
  – Alternative with individual heat pumps

• District heating
  – 60 °C forward and 37 °C return
  – 40 °C forward and 20 °C return
    • Booster heat pump
    • Electrical cartridge
Methods

• District heating network in Termis
  – Heat loss estimate
    • 60 °C forward 37 °C return: 17 % heat loss
    • 40 °C forward 20 °C return: 9 % heat loss
  – District heating grid investment costs

• Energy system analyses in EnergyPro
  – Operation and maintenance costs
  – Damage costs

• Private- and socioeconomic analyses
Results

• Socioeconomic
  – Natural gas individual heating: 585 DKK/MWh-heat
  – Individual heat pumps: 573 DKK/MWh-heat
  – LT district heating with electric cartridge: 637 DKK/MWh-heat

• Private economic
  – Individual heat pumps: 898 DKK/MWh-heat
  – Natural gas individual heating: 909 DKK/MWh-heat
  – 60 °C forward district heating: 793 DKK/MWh-heat
  – 40 °C forward district heating: 796 DKK/MWh-heat
Conclusions

• Socioeconomic
  – Individual heating preferable
  – Gains for large scale production to small to offset investment costs
  – Electric cartridge scenarios are better than heat pump scenarios for low temperature in this case

• Private economic
  – DH scenarios preferable
  – 60 °C DH cheaper than 40 °C DH
  – Removing the PSO tax makes the electric cartridge scenario cheaper than 60 °C district heating
Questions
Thank you for listening