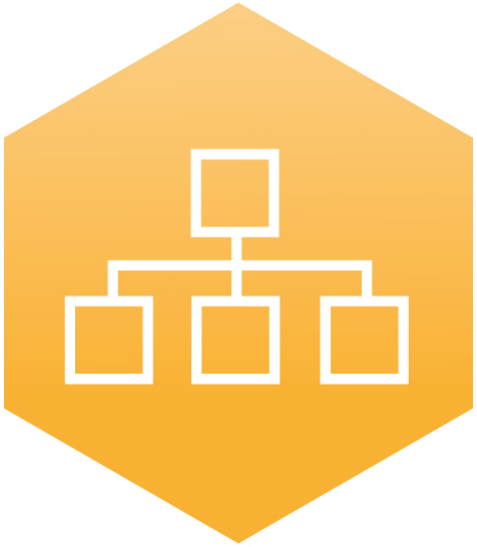
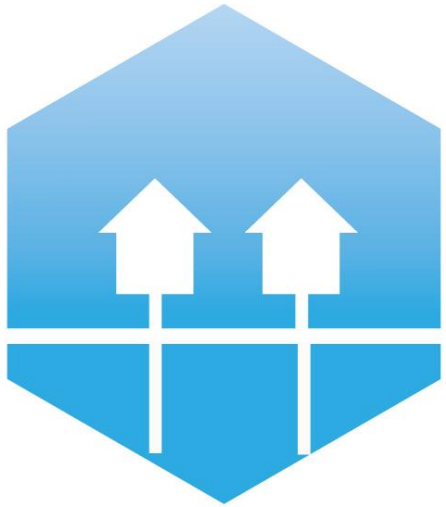
2nd International Conference on Smart Energy Systems and 4th Generation District Heating
Aalborg, 27-28 September 2016

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

Christian Sjøstrann Jørgensen





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Agenda

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- **Introduction and Framework conditions**
- **Scenarios**
- **Methods**
- **Results**
- **Conclusions**
- **Questions**

Introduction and framework conditions

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- 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

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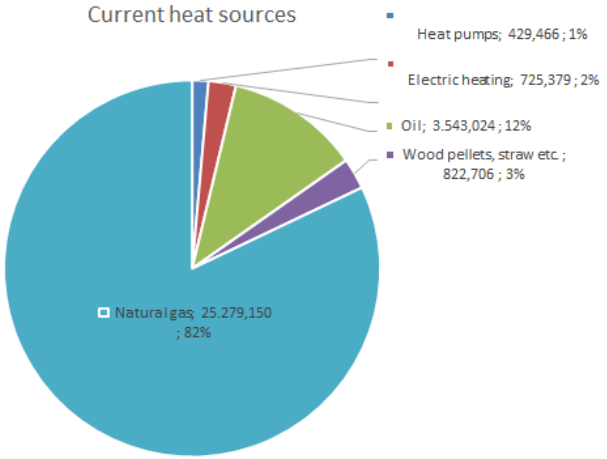
Introduction and framework conditions



Heat demand: 30.800 MWh
90/10 split between space heating and hot water

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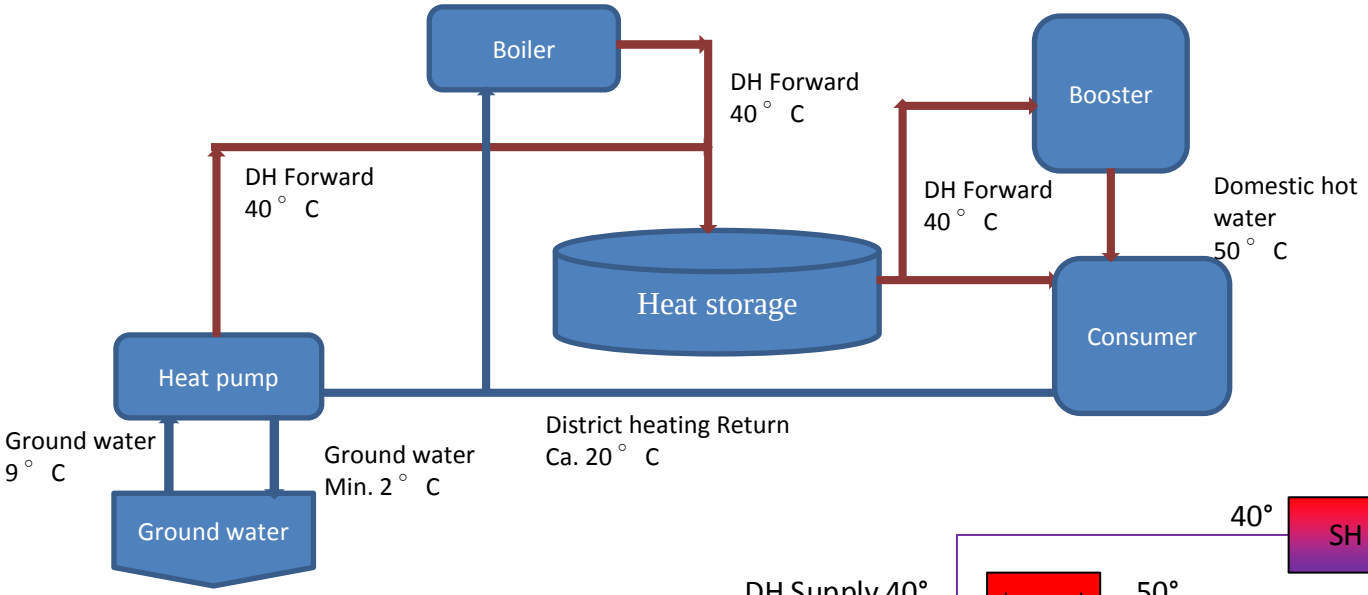
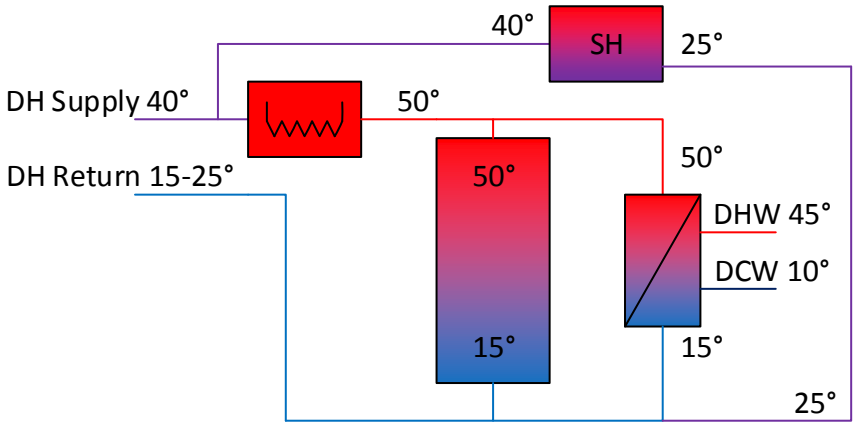
Scenarios

- 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

Scenarios





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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

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Thank you for listening

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