Smart energy systems
A study of possible district heating solutions for the Aarup area.

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Agenda

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

- Based on long term climate goals
- Town of Aarup
  - Located on Funen
  - 3120 inhabitants
  - 30,800 MWh-heat/year

Current heat sources

- Natural gas; 25,279,150; 82%
- Oil; 3,543,024; 12%
- Wood pellets, straw etc.; 822,706; 3%
- Electric heating; 725,379; 2%
- Heat pumps; 429,466; 1%
Scenarios

• Reference scenarios
  – Current heating system
  – Individual heat pump

• District heating scenarios
  – Nine scenarios with 60°C forward/37°C return
  – Nine scenarios with 40°C forward/20°C return

Technologies: Woodchip boiler, groundwater heat pump and solar heating
Methods

• Termis model of the DH grid
  – Heat loss
    • 60°C/37°C: 17 % heat loss
    • 40°C/20°C: 9 % heat loss
  – Grid investment costs

• EnergyPRO models of each scenario

• Private- and socioeconomic analysis of each scenario
  – Private economically includes taxes and VAT
  – Socioeconomic is the socioeconomic cost
Results

• Socioeconomic results
  – Individual heat pumps: 573 DKK (77€)/MWh-heat
  – Current configuration: 585 DKK (78,5€) /MWh-heat
  – DH with 10 % solar heat, rest HP, 60°C/37°C: 633 DKK (85 €) /MWh-heat

• Private economical results:
  – Individual heat pumps: 898 DKK (120,5 €)/MWh-heat
  – Current configuration: 909 DKK (122 €)/MWh-heat
  – DH with 10 % solar, 2 MW GW HP, rest woodchip boiler 60°C/37°C : 750 DKK (100,5 €)/MWh-heat
Conclusions

• Socioeconomically:
  – Individual scenarios are better
  – Heat pumps are preferable
  – Best DH scenario: 10% solar heat and rest heat pumps

• Private economically:
  – DH scenarios are better
  – HP are feasible in DH system

• Feasibility of 4th generation DH
Questions
Thank you for listening