Demand side Transition to 4th Generation District Heating and Motivation Tariffs

Henrik Lund, Aalborg University and Vaarst Vestervang.
Jan Eric Thorsen, Danfoss.
Steen Schelle Jensen, Kamstrup.
Flemming Pentz Madsen, Vaarst Vestervang

Powered by
Context

• Smart Energy Systems
• 4G District Heating
• Demand side implementation of low temperature solutions
• Motivation Tariffs
Motivations Tariffs: Aalborg DH

- Up to 25% penalty on high return temperatures
- Up to 25% discount on low
- Depends on the supply temperature
Case: Vaarst Vestervang
Problem: High return on 40-50 C

- Return temperature on 40-50 C

- When disconnecting hot water tanks then return is 30 C
Trend for thermal length of Heat Exchangers for DHW preparation towards 4GDH

**Year ~2005**

Thermal length: $\text{NTU} = 3.2$

$60°C  \rightarrow  T_{12}  \rightarrow  50°C$

$23.1°C  \rightarrow  T_{12}  \rightarrow  10°C$

XB06 H Type - 30 plates

32.3 kW DHW capacity (DK Norm)

dP in the range of 6 to 10 kPa

Same platform, different plate corrugations

**Year ~2013**

Thermal length: $\text{NTU} = 4.8$

$60°C  \rightarrow  T_{12}  \rightarrow  50°C$

$17.7°C  \rightarrow  T_{12}  \rightarrow  10°C$

XB06 H+ type - 40 plates

**Year ~2021**

Thermal length: $\text{NTU} = 6.5$

$60°C  \rightarrow  T_{12}  \rightarrow  50°C$

$14.7°C  \rightarrow  T_{12}  \rightarrow  10°C$

XB06 HU Type - 50 plates

As installed in Vaarst Vestervang
Solution: Instantaneous heat exchangers

- 40°C with and increase to 50°C when water is used
- 30°C with and decrease to 20°C when water is used
Next Step: Smart meters

- Installations of 17 smart meters for heat and water
- Central supervision of flows and temperatures
Smart Meters: temp. monitoring

- Used to identify and correct faults in measurement og supply temperatures
Example: Fault in a shunt thermostat

- Measurements from smart meters have been used to identify and correct faults in the floor heating systems of the buildings.
Results and problem in motivation

• Motivation has been successful (green arrow)

• But is it fair... (blue arrow)
Conclusions and discussion

• Use of instantaneous heat exchangers and smart meters has been successful to decrease return temperature to 30 C and maintain decrease also with low supply temperatures (60-65 C).
• Case has proven near 4G District Heating possible with 60-65 C supply and 30 C return
• Motivation tariffs has been successful: Return temperature has been decreased from 40 to 30 C
• But is the motivation tariff fair: Benefits are not available to consumers because the supply system is not yet ready for the 60 C...?!
Thank You...

Henrik Lund, Aalborg University and Vaarst Vestervang.
Jan Eric Thorsen, Danfoss.
Steen Schelle Jensen, Kamstrup.
Flemming Pentz Madsen, Vaarst Vestervang