Building solutions for low-temperature heat supply

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What are the complications of moving towards the 4GDH?

› The connected buildings need to be able to cope with low temperature supply
  – Well insulated
  – Low temperature radiators or floor heating

› Low temperature supply demands accurate control
  – For example 5°C less cooling of the supply than design (25°C) can lead to:
    › 9% increased distribution heat loss
    › 95% increased pumping costs

› We need to fulfill health standards
  – Legionella safe domestic hot water preparation

› Due to these it becomes very important to apply accurate and efficient control equipment at the buildings
Can all buildings be supplied by low-temperature heat supply?

- Extensive research has been made into the viability of applying low-temperature district heating to existing single-family buildings.

- The results show that even for non-renovated buildings, 50°C supply temperature is sufficiently high for 78.6% of the year.

- By only moderate renovations, new windows, the low-temperature supply can be used for 93.2% of the time.

- This implies that already today low-temperature district heating could be achieved with a temperature boosting during the coldest periods.

- Some buildings might need higher supply temperature.

- The solution could be to use local temperature boosters to boost the temperature at these buildings until they have been energy renovated.

### General heating interface solutions

- **Indirect consumer interfaces**
  - The building heating system is connected to the district heating system via heat exchanger unit, which regulates the heating system supply temperature

- **Direct connection with a mixing loop**
  - The mixing loop has the purpose to adjust the supply temperature to the requirements of the building heating system

- **Direct connection**
  - The district heating supply runs directly into the building without any adjustments

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Danfoss-recommended application

Primary alternative to Danfoss-recommended application

Application not recommended
Due to the importance of good control for the economics of the district heating system the following technologies should be carefully considered:

- Thermostatic radiator valves (TRV) with a pre-setting function
  - Adjusts the supply to the demand
  - Minimizes the maximum draw off and consequently increases the hydraulic balance

- Return temperature limiters
  - To prevent inefficient utilization of the radiator
  - The valve closes if too high radiator outlet temperature is experienced

- Differential pressure controllers, to ensure good working conditions for the TRV’s
Domestic hot water systems

› Generally 45°C should be enough to fulfill all normal domestic hot water requirements

› With an efficient heat exchanger 50°C supply would be enough to achieve 45°C domestic hot water

› However 45°C is within in the optimal growth zone of the Legionella bacteria

› Solution: Instantaneous preparation!
  – No domestic hot water circulation
  – No storage of domestic hot water
  – Domestic hot water system volume < 3 liters

› During taping periods new fresh Legionella free water fills up the pipe volume

› During non-taping periods the water in the installation is cooled down to room temperature
Domestic hot water applications

› In general there are two instantaneous applications for low-temperature district heating

› Instantaneous heat exchanger application
  – Higher network capacity requirements
  – Maximum cooling
  – Minimum heat loss
  – Inexpensive application

› Primary side storage tank and instantaneous heat exchanger application
  – Lower network capacity requirements
  – In general higher total heat loss
  – Expensive application
Domestic hot water waiting time

› With the elimination of domestic hot water circulation a new (old) issue emerges:
  – **People are in general impatient**

› To limit the waiting time for domestic hot water some aspects need to be considered:
  – a) Minimize the pipe distances and dimensions from the DHW unit to the taps and
  – b) To keep the supply pipe and/or the domestic hot water heat exchanger warm during non-tapping periods by using by-passes, on the primary side
Can all buildings be supplied by low-temperature heat supply?
Conclusions

› It is clear that the industry is ready for the 4th generation district heating
  – All the necessary technologies are already available
  – It has been proven to work:
    › Lystrup, Sønderby and Albertslund in Denmark

› Benefits of bringing down the district heating supply temperatures are
  – Significant reduction of distribution heat losses
  – Increased potential to access local low temperature renewable heat sources

› The future of district heating as an energy efficient infrastructure is bright
  and will without doubt play a vital part towards achieving the ambitious goals of limiting the global climate change from human activities
Thank you for your attention

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