Aarhus (Lystrup), Denmark

Since 2010, a low-temperature district heating system has been in operation in Lystrup, a suburb of Aarhus, Denmark. Lystrup Fjernvarme delivers district heating to a central point at the demonstration. The local site network supplies 40 terraced low-energy houses and one communal building with domestic hot water and space heating

Table 1. Key data for the Aarhus case study. Measured data from 2012.

Parameter	Value
Year of construction	2009-2010
New development/renovation	New development
Type of houses	Terraced houses and one communal building
Number of houses	40 + 1
Total heated area	4,115 m²
Supply temperature (design/measured)	55 / 52.1 °C
Return temperature (design/measured)	30 / 33.7 °C
DHW temperature	45 °C
SH design temperatures (supply/return)	55/25 °C
Trench length	723 m
Supplied heat	282.6 MWh
Delivered heat	232 MWh
Distribution losses	17.9 %

Supply-side technologies/System solution

- Shunt connection to a medium-temperature DH system (supply temperature 80 °C during winter and 60 °C during summer).

Distribution technologies

- All pipes are twin pipes. 82 % are plastic pipes (AluFlex) and the rest are steel pipes.
- Maximum pressure level 10 bar. Minimum pressure difference at substations 0.3 bar.
- Small pipe dimensions were used. Booster pumps raise the pressure locally in the network.

Demand-side technologies

- Two different types of substations are used in this project: substations with 120 litre district heating storage tanks and substations with instantaneous heat exchangers. In both cases the systems are designed for a DHW temperature of 45°C. The risk of Legionella is handled by the small volume approach (reducing the DHW volume to maximum 3 litres according to German guidelines). In the substations with storage, this is achieved by storing DH water and not hot water.

- The heating systems use direct connection; radiators are designed for 55/25/20°C (supply/return/room temperature) and underfloor heating is used in the bathrooms.
- Each dwelling is connected directly to the district heating system (there are no internal systems in the terraced houses).

Lessons learned

This demonstrator project is relatively well studied and described in literature. Some conclusions drawn are:

- The results show that it is possible to supply customers with a supply temperature of approximately 50 °C and satisfy both the storage heater requirements and safe preparation of DHW.
- It is very important to ensure the proper functioning of each substation; otherwise unacceptable return temperatures will result.
- Low network heat loss can be achieved despite low heat demand in the low-energy buildings.
- The distribution heat loss for the area with district heating storage units is slightly lower than in the area with instantaneous heat exchangers. However, this is counteracted by heat losses from the storage tanks, leading to larger total losses in the case with DH storage.
- Despite higher heat losses, the DH storage solution offers some advantages, due to lower peak pressure/load requirements.