Aalto University
School of Engineering

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Towards low-emission district heating systems

Title of the dissertation	District heating with low-carbon heat sources and low distribution temperatures
Contents of the dissertation	District heating is a technology for efficient distribution of heat to customers via a distribution network, and has the potential to utilize the most efficient low-emission heat supply technologies. The chosen heat supply options play a decisive role in terms of total emissions, but building energy efficiency, their internal heat distribution system design and the temperature level within the district heating network have a significant impact on the performance of the system as well. Low distribution temperatures could facilitate use of more renewable and excess heat sources and further improve the distribution efficiency. The research presented in this dissertation focuses on three low-carbon heat sources; heat pumps, solar collectors and nuclear district heating. The impact of the distribution temperature level on heat supply and the overall system operation was also investigated. The emphasis in the work is on techno-economic assessments. Furthermore, the research points out the need to assess a system as a whole when considering new low-carbon heat sources and lower distribution temperatures. The benefits of the transition to a low temperature system show mainly on efficiency of heat supply while the costs result from changes needed within buildings and partly within the distribution network. As buildings and some-times also the distribution network and heat supply operators are all represented by different stakeholders, the situation creates a need for new business models and makes the role of the consumer more significant in developing district heating systems. The dissertation as a whole presents guidelines and tools for developing future district heating systems using concrete examples.
Field of the dissertation	Energy technology
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