Numerical modelling and experimental measurements for a low-temperature district heating substation for instantaneous preparation of DHW with respect to service pipes

Traditional district heating (DH) systems are becoming uneconomic as the number of new and renovated buildings with reduced heating requirements increases. To keep DH competitive in the future, heat losses in DH networks need to be reduced. One option is to reduce the supply temperature of DH as much as possible. This requires a review and improvement of a DH network, in-house substations, and the whole domestic hot water (DHW) supply system, with the focus on user comfort, hygiene, overall cost and energy efficiency. This paper describes some practical approaches to the implementation of low-temperature district heating (LTDH) with an entry-to-substation temperature around 50 °C. To this end we developed a numerical model for an instantaneous LTDH substation that takes into consideration the effect of service pipes. The model has been verified and can be used for the further optimization of the whole concept as well for individual components. The results show that the way that the service pipe is operated has a significant effect on waiting time for DHW, heat loss, and overall cost. Furthermore, the service pipe should be kept warm by using a bypass in order to fulfill the comfort requirements for DHW instantaneously prepared.