Optimization of District Heating Systems: European Energy Exchange Price-Driven Control Strategy for Optimal Operation of Heating Plants

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Abstract

District heating (DH) systems are often seen as a good practical approach to meet the local heat demand of districts, especially CHP-based DH systems and, therefore, these CHPs are frequently heat driven. Consequently, CHP's electricity is fed into the grid at a variable or fixed tariff, which leads to some additional profits. Yet, under today's regulations to renovate buildings on high efficiency standards, the local heat demand is decreasing. This demand profile and the national electricity demand fluctuate seasonally and hourly with asynchronous patterns, thus this might lead to less profit for the operators of DH systems. Therefore, it is important to guarantee an optimal-operation of the heating plants coupled to the DH networks. Thus, the operators strive for an optimal operation at which the heat demand is met and the profits are maximized. In this work, a control strategy for optimal operation of a combined heat and power (CHP) based DH is presented. The proposed control strategy couples the operation of CHPs to the European energy exchange (EEX) price by implementing different operation constraints. To test this strategy, a validated power-based model of a DH system is used. This model shows the amount of energy flows between the different parts of the DH system (supply side, transmission network and demand side). Moreover, this configuration is accompanied with another, which is the installation of additional storage volume. Thereby it is held to provide the optimal operation for the plant technically and economically.