Investigation of real-time flexibility of combined heat and power plants in district heating applications - DTU Orbit (09/11/2019)

Denmark has the ambitious goal of achieving 100% renewable electricity and heating sectors by 2035. Coupling these two energy sectors, combined heat and power (CHP) plants play an important role in providing flexibility in terms of economic dispatch of heat production and balancing power systems with high penetration of intermittent renewable like wind power.

In this paper, a twofold flexibility potential of different CHP applications in the Danish district heating systems was investigated and compared based on a proposed two-stage optimal dispatch model. In the first stage, the heat production plan of a CHP plant was derived to minimize the system heat cost in a deregulated heat market by using its flexibility; in the second stage, the CHP plant was redispatched to provide real-time balancing service with the remaining flexibility. The diversified applications include different types of CHP plant, various operation modes, and the inclusion of heat accumulator (HA) or not. A case study using information collected from Denmark was presented to validate the proposed algorithm and to quantitatively illustrate the flexibility difference of various CHP applications in real time. The results provide a practical guide to activities aiming to take advantage of the flexibility potential of CHPs for both minimizing the heat cost and balancing a local energy portfolio.

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