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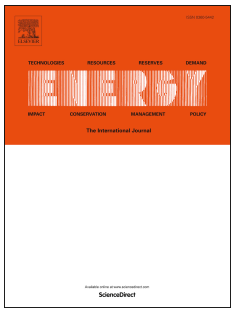

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Philipp Vögelin, Ben Koch, Gil Georges, Konstatinos Boulouchos

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Heuristic approach for the economic optimisation of combined heat and power (CHP) plants: operating strategy, heat storage and power

Philipp Vögelin, Ben Koch, Gil Georges, Konstatinos Boulouchos

Aerothermochemistry and Combustion Systems Laboratory, ETH Zurich, Sonneggstrasse 3, 8092 Zurich, Switzerland

Abstract

CHP plants produce power and heat in parallel and operate between power and heat consumers as well as prices for their supply. The profitability of a plant with given power depends on operating strategy and heat storage size. In this paper, we present a fast heuristic algorithm to determine the most profitable setting for given boundary conditions, as a substitute for the state-of-the-art approach based on mixed-integer linear programming (MILP). The presented heuristic algorithm is appropriate for thousands of plant calculations or real-time operation planning of single as well as interconnected plants. We used hourly resolved full-year data reflecting electricity market price and heat demand, which was simulated using a typical multi-family house configuration. The heuristic algorithm found the optimal operating strategy and heat storage size 34 times faster than the MILP solver. Additional optimisation runs of the operating pattern at various fixed heat storage sizes, resulted in equal solutions of both approaches. The heuristic algorithm found in this case the operating patterns around 200 times faster. Furthermore, the heuristic algorithm can be enhanced to find optimal CHP power, heat storage size and operating strategy in one process using characteristic curves for plant efficiencies and costs.

Keywords: Combined heat and power; Thermal energy storage; Economic optimisation; Heuristic algorithm; Mixed-integer linear programming; Building heat demand