An Economic Optimization Strategy for Residential Micro Combined Heat and Power Units

Emrah Gunel
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Abstract
This thesis investigates the problem of integrating micro combined heat and power (micro CHP) systems in households to fulfill residential energy requirements. The micro CHP system is able to generate both useful electricity and thermal energy from a single source of fuel, such as oil or natural gas. In this study, comparisons are made between micro CHP systems and existing systems with respect to efficiency, environmental impact, and economic benefits. Then the cost minimization problem for energy usage of a household equipped with a micro CHP system is solved. We consider the case where the micro CHP system replaces the existing hot water tank. Models are developed for both the micro CHP system and the current system with a hot water tank and the daily cost optimization problem is presented for the micro CHP system. Conditions are derived under which the problem becomes a convex or non-convex optimization problem and the solution of the cost minimization problem is obtained for both cases. Finally, cost benefits are shown for several occupancy patterns by comparing models both with and without a micro CHP system.