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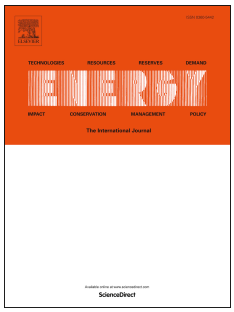

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Generation and Storage Scheduling of Combined Heat and Power

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Abstract

Generation scheduling of combined heat and power extends the traditional power generation scheduling by satisfying the thermal load in parallel with the electrical load; the integration of storages into the system further improves the economic efficiency of the traditional generation scheduling. Such combined heat and power scheduling of the dispatchable generators and storages, which incorporates the dispatch of both electrical and thermal energy storages with the scheduling of the dispatchable generators, is realised as the main contribution of this study, by enhancing the technique of the metaheuristics-enabled "storage-integrated generation scheduling". The metaheuristic approach relieves the modelling complexity of the scheduling, by using fewer decisions variables of the optimisation than the existing methods like the linear programming. The non-dominated sorting genetic algorithm II (NSGA-II) serves as the metaheuristic tool, which supports concurrent binary and real-number encoding that fits the variable types of the generation scheduling. The combined heat and power scheduling is evaluated in a hypothetical building to serve the electrical and thermal loads driven by the occupants' comfort requirements, which proves the advantage of integrating the storages into the system, and in the perspective of application, has the value of guiding through the building heat and power operation.

Keywords: building; combined heat and power; generation scheduling; NSGA-II; storage dispatch.

1. Introduction

A combined heat and power (CHP) system captures the waste heat associated with the power generation that meets the electrical load, to jointly meet the thermal load. The traditional generation scheduling that determines the commitment and dispatch of the generation units for an economic power generation – load match, has to enlarge its coverage for economic heat generation – load match. Moreover, as the storage has proved to improve the performance of generation scheduling, two types of storages, the electrical energy storage (EES) and the thermal energy storage (TES), are obliged to assist the dispatchable generators of the CHP system on the scheduling timescale. This study proposes the generation and storage scheduling of combined heat and power ("CHP scheduling" hereafter), which extends the boundaries of traditional generation scheduling by adding up to it (i) a parallel scheduling task, namely the heat generation – load match, and (ii) a parallel storage type, namely the thermal energy storage. To achieve such extension, the CHP scheduling here inherits, and serves as a more complex demonstration of, the storage-integrated generation scheduling, which is built on the basic, deterministic scheduling framework, and embeds the non-dominated sorting genetic algorithm II (NSGA-II) as the numerical tool in [1]. As the main technical contribution of this study, the CHP scheduling will expand the literature with a complete and convenient scheduling model of both the generation units and storages of the CHP

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