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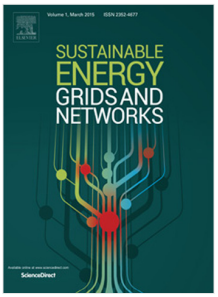

Integration of heat production and thermal comfort models in microgrid operation planning

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Integration of heat production and thermal comfort models in microgrid operation planning

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Abstract

In this paper, a procedure aiming to integrate a detailed description of a multi-source thermal production system in a microgrid framework is proposed. The approach involves electric energy production and consumption as well. In particular, a bottom-up engineering viewpoint is adopted, involving energy flows interesting user buildings and mass flow rates and temperatures in the thermal supply facility. Different heating production systems, such as CHPs, boilers and solar thermal devices, are considered, as well as heat exchangers, thermal storage and pipe network. The proposed model is therefore embedded in the day-ahead energy management procedure of the microgrid. The optimal operation plan is evaluated by minimizing operation and emission costs over a daily horizon, satisfying electric demand and thermal comfort requirements. Tests are carried out on a model of the experimental microgrid system built at Electric Power System laboratory of Politecnico di Bari.

Keywords

- Microgrids
- Multi-energy systems
- Energy Management
- Temperature-based heat demand model
- Building thermal comfort.

1. Introduction

The concept of Microgrid is based on two typical aspects: it is designed to supply electrical and thermal loads for a small community, operating as a controlled entity connected to the distribution grid by the Point of Common Coupling, and can operate either in grid-connected or islanded mode [1][2]. The use of combined heat and power (CHP) facilities enforces the interaction between the electric side and the heating, ventilation and air-conditioning system [3][4], along with technologies for heating/cooling demand coverage such as heat pumps [5][6]. Moreover, the presence of elasticity in energy demand, represented by controllable loads and energy storage devices, can improve the integration of MGs as sources of regulation services for the energy distribution systems [7][8].

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