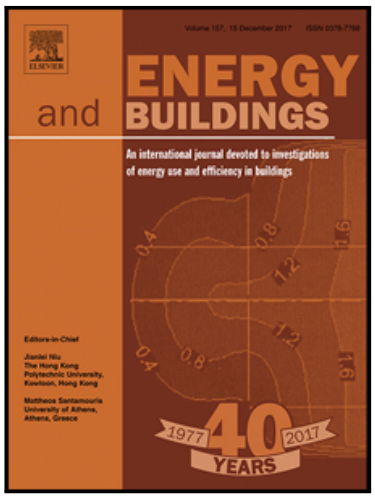

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A Swarm Intelligence based Distributed Decision Approach for Transactive Operation of Networked Building Clusters

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Abstract

Recently, existing research has demonstrated that more benefits of energy cost saving, environmental sustainability and reliable power supply can be achieved by clustering buildings together to freely exchange information and energy. To enable efficient transactive operation among buildings in the cluster, both centralized and distributed decision approaches were developed in the recent decades. However, most of the existing approaches are only applicable for small scale building clusters and/or the privacy of each stakeholder (e.g., building) is not well protected. To bridge these research gaps, we propose a swarm intelligence based bi-level distributed decision approach. A particle swarm optimizer is employed at the system level to coordinate the transactive operations among buildings, and a mixed integer programming model is developed for each building to simultaneously obtain operation decisions for its energy systems. The only information exchanged between the system level and building level is the marginal price of transactive energy which can protect the private information for each building. The performance of the proposed decision approach in terms of accuracy, scalability, and robustness is evaluated using various building clusters with the number of buildings from 2 to 256. It is demonstrated that our proposed approach is very computationally efficient, scalable and robust, and the computational complexity is $O(n)$ where n is the number of buildings in the cluster.

Keywords:
Building clusters, Smart grid, Swarm intelligence, Marginal price, Transactive operation

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