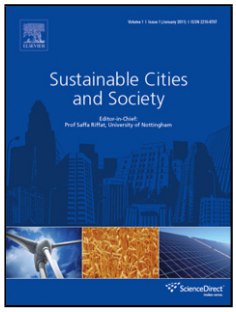

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A Scenario-Based Optimization of Smart Energy Hub Operation in a Stochastic Environment using Conditional-Value-at-Risk

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Highlights

- A stochastic model for electricity, natural gas prices and user's demand is proposed.
- Minimizing the S.E.Hub operational cost in an uncertain environment.
- Operational risk of the S.E.Hub is managed by CVaR technique.

Abstract

Besides increasing the installation of distributed generation plants, investigation on multi-carrier energy systems leads recent studies to focus on several aspects of Smart Energy Hub (S. E. Hub) systems. An S. E. Hub incorporates several modules calculating an optimal size and operation of each have already attracted a great deal of research. Uncertainty in the modelling of these modules is an imperative factor that has not been associated in S. E. Hub models properly. To build up a more precise framework for S. E. Hubs, here we present a stochastic model for real time electricity and natural-gas prices and electricity demands. In this paper, an S. E. Hub operates based on minimizing weighted sum function, which consists of operational cost and emissions. Simultaneously, by using conditional value at risk (CVaR) technique, we control the operational risk of an S. E. Hub perfectly when electricity and natural gas are converted to electrical, heating, and cooling energy in its output ports. Validation of proposed optimization method is carried out by a simulation on a real office building in Tehran, Iran.

Keywords: Smart Energy Hub (S. E. Hub), Sustainability, Optimization, Greenhouse Gases Emissions.