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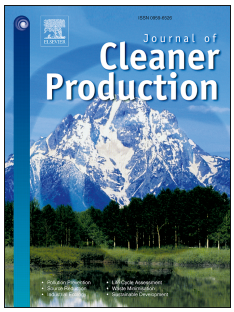

Adaptation planning of community energy systems to climatic change over Canada

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Adaptation Planning of Community Energy Systems to Climatic Change over Canada

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Abstract: Adaptation planning of energy systems to climatic change is highly complicated due to complex interactions among various adaptation responses, and among energy-related activities. These complexities may be further compounded as a result of the presence of interval-format uncertainty associated with energy systems management and climate change adaptation responses. This study is to develop an inexact community-scale energy system adaptation model (ICEAM) for supporting adaptation planning of community-scale energy systems under uncertainty. The objective entails the tasks including: (1) investigation of adaptation responses of the energy sector to climate change, (2) uncertainty analysis, and (3) development of ICEAM and apply it to the City of Waterloo, Canada. The results indicate that, to adapt to a changing climate by the City of Waterloo, more electricity and gasoline and less natural gas would be imported. The results also suggest that the ICEAM has an advantage of the planning adaptation response of energy activities, but also addressing the uncertainty existing in energy management systems and regional climate prediction.

Keywords: Adaptation planning; adaptation model; climate change; community energy systems; GHG emission; uncertainty

1 Introduction

Globally, including Canada, the effects of global climate change are already upon all aspects of human life. Adaptation planning is crucial to limit the damage influenced by climate change (Wamsler et al. 2013). However, the energy system adaption planning is highly complicated as energy sector will not only have its own adaptation responses, but also interacts with the responses by many other energy related activities including energy supply, demand and conversion. These complexities may be further compounded due to a variety of energy, environmental and economic factors (Zhen et al. 2016; Lin et al. 2008). Consequently, the effective system analysis is desired in order to facilitate the adaptation planning through reflecting such complexities associated with energy management systems (Lin et al. 2004).

In the recent years, a number of researchers emphasized in planning and managing energy system toward energy-allocation scheme optimization, environmental emission reduction as well as cost minimization (Zhang and Rong, 2010; Tan, 2011; Lotfi and Ghaderi, 2012). For instance,

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