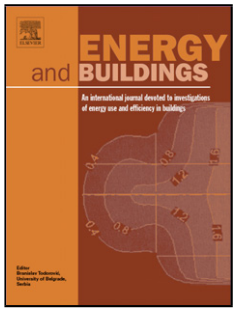

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A Behavior-based Decision-making Model for Energy Performance Contracting in Building Retrofit

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ABSTRCT:

Energy Saving Performance Contracts (ESPCs) are a business model that aims to promote building energy efficiency through retrofitting with minimal or zero upfront costs for owners. Many studies show that occupants tend to use more energy than expected after retrofits (referred as rebound effect), which results in underestimated retrofitting costs. However, end users' energy-using behaviors and their relationship to the ESPCs decision-making process have seldom been studied. This study aims to propose such a behavior-based model to assist the contract decision-making among the major stakeholders in a building's retrofit, including building owners, Energy Service Companies (ESCOs), and renters. The proposed model incorporates renters' rebound effect and investigates the impact that major variables have on the rebound effect. To validate and evaluate the performance of the proposed model, a real retrofitting project in Maryland, United States, was examined. The results show that the rebound effect can significantly increase the payback period of ESPCs contracts by up to 4 years and the contract duration is significantly affected by renters' risk attitudes. The proposed model and findings can help ESCOs and building owners predict more accurate energy saving amounts and design proper retrofitting contracts.

Key Words: Energy Savings Performance Contracting, Decision-making, Renters' Behavior, Rebound Effect, Contract Design.