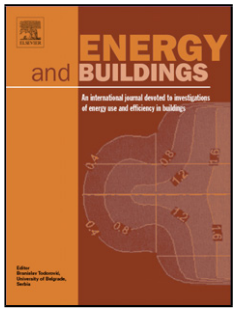

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Authors: Zheng Yang, Jonathan Roth, Rishee K. Jain

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DUE-B: Data-driven Urban Energy Benchmarking of Buildings using Recursive Partitioning and Stochastic Frontier Analysis

Zheng Yang, Jonathan Roth, Rishee K. Jain[1]

Urban Informatics Lab, Department of Civil and Environmental Engineering, Stanford University

Highlights

1. We propose a Data-driven Urban Energy Benchmarking (DUE-B) method for buildings.
2. DUE-B integrates recursive partitioning and stochastic frontier analysis to benchmark.
3. This integrative method enables DUE-B to identify inefficient buildings across a city.
4. We apply and validate DUE-B on a dataset of 10,000+ buildings in New York City.
5. DUE-B is shown to be more robust than other methods and maintains interpretability.

Abstract

With the world rapidly urbanizing, addressing the energy intensive urban built environment is becoming increasingly important. Cities across the United States and the world are turning to energy benchmarking as a means of understanding the relative energy efficiency of their building stock and identifying potential opportunities to reduce energy usage. Benchmarking utilizes building characteristics and energy use data to measure a building's energy consumption against a performance baseline and derive a level of energy efficiency. Over twenty cities in the United States and many others across the world have passed laws mandating the collection and disclosure of energy use data to enable benchmarking and pinpoint potential energy saving opportunities. However, municipalities are struggling to convert this data into actionable insights and identify which buildings are prime candidates for energy efficiency interventions. Although an extensive body of work exists on benchmarking building energy performance, previous works are limited in their ability to leverage such emerging data streams and conduct analysis at the city scale. Moreover, previous methods are largely based on black-box models that limit the interpretability of results and in turn hinder the ability of policy-makers to employ such models in their policy design and decision-making processes. In this paper, we propose DUE-B, a new Data-driven Urban Energy Benchmarking methodology based on recursive partitioning and stochastic frontier analysis. To test DUE-B, we evaluate its performance using real energy and building data from over 10,000 buildings in New York City, and we compare the results to other common benchmarking models using the Kendall tau-b correlation coefficient. Results indicate that DUE-B is more robust than conventional benchmarking methods in respect to identifying subsets of efficient and inefficient buildings. Furthermore, we highlight how results from DUE-B can be utilized by municipal officials and other policy-makers to target inefficient buildings for energy efficiency interventions, incentives, and programs. Specifically, we indicate how DUE-B can be utilized by

[1] Corresponding author; Asst. Professor of Civil & Environmental Engineering, Stanford University; 473 Via Ortega Way, Rm 269A, Stanford, CA 94305, USA; rishee.jain@stanford.edu