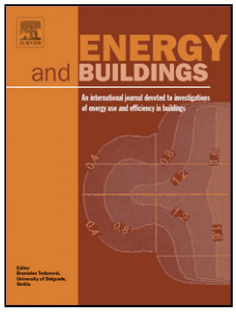

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On the Development of Multi-Linear Regression Analysis to Assess Energy Consumption in the Early Stages of Building Design

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Research Highlight

- Building envelope parameters are considered as design variables.
- Presents a simple model to predict and quantify energy consumption in commercial buildings in the early stages of the design.
- Shape of the building has a significant effect on its energy consumption.
- Regression models are able to predict annual energy consumption.

Abstract

Modeling of energy consumption in buildings is essential for different applications such as building energy management and establishing baselines. This makes building energy consumption estimation as a key tool to reduce energy consumption and emissions. Energy performance of building is complex, since it depends on several parameters related to the building characteristics, equipment and systems, weather, occupants, and sociological influences. This paper presents a new model to predict and quantify energy consumption in commercial buildings in the early stages of building design. Building simulation software including eQUEST and DOE-2 was used to build and simulate individual building configuration that were generated using Monte Carlo simulation techniques. Ten thousands simulations for seven building shapes were performed to create a comprehensive dataset covering the full ranges of design parameters. The present study considered building materials, their thickness, building shape, and occupant schedule as design variables since building energy performance is sensitive to these variables. Then, the results of the energy simulations were implemented into a set of regression equation to predict the energy consumption in each design scenario. A good agreement was seen between the predicted data based on the developed regression model and DOE simulation and the maximum error was less than 5%. It is envisioned that the developed regression models can be used to

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