A NOVEL STATISTICAL MODEL FOR MONITORING AND PREDICTING ENERGY BEHAVIOR IN AN OFFICE BUILDING

Abstract

In 2012, commercial buildings accounted for nearly 18% of the total energy consumption in the United States, thus making it a major cause of global Greenhouse Gas (GHG) emissions. Specifically, office buildings accounted for 14% of the energy usage within the commercial sector and were major urban building-related energy users. Hence, their energy performance must be closely monitored and evaluated to address the critical issue of GHG emissions and rising energy demand in cities. Monitoring, at a building level, additionally facilitates evaluation of the occupant's behavior and energy systems, which is vital for managing energy demand and fault detection in energy systems. Several data-driven models had been proposed as alternatives to building energy simulation models to accurately model energy performance of an office building based on its historical energy behavior. While they are accurate at predicting energy consumption, they lack in providing interpretation of relationships between variables and their impact on energy consumption. Interpretability is crucial to control and manage variables impacting energy consumption. This study presents a Generalized Additive Model as a robust alternative approach to existing data-driven models for predicting and understanding the energy behavior of an office building. They offer the possibility of incorporating available knowledge of the building into the modeling process, resulting in better interpretability, flexibility, and regularization, often with less compromise on the prediction accuracy. The proposed modeling approach is applied to historic building-level energy interval data of a mixed-use multi-tenant office building in Chicago, Illinois, USA, to demonstrate its capabilities.

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