


Article

# Occupant Behavior for Energy Conservation in Commercial Buildings: Lessons Learned from Competition at the Oak Ridge National Laboratory

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**Abstract:** Accompanying efforts worldwide to deploy sustainable building technologies shows a pressing need for expanded research on occupant behavior. Discourse is lacking concerning drivers of occupant behavior for energy conservation, especially in the case of commercial buildings. This paper explores potential determinants of occupant behavior for energy conservation in commercial buildings. This is investigated in a case study of a two-month energy conservation competition involving eight office buildings at the Oak Ridge National Laboratory. Four buildings achieved energy savings based on the previous year's baseline. Potential challenges and success factors of occupant behavior for energy conservation during the competition were explored based on an explanatory research design incorporating energy data, participant interviews, and surveys. The findings suggest that both social and technological aspects may be important drivers of energy conservation. The determinants of occupant behavior for energy conservation in commercial buildings suggested for further research include bottom-up involvement, stakeholder relationship management, targeted information, real-time energy visualization, and mobile social platforms. This paper presents initial implications, with a need for further research on these propositions and on their impacts on occupant behavior. This paper aims to contribute to both academia and practitioners in the arena of commercial building sustainability.

**Keywords:** occupant behavior; energy conservation; sustainable buildings; behavioral change; commercial building; competition

## 1. Introduction

There is an emerging area of academic discourse integrating social dynamics and behavior in the analysis of technical systems [1,2], hereon referred to as sociotechnical systems. Buildings are examples of such systems [3,4], with a complex interplay of social, technical and environmental factors. In the United States, residential and commercial buildings account for 40% of national energy consumption [3]. Over 20% of national consumption is attributable to commercial buildings, which also show the highest energy intensity and growth rates [5]. With pressures of climate change and sustainability goals, there have been numerous efforts to improve building energy efficiency via technological modifications. For example, building energy management systems (BEMS) integrate smart technologies to manage energy consumption [6]. However, the impact of technological innovation in buildings also depends on occupant behavior, indicating a sociotechnical system core [6,7]. Occupant behavior in buildings is a