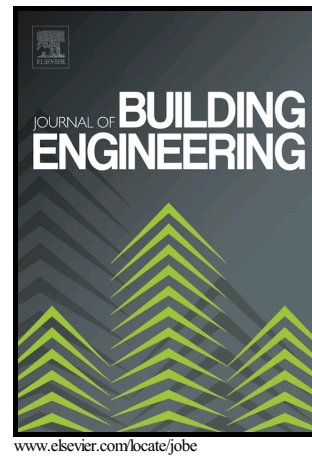


Author's Accepted Manuscript

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PII: S2352-7102(17)30825-2
DOI: <https://doi.org/10.1016/j.jobee.2018.03.008>
Reference: JOBE430

To appear in: *Journal of Building Engineering*

Received date: 20 December 2017
Revised date: 7 March 2018
Accepted date: 17 March 2018

Cite this article as: Toni Tukia, Semen Uimonen, Marja-Liisa Siikonen, Claudio Donghi and Matti Lehtonen, High-resolution modeling of elevator power consumption, *Journal of Building Engineering*, <https://doi.org/10.1016/j.jobee.2018.03.008>

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High-resolution modeling of elevator power consumption

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Abstract

This paper proposes a framework for modeling the instantaneous power consumption of individual elevators and elevator groups based on passenger traffic. Though elevators have a key role in the modern urban society, they have remained as rather neglected appliances in the energy efficiency research. To accelerate the energy efficiency studies of elevators, this paper has two major contributions. First, we propose means to model the instantaneous power consumption of individual elevators and elevator groups and analyze the reliability of these means versus the complexity of the modeling. Second, we present an elevator group control scheme to organize the elevator dispatching according to the simulated passenger traffic. When combined, these methods yield enhanced predictions about the energy and power consumption of elevators in a specific type of building with measured or simulated movement of occupants.

Keywords: elevators, high-resolution modeling, power consumption, energy efficiency, passenger traffic

1. Introduction

Urbanization and sustainability have become major drivers for almost any industry. The elevator industry is a special case where urbanization and sustainability have strong synergy. First of all, elevators enable construction of tall buildings, increasing land use efficiency. Furthermore, the customer demand for energy efficient elevator systems is increasing [1]. Thus, the evaluation of energy consumption and power demand of these devices has become more important than ever before.

Elevators typically consume less than 10 percent of the building total electricity consumption annually [2, 3]. However, the ratios vary in time and between buildings and can be even up to 40% during peak usage hours [4, 5]. The energy efficiency of elevators has increased its importance in the elevator market with companies, researchers, and customers aiming to perform the life cycle assessments for elevators [6].

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