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Impact of daily passenger traffic on energy consumption of intermittent-operating escalators

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Keywords

Escalators, Energy consumption, Intermittent-operating escalators, Passenger traffic, Load profile, Passenger distribution, Modeling;

Abstract

Currently, intermittent-operating escalators are gaining popularity on the market. The energy consumption of such devices highly relates to the passenger traffic profile during a day. This paper models the energy consumption of intermittent-operating escalators with four different passenger profiles and analyzes the resulting differences in the daily electricity consumption. The passenger profiles and their impact on escalator energy consumption are based on multiple long-term measurements and previous research studies. The results indicate that passenger volumes and density during a day affect the overall energy consumption drastically. The main reason for the differences is the principle of intermittent-operating escalators, the “power demand cycle”, along with the Variable Speed Drive.

1. Introduction

An escalator is, generally, the most efficient way to transport large amounts of passengers [1] within a few floors distance. With increased concerns about energy efficiency, intermittent-operating escalators have become a dominant solution for new installations in passenger transportation. Today, little research is conducted on the escalator energy consumption and the effect of passengers.

Currently, according to Almeida et al. [2], around 75% of all the escalator installations in the EU are in the commercial sector, while the remaining part is in the public transportation. Concurrently, escalators in the public transportation consume up to 75% more energy per day compared to the commercial sector. The difference in the daily energy consumption is due to the specification of the escalators and the requirements of the transportation sector. Generally, the escalators in the public transportation sector work longer hours and are often larger. Additionally, the variety of the installations in mechanical design (e.g. width, height, length, and angle) is an obvious reason for differences in the daily energy consumption between installations. However,

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