

A methodology to estimate baseline energy use and quantify savings in electrical energy consumption in higher education institution buildings: Case study, Federal University of Itajubá (UNIFEI)

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Abstract

Accurately forecasting energy consumption in a building is an important strategy for achieving the goal of reducing energy demand and improving energy efficiency. University campuses represent specific groups of diverse buildings with significant energy consumption. Therefore, they provide an excellent testbed to characterize and understand the energy consumption of a group of mixed-use buildings. This paper presents a novel methodology that considers the recommendations of ISO 50001: 2011 and ISO 50006: 2014 for establishing energy baselines and energy performance indicators in higher education institution buildings to identify electrical energy consumption reduction potentials in buildings and establish energy management strategies related to electricity use. The study was implemented in three buildings at the Federal University of Itajubá (José Rodrigues Seabra Campus). Several methods and indicators were evaluated to monitor and measure energy performance in buildings. A wide range of factors that influence operating system energy consumption in the buildings were studied and taken into account, such as the types of activities carried out in the building, weather conditions, building materials, air conditioning system and occupancy, since these contribute directly and indirectly to the difficulty of accurately measuring the building's energy consumption. The results showed that potential annual savings in electric energy consumption for the campus could be around 9.6%, which translates into a R\$ 93,647.2 economic value and a 20.3 tCO_{2eq} emissions reduction without economic investment. It was concluded that the methodology proposed for establishing and monitoring an energy efficiency indicator can be applied to any institute of higher education because it is flexible and adaptable since each institute can define the period of analysis for the indicator. This research is expected to provide theoretical guidance and a practical data reference for relevant evaluations of building energy efficiency.

Keywords

Energy baseline; Buildings; Energy consumption; ISO 50006; ISO 50001