

Defining a Pathway to Zero Energy Building: A Case Study on Retrofitting an Old Office Building into a Net Zero Energy Building for Hot-Humid Climate

Authors : Kwame B. O. Amoah

Abstract : This paper focuses on retrofitting an old existing office building to a net-zero energy building (NZEB). An existing small office building in Melbourne, Florida, was chosen as a case study to integrate state-of-the-art design strategies and energy-efficient building systems to improve building performance and reduce energy consumption. The study aimed to explore possible ways to maximize energy savings and renewable energy generation sources to cover the building's remaining energy needs necessary to achieve net-zero energy goals. A series of retrofit options were reviewed and adopted with some significant additional decision considerations. Detailed processes and considerations leading to zero energy are well documented in this study, with lessons learned adequately outlined. Based on building energy simulations, multiple design considerations were investigated, such as emerging state-of-the-art technologies, material selection, improvements to the building envelope, optimization of the HVAC, lighting systems, and occupancy loads analysis, as well as the application of renewable energy sources. The comparative analysis of simulation results was used to determine how specific techniques led to energy saving and cost reductions. The research results indicate this small office building can meet net-zero energy use after appropriate design manipulations and renewable energy sources.

Keywords : energy consumption, building energy analysis, energy retrofits, energy-efficiency

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