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Energy Audit and Optimal Power Supply for a Commercial Building in Nigeria

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Received 07 Jun 2018, Accepted 07 Nov 2018, Accepted author version posted online: 13 Nov 2018

Abstract

Energy is indispensable to human existence and its need is on the increase daily due to technological advancement. In recent times, there is sporadic increase in the development of modern buildings, and these buildings require a cost effective and sustainable source of energy. Nigeria and some other African countries have major energy shortage issues due to the insufficient power generation and distribution facilities. This energy poverty creates a challenge for the growing population and as such, it is vital to ensure that the energy supplied to a building is duly optimized and delivered cost effectively. In this study, an energy audit of an eight floor multipurpose business complex was performed to determine the nature and type of loads within the building. Based on the load profile and energy consumption over a ten year period, three alternative energy sources (National grid, Diesel generator and PV system) were considered using various load sharing ratios. The result reveals that though PV solar system is a renewable energy source that reduces the production of greenhouse gases generated by burning diesel, but its continuous application in low middle income country like Nigeria may be challenged by the initial start-up capital which raises the cost of its unit energy.

Keywords: Energy audit, load profiling, renewable energy optimization, photovoltaic power system, techno-economic analysis, building energy demand

Additional information

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Adeyinka A. Adewale is registered electrical engineer in Nigeria. He had both his BSc and MSc degrees from the University of Lagos in 1998 and 2004 respectively; a PhD degree in Information and Communication Engineering in 2017 from the department of Electrical and Information Engineering, Covenant University, Ota. He had worked in the industry as an electrical/electronics engineer, and had handled projects on electrical installations, computer networking and as an electronics engineer/observer in the seismic industry. He is presently a lecturer and researcher at the department of Electrical and Information Engineering, Covenant University, Ogun state, Nigeria. This research was necessary to minimize the cost of energy in an environment of epileptic power supply to reduce over reliance on the mains and greenhouse effect caused by alternative energy sources like diesel generators. It is expected that with this research, some huge or excessive energy bills will be prevented.

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