

# Development and Implementation of a Web Based Sustainable Alternative Energy Supply for a Retrofitted Office

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## Abstract:

Lack of electric power to support business and basic office activities is a regular feature in Sub Saharan African (SSA) countries. Poor electricity supply has led to high down time, reduction of profit margins and reduced interest in productive ventures. Portable generators are used mostly to power business activities. Using fossil fuels to generate power has not been a sustainable method considering the running cost and environmental pollution challenges. In order to improve on the availability of power and efficiently manage available energy in a typical office, an alternative energy efficient renewable energy system was developed to power the office. The system comprised of solar photovoltaic (PV) as the source of energy, a charge controller, storage batteries and a web-based switching application. In implementing the new system, load audit was carried out to determine the office energy requirements. Adapting the loads to the new supply and further improve on energy efficiency, most gadgets in the office were retrofitted to now operate on a direct current solar powered source. The management of the system used a web application developed to run on personal computers or mobile devices to switch the loads 'ON' and 'OFF' through a microcontroller. The web application introduced access control and ensure effective and efficient management of energy usage from any location where internet could be accessed. Sizing of all components was done and installation was carried out. Test results showed that the solar PV system served as a dependable, clean and sustainable alternative power source for the office. The energy consumption of the office was efficiently reduced from 11350Wh to 4626Wh due to the retrofit and introduction of web access control. During the test period, excess capacity of 43535Wh was stored for use at no extra cost which was not possible in the previous supply system.

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## I. Introduction

The operation of most office equipment and gadgets depend on the availability of electricity supply. This is a very important factor that determines how comfortable, convenient, healthy and profitable a business operation could be with respect to operational cost amongst other things. Access to affordable, accessible, reliable, efficient cost effective energy services is a fundamental determinant for the improvement, development and growth in any business venture [1], [2]. Globally, approximately 1.6 billion people still have no access to electricity [3]. Eighty-percent of these people live in rural areas in the developing world, mostly in South Asia and sub-Saharan Africa [4]. Nigeria being the most populous country in Africa with its population currently standing at about 180 million people with an expectation to reach 230 million by 2030 is amongst the lowest in the world in terms of per capita electricity consumption from public utility [5]–[7]. This clearly shows that the supply from the utilities is unavailable, inefficient and not reliable.

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