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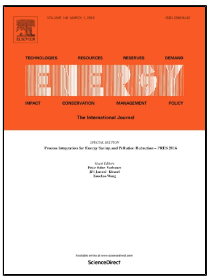

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A Biased Load Manager Home Energy Management System for Low-cost Residential Building Low-income Occupants

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Abstract
This research paper presents the development of a biased load manager home energy management system for low-cost residential building occupants. As a smart grid framework, the proposed load manager coordinates the operation of the inverter system of a low cost residential apartment consisting of rooftop solar photovoltaic panels, converter and battery, and provides a platform for discriminating residential loads into on-grid and off-grid supply classes while maximizing solar irradiance for optimum battery charging and improving consumer comfort from base levels. Modelled in a Matlab simulation environment, the system incorporates a converter system for maximum power point tracking using a hopping algorithm, with a dedicated mechanism for smart dispatch of specified loads to meet the users' comfort based on the priority ranking of the loads. Results obtained indicate a 34% reduction in electricity cost, 26% reduction in carbon emissions and a 4% increase in comfort level for the photovoltaic/battery/utility option compared to the utility only option. The results further show that cost is a major factor affecting the users' comfort and not necessarily dispatch of appliances to meet energy needs. The research can be useful for encouraging the adoption of the photovoltaic/battery/utility option by low/middle income energy users in developing countries.

Keywords: - low-cost residential buildings, BLM-HEMS, hopping algorithm, consumer comfort, return on investment, carbon footprint

Highlights

- Presents a load manager for low-income residential homes.
- Evaluates the contribution of the load manager in improving household comfort.
- Evaluates associated reduction in carbon emissions and electricity cost.
- Discusses and presents solution to the challenge of adopting the load manager.

1.0 Introduction

Energy (electricity) access is still a major problem for over 800 million people in sub-Sahara Africa (SSA) and South Asia. In Nigeria, over 80 million people are still without