ABSTRACT

Telecommunications industry requires efficient, reliable and cost-effective hybrid power system as alternative to the power supplied by diesel generator. This paper proposed an operational control algorithm that will be used to control and supervise the operations of PV/Wind-Diesel hybrid power generation system for GSM base station sites. The control algorithm was developed in such a way that it coordinates when power should be generated by renewable energy (PV panels and Wind turbine) and when it should be generated by diesel generator and is intended to maximize the use of renewable system while limiting the use of diesel generator. Diesel generator is allocated only when the demand cannot be met by the renewable energy sources including battery bank. The developed algorithm was used to study the operations of the hybrid PV/Wind-Diesel energy system. The control simulation shows that the developed algorithm reduces the operational hours of the diesel generator thereby reducing the running cost of the hybrid energy system as well as the pollutant emissions. With the data collected from the site, a detailed economic and environmental analysis was carried out using micro power optimization software homer. The study evaluates savings associated with conversion of the diesel powered system to a PV/Wind-Diesel hybrid power system.

Keywords: Base Station Site, Control Strategy, HOMER, Hybrid System, Optimization Algorithm, Pollutant Emission, Power Supply, Renewable Energy, University of Nigeria

INTRODUCTION

Power supply is one of the critical challenges the telecom operators confront in deploying their networks. At present the problem of poor electricity supply experienced at the telecom installations in Nigeria is being tackled by using diesel generators. These generators, however, are associated with many problems. These include, among other things, noise pollution emanating from the generators and environmental pollution. Diesel generators exhaust harmful hydrocarbons in the atmosphere during operations. The operation and maintenance is relatively costly which typically accounts for 35 percent of the Total Cost of Ownership (TCO).
Problem Statement

From the above overview, it is evident that lack of grid power supply in rural Nigeria poses great challenges to all stakeholders in the telecommunications industry. Regrettably, available solutions can best be described as begging the issues, with much emphasis on conventional energy supplies (diesel generators). Little or no attention has been paid to the exploitation of all other available energy (renewable) resources in rural areas and the latest technologies in the field. It has been established that the main cost of telecommunication accrues from energy consumption. Renewable energy is believed to contribute significantly to the reduction of this energy cost, if properly integrated into the BTS energy sources. Hybrid Power Systems (HPSs) have been described as among the popular cost-saving renewable energy applications in the telecommunications industry. But till date these systems (HPSs) have found little or no applications in Nigeria. This may be attributed to the lack of information on the necessary site and system parameters required to design suitable HPSs to meet given loads of BTS sites.

Hybrid Power Systems (HPS)

A hybrid powered system can be described as an electricity production system which supply consists of a combination of two or more types of electricity generating sources (e.g. solar photovoltaic panels, wind turbine generators, pico-hydro plants, and/or fuel generators). The useful components of hybrid systems considered in this study are the diesel generator, the solar photovoltaic panels and wind turbine generator. A diesel generator can provide energy at any time, whereas energy from PV and wind is greatly dependent on the availability of solar radiation and wind speed, respectively (Wichert, 1997; Yu, Pan, & Xiang, 2005). This makes the system (generator) more reliable, and can be used to operate when PV and/or wind fail to satisfy the load and when the battery storage is depleted.
Generation Scheduling Based on Two-Level Optimization Problem
www.igi-global.com/article/generation-scheduling-based-on-two-level-optimization-problem/105979?camid=4v1a

Implementation of the Acumen Concept on 1-D Core Neutronics Codes
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