Chapter 50


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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.

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) (ALCATEL-LUCENT, 2009) of a Base Transceiver Station (BTS). Mobile Telecommunication of Nigeria (MTN), one of the four mobile telecoms operators in Nigeria with 4,798 base stations spends a whopping $82.8 million on generator acquisition almost every three years and $3.5 million monthly on diesel oil and generator maintenance (IT News Africa, 2010). This puts the Operating Expenditure (OPEX) of generators and diesel at about $69 million annually. Engr. Eyo Ita advanced that global system for mobile communication (GSM) operators had spend over $3,086.42 (N500, 000) on diesel generators in each of their base stations - roughly 520 - with costs being transferred to subscribers in terms of billing (Melford, 2003). Taking into consideration the excess cost of normal operation that the utilization of diesel generating sets brings to the operators, it is inevitable that consumers pay more for mobile service (Ani, & Emetu, 2013a). Apart from high-call-cost that is blamed on high running cost, even poor services is also linked with use of diesel generating set and this could be true if no mischief is intended because generating sets have to be periodically maintained besides, even though seldom, breakdown maintenance. Thus, it has become increasingly evident that diesel generator powered stations are becoming a much less viable option for network operators.

Renewable energy sources system is an option which would have been the best for network operators, but it cannot provide a continuous source of energy due to the low availability during different seasons. Hybridizing diesel with renewable energy sources (solar and/or wind power) will be one method of reducing call-cost and improving the services of the wireless telephony from the angle of powering the base station sites. This will allow telecom companies to circumvent rising energy costs and realize an excellent Return on Investment (ROI) and make communications more accessible and again reduce the environmental impact. Hybrid power system is therefore proposed to solve the aforementioned problems.

**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
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