Impact of a Web Based Crowdfunding Application for Renewable Energy Projects in Nigeria

Ayokunle Awelewa; Ebubechi Ezenwanne; Kayode Ojo; Isaac Samuel; Popoola Olawale

Abstract:
Energy crisis is one of the major challenges confronting African countries. Nigeria has a growing energy demand, and about 70% of its citizens lack access to electricity, especially in rural areas which constitute 60% of the population in the country that depends mainly on fuel wood. The adoption of renewable energy systems as a viable alternative to solve the energy crisis has been hampered by major challenges such as inadequacy, unsustainability, and poor reliability. Access to credit and other financial services remains limited, worsening these issues and hindering progress toward the provision of affordable and clean energy. Hence, the thrust of this work is to develop a web application for crowdfunding renewable energy projects in Nigeria. The purpose is to create a financial technology in mobilizing funds from fellow citizens towards driving a stable electricity supply to every location around the country. The crowdfunding application consists of a frontend application built with react.js, a backend application built with node.js, databases, and a payment system. Two case studies are considered and economically analyzed: a wind turbine system and a wind-diesel hybrid system. The comparative analysis carried out shows that, for the two case studies, the total cost of electricity (COE), simple payback (SPB), and internal rate of return (IRR) are 12.89 $/kWhand14.21/kWh, 161 years and 144 years, and 113.47% and 114.81%, respectively. Further, the sensitivity analysis results reveal that it is more cost-effective to use the wind turbine system alone than the hybrid configuration of wind and diesel.
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I. INTRODUCTION

Energy is an indispensable pillar for the socio-economic development of a nation, determining to a high degree the quality of life and comfort of the citizenry [1], [2], [3]. It is realistic to state that the community's infrastructural development strongly depends on the constant availability of energy supply for industrial, domestic, and agricultural usage [4]. It has been argued that a reliable and adequate power supply will promote low product cost; enhanced storage system for perishable goods; improved educational standards and enhanced standard of living [5]. Ability to access reliable and stable electricity is a key challenge in both urban and rural Nigeria [6]. Quite a number of issues are attributed to conventional power generation. It is reported that global electricity supply largely depends on fossil fuels and with about 70% were derived from it [7]. Some of these issues are related to high cost, environmental degradation, and adverse effects on economy. For this reason, many countries are moving to different forms of viable alternative energy sources for electric power generation [8]- [9]. With a focus on the actualization of SDG 7 that centers on "Affordable and Clean Energy," the use of renewable energy systems to solve energy crisis in Nigeria would be in the right direction [10]. Though the use of renewable energy system has been steadily on the rise; however, there are associated challenges with renewable energy systems which includes inadequacy [11], unreliability [12] and unsustainability [13]. Cost is an important factor that determines the acceptability of any solution; hence, economic studies [14], [15], [16] have become a household name in the field of renewable energy systems.

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