

Case Study

EVALUATING THE CONTRIBUTION OF OFF-GRID SOLAR POWER KIOSKS FOR SUSTAINABLE ENERGY SOLUTIONS FOR RURAL AREAS IN SOUTHWEST NIGERIA

Amuge Robinson^{1*}, Hamzat K.A², Oyeniyi R.O.A³

¹ Department of Electrical/Electronics Engineering, Faculty of Engineering and Technology, Osun State College of Technology, Esa-Oke, Nigeria.

² Department of Electrical/Electronics Engineering, Osun State College of Technology, Esa-Oke, Nigeria.

³ Department of Mechanical Engineering, Osun State College of Technology, Esa-Oke, Nigeria.

Correspondence should be addressed to Amuge Robinson: damokwokpo@gmail.com

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Abstract: Lack of access to electricity is one of the major impediments to the growth and development of rural economies in developing countries like Nigeria. Energy in particular is critical in achieving virtually all the sustainable development goals; it can be used to support important development like access to education, improved health, communication and empowerment. This research work will assess the direct and indirect linkages between energy efficiency, employment, and social welfare in rural areas using a mixture of qualitative and quantitative approaches to carry out the analysis. The obtained data were analyzed using descriptive statistics method of data using pie and bar charts. The study shows that energy availability in rural areas generates employment for the rural inhabitants as well as improves the social well-being of the people living in the arrears. The work intends to scale up an inclusive business model based on a unique technology and building solution for modular energy supply, offering sustainable, reliable and affordable electricity products and services through solar-powered kiosks to rural areas in Nigeria. The result is in agreement with goal seven of the Sustainable Development Agenda 2030.

Keywords: Employment, Energy, Social Well-being, Sustainable development, and Rural Areas

Introduction

Access to energy offers great benefits to development through the provision of reliable and efficient lighting, heating, cooking, mechanical power, transport and

telecommunication services. Additionally, access to power has proven economic welfare, as productivity increases with businesses, substituting manual work by automated processes and finally leading to a positive virtuous growth cycle. According to the United Nations (UN), Sustainable Development (SD) is not possible without sustainable energy, such that the issue has been prioritized by devoting a stand-alone SD goal (No. 7) to sustainable energy, which implies universal access to affordable, reliable and modern energy (Sarah, 2016)

Energy is a fundamental resource that drives the economy, and almost all activities require energy for growth. Consequently, economic growth is directly related to energy consumption. As Alam (2016) puts it, energy is indispensable, and it is the driving force for all economic activities. It is widely regarded as a propelling force behind any economic activity and indeed industrial production. (Okeoma et al., 2023). Therefore, high access to energy by inhabitants of a community will amplify the impact of technology and create tremendous economic growth

Unavailability of energy in rural communities is one of the major impediments to growth and development of rural economies in developing countries like Nigeria because rural electrification was not considered as a basic human need like water and food, etc. (Wasiu, 2013). A number of recent studies provide insight into how access to electricity in rural areas helps in the betterment of rural society in various ways (Tarujyoti, 2012). The World Bank, in their study for 11 countries, reveals that rural electrification results in great benefits, such as improvements in health facilities, better health from cleaner air, as households reduce use of polluting fuels for cooking, lighting and heating, improved knowledge through increased access to television and better nutrition from improved knowledge and storage facilities from refrigerators (Sunday, 2012). According to Global Network on Energy for Sustainable Development (GNESD, 2007), without adequate supplies of affordable energy, it is impossible to improve health, education and the reduction of poverty (Tarujyoti, 2012).

About 1.6 billion people in the world have no access to electricity, of which about 80 per cent of these people live in the rural areas of developing countries of the world, and this number is not likely to go down without a concerted effort (Buragohain, 2012). In 2001, the 9th session of the Commission on Sustainable Development (CSD-9) gave special attention to energy. It concludes that “Energy is central to achieving the goals of sustainable development, ([http: www.gnesd.org](http://www.gnesd.org), 2007).

Access to clean modern energy services is an enormous challenge facing developing countries like Nigeria, and it is fundamental for socioeconomic development and poverty eradication (Sunday, 2012). About 60 percent of Nigeria’s population has no access to electricity, and 90 percent of them live in rural areas (Pedro Antmann, 2009). Electricity helps to satisfy the basic needs of people and is also an important catalyst for rural development. The majority of the rural inhabitants have low access to energy and therefore retard the social and economic development. Obstacles such as dispersed population, difficult terrains, geographical remoteness, low commercial energy consumption and

limited income of consumers make extension of the electricity network to rural areas economically inefficient for both public and private organizations (Wasiu, 2013).

The lack of electricity raises a list of negative effects that dramatically limit a community's potential rate of growth, as well as its residents' basic quality of life. Some of the most pressing effects are listed below (Dominic & Peter, 2014).

Development is a socio-economic-technological process with the objective of raising the standard of living of the people (Wasiu, 2012). For this process to be successful, there is a need for an adequate supply of energy to facilitate the growth in every sector of the economy. It is essential to consider the sustainability of the development and plan it in a manner that does not endanger the environment. There is little hope for improvement in the standard of living of the rural inhabitants without the support of modern energy technology (Samuel V. Brown, David G. Nderitu, Paul V. Preckel, Douglas J. Gotham, Benjamin W. Allen, (2011), The wide range of energy services, such as cooking, water pumping, water heating, lighting and health access to information technology and internet education, can bring about development, which in turn can facilitate sustainable livelihoods, improve health and education and significantly reduce poverty in rural communities (Wasiu Orewale, 2013). For the rural people to contribute meaningfully to the socio-cultural and economic development of the country, there is a need for rural development programs, towards a sustainable modern energy production model. Energy plays the most vital role in the economic growth, progress, and development, as well as poverty eradication and security of any nation (Okoye A.C, Dioha I.J, Ezeonu F.C, Eboatu A.N, and Onuegbu T.U, 2011). Uninterrupted energy supply is a vital issue for all countries today. Future economic growth crucially depends on the long-term availability of energy from sources that are affordable, accessible, and environmentally friendly. Security, climate change, and public health are closely interrelated with energy (Oyedepo, 2012). Energy is an important factor in all the sectors of any country's economy. The standard of living of a given country can be directly related to the per capita energy consumption. The recent world's energy crisis is due to two reasons: the rapid population growth and the increase in the living standard of whole societies.

Energy supports the provision of basic needs such as cooked food, a comfortable living temperature, lighting, the use of appliances, piped water or sewerage, essential health care (refrigerated vaccines, emergency, and intensive care), educational aids, communication (radio, television, electronic mail, the World Wide Web), and transport (Sunday Olayinka, 2012). Energy also fuels productive activities, including agriculture, commerce, manufacturing, industry, and mining. Conversely, a lack of access to energy contributes to poverty and deprivation and can contribute to economic decline. Energy and poverty reduction are not only closely connected with each other, but also with the socioeconomic development (Oyedepo, 2012).

Most developing countries have abundant renewable energy resources, including solar energy, wind power, geothermal energy and biomass, as well as the ability to manufacture the relatively labor-intensive systems that harness these. By developing such

energy sources, developing countries can reduce their dependence on oil and natural gas, creating energy portfolios that are less vulnerable to price rises (Dilip Ahuja¹ and Marika Tatsutani 2009). In many circumstances, these investments can be less expensive than fossil fuel energy systems. In isolated rural areas, electricity grid extensions are often not economical. Off-grid renewable technologies provide a sustainable and cost-effective alternative to the diesel generator that would otherwise be deployed in such areas. ([https://en Wikipedia.org](https://en.wikipedia.org)).

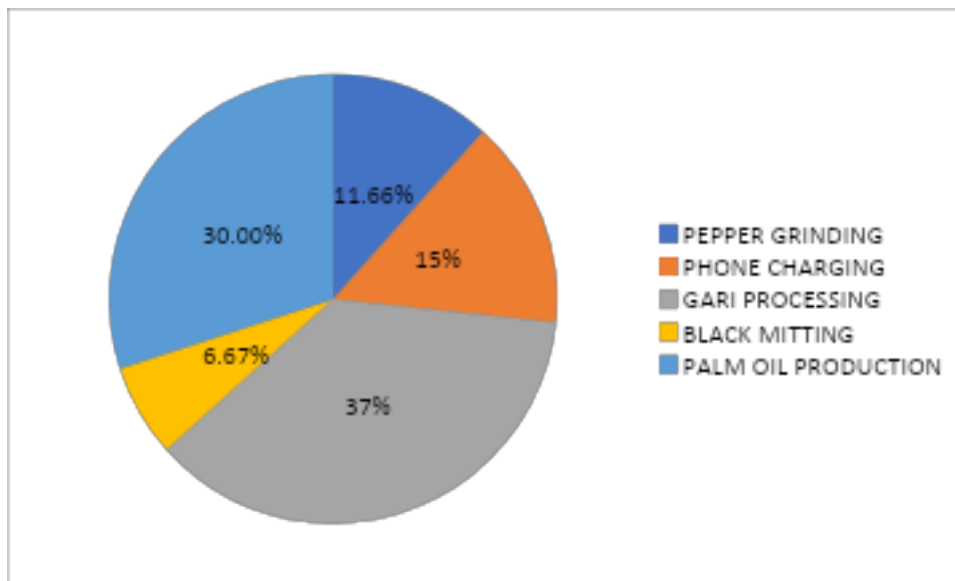
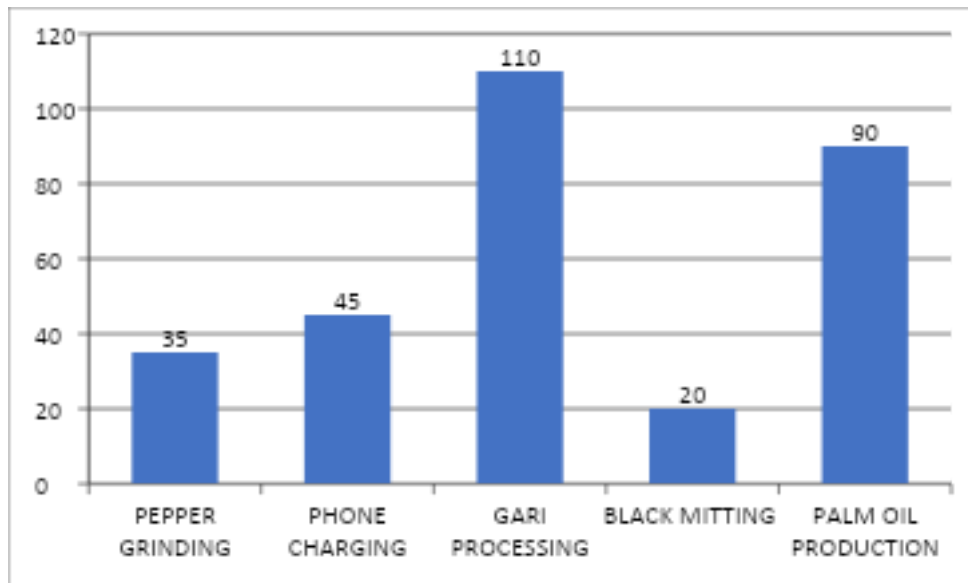
The sun emits an enormous amount of energy that is sometimes hard for us to comprehend. In theory, the sun can easily provide a more than sufficient amount of energy to meet the worldwide energy demand, provided that we have the appropriate solar energy-capturing devices. In reality, though, solar power alone is not the answer to the world's energy challenge due to the technological limitations of solar power technology. That being said, it has been proven to be one of the best solutions for rural areas' electrification (Dominic & Peter, 2014). A solar cell is a semiconductor, a solid-state electronic device that converts radiant energy directly into electrical energy by employing the photovoltaic effect (Robert Ehrlich, 2013). A solar panel's power output depends on the load resistance, irradiance and temperature. Several techniques can be employed to create a reliable energy output by attempting to control these three parameters (Mohammad Omar Abdullah, 2013),

METHODOLOGY

The study area is two villages/rural areas in each of the states in South West Nigeria, which comprises Osun, Oyo, Ogun, Ondo, Ekiti and Lagos. A questionnaire was produced to collect data from the field (rural area inhabitants, artisans- barbing saloon, and business centers). The method chosen are due to the following benefits; Questionnaires are absolutely one of the most affordable ways to gather qualitative and quantitative data, Large amounts of information can be collected from a large number of people in a short period of time and relatively cost-efficient, Questionnaires are a practical way to gather the data needed, can be targeted to groups of choosing area and administered in various forms, It's quick and easy to collect results and the result can easily and quickly quantified by a research or through the use of appropriate software, Scientific analysis and predictions are achieved when questionnaire are used than any other forms of method The analysis of the data was carried out by use of descriptive statistics methods.

RESULT AND DISCUSSION

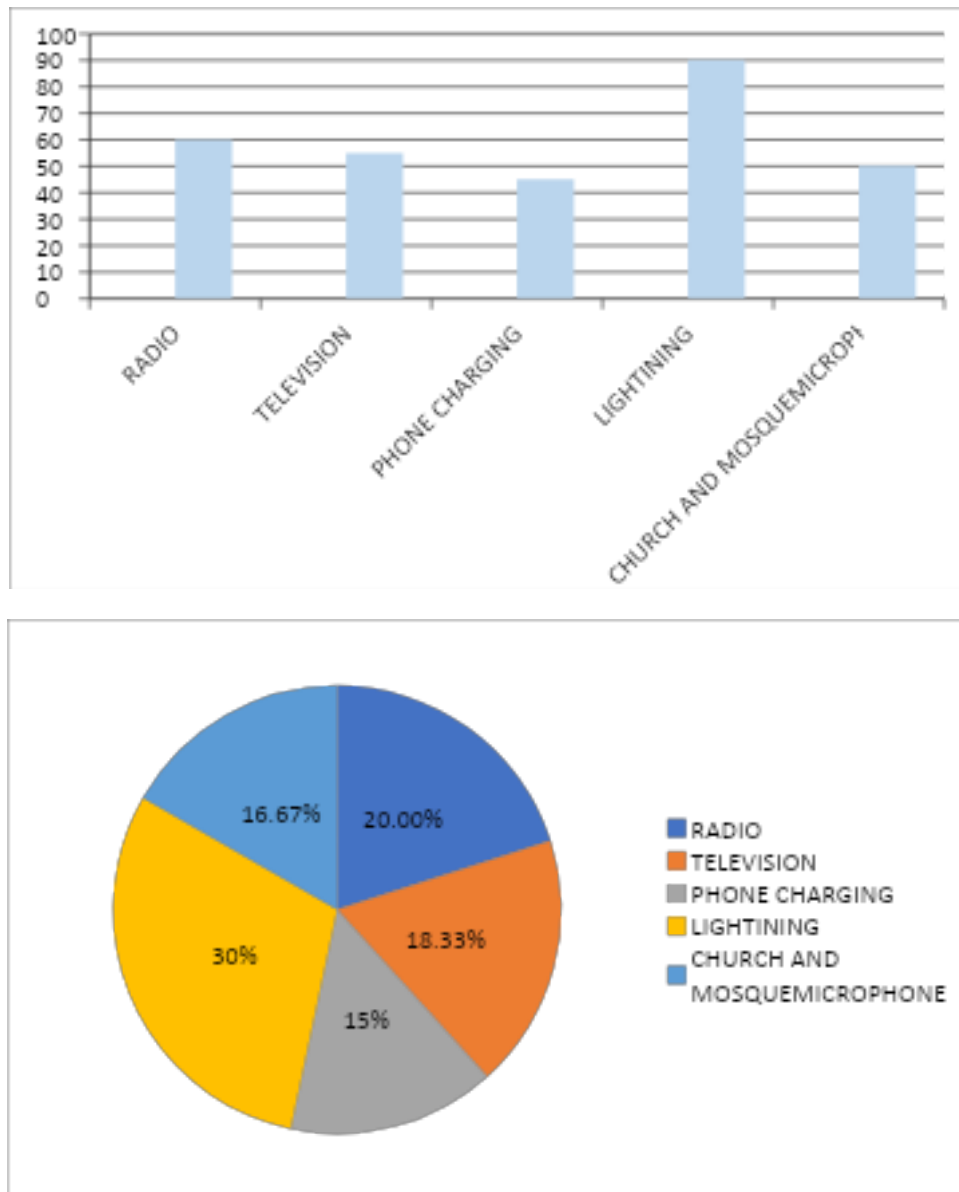
Employment and Energy availability



It was discovered that 36.67% engaged in garri production, 30% engaged in palm oil production, 15 % engaged in phone charging business, 11.66% in pepper grinding and 6.67 engaged in black mitting.

The result is in agreement with Oduyele (2020), who confirmed that there is a positive correlation between employment opportunities and rural areas. The study is also in agreement with Olabisi (2021), who uses factor analysis to evaluate various types of employment opportunities created by the presence of electricity in rural areas.

Social activities and Electricity availability



It was seen and discovered that 20% listen to the radio, 18.33% watch television, 15% make use of electricity to charge phones, 30% use lightning from electricity in the village square while listening to stories and tales. 16.67% use microphones and electronic appliances for church and mosque programs. The research is in alignment with (Ajani, 2019), which used regression analysis to evaluate the various types of social activities the people in the rural area engaged in with respect to the available electricity.

CONCLUSION

This study has examined the link between energy availability, social and economic life of the selected rural areas in South-West Nigeria. The study revealed that energy consumption has a significant impact on economic growth and social well-being of the rural area as indicated by the research findings, it is therefore recommended that as a matter of policy and to achieve goal 7 of the Agenda 2030 all the rural areas in the country must be

provided with any form of energy that will be sourced from any dominant natural resources found in the area. using solar power energy kiosks model

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