

Energy-Environment Interactions: Potentials and Problems of Renewable Energy in Nigeria

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Abstract

Renewable energy is that form of energy obtained from sources that are essentially inexhaustible, unlimited and rapidly replenished or naturally renewable such as wind, water, sun, wave, refuse, biofuels etc. Today, the rapidly growing global population is increasingly dependent on energy-efficient and reliable supply and access. Nigeria is fortunately blessed with not only abundant sunshine (solar energy), but plentiful wind energy, wood and biomass resources, geothermal energy, etc, more than most other continents of the World. Yet, In view of the uncertain energy scenario across the country, only about 35% of Nigerians have access to electricity (though unreliable) compared with 95% in Egypt and 75% in South Africa. A deplorable Alternative energy sector is impacting very negatively on the nation's economy. This paper addresses how development initiatives were done to harness the renewable energy to most of the Nigeria's community impact.

Keywords: Nigeria, Government, Renewable Energy sources, Environment.

1. Introduction

Energy is central to all human activities and it is needed to support development. Access to energy is inevitable for poverty alleviation. Nigerian citizens have extremely low access to energy, and the richer countries consume far more energy than the poor countries, suggesting that access to energy is the dividing line between the rich and the poor countries of the world (6). There is considerable Climate change, the soaring global electricity demand, the scarcity of fossil fuels and, consequently, their rising costs, make renewable energy gain in importance. Among them, alternative energy,

wind power and solar energy are the most important energy sources, along with hydro energy. In Nigeria, renewable are present nearly everywhere and available without long transport. This can help the country to gain greater independence from fossil fuel. Nigeria is the most populous country in Sub-Saharan Africa, nearly one quarter of Sub-Sahara Africa's population and is one of the poorest countries in the world despite the huge resources from crude oil export (11). An estimated 60-70% of the Nigerian population does not have access to electricity. Energy demand in Nigeria is dominated by fuel wood and women and children are the most affected in the energy crisis (12). The recent project termed: 'Promoting Renewable Energy and Energy Efficiency in Nigeria' (PREEEN) was designed to address the energy crisis in Nigeria (2). The overall goal of the PREEEN project is to increase Nigerians' access to electricity and modern energy services using renewable energy facilities and to promote energy efficiency. The vision of the project is to provide renewable energy facilities to 10 million people in a period of 5-6 years (2).

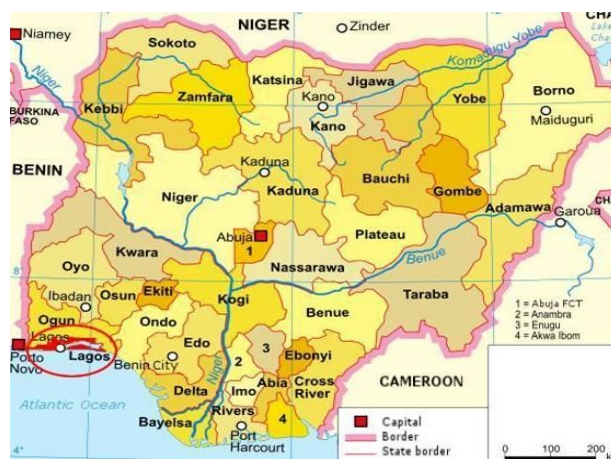


Figure 1: Map of Nigeria showing the 36 states and the FCT Abuja (7)

2. Location, Size and Climate

Nigeria is located in the western part of Africa, between latitudes $4^{\circ} 16'N$ and $13^{\circ}52'N$; and between longitudes $2^{\circ}49'E$ and $14^{\circ}37'E$ (7). It occupies a total land area of $923,768\text{km}^2$ with a population of 147million people as at 2006. By virtue of its geographical extent, it spans different climatic and ecological zones. The variable climatic conditions and physical features have endowed Nigeria with a very rich biodiversity and renewable energy sources. The mean annual rainfall ranges from about 450-700 mm in the northeast to about 3,500-4,300 mm in the coastal south-east, with rains falling within 90 to 290 days respectively. The mean annual temperature ranges from 21°C in the south to 30°C in the north with extremes of 14°C and 45°C and an altitude range of 0 - 1000m above sea level (7).

3. Renewable Energy Potentials in Nigeria

Solar Energy: Nigeria has high potential to harness energy from sun (11). The country falls within the tropics of Cancer and Capricorn where the abundance of sunlight is inevitable. This energy whose reservoir is the Sun is one of the energy resources whose availability is infinite if it is developed. Furthermore, unlike the conventional energy resources, solar energy development is not as capital intensive. Therefore, it is fundamental to proffer the strategy of diversifying energy resource development outside the conventional energy resource (11). This means that the proceeds of the sale of the conventional energy resources which are in high demand should directly be channeled towards the development of other non-conventional, less capital intensive and non-hazardous energy resources in the Country (3). With the abundance supply of solar energy in Nigeria, efforts need to be geared towards research and development of solar electricity conversion by both direct and indirect methods (2). Over the years, the sun's energy had been wasting without utilization towards renewable energy harnessing from it.

Wind Energy: This is a secondary form of solar energy. Experts reported that approximately 2.5% of solar energy captured by the atmosphere is being converted into wind (9). The development of wind power plants is being undertaken by many organizations in the Country for the generation of electricity in their quest to exploit renewable energy sources. For instance, in Katsina State, the current Governor, Alhaji Ibrahim Shehu Shema established a Biogas project at Kurfi village, some 30 kilometers away, south of Katsina city, also a 10 megawatts wind farm project at *Lambar Rimi* village, near Katsina city, northern Nigeria (8).

With wind energy available at an annual average speed of 2.0 m/s near the coast to 4.0 m/s at the northern borders, the country can possess enormous potential to develop and utilize energy from the wind for electricity generation (2). The coastal regions of the south and the northern part of the country are possible suitable sites for wind energy exploitation (10). There is need to embark on research to determine actual values for wind energy potential.

Bioenergy: The potential for bioenergy development is high. Nigeria has all the vegetation regions of West Africa except that of the desert. Agriculture is the dominant economic activity, which contributes 41% of Nigeria's GDP and employs the highest labor in the country. Roughly 75 percent (74 million hectares) of Nigeria's total land (98 million hectares) is arable and about 40 percent of this is cultivated, leaving the remaining 60% of arable land barren (12). If Nigeria's farmland is cultivable, it would have medium for good productivity if properly managed. Policy, institutional and technological approach is inevitable to harness bioenergy potentials in the country (6, 9). Nigeria's biomass resources include wood, forage grasses and shrubs, animal wastes and other wastes from forestry, agriculture, municipal and industrial activities, and aquatic biomass (1). Biomass (fossil fuel) is made up of hydrocarbons that readily burn to release heat. Its easy availability and simple technology conversion make it the most widely used source of energy in the country (1, 12).

Wave Energy: All sort of installations have been tried to obtain energy from this source, but with modest results. This is Piston arrangements, moving up and down by waves, which in turn move turbines connected to electrical generators (5). This have

been tried in the Netherlands, but the project was abandoned. Waves are prominent in the oceanic areas of Nigeria, but are not dependable, and the end product is electricity. Producing it in significant quantities from waves seems to be a remote and insignificant prospect in Nigeria (10).

Tidal Power: It takes a special configuration and a high tide of a coastline and a narrow estuary which can be dammed, to be a tidal power site of value. Only about nine tidal sites have been identified in the World. Two are not in use (Russia and France) and generate some electricity. Daming estuaries would have considerable environmental impact, like their abundance in Nigeria. Areas in southern part of the country have, for a long time considered places for tidal power sites (5). Developing them would not have negative effect on the fisheries and other sea-related economic enterprises, rather it will not disturb the habitats of millions of birds which use the areas as part of their migration routes. Tidal power is not a significant power source, but the end product is electricity (4).

Nuclear Fusion: This involves the fusion of either of two hydrogen isotopes deuterium or tritium. The former exist in large quantities in ordinary water, and from that perspective, fusion is theoretically an almost infinitely a renewable energy source. This is the only grail of ultimate energy. Fusion is the energy which powers the sun. The temperature of the sun ranges from about 10, 000⁰ C on its surface, to an estimated 15 to 18 million degrees in the interior where fusion takes place. Containing such a temperature on earth in a sustainable way and harnessing the heat to somehow produce power has so far escaped the very best of scientific talent. However, even if commercial fusion were accomplished, the end product again is electricity, not a direct convenient replacement for oil (5).

Ocean Thermal Energy Conversion (OTEC) Within about 25 degrees each side of the equator the surface of an ocean in Nigeria is warmed, and the depths are cold to the extent that there is a modest temperature differential (3). This can be a source of energy, using a low boiling point fluid such as ammonia, which, at normal atmospheric temperature of 700⁰F (240⁰C) a gas, colder water can be pumped from the deep ocean to condense the ammonia and then let it warm up and expand to gas. The resulting gas pressure can power a turbine to turn a generator. But the plant would have to be huge and anchored in the deep open ocean or on a ship, all subjects to storm and corrosion, and the amount of water which has to be moved is enormous as the efficiency is very low (4). How to store and transport the resulting electricity would also be a large issue. OTEC does not appear to have much potential as a significant energy source, but the end product is electricity (4). This is also vastly available in Nigeria, if managed and harnessed.

4. Government's Effort Towards Tapping The Renewable Energy Resources

Government's effort in the area of developing energy sector to the improvement of the poor status quo is on-going as seen in the current legislative process on national energy bill for an act that will lead to the establishment of a national agency that will take charge of regulating, enforcing policies and developing the energy sector. For the

moment, there is body; National Nuclear Regulatory Authority (NNRA). To achieve energy efficiency, gas flaring must not exist and in the face of government's discouraging effort in that direction, much is expected to be done, particularly by the civil society (2). Although the issuance of deadline for flares-out, January 2008 is reasonable, whereas its commitment to realizing it is absolutely discouraging due to lack of compliance on cash calls to the tune of \$4billion (N508 billion) yearly for joint venture projects (JVP). This is due to the fact that the Federal Government through NNPC owns the largest stake in the JVP (2). The oil/gas sector have since been working on various gas utilization projects, by way of using gas for power generation to, at least, improve epileptic nature of power supply in the country, while some are working on exporting the gas.

5. Discussion

Over 60% of the country's population depends on fuelwood for cooking and other domestic uses. The consumption of fuelwood is worsened by the use of inefficient cook stoves, which have very low thermal efficiency and produce smoke hazardous to human health. Increasing fuel wood consumption contributes to deforestation, leading to desertification and soil erosion. Women and children are most affected, making them vulnerable to respiratory disorders and other adverse health conditions.

6. Conclusion

Efforts have so far been focused on enhancing the adoption of improved wood stoves, briquetting and biomass technologies (1) It is obvious that there is need for Nigeria to explore alternative source of energy especially to reach out to the people that do not have access to electricity and other modern energy services. It is also established that renewable energy and energy efficiency are two components that should go together to achieve sustainable power development. The need to conserve the present energy generated in the country using energy efficiency products and practices is essential for sustainable development.

7. Recommendations

The following observations are made as recommendations:

The government should develop policies on energy efficiency and integrate them into current energy policies and promote energy efficiency products and practices at the side of end users and energy generation. The government should also educate her citizens and create awareness on renewable energy and energy efficiency, and establish agency to promote the use of energy efficiency products and ensure energy efficiency practices. Efforts must be made to develop and imbibe energy efficiency technologies to develop appropriate drivers for the implementation of energy efficiency policy (12).

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