

An Overview of Nigeria Energy Profile for Power Generation

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ABSTRACT

This study identifies crude oil, natural gas, coal, solar, hydro, wind, and nuclear as energy resources in Nigeria. They abound in the nation, yet they are not fully utilized. The general overview of these resources is presented to reveal their potential base and level of utilization. It was reported that the energy profile of Nigeria has 25 billion barrels as the total estimated reserve of oil, 3.4 trillion cubic meters as the total estimated reserve of natural gas, and 2.7 billion tones as the total estimated reserve of coal. Thus Nigeria holds great potential energy resources (renewable and non-renewable). The level of utilization of these resources is below expectation. This article presents strategies for the sustainable development of the energy resources and their optional utilization.

INTRODUCTION

Nigeria is abundantly blessed with energy resources, which include oil, natural gas, coal, water, and wind etc. However, it is pathetic to know that despite the natural endowment, Nigeria has witnessed energy crisis even more than countries that depend on her for survival.

Investigation reveals that Nigeria's energy scene (conversion, conservation, development, utilization, and management) is characteristically poor, and as a result the energy sector has not developed as expected (Ukaegbu, 1999). A critical review of this viable sector is necessary as a way of identifying its problems and prospects so that a framework for sustainable development and management can be produced.

A true image of the Nigerian energy sector can only be seen by

viewing through the transparent prism of potential energy resource base of the country. Such should include a discussion on the level of utilization of the resources and how they can be developed and managed on a sustainable basis. The basic objective of this study is to review the energy profile of Nigeria for the purpose of infrastructural development.

POTENTIAL ENERGY RESOURCE BASE

Oil is the dominant resource in the Nigerian energy mix, with an estimated total reserve of over 25 billion barrels. It has made tremendous strides not merely on account of being the engine of growth for the economy in terms of revenue generation and foreign exchange, but also because of its versatility as fuel for all purposes and thus a flexible tool at all levels of industrial development.

Natural gas (mainly methane) is abundant in Nigeria and occurs either associated or unassociated with crude oil. Many views have been expressed in recent times about the natural gas potential of Nigeria. The total reserve has been estimated at over 3.4 trillion cubic meters, or 124 trillion cubic feet, which places Nigeria among the top ten countries with the largest natural gas deposits in the world.

A significant percentage of the associated gas is usually produced during crude oil production. However, about 75 percent of this is flared while the rest is either re-injected or treated to pipeline quality gas. The unassociated gas still remains untapped because of low industrial demand, a situation which has started taking a new look since beginning of NLNG (Nigeria liquefied natural gas) project. Gas wastage will be reduced by about 25 percent through exports from the project.

Coal is another energy resource. It is a readily combustible substance that has the composition of organic matter, mineral matter, and moisture. It is abundant in Nigeria, with an estimated total reserve of 2.7 billion tons, out of which about 650 million tons is proven. Coal occurrence is spread over 13 states of Nigeria with 27 mine sites (*Coal News*, 1999). The contribution of this resource to infrastructural development (power) declined from about 90 percent in the 1950s to 0.4 percent in the 1990s. Its development and utilization before 1960 gave rise to premier industries such as railways (for powering their locomotives), marine, for powering ships; and electricity generation at Oji and Ijora and a cement company sited at Nkalagu.

The total land area of Nigeria is about 960,000km², 40 percent of which is classified as forest land with high forest zone of about 37 percent and savannah wood and of about 63 percent. There are abundant trees from which firewood (energy resource) can be produced.

Electricity generation in Nigeria relies on hydro (water) as a resource. Nigeria is blessed with natural dams at Kainji and Shiroro where hydro power plants are built. A greater percentage of the country atmospheric surface receives solar radiation of about 5.5 kilowatt hour/square meter/day. Thus Nigeria holds great potential for solar energy. Energy from wind is generating a lot of interest all over the world. In Nigeria, wind speed exceeds the cut-in-wind speed of 2.2 meters per second at 25 meter height for more than 80 percent of stations. There are high wind speed regions in the country that a 25 meters diameter wind turbine with about 30 percent efficiency can generate up to 97 megawatts/year of electricity.

ENERGY RESOURCES UTILIZATION

According to Ojinnaka, (1998), Nigeria is producing crude oil at an average rate of 2 million barrels per day. With marked improvements in technology of oil exploration, development, and production, more oil reserves can be discovered and consequently developed. The increasingly widespread use of three dimensional seismic imaging, horizontal drilling, and sub-sea well completion technology will have a positive effect on energy resources utilization in Nigeria.

Nigeria is ranked tenth in the world in terms of natural gas reserves, but this resource has been greatly neglected since the inception of oil production. In 1980, when there was a peak in oil production, a daily average of 99.5 percent mcm of gas was produced in association with oil, out of which 95 percent was flared and only 4.5 percent utilized, thus making Nigeria the major producer of this commodity in sub-Shara Africa. Production of gas has more than doubled over the last 18 years, which shows that natural gas industry will play a significant role the future.

Besides the monetary loss Nigeria has witnessed through gas flaring, its environmental effects are monumental. It produces oxides of nitrogen, carbon and sulphur that usually cause "acid rain," which pollutes the environment. Gas flaring encourages deforestation because the

majority of Nigerians rely on firewoods for their energy needs, as LPG is not within their reach.

Coal was actually the dominant energy resource until the discovery of petroleum. Owing to the fact that coal mines were shut down during the Nigerian civil war in 1967, many coal users switched to more readily available fuel, such as petroleum products. As in 1970, the energy and economic planners excluded coal in the equation of their development plans, thus creating an imbalance in the energy mix of the country. However, coal is expected to supply about 25 percent of all energy consumption over the next two decades. On a worldwide basis, coal consumption is expected to rise at about the rate of growth for all energy. The total installed capacity of the National Electric Power Authority (NEPA) is about 5,000 megawatts, which come from three hydro-power plants at Jebba, Kainji, and Shiroro, and two gas thermal plants at Afam Sapele.

However, available data have shown that the current utilization of energy from these plants is about 37 percent of their installed capacities. This may be the reason why electricity supplies are limited mainly to the urban and semi-urban areas. The under-utilization of this resource has a limiting effect on the rural electrification scheme of the federal government of Nigeria. The rapid growth in demand for energy (electricity), which stands at about 16.5 percent per annum, coupled with the distribution problems, has not contributed to resolving the problem of under-utilization of energy resources in Nigeria.

It has been revealed that Nigeria can be referred to as an energy state. The use of the potential solar energy in the country has been limited by unavailability of solar appliances, e.g. heaters, cookers, refrigerators, on a commercial basis. The development of indigenous and efficient solar appliances is still at an elementary stage and should be accelerated for long-term integration into the energy mix of Nigeria. This situation is similar to that of other renewable energy resources like wind, nuclear, and biomass. They are yet to be utilized despite the fact that they abound in the nation. Incorporating their development into long-term energy mix plan of Nigeria is therefore necessary.

CONCLUSION

To consider the future of the Nigerian energy sector, it is necessary to establish a proper perspective of how the potential energy resources can be fully harnessed and developed on a sustainable basis. Policy

formation on any system has never posed problem to Nigeria. However, it has been recognized that the implementation of the policies has not been an easy task.

Trends of energy consumption were analyzed in detail by Okoriji and Chima, (1981). Also, Nigerians energy policy of 1987 explicitly states that the nation's energy resources shall be protected and optimally harnessed in the overall interest of the nation at all times. The following strategies should therefore be adopted.

1. Developing and maintaining a regular inventory of Nigeria's energy resources; current and projected needs including human and material resources.
2. Improving and intensifying the technological performance capability and attaining economic competitiveness.
3. Providing a coordinated institutional framework for the implementation of governmental policies on energy.
4. Guaranteeing the continuity and adequacy of energy supply in the short and long terms, including appropriate conservation plans.
5. Supplying energy at economically affordable cost.
6. Giving due and timely consideration to security and the need for environmental protection of the public and the working population from hazards arising from the exploitation, conversion, and utilization of energy.

Reference

Ukaegbu, O.D. (1999) "Managing Nigeria's Energy Sector for Sustainable Development" A paper presented at NSE Annual Conference.

Coal News (1999) A quarterly publication of the Nigerian Coal Corporation, Ojinnaka, I.P. (1998) "Nigeria's Natural Gas Industry: Issues for its Sustainable Development" A paper presented at the SPE 22nd Annual Conference.

Okoriji and Chima, (1981) "Energy sources for Nigeria," *ENERGY: The International Journal*.