

# A Model for the Mitigation of Energy Scarcity for a Sustainable Market in Africa

Amaize A.P., Airoboman A.E., Adoghe A.U., and Sanni T.F.

Department of Electrical and Information Engineering,  
Covenant University,  
Ota, Nigeria.

peter.amaize@covenantuniversity.edu.ng

**Abstract**—A sustainable environment is one with advancement in science and technology, but an ingredient that can foster this drive is the availability of power supply within all sector of the economy. The scarcity of electrical power in Africa particularly in the Sub-Sahara region has been a major setback towards attaining a sustainable technology infrastructure, as a result of this most business that requires electrical power for their daily operation are forced to run their generators during working hours thereby placing the electric power supply authority on standby. The result of this anomaly is an increase in price of goods and services hence, Potential investors who cannot meet up with the huge amount required in running generators tends to look out for where the electrical power is cheap, readily available and not scarce to cite their industries. In this paper, a model has been proposed for the improvement of energy scarcity in Nigeria. The merits of the model if implemented will bring back investors to the country, reduce energy poverty and improve on the reliability of the power system network. The model is also seen as one that will ease the trace of failure within a decentralized power network.

**Keywords:** *Electric Power, Nigeria, Scarcity, Sustainable.*

## I. INTRODUCTION:

Availability of constant and less expensive electrical energy is crucial for the development of industries, people empowerment and development of the nation. Nigeria is a country that is blessed with abundance of energy in theory with the available energy sources in the country; it is quite painful that we have not been able to convert these various energy sources into energy surplus as a result of poor policy by the institution put in place to take charge of the power sector. Hence, Nigeria is still faced with the nightmare of “darkness” caused by irregular supply of electrical energy that is vital for socio-economic development. According to [2], the generation of electrical energy in Nigeria has reduced drastically as a result of rise in diesel and petrol prices and this has affected the growth of the country’s productive and commercial activities in the past decades. In

an effort for the Federal Government to curtail these challenges, has emphasized the n outlined in the National Electric Power Policy (2002) and enshrined in the Electric Power Sector Reform (ESPR) Act of 2005. According to [12], the irregular power supply and other infrastructure, has affected the growth of industries and individual development and this has led to a perpetuating electric power scarcity. This paper therefore identifies electrical energy poverty as one of the drivers of a reform process.

Despite the enormous finances government has committed to this sector and with continuous assuring customers of better services through the rebranding policy targeted at the concerns, values, image and feelings of both the employees and customers of the sector, consumers are still not satisfied with the quality of service rendered by the sector.

Recent energy sector reforms in Nigeria as observed by [1] are simply following international trends. Private sector is gradually taking the lead in energy supply systems as a result of government dominance. This paradigm shift is caused by constraints such as fiscal pressures, environmental factor, efficiency and the need to attract private sector investment. Power sector reforms in Nigeria started temporarily with the adoption of Structural Adjustment Programme (SAP) in 1986. However, it was not until the enactment of the Electric Power Sector Reform Act in 2005 that significant momentum was achieved in the electricity sub sector. The ongoing reforms in the nation's power sector which started in 2005 thus constitute a U-turn or policy reversal for the sector. Gross inefficiency in the sector, the heavy dependence on government treasury, rapid technological development and trends in the management of electricity sectors of other countries were the major motivating factors for the reforms. The reasons for power sector reform are clearly understood. Honestly, the reason for power reform is the irregular supply of electricity in Nigeria which has led to high revenue losses. As a matter of fact, the reasons include but not limited to: First, power sector reforms is expected to lead to reduction in costs, including short term power and

operation costs through efficiency gains, arising from economies of scale as larger-scale plants are enabled by larger markets [3]. This will lead to improved supply conditions, including better reliability and security of supply due to access to imports during emergency situations [3]. Only 40 percent of Nigeria population have access to electricity. This further tells us the level of energy poverty in Nigeria. Also considering the per capita energy consumption of Nigeria, we have 100kWh connected to the grid as stated by [10] which is far less as compared to South Africa, Brazil and China with per capital consumption of 4500kWh, 1934kWh, 1398kWh respectively [10].

## II. THE PROPOSED MODEL

The proposed model for the mitigation of energy scarcity in Sub-Sahara Africa country like Nigeria is as shown in figure 1.1 below.

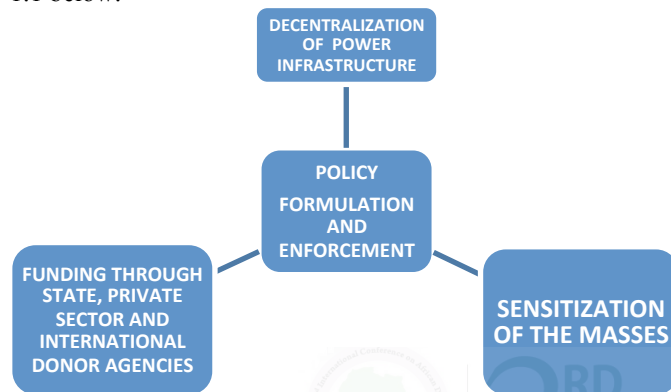


FIG. 1.1 PROPOSED MODEL

## III. POLICIES FORMULATION AND ENFORCEMENT

As can be seen from the model, policy formulation and enforcement is at the heart of solving the issue at hand, meaning that if we get this first stage right then every other stage in the model will not be much of a problem and hence the following points have been suggested:

- According to [11], renewable energy technologies should be made national priority on national development policy agenda that is exactly what Kenya did. But in Nigeria such policy does not exist. All we do to lay emphasis on restructuring the old order under the defunct NEPA under the new GENCOS, DISCOS and the regulatory frameworks provided by the NERC. Importance of renewable energy and decentralized energy options have not been properly harnessed and used in Nigeria electricity situation unlike in Kenya. The advantages of the adoption of these technologies in Nigeria include:
  - 1 Reduction of emissions that can lead to global warming
  - 2 Ensure price stability since the cost of renewable energy is dependent on the invested

amount and not on the increase or decrease of inflated cost of natural resource.

- 3 This would therefore give room to job creation and for other economic benefits
- 4 Improvement of public health and quality of environment will eventually be noticeable due to availability of power supply.

- Policy to make electricity and modern cooking fuel should be available to all especially to the rural dwellers.
- Registered and qualified engineers whose area of competence are related to the power sector should be involved in policy making
- Policies on the implementation of modern maintenance technique as well as regular training of personnel should be incorporated in the sector.
- The imposition of appropriate penalties such as life imprisonment as stipulated by decree 22 of 1985 as amended on any person or group of persons caught vandalising the electric utility equipment(s) of any level.
- Policy aimed at addressing issues on energy theft should also be enforced
- Policy aimed at enabling the government to focus on the power sector rather than been distracted by other security issues should be incorporated.

## V. DECENTRALIZATION OF POWER INFRASTRUCTURE

The decentralization of energy centres on over hauling method to sustainable energy policy for a nation like Nigeria. This involves decentralization of the governance structure, infrastructure, means of production be multiplied, provision of cheap options and devolution of governance, control and management duties. Adoption of decentralization with respect to the infrastructure will help in restructuring the energy and natural resources sectors of Nigeria. Although the sector is now privatized but the nature of service rendered as of the time of writing this paper is nothing to write home about hence, a total decentralization of the power sector infrastructure will therefore implies the:

- Building of generating stations in each of the distribution zones to supply the power need of these zones
- The generated power should be evacuated directly for consumption using embedded generation scheme such that the excess power is eventually sent to grid
- This will eventually make the tracing of faults easier and the resultant effect will be losses minimization as a result of reduction of the distance between the generating stations and the load centres, thereby increasing the system stability.
- Government should give all the six generating stations , the transmission company and the eleven distribution stations all the support needed especially in the areas of governance

#### IV. FINANCING THROUGH STATE

To solve the problem of energy scarcity with respect to the fact that about 60 percent of the masses in Nigeria are not presently having access to modern energy, it is necessary for the state governments to make institutional, regulatory, legal framework and finance available. The private sector should also be involved in the financing. The importance of using modern and cleaner energy publicity can be done by international donor agencies, as well as paying part of the investment on production and distribution of electricity.

According to [4] to reduce power scarcity, a two sided method is vital. The first one is that the developing countries should be rendered assistance to increase their capacity to embark on the use of other fuel sources such as LPG and Oil products. Secondly they should be assisted in building new power generating stations, transmission lines and distribution lines to make electrical energy surplus, efficient and increase stability margin of the power system.

Some other measures to be taken to reduce power scarcity include:

- Investors should be encouraged by making loans with no or little interest rates and with long time of repayment periods available.
- In cases where this may not be feasible due to financial challenges by the state then the state should seek support from international agencies in the area of international trade of energy products.

#### VI. SENSITIZATION OF THE MASSES

The population in Nigeria keeps increasing without a corresponding increase in the amount of power generated. It is in this wise that adequate sensitization of masses is required in the following areas:

- On the need to save energy by embracing energy saving household equipment
- On the need to save energy by disconnecting/switching off all electrical appliances when not in use
- On the need to secure the power utility equipment by guarding it against vandals
- On the need to avoid back-feeding and all forms of energy theft
- If affordable, should incorporate solar panels (or any other form of renewables) when building a new house.
- In cases where this may not be feasible due to financial challenges by the state then the state should seek support from international agencies in the area of international trade of energy products.

#### VII. CONCLUSION

Energy scarcity in Nigeria will be a thing of the past if the things addressed in the model are strictly adhered to. The paper concludes by suggesting the need for mainstreaming decentralized electricity governance model into the existing

framework of energy regulation in Nigeria given the peculiar nature of the country and the use of energy efficient appliances. This is because the decentralization of energy model advocates the decentralization of governance structure to involve the local communities, means of energy production be multiplied, provision of cheap energy options as well as devolution of governance, control and management duties in the other tiers of government to maximize the benefit of the reformed electricity sector in Nigeria.

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