

## Improvement Of Distribution Power Stability in Nigeria: A Review of Kwara State Power System

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DOI:10.56201/ijemt.v10.no11.2024.pg49.54

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### Abstract

*The Nigerian electric power system is being operated close to their capacity limits due to economic growth and environmental constraints. The constraints have led to voltage instability or total power collapse which has placed limitation to the power system operations. Thus, maintaining a stable operation of Nigerian power system is one of the main challenges of electrical power system operator in the country which is not excludes the Kwara State. Therefore, this study presented an alternative ways of improve the Kwara State electrical system stability through the application of renewable energy sources. The study would establish the power supply system's reliability and its ability to withstand energy growth in the state.*

**Keywords:** Kwara State, Electric Power System, Renewable Energy Sources, Voltage Instability, Energy growth,

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### INTRODUCTION

Nigeria has been operated a single unitary grid (transmission system). The power system comprises of 77 grid-connected generating plants with a total installed capacity of 12, 800 MW and available capacity of 7,139.6 MW. However, the average power generated fluctuates between 3,000 MW and 6,000 MW which is inadequate when compared to the 10,000 MW of energy demanded by the millions of consumers craving for electrical energy, thereby resulting in recurrent power outages across the nation which is not excludes the Kwara State [1 -5]

Basically, electricity distribution should be planned so that it can be extended into new load areas (housing or commercial building) at their construction stages [1, 4]. But, this has not been the usual practice in Nigeria electricity industry due to the lack of proper infrastructures and also the power sector is in a state of transition because of increasing industrialization and the deregulated economy. Therefore, utility companies are faced with the challenge of providing reliable electrical energy to most of the Nigeria populace [2, 7- 9]

Thus, in order to improve the electricity distribution in Kwara State and in the nation at large as to meet the load demand with regards to plan and operate of electric utilities, the Nigerian Government, by extension, the governors and legislators must move away from the outdated power

infrastructure model of the national grid. The power grid cannot engender adequate power supply on a national scale and must be deconstructed to state level.

In addition, actively promote Distributed Generation (DG) or Embedded Generation (EG) power supply (renewable energy source) provides a better alternative way for power system expansion than construction of new generation power plant [10 -15].

### **I. DISTRIBUTED GENERATION RESOURCES**

The DG is an electricity-generating plant that connected to a distribution level rather than the transmission level. The DG has been growing rapidly in deregulated power systems due to their potential solutions in meeting localized demands at distribution level and to limited transmission capacities from centralized power stations. It reduces the effect of losses while providing reactive power and contingency reserves to the power system. It also reduces the need for new transmission and distribution facilities, consequently reducing overall costs [16 -20]

This electricity-generating plant include stand-alone renewable source such as solar energy (Photovoltaic (PV) cells), and wind turbines; biomass and diesel generator sets. The solar energy is the energy produced as a result of nuclear fusion of hydrogen within the mass of the sun. Solar power systems mainly consist of solar panel (Photovoltaic (PV)) made up of PV cells also called solar cells or panels shown in Figure 1 below, which converts the energy from sunlight into d.c electricity and batteries which store the power generated [6, 9, 13, 19].



Fig.1: Solar Panel

The wind turbine shown in Figure 2 below is the transformation of wind energy into more useable forms, typically electricity using wind turbines. The power extracted by a wind turbine has a mean value during a specific time interval with variations about the mean due to fluctuations in wind speed. Generally the output of a wind turbine is assumed to be proportional to the cube of the wind speed. Therefore the best sites for mounting wind turbines are on hilltops, the open plains, through mountain passes and near the coasts of oceans or large lakes close to the base station sites location [2, 9, 14, 18, 20]



Fig 2: Wind Turbine

The biomass uses the energy from plants and waste materials to produce electrical energy as shown in Figure 3 below. A variety of biomass resources exist in the country in large quantities with opportunities for expansion. Considering the abundance of biomass, there is high potential for biofuel production from these resources. The available biomass resources are agricultural crop residues, agricultural crops, forestry resources, municipal solid waste and animal waste [ 1, 5, 16, 18, 20].



Fig 3: Biomass

The diesel generator sets refer as diesel engine shown in Figure 4 below, comprised of an internal combustion engine, coupled electric generator and controller which are commonly used in microgrid applications for backup power and off-grid power to generate electrical energy in remote locations where utility interconnections are not possible. The generator sets converts the chemical energy available into mechanical power that rotates the engine shaft connected to the alternator. The influx of these DG energy source has reported to provide a means for providing off-grid electrification services [4, 11, 13, 17, 19]



Fig 4: Diesel Generator

## II. APPROACHES SUGGESTION

Since, the Kwara State Nigeria has potential resources for solar radiation and wind due to its geographical location and also, agricultural waste materials are already available. Hybridizing two or three of these generating plants in a single power system configuration offer an attractive alternative for power distribution as to meet the load demand in the State. The hybrid model is recommended due to the intermittent nature of the generating plant which poses a challenge, as energy generation of individual generating plant does not always correspond with its usage.

The hybrid power system is a combination of two or more electricity generating plants with back-up, as well as a storage system used to response to a given load energy requirements. These energy systems are considered as a way to reduce the transmission power losses and the power generation solution as it only involves the use of DG energy sources. Hybrid approach reduced fuel requirements and provided an alternative to installing uneconomical distribution feeders to remote locations.

## III. CONCLUSION

This study has successfully presented a various renewable energy sources which can be utilized as alternative electric power supply to the Kwara State Nigeria at large due to high energy demand in the State. Therefore, with the aggregation of the views expressed above, it can be concluded that, if these are well implemented, the epileptic power supply in the Kwara State and in the country will be in the past.

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