

Panacea to Epileptic Power Supply in Nigeria.

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ABSTRACT

Epileptic power supply is a situation whereby there are consistent power outages in an area over a given period of time. At times it may take the form of low voltage, when there is supply at all. This can arise from either the generating or transmitting end, but is ultimately felt at the utilizing end and any nation that is always confronted with an irregular supply of electricity is always retarded in development and presents risk potentials to investors. The power demand in Nigeria is increasing at an accelerated rate and it is imperative that adequate attention be paid to the prospects of the power industry by planning effectively to put an end to the problems and causes of irregular power supply since socio-economic development is one of the indices for comparison of the standard of living in various countries. Nigeria, a country of over 140 million people, has for the past 36 years of establishment of the national power industry been empowered with electricity generation, transmission, and distribution. The country has witnessed frequent and persistent power outages. Presently, the federal government has embarked on power sector reforms with the intention of improving the above unpalatable scenario and, in turn, reduce the scope of monopoly control of the nation's power industry. This paper therefore looks at the overall causes of epileptic power supply in Nigeria and the suggest solutions to this irregular power supply as a way of finding lasting solution to problem.

(Keywords: electricity, generation, transmission, distribution, power, vandalism, equipment)

INTRODUCTION

The issue of electricity supply cuts across all aspects of society as it is used by industrial and

domestic sectors. Adequate power supply impacts that the backbone of infrastructure development, wealth creation, job opportunities, and human/capital development [3]. A lot has been written about power supplies in Nigeria, the problems bedeviling the sector, and solutions to the problems. Unfortunately, the power sector (just like every sector of our economy and national life), is facing perpetual decay.

However, remedies to the power sector must be given the utmost priority because of the essential role electricity plays in our economic life. Manufacturers have rightly complained that any interruption in electricity supply is bound to have negative effect on their output. Residential users of electricity have complained that power outages can affect their electrical/electronic appliances. Small- and medium-scale users of electricity have admitted that interrupted electricity is the bane of the smooth running of their businesses [6]. Therefore, there is no stratum of our socio-economic life that is not affected by the electricity supply.

The Power Holding Company of Nigeria (PHCN) has been held responsible for epileptic power supply in Nigeria. But it will be foolhardy of PHCN to cut the supply from her costumers without a reasonable justification for it. Full blame should not be placed on PHCN alone but also on the government of the past for failure to provide full financial support for smooth running of power industry [4].

While other countries are busy increasing their power generation capacity, the Nigerian government has in the past, either under-funding the sector or not funded it at all. Out of three African's largest economic countries, Nigeria is the most underdeveloped. South Africa, with 40 million people, enjoys 40,000MW of electricity and over 75 million Egyptians have access to

20,000MW of electricity, while 140 million Nigerians, a population larger than both Egypt and South Africa combined, share less than 10,000MW [3].

On assumption of office on 29th May, 2007, President Umaru Musa Yar' Adua, GCFR, rolled out his election covenant with the people of Nigeria. The seven point agenda included reforming the power sector. Since then, the agenda has been properly conceptualized and comprehensively articulated and the implementation strategies adequately outlined, to ensure the realization of vision 20: 2020 [4].

The infrastructure reforms in the critical power sector through the development of sufficient and adequate power supply will be to ensure Nigeria's ability to develop as a modern economy and an industrial nation by the year 2015 [4]. Meanwhile, members of the society who are customers of PHCN have also contributed immensely towards the problems of epileptic supply of power, for their failure to settle their electricity bills and for allowing vandalism of power equipment in their vicinity. In fact, the story of electricity supply in this country is a continuous one to be told.

One must applaud the efforts of President Musa Yaradua's administration over his 7-point agenda which encompasses power sector reformation [1]. But a vital question is if the solution being proffered in the agenda is different from the steps taken by past administrations? If it involves the same steps, how will it solve our problems in the power sector now if it could not solve the problems in the past?

Taking a brief look at the three key sections of electrical power system (i.e., generation, transmission, and distribution), one would realize that all the three sections must be totally overhauled and radical change is inevitable if we want any future for our children in this country.

On this note, a holistic approach must be taken with more emphasis being laid on the administrative and technical aspects of the power generation, transmission, and distribution network. Electrical power supply is not just about generating enough megawatts; transmission and distribution of the generated power are essential parts of the whole system.

The main objective of this paper is to analyze various problems that cause the irregular power

supply in Nigeria and to suggest a viable solution that when fully implemented will minimize the problem of epileptic power supply, if not completely eradicate it.

METHODOLOGY

The majority of the data used in this paper are largely secondary and were obtained from various PHCN publications, internet research and also, from personal visitation to various generating, transmitting, and distributing stations. Moreover, some officials of PHCN were interviewed about some problems which hinder the regular supply of electricity in Nigeria.

SOURCES OF PROBLEMS ON ELECTRIC POWER NETWORK

Epileptic power supply occurs as a result of one or more technical problems, which occur on the electrical network during the process of power generation, transmission and distribution.

One of the functions of the power industry is to generate adequate power for the use of their customers. Power generation is the process by which power is produced. This involves the conversion of any form of energy to electrical energy [6]. Various types of generating stations depend on a source of input energy to drive the turbines of the generator. Those available in Nigeria are hydro and thermal power generating stations. Hydroelectric power stations utilize the potential energy of water to drive the turbine while thermal generating station uses heat energy derived from fuel material to rotate the turbine.

Power transmission is the delivery of bulk power through the national grid to the primary point of the distribution. This involves several transformers, substations, and thousands of kilometers of transmission lines supported by steel towers as in the case of 330KV and 132KV lines and concrete/wooden poles as in 33KV and 11KV transmission lines. The national grid is composed of several long radial 330KV and 132KV transmission lines with a few mesh networks [1]. The larger part of the transmission lines are constructed through the bush and forest in order to ensure a linear path transmission lines and the shortest distance to the desired destination which exposes the lines to a lot of

problems that invariably lead to epileptic power supply.

The distribution sector of the electricity network is of paramount importance to the consumers. It is at this point that high voltage supply from transmission substation is being stepped down to low voltages of 33/11KV for industrial consumers and 230/415V for domestic consumptions [1]. At this point, the consequences of all the problems emanating from all other sections are being felt. In fact, it is not therefore an over statement to say that the public image of PHCN is mirrored more through the performance of this section than the others.

Various Problems that Occur at Different Stages of Electrical Network:

A. Problems Facing Power Generation

1. *Insufficient power generating station:* The present power demand in Nigeria has far outreached its available generating capacity. If all the installed generators are working to their maximum capacity they will still not be able to meet the demand of the population [3]. As there are no means of getting additional supply apart from what is being generated, the situation then calls for some part of the network for others to have supply.

2. *Lack of maintenance culture:* There is no proper maintenance of the installed generators and other generating equipment. Most of the generators in our generating stations are very old and they require routine maintenance. Generators are being managed when they developed minor faults, and this makes them to generate below their rated capacity until they finally brake down [6].

3. *Climatic Condition:* The major effect of climatic change on the operation of electric power systems includes the following [7]:

- (a) Inadequate inflow of water into the reservoirs of the hydro-generating stations. When the water level is very low, the potential of water reduces. This period only the machines with variable blade suitable for this condition and there will be complete shutdown of fixed blade machines to prevent them from being damaged.

- (b) The Harmattan and dry season also affect the operation of the gas. High exhaust temperature and clogging of air inlet filters causes forced shutdown of the gas turbine during Harmattan season.

The performance of the steam power plants is affected by the quantity of cooling water. At the Egbin thermal station, the salinity and algae formation of the lagoon water used for cooling increases during the dry season leading to poor vacuum, de-rating the unit capacity, and forced shutdowns. It takes a minimum of an 8-day shutdown to clean the condenser of each Egbin unit. Such lengthy shutdowns have serious implications on the reliability and stability of power supply.

4. *Gas constraints:* In spite of the fact that Nigeria is designated as natural gas zone, with gas reserves ranging into several trillions of standard cubic feet and a large quantity of natural gas being flared, the availability and reliability of natural gas supply in Nigeria is being affected by the following factors [6]:

- (a) Activities of the host community {characterized by frequent clashes and agitation}
- (b) Under-developed distribution network
- (c) Treatment plant/component failures resulting to insufficient supply of gases and poor gas quality. This greatly affects the operation of thermal generating stations which makes them generated below their rated capacity and most of the thermal stations are grounded due to the inability of gas. This in turn reduces the contribution of thermal stations of the national grid and leads to power outage.

5. *Poor technological development:* Because of the low technological condition of industry in Nigeria, an ordinary 10KVA transformer cannot be made and the spare parts needed for maintenance and repair are often not available. Nigerians depend solely on importation of equipment and spare parts; which may take a longer time for which there will be no supply. Also due or low level of technology, we lack modern testing equipment which makes operations and maintenance easier and faster. Instead we make use of our old methods in our operation which may be time consuming, inaccurate, and often difficult [4].

6. *Lack of courage and motivation*: It is observed that the junior staff, who are working tirelessly around the clock, are the ones that are being paid less and their promotions are not regular. They have no place to rest after the day's job [7], and there are no periodic training and workshops for them to improve and update their knowledge. All these factors impact their dedication to work which may have a direct impact on the smooth running of the power operation [7].

7. *Shortage of staff*: The power industry is one of the industries that have the largest population of workers in Nigeria, but the technical section that requires large numbers of staff is being understaffed [7].

8. *Poor management*: Management is one of the major problems which impacts the efficiency of any government owned industry. PHCN is not left out in this analysis. The manner of selecting the board of management is by politics, tribalism, and some other inappropriate ways [1].

9. *Human error*: As human beings are bound to make mistakes, during the process of power generating operations, the state of mind of the operators can often lead to power failure [1].

B. Problems Facing Power Transmission

1. *Vandalism*: This is ignorant destruction of public or private property. Vandalism of materials and equipment is the greatest danger posed against the power industry and it is the only single act that if not properly addressed will render the efforts of government and power industry useless. There have been several reported cases of vandalism of PHCN properties across Nigeria. This is mostly common in the rural areas; especially on the part of the transmission lines that pass through the forest areas. The most targeted items include; aluminum conductors, pin insulators, stay rods, transformers, and energy meters. The motives of these vandals are economic in nature but their actions put their lives at very high risk. Whenever any electrical equipment is being vandalized, it always takes a long period of time before reconstruction [1].

2. *Bush Burning*: During the dry season, farmers and cattle ranchers set fire to the bush under transmission lines. The resulting tick smoke

causes flashover between towers and phase conductors of the 330KV transmission lines which leads to forced outage [1].

3. *Lack of modern testing equipment*: The common faults on transmission lines include; short circuits, open circuits, and earth faults. The point of fault may be located at several kilometers from the closest settlement of PHCN station inside the bush. There is no modern equipment available to the power industry in Nigeria to indicate the exact point of the fault. It takes the maintenance crew a lot of time tracing the transmission lines of several kilometers by foot, inside the bush. This is a difficult task and is time consuming [6]. The feeder concerned is likely to be in darkness for a long period of time.

4. *Storms and lightning strike*: This is mostly common during the raining season, as rain always accompanies storm lightning strikes, this causes a lot of damages to conductors, insulators, towers, poles, and cross arms. Lightning also causes over current and flashover that consequently trips breakers. This often leads to power outages for a period of time that the repair of the affected device or material will be carried out [3].

5. *Construction activities and accidents*: There used to be spiking of transmission lines by construction machines during the process of road construction. As most of the transmission lines are constructed very close to the main roads, a lot of damage can be caused to the transmission lines. There were also some reported cases of motor vehicles running into towers and poles [7].

6. *Trees growing under transmission Lines*: As longer parts of transmission lines are being run through the bush and forest areas, trees tend to grow under the transmission lines. If left unclear they may grow to the height of the transmission lines. This often leads to earth faults and over current flows when the fresh tree bridges two or more current carrying conductors [1].

7. *Incompliance of operators*: During the load fluctuation, the monitoring engineers at the National Control Center [NCC], Oshogbo, attempts to regulate frequency in order to prevent system collapse. The engineer will therefore pass information to the operator at the desired transmission station to load or unload some of his feeders to normalize the frequency.

At times, some operators failed to comply and this lead to system collapse, which contributes to irregular power supply [5].

C. Problems Facing Power Distribution

1. *Overloading of equipment:* The distribution network in various part of Nigeria are undergoing severe overloading due to limitation in transformer capacities. This overloading normally results in failure of distribution transformers or melting of protective devices, like fuses. At times, this overloading results in low voltages that may not be useful for most domestic purposes. The situation is very serious in many places particularly in some part of Lagos state and some urban centers with high population [7].

2. *Illegal connections:* Many users of electricity have no formal business arrangements with PHCN; they only get their houses connected illegally. This results in the inability of PHCN to account for their true customers and plan for the load demand by them. Some people are also found of hanging their wires to the PHCN distribution lines in the night when nobody would check them. They make use of low rated cables, this normally causes sparking and very serious damage to the distribution lines [1].

3. *Corruption:* Some of the staff of PHCN who distribute bills and take meter readings undertake corrupt practices. Many prefer to take a token amount from consumers rather than to encourage them to settle their bills. These corrupt officials go to the extent of adjusting the energy meters for some amount, intimidating the consumers with disconnection, sending fictitious bills, and extortion of illegal money from consumers who have outstanding accounts. This has a negative effect on the smooth running of the power industry, as they cannot meet their expectations. Consequently, they are unable to finance their project effectively due to shortage of funds [6].

4. *Power wastage:* Most consumers of electricity are ignorant of their usage. They leave their security lights on during the daytime and leave refrigerators and other electrical appliances on in the offices and shops over the weekends. This results in higher demand and contributes to epileptic power supply.

5. *Defective Appliances:* Using defective or faulty home appliances normally results in damage of electrical installation equipment and invariability causes variability in the available of power supply [3].

6. *Poor installation of electrical appliances:* Most installations are carried out by unqualified electricians or by using “do it yourself” wiring methods. A large number of this kind of installation results in damages to electrical distribution equipment like transformers, etc. [5].

RECOMMENDED SOLUTION TO THE PROBLEMS

In the previous section, various problems that lead to the epileptic supply of electricity in Nigeria were discussed and grouped under generation, transmission, and distribution. The solutions to these problems are also going to be classified under generation, transmission, and distribution of electricity.

A. Power Generation

1. *Construction of additional power generating stations:* In order to meet the present power demands of this country, there is a need for additional power generating stations. It is also important to site power stations close to major base loads as to reduce length of transmission lines, losses and reactive power compensation problems.

2. *Establishment of a maintenance scheme:* The PHCN should establish an effective schedule of preventive maintenance to aid the efficient performance of the generators. Corrective maintenance should also be carried out on generators whenever any abnormality is noticed. All the grounded generating stations should also be repaired.

3. *Installation of variable blade turbine generators:* In order to overcome the resulting problem of generator shutdown due to low levels of water in the reservoir of a hydro-generating station during the dry season, installation of variable/unfixed blade turbine is necessary. This will work with all conditions of water by automatically adjusting its number of blades to the one suitable for any levels of water and its efficiency remains unchanged.

4. *Technological improvement*: The government of Nigeria should find a means of improving the general state of Nigerian technology to prevent us from being over-dependent on the importation of equipment and materials.

5. *Provision of modern equipment*: The latest technology used in developed nations should be provided to the power industry, including equipment with high reliability, accuracy, speed and ease of operation.

6. *Encouragement and motivation*: The authority of the Power Holding Company of Nigeria should develop a means of motivating its workers, especially those at the technical sections, through regular promotion and regular payment of due allowances.

7. *Employment of recent graduates*: In order to relieve the technical personnel of the generating station of their heavy burden, there should be recruitment and training of young recent graduates to work hand-in-hand with more experienced workers, to ensure sufficient personnel to take care of the generating equipment.

8. *Establishment of regular training and workshop*: A regular training program should be organized for the technical personnel of the power industry. This will update their knowledge and improve their experience to meet up with the present day technological development.

9. *Implementation of due process*: Contracts must be awarded to competent contractors who are capable enough to handle the job satisfactorily and the award of contract must not be based on politics and tribalism.

10. *Appointment of competent people to the board of electricity*: The government should appoint an autonomous board of competent people, of proven ability and integrity, who will bring their background to bear in managing PHCN more efficiently.

B. Power Transmission

1. *Monopolizing the sale of power equipment*: Since vandalized equipment is sold back to the contractors handling electrification projects, the sale of power equipment should be monopolized to the power industry alone.

2. *Implementation of laws and public sensitization campaign*: To eliminate the problem of bush burning and vandalism, there should be proper implementation of appropriate laws.

3. *Provision of modern equipment*: Modern testing equipment should be made available to the maintenance crew in order to reduce the long time of power outages due to the problems of fault location.

4. *Establishment of maintenance scheme*: There should be frequent line patrols to clear the bushes and trees away from the transmission lines. This will minimize the effect of trees on transmission lines.

5. *Provision of redundancy transmission lines*: The effect of lines being severed introduce transient instability which can be checked if the lines were to be double circuit, since the load on one line could be transferred to the other automatically, provided that the capacity of the conductors will withstand the load.

C. Power Distribution and Sales

1. *Provision of additional distribution transformers*: In order to minimize the problem of overloading at the distribution ends, there is need to install more transformers to take care of excess loads that cause overloading on distribution networks. This will improve the supply of electricity in Nigeria.

2. *Introduction of pre-paid meters*: If the prepaid meter system can be introduced in all parts of the country, this will check a lot of problems including power wastage and block one of the lucrative way of making illegal money for the PHCN officials, as they can no longer exploiting consumers with disconnection ladders, send fictitious bills, and tamper with energy meters. Above all they can no longer extort money from consumers who have outstanding arrears.

3. *Public enlightenment campaign*: It is very important for the power industry to embark on public enlightenment campaigns to orientate their numerous customers on how to use electricity efficiently and cheaply. Also, to enlighten their customers on the important of electric bills and discourage them from vandalizing power industry properties.

4. *Punishment enforcement*: The government should enforce tougher penalties for illegal users of electricity and on the vandals of public properties.

5. *Accurate consumer census*: During operational planning, there should be a proper and accurate census of consumers of electricity. This will allow the power company to know the number of consumers to be catered to.

6. *Installation inspection*: Before any new electrical installation can be connected to supply, it should be subjected to thorough inspection as to ensure that such installation conforms with IEE regulation standards.

CONCLUSION

It is the conclusion of this paper that if the issues raised here and the suggested solutions to the irregular power supply are fully implemented by government of Nigeria, the management of the power industry and individual users of electricity can be improved and a great future can be forecast for Nigeria.

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