TECHNIQUES FOR IMPROVING POWER SUPPLY IN ABUJA ELECTRICITY DISTRIBUTION COMPANY (AEDC) CHANCHAGA DISTRICT MINNA, NIGER STATE

BY

UGORJI, Iheanacho Emmanuel
2016/1/62739TI

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FEDERAL UNIVERSITY TECHNOLOGY, MINNA, NIGERIA

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A PROJECT SUBMITTED TO THE SCHOOL OF SCEINCE AND TECHNOLOGY EDUCATION, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGERIA IN PARTIAL FULFILLMENT OF THE REQIUREMENTS FOR THE AWARD OF THE DEGREE OF BACHELOR OF TECHNOLOGY IN INDUSTRIAL AND TECHNOLOGY EDUCATION (ELECTRICAL/ELECTRONICS TECHNOLOGY)

MARCH, 2023

DECLARATION

I UGORJI, Iheanacho Emmanuel Matric No: 2016/1/62739TI an undergraduate student of the Department of Industrial and Technology Education certify that the work embodied in this project is original and has not been submitted in part or full for any other diploma or degree of this or any other University.

……. …….

UGORJI, Iheanacho Emmanuel
2016/1/62739TI

Signature & Date

CERTIFICATION

This project has been read and approved as meeting the requirement for the award of BTech degree in Industrial and Technology Education (Building Technology) of Federal University of Technology, Minna.

Mr. I. K. Kalat ----------
Supervisor Signature & Date

Dr. T M. Saba ----------
Head of Department Signature & Date
Industrial and Technology Education

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External Examiner Signature & Date

DEDICATION

This work is dedicated to my mother, who inculcated hard working in me, her disciplinary life has been my source of inspiration and strength throughout this program.

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The researcher's gratitude goes to the Immutable God for His faithfulness. The researcher appreciate his supervisors Dr. M. AbdulKadir for their time to read, correct and contribute toward the success of this work. The researcher acknowledges the academic and non-academic staff of the Department of Industrial Technology Education and for their immense contributions toward success of the work.

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ABSTRACT

This study is geared toward investigating the techniques for improving power supply in Abuja Electricity Distribution Company (AEDC) Chanchaga District Minna, Niger State. Three (3) research questions set to guide the study and three (3) hypothesis were tested at 0.05 level of significance. The research design used in carrying out this study was the survey research design. The study covered some selected Roadside Mechanics in Chanchanga Minna Metropolis Niger State. The targeted population consist of consumers and staff of Abuja Electricity Distribution Company in Chanchanga Minna. This consist of one hundred and sixteen (116) consumers and forty-five (45) staff of Abuja Electricity Distribution Company Minna participants with six (6) Engineers, thirty four (34) Technician/Maintenance Officers, and five (5) administration officers. A constructed questionnaire titled "Assessment on Techniques on Improving Power supply In Abuja Electricity Distribution Company in Chanchanga District Minna, Niger State Questionnaire (AIPOSAEDQ)" was used to get the desired information from the students. Responses from the questionnaire was analyzed using the descriptive statistics and t-test. Descriptive statistics of mean and standard deviation was used for the research questions. While t-test was used for the hypotheses testing at 0.05 level of significance. The findings of the study revealed that there is moderate level of power supply in Minna metropolis and that circuit breaker tripping, transformer failure, transmission line failure, bus bar failure, inadequate maintenance are factors affecting power supply. Then the finding revealed that adequate maintenance and regulation of power generation, transmission and distribution among others are the intervention needed. The researcher there by recommends that: replacement of aged equipment with new ones (tested and of high quality), proper and adequate maintenance of electrical power equipment, and stringent and urgent action should be taken by anticorruption agencies to nip the problem of corruption and looting of funds meant for power sector reform in the bud.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Power is considered as one of the major instrument and driver for economic development. A nation that cannot generate enough electricity to power its nascent industries will remain at the fulcrums of economic quagmires (Adedeji, 2017). In Nigeria, successive government over the years has been promulgating myriads of policy options on how to improve the power sector in the country but still yet the country is yet to record significant success in the power sector.

Electricity is generated from primary energy sources such as solar, water, waves, wind, oil, gas, coal, tide, etc. Nigeria is well blessed with all these sources of energy. The country has an annual average daily sunshine of 6.25 hours, an average solar radiation of about 5.25 kilowatts/m^2/day and receives about 4.851 x 1012 kilowatts (kw) of energy per day from the sun (Odetunde, 2013 and Solar Energy International, 2016). Proven crude oil reserves for the country as at 2013 is 37.2 billion barrels and proven natural gas reserve is 182 trillion cubic feet. Its coal reserve is estimated at 2 billion metric tonnes (Sambo et al., 2016; United States Energy Information Administration (USEIA, 2017). The country is bounded on the South by Atlantic Ocean. Rivers Niger, Benue and many others traverse the country from North to South. There are many waterfalls, abundant wind, tides and waves. Despite the abundance of electricity generation sources, Nigeria as reported by CIA (2014) has one of the lowest net electricity generation per capita rates in the world. Electricity distribution network and voltage profile are very poor resulting to more than 50 percent of the populace living without electricity supply (Osueke and Ezugwu, 2015).

Electricity production and distribution system are weak and susceptible to major setbacks. The weak and inefficient system results from old and decaying infrastructure. Some of the electricity generation stations were built in the 1970s and are still being operated without major rehabilitations, retrofit or upgrade (Oyedepo, 2012). They are also poorly maintained. Also, until very recently, electricity generation, production and distribution has been an exclusive preserve of the poorly managed government monopoly under National Electric Power Authority (NEPA) and later Power Holdings Company of Nigeria (PHCN).

Since 1972 until the early part of 1998, electricity generation, transmission and distribution in Nigeria had been a monopoly of the Federal Government through the then National Electric Power Authority (NEPA). However, a combination of factors such as inadequate funding, institutional corruption, and excessive political interference along with poor managerial and operational strategies implied that electricity supply during the era of NEPA was abysmal (Adewuyi and Emmanuel, 2018). Consequently, the Electric Power Sector Reform (EPSR) Act was signed into law by the Administration of President Olusegun Obasanjo in 2005. The essence of the reform was the liberalization, deregulation and privatization of the nation's power sector in order to stimulate stable and uninterrupted power supply in the country.

Nigeria, a country with a population of 140 million people according to 2006 national population census and richly endowed with various sources of energy, crude oil, natural gas, coal, hydropower, solar and wind etc is still mired in the dark. Poor electricity supply has been a serious problem in Nigeria and despite the huge amount of money said to have been expended by successive administrations to revamp the power sector, there is no evident or obvious change as not much seems to have been achieved as the country still witnesses frequent and persistent power outages (Abotsi, 2016). While businesses crumble daily owing to this long running problem of

power supply with manufacturing companies spending so much to generate their own power supply with the costs eating into profits, generator dealers are the beneficiaries of the rots and decays in the power sector as virtually every business in the country patronizes them.

In view of the above, Nigeria's power sector privatization program was crystallized in November 2013 with the emergence of one(1) Transmission Company(TRANSCO),Six(6) Generation Companies(GENCOs),and eleven (11) Distribution Companies (DISCO's) (Doe and Emmanuel, 2016). The eleven (11) Distribution Companies (DISCO's) consist Yola, Port Harcourt, Ikeja, Eko, Kano, Kaduna, Jos, Ibadan, Enugu, Benin and Abuja electricity distribution. Despite all this distribution centres, power outage is yet to become a history in the power sector (Umar, 2020).

The availability of reliable electric power to the homes and businesses of Nigeria citizens has been one item in our national life that we have approached with so much hope and yet experienced so much frustration over the past decades. Various regimes, in the distant past, paid little attention to the sector but in the recent decades, subsequent regimes have put in billions of naira to reverse the neglect and mismanagement which has characterized the sector. Nigeria's electric power sector had been dominated by a State-controlled monopoly generally regarded as not meeting expectations (Rud, 2014).

Oseni (2017) gave an overview of the challenges necessitating the reform process as follows (i) Poor sectoral capacity; (ii) Government's inability to run a world class sector; (iii) Endless capital injection without corresponding output; (iv) National power dilemma entangled in Politics; (v) Government funding always outstripped by sector's colossal financial appetite and (vii) A national culture of non-payment for public goods.

1.2 Statement of the Problem

Energy is the basic necessity for national development and in this modern world, it has become part of our daily lives. Availability of sufficient amount of energy has led to shorter working days, improved agricultural output, increased industrial production, better health conditions, more nutritious diets and better transportation facilities (Stern et al., 2017). Different forms of energy exist but electrical energy is by far the most important form. Development indicators generally correlate positively with electric power consumption (Doe and Emmanuel, 2016).

Evidence from empirical studies, lend credence to these facts. For instance, Rud (2014) examined the effect of rural electricity provision on industrial output in India and found a significant positive relationship between rural electrification and industrial output. In the same light, Fisher-Vaden et al. (2015) analysed the effects of electricity shortages on firm productivity in China and shows significant output and revenue losses due to outages. With the significant important of electrical energy to man, Nigeria is still among the Africa country with poor electricity.

Doe and Emmanuel (2016) demonstrated that poor electricity leads to decline in output, revenue and firm's profit in Ghana; Abotsi (2016) also shows that power failure reduces the production efficiency of firms in most African countries; Mensah (2016) found power failure to have a negative effect on manufacturing output in Sub-Saharan Africa (SSA). In spite of these overwhelming evidence in the economic literature and government intervention in the sector for many decades, access to quality and uninterrupted electricity supply in Nigeria has continued remained poor. According to World Bank (2015), the average outage intensity in Nigeria is 32.8 in a typical month, which is adjudged to be the highest in SSA (Alby et al., 2012; Mensah 2016).

Despite the increase in the finance of Abuja Electricity Distribution Company on the construction and maintenance of power infrastructures, the output of electricity generated or power supply over the years was not enough to match the electricity output or power supply needed for a level that will bring about sustainability increase in service delivery by Abuja Electricity Distribution Company (AEDC), hence, the need for power sector reform (Mensah 2016; Adedeji, 2017; Umar, 2020). This research is therefore intended to provide a pivot for improving techniques for improving power supply in Abuja electricity distribution company (AEDC)

1.3 Purpose of the Study

The main aim of this study is to investigate the techniques for improving power supply in Abuja electricity distribution company (AEDC) Chanchaga district Minna, Niger State. Specifically, the study seeks to;

1. Determine the level of power supply in Abuja electricity distribution in Chanchaga district Minna, Niger State.
2. Find out the factors responsible for the power outage situation in Abuja electricity distribution company in Chanchaga district Minna, Niger State.
3. develop interventional strategies and techniques for improving power supply in Abuja electricity distribution company in Chanchaga district Minna, Niger State.

1.4 Significance of the Study

It is expected that the recommendation drawn from the findings of this study if actually implemented will be of great benefit to the government, residents of Chanchaga district Minna Niger States, Industries/MSEs operators, AEDC Chanchaga district Minna as well as prospective researchers.

The findings of the study will reveal the level of power outage in the supply of electricity to consumers. This will in turn help the government in making sound policy on adequate electricity distribution and consequently result to enjoying uninterrrupted power supply; also it will help the government to see the need to be directly be involved in the promotion of adequate power supply to its citizen.

The study presents the need for check mate of the distribution power supply, in the way that there will be improvement in the supply of electricity to the residents.

Industries/MSEs operators in Minna, Niger State will benefits immensely from this study because the study presents the need for an improved power supply by the AEDC Chanchaga Minna by revealing various strategies and techniques that improve power supply which will consequently mean an improved power supply for their businesses and that will in turn translate to boost in their business enterprise and making of profits from their ventures.

The study point out the needs for more attention to be given to electricity distribution and as such will be of great benefits to electricity power providers. Also, The study also add to existing body of literature and therefore will serve as empirical evidence for students and prospective researchers that wants to carry out a similar study.

1.5 Scope of the Study

In the present study, the scope of inquiry is limited to the level of power outage situation by AEDC, factors responsible and suggest for improvement in the distribution channel. The study is further limited considering assessing the power supply in Chanchaga Minna and service delivery of AEDC Chanchaga Minna district as study targeted Location.

1.6 Research Questions

The following questions will guide the study:

1. What is the level of in power supply Abuja electricity distribution in Chanchaga district Minna, Niger State.
2. What are the factors responsible for the power outage situation in Abuja electricity distribution company in Chanchaga district Minna, Niger State.
3. What are the interventional strategies and techniques for improving power supply in Abuja electricity distribution company in Chanchaga district Minna, Niger State.

1.7 Research Hypotheses

The following null hypotheses are formulated at $p < .05$ as a guide to carry out the study;

H_{O1}: There is no significant difference among the mean responses of AEDC Chanchanga staff and consumers as regards the level of power supply in Abuja electricity distribution in Minna, Niger State.

H_{O2}: There is no significant difference among the mean responses of AEDC Chanchanga Minna Staff and consumers as regards the factors responsible for the power supply in Abuja electricity distribution in Minna, Niger State.

H_{O3}: There is no significant difference between the mean responses of AEDC Chanchanga Minna Staff and consumers as regards the interventional strategies and techniques needed for improving power outage situation in Abuja electricity distribution company in Minna, Niger State.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Conceptual Framework

2.1.1 Electricity

The Concise Oxford Dictionary defines electricity as a form of energy resulting from the existence of charged particles (like electrons and protons), either statically as an accumulation of charge or dynamically as a current (Frederick & Adarkwah, 2016). Similarly with reference to electrons Zheng et al., (2018) defines electricity as an invisible phenomenon created by the movement of electrons in a conductor. It is important to note that getting one definition of electricity has been quite challenging. This is evident in the numerous definitions of electricity that exist and the interchangeable use of the word "electricity". This can be seen in the Concise

Oxford dictionary for example, where the word "electricity" has four different definitions including being expressed as a human emotion "a state of heightened emotion, excitement, tension". To this effect, (Ogbuefi et al., 2019) notes that, the challenge in getting one acceptable definition of electrical energy is a reflection of the world which is filled with too many possibilities and unknowns. However, various authors who have made an attempt at defining electrical energy (which is the focus of this paper) stick to put across an understanding of its various properties; how it is generated, transmitted from one point to another and how it is used. A typical of this kind of definitions is made by (KPMG, 2013) which defines electricity as a type of energy fuelled by the transfer of electros from positive and negative points within a conductor. These authors go further to indicate that electricity is widely used for providing power to buildings, electrical devices and even automobiles. The concept of electricity can be traced far back to the 1740s, as a

phenomenon which was on people's minds but not in the way we perceive and think about it today. It was used in the 1740s as a way of creating magic tricks by creating sparks and shocks and scientists at the time used electricity in conducting experiments. Even though it was used by scientists, scientific thinking about electricity up to 10 years after the 1740s had not changed much. Electricity was still not useful. The concept of electricity as it is being used today was developed by Benjamin Franklin in 1759 following a discovery he made about the similarity between electricity and lightening as two phenomena that created light, made loud sounds when they exploded, were attracted to metal and had a particular smell (Akyuz & Opusunju, 2019).

Today, the movement of electricity from its sources to a final consumer involves 3 main processes – generation, transmission and distribution by Nigerian Electricity Regulation Commission (NERC, 2019). Thus, it is important to note here that, making discussions on electricity distribution in isolation of generation and transmission will be presenting an incomplete discussion. This paper thus will make references to electricity generation and electricity transmission in Nigeria where ever necessary. Nigeria's Power Holding Company is made up of three types of subsidiaries these are: generation companies (GENCO), transmission and systems operations companies (TRANSYCO), and distribution Companies (DISCO) (Dina, 2017). Electricity is generated at a power station by electromechanical generators which are primarily driven by heat engines and fuelled by chemical combustion or nuclear fission. It is also generated by other means such as kinetic energy of flowing water and wind. As noted earlier in chapter one, electricity can be generated through various means. In Nigeria for example, electricity in various power stations is generated using different means. The Kainji, Jebba and Shiroro power stations use water for the generation of Electricity, Egbin and Sapele use steam while Sapele, Afam and Delta power stations currently use gas (Oricha & Olarinoye, 2016).

According to the South African electricity company – Eskom, electricity is different from the other services that can be harvested from nature and provided to households such as water (Olaoluwa, 2017). The difference lies in the fact that electricity must be manufactured. Most importantly, it must be manufactured at low cost to keep power bills low and ensure that the lowest-possible impact is felt on the environment (Olaoluwa, 2017). The amount of electricity manufactured in each country is measured in megawatts and differs depending on the country's demand for electricity. This will be discoursed in detail in later parts of this chapter. It is however important to note here that, there has been a global increase in the demand for electricity putting increased pressure on electricity manufacturers and distributors (World Bank, 2013). In an attempt to meet increasing demand and to cope with the global scarcity of water due to climate variability, countries such as India and South Africa also use low quality coal in power stations next to coal deposits to generate electricity (Olaoluwa, 2017). Even though using coal is an economical means of generating electricity, it not ideal because, no matter how carefully it is burnt, there are gaseous and solid emissions. The gases that are given off include sulphur dioxide, carbon dioxide and oxides of nitrogen, the first two of which are regarded as having climate-change effects on the environment (Olaoluwa, 2017).

Electricity transmission is the more technical part in the process of getting electricity to the final consumer. It involves the transfer of electrical energy to electrical substations located near demand centres after generation (Adesina & Ademola, 2016). According to Ogbuefi et al. (2019), a strong electricity transmission system is important for 4 main reasons:

1. It improves the reliability of the electric power system
2. It gives electricity customers flexibility to diversify the mix of fuels that produces their electricity by giving them access to power plants,

3. It improves the cost structure of the entire industry by giving low-cost power plants access to high-cost power markets, and
4. Enables competition among power plants by giving more plants access to more markets

Electricity that is generated at power stations is being transmitted through power lines that exist all over cities, towns and rural areas which are visible as one walks along the road (Adeniran, 2019). These power lines carry the electricity. As large electricity generators spin, they produce electricity with a low voltage. (A volt is a measurement of the electric force that pushes electrons around a circuit) (Mehta & Mehta, 2015). Once the electricity has been produced, it first goes to a transformer that boosts the voltage up. The need for a boost in the voltage is because scientists have noted that in traveling long distances, it is better for electricity to be transferred at higher voltage. In addition, electricity is said to be transmitted more efficiently at higher voltages (Mehta & Mehta, 2015). The power lines go into substations near businesses, factories and homes. Here transformers change the very high voltage electricity back into lower voltage electricity.

From these substations electricity in different power levels is used to run factories, street cars and mass transit, light street lights and stop lights, and is sent to neighbourhoods. In the neighbourhoods, another small transformer mounted on poles or in a utility box converts the power to even lower levels to be used in your house (Mehta & Mehta, 2015). The voltage is eventually reduced for larger appliances, like stoves and clothes dryers, lights TVs and other smaller appliances. Rather than over-headlines, some new distribution lines are underground. The power lines are protected from the weather, which can cause the line to break (Mehta & Mehta, 2015).

2.1.2 Electricity Distribution

Electricity distribution is the final stage in the delivery of electric power and the main focus of this study. At this stage the electric power distribution carries electricity from the transmission system to individual consumers (Frederick & Adarkwah, 2016). Electricity distribution companies have been identified as a vital link between the supplier of electricity and customers that buy and use electricity. It involves a process which constructs and maintains equipment that transforms the power supply to the type that meets the customer's needs, meters the amount the customer uses, provides the appropriate billing and collects the payments. In different countries, electricity distribution is managed by the central government, private organisations or the local government (Mehta & Mehta, 2015). In some countries in Africa, up to 500 electricity distributors may exist. In South Africa, for example, where electricity distribution is managed by Eskom and local governments, the number of electricity distributors recently reduced from 500 to 300 distributors (Eskom, 2016). The effective management of this large number of distributors has been difficult, reasons why in the past 2 decades the South African Electricity Distribution Company has been talking to its central government, local government and other involved stake holders like the National Energy Regulator about rationalising the Electricity Distribution Industry (EDI) (Eskom, 2016).

With a recognition that it will be more effective to manage a fewer number of distribution companies, Eskom is proposing the formation of six regional electricity distributors (REDs) whose sole responsibility would be to manage and drive all electricity distribution throughout the country (Eskom, 2016). This would allow tariffs to be aligned, service to be improved and the equipment to be better maintained and updated. Additionally, Interruptions of service (blackouts) because of old equipment would be much reduced (Eskom, 2016). Comparatively, Nigeria has a fewer

number of distribution companies – 11. These will be discussed in detail in later sections of this chapter. As noted by (Eskom, 2016), it becomes difficult to manage and ensure effective distribution of electricity when there are many distribution companies. However, what can be noted here is that, even with a fewer number of distribution companies, Nigeria still seems to be facing challenges with electricity distribution. These challenges will be discussed more in later parts of this chapter. Thus this paper will seek to diagnose the managerial problems that are faced with the distribution of electricity in Africa and in Nigeria in particular.

In the distribution of electricity there exist a Distribution Management System (DMS) which is a collection of applications designed to monitor and control the entire distribution network efficiently and reliably (Oricha & Olarinoye, 2016). A DMS is a very important aspect in the distribution of electricity. It acts as a decision support system that makes decisions that assist with the control room and field operations. It also performs other functions such as improving the reliability and quality of services in terms of reducing outages, minimising outage time, maintaining acceptable frequency and voltage levels (Akyuz &Opusunju, 2019). Given its importance, it means that it is important for various countries to have effective DMS' to ensure effective distribution of electricity. In recent years, most DMS have been comprehensively using information technology solutions through their Outage Management System (OMS). An OMS is a combination of other systems that give feedback about customer satisfaction. These include a Customer Information Systems (CIS), Geographical Information System (GIS – which provides information about customer geographical location) and Interactive Voice Response System (IVRS) (Zheng et al. 2018). The most advanced and widely used DMS is the

Schneider Electric's Advanced Distribution Management System (ADMS) which provides the most comprehensive network management solution, including monitoring, analysis, control,

optimization, planning, and training tools that all function on a common representation of the entire electric distribution network (Zheng et al. 2018). By merging distribution management (DMS), outage management (OMS), and supervisory control and data acquisition (SCADA) systems into one secure, unified solution with more than 50 advanced functions, it can maximize the benefits possible from a growing foundation of intelligent grid devices, distributed renewable energy, advanced metering, and all things smart grid.

2.1.3 Background and overview of the Nigeria Power and Electricity Sector

The history of the Power sector in Nigeria is dated back to 1896 when electricity generation started in Nigeria (KPMG, 2013). However, it was only about 30 years later in 1929 that the first utility (distribution) company was created. Nigeria's first electric power plant was located in

Lagos and managed by the country's Public Works Department (PWD) NEPA which is otherwise known today as the Power Holding Company of Nigeria (PHCN) came into existence in 1972. It had the mandate to develop and maintain an efficient, coordinated and reliable power supply in the country. In 1973, only 8 of the present 36 States in Nigeria were directly connected to the National Grid. However, today all Nigerian states are fed from the National grid (Harnzat, 2005: 4). According to KPMG, despite the government's continuous effort to manage the state owned utility which operated as a monopoly, it became clear in the late 90s that the Nigerian

Electricity sector was failing to meet demands placed on it. This necessitated reforms in the sector. The Nigerian Power sector is said to have taken one of the boldest privatization initiatives on globe in the past decade, costing them about $3.0 billion (KPMG, 2013). In addition to this, over the past decade, the Federal government of Nigeria has been able to complete the privatization of the generation and distribution processes of electricity while retaining the ownership of the

transmission process (management under concession) (KPMG, 2013). The main organisation rover seeing the distribution of electricity in Nigeria today is the Power Holding Company of Nigeria (PHCN). It took over from the National Electric Power Authority (NEPA) which was a monopoly and was noted for its inefficiency. PHCN was seen by many as a better alternative for NEPA because it was established to solve the problems NEPA faced.

As it has been clearly stated above, the power sector involves three processes which are the generation, transmission and distribution process. Nigeria's electricity transmission process is currently being managed by an international management contractor from Canada called the Manitoba Hydro International (Agboola, 2011). This organisation is responsible for the technical and financial adequacy and providing stable transmission of power. The generation process has been privatised, with 23 grids connected generating plants that are in operation in the Nigeria Electricity Supply Industry with 6 successor Generation companies

The 11 distribution companies (DisCos) responsible for the distribution of electricity in Nigeria are presented on Table 2.1 below as well as the areas which they distribute electricity tp. These distribution companies are mandated to undertake wiring, sales, billing, collection and customer care functions within their area of geographical location (Agboola, 2017). These distribution companies are divided into five groups which are residential, commercial, industrial, special and street lighting and have particular coverage areas. The table which follows gives the location of each Disco and the various areas which they cover.

Table 2.1: Electricity Distribution Companies and their areas of Coverage

Distribution Comapany	Address	Areas Covering	City Located
Abuja Electricity Disco	Wuse Zone 4, Abuja	FCT, Niger, Kogi , and Nassarawa	Abuja
Benin Electricity Distribution Company	No 5 Akpakpava Street, Benin-City	Edo, Delta, Ondo, and part of Ekiti	Benin
Eko Electricity Distribution Company	24/25 Marina, Lagos	Lagos	Eko
Enugu Electricity Distribution Company	No 12 Station Road, Okpara Avenue, Enugu	Enugu, Abia, Imo , Anambra and Ebonyi	Enugu
Ibadan Electricity Distribution Company	Capital Building, 115 Ring Road, Ibadan	Oyo, Ogun, Osun, Kwara and part of Ekiti	Ibadan
Ikeja Electricity Distribution Company	Secretariat Road, Alausa, Ikeja	Lagos	Ikeja
Jos Electricity Distribution Company	No 9 Ahmadu Bello Way, Jos	Bauchi,	Jos
Kaduna Electricity Distribution Company	Nagwamatse Building, Ahmadu Bello Way, Kaduna	Kaduna,Sokoto, Kebbi and Zamfara	Kaduna
Kano Electricity Distribution Company	No 1 Niger Street, P.M.B. 3089, Kano	Kano, Jigawa and Katsina	Kano
Port Harcourt Electricity Distribution Company	No 42 Obiwali Road, Rumuigbo, Port Harcourt	Rivers, Cross River, Bayelsa and Akwa Ibom	Port Harcourt
Yola Electricity Distribution Company	No 2 Atiku Abubakar Road, Jimeta Yola	Yola, Adamawa, Borno, Taraba and Yobe	Yola

Source: Nigeria Electricity Regulatory Commission (2016)

As can be observed from Table 2.1, apart from the Discos in Ikeja and Enugu, the Discos cover at least 3 or more areas in the country. It can also be observed that Lagos alone is covered by 2 Discos exclusively. All of these Discos are public limited companies (Plc). Since its privatisation in 2013,

electricity distribution in Nigeria has been undergoing sectorial reforms all aimed at ensuring reliable and effective distribution of electricity in the country (Amoda, 2013). Some of these reforms include the change of Disco names and web addresses. Also, some of the reformations include the possibility of investors in Discos to enlarge and extend their operations into other Discos. According to the Managing Director of the Eko Disco, with the privatisation the electricity generation capacity in the country is expected to go up in coming years. This will enable the provision of more bulk power available for a distribution companies to provide supply electricity for more hours to its customers (Amoda, 2013).

2.1.4 Challenges of Electricity Distribution Company

The challenge of initial take-off

Despite the privatization of PHCN in 2013, Nigeria's electricity generation capacity has declined from the peak generation level of about 4,517.6 mega- watts (MW) recorded in December, 2012 to about 3,670 MW in January, 2014.The electricity generation forecast was 12,800 MW of electricity, energy generation capacity 3,670 MW hour per hour (MWH/H), while actual electricity sent out into the national grid was 3,585.32 MWH/H. (nigeriapowerreform.org).

According to the recent poll by NOIPolls Limited Electricity supply in Nigeria worsened in the fourth quarter (Q4) of 2013, at the peak of the privatisation process. Journal of Sustainable Development Studies 169 According to the report, although power supply to households worsened in Q4, nevertheless, majority of Nigerians (70 percent) were hopeful about the ongoing reform in the power sector. The report indicated that an average of 46 percent of Nigerians received between 1-4 hours of continuous power supply daily, while 17 percent said they have received absolutely "No Light" in their households. The Poll however, noted that in Q4, the Nigerian power sector saw

an achievement of a milestone as the privatisation process, initiated to reform the power sector was taken to the next level (Adelakun & Olanipekun, 2020). The Transmission Company of Nigeria is also facing initial challenge of fund as it requires about $4.4billion to increase power transfer capacity, make the network more stable and reliable, and improve efficiency of electric power transfer by reducing transmission technical losses and enable TCN to increase transmission capacity to 16843 MW by end of 2018 (Vanguard, March 1st,2014)

Funding

The power sector is a highly capital intensive industry. Many of the investors that acquired the unbundled PHCN borrowed money from banks and having acquired these loans from these banks, continuous financing of the projects will become a herculean task. Nigerian banks provided 70 per cent of the funds in loans and equity of the N404bn paid for the power assets. The acquired loans and Federal government intervention funds disbursed through Money Deposit Banks will not be sufficient to fast track the rapid turn- around expected in the sector. Further challenge is that the estimated $4.28bn required capital expenditure and rehabilitation expenditure which is hoped to be provided by indigenous banks (Punch, Dec.26, 2013). Having acquired PHCN subsidiaries, The Bureau of Public Enterprises Director General declared that the distribution companies (Discos) would be required to spend a total of $357.7m in 2013 alone. Of the $357.7m, the Abuja Disco would be expected to invest $36.6m; Benin, $24.3m; Enugu, $27.2m; Ibadan, $43.86m; Jos, $22.75m; Kaduna, $29.96m; and Kano, $30. 38m. Others are the Eko Disco, $45.2m; Ikeja, $58.74m; Port Harcourt, $25.5m; and Yola, $13m. The expected spending by Discos is to cover the following areas: metering, health, safety and environmental practices, reduction in the number of customer interruptions due to network faults, new customer connections and network expansion, improving customer services and complaints handling procedures. Some of the successful bidders

have not completed the payments as many of them still own the federal government. According to the Nigerian Electricity Regulatory Commission of the 11 electricity distribution companies in the country, only three have so far remitted to the Federal Government money due it (Punch, February, 26, 2014).

Inadequate Gas supply

The power sector reform is anchored on the use of gas to power systems in order to meet the needs of the country. The availability of gas to ensure consistency in power supply has been a great challenge. This challenge is a result of the inadequate infrastructure needed for gas gathering, processing and transportation. The negative effects of saboteurs and vandals in gas production affect the availability of gas. Gas supply to the power plants was not taken into consideration that this will affect the operation of the power .For instance approval for the construction of some plants like the Alaoji 1074 mega- watts (MW), Egbema 338MW, Geregu 848MW and Omotosho 786MW gas turbines by the Obasanjo's administration did not factor in the issue of gas supply to these plants. The resultant effect is that these plants has remained unutilized long after they were commissioned.

Consumers' fraudulent practices

There are many fraudulent practices by many electricity consumers that were ignored by the former PHCN either due to lack of information or with the active connivance of dubious staff of the organization. These fraudulent activities reduce the income generation of the former PHCN. If left unchecked it will hinder revenue of the new owners of the privatized PHCN. These offences were committed when consumers and utility staff resort to unlawful direct hooking from line; bypassing

energy meter; injecting foreign elements into the energy meter; drilling holes in electro-mechanical meter; or assigning illegal amount of energy units to consumers.

Determining the end user tariffs

The efficient pricing of electricity is central to a well-functioning power sector. Power pricing guides investment decisions and is critical for cost recovery. It also signals to users the cost of marginal consumption and should ideally encourage the optimal utilization of installed capacity. But achieving efficient power pricing is easier said than done. The power sector is characterized by substantive up-front fixed costs, and it takes many years for capacity to be fully utilized. Beyond that, costs vary across times of the day (peak/off-peak), seasons (dry/rainy), users (residential/commercial), and geographic areas (urban/rural), which should be taken into consideration when setting prices that promote efficient use (Airoboman et al., 2016). Electricity prices in Nigeria are currently below production costs. Therefore, the industry is barely able to generate enough revenue to cover its operating costs let alone meet its considerable capital expenditure needs. This is a huge challenge that new owners will have to contend with as they cannot source for fund from government the way PHCN did. Whatever approach that the new owners will adopt must take into consideration the ability of the end users to pay. Technicality behind setting efficient tariffs were complex, power providers and regulators also face a conflict between promoting economic efficiency and societal well-being. As Borenstein (2008) observed that if income challenged groups are to enjoy the benefits of power provision, policy makers must set affordable tariffs below production costs or introduce an explicit subsidy regime.

In an attempt to address this tariff issue, Nigerian Electricity Regulatory Commission (NERC) has been charged with the dual function of ensuring that the prices charged by licensees are fair to the

consumers and sufficient to allow the licensees to finance their activities and to allow for reasonable earning and profits for efficient operation. NERC has developed a new tariff approach called the Multi Year Tariff Order, MYTO. At the centre of this is an order that calculates electricity prices based on revenue requirements of the whole industry. The workability of this approach remains to be tested when full takeover and operation commences.

Reconciliation of assets and liabilities of PHCN

The unbundled PHCN was poorly managed which was one of the reasons why it could not sustain itself by generating enough revenue to remain in operation. Therefore there is the challenge of not having comprehensive information detailing the assets and liabilities of the erstwhile PHCN. In a bid to solve this issue the Federal Government set the Nigerian Electricity Management Company (NELMCO). It is serve as a government Special Purpose Vehicle based on the understanding that it would assume and manage extant assets, liabilities and other obligations that could not be easily transferred from PHCN to the Successor Companies. There will likely arise conflicting interest between the new investors and the government over the quality of assets that were privatized as the assets will require additional huge investment to upgrade the assets to standard that will ensure smooth running of the equipment. Government as equity shareholder may be unwilling to commit substantial amount to such investments

Workforce

The former employees of PHCN like every employee of privatized companies elsewhere have been averse to the privatization of the sector. The fear of the future of their employment created the initial resistance to the unbundling process. Some of their initial concerns that bothers on arrears in salaries, pensions, severance and other benefits) owed to them had been taken care of.

What could pose further challenge are issues that hinges on the criteria to be adopted in choosing those to be retained and those to be laid off. This become an issue when most of them were retained to keep the business going even when their severance allowances had been paid with the hope that they will be reabsorbed. This might create room for sabotage from disappointed staff.

2.1.5 Factors affecting Power Distribution

The factors that affect the efficiency and stability of power supply in any developing country/region can be classified as follows: government policy; economic factor; natural factor; society/community factor; effective energy management; skilled personnel; efficient technology and security factor (Oricha and Olarinoye, 2016). These factors can be broken down to the following factors believed to be responsible for the erratic power supply in Nigeria:

1. Government Policy

Government's inconsistent energy policies have been a major contributor to the Nigerian energy crisis. For instance, the government's policies for over fifty years now have been favoring monopoly in the power generation, transmission, distribution and sales. From the establishment of ECN in 1950 to the setting up of NEPA in 1972, the policy has been that of having an entity with full control of power generation and supply. If after these years, government is now bringing up policies to unbundle the power sector of the economy, then it is obvious that the earlier policies have not helped the system.

2. Inefficiency in Power Generation, Transmission, Distribution and Consumption

From the point of power generation in Nigeria, there is over fifty percent power loss. For instance, a study of Delta four power plants revealed a total average power generation of 30.5% out of the installed capacity (Oyem, 2013). This means that a total of 69.5% of power that would have come out of these four power plants and added to the national grid, is lost just at the point of generation. At the stage of transmission and distribution, a reasonable amount of power is also lost due to transmission lines and equipment that are grossly ill maintained or below capacity. According to the international Energy Agency report (2012), electric power transmission and distribution losses in Nigeria stood at 17.22% in 2010, and the maximum figure between 1971 and 2010 occurred in year 1981 where the loss stood at 49.27%. Figures 3.1 and 3.2 give a plot of electric power transmission and distribution losses in Nigeria from the year 1971 to 2010 in terms of total power loss and percentage loss of the total power generated, respectively, as extracted from IEA report (2012).

At the point of consumption, majority of power consumers in Nigeria leave their electric devices „ON" even when they are not needed, because of the default billing method adopted by the power distribution companies. This results to great power loss to the system and also to the over loading of the transmission and distribution equipment.

3. Incompetent Staff of the Energy Companies

This is a general Nigerian problem where companies especially government firms, employ workers not based on merit and competence but on favoritism and tribalism. Because of this, no government company in Nigeria that requires workers with professional and technical competence has ever

succeeded. NEPA and PHCN had staff, majority of which were employed through the back door and therefore, the only thing they seemed to know was how to climb electric poles and cut cables.

On November 5, 2013, Nigerians rejoiced as government handed over generation, transmission and distribution of electricity to private companies. At least Nigerians believed that with the private ownership of these companies, the companies would immediately hire competent staff that will work towards the growth and betterment of the system. But six months after, Nigerians from all walks of life continue to grumble that power supply has gone from bad to worse (Ukoko et al, 2014). These new companies still retain the old incompetent staff of NEPA and PHCN for reasons best known to them.

Other causes are:

4. Natural causes

Weather is the leading cause of power outages. High winds, lightning, freezing rain, ice on the lines, and snow are all culprits. Tree branches contacting power lines and wildlife can also be what causes power outages. Read what to do if you see a downed power line.

5. Equipment failures

We work hard to maintain our equipment, but things can still go wrong. Problems with cables, connectors, transformers, and switches can be what causes power outages. We'll work as quickly as safely possible to make the repairs and get the power back on.

6. Human error

Homeowners can accidentally cause a power outage while working with a ladder or antenna too close to power lines or hitting a buried line while digging. Traffic accidents can also affect the power supply if a piece of power equipment is hit and damaged.

7. Scheduled maintenance

Occasionally, we turn off power to do maintenance and repair equipment. We do this for the safety of our crews. We try to keep these interruptions as short as possible and schedule them during the least inconvenient times.

2.1.6 Improving Nigeria Power Supply

Having studied and analyzed the causes of erratic power supply in the Country, the following recommendations to solving the Nigerian erratic power supply are hereby made:

1. Adoption of Energy Conservative Policies

Government should outlaw the use of electric gadgets and devices that waste electric energy and

encourage the use of models of these gadgets that save energy. For instance, a 10W LED electric bulb can give the same illumination as a 100w incandescent bulb. This means 90% energy saving. Also a 120W modern refrigerator can render the same service as a 600W older version of the fridge. Worldwide, nations are beginning to face up to the challenge of sustainable energy by re-evaluating the way energy is generated and utilized so that social, environmental and economic aims of sustainable development are supported. The benefits of energy efficiency upon the environment are self-evident and the economic benefits of improving energy efficiency have been well documented since the first oil crisis in early 1970‟s. Many forward-thinking industrial and

commercial concerns have already adopted energy efficiency as a k ey policy towards maximizing profits. Niger republic which relies partly on Nigeria for its electric energy supply, were able to achieve some level of high energy conservation and efficiency by the adoption of energy saving policy that mandated the consumers to shift from the use of incandescent bulbs to fluorescent lamps (Ruma et al., 2011). Also, Ghana adopted a similar policy whereby the government collaborated with product and sales companies, and asked residents to return their energy inefficient refrigerators for modern energy efficient ones at a good discount. Nigeria can adopt a similar policy and also outlaw the use of incandescent bulbs. The price of LED bulbs should be subsidized, as high price of these bulbs has been a major factor responsible for low use of the bulbs in Nigeria. The Government can withdraw the subsidy after sometime, when the people have gotten used to the new technology and have realized that one LED bulb can outlast ten incandescent bulbs.

2. Immediate Discontinuation of Default/Estimated Billing System

As a matter of urgency, the default billing system adopted by NEPA and is still used by the new power distribution companies, should be outlawed as it is stupid, criminal, exploitative and destructive. A billing system that charges the same amount of money on a consumer with ten LED bulbs of 10W each (= 100W), another consumer with ten 200W bulbs (= 2000W) and still a third consumer that did not use electric power in his house for the whole month either because the power transformer in his area was faulty or because the family travelled, should be condemned and discontinued. If this is not done because of the criminal nature of the billing system, let it be done because of the fact that it encourages power wastage and leads to breakdown of power distribution and transmission equipment

3. Upgrade of Power Distribution and Transmission Equipment

The new companies that took over electric power transmission and distribution business in Nigeria should embark on immediate upgrading of the power transmission and distribution infrastructures. More emphasis should be on distribution infrastructure now and then after ensuring that the equipment on ground can comfortably distribute the power currently being generated and the amount of power the generating companies intend to generate in the near future, then emphasis will now shift to power generation.

4. Engagement of Competent and Qualified Staff by the Electric Power Companies

The new power generation, transmission and distribution companies should retain only the staff of NEPA and PHCN which they have tested and certified as qualified and competent, and dismiss all those that were engaged through the back door. They should then employ qualified and technically competent workforce to drive the new efficient and sustainable system.

2.2 Review Empirical Study

Oricha and Olarinoye (2016) investigated interrelated factors affecting efficiency and stability of power supply in Nigeria. In order to have stable and improve efficiency in power supply, there is need to analyse and understand the complex interrelated factors affecting the efficiency and stability of power supply. The factors that affect the efficacy and stability of power supply in any developing country/region could be classified as follows: government policy; economy factor; natural factor; society/community factor; effective energy management; skilled personnel; efficient technology and security factor. All these factors mentioned above have direct or indirect influence on the stability and efficiency of power supply. Various numbers of complicating factors

that can prevent restructuring of energy sector to create electricity market that can improve efficiency of power supply in Nigeria are analysed. Suggestions of steps or actions that should be taken into consideration before proposing solutions to some of the problems of power sector are also highlighted in the study.

Airoboman *et al*. (2016). Economic Implication of Power Outage in Nigeria: An Industrial Review. This work shows how poor power supply to industrial consumers has contributes to the increase of prices of consumer goods and services in Nigeria thereby affecting the standard of living and thus placing the average citizenry of the present day Nigeria in a pitiable condition. For the purpose of this research, relevant data was collated from various operators for a period of twelve months, the data was analyzed sequentially using spread sheet analysis and results were obtained. From the data it was established that the total monthly cost of generating power from the industry in question is ₦45,811,859, Further results shows that if the power generated by the appropriate power utility is used, there will be a 30% reduction in the cost of generating power thus leading to a corresponding reduction in the prices of goods by the industry. The study has therefore shown that increase in the cost of power generated often lead to a corresponding increase in the prices of goods and services.

Olaoluwa (2017) conducted a study on Power Quality Improvement Strategy, Renewable Energy, A Solution to Long Power Outage in Nigeria. Electrical power, in the short span of two centuries, has become an indispensable part of modern day life. Our work, leisure, healthcare, economy, and livelihood depend on a constant supply of electrical power. Even a temporary stoppage of power can lead to relative chaos, monetary setbacks, and possible loss of life. Power outages can be especially disastrous when it comes to life-support systems in places like hospitals and nursing homes, or in co-ordination facilities such as in airports, Automatic Teller Machine (ATM), and

traffic control. While the majority of power failures from national grids last only a few hours, some blackouts can last days or even weeks, completely shutting down production at companies and critical infrastructures such as telecommunication networks, financial services, water supplies and hospitals. Controlling that risk should not just be limited to having emergency back-up generators or being able to relocate their operations and workforce it also needs to take into account the effect that a power outage could have on their supply chains as well. Renewable energy resource is as resource that can be re- generated through natural process within a relatively short time which can be used to bridge the gap in times of long power outage. This study therefore examined the renewable energy as a solution to long power outage in Nigeria.

Dina (2017) investigate the effects of electricity power outage on the provision of Electronic newspaper services Samuel Adegboyega University, Ogwa, Edo State, Nigeria. The electrical power supply is a panacea for provision of e-library services such as the enewspaper services in university libraries. The power failure affects the efficacy and effectiveness of e-newspaper services in today's university libraries. The study examined effects of electricity outage on e-newspaper services in university libraries in Nigeria with Samuel Adegboyega University, Ogwa, Edo State as a case study. The study employed the use of questionnaire as the instrument for data collection. 40 staff members of Samuel Adegboyega University staff were sampled. The findings indicate that the country is yet to provide desired level of electricity supply to meet the needs of libraries in the provision of electronic newspaper services in university libraries. It was also revealed that no meaningful e-newspaper services can be recorded without constant supply of electricity. It was therefore recommended that adequate electrical power supply should be provided for provision of effective and efficient newspaper services in university libraries.

Adelakun and Olanipekun (2020) conducted a research on Outage Analysis and System Disturbances on 330 kV and 132 kV Transmission System in Nigeria. The Persistent power outage in the country due to faults has become alarming to the government and the body responsible for electricity generation in the country. It also creates a major problem for electricity consumers in Nigeria, there must be an improvement in the reliability of the transmission system in Nigeria. This research work is predominantly concerned with the analysis of outages on 330kV and 132kV transmission system, and system disturbances on generation and transmission system for five (5) years. The result shows that the forced outages are the most occurred outages on the 330 kV line, while on 132 kV line, emergency outages have the highest number of outages in 2014 but decreases rapidly over the years, similarly, twenty-seven (27) major system disturbances occurred in 2016 with 31% against ten (10) with 11% disturbances in 2015, while 2014 and 2018 with the same number of system disturbances of thirteen (13) with 15%, it is apparent that more disturbances occur on the transmission system, and there should be a proper protection scheme to maintain stable grid network. Consequently, Mini-grid and off-grid solutions will prominently address the issue of power supply shortage and instability in Nigeria.

Baribefe and Ahiakwo (2019) evaluate electrical power outages in Port Harcourt, Nigeria. Several studies have been carried out to evaluate the causes of electrical power outage in different cities in Nigeria. This study was conducted to evaluate electrical power outages in Port Harcourt, Nigeria. Outage and operational data were gathered from two major transmission centers in Port Harcourt. Reliability and customer indices were used for the analysis. The mean time between failures (MTBF), mean time to failure (MTTF) and availability were used to determine the feeder sunder study. Investigations were carried out to identify the causes of circuit breaker trip, transformer failure, transmission line failure and bus bar failure for the period of 5 years (2012– 2016). The

overall result showed that for the period under study, circuit breaker trip the most due to overload, short circuit and ground fault followed by transformer and transmission line failures. Results further reveal that the feeders were progressively overloaded as the population in the city increased. This resulted in a low per customer availability of power supply. It is evident that the analysis provided the guide and hence recommendation to sustain every supply to users in Port Harcourt was made.

2.3 Summary of Literature Review

The different concepts electricity and electrical distribution were reviewed. The cause and effect as well as recommendation on power outage have also been checked. Numerous studies carried out by the different authors (Olaoluwa, 2017; Dina, 2017; Adelakun and Olanipekun, 2020; Baribefe and Ahiakwo, 2019 and so forth) together with their findings make this study necessary to analyze the power outage and energy distribution in Nigeria immediately and focused. The empirical assessment also shows that limited research on the improvement power outage by Abuja Electricity Distribution in Minna. The present study was aimed at filling the vacuum by studying the improvement of power outage by Abuja Electricity Distribution in Minna.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Design

The research design used in carrying out this study was the survey research design. The survey research design was chosen as an appropriate method for the research as it seeks the view of people about a particular issue that concerns them, give room for research to study the group of people and items to source for information from the respondents. (Sambo, 2012).

3.2 Area of the Study

The study covered some selected Roadside Mechanics in Chanchanga Minna Metropolis Niger State. Minna, the capital of Niger State is situated between latitude 09°36'45"N and longitude 06°31'12"E. Minna has a population of 291,905 as of the 2006 population census count making it the biggest city in Niger State. Minna is about 135km away from the Federal Capital Territory and 300km away from Kaduna city.

3.3 Population of the Study

The targeted population consist of consumers and staff of Abuja Electricity Distribution Company in Chanchanga Minna. This consist of one hundred and sixteen (116) consumers and forty-five (45) staff of Abuja Electricity Distribution Company Minna participants with six (6) Engineers, thirty four (34) Technician/Maintenance Officers, and five (5) administration officers.

3.4 Sampling and Sampling Techniques

Since the population size is of considerable size, the whole population will be used for the study hence no sampling techniques were used.

3.5 Instrument for Data Collection

A constructed questionnaire titled "Assessment on Techniques on Improving Power supply In Abuja Electricity Distribution Company in Chanchanga District Minna, Niger State Questionnaire (AIPOSAEDQ)" was used to get the desired information from the students. The questionnaire was divided into two parts (A and B). Part A will be for the collection of information on personal data of respondents while Part B which consist of sections (A - D), Section A will address research question one which contains item, Section B will address research question two and finally Section C will address research question three

3.6 Validation of the Instrument

The designed questionnaire will be submitted to the project supervisor and 3 other lecturers from the Department of Industrial and Technology Education for vetting, correction and approval before distributing it to the respondents.

3.7 Reliability of the Instrument

The reliability of the research instrument will be used to determine using a split-half test using the odd and even-numbered items to form the two halves. The two halves will have administered to a sample of Electricity Distribution Staff under Bida District since the area is not selected for the main study. The Cronbach alpha test will be used to determine the reliability of the instrument.

3.8 Method of Data Collection

The researcher will collect the needed data through the use of a questionnaire and its administration in the selected respondents. The administration of the questionnaire will be carried out by the researcher and two other research assistants. A total of 161 copies of the questionnaire will be distributed to obtain responses from the students and retrieved on the spot by the researcher and research assistant.

3.9 Method of Data Analysis

Responses from the questionnaire will be analyzed using the descriptive statistics of frequency counts, percentage, mean and standard deviation and t-test. Descriptive statistics of frequency counts and percentages were used in analyzing demographic variables and mean and standard deviation will be used for the research questions. While t-test will be used for the hypotheses testing at 0.05 level 0f significance.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Research question one

What is the level of in power supply Abuja electricity distribution in Chanchaga district Minna, Niger State.

Table 4.1 level of power supply Abuja electricity distribution in Chanchaga district Minna, Niger State.

SN	Statement	$\bar{X}_S$	SD_S	$\bar{X}_C$	SD_C
1	There is available of at least 10hours power for a day	2.55	1.00	2.38	1.07
2	Power is always available for at 5days in a week	3.04	0.82	3.11	0.80
3	There is moderate power supply at any point any time	2.89	0.71	2.56	0.68
4	Most supply power serve it purpose and used both domestic and commercial in the area	2.79	0.80	2.57	0.80
5	The electric power supply is given during works hours of the day for the consumption and usage, most especially the businesses	2.71	0.98	2.80	0.97
6	There are prompt repairs of faulty transformer to avoid power outage	2.70	1.06	2.51	1.08
7	The case of power outage is believed by the consumers to be a norm	2.44	0.84	2.53	0.87
8	Most at times the power distribution agency purposefully turn off power supply	2.61	0.99	2.72	0.97
9	Power outage in Minna can be rate to be very high across all the environs	2.46	0.94	2.33	0.91
10	Power outage in Minna can be rate to be very high is some selected environs	2.69	0.97	2.95	0.98
	Grand Mean	2.69	0.91	2.65	0.69

$\bar{X}_S$&SD_S: Mean and Standard Deviation response of staff of AEDC
$\bar{X}_c$&SD_c: Mean and Standard Deviation response of consumer

Table 4.1 shows the staff of AEDC Chanchaga District Minna and consumers responses on the level of power outage situation in Abuja electricity distribution in Minna, Niger State. From the result, it was revealed that both staff of AEDC Chanchaga District Minna and consumer agreed that: power is always available for at 5days in a week, there is moderate power supply at any point any time, most supply power serve it purpose and used both domestic and commercial in the area, the electric power supply is given during works hours of the day for the consumption and usage, most especially the businesses, there are prompt repairs of faulty transformer to avoid power outage, most at times the power distribution agency purposefully turn off power supply, power outage in Minna can be rate to be very high is some selected environs with mean value ≥ 2.50. but AEDC Chanchaga District Minna and consumers are not of the same opinion on the availability of at least 10hours power for a day, the case of power outage is believed by the consumers to be a norm.

On the other hand, staff of AEDC Chanchaga District Minna and consumers both disagreed on the fact that power outage in Minna can be rate to be very high across all the environs with mean $\leq$ 2.50. Lastly it was observed that the grand mean value of staff of AEDC Chanchaga District Minna and consumers 2.69 and 2.65 revealed a fair power supply in Minna.

4.2 Research question two

What are the factors responsible for the power outage situation in Abuja electricity distribution company in Chanchaga district Minna, Niger State?

Table 4.2 Factors responsible for the power outage situation in Abuja electricity distribution company in Chanchaga district Minna, Niger State

SN	Statement	$\bar{X}_S$	SD_S	$\bar{X}_C$	SD_C
1	Circuit Breaker Tripping	2.55	0.85	2.65	0.90
2	Transformer Failure	2.58	0.95	2.66	1.02
3	Transmission Line Failure	2.58	1.02	2.60	1.00
4	Bus bar Failure	2.56	0.97	2.51	1.00
5	Inadequate Maintenance	2.84	0.91	2.88	0.89
6	Poor Location of transformer and Tree limb/Bird contact	2.37	0.88	2.46	0.90
7	Lack of Adequate power generation	2.60	0.93	2.56	0.93
8	Lack of payment by consumers is major contributing factors	2.73	0.90	2.76	0.89
9	Vandalism and theft of transformer component	2.65	1.02	2.59	1.04
10	By passed and insincerity on the part of consumer most especially those that use prepaid meters	2.57	1.14	2.59	1.16
11	Dishonesty and corruption on the side of staff of the distribution company by colluding with the consumers to always make table money.	2.44	1.12	2.48	1.15
	Grand Mean	2.59	0.97	2.61	0.99

$\bar{X}_S$&SD_S**:** Mean and Standard Deviation response of staff of AEDC
$\bar{X}_c$&SD_c**:** Mean and Standard Deviation response of consumer

Table 4.2 shows the staff of AEDC Chanchaga District Minna and consumers responses on the factors responsible for the power outage situation in Abuja electricity distribution in Minna, Niger State. From the result, it was revealed that both staff of AEDC Chanchaga District Minna and consumer agreed that: circuit breaker tripping, transformer failure, transmission line failure, bus bar failure, inadequate maintenance, lack of adequate power generation, lack of payment by

consumers is major contributing factors and vandalism and theft of transformer component, By passed and insincerity on the part of consumer most especially those that use prepaid meters are factors responsible for the power outage situation with mean value ≥ 2.50.

On the other hand, staff of AEDC Chanchaga District Minna and consumers both disagreed on the fact that poor location of transformer and tree limb/bird contact and dishonesty and corruption on the side of staff of the distribution company by colluding with the consumers to always make table money. with mean ≤ 2.50.

4.3 Research Question Three

What are the interventional strategies and techniques for improving power supply in Abuja electricity distribution company in Chanchaga district Minna, Niger State.

Table 4.3 Interventional strategies and techniques for improving power supply in Abuja electricity distribution company in Chanchaga district Minna, Niger State

SN	Statement	$\bar{X}_S$	SD_S	$\bar{X}_C$	SD_C
1	Adequate maintenance and regulation of power generation, transmission and distribution	2.72	0.93	2.67	1.03
2	Transformer should be located at the right site to avoid hazardous accident and power outage	2.81	0.95	2.62	0.99
3	Ensuring all the prepaid meters is install to every consumers	2.77	0.81	2.85	0.80
4	Addressing payment risk	2.68	0.76	2.71	0.76
5	Pricing and tariff structure	2.82	0.77	2.85	0.79
6	Consumers should be enlighten and encourage to always follow due process in obtaining prepaid meter and paying for power consumption	2.77	0.72	2.75	0.77

7	Resident should also be enlighten on adverse effect of theft and vandalism of transformer component to the level of power outage	2.99	0.68	2.88	0.75
8	Strict rules and regulation should be set to dealt with staff and consumer that bypass the protocols	2.88	0.82	2.89	0.81
	Grand Mean	2.71	0.80	2.72	0.84

$\bar{X}_S$&SD_S**:** Mean and Standard Deviation response of staff of AEDC
$\bar{X}_c$&SD_c**:** Mean and Standard Deviation response of consumer

Table 4.3 shows the staff of AEDC Chanchaga District Minna and consumers responses on the Interventional strategies needed for improving power outage situation in Abuja electricity distribution in Minna, Niger State. From the result, it was revealed that both staff of AEDC Chanchaga District Minna and consumer agreed that: adequate maintenance and regulation of power generation, transmission and distribution , transformer should be located at the right site to avoid hazardous accident and power outage, ensuring all the prepaid meters is install to every consumers, addressing payment risk, pricing and tariff structure, consumers should be enlighten and encourage to always follow due process in obtaining prepaid meter and paying for power consumption, resident should also be enlighten on adverse effect of theft and vandalism of transformer component to the level of power outage, strict rules and regulation should be set to dealt with staff and consumer that bypass the protocols are interventional strategies needed for improving power outage situation in Abuja electricity distribution with mean value ≥ 2.50.

4.4 Research Hypothesis One

H_{O1}: There is no significant difference among the mean responses of AEDC Chanchanga staff and consumers as regards the level of power supply in Abuja electricity distribution in Minna, Niger State.

Table 4.4: Summary of T-test between mean response of AEDC Chanchaga staff and consumers as regards the level of power supply in Abuja electricity distribution in Minna, Niger State.

Variables	N	$\bar{x}$	SD	Df	p-value	Decision
Staff AEDC Chanchaga District Minna	40	2.69	0.91	134	0.069	NS
Consumer	95	2.65	0.69			

*NS - Not Significant

Table 4.4 shows the Mean score of 2.69with standard deviation of 0.91for Staff AEDC Chanchaga District Minna and Mean score of 2.65 with Standard Deviation of 0.69 at df = 134, give the p-value of 0.069. Therefore, the null hypothesis one (H_{O1}) was not rejected because p-value of 0.069 is greater than 0.05 alpha level. This indicates that, there was no significant difference between the mean responses of AEDC Chanchaga District Minna Staff and consumers as regards the level of power outage situation in Abuja electricity distribution in Minna, Niger State.

4.5 Research hypotheses two

H_{O2}: There is no significant difference among the mean responses of AEDC Chanchaga Minna Staff and consumers as regards the factors responsible for the power supply in Abuja electricity distribution in Minna, Niger State.

Table 4.5: Summary of T-test between mean AEDC Chanchaga Minna Staff and consumers as regards the factors responsible for the power supply in Abuja electricity distribution in Minna, Niger State.

Variables	N	$\bar{x}$	SD	Df	p-value	Decision
Staff AEDC Chanchaga District Minna	40	2.59	0.97	134	0.05	NS
Consumer	95	2.61	0.99			

*NS: Not Significant

Table 4.5 shows the Mean score of 2.59with standard deviation of 0.97 for AEDC Chanchaga District Minna Staff and mean score of 2.61 with Standard Deviation of 0.99 for the consumers at df = 134, give the p-value of 0.05. Therefore, the null hypothesis two (H_{O2}) was not rejected because p-value of 0.05 is equals to 0.05 alpha level. This indicates that, there was no significant difference in the mean response of AEDC Chanchaga District Minna Staff and teachers and consumers as regards the factors responsible for the power outage situation in Abuja electricity distribution in Minna, Niger State.

4.6 Research hypotheses three

H_{O3}: There is no significant difference between the mean responses of AEDC Chanchaga Minna Staff and consumers as regards the interventional strategies and techniques needed for improving power outage situation in Abuja electricity distribution company in Minna, Niger State.

Table 4.6: Summary of T-test between mean responses of AEDC Chanchaga Minna Staff and consumers as regards the interventional strategies and techniques needed for improving power outage situation in Abuja electricity distribution company in Minna, Niger State

Variables	**N**	$\bar{x}$	**SD**	**Df**	**p-value**	**Decision**
Staff AEDC Chanchaga District Minna	40	2.71	0.80	134	0.083	NS
Consumer	95	2.72	0.84			

*NS: Not Significant

Table 4.6 shows the Mean score of 2.71 with standard deviation of 0.80 for AEDC Chanchaga District Minna Staff and mean score of 2.72 with Standard Deviation of 0.84 for the consumers at df = 134, give the p-value of 0.05. Therefore, the null hypothesis two (H_{O2}) was not rejected because p-value of 0.05 is greater than 0.05 alpha level. This indicates that, there was no significant difference in the mean response of AEDC Chanchaga District Minna Staff and teachers and consumers as regards the interventional strategies needed for improving power outage situation in Abuja electricity distribution in Minna, Niger State.

4.7 Summary of Finding

The following are summary of finding of the study.

1. From the findings on research question one, it was revealed that there is moderate level of power supply in Minna metropolis.
2. From the findings research question two it was revealed that circuit breaker tripping, transformer failure, transmission line failure, bus bar failure, inadequate maintenance, lack of adequate power generation, lack of payment by consumers is major contributing factors and

vandalism and theft of transformer component among others are factors responsible for power outage situation in Abuja electricity distribution in Minna, Niger State.

3. From the findings research question three, it was revealed that adequate maintenance and regulation of power generation, transmission and distribution, transformer should be located at the right site to avoid hazardous accident and power outage, ensuring all the prepaid meters is install to every consumers, addressing payment risk, pricing and tariff structure among others are interventional strategies needed for improving power outage situation in Abuja electricity distribution in Minna, Niger State.
4. From the findings on research hypothesis one, it was revealed that there was no significant difference between the mean responses of AEDC Chanchaga District Minna Staff and consumers as regards the level of power outage situation in Abuja electricity distribution in Minna, Niger State.
5. From the findings research hypothesis two, it was revealed that there is no significant difference in the mean response of AEDC Chanchaga District Minna Staff and consumers as regards the factors responsible for the power outage situation in Abuja electricity distribution in Minna, Niger State.
6. From the findings on research hypothesis three, it was revealed that there is no significant difference in the mean response of AEDC Chanchaga District Minna Staff and consumers as regards to the interventional strategies needed for improving power outage situation in Abuja electricity distribution in Minna, Niger State.

4.8 Discussion of Results

This study focusses on the investigation in to improving power outage situation in Abuja electricity distribution in Minna Niger State Nigeria. The finding of the study revealed that there is average

level of efficient power distribution in Minna metropolis. This agrees with the study of Olaoluwa (2017) that researched on power quality improvement strategy, renewable energy, a solution to long power outage in Nigeria. It was asserted major areas in the country are greatly experiencing power outage.

The finding of the study also disclosed that that circuit breaker tripping, transformer failure, transmission line failure, bus bar failure, inadequate maintenance, lack of adequate power generation, lack of payment by consumers is major contributing factors and vandalism and theft of transformer component among others are factors responsible for power outage situation in Abuja electricity distribution in Minna, Niger State. This finding does fully support the findings of Dina (2017) that investigated the effects of electricity power outage on the provision of Electronic newspaper services Samuel Adegboyega University, Ogwa, Edo State, Nigeria. Also agreed to that of Adelakun and Olanipekun (2020) conducted a research on Outage Analysis and System Disturbances on 330 kV and 132 kV Transmission System in Nigeria.

The study findings also disclosed adequate maintenance and regulation of power generation, transmission and distribution, transformer should be located at the right site to avoid hazardous accident and power outage among other to be interventional strategies needed for improving power outage situation in Abuja electricity distribution in Minna, Niger State. This supported the findings of Baribefe and Ahiakwo (2019) and Adelakun and Olanipekun (2020).

Finally, the findings of the study revealed that both staff of AEDC and consumer shared the same opinion as regards to the level of power outage, factor responsible for the power outage and interventional strategies required to improve power distribution in the study area.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Summary of the Study

This study is geared toward investigating the techniques for improving power supply in Abuja Electricity Distribution Company (AEDC) Chanchaga District Minna, Niger State. Three (3) research questions set to guide the study and three (3) hypothesis were tested at 0.05 level of significance. The research design used in carrying out this study was the survey research design. The study covered some selected Roadside Mechanics in Chanchanga Minna Metropolis Niger State. The targeted population consist of consumers and staff of Abuja Electricity Distribution Company in Chanchanga Minna. This consist of one hundred and sixteen (116) consumers and forty-five (45) staff of Abuja Electricity Distribution Company Minna participants with six (6) Engineers, thirty four (34) Technician/Maintenance Officers, and five (5) administration officers. A constructed questionnaire titled "Assessment on Techniques on Improving Power supply In Abuja Electricity Distribution Company in Chanchanga District Minna, Niger State Questionnaire (AIPOSAEDQ)" was used to get the desired information from the students. Responses from the questionnaire was analyzed using the descriptive statistics and t-test. Descriptive statistics of mean and standard deviation was used for the research questions. While t-test was used for the hypotheses testing at 0.05 level of significance.

The findings of the study revealed that there is moderate level of power supply in Minna metropolis and that circuit breaker tripping, transformer failure, transmission line failure, bus bar failure, inadequate maintenance are factors affecting power supply. Then the finding revealed that

adequate maintenance and regulation of power generation, transmission and distribution among others are the intervention needed.

5.2 Implication of the Study

The implications of the study are:

The revealed the level of power outage in the supply of electricity to consumers, and also enjoin help the government to see the need to be directly be involved in the promotion of adequate power supply to its citizen.

The study presents the need for check mate of the distribution power supply, in the way that there will be improvement in the supply of electricity to the residents.

Industries/MSEs operators in Minna, Niger State will experience improved power supply by the AEDC Chanchaga Minna by revealing various strategies and techniques that improve power supply which will consequently mean an improved power supply for their businesses and that will in turn translate to boost in their business enterprise and making of profits from their ventures.

The study point out the needs for more attention to be given to electricity distribution and as such will be of great benefits to electricity power providers. Also, The study also add to existing body of literature and therefore will serve as empirical evidence for students and prospective researchers that wants to carry out a similar study.

5.3 Contribution to Knowledge

The study established the fact that power supply is not adequate in Chanchaga area of Niger State, which is major attributed to the lack of adequate power generation, lack of payment by consumers is major contributing factors, vandalism and theft of transformer component by passed and

insincerity on the part of consumer most especially those that use prepaid meters, dishonesty and corruption on the side of staff of the distribution company by colluding with the consumers to always make table money. The interventional strategies and techniques for improving power supply in Abuja electricity distribution company in Chanchaga, adequate maintenance and regulation of power generation, transmission and distribution, transformer should be located at the right site to avoid hazardous accident and power outage, ensuring all the prepaid meters is install to every consumers and addressing payment risk.

5.4 Conclusion

Based on finding of the study on the investigation into improving power outage in Minna metropolis in Niger State, which further explores the level of power outage, factor responsible for power outage and strategies required in improving power outage in Minna Niger State. It could be concluded that resident of Minna metropolis still experience power outage to a moderate extent the study area.

It could also be concluded that there is circuit breaker tripping, transformer failure, transmission line failure, bus bar failure, inadequate maintenance, lack of adequate power generation, lack of payment by consumers is major contributing factors and vandalism and theft of transformer component among others are factors responsible for power outage situation in Abuja electricity distribution in Minna, Niger State.

Similarly, it could be asserted adequate maintenance and regulation of power generation, transmission and distribution, transformer should be located at the right site to avoid hazardous accident and power outage, ensuring all the prepaid meters is install to every consumers, addressing payment risk, pricing and tariff structure among others are interventional strategies

needed for improving power outage situation in Abuja electricity distribution in Minna, Niger State.

5.5 Recommendations

Based on the conclusion of the study following recommendation were made:

i. Replacement of aged equipment with new ones (tested and of high quality).

ii. Proper and adequate maintenance of electrical power equipment.

iii. Stringent and urgent action should be taken by anticorruption agencies to nip the problem of corruption and looting of funds meant for power sector reform in the bud.

iv. Other means of power generation should be explored e.g. solar and nuclear power plants.

v. Staff of energy companies should be trained and re-trained

vi. Prompt payment of salary and entitlement of staff of energy companies.

vii. Government should come up with policies and support systems for effective monitoring and regulation of energy companies.

viii. Government should follow-up on energy policies formulated.

ix. Provision of adequate transformers to localities where such are needed to avoid overloading

5.6 Suggestion for Further Studies

The following are suggested for further studies

1. Assessment Causes and Possible Solutions of Power Outage in North Central, Nigeria

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APPENDIX

Department of Industrial and Technology Education

Federal University Technology, Minna,

Niger State.

Dear Respondent,

I am an undergraduate student of Industrial and Technology Education in the above named University. I am presently conducting research on improving power outage situation in Abuja electricity distribution.. The Questionnaire is designed as part of the study to collect relevant information for a successful completion of this research.

Please kindly provide response to these questions; assuring you that it will purely be used for academic purposes alone.

Thank you for your anticipated cooperation.

Yours sincerely,

UGORJI, Iheanacho Emmanuel

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

M.B 65, MINNA NIGER STATE

NIGERIA

SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION

DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION

IMPROVING POWER OUTAGE SITUATION IN ABUJA ELECTRICITY DISTRIBUTION

INSTRUCTION:

Below are respondents' personal information. Please tick (√) the appropriate information in the spaces provided.

SECTION A

RESPONDENT'S PERSONAL DATA

1. Sex

Male ( ) Female ()

2. Age

23 – 32 ( ) 33 - 42 ( ) 43 and above ( )

3. Education Qualification

OND ( ) BTECH/BSC/ HND ( ) PhD ( ) Others ( )

SECTION B

INSTRUCTION:

Below are some questions to improving power outage situation in Abuja electricity distribution..

Please tick (√) the appropriate column to indicate the extent to which these skills are required.

SA = Strongly Agree SD = Strongly Disagree

A = Agree D = Disagree

Question One: Level of power outage situation in Abuja electricity distribution in Minna, Niger State?

SN	Level of power outage situation	SA	A	SD	D
1	There is available of at least 10hours power for a day				
2	Power is always available for at 5days in a week				
3	There is moderate power supply at any point any time				
4	Most supply power serve it purpose and used both domestic and commercial in the area				
5	The electric power supply is given during works hours of the day for the consumption and usage, most especially the businesses				
6	There are prompt repairs of faulty transformer to avoid power outage				
7	The case of power outage is believed by the consumers to be a norm				

8	Most at times the power distribution agency purposefully turn off power supply				
9	Power outage in Minna can be rate to be very high across all the environs				
10	Power outage in Minna can be rate to be very high is some selected environs				

Question Two: Factors responsible for the power outage situation in Abuja electricity distribution in Minna, Niger State

SN	**Factors affecting** power outage situation	SA	A	SD	D
	Technical Factors				
1	Circuit Breaker Tripping				
2	Transformer Failure				
3	Transmission Line Failure				
4	Bus bar Failure				
5	Inadequate Maintenance				
6	Poor Location of transformer and Tree limb/Bird contact				
7	Lack of Adequate power generation				
	Socio economic				
8	Lack of payment by consumers is major contributing factors				
9	Vandalism and theft of transformer component				
10	By passed and insincerity on the part of consumer most especially those that use prepaid meters				
11	Dishonesty and corruption on the side of staff of the distribution company by colluding with the consumers to always make table money.				

Question Three: Interventional strategies needed for improving power outage situation in Abuja electricity distribution in Minna, Niger State.

SN	**Interventional strategies needed**	SA	A	SD	D
1	Adequate maintenance and regulation of power generation, transmission and distribution				
2	Transformer should be located at the right site to avoid hazardous accident and power outage				
3	Ensuring all the prepaid meters is install to every consumers				
4	Addressing payment risk				
5	Pricing and tariff structure				
6	Consumers should be enlighten and encourage to always follow due process in obtaining prepaid meter and paying for power consumption				
7	Resident should also be enlighten on adverse effect of theft and vandalism of transformer component to the level of power outage				
8	Strict rules and regulation should be set to dealt with staff and consumer that bypass the protocols				