



Protection of Power Supply Equipment: A Panacea for Effective Power Delivery to Consumers in Benue State University, Makurdi

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ABSTRACT

The study was carried out to investigate the protection of power supply equipment, a panacea for effective power delivery to consumers with special reference to the protection of power facilities in Benue State University Makurdi. Three research question and one hypothesis were raised for the study. The study adopted a descriptive survey research design with total population of 20 respondents. A purposive sampling technique was used for the study. A self-developed questionnaire was employed to collect data for the study. The instrument was faced validated by three professionals. The reliability of the instrument was found to be 0.72. Data was collected through direct contact. The data collected was analyzed using descriptive statistics of mean and standard deviation; ANOVA was also used to test the hypothesis at 0.05 level. The findings revealed that, protection of power supply equipment has a great impact on power supply. The study identified some major causes of power failure to include; the use of substandard of materials, overloading, and climate change among others. Provision of standard protective equipment and strengthening of security surveillance among others were also identified as ways of mitigating power failure on consumer premises. The study recommended equipment/system policy strategic techniques in protection of power facilities. These included stiffer penalty verdicts with reference to abrogation of option or fines and criminalizing the possession of copper materials. On equipment and system strategy policy, the study recommended that high capacity distribution transformers covering larger areas should be replaced with numerous smaller pole mounted power transformers with a view to making vandals' access to it difficult and also that attacks on these transformers would become localized since resulting power outage would be limited to a smaller area.

Key words: Protection, Power Supply, Equipment

INTRODUCTION

Effective protection of power equipment is a panacea to nation's security, economic vitality, public health and safety. According to Saladin (2018), the central goal of effective protection of critical equipment is to secure, prevent, neutralize or mitigate the effects of accidental or deliberate efforts by terrorists plan to destroy, incapacitate or exploit the facilities. When these facilities are safe and effective then development is assured. Saladin (2018) Opined that sustainable development is attainable with solid infrastructural base and availability of critical infrastructure for public usage is susceptible to natural and man-made attacks. Badiora and Obadiora (2011) alleged that deficit in supply of infrastructure is actually worsened by man-made activities and there is need to plan for protection. Protection of equipment may include building resiliency around the facility, installing security systems and initiating counter measures (Ola and Adewale, 2010). In Nigeria, the establishment of Nigeria Security and Civil Defense Corps (NSCDC) is therefore one of the measures to protect critical national assets and infrastructure. To show commitment to protection, the NSCDC was supported by NSCDC Act 2003 and amended NSCDC Act in 2007 to confirm the sincerity and commitment of the Federal Government to protect critical National assets and infrastructure in Nigeria otherwise referred to as risk management approach (Saladin (2018). Risk management approach explains that the best protection result is gotten when



surveillance and access management to the facility is adequately implemented. The concept in the word of Paulsen and Robinson (2004), involve hardening of protecting equipment targets, deterrence, punishment of accused persons, better illumination and lighting up of targets of vandalism.

The fact that energy sector has domineering influence to upshot the deliverables from all other protecting equipment accounts for its vulnerability; and it is important to note that production and supply of electrical energy relies on complex system which includes but not limited to gas pipelines, flow stations and refineries where oil and gas is the source of fuel (Saladin, 2018). When it comes to transmission of the generated energy, attention is shifted to electrical energy pylons, tower members, injection stations and substations. Electrical power facility in Nigeria is divided into Power Generating, Transmission and Distribution sections. Although there are many Steam-Power Generating Stations, Gas-Power Generating Stations and Hydro Power Stations, there exist one transmission company known as Transmission Company of Nigeria (TCN) and eleven Power Distribution Companies in the country. All these companies are privately owned except the Transmission Company of Nigeria (Saladin, 2018). Power supply has become very significant owing to the seeming indispensable role it plays in every facet of our daily lives. Absence of electricity for long a period of time causes discomfort and hampers productivity. It is also a known fact that electricity consumption has become a parameter by which the standard of living as well as the level of industrialization of many nations is measured. Electricity is generated and transmitted over a long distance. It is then distributed to the various consumers and all these processes require optimal protection of all the equipment for effective power delivery. The absence of this protection has impacted negatively on both consumers and the supply equipment. The impact of power failure can be measured on the household, firms and the economy in general. Power supply failure on the Nigerian economic growth cannot be overemphasized, starting from its effect on the household, industry and the economy at large. The epileptic power supply has crippled the Nigerian industrial growth, raised production cost, and the inflation rate of the country is on the move because of the power supply failure.

The effects of power outage on businesses can be catastrophic. Enjoyment of basic social amenities such as quality health care, adequate water supply, telecommunication service, becomes limited or even impossible due to long term electrical power outage. Huge revenue loss, business disruptions, laying-off of workers by affected industries, loss of very important records at data centers, wastage of perishable foods, destruction of home appliances, are some of the effects of electrical power crisis (Fabiya, Abdulmalik and Tiamiu, 2015). Benue State University as an institution of learning also suffers this disturbing impact of power failure. Both teaching and learning becomes defective. Accesses to E-learning materials are denied. Practical classes cannot hold and processing of students examinations and records is grossly hampered. The impact varies from the experience of darkness to a lot of damages being caused to household requirements. Power supply in Benue State University and Nigeria at large is seen by many consumers as unreliable and seems to be made available in what may be described from the consumer's



point of view as epileptic power supply. Ale and Odesola (2013) alleged that despite the allocation and expenditure of huge amounts of funds for the acquisition of new equipment and the repair of existing ones, it has been observed that while the installed capacity increases, any increase in available capacity appears to be transient. In Benue State University for instance, the processing of water supply, treatment of patients in the school clinic, processing of examinations and administrative records among others cannot be overemphasized. One wonders if lecturers and their co-workers are not comfortable in their offices, how then will they attend to student's needs. This erratic power supply and prolonged power outages experienced in Benue State University campus has grossly encouraged a significant percentage of offices and other non-office electricity consumers to seek alternative sources of power supply as earlier noted by a number of researchers (Iwayemi, 2008; Odularu, and Okonkwo, 2009).

In the event of power outages, private generating plants aid continuations of important electrical appliances where halting will severely affect activities (Azodo and Adejuyigbe, 2013). A large number of offices, classrooms, laboratories and student hostels in Benue State University campus, though the figure are uncertain; still rely on generators for their electricity needs despite the present of a 33KVA substation located on campus. Power interruption challenges to electricity consumers are associated with some latent variables such as inconveniences, interference and disruption of office and learning activities including examination. Odularu and Okonkwo (2009) reiterated that electricity is necessary for the realization of uninterrupted comfort. The appalling part of owning and operating private generators includes its relative high operation cost, considerable power insufficiency and the accompanied health issue due to the massive production of Carbon monoxide and other related gases.

Statement of the Problem

Electric power supply which is the most vital of the critical infrastructure and key resources is made available with the aid of a national grid, interconnecting numerous generating stations to the loads. This grid must supply basic national needs of residential, lighting, heating, refrigeration, air conditioning, and transportation as well as critical supply to governmental, industrial, financial, commercial, medical and other communities. Many power problems originate in the commercial power grid, with its thousands of miles of transmission lines. Many researchers (Srikanth, Narasimha, Babu and Ramesh, 2014) alleged that power failure is subject to weather conditions such as lightning, storms and flooding along with equipment failure, traffic accidents and major switching operations. Other researchers feel that power system problems could arise through any number of situations, such as local construction, heavy start-up loads and societal behaviors. In either of the cases; protection of the system is required for continuity of power supply after the fault is cleared. Protection can also prevent damage to the system. Electricity is so important but its generation, transmission and distribution in Benue State University (BSU) just like many other university campuses and Nigeria at large cannot be guaranteed due to equipment failure arising from poor or inefficient protection system as distribution is erratically being witnessed. All these put together give rise to irregular



power supply, jeopardizing ease of carrying out teaching and learning process in the university as well as its effects of hardship and inconveniences to the entire university community. It is therefore important to determine the causes and effect of power failure on university community as well as proper solutions to such failure.

Purpose of the Study

The purpose of this study is to analyze the protection of power supply equipment as a panacea for effective power delivery to consumers in Benue State University Makurdi. Specifically the study seeks to:

1. Determine the impact of protective equipment on power supply.
2. Determine the major causes of power failure.
3. Identify measures to mitigate power failure.

Research Questions

1. What is the impact of protective equipment on power supply?
2. What are the major causes of power failure on Benue State University campus?
3. What are the ways of mitigating power failure?

Research Hypothesis

H₀. There is no significant difference among BSU maintenance staff, lecturers and technical college teachers in their mean responses on protection of power supply equipment.

METHODOLOGY

The study employed a descriptive survey research design. Three research questions and one null hypothesis guided the study. A purposive sampling technique was used to select 10 members of staff from Benue State University Maintenance unit, 5 lecturers from the Department of Vocational and Technical Education and 5 teachers from Benue State University Science and Technical College that are knowledgeable in the area of power system as both deal with electrical energy and train students in the field. A self-structured questionnaire on a four point scale was used for data collection. The instrument was face validated by three experts from the Department of Vocational and Technical Education. The reliability of the instrument was ascertained using coefficient alpha and it yielded a reliability coefficient of 0.72. Data was collected through direct contact with respondents. The data was analyzed using mean and standard deviation, while analysis of variance (ANOVA) was used to test the null hypothesis at 0.5 level of significance. The cut off mark of 2.50 was used for taking decision. Any item that attains a mean response score of 2.50 and above was considered agree while items with mean rating score of 2.49 and below were considered disagree.



RESULTS

Research Question 1: What is the impact of protective equipment on power supply?

Table 1: Mean and standard deviation of maintenance staff, lecturers and technical college staff on the impact of protective equipment on power supply

S/N	Item	\bar{X}	SD	Remark
1	Circuit breaker prevents electrical surge, and hence power outage	2.80	1.35	Agree
2	Electrical fuses do not prevent damage of other electrical equipment	2.55	1.08	Agree
3	ELCB prevents earth leakage and other damages	3.05	0.50	Agree
4	Power surge protectors are used for all equipment	2.60	1.76	Agree
5	Fuses are widely used to protect distribution transformers in public networks	2.74	1.17	Agree
	Grand mean \bar{X}	2.74	1.17	Agree

Result of data presented in table 1 shows that respondents agreed that protective equipment has a great impact on power supply. The Grand mean \bar{X} 2.74 clearly shows that. Respondents agreed that all the items presented as protective devices to power supply have impact on power supply system.

Research Question 2: What are the major causes of power failure on Benue State University campus?

Table 2: Mean and standard deviation on the major causes of power failure

S/N	Item	\bar{X}	SD	Remark
1.	Use of substandard electrical equipment for repairs	3.05	1.25	Agree
2.	Broken infrastructure due to Climatic conditions can cause power failure in an environment	2.60	1.30	Agree
3	Wind is a major course of power failure in public power supply system	2.45	0.65	Agree
4	Overhead Cable sag can lead to power failure	2.43	1.15	Disagree
5	Lack of good maintenance culture	2.56	1.22	Agree
6	Overloading of transformers and electrical equipment	2.55	1.80	Agree
	Grand Mean \bar{X}	2.60	1.22	Agree

Result of data presented in table 2 shows that respondents are of the opinion that power failure has a great number of causes. The Grand mean \bar{X} 2.60 clearly shows thus. Respondents agreed that use of substandard electrical equipment for repairs, broken infrastructure due to Climatic conditions, lack of good maintenance culture, overloading of transformers and electrical equipment among others are some of the major causes of power failure on campuses.

Research Question 3: What are the ways of mitigating power failure?

Table 3: Mean and standard deviation on the Ways of mitigating power failure

S/N	Item	\bar{X}	SD	Remark
1	Do you think the presence of armed personnel reduces attack on power equipment?	3.02	0.63	Agree
2	Do you agree that the Power Company should be responsive to security officers' welfare packages	2.65	1.23	Agree
3	Power company should provide security officers with	2.25	1.17	Disagree



	security gadgets to perform their statutory duty.			
4	Do security personnel respond fast to attacks on power equipment?	2.55	1.30	Agree
5	Is the government adequately funding security personnel to protect power equipment as expected?	2.80	1.84	Agree
	Grand Mean \bar{X}	2.65	1.23	Agree

Result of data presented in table 3 shows that respondents are of the perception that, there are ways of mitigating power failure on power supply. The Grand mean \bar{X} 2.65 clearly shows thus. Respondents agreed that the presence of armed personnel reduces attack on power equipment, power companies should be responsive to the welfare of security officers, security personnel respond fast to attacks on power equipment and that government is adequately funding security personnel to protect power equipment.

Hypothesis

There is no significant difference among BSU maintenance staff, lecturers and technical college teachers in their mean responses on protection of power supply equipment.

Table 4: One way ANOVA of BSU maintenance staff, lecturers and teachers on protection of power supply equipment.

Variables	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	17.20	2	8.60	4.47	.10
Within Groups	188.24	18	1.92		
Total	205.44	20			

NS = Not significant, $p > 0.05$, $df = 18$

Result of data presented in table 4 show that there is no significant difference in the responses of BSU maintenance staff, lecturers and technical college teachers in their mean responses on protection of power supply equipment. $F(2, 18) = 4.47, p = 0.10$. This therefore, shows that the null hypothesis (H_0) is retained.

DISCUSSION OF FINDINGS

The finding regarding the impact of protective equipment on power supply revealed that circuit breakers prevents electrical surge, and hence power outage. Earth leakage circuit breakers prevents earth leakage and other damages, power surge protectors are used for all equipment, and fuses are widely used to protect distribution transformers in public networks and all these have impact on power supply system. The finding on impact of protective equipment on power supply system is consistent with Badiora and Obadiora (2011) who stated that failure of protective equipment to act adequately will render a power supply system defective. The finding on causes of power failure revealed that the use of substandard electrical equipment for repairs, broken infrastructure due to climatic conditions, and lack of good maintenance culture as well as overloading of transformers and electrical equipment among others are some of the major causes of power failure on Benue State University Campus. This findings agreed with Fabiyi, Abdulmalik and



Tiamiu (2015) who earlier identified the major causes of power supply failure on consumers' premises to include but not limited to: lack of maintenance culture, overloading, climate condition among others. The finding on measures to mitigate power failure revealed that there are many ways of mitigating power failure on a power supply system. The finding shows that the presence of armed personnel reduces attack on power equipment and security officers' primary duty is to protect power equipment as well as personnel working on the system. This agrees with Saladin's (2018) submission that the central goal of power protective system is to mitigate the effects of accidental or deliberate efforts by terrorists to destroy, incapacitate or exploit the facilities. When these facilities are safe and effective then development is assured. The null hypothesis established that there is no significant difference in the responses of BSU maintenance staff, lecturers and technical college teachers in their mean responses on protection of power supply equipment with $F(2, 18) = 4.47, p = 0.10$. This therefore, shows that the null hypothesis (H_0) is retained.

CONCLUSION AND RECOMMENDATIONS

This study investigated the protection of power supply equipment, a panacea for effective power delivery to consumers with special reference to the protection of power facilities in Benue State University Makurdi. Based on the findings, it was concluded that the absence or nonfunctional nature of protective equipment such as circuit breakers, surge protectors and fuses will impact negatively on power supply system. The study also revealed that, the use of substandard electrical materials, climate change, overloading among others are some of the major causes of power failure on consumer premises. Finally; the study found that effective security surveillance within and around the area, provision of standard protective equipment and materials will minimize power outage on consumers' premises. The study recommended equipment/system policy strategic techniques in protection of power facilities such as the establishment of community anti-crime surveillance groups and provision of free toll hotline for emergency purposes. Provision of functional electronic surveillance monitoring gadgets and transformer risk management insurance scheme is another policy strategy worthy of consideration. On equipment and system strategy policy, the study recommended that high capacity distribution transformers covering larger areas should be replaced with numerous smaller pole mounted power transformers with a view to making vandals' access to it difficult and also that attacks on these transformers would become localized since resulting power outage would be limited to a smaller area.

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