Strategies for Effective Protection of Electrical Installations in Tertiary Institutions in Rivers State

Sunny Nwakanma
Department of Technical Education,
Ignatius Ajuru University of Education,
Port Harcourt, Rivers State
sunny.nwakanma@iaue.edu.ng

Bamgboye Olusanjo Pius
Department of Facility Maintenance,
Alpha Mead Facilities,
Nigeria LNG, Bonny Island,
Rivers State

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Abstract

The study was necessitated by the need to provide strategies for effective protection of electrical installations in tertiary institutions in Rivers State. Three research questions and hypotheses guided the study. The study adopted descriptive survey research design. The entire population of 109 security guards in tertiary institution in Rivers State was studied without sampling. A structured questionnaire validated by experts was used for data collection. Cronbach Alpha reliability method was used to establish the internal consistency of the items which yielded an overall coefficient of 0.79. Data collected were analyzed using mean and standard deviation to answer the research questions while ANOVA was used to test the hypotheses at .05 level of significance. Findings revealed that security guards agreed that solar powered security lights, camera and alarm system are effective strategies for the protection of electrical installations in tertiary institutions in Rivers State and year of experience did not significantly influence there opinion. It concluded that the adoption of these strategies will provide effective protection of electrical installations. The study recommended among others that, Management of tertiary institutions should be encourage to install solar powered security lights, cameras and alarm system in all critical electrical installations in their institutions.

Introduction

One of the core mandates of the management of tertiary institutions is the protection of critical infrastructures and facilities within the environment of the institutions that have direct and remote bearing on teaching and learning. The infrastructures and facilities include classrooms, laboratories, staff offices, hostels, libraries, workshops, electrical installations among others.

An electrical installation is a group of items of electrical equipment that are permanently electrically connected together and can be supplied with electricity from the works of an electricity entity or from a generating source. Ephraim (2017) defined electrical installation as any machinery, in or on any premises, used for the transmission of electricity from a point of control to a point of consumption anywhere on the premises, including any article forming part of such an electrical installation irrespective of whether or not it is part of the electrical circuit. Goodman (2018) stated that electrical installation means a fixed installation or other similar functional unit consisting of electrical equipment and any other equipment, materials and structures, including electricity generationinstallations that can be used for generating electricity and that operate in parallel with the distribution network Also, Adolf (2018) noted that electrical installation means any cable, wire, fitting, accessory, apparatus or other device used for or for purposes incidental to the conveyance, control or use of electricity. While James (2019) stated that electrical installation means: all Fittings that form part of a system for conveying electricity at any point from the Consumer's Point of Connection to any point from which electricity conveyed through that system may be consumed; and includes any Fittings that are used, or designed or intended for use, by any person, in or in connection with the generation of electricity for that person's use and not for supply to any other person; but does not include any appliance that uses, or is designed or intended to use, electricity, whether or not it also uses, or is designed or intended to use, any other form of energy.

Electrical installation is an assembly of associated electrical equipment having co-ordinated characteristics to fulfil specific purposes.' ln the context of this study, electrical installation is any item for such purposes as generation, conversion, transmission, distribution or utilisation of electrical energy, such as machines, transformers, apparatus, measuring instruments, protective devices, wiring systems, accessories, appliances and luminaires. Some Examples of an electrical installation: includes switchboard, wiring, lighting, socket outlets among others.

The importance of functional electrical installation which provides power supply to schools cannot be over emphasized. Electricity plays a significant role in improving administrative tasks, and teaching and learning outcomes at schools. Benjamin (2014) reported that at least five positive benefits related to the electrification of schools include: (1) lighting and extended studying hours, (2) facilitation of ICT in the classroom, (3) enhanced staff retention and teacher training, (4) better school performance based on attendance, completion rates, and test scores, and (5) co-benefits such as improved sanitation and health, gender empowerment, and community resilience.

Electricity installations at schools facilitates the use of a bundle of ICT technologies including not only telephones (mobile or not) and televisions but also computers and the internet, audio tapes, projectors and slide projectors, printers and copy machines, digital cameras, and radios. UNESCO (2014) reported, that the provision of ICT can produce a profound impact for schools.

It improves student achievement, improve access to schooling, increase

efficiencies and reduce costs, enhance students' ability to learn and promote their

lifelong learning, and prepare them for a globally competitive workforce. As the power and capability of computers have increased, as they have become interconnected in a worldwide web of information and resources, as they provide a conduit for participation and interaction with other people (UNESCO, 2011). For example, electricity installation has enabled teachers to integrate radios into the classroom, keeping students informed about current events, and playing music to accompany celebrations and social events. Recording devices have been utilized to improve phonetics among students improving their mother tongue or those trying to learn new languages such as English. Televisions and video players permitted classes to watch educational films (Alazraki & Haselin, 2007). In many tertiary institutions , electricity installations have yielded the ability to conduct experiments in a science laboratory and improved the efficiency of processing information through computers and photocopying machines. Schools have also begun to offer expanded vocational classes in engineering, welding, metal works, and carpentry, all made easier with electric appliances and tools (Kirubi; Jacobson; Kammen & Mills, 2009). The most transformative impact ICT can have on schooling, however, is through the internet and connections to the worldwide web. It is the internet, some studies suggest, that serves as one of the best tools for exposing students to a broad set of information and experiences that can become central to their education, socialization, and future employment (Kozma; McGhee; Quellmalz & Zalles, 2004). Internet provision has been statistically correlated with higher rates of school completion, higher rates of literacy, trade openness, and even income (Menzies, ; Chinn & Robert, 2006). This makes the internet one of the key tools in bridging a "digital divide" between rich and poor as it integrates students into a global culture and can also mobilize civic participation and deliberative democracy (Norris, 2001)

Operational electrical installations not only attracts students and enhances their learning experience; it can also enhance staff retention and lead to better teacher training. UNESCO (2015) put it succinctly, Teachers are understandably reluctant to work in deprived areas, which lack basic facilities such as electricity, good housing and health care. Electricity, in addition to providing lights and computers, can also improve facilities with fans and other amenities that make them more comfortable (Dasso ; Fernandez & Nopo, 2014). One survey of schools electrified with solar PV panels in Argentina found that almost two-thirds (63%) of staff and faculty surveyed said they had been able to improve the quality of their work thanks to the better working conditions and teaching aids electricity offered (Alazraki & Haselin, 2007).

Electrified schools also provide teachers with better training, new skills and techniques for improved practices in the classroom. In both Sub-Saharan Africa and South America, electrification enabled teachers to become familiar with computers that they then used to engage in professional societies, conduct e-learning, better manage student marks and parental reports, search for educational content, and plan lessons (UNESCO, 2011).

Electricity according to Makoto and Toshihiko (2008) improves education in the following ways:

- Lighting appliances enable children to study after sunset

- Use of electrical appliances narrow the digital divide through Information communication Technologies (ICTs)
- Improved literacy rate
- Higher enrolment rates
- Rise in years of completed schooling

Power supply also promote economic, social and after school hour activities. The after-hour school activities as stated by Lyons (2000) include:

1. Adult learning
2. Resource use and information dissemination
3. Cultural and social
4. Youth activities, including day care
5. Health, leisure, and recreation

The continued existence, functionality and operation of these installations in tertiary institutions require proper, efficient and adequate security and protection.

Protection according to Webster (2022) the act of shielding something from harm or the state of being shielded from harm. Protection is any measure taken to guard a thing against damage caused by outside forces (Scaddan, 2015). Protection also means the condition or state of being kept safe from injury, damage, or loss (Cambridge Dictionary, 2022).

Therefore the protection of electrical installation in the act of shielding electrical materials and equipment from harm, damage, loss and destruction. Such protection requires techniques or strategies. A strategy is a carefully developed plan or method for achieving a goal or the skill in developing and undertaking such a plan or method. It also seen as the arrangement, blueprint, design, game plan, ground plan, master plan, program, project, road map, scheme, system employed to carry certain activity. (Webster, 2022).

The strategies employed for the protection of electrical installations includes fencing such installations with block walls, wire gouges or electrocuted wire gouges. Those methods often fails as vandals usually brake the walls or cut the wire gouges, hence carting way some important components of the installations such as transformers, amound cables, relays among others. Reports indicate that such incidents of vandalism occur regularly in tertiary institutions in Rivers State.

Some security experts have suggested the use of solar powered light, camera and alarm at the locations of electrical installations in these tertiary institutions as a way curbing this menace.

Solar powered security light is a security light that is energized by solar energy. The light taps energy from the sun. Since a solar powered security light uses no grid electricity, the light is always available, reliable and functional especially in the night when it's services and operation is highly needed. Solar powered security light and camera may have proven to be among excellent strategies of security.

Solar powered camera just like security light, rely on small solar panels that convert sunlight to electricity to charge the cameras' built-in rechargeable batteries. Integrated inverters in the security cameras can also convert direct current (DC) power from solar panels into alternate current (AC) electricity to provide power when the sun is out. Power stored in their rechargeable batteries during the day is another way that solar-powered security cameras keep working through the night. Unlike wired security cameras, solar security cameras do not require running wires to connect them to power sources. They connect to home security systems via a Wi-Fi connection rather than data cables. The operation of the security camera is similar to that the alarm system.

Solar powered wireless security alarm system is a video surveillance system that relies on wireless cameras connected to the internet with the intent to transfer necessary information via Wi-Fi or infrared. solar alarm system or a solar panel security camera system uses the natural energy from the sun for powering surveillance cameras. The solar energy is transformed into electrical power needed to make these cameras work. This is done with the help of solar panels that capture the light from the sun and turn it into that direct current electricity (DC). Next, with the help of an inverter, the direct current is turned into alternating current or AC, which finally powers security surveillance cameras.

While security experts based on year of experience have argued that those strategies may not be effective, there is no research work that has attested to that. The present study investigated those strategies as alternative techniques for the protection of electrical installations in tertiary institutions in Rivers State

Statement of Problem

The functionality of electrical installations is the life wire of most academic, administrative, economic and social activities carried out in tertiary institutions. It only promote conducive teaching and learning environment, but also fosters recreational activities.

However, the incessant cases of vandalism of electrical installations in tertiary institutions in Nigeria and especially in Rivers State live much to be desired. These incidents usually disrupt academic and administrative activities in those tertiary institutions. Some time the institutions is plunge into darkness for weeks if not months since some of the items stolen are very much expensive to be replaced. The replacement of installations worth millions of naira every now and again is counterproductive and detrimental to the tertiary institutions. The present researchers were worried as a result the ugly situation, hence sought to examine the use of solar powered security light, solar powered cameras and the building of security houses for security guards at the locations of these installations as effective strategies for protecting it.

Purpose of the Study

The purpose of this study was to determine strategies for effective protection of electrical installations in tertiary institutions in Rivers State. Specifically, the study sought to determine whether security operators consider:

1. the use of solar powered security light as effective strategy for protecting electrical installations in tertiary institutions in Rivers State

2. the use of solar powered security camera as effective strategy for protecting electrical installations in tertiary institutions in Rivers State
3. the use of solar powered security alarm system as effective strategy for protecting electrical installations in tertiary institutions in Rivers State

Research Questions

The following research questions guided the study:

1 how effective is the use of solar powered security light for protection of electrical installations.

2. how effective is the use of solar powered security camera for protection of electrical installations.

2 how effective is the use of solar powered security alarm system for protection of electrical installations.

Hypotheses

The following null hypotheses were tested at .05 level of significance:

1 there is no significant difference in the mean ratings of respondents on the use of solar powered light as effective strategy for the protection of electrical installations based on years of experience (0 – 10 years ; 11year – 22 years and 23 years - above)
2 there is no significant difference in the mean ratings of respondents on the use of solar powered camera as effective strategy for the protection of electrical installations based on years of experience (0 – 10 years ; 11year – 22 years and 23 years - above)
3 there is no significant difference in the mean ratings of respondents on the use of solar powered alarm system as effective strategy for the protection of electrical installations based on years of experience (0 – 10 years ; 11year – 22 years and 23 years - above)

Method

The descriptive survey research design was adopted for the study. The population of the study consisted of 109 security personnel (35 in federal and 74 in State) tertiary institutions in Rivers State. Sampling was not done since population is not large and is manageable. The instrument for data collection was a structured questionnaire designed by the researcher. The questionnaire was structured on five-point scale of Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD) and Undecided (U). Three experts in Industrial Technology Department of Ignatius Ajuru of Education validated the instrument. Cronbach Alpha was used to ascertain the internal consistency of the instrument. This yielded an overall reliability coefficient of .79. The researcher administered 109 copies of the questionnaire. All copies of the questionnaire distributed were returned and used for data analysis. Data collected for the study were analyzed using mean to answer the research questions and standard deviation to determine the homogeneity or otherwise of the respondents views. T-test and ANOVA were used to test the null hypotheses at .05 level of significance. Where the p-value is less than or equal to .05, the null hypotheses is rejected, but if the p-value is greater than .05, the null hypotheses is retained.

Results

The findings of the study were obtained based on the results of data analysis.

Research Question 1: How effective is the use of solar powered security light for protection of electrical installations.

Data collected in respect of research question 1 was analyzed and presented in Table 1.

Table 1

Respondents mean ratings on effect of the use of solar powered security light for protection of electrical installations

S/No	Aspect of Solar Powered Security Light	Mean	SD	Remarks
1	It provides proper illumination	4.21	0.46	A
2	The light is always available	4.49	0.51	SA
3	It is easy to install	4.23	0.45	A
4	Low maintenance cost	4.07	0.54	A
5	It scares vandals	4.23	0.61	A
6	Uncompromised performance and zero energy use.	4.20	0.43	A
7	It is durable	4.40	0.53	A
8	No power fluctuation	4.32	0.56	A
9	Low energy consumption	4.43	0.61	A
10	It is environmental friendly	4.21	0.62	A
11	It is self-activated	4.51	0.51	SA
12	Cost of purchase is not high	4.56	0.49	SA
	Cluster Mean	4.32	0.53	A

Table 1 shows that all the items have a cluster Mean of 4.32, which means that security guards agree that the use of solar powered security lights are effective strategy for the protection of electrical installations in tertiary institutions in Rivers State. The standard deviation of 0.53 show that the respondents are homogenous in their responses.

Research Question 2: How effective is the use of solar powered security camera for protection of electrical installations.

Data collected in respect of research question 1 was analyzed and presented in Table 1.

Table 2

Respondents mean ratings on effect of the use of solar powered security camera for protection of electrical installations.

S/No	Aspect of Solar Powered Security Camera	Mean	SD	Remarks
1	Capture and transmit images in real time	4.52	0.56	SA
2	Easy to install	4.52	0.50	SA
3	Low maintenance level	4.32	0.49	A
4	Weather conditions does affect its functionality	4.56	0.54	SA
5	The picture and image quality is very clear	4.61	0.41	SA
6	Is dependable	4.26	0.47	A
7	The purchase cost is affordable	4.50	0.53	SA
8	Low energy consumption	4.61	0.57	SA
9	It ensures continuous recording	4.68	0.41	SA
10	It has high definition resolution	4.52	0.53	SA
11	It has wide field of view	4.61	0.61	SW
12	It is environmental friendly	4.62	0.49	SA
	Cluster Mean	4.53	0.52	SA

Table 2 shows that all the items have a cluster Mean of 4.53, which means that security guards strongly agree that the use of solar powered camera is an effective strategy for the protection of electrical installations in tertiary institutions in Rivers State. The standard deviation of 0.52 show that the respondents are homogenous in their responses.

Research Question 3: How effective is the use of solar powered security alarm system for protection of electrical installations.

Data collected in respect of research question 3 was analyzed and presented in Table 3.

Table 3

Respondents mean ratings on effect of the use of solar powered security alarm system for protection of electrical installations

S/No	Aspect of Solar Powered Security Light	Mean	SD	Remarks

1	It is easy to install	4.51	0.46	SA
2	It is not expensive to purchase	4.50	0.51	SA
3	It works in conjunction with the camera in real time	4.61	0.45	SA
4	The alarm is very laud	4.56	0.54	SA
5	It scares vandals	4.56	0.61	SA
6	It is easy to maintain	4.30	0.43	A
7	It is durable	4.40	0.53	A
8	It is weather friendly	4.39	0.56	A
9	Low energy consumption	4.51	0.51	SA
10	It is environmental friendly	4.21	0.62	A
11	It is self-activated	4.50	0.51	SA
12	It has wide range of coverage	4.56	0.49	SA
	Cluster Mean	4.50	0.52	SA

Table 3 indicates that all the items have a cluster Mean of 4.50, which means that security personnel strongly agree that the use of solar powered alarm system is an effective strategy for the protection of electrical installations in tertiary institutions in Rivers State. The standard deviation of 0.52 show that the respondents are homogenous in their responses.

Hypothesis 1: There is no significant difference in the mean ratings of respondents on the use of solar powered light as effective strategy for the protection of electrical installations based on years of experience (0 – 10 years ; 11year – 22 years and 23 years - above)

Data obtained in respect of hypothesis 1 were analyzed and presented in Table 4.

Table 4:

Summary of analysis of variance of the mean ratings of respondents on the use of solar powered security light for protection of electrical installations.

Year of Experience	Sum of Square	df	Mean of Square	F	p-value	Decision
Between Groups	9.528	3	38.263	2.333	0 .067	not significant

Within Groups	294.957	105	3.798
Total	374.485	108	

Results in Table 4 show that the p-value of 0.067 is greater than the significant level of 0.05. This means that there is no significant difference in the mean ratings of respondents on the use of solar powered light as effective strategy for the protection of electrical installations based on years of experience. Therefore, the null hypothesis is accepted.

Hypothesis 2: There is no significant difference in the mean ratings of respondents on the use of solar powered camera as effective strategy for the protection of electrical installations based on years of experience (0 – 10 years ; 11year – 22 years and 23 years - above)

Data obtained in respect of hypothesis 2 were analyzed and presented in Table 5

Table 5:

Summary of analysis of variance of the mean ratings of respondents on the use of solar powered security camera for protection of electrical installations.

Year of Experience	Sum of Square	df	Mean of Square	F	p-value	Decision
Between Groups	9.526	3	37.263	2.337	0 .081	not significant
Within Groups	294.951	105	3.768			
Total	374.477	108				

Results in Table 5 show that the p-value of 0.081 is greater than the significant level of 0.05. This means that there is no significant difference in the mean ratings of respondents on the use of solar powered camera as effective strategy for the protection of electrical installations based on years of experience. Therefore, the null hypothesis is accepted.

Hypothesis 3: There is no significant difference in the mean ratings of respondents on the use of solar powered alarm system as effective strategy for the protection of electrical installations based on years of experience (0 – 10 years ; 11year – 22 years and 23 years - above)

Data obtained in respect of hypothesis 3 were analyzed and presented in Table 6.

Table 6:

Summary of analysis of variance of the mean ratings of respondents on the use of solar powered security alarm system for protection of electrical installations.

Year of Experience	Sum of Square	df	Mean of Square	F	p-value	Decision
Between Groups	9.522	3	36.263	7.333	0 .077	not significant
Within Groups	294.953	105	3.795			

Total	374.475	108

Results in Table 6 show that the p-value of 0.077 is greater than the significant level of 0.05. This revealed that there is no significant difference in the mean ratings of respondents on the use of solar powered alarm system as effective strategy for the protection of electrical installations based on years of experience. The null hypothesis is therefore accepted.

Discussion

Findings of the study reveals that security guards considers the use of solar powered security lights as an effective strategy for protecting electrical installations in tertiary institutions in Rivers State. They are of the opinion that solar powered security lights scares vandals, provide constant illumination, easy to install, easy to maintain, dependable, durable among others. This finding is in consonance with that of Stanford (2018) who noted that solar powered security lights have low maintenance, un-compromised performance and zero energy use. The finding also tallies with that of Benson (2000) who stated that solar powered security lights give off a bright white light. This makes it easy to see in the illuminated area at anytime of the night. Benson also noted that, the best part about solar powered security lights is the fact that even in a power outage, they will still work. It does not matter if there is limited power, fluctuating power or no power at all; since solar powered security lights get their power from the sun. They will come on at dusk regardless of what is happening with the electrical supply grid. No matter what, the areas one need illuminated will always be lit.

The study is also in agreement with that of Thomas (2015), who stated that for those properties that are striving to meet environmental regulations, there is no easier way than to install solar powered security lights. The analysis of the hypothesis indicates that there is no significant difference in the mean ratings of respondents on the use of solar powered security lights as an effective strategy for protection of electrical installations in tertiary institutions in Rivers State based on years of experience.

Results of the study showed that security guards strongly agreed that solar powered security cameras are effective strategy for the protection of electrical installations in tertiary institutions in Rivers State. The study revealed that solar powered security camera captures and transmit images in real time, has clear image and picture quality, has high definition resolution, is not affected by weather condition, durable, low maintenance cost among others. The findings is line with that Freeman (2017) who stated that solar-powered security cameras can record continuously, regular wireless security cameras stay mostly in power-saving mode to conserve battery power and only wake up when they detect motion.

The study also agrees with that of Gang (2018) who stated that camera resolution, field of view, solar panel wattage, night vision, motion activation, remote monitoring and smartphone alerts makes it very remarkably efficient. The camera resolution determines the sharpness of the security footage captured by the security camera. The night vision and motion activation indicate that the camera can

see at night and start recording when it detects motion within its coverage area. The analysis of variance indicates that there is no significant difference in the mean ratings of respondents on the use of solar powered security camera as an effective strategy for protection of electrical installations in tertiary institutions in Rivers State. The findings of the analysis of the hypothesis indicates that there is no significant difference in the mean ratings of respondents on the use of solar powered security camera as an effective strategy for the protection of electrical installations in tertiary institutions in Rivers State based on years of experience.

The findings of the study reveals the security personnel strongly agreed that solar powered alarm system is an effective strategy for the protection of electrical installations in tertiary institutions in Rivers State. The study shows that solar powered alarm system works in conjunction with the camera in real time, scares vandals, is environmental and weather friendly, reliable, durable among others This is in line with the findings of Tuckman (2017) who posited that solar powered security alarm system is useful for security purpose since the sound it produces scares criminals is self-activated. The findings of the analysis of the hypothesis indicates that there is no significant difference in the mean ratings of respondents on the use of solar powered security alarm system as an effective strategy for the protection of electrical installations in tertiary institutions in Rivers State based on years of experience.

Conclusion

It is clear that solar powered security lights, camera and alarm system are effective strategies for protecting electrical installations in tertiary institutions. Its usage scares vandals; is reliable, cost effective, durable and easy to maintain and install.

Recommendations

Based on the findings and conclusion of the study, the following recommendations were made:

1 The management of tertiary institutions should be encouraged to install solar powered security lights, cameras and alarm system in all critical electrical installations in the institutions.
2 Existing solar powered security systems such as alarm, cameras and lights should be maintained.

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