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Usage of Solar Inverter Technology as Alternative Energy Source: A Catalyst for Round the Clock Electronic Services in Nigerian University Libraries

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Abstract

This study examines usage of solar-inverter technology as alternative energy source: a catalyst for round the clock electronic services in Nigerian university libraries. The total population for this study comprised three hundred and seventy one (371) librarians from 40 university libraries in South West, Nigeria. The data collected were analyzed using simple percentage/frequency counts and weighted mean. Findings from this study revealed among others that the extent of librarians' awareness of solar-inverter technology as alternative sources of energy in university libraries in South West, Nigeria is very high; electronic reference service, online interlibrary loan service, online cataloguing and classification service, OPAC service, online current awareness service, electronic indexing and abstracting service, online selective dissemination of information service, e-mail service, electronic charging and discharging service among others are types of electronic services that can be provided round the clock in university libraries in South West, Nigerian using solar-inverter energy as alternative energy source and that the extent to which solar-inverter energy can be used as alternative energy source to power ICT equipments for electronic services in university libraries in South West, Nigeria is high among other findings. Recommendations made based on the findings of the study include: University library management should make it a point of duty and also take it as priority to allocate fund for the acquisition and installation of solar-inverter technology as this will help them fulfil the library goal of rendering round the clock electronic library services to their users among others.

Keywords

Solar, Inverter, Energy, Electronic Service, University Libraries

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Introduction

Libraries as the heart of educational enterprise serve as the reservoir of knowledge that is communicated through information resources which is a vital national resource that determines the direction of any nation. To be able to fulfil their mandate, libraries are striving to employ and utilize digital technologies which present new opportunities that enhance their services (Abbas, 2014). Due to the advancement of Information and Communication Technologies (ICTs), libraries are radically transforming from book collection and organization to electronic collection, which is the ultimate foundation of electronic library services. Consequently, librarians have been saddled with the responsibility of dealing with the consistent change in the information needs of library users; anchored on ease of access without limitation of time and space. Tyson (2007) stressed the need to adapt to changes brought about by the application of modern technologies in libraries, calling on librarians to be equipped in order to serve the present generation of library users who are in need of current and timely information.

In the 21st Century, traditional library processes/practices have proven to be unsatisfactory in responding quickly enough to technology driven environment, hence the need to apply the use of computers to offer better services within the shortest possible time, without limitations of place or time (Ayiah & Kumah, 2011). Parvez (2011) opined that, in dealing with new challenges and increasing demands of library users, libraries currently reconsolidate, reshape, redesign and repackage their services and information products by incorporating ICT-based products and services through the introduction of more computer content. This usage of computers has made Nigerian libraries to become more effective and efficient in the performance of various tasks in relation to acquisitions, cataloguing and classification, indexing, serials control, processing and circulation (Nkanu & Okon, 2010). Vijayakumar and Vijayan (2011) highlighted some of the advantages of the use of ICTs to include increase in the range of services offered, save the time of the users, speedy and easy access to information, improvement in the quality of library services, access to unlimited information from different sources and provide round the clock access to users. Furthermore, with the advent of digital revolution, communication has become easier and faster and decisions are made instantaneously. The internet which is the latest among the superhighways has cut down distance and made it easier to have access to information to all people at all places and at all the times (Kaul, 2004).

There is no gain saying that the 21st Century library users are no longer mere consumers of library resources and services, they now demand access to library resources and services that is not limited by time and space. As asserted by Chukwusa (2008), the knowledge base which library users want to access is no longer stored in print media such as textbook and other items that are paper-based alone, but rather in a computerized/electronic domain. However, as librarians struggle to introduce the use of information technologies in university libraries in their attempt to join the information super highway and meet these changing needs of information seekers, they are being challenged by some factors which pose as hindrance to this innovation (Chukwusa, 2015). In developing nations, especially in Africa, energy/power i.e. electricity has been a hindrance to the development of many technological innovation that can benefit humanity in academic environment and Nigeria is not spared of this problem. Power outages portend negative cost effect for the academic community, which also include the library, because of the high cost of running generators as alternative source of energy/power supply.

According to Arubayi (2011), the Delta State University, Abraka spends thirteen million naira per month on only one campus, which is too costly for the university's finances and has a negative impact on library services because it prevents the library's E-library section/unit from providing round-the-clock electronic library service to its users. An abundant and inexpensive supply of energy/power is therefore one of the most critical requirements for providing effective and round the clock electronic library and information services to the users. The Nigerian power sector has been in crisis for many years, for much of the generation, transmission and distribution capacity has become worn out or damaged. According to Adam Smith International (2015), in Nigeria, the average annual per capita power consumption, which is 155 kWh only, is among the lowest in the world and Nigeria's per capita electricity consumption is 7% of Brazil's and 3% of

South Africa's (Adam Smith International, 2015). It is worthy of note that, in the ICT environment, university libraries in Nigeria just like in other developing nations of the world have long realized the need to render effective electronic library services so as to be able to satisfy the numerous and changing information needs of their users, they however suffer from the economic and social effects of power outages like other sectors of the nation, since the university community is not removed from the larger society that is suffering from the same issue of power outage (Chukwusa, 2015).

Amaefule (2012) asserted that one of the major factors hindering the penetration of information and communication technology (ICT) devices in developing nations is the absence and inadequacy of electricity to provide power for technological devices. This inadequacy of power supply by the national grid, among other factors has led developing nations like Nigeria and organizations within it to look for alternative power sources like generators and solar and inverter generated energy. Solar energy implies tapping radiant light energy emitted by the sun as a means of energy source and converting it into electricity directly using photovoltaics (PV), indirectly using concentrated solar power, or a combination. It serves as an important tool in the elimination of pollution and creates a highly reliable electricity backup to electrical/electronic appliances. Places powered by solar energy have been installed with inverters of different capacities and batteries with the capability of storing power that is able to operate electrical appliances such as computers, television, radio, laptops, ipads, tablets, and refrigerators (Adeyoyin, Alawiye & Ewolu, 2019).

The hope of constant power/electricity in libraries lies in seeking solutions to the poor power generation from the government and this include looking for alternative electricity source, especially in the face of prolonged helplessness of power providing authorities in Nigeria. Improving the quality of libraries in higher education systems via solar-inverter energy back-up will no doubt, translate to improving the quality of products of the system. The development of uninterrupted power supply will be a great relief to some of the challenges faced by librarians and indeed the entire staff of the library; particularly the problems inhibiting the provision of round the clock electronic services. Library processes and services can go on uninterrupted, thereby providing solution to one of the greatest threats to information and communication technology and power outages. It is on the basis of this that this study seeks to examine usage of solar-inverter technology as alternative energy source: a catalyst for round the clock electronic services in Nigerian university libraries.

Statement of the Problem

Libraries around the world are striving to keep up with current trends in the area of information dissemination through adoption and use of ICT. In the 21st Century library environment, emphasis is on the provision of effective library services that is not limited by either space or time. In the developed nations of the world such as United Kingdom, China, Canada, New Zealand for example, having round the clock access to technological infrastructures is a norm due to stable electricity supply and this is made possible by the advance level of the adoption and usage of alternative energy source such as the solar and inverter energy. However, it has been observed over time that, poor power (electricity) supply in developing countries; especially in Nigeria, has been a bane to enjoying round the clock supply of electricity which also affects running effective round the clock electronic library services in Nigerian university libraries (Amaefule, 2012). This situation is almost the same in all Nigerian government owned university both and the federal and the state level.

Inadequate supply from the national grid, land and water pollution from oil spillage in the oil producing communities among other factors have led Nigeria and indeed the world to look for alternative power supply such as solar-inverter energy. While university libraries may have struggled to acquire electronic technologies with the lean resources available to them, they seem to find it difficult most times to provide information to the library users outside the university working hours either because of the epileptic power supply from the national grid, or the rising cost of fuel for generators to power their server and other electrical/electronic appliances for twenty four hours daily. This has been a challenge to the library's objective of rendering effective service that is not limited by time, boundary or distance. It is against this background this study seek to investigate how solar-inverter technology can be used as an alternative source of power to help provide for round the clock electronic services in university libraries in Nigeria.

Objective of the study

The main objective of the study is to investigate how solar-inverter technology can be used as an alternative source of power to help provide for round the clock electronic services in university libraries in Nigeria. The specific objectives are to:

1. know the extent to which librarians are aware of solar-inverter technology as alternative source of power in university libraries in South West, Nigeria;
2. ascertain the types of electronic service that can be provided round the clock for users in university libraries in South West, Nigeria;
3. know the extent to which solar-inverter technology can be used as alternative source of power for round the clock electronic library service in university libraries in South West, Nigeria and
4. find out the benefits that can be derived from using solar-inverter technology as alternative source of power for electronic services delivery in university libraries in South West in Nigeria.

Research Questions

The following research questions were raised to guide the study.

1. What is the extent of librarians' awareness of solar-inverter technology as alternative source of power in university libraries in South West, Nigeria?
2. What are the types of electronic service that can be provided round the clock for library users in university libraries in South West, Nigeria?
3. To what extent can solar-inverter technology be used as alternative source of power for round the clock electronic library services in university libraries in South West, Nigeria?
4. What are the benefits that can be derived from the use of solar-inverter technology as alternative source of power for electronic services delivery in university libraries in South West, Nigeria?

Literature Review

Libraries worldwide are accepted as the heartbeat of the educational enterprise. Therefore, university libraries in Nigeria have long realized the need to run effective systems and integrated services for her immediate community (Chukwusa, 2015). Consequently, improving the quality of library services in higher education systems via solar-inverter energy back-up has become necessary as a result of the inadequacy of power generation and distribution in Nigeria. It is however natural to be able to conveniently utilize what someone is aware of. The effective usability of solar-inverter technology as alternative source of power for round the clock electronic services in Nigerian university libraries is dependent on librarians' awareness of its usage and importance. Commenting on the awareness of solar-inverter technology, Adedoyin, Alawiye and Ewulo (2019) conducted a study on awareness and use of solar energy as alternative power source for ICT facilities in Nigerian university libraries and information centres and found that all the respondents have good knowledge of what solar energy is, as they all responded in the affirmative when quizzed if they are aware of what solar energy is about.

The study also found that 48 (55.2%) representing majority of the respondents have experienced solar energy as alternative power source before and that 66(75.9%) of them are well informed about solar energy equipment, while 63(72.4%) indicated that they have alternative power source in their libraries. The study further discovered that 81 (93.1%) respondents were aware that solar energy can power their ICT equipment while all the respondents, 87 (100%) believe that with the use of solar energy, erratic power supply can be mitigated to a large extent. Also, Bokfors (2018) conducted a study on awareness of solar energy in Kenya and found that, according to the stakeholders that have been interviewed, there is some awareness on solar energy. However, it is not clear to many people in Kenya. Most people lack information on the technical aspects of solar energy while some believe that solar is only applicable in the rural areas and not in an urban setting.

Where there is awareness of the existence and usability of solar-inverter energy among librarians, electronic library services provision becomes achievable. The back bone of electronic library services is power

i.e. electricity, to run the gadgets that are being used for the electronic services. Where all resources are readily available for library services provision in the library, electronic library objectives of creating opportunities for the users to access and retrieve appropriate information that cater for their information needs at their “beck and call” is achieved. University e-library is responsible for providing instant access to digitized information, electronic information resources and services with the aid of computer or telecommunication technologies to satisfy users’ dynamic needs. To this end, electronic libraries acquire, process, store, evaluate and disseminate information via electronic means to the audience in need of information (Anyim, 2018). Electronic library is the library where some or all of the holdings of the library are available in electronic format, and the services of the library are also made available electronically-frequently over the Internet so that users can access them remotely (Onwuchekwa & Jegede, 2011).

In the same vein, Ekere, Omekwu and Nwoha (2016) showed the various services provided at digital/electronic libraries which include: online internet search services; e-mail services; online reference services; online cataloguing and classification service; customer care services; management of online databases; subscription services; awareness and workshop services; audio and video communication services; news groups/dialogue databases; electronic document delivery services; interoperability services; technical training in ICT for staff and users; online interlibrary services; digitized finding aids such as online indexes and bibliographies and online cataloguing and classification services.

Also, Anyim (2018) conducted a study on e-library resources and services: improvement and innovation of access and retrieval for effective research activities in University e-libraries in Kogi State Nigeria and found that the major library services provided to satisfy the information needs of academic researchers in digital/electronic libraries of universities in Kogi State Nigeria include: information literacy services, digitalization of local contents, online internet search service, electronic document delivery services, e-reference services, CD-Rom searching service, online inter-library service, technical training in ICT for staff and users and data management services.

The generation of electrical power is one of the most important applications of solar-inverter energy which is significantly beneficiary to library’s quest of round the clock electronic services if properly applied and utilized. The development and maximum utilization of uninterrupted power supply through solar power generation will be of great relief while also challenging the librarians and indeed the entire staff of the library. This is because library processes and services can be interrupted by one of the greatest threats to information and communication technology, which is power outages (Chukwusa, 2015). It is however worrisome that the level and extent of the use of solar-inverter power as alternative power supply in the face of the power outage problem in Nigeria is very low. This is evident from the inability of most federal university libraries in Nigeria to confidently run 24 hours steady electronic services to their users. Commenting on the extent and level of the use of solar energy as alternative power source in Nigerian institution, Ohunakin, Adamola, Oyewola and Fagbenle (2014) found that solar energy devices (mainly solar thermal) have been designed, built or adapted by research institutes and tertiary institutions across the country. In the same vein, Adeyoyin, Alawiye and Ewolu (2019) found that librarians are aware to a large extent that solar energy can power their ICT equipment as they also believe that using solar energy, erratic power supply can be mitigated to a large extent. Ajala, Arinola, Adigun and Ogunmodede (2014) in their study of extended hours in academic libraries: The experience of three public universities in South Western Nigeria recommends that, there is the need to ensure a back-up supply of electricity to the library at night. That if the electricity supply is interrupted, users might be tempted to bring flammable materials such as lanterns, candles, lighters and matches into the library, which, if carelessly handled, might result in fire outbreaks, this recommendation is however a testament to the low extent of the application and use of solar-inverter power as alternative source of power/electricity in university libraries in Nigeria.

There is no gain saying that, the maximum use of solar-inverter energy as alternative source of energy for the purpose of powering up the library’s ICT appliances is very beneficial to the overall activity of the library as it allows for steady running of ICT facilities that are being used by librarians to render unhindered

electronic library services. Even though there is drought of literatures that are particular about the benefits of the use of solar-inverter energy as alternative source of energy in university libraries in Nigeria, Zarma, Dioha, Tijjani and Alhassan (2017) asserted that solar electricity is used for many purposes (to power electrical appliances) and is either used as direct current electricity (DC) or alternating current electricity (AC). Solar power is one of the most promising renewable energy sources in the World. Compared to non-renewable sources such as coal, nuclear gas and oil, some of the advantages solar power energy source according to Zarma, Dioha, Tijjani and Alhassan (2017) are: it generates free energy from the sun, it has no moving part to break down thus requiring minimal maintenance, it is a non-polluting energy because it reduces emissions (has no direct impact on the environment), the cells are modular, giving room for expansion from small systems, it has long life and its very durable as the cells last up to 25 years, it can be installed and operated anywhere including areas of difficult access and remote locations and it makes no noise and give off no exhaust among others. Via solar-inverter energy back-up, the quality of libraries in higher education systems will no doubt be improved which will subsequently translate to improving the quality of products and services of the system. According to Akintunde (2002), the installation and activation of the 800 watts solar electric power back-up system in the University of Jos, Nigeria main library in February 2002 was certainly a great relief to both staff and students. The author further stressed that it is not only a relief to the staff and students of the University of Jos, the installation and usage of solar-inverter technology has also become a relief to other university libraries in developing countries of the world, which have been experiencing incessant power outages.

Research Methodology

A descriptive survey design was adopted for this study because it was considered appropriate for collecting data from a large population. It is also capable of getting quality and unbiased feedback from respondents. The population of the study comprised of three hundred and seventy one (371) librarians from 40 university libraries in South West, Nigeria. This constitutes the total number of librarians working in all the university libraries in South West, Nigeria. As at the time of the study, there were ~~seven~~ federal universities, eight state universities and 25 private university libraries in South West, Nigeria. The entire population of 371 librarians was used because it was manageable for the researcher. Questionnaire was the research instrument used for the study.

Table 3.1: Population of the Study

S/N	Name of Institutions	Zone	Ownership	No of Librarians
1	Federal University of Technology, Akure , Ondo State.	South-West	Federal	10
2	Federal University of Oye Ekiti , Ekiti State.	South-West	Federal	08
3	Obafemi Awolowo University, Ile-Ife, Osun.	South-West	Federal	21
4	University of Agriculture, Abeokuta, Ogun State.	South-West	Federal	16
5	University of Ibadan, Ibadan. Oyo State.	South-West	Federal	30
6	University of Lagos, Lagos State.	South-West	Federal	23
7	National Open University, Lagos State.	South-West	Federal	21(as broken down below)
	Lagos	South-West	Federal	6
	Ibadan	South-West	Federal	3
	Abeokuta	South-West	Federal	2
	Benin	South-South	Federal	2
	Asaba	South-South	Federal	1
	Awka	South-East	Federal	3
	Enugu	South-East	Federal	4
8	Adekunle Ajasin University, Akungha, Ondo State.	South-West	State	05
9	Ekiti State University, Ado Ekiti, Ekiti	South-West	State	18

	State.			
10	Ladoke Akintola University of Technology, Ogbomoso, Oyo State	South-West	State	14
11	Olabisi Onabanjo University Ago-Iwoye, Ogun State.	South-West	State	13
12	Ondo State University of Science and Technology, Okitipupa, Ondo State.	South-West	State	05
13	Osun State University, Oshogbo, Osun State.	South-West	State	10
14	Tai Solarin University of Education, Ijebu- Ode, Ogun State	South-West	State	10
15	Lagos State University, Ojo, Lagos State.	South-West	State	14
16	Achievers University, Owo, Ondo State.	South-West	Private	02
17	Adeleke University, Ede, Osun State.	South-West	Private	06
18	Afe Babalola University, Ado-Ekiti, Ekiti State.	South-West	Private	11
19	Augustine University Ilara, Lagos.	South-West	Private	03
20	Ajayi Crowther University, Ibadan, Oyo State.	South-West	Private	09
21	Babcock University, Ilishan-Remo, Ogun State.	South-West	Private	17
22	Bells University of Technology, Otta, Ogun State	South-West	Private	08
23	Bowen University, Iwo, Osun State.	South-West	Private	11
24	Caleb University, Lagos, Lagos State.	South-West	Private	02
25	CETEP City University, Lagos, Lagos State.	South-West	Private	04
26	Chrisland University, Abeokuta, Ogun State.	South-West	Private	02
27	Covenant University, Ota, Ogun State.	South-West	Private	15
28	Crawford University Igbesa, Ogun State	South-West	Private	02
29	Crescent University, Ogun, Ogun State.	South-West	Private	04
30	Elizade University, Ilara-Mokin, Ondo State.	South-West	Private	03
31	Fountain University, Oshogbo, Osun State.	South-West	Private	04
32	Hallmark University, Ijebu-Itele, Ogun State.	South-West	Private	02
33	Joseph Ayo Babalola University, Ikeji-Arakeji, Osun State.	South-West	Private	05
34	Leed City University, Ibadan, Oyo State.	South-West	Private	09
35	Oduduwa University, Ipetumodu, Osun State.	South-West	Private	06
36	Pan-Africa University, Lagos. Lagos State.	South-West	Private	05
37	Redeemer's University, Mowe, Ogun State.	South-West	Private	07
38	Mcpferscon University, Seriki, Sotayo, Ajebo, Ogun State	South-West	Private	05
39	South Western University, Oku Owa, Ogun State.	South-West	Private	07
40	Wesley University of Science and Technology, Ondo, Ondo State.	South-West	Private	04

Three hundred and seventy one (371) copies of the questionnaire were administered to the librarians in the university libraries under study and 286 were duly completed and found usable. Hence, there was 77% response rate. The data collected were analysed and presented using percentage and frequency counts and weighted mean.

Research Question 1: What is the extent of librarians' awareness of the use of solar-inverter technology as source of power in university libraries in South West, Nigeria?

Data in table 2 provides answer to the question

Table 2: Extent of Librarians Awareness of Solar-inverter Technology as Alternative Source of Energy in University Libraries

S/N	Librarian's Extent of Awareness of Solar-inverter Technology	Very High Extent	High Extent	Low Extent	Very Low Extent	Weighted Mean
1	I am aware of what solar-inverter energy is?	65	183	26	12	3.05
2	I have experiences on how solar-inverter energy works?	62	189	15	20	3.02
3	I have an idea of the components and accompanying facilities of solar-inverter energy?	32	79	52	123	2.06
4	I have an idea of the usefulness of solar-inverter energy?	286	0	0	0	4.00
5	I know that solar-inverter technology can be used to successfully power your ICT equipments?	286	0	0	0	4.00
6	I am aware that solar-inverter technology can serve as alternative power source in your library?	286	0	0	0	4.00
7	I am aware that solar-inverter energy source can help to eradicate the problem of epileptic power supply plaguing the library?	286	0	0	0	4.00
Aggregate Mean						3.44
Criterion Mean						2.50

From table 2 which showed an aggregate mean of 3.44 which is higher than the criterion mean of 2.50, it can be concluded that the extent of librarians' awareness of the use of solar-inverter technology as sources of power in university libraries in South West, Nigeria is very high.

Research Question 2: What are the types of electronic services that can be provided round the clock for library users in university libraries in South West, Nigeria?

Data in table 3 provides answer to the question.

Table 3: Types of Electronic Services that can be provided Round the Clock in University Libraries

S/N	Types of Electronic Services that can be Provided Round the Clock in the Library	Agree	%	Disagree	%
1	Electronic Reference Service	286	100%	0	0
2	Online Interlibrary Loan Service	286	100%	0	0
3	Online Cataloguing and Classification Service	286	100%	0	0
4	OPAC Service	286	100%	0	0
5	Online Current Awareness Service	286	100%	0	0
6	Electronic Indexing and Abstracting Service	286	100%	0	0
7	Online Selective Dissemination of Information Service	286	100%	0	0
8	E-mail Service	286	100%	0	0
9	Electronic Charging and Discharging Service	286	100%	0	0
10	Online Search Service	286	100%	0	0
11	Electronic Document Delivery Service	286	100%	0	0

Table 3 reveals that 286(100%) representing all the respondents unanimously agreed that electronic reference service, online interlibrary loan service, online cataloguing and classification service, OPAC service, online current awareness service, electronic indexing and abstracting service, online selective dissemination of information service, e-mail service, electronic charging and discharging service, online search service and electronic document delivery service are all types of electronic services that can be provided round the clock in university Libraries in South West Nigerian using solar-inverter power source.

Research Question 3: To what extent can solar-inverter technology be used as alternative source of energy for round the clock electronic library services in university libraries in South West, Nigeria?

Data in table 4 answers the question

Table 4: Extent to which solar-inverter technology can be used as alternative source of power for round the clock electronic library services in university libraries

S/N	Extent to which solar-inverter technology power can be used for electronic library services	Very High Extent	High Extent	Low Extent	Very Low Extent	Weighted Mean
1	Solar-inverter technology can be used to sustain electricity when there is power outage from National grid.	61	168	42	15	2.96
2	Solar-inverter energy source can be used to support national power source for the purpose of running 24 hours/round the clock electronic library service.	99	167	14	6	3.25
3	Solar-inverter energy source can outrightly be used as the main source of power to provide electronic library service.	45	102	123	16	2.61
4	Solar-inverter energy source can be relied upon to provide round the clock electronic library service for university libraries in remote areas in Nigeria.	89	149	32	19	3.09
5	With solar-inverter energy source, library's ICT equipments that are useful for electronic services can be powered up always.	102	178	6	0	3.33
6	With solar-inverter energy source, the library OPAC as well as the IR can be accessible to users round the clock.	85	152	30	19	3.05
7	With solar-inverter energy source the library's free and subscribed databases such as virtual library, PetroOne, etc. can be accessed round the clock by library users.	78	158	32	18	3.03
Aggregate Mean						3.1
Criterion Mean						2.5

From table 4 above revealed an aggregate mean of 3.04 which is greater than the criterion mean of 2.50, it can be concluded that the extent to which solar-inverter energy source can be used for electronic services in university libraries in South West, Nigeria is to a very high extent.

Research Question 4:What are the benefits that can be derived from the use of solar-inverter technology as alternative source of power for electronic services delivery in university libraries in South West, Nigeria?Data in table 5 provide answers to the question

Table 5: Benefits of the use of solar-inverter technology as alternative power source for electronic services delivery in university libraries

S/N	Benefits of the use of solar-inverter power source for electronic services delivery in Libraries	Agree	%	Disagree	%
1	Round the clock access to electronic library services.	286		0	0%
2	Breaking the barrier of time in accessing electronic library services.	286	100%	0	0%
3	Breaking the barrier of distance in accessing electronic library services.	286	100%	0	0%
4	Creating wider/global visibility of the library's electronic information resources and services.	187	65%	99	35%
5	Serves as long term solution to power outage in the library.	286	100%	0	0%
6	Allow for maximum usage of library's fee based databases.	286	100%	0	0%
7	Projects positively the image of the library.	164	57%	122	43%
8	Allow for better delivery of electronic library services.	286	100%	0	0%
9	Allow for library's conformity with international standard and practices in the profession.	286	100%	0	0%
10	Helps to increase user patronage of the library resources and services.	286	100%	0	0%

Table 5 reveals that 286(100%) representing all the respondents unanimously agreed that the use of solar-inverter as energy source will be beneficiary to the library because it will: allow for round the clock access to electronic library services; break the barrier of time in accessing electronic library services; break the barrier of distance in accessing electronic library services; serve as long term solution to power outage in the library; allow for maximum usage of library's fee based databases; allow for better delivery of electronic library services; allow for library's conformity with international standard and practices in the profession and help to increase user patronage of the library resources and services. Also, 187(65%) representing majority of the respondents agreed that solar-inverter technology can benefit the library by creating wider/global visibility of the library's electronic information resources and services while 99(35%) of them disagreed with that. Also, 164(57%) of the respondents which represent a little above half of them agreed that the use of solar-inverter energy source can benefit the library by projecting positively the image of the library and 122(43%) of them disagreed.

This means that the benefits of the use of solar-inverter energy source in the library include: it allows for round the clock access to electronic library services; breaks the barrier of time in accessing electronic library services; breaks the barrier of distance in accessing electronic library services; serves as long term solution to power outage in the library; it allows for maximum usage of library's fee based databases; it allows for better delivery of electronic library services; it allows for library's conformity with international standard and practices in the profession; it helps to increase user patronage of the library resources and services; it creates wider/global visibility of the library's electronic information resources and services and it helps to project positively the image of the library.

Discussion of Findings

This study revealed that the extent of librarians' awareness of solar-inverter technology as alternative sources of power in university libraries in South West, Nigeria is very high. This finding agrees with that of Adedoyin, Alawiye and Ewulo (2019) who conducted a study on awareness and use of solar energy as alternative power source for ICT facilities in Nigerian university libraries and information centres and found that all the respondents have good knowledge of what solar energy is as they all responded in affirmative when quizzed if they are aware of what solar energy is all about. This study clearly shows that electronic reference service, online interlibrary loan service, online cataloguing and classification service, OPAC service, online

current awareness service, electronic indexing and abstracting service, online selective dissemination of information service, e-mail service, electronic charging and discharging service, online search service and electronic document delivery service are all types of electronic services that can be provided round the clock using solar-inverter energy source in university libraries in South West, Nigerian. This finding also agree with that of Ekere, Omekwu and Nwoha (2016) who outlined the electronic services available to users in academic libraries as: online internet search services; e-mail services; online reference services; online cataloguing and classification service; customer care services; management of online databases; subscription services; awareness and workshop services; audio and video communication services; news groups/dialogue databases; electronic document delivery services; interoperability services; technical training in ICT for staff and users; online interlibrary services; digitized finding aids such as online indexes and bibliographies and online cataloguing and classification services.

Also, the study found that the extent to which solar-inverter energy source can be used as alternative energy source for electronic services in university libraries in South West, Nigeria is high. This finding corroborates that of Adeyoyin, Alawiye and Ewolu (2019) who found that librarians are aware to a large extent that solar energy can power their ICT equipment as they also believe that using solar energy, erratic power supply can be mitigated to a large extent. To further corroborate the finding, Ajala, Arinola, Adigun and Ogunmodede (2014) in their study of extended hours in academic libraries: The experience of three public universities in South Western Nigeria recommends that there is the need to ensure a back-up supply of electricity to the library at night. From this study, findings clearly shows that the benefits of the use of solar-inverter energy source in the library include: it allows for round the clock access to electronic library services; breaks the barrier of time in accessing electronic library services; breaks the barrier of distance in accessing electronic library services; serves as long term solution to power outage in the library; it allows for maximum usage of library's fee based databases; it allows for better delivery of electronic library services; it allows for library's conformity with international standard and practices in the profession; it helps to increase user patronage of the library resources and services; it creates wider/global visibility of the library's electronic information resources and services and it helps to project positively the image of the library. This finding also align with the conclusion of Akintunde (2002), that the installation and activation of the 800 watts solar electric power back-up system in the University of Jos, Nigeria main library in February 2002 was certainly a great relief to both staff and students.

Conclusion and Recommendation

It is safe to infer from this study that librarians'are very much aware of solar-inverter technology as alternative sources of energy in university libraries in South West, Nigeria and with the use of solar-inverter technology, a good number of electronic library services can be rendered,round the clock to users in university libraries in South West, Nigeria. Also librarians in university libraries in South West, Nigeria are highly aware that if their libraries are provided with solar-inverter as alternative energy source to power their ICT facilities, the goal of rendering round the clock electronic library services will be achieved because librarians knows thatto a high extent; solar-inverter energy along with its numerous benefits can be used as alternative energy source to power ICT equipments for electronic services in university libraries in South West, Nigeria. The In view of the aforementioned, the following recommendations were made:

1. University library management should make it a point of duty and also take it as priority to allocate fund for the acquisition and installation of solar-inverter technology as this will help them fulfil the library goal of rendering round the clock electronic library services to their users.
2. The NUC should make the availability of solar-inverter technology a priority for the library of university libraries at the point of accrediting their programmes as this will ensure that university libraries are provided with a standby alternative power source that can be relied upon for the provision of round the clock electronic library services.

3. Since the yearly allocation to academic library development by the federal government are majorly being used for the acquisition of relevant information bearing materials i.e. books and journals both in physical and electronic formats, NGO's needs to step in and come to the rescue of university libraries in Nigeria by providing them funds to acquire other equipments such as ICT facilities and solar-inverter to power them up so that rendering information services will become more interesting to the librarians.

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