Consumers Utilisation of Solar Energy Technologies for Electricity Generation in Kogi State, Nigeria

EKELE OJONUGWA ABRAHAM[1], SAMUEL AYANDA OWODUNNI[2], RUFAI AUDU[3]
[1, 2, 3] *Department of Industrial Technology Education, Federal University of Technology Minna*

Abstract- ***The study investigated consumer's utilisation of solar energy technologies for electricity generation in Kogi state, Nigeria. Specifically, the study assessed the level of awareness of consumers, the factors affecting the effective utilization and the interventional strategies for effective utilization of solar energy technologies for electricity generation. Three research questions were answered and three hypotheses were tested at 0.05 level of significance. A descriptive survey design was used. The population used for the study comprised all household heads, Micro and Small enterprises (MSEs) operators and licensed electrician in Kogi State. A sample of 394 comprised of 222 household heads, 108 MSEs operators and 64 licensed electrician was used for the study. 30 respondents were used for trial test of the instrument and the reliability coefficient of the instrument was found to be 0.76 using cronbach alpha. Mean, standard deviation, ANOVA were used for testing the research questions and hypothesis respectively. The findings revealed that consumers are aware of solar energy technologies and believe that lack of manpower and the desired technological skills to manage solar energy technologies efficiently among others are factors affecting effective utilisation of solar energy technologies. Based on the findings, it was recommended among others that there should be training and re-training programme for improving the technical-know-how of technicians on solar energy technologies installation and maintenance.***

Indexed Terms- Awareness, Consumers, Electricity, Solar Energy, Technologies

I. INTRODUCTION

Solar power is energy from the sun and it is seen as a good source of energy for many years because of the vast amounts of energy that are made freely available, and because the conventional sources of energy are finite in nature and pose severe threats to man's environment. Rochell (2010) sees solar energy as a more sustainable alternative for the supply of electricity if harnessed by modern technology. Sambo (2009) noted that environmental degradation due to energy use and exploitation is already prevalent in Nigeria hence solar energy is a promising renewable energy sources in view of its apparent limitless potential. Also, Sambo (2012) believed that the massive load shedding experienced all over the nation had made electricity supply only for a few hours a day, implying that the energy supply all over the nation is not adequate for the teaming number of consumers regardless of the enormous potentials presented by the earth's resource system.

Since energy received directly from the sun is silent, inexhaustible, and non-polluting, Nasir (2016) believes that the utilisation of such energy (solar) using the appropriate technologies such as the solar technologies will lead to a more sustainable living and productivity. In addition to electricity generation, solar power is employed to produce thermal energy (heating or cooling, either through passive or active means), to meet direct lighting needs and, potentially, to produce fuels that might be used for transport and other purposes. Since this renewable energy (solar) can be used to generate electricity or be stored in batteries or thermal storage, raising awareness on it enormous potential will have a positive feedback on the larger population as people especially from Kogi State will be able to understand the importance of having renewable energy in their households and in their businesses. These will enable more solar energy used and less carbon emissions which will in turn help the economy and the environment. Thus, Rochell (2010) believed that the sun is the most readily and widely available renewable energy source capable of meeting the energy needs of the whole world sustainably.

Nigeria is one of the tropical countries of the world which lies approximately between 4° and 13° with landmass of 9.24 x 105 km^2 which enjoys an average daily sunshine of 6.25 hours, ranging between about 3.5 hours at the coastal areas to 9.0 hours at the far northern boundary (Bala, 2017). Its climate varies from tropical to subtropical. There are two main seasons; the dry season lasting from October to March and the rainy season lasting from April to October. In the north central Nigeria where Kogi State is part, it is hot and dry, rainy season extends between April and September. While in the southern Nigeria, it is hot and wet, rainy season extends between March and December. From December to March there is a long dry season (Ojo, 2014).

These facts and figures regarding geographical location of the Kogi State clearly indicate that the potential to generate significant amount of electrical energy from solar energy is very high. However, very little has been done in this direction as the government, corporate bodies and individual are yet to take pragmatic steps towards developing and implementing policies and plans that will serve as a base line on which solar energy utilisation can thrive; a development which (Nasir, 2016) attributed to lack of awareness of solar energy technologies, and as a result vast majority of the people resident in Kogi State rely on electricity supply from the Abuja Electricity Distribution Company (AEDC) which is short in supply and epileptic in nature. Awareness is a state of knowing and being informed of something. Hence, awareness level affects the adoption and utilisation of electrical energy behavior of consumers (Kang *et al.*, 2012). Adoption and utilisation of new solar energy technologies can become a very easy issue if the electricity consumer gains basic knowledge on it limitless potentials. This will drive consumers to pay more attention to solar energy technologies and most probably change their everyday behavior towards it (Thorgersen and Gronhoj, 2010). Awareness of solar energy technologies is an all-important element of electrical energy generation and utilisation, as lack of awareness will leads to underutilisation of the readily available resource and consequently leads to shortage of electricity supply (Choong *et al.*, 2019). Awareness helps to change attitudes thus encouraging users to seek out ways to generate and utilize energy.

Nasir, (2016) further reiterate that, apart from the general knowledge that the sun's radiation is used for drying clothes and food stuffs, majority of the people are not aware about the use of solar technologies to generate electricity, heat water and cook food. This is due to little or lack of education or sensitization in this regard. The lack of awareness of the potentials of solar energy for electricity utilisation results to low power supply which undoubtedly have impacted negatively on the economy of the people doing business in Kogi State especially the operator of Micro and Small Enterprise (MSEs). MSEs are defined in terms of number of employees. Hence Micro Enterprises is between 1 and 9 employees while Small Enterprises is between 10 and 49 employees. Considering the facts that MSEs plays a big role in the Nigerian economy and economies around the globe are also responsible for driving innovation and competition in many sectors, adopting solar energy technologies in order to enjoying an uninterrupted power supply will bring about positive impacts on the economic performance of the State. According to Odularu and Okonkwo (2016) investment into sustainable energy such as solar energy can contribute to economic performance in Nigeria particularly now that Nigeria's economy face deepening challenges: a widening trade imbalance, growing competition from developed countries, a collapse of big manufacturing companies, and a sharp increase in the cost of doing business. Also, the technical-know-how of technicians on solar energy technologies installation and maintenance has raised concern in the adoption and utilisation of solar technologies. Solar Installation Electricians are responsible for connecting solar equipment, such as panels and inverters, to a building's main power supply or to the region's electrical grid. They plan the layout of wiring and fixtures, do voltage testing and ensure that the system complies with all applicable city, county, state, and national codes. Electricians work at homes, businesses, and construction sites, and generally work as contractors. Therefore their competence will play a major role in the energy demand.

The energy demand in Kogi State will continue to increase as the Nigerian population continues to increase and as the energy demand per person increases due to fast urbanization. This means that the pressure on existing energy sources will continue to

increase which will negatively impact on the economy around the area. Solar energy provides the right platform to turn the negative trend of epileptic power supply around as solar energy has resource potential that far exceeds the entire global energy demand (Kurokawa *et al*, 2017)

II. PURPOSE OF THE STUDY

The purpose of the study is to investigate consumer's utilisation of solar energy technologies for electricity generation in kogi state, Nigeria. Specifically, the study assessed the level of awareness of consumers, the factors affecting the effective utilisation and the interventional strategies for effective utilisation of solar energy technologies for electricity generation and utilisation.

III. RESEARCH QUESTIONS

The following research questions guided the study:

1. What is the level of awareness of consumers on solar energy technologies for electricity generation and utilisation?
2. What are the factors affecting the effective utilisation of solar energy technologies for electricity generation?
3. What are the possible interventional strategies for the effective utilisation of solar energy technologies for electricity generation?

IV. HYPOTHESES

The following null hypotheses guided the study and were tested at 0.05 level of significance:

H_{O1}: There is no significant difference among the mean responses of electrician, residents and MSEs operators as regards the level of awareness of of solar energy technologies for electricity generation and utilisation.

H_{O2}: There is no significant difference among the mean responses of solar energy technicians, residents and MSEs operators as regards the perception of electricity consumers on the utilisation solar energy technologies for electricity generation.

H_{O3}: There is no significant difference among the mean responses of electrician, residents and MSEs operators as regards the possible interventional strategies for effective utilisation of solar energy technologies for electricity generation.

V. DATA AND METHODOLOGY

A. Study area, population and sample of the study

The study was carried out in Kogi State, Nigeria. Kogi State has a total land area of 27,747Km^2 (Geological Survey Division, 2014). The area lies approximately along latitude 7^0N and 6^0E and is bordered by ten states. The area receives abundant sunshine all the year round being just above the equator.

The population for the study was 936,736 respondents comprising of 136, 105 household heads, 800,431 Micro and Small enterprises (MSEs); 200 licensed electrician in Kogi. The population distribution for the study is shown in table 1 below:

Table 1: Population Distribution for the Study

S/N	Consumers	Population
1	House-hold	136, 105
2	MSEs operators	800,431
3	Electrician	200
Total		936,736

Source: Abuja Electricity Distribution Company (AEDC); The Small and Medium Enterprises Development Agency (SMEDAN)/National Bureau of Statistics (NBS) collaborative survey (2019) and Licensed Electricians Contractors Association of Nigeria (LECAN).

Multistage sampling technique was adopted for the study; cluster sampling techniques was used to group the population into the three geo-political zones in Kogi state namely Kogi East, West and Centre. Purposive sampling was then used to select one town each from the three geo-political zones namely Anyigba, Lokoja and Okene and simple random sampling technique was used to draw 394 respondents from the zones respectively with the distribution shown in table 2.

Table 2: Sample Distribution for the Study

S/N	ZONE	TOWNS	Population
1	East	Anygba	132
2	West	Lokoja	133
3	Centre	Okene	129
Total			394

B. Method of data collection and analysis

The instrument for data collection was a structured questionnaire titled Consumers Utilisation of Solar Energy Technologies for Electricity Generation (CUSETEG). CUSETEG consists of 47 items, developed after review of relevant literature and experts' opinion in notable solar energy consult. The questionnaire was divided into two parts (1 & 2). Part 1 contains items designed to obtain personal information of the respondents. Part 2 was divided into three clusters (A, B, C,). Cluster A contains 22 items on awareness, B consists of 15 items on factors affecting the effective utilisation of solar energy technologies and C has 10 items on interventional strategies for the effective utilisation of solar energy technologies for electricity generation. The questionnaire items were assigned a four-point response scale option of Strongly Agreed (SA)/Highly Aware (HA), Agree (A)/Aware (A), Disagree (D)/ Not Aware (NA) and Strongly Disagree (SD)/ Highly Not Aware (HNA) with a corresponding value of 4, 3, 2 and 1 respectively. The instrument was validated by three experts from Electrical/Electronic option of the department of Industrial and Technology Education, Federal University of Technology, Minna and the reliability coefficient of the instrument was found to be 0.78 using cronbach alpha.

The questionnaire was analyzed using mean and standard deviation. The weights assigned as indicated against the scale was used to compute the means and standard deviation scores of each item of the questionnaire and that of each of the clusters. Real limits of numbers and criterion mean were used to answer the research questions while analysis of variance (ANOVA) was used to test the hypotheses. The decision on each item was based on the following real limits of numbers: 0.50-1.49 = Strongly Disagree (SD)/ Highly Not Aware (HNA) 1.50-2.49 = Disagree (D)/ Not Aware (NA), 2.50-3.49 = Agree (A)/Aware (A), 3.50-4.00= Strongly Agreed (SA)/Highly Aware (HA). ANOVA was used to test the significant difference between the mean scores of the respondents. The qualitative interpretation of the means scores of the respondents is presented on the tables below:

VI. RESULTS

Research Question 1: What is the level of awareness of consumers on solar energy technologies for electricity generation and utilisation?

Table 1: Mean and Standard Deviation of Respondents Responses on the level of awareness of consumers on solar energy technologies for electricity generation and utilisation

S/N	Description/Item Statement	$\bar{x}_R$	SD	Remark
1	Solar technologies operation is noiseless	3.22	0.86	A
2	Solar technologies has infinite energy source	3.11	0.94	A
3	Solar technologies has a very high life span	3.22	0.97	A
4	Solar technologies are environmentally friendly in nature with respect to release of greenhouse gases, global warming, ozone layer depletion	3.29	0.63	A
5	Solar energy technologies is convenient, safe and has no monthly bills after initial investment	3.60	0.48	HA
6	Solar energy technologies could help address energy access for MSEs and domestic use	3.59	0.49	HA
7	Concentrating solar power plants provide the lowest cost power of any solar technology	3.20	0.87	A
8	Photovoltaic (PV) panels are available in different sizes or modules over a wide range of power rating	3.19	0.59	A

9	Concentrated Solar Power will decrease global warming	3.40	0.66	A
10	Investment in solar technologies for electricity generation saves money since there are no monthly bills after initial investment	3.29	0.63	A
11	Generating electrical energy through PV and CSP systems have low operational and maintenance cost	2.87	0.82	A
12	Solar energy technologies produces no smoke like gasoline generators when generating electricity	3.29	0.77	A
13	Solar power plants can last more than 35 years	3.01	0.78	A
14	Solar panels actually work more efficiently in colder temperatures because excessive heat can reduce output voltage	3.19	0.59	A
15	The solar panels generally increases home values	3.60	0.48	HA
16	Concentrating solar power system has Shorter energy-payback period	3.19	0.97	MA
17	Solar energy technology can be embraced by people across an entire sociopolitical spectrum	3.50	0.50	HA
18	Solar panels are generally sleek, compact and fit neatly against the roof	3.39	0.66	A
19	Power generated through solar energy technologies can be used for pumping of water and operates electronics appliances	3.41	0.66	A
20	Solar energy technologies allow you to enjoy 24 hours power supply with the aid of battery	3.09	0.82	A
21	With the use of solar technologies, I can power my home when the power from the grid system goes out	3.07	0.83	A
22	Concentrated Solar Power creates recyclable energy	2.79	1.07	A

Note: N = Number of respondents; $\bar{x}_R$ = mean; SD = Standard Deviation; HA = Highly Aware; A = Aware

Data in Table 1 revealed that four out of the 22 level of awareness items had their mean values within the real limit of 3.50 – 4.00, indicating that electricity consumers are highly aware of the 4 awareness items on solar energy technologies for electricity generation and utilisation. Similarly, the data further revealed that eighteen (18) items had their mean values within the real limit of 2.50 – 3.49, indicating that the consumers are awareness of 18 of items on solar energy technologies for electricity generation and utilisation. All the 22-standard deviation on each item were within the real limit of 1.96 indicating that the respondents were not too far from the mean response of one another in their responses.

Research Question 2: What are the limiting factors affecting the effective utilisation of solar energy technologies for electricity generation?

Table 2: Mean and Standard Deviation of Respondents Responses on the limiting factors affecting the effective utilisation of solar energy technologies for electricity generation.

S/N	Description/Item Statement	$\bar{x}_R$	SD	Remark
1	Absence of establishment such as renewable energy data recording stations amongst others	3.32	0.77	A
2	High propensity to theft	3.10	0.53	A
3	Has initial high costs of purchase and installation	2.87	0.70	A
4	Solar technologies require high up frontal capital cost compared to its conventional energy alternatives	3.10	0.53	A
5	Solar technologies require large expanse of land for their installation	3.11	0.94	A
6	Some PV panels are characterized with low efficiencies	2.70	0.89	A
7	Absence of equipped laboratories/research centers for solar PV research	2.99	0.99	A
8	Lack of credit facilities to purchase solar technologies	3.19	0.86	A

9	Lack of manpower and the desired technological skills to manage solar energy technologies efficiently	3.70	0.45	SA
10	Limited application of solar energy technologies domestically and commercially	3.10	0.53	A
11	Limited or few service providers of solar energy technical services	3.22	0.74	A
12	Several counterfeit solar energy technologies goods on the market	3.29	0.64	A
13	Low level of awareness on the huge health, socio-economic and environmental benefits derivable from solar energy use	3.37	0.68	A
14	Lack of effective national energy policy	3.19	0.74	A
15	Lack of financial and fiscal incentives towards the utilisation of solar technologies	3.01	1.00	A

Note: *N = Number of respondents;* $\bar{x}_R$ *= mean; SD = Standard Deviation; A = Agree; SA = Strongly Agree.*

Data in Table 2 revealed that one out of the fifteen items had it mean values within the real limit of 3.50 – 4.00, indicating that the one limiting factors affecting the effective utilisation of solar energy technologies for electricity generation was strongly agreed. Similarly, the data further revealed that fourteen items had their mean values within the real limit of 2.50 – 3.49, indicating that 14 items were agreed on the limiting factors affecting the effective utilisation of solar energy technologies for electricity generation. Fourteen items had their standard deviation within the real limit of 1.96 indicating that the respondents were not too far from the mean or from one another in their responses.

Research Question 3: What are the interventional strategies for the effective utilisation of solar energy technologies for electricity generation?

Table 3: Mean and Standard Deviation of Respondents Responses on the interventional strategies for the effective utilisation of solar energy technologies for electricity generation.

S/N	Description/Item Statement	$\bar{x}_R$	SD	Remark
1	There is need to put in place an effective mechanism to check the entry of counterfeits, because they affect public confidence in the solar technologies available on the market	3.29	0.63	A
2	Information concerning the development, applications, dissemination and diffusion of solar energy resource and technologies should be stepped up through; the media, mobile networks, schools and so on.	3.27	0.65	A
3	Subsidized cost of importation of solar PV devices by Government	3.19	0.59	A
4	Eradication or reduction of poverty level to the Barest minimum by the Government so that people can afford to invest in solar energy technologies	3.41	0.66	A
5	Introduction of renewable energy incentives similar to the "feed-in-tariffs" by the Government to enhance increased consumption of renewable energy such as solar energy	3.10	0.69	A
6	Provision of soft loans and financial assistance by financial institutions, government and non-governmental organizations to individuals so that people can afford to invest in solar energy technologies	2.92	1.05	A
7	Sensitization programme through mass media to increase the level of awareness on the merit of investment of consumption of renewable energy products such as solar technologies	2.80	0.74	A
8	Establishment of Research centers on renewable energy technology and properly equipped existing ones	2.68	0.99	A

9	Placing restrictions on the importation of diesel and petrol engine generators by the government because of its adverse effects on the environment	2.60	0.91	A
10	Funding of solar technology researches and development initiatives in higher institutions so as to develop solar PVs with increased efficiency that will be adaptable to our environment	3.40	0.79	A

Note: *N = Number of respondents;* $\bar{x}_R$ *= mean; SD = Standard Deviation; A = Agree.*

Data in Table 4.5 revealed that all the 10 items had their mean values within the real limit of 2.50 – 3.49, indicating that all the interventional strategies for the effective utilisation of solar energy technologies for electricity generation were strongly agreed. Similarly, ten (10) items had their standard deviation within the real limit of 1.96 indicating that the respondents were not too far from the mean or from one another in their responses.

Hypothesis 1

There is no significant difference among the mean responses of electrician, residents and MSEs operators as regards the level of awareness of solar energy technologies for electricity generation and utilisation.

Table 4: One way analysis of variance summary table showing the difference among the mean responses of electrician, residents and MSEs operators as regards the level of awareness of of solar energy technologies for electricity generation and utilisation.

	Sum of Squares	*Df*	Mean Square	F	Sig.	Remark
Between Groups	.488	2	.244	.014	.986	NS
Within Groups	5385.574	305	17.658			
Total	5386.062	307				

(P<0.05)NS = No Significant

Table 4 revealed that there was no significant difference (P<0.05) in the mean ratings of the respondents. Therefore, the null hypothesis is accepted.

There is no significant difference among the mean responses of electrician, residents and MSEs operators as regards the limiting factors affecting the effective utilisation of solar energy technologies for electricity generation.

Hypothesis 2

Table 5: One way analysis of variance summary table showing the difference among the mean responses of electrician, residents and MSEs operators as regards the limiting factors affecting the effective utilisation of solar energy technologies for electricity generation.

	Sum of Squares	Df	Mean Square	F	Sig.	Remark
Between Groups	.448	2	.224	.010	.990	NS
Within Groups	6841.432	305	22.431			
Total	6841.880	307				

(P<0.05)NS = No Singnificant

Table 5 revealed that there was no significant difference (P<0.05) in the mean ratings of the respondents. Therefore, the null hypothesis is accepted.

Hypothesis 3

There is no significant difference among the mean responses of electrician, residents and MSEs operators as regards the possible interventional strategies for

effective utilisation of solar energy technologies for electricity generation.

Table 6: One way analysis of variance summary table showing the difference among the mean responses of electrician, residents and MSEs operators as regards the possible interventional strategies for effective utilisation of solar energy technologies for electricity generation.

	Sum of Squares	Df	Mean Square	F	Sig.	Remark
Between Groups	1.094	2	.547	.067	.935	NS
Within Groups	2483.020	305	8.141			
Total	2484.114	307				

(P<0.05)NS = No Significant

Table 6 revealed that there was no significant difference (P<0.05) in the mean ratings of the respondents. Therefore, the null hypothesis is accepted.

VII. DISCUSSION OF FINDINGS

The finding relating to research question one revealed that the respondents are highly aware of 4 items and are also aware of the remaining 18 items which is indicative of the fact that the consumers are aware of solar energy technologies for electricity generation and utilisation. The findings of the study on awareness of consumers on solar energy technologies are in agreement with the findings of Britt and Wiedeman (2012) that ascribe solar energy technologies prominence to its potentials in addressing energy access for MSEs and domestic use**,** increase in home values and the fact that it can be embraced by people across an entire sociopolitical spectrum, and that it is safe and has no monthly bills after initial investment.

Similarly, the findings of the study is also in conformity with the findings of Lawal (2010)**,** which found that, investment in solar technologies for electricity generation saves money since there are no monthly bills after initial investment. The findings however does not corroborate with the findings of Wani and Pandya, (2016) who observed that students in Vadodara city do not possess enough knowledge regarding the solar policies and solar technologies. The findings of van Rijinsoever and Farla (2014) that revealed that public acceptance is becoming more prominent, due to the development of societies where scientific information is more accessible to the public could justify the reason for high level of awareness among the respondents for this study. Also, Sambo *et.al* (2010) assertion that the massive load shedding that result to most supply of electricity to be for only few hours a day has constituted a major obstacle which undoubtedly has increased the quest for alternative power sources among the teaming populace and has consequently increased the awareness level.

The finding relating to research question two showed that the respondents highly agreed to one; while the remaining 14 items were agree as a limiting factor affecting the effective utilisation of solar energy technologies for electricity generation. The findings of the study on the limiting factors affecting the effective utilisation of solar energy technologies were in consonance with the findings of Roman and Alan (2016) who revealed that lack of manpower and the desired technological skills to manage new technologies efficiently affects the adoption of a the technology. Similarly, the findings of the study is also in line with the findings of Adeleke and Akinbode (2016) who found that absence of establishment and data recording stations amongst others impose serious setbacks on the research and applications of renewable energy related products.

The finding to research question three showed that the respondents agreed to all the ten items as regards to interventional strategies for the effective utilisation of solar energy technologies for electricity generation. The findings of the study on the interventional strategies for the effective utilisation of solar energy technologies are in consonance with the findings of

Abdullahi *et al*. (2017) found out that increased publicity concerning the development, applications, dissemination and diffusion of solar energy resource and technologies the media, mobile networks, schools and so on can bring about good knowledge of the importance of utilizing solar technologies. Similarly, the findings of Sampaio *et al*. (2017)**,** also agreed with the finding of the study that, revealed that actions such as subsidy of cost of importation of solar PV devices by the government, provision of soft loans and financial assistance by the government and non-governmental organizations to individuals, funding of solar technology researches and development initiatives in higher institutions so as to develop solar PVs with increased efficiency that will be adaptable to our environment among others can increase renewable energy use. In addition, the study of Saka *et al.* (2017) which showed a clear correlation between energy consumption and living standards and the quest for improved power supply in the area could justify the reason for opinions of the respondents on the interventional strategies for effective utilisation of solar energy.

VIII. CONCLUSION AND RECOMMENDATIONS

It is evident from the study that the consumers of electricity in the study area are aware of the potentials of solar energy technologies for electricity generation. This can be attributed to the fact that solar energy technologies have become increasingly more popular due to their economic benefits and in view of the fact that with a battery backup, solar energy can even provide all day long steady supply of electricity, even on cloudy days and at night. There is no doubt that solar energy has more benefits compared to other forms of energy like fossils fuels and petroleum deposits. It is an alternative which is promise and consistent to meet the high energy demand.

The conclusions drawn from this study therefore, show that large proportions of the respondent demonstrate high awareness of solar energy technologies for electricity generation and utilisation. The following recommendations were made based on the findings of the study;

1. Renewable stakeholders should commit themselves in funding solar energy technologies as well as training many people on the operations of the technologies so as to develop the capabilities to liberate Nigeria from depending on fossil fuel as the only alternative to generate electricity in various households. This will further create access to diverse energy sources.
2. Relevant agencies should be committed it to creating an enabling environment for the private sectors to operate successfully in using RETs to generate electricity as this will facilitate easier access to electricity in various communities since it has been established that consumers are willing to pay more once there is stable electricity supply.
3. Effective mechanism to check the entry of counterfeits should be put in place as counterfeit products affect public confidence in the solar technologies available on the market.

REFERENCES

[1] Abdullahi, D., Suresh, S., Renukappa, S., &Oloke, D. (2017). Solar Energy Development and Implementation in Nigeria: Drivers and Barriers. In *IEA SHC International Conference on Solar Heating and Cooling for Buildings and Industry* (pp. 1-9).

[2] Adeleke, S. O., & Akinbode, S. O. (2016). Analysis of Households' Demand for Alternative Power Supply in Lagos State, Nigeria.*Current Research Journal of Social Sciences*, 4(2), 121-127

[3] Bala, E., Ojosu, J., Umar, I. (2000). Government policies and programmes on the development of solar-PV Sub-sector in Nigeria. *Nigerian Journal of Renewable Energy* 8(1&2), 1-6.

[4] Britt, D. M., Wiedeman, M. (2012). Photovoltaic technologies.*Energy Policy*, *36*(12), 4390-4

[5] Choong, C. K., Lau, L. S., Ng, C. F., Liew, F. M., & Ching, S. L. (2019). Is nuclear energy clean? Revisit of Environmental Kuznets Curve hypothesis in OECD countries. *Economic Modelling*, *77*, 12-20. http://ezinearticles.com

[6] Geological Survey Division, (2014). Geological Map of Nigeria. Publication, Federal Ministry of Mines and Power, Nigeria.

[7] Kang, M. H., Kim, H. Y., Kwon, S. H., Lee, J. S., Choi, Y. S., Chung, H. R., …& Kwak, T. K.

(2012). Development of a nutrition quotient (NQ) equation modeling for children and the evaluation of its construct validity. *Journal of Nutrition and Health*, *45*(4), 390-399.

[8] Kurokawa A.S., Garba, B., Zarma, I.H., and Gaji, M.M. (2017). Electricity Generation and the Present Challenges in the Nigerian Power Sector. Energy Commission of Nigeria.

[9] Lawal Nadabo, S. (2010). Renewable Energy as a Solution to Nigerian Energy Crisis.

[10] Nasir, A. (2016). A Technology for Helping to Alleviate the Energy Problems; Solar Energy for Cooking and Power generation. *paper presented at 8th annual Engineering conference of Federal University of Technology, Minna.*

[11] Odularu, G. O., Okonkwo, C. (2016). Does Energy Consumption Contribute to Economic Performance? Empirical Evidence from Nigeria. J*ournal of Economics and International* Finance Vol. 1, Issue 2, Pp. 44-58.

[12] Oji, J. O., Idusuyi, N., Aliu, T. O., Petinrin, M. O., Odejobi, O. A., & Adetunji, A. R. (2012). Utilisation of Solar Energy for Power Generation in Nigeria. *International Journal of Energy Engineering*, *II*(2), 54-59.

[13] Ojo, O. (2014). *Fundamentals of Physical and Dynamic Climatology*. (First, Ed.) Lagos, Nigeria,: SEDEC Publishers.

[14] Rochell, M. (2010). *The History of Solar power today*. http://enzinearticles.com

[15] Roman, J., Alan, P.K. (2016). *Solar Energy Technologies Program: Accelerating the Future of Solar.* Proceedings of the Technology Commercialization Showcase, Washington, DC.

[16] Saka, A. B., Olawumi, T. O., & Omoboye, A. J. (2017). Solar photovoltaic system: a case study of Akure, Nigeria. *World Scientific News*, *83*, 15-28.

[17] Sambo A.S. 2012. Renewable energy policy and regulation in Nigeria. Paper Presented at the International Renewable Energy Conference, Abuja, October.

[18] Sambo, A.S. (2009). Renewable Energy Technology for National Development: Energy Crisis in Nigeria. The Way Forward. *Proceedings of the Annual General Meeting of the Nigerian Society of Engineers. Bauchi branch*.

[19] Sampaio, P. G. V., & González, M. O. A. (2017). Photovoltaic solar energy: Conceptual framework. *Renewable and Sustainable Energy Reviews*, *74*, 590-601.