



Awareness of Residents, Micro and Small Enterprise Operators in Kubwa on the Potentials of Solar Energy as Supplementary Source to Conventional Energy

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Abstract

The study investigated the awareness of residents, Micro and Small Enterprise (MSEs) in Kubwa on the potentials of solar energy for electrification. A descriptive survey design was used. The population used for the study comprised all residential buildings and commercial centers in Kubwa, Abuja. The sample for the study was 130 respondents comprised 100 households and 30 MSEs. A structured questionnaire titled 'Awareness of Solar Energy Potentials Questionnaire (ASEPQ)' was used for data collection. 30 respondents were used for trial test of the instrument and the reliability coefficient of the instrument was found to be 0.78 using cronbach alpha. Data from the instrument was analyzed using mean and standard deviation while t-test was used to test hypotheses at 0.05 level of significance. The results revealed that there is no significant difference between the responses of residents and MSEs. Hence, the study recommends government-private partnership among others.

Keywords: Awareness, Solar Energy, Potentials, Conventional, Supplementary.

Introduction

Solar power is a non-conventional 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 if harnessed by modern technologies such as photovoltaic (PV) for electricity generation. 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. Since solar power is silent, inexhaustible, and non-polluting, Nasir (2016) believes that the utilization of such energy (solar) using the appropriate technologies will lead to a far more sustainable living and productivity than the conventional sources of energy. The conventional sources of energy like the fossil fuel, nuclear power among others are finite in nature and pose severe threats to man's environment. From an environmental perspective, solar power is the best substitute. A 1.5 kilowatt photo-voltaic (PV) system will keep more than 110,000 pounds of carbon dioxide, the chief greenhouse gas, out of the atmosphere over the next 25 years. The same solar system will also avoid the need to burn 60,000 pounds of coal. With solar, there's no acid rain, no urban smog, no toxic waste or pollution of any kind (Alternative energy solutions for the 21st century, 2016).

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, hydro power generation in Nigeria is characterized with massive load shedding in such a manner that most supply is only for a few hours a day, implying that the country indeed is in a crisis as far as electricity supply is concerned (Sambo, 2018).

The importance of electricity in the development process of any nation is well known and cannot be over-emphasized. Suitable supply of electricity is an important factor in the production process and indispensable factor in social and economic development and overall worth of life of the population. Unfortunately, the supply of electricity, undoubtedly, fall short of demand in Kubwa and the energy sources for modern world is under-utilized.

Kubwa is a residential district in Bwari, one of the area councils in the Federal Capital Territory of Nigeria. It is one of the major suburbs within the metropolitan area of Abuja. The Community has been in existence since 1990 as a satellite town of Abuja. The Gbagi people were the original residents, but Kubwa community became an entirely new and heterogeneous community as a result of government policy on relocation of the Gbagi people, having the three major ethnic groups Hausa, Yorubas, Igbos and other ethnic minorities as the main inhabitants of the community; they are mainly civil servants, businessmen and women, artisans and entrepreneurs (Wikipedia, 2019) who rely on electricity supply from the Abuja



Electricity Distribution Company (AEDC) which is short in supply and at best epileptic in nature for domesticity and running of their Micro and Small Enterprise (MSEs) such as restaurants, hair/barbing saloons, provision stores, mechanic workshops, bakery/eateries, block industries, shoemakers/vendors, and furniture industries. Considering the facts that MSEs plays a big role in the livelihood of many Nigerians and the economy, adopting solar energy technologies in order to enjoying an uninterrupted power supply for both residents and MSEs operators in Kubwa will bring about positive impacts on the economic performance of the area. There is therefore the need to adopt electricity from solar energy source as supplementary to the supply from the AEDC and fossil fuel generators which is characterized with carbon emission (smoke).

Supplementary or Alternative energy refers to energy sources that have no unwanted consequences. They are renewable and are thought to be free energy sources. They all have low carbon emissions, compared to conventional energy sources like fossil fuel and nuclear power. They include Biomass Energy, Wind Energy, Solar Energy, Geothermal Energy, Hydroelectric Energy sources. Incorporated with the use of recycling, the use of clean alternative energies such as the home use of solar power systems will help ensure man's survival into the 21st century and beyond (Alternative energy solutions for the 21st century, 2016).

Electricity is pivotal to the development of any nation. Its use is directly correlated with healthy economic growth (Kaseke & Hosking, 2013). Nigeria is one of the most populated countries in Africa but only about 40% of the people are connected to the energy grid (Aliyu *et al.*, 2013). Nigeria has one of the lowest per capita net electricity generations in the world owing to the effect of the electricity crisis situations in the country (Ozoegwu *et al.*, 2017). The continuous absence of reliable and affordable electricity supply in the country has always been a challenge to the entire economic growth, which in turn, has effects on the standard of living of the people. The situation is bad and should be of concern to researchers and the entire public. Kubwa is an integral part of the Federal Capital Territory and is faced with the energy crisis. Thus, there is a need to integrate solar energy, being a renewable source of energy into the system to serve as supplementary

source so as to ensure improved power supply to the people of the area.

Purpose of the Study

The purpose of the study is to investigate the awareness level of residents, Micro and Small Enterprise (MSEs) in Kubwa on the potentials of solar energy as supplementary source to conventional energy sources. Specifically, the study determined: The awareness of solar energy, challenges of utilizing solar energy, ways of utilizing solar energy as perceived by residents, Micro and Small Enterprise (MSEs) in Kubwa, Abuja.

Research Questions

Three research questions that guided the study are:

1. What is the level of awareness of the potentials of solar energy?
2. What are the challenges of utilizing solar energy?
3. What are the ways of utilizing solar energy, as a supplementary to other conventional sources in Kubwa, Abuja?

Hypotheses

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

- H₀₁:** There is no significant difference in the mean awareness response of the residents of Kubwa-Abuja and the MSEs on the potentials of solar energy
- H₀₂:** There is no significant difference in the mean response of the residents of Kubwa-Abuja and the MSEs on the challenges of utilizing solar energy
- H₀₃:** There is no significant difference in the mean response of the residents of Kubwa-Abuja and the MSEs on the ways of utilizing solar energy, as a supplementary to other conventional sources

Data and Methodology

Study area, population and sample of the study

Kubwa is a residential district in Bwari, one of the area councils in the Federal Capital Territory of Nigeria. It is one of the major suburbs within the metropolitan area of Abuja with latitude 9.1596°N, 7.3386°E (Abubakar, 2015). According to the National Population Census (2006), the population of Kubwa is about 12,183 people. The dominant tribe in the area is Gbagi otherwise known as Gwari. The



Gwari people are the indigenous tribe in the area but various other Nigerian tribes from different parts of the country moved to Kubwa as a result of resettlement scheme in the area. The area is now socially heterogeneous with people divergent tribes exhibiting divergent cultures and traditions. Other minority tribes in the area include Koro, Gwardara, Gada, Hausa/Fulani, Igbo and Yoruba.

The population used for this study comprised all residential buildings and MSEs operators in Kubwa-Abuja. In order to obtain a representation of the population, stratified random sampling of households and MSEs in the study area was adopted based on the zones in the study area to select a sample of 130 respondents comprising of 100 households and 30 MSEs. The number of questionnaires administered in each zone is proportional to the population size of the zone. **Table 1** below shows the number of questionnaire administered in each administrative zone.

Table 1: Administrative Zones in Kubwa

Zones	Population Size	No. of Questionnaire	%
Phase 1	1,063	21	17%
Phase 2	4,029	34	17%
Bhyzin	1,077	21	24%
Gbanzango	3,012	27	21%
Kubwa town	3,002	27	21%
Total	12,183	130	100

Method of data collection and analysis

The instrument for data collection was a structured questionnaire titled Awareness of Solar Energy Potentials Questionnaire (ASEPQ) divided into two sections: Section A contains personal data of the respondents while section B contains the items of the questionnaire structured into three clusters: A, B and C.

Cluster A contains ten (10) items dealing with the potential of solar energy; Cluster B contains fourteen

(14) items dealing with Challenges of utilizing solar energy in Kubwa and Cluster C contains eleven (11) items dealing with Ways of utilizing solar energy as a supplementary to conventional sources in Kubwa-Abuja. The questionnaires were administered to residents and operators of micro and small enterprises in Kubwa that were selected. A four-point scale type questions were used to get the needed information from the respondents, mainly Strongly Agree [4], Agree [3], Disagree [2], and Strongly Disagree [1]. 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.

In carrying out this study, the descriptive survey research design was adopted. According to Fox and Bayat (2007) descriptive survey is considered most appropriate for a study that is “aimed at casting light on current issues or problems through a process of data collection that enables them to describe the situation more completely than was possible without employing this method”. The data gathered was analyzed using mean and standard deviation. t-test was used to test the significant difference between the mean scores of residents and MSEs. The cut-off mean score was fixed at 2.50, as a benchmark. Any item with a mean score of 2.50 and above was regarded agreed while any mean below 2.50 was regarded as disagreed. The qualitative interpretation of the means scores of the respondents is presented on the tables below:

Results

Research questions 1: What is the level of awareness of the potentials of solar energy?

Table 2: Awareness of residents and MSEs in kubwa on the potentials of solar energy

N1=100 N2=30								
S/N	ITEMS	\bar{X}_1	SD	\bar{X}_2	SD	\bar{X}_t	SD	Dec.
1	Solar energy can be used to power residential buildings	3.59	.75	3.64	.63	3.62	.71	A
2	Solar energy provides electricity without dangerous gas emissions	3.39	.85	3.43	.67	3.41	.79	A
3	solar energy is dependable form of renewable energy due to its availability for usage	3.54	.66	3.57	.55	3.56	.63	A



4	Solar energy serves as an alternative to gasoline and diesel generators in Kubwa	3.50	.54	3.57	.51	3.54	.53	A
5	solar energy utilization is not affected by dwindling oil price in the country	3.47	.62	3.57	.52	3.52	.58	A
6	Solar energy utilization can boost the economy of Kubwa	3.47	.62	3.57	.52	3.52	.58	A
7	Solar energy utilization assures one of stable electricity supply	3.37	.69	3.43	.70	3.40	.80	A
8	Solar energy utilization will provide employment opportunity for the people of Kubwa	3.46	.91	3.54	.71	3.50	.86	A
9	Solar energy utilization will promote industrialization in Kubwa	3.46	1.02	3.43	.75	3.45	.96	A

Key: N1= number residents, N2= number of MSEs, \bar{X}_1 = mean response of residents, \bar{X}_2 = mean response of MSE, \bar{X}_t = average mean of residents and MSEs, SD= Standard Deviation, Dec. = Decision, A= Agree
The table above shows that item no 1 came up with the highest total mean value with a mean value of 3.62 followed by items 3, 4, 5, 6, 9, 2, and 7 with total mean values of 3.56, 3.54, 3.52, 3.52, 3.45, 3.41

and 3.40 respectively. The items were all accepted as their mean were more than 2.50.

Research Question 2: What are the challenges of utilizing solar energy in Kubwa, Abuja?

Table 3: Awareness of residents, and MSEs in kubwa on challenges of utilizing solar energy

N1=100 N2=30								
S/N	ITEMS	\bar{X}_1	SD	\bar{X}_2	SD	\bar{X}_t	SD	Dec.
1	Lack of adequate technical competence	3.59	.62	3.61	.46	3.60	.57	A
2	Political instability	3.39	.83	3.32	.61	3.36	.77	A
3	Thieves are threats to solar energy installations	3.56	.55	3.46	.51	3.51	.54	A
4	The economic situation in the country is a barrier to utilization of solar energy	3.49	.74	3.50	.61	3.50	.71	A
5	The cost of installing solar energy source for private use	3.57	.77	3.64	.69	3.61	.75	A
6	Lack of knowledge of solar energy	3.53	.72	3.61	.56	3.57	.67	A
7	Poor interest	3.58	.71	3.64	.56	3.61	.66	A
8	Overreliance on the government	3.36	.78	3.29	.60	3.33	.72	A
9	High cost of maintenance of solar energy installations	3.54	.70	3.39	.66	3.47	.69	A
10	Lack of foreign investors in the energy sector	3.64	.46	3.64	.73	3.64	.87	A
11	Corruption in the energy sector	3.75	.63	3.71	.82	3.73	.73	A
12	Some energy consumers are not willing to pay	3.65	.76	3.68	.82	3.67	.80	A
13	Some energy workers are not ready to upgrade their knowledge	3.57	.68	3.61	.80	3.59	.77	A

Key: N1= number residents, N2= number of MSEs, \bar{X}_1 = mean response of residents, \bar{X}_2 = mean response of MSE, \bar{X}_t = average mean of residents and MSEs, SD= Standard Deviation, Dec. = Decision, A= Agree

The table shows the perceived challenges of utilizing solar energy in Kubwa-Abuja. The items were all accepted as their mean were more than 2.50. Item 12 came up with the highest total mean value (3.73), which is indicative of the fact that the respondents



believed that the increase in corruption in the energy sector is the major challenge in the utilization of solar energy in the study area.

Research Question 3: What are the ways of utilizing solar energy as a supplementary to conventional energy sources in Kubwa-Abuja?

Table 4: Awareness of residents and MSEs in Kubwa on the ways of utilizing solar energy as supplementary to conventional energy source

N1=100 N2=30								
S/NO	ITEMS	\bar{X}_1	SD	\bar{X}_2	SD	\bar{X}_t	SD	Dec.
1	Solar water heaters for homes	3.70	.61	3.79	.78	3.75	.74	A
2	Solar standing fan	3.83	.61	3.82	.63	3.83	.65	A
3	Solar lanterns	3.58	.59	3.68	.57	3.63	.60	A
4	Solar operated lighting unit for homes	3.76	.79	3.79	.77	3.78	.81	A
5	Solar system for water pumping	3.47	.90	3.57	.68	3.52	.71	A
6	Solar powered charging outlets for public charging of phones	3.55	.90	3.57	.73	3.56	.85	A
7	Solar power boilers can be installed in the homes	3.48	.57	3.57	.78	3.53	.87	A
8	Solar energy can be used to power offices	3.68	.56	3.68	.57	3.68	.60	A
9	Solar energy can be used to power schools	3.46	.55	3.54	.50	3.50	.57	A
10	Solar energy can be used for pumping water	3.64	.65	3.68	.63	3.66	.55	A

Key: N1= number residents, N2= number of MSEs, \bar{X}_1 = mean response of residents, \bar{X}_2 = mean response of MSE, \bar{X}_t = average mean of residents and MSEs, SD= Standard Deviation, Dec. = Decision, A= Agree. The above table show the respondents' perceived way of utilizing solar energy as a supplementary to conventional sources of electricity in Kubwa, Abuja. Most believed that the use of solar standing fan for homes is a very good way of utilizing the solar energy as a supplementary to the existing hydro power in the study area. Item no 2 comes first followed by items no 4, 1, 8, 10, 3, 6, 7, 5 and 9 with total mean values of 3.78, 3.75, 3.68, 3.66, 3.63, 3.56, 3.53, 3.52 and 3.50 respectively.

Hypothesis 1: There is no significant difference between the responses of residents and MSEs operators on the potentials of solar energy?

\bar{X}	S.D	N	t-cal	t-crit	Rmk
3.53	0.08	95	0.126	1.98	NS
3.47	0.07	28			

The result of hypothesis one shows that there is no significant difference between the responses of residents and MSEs operators on the potentials of solar energy. The t-cal value is 0.126 and t-critical of

1.98. Therefore, the null hypothesis is accepted.

Hypothesis 2: There is no significant difference between the responses of residents and MSEs operators on the challenges of utilizing solar energy in Kubwa, Abuja?

\bar{X}	S.D	N	t-cal	t-crit	Rmk
3.56	0.10	95	0.85	1.98	NS
3.54	0.14	28			

This table shows the t-test analysis of responses of residents and MSEs operators on the challenges of utilizing solar energy in Kubwa, Abuja. The result shows that there is no significant difference in the responses of residents and MSEs operators with a t-cal of 0.85 and t-critical of 1.98.

Hypothesis 3: There is no significant difference between the responses of residents and MSEs operators on the ways of utilizing solar energy as a supplementary to hydro-electric power in Kubwa Abuja?

\bar{X}	S.D	N	t-cal	t-crit	Rmk
3.61	0.13	95	0.32	1.98	NS
3.67	0.10	28			



This table shows the analysis of the result of respondents' responses on the ways of utilizing solar energy as a supplementary to hydro-electric power in Kubwa, Abuja. The result shows that there is actually no significant difference in their responses. The t-cal is 0.32 and t-critical value of 1.98. Therefore, the null hypothesis is accepted.

Discussion of findings

The result from table 2 shows that both residents, Micro and Small Enterprise (MSEs) in Kubwa are aware of the potentials of solar energy being an alternative form of power supply in the area; they are aware that solar energy can be used to power residential buildings with the use of panels and solar cells, solar energy produces electricity without dangerous gas emissions, solar energy utilization will promote industrialization in Kubwa. The result from table 3 also shows that the respondents are aware and agreed that Corruption in the energy sector, lack of adequate technical competence among others are the major challenges that hinder utilization of solar energy source in the area. In addition, the result from table 4 shows that the respondents are aware and agreed that the use of solar standing fan, solar operated lighting unit for homes, solar powered water pump, solar water heaters for homes, are some of the ways of utilizing solar energy as a supplementary to conventional energy source in Kubwa.

These findings do not corroborate with Akinboro *et al.* (2013) study that discovered that the awareness on solar energy as alternative power source was low among the people. The findings of Ismail *et al.* (2015) study that there is a clear correlation between energy consumption and living standards and the quest for improved power supply in the area could justify the reason for high level of awareness among the respondents for this study. Amaefule (2012) noted 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. This undoubtedly has increased the quest for alternative power sources among the teeming populace.

Conclusion and Recommendations

The study which looked into the awareness of residents, Micro and Small Enterprise (MSEs) in Kubwa on the potentials of solar energy as supplementary source for electrification shows that both residents, Micro and Small Enterprise (MSEs) in

Kubwa are aware of the potentials of solar energy being an alternative form of conventional energy sources of power supply in the area. They are also aware that if solar energy is utilized in kubwa as supplementary source for electrification, it will help to boost the economy of the town by attracting more business opportunities and investors. Furthermore, they are also aware of the numerous challenges facing the efficient utilization of solar energy in the area.

Based on the findings of this study, the following recommendations are made. First government-private partnership should be encouraged to enable private investment in solar energy generation in Kubwa. Secondly, favorable policies as well as protection of solar energy installations should be enhancement by security agents in the area. In addition, awareness on the need for utilization of solar energy as supplementary source for electricity generation in kubwa should be intensified.

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