ENVIRONMENTAL IMPACT OF SOLAR ENERGY USE AMONG RESIDENTS OF BIG QUA TOWN, CALABAR MUNICIPALITY, CROSS RIVER STATE.

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Abstract:
This study investigated the environmental impact of solar energy use among residents of Big Qua town, Calabar Municipality, Cross River State. One hypothesis was formulated, and literature review of relevant works were consulted while the theoretical framework explored, considered and anchored on, was The Social Impact (SIT) theory by Bibb Latane. The survey research was adopted for this study and the instrument used for data collection was a self-designed structured 10-item questionnaire with two sections titled Impact of Solar Energy Usage Questionnaire (ISEUQ) and administered to a total of 316 residents of Big Qua Town. The proportionate random sampling technique was used for this study with a purposive sample of 0.5% of estimated population which is 316. Analysis of variance (ANOVA) was the statistical tool used to analyse data and the results at 0.05 level of significance, which showed that environmental impact significantly influenced energy usage of residents of Big Qua Town, Calabar Municipality in Cross River State and that the positive aspects of environmental impact of solar energy usage far outweighs the negative environmental impact that may be associated with solar energy usage. Based on the findings, it was recommended that more persons should be encouraged to use solar energy as it is more environmentally friendly than other energy sources.
Key words: environment, impact, energy, solar, usage, residents.

Introduction and Background

The epileptic power supply in the country has led some residents to explore alternatives like solar energy usage with possible environmental concerns about its impact among residents like those of Big Qua Town in Calabar Municipality, Cross River State of Nigeria as a source of concern. Solar energy, according to National Geographic Society (2023), can be said to be any type of energy generated by the sun. Solar energy can also be said to be the radiation from the sun capable of producing heat, causing chemical reactions, or generating electricity (Ashok, 2023).

Solar energy is a creation of nuclear fusion that takes place in the sun when protons of hydrogen atoms violently collide in the sun's core and fuse to create a helium atom. It is necessary for life on Earth and can be harvested directly or indirectly for human uses such as electricity. The energy of the sun is harnessed in the form of electromagnetic radiation (light, heat and ultraviolet rays) and this is easily done using either of two available technologies: photovoltaic solar technology which directly converts sunlight into electricity, and solar thermal technology which captures the sun's heat into electricity (National Geographic Society, 2023). Some other types of energy sources include light energy, heat energy, mechanical energy, gravitational energy, electrical energy, sound energy, chemical energy, nuclear or atomic energy.

There are different types of energy, renewable and non-renewable sources of energy. People have developed processes for extracting these fossil fuels and using them for energy. However, fossil fuels are a non-renewable resource. They take millions of years to form. Solar energy is a renewable resource, and many technologies can harvest it directly for use in homes, businesses, schools, and hospitals. Some solar energy technologies include photovoltaic cells and panels, concentrated solar energy, and solar architecture. There are different ways of capturing solar radiation and converting it into usable energy. Each form can be changed from one form to the other. The methods used can be either active solar energy or passive solar energy ((Nicholas, 2020). There are different sources of this all-important energy, ranging from coal, oil, natural gas, uranium, biomass, nuclear energy, fossil energy -- like oil, coal and natural gas -- and renewable sources like wind, solar, geothermal and hydropower. All primary source fuels except biomass are non- renewable. Primary sources also include renewable sources such as sunlight, wind, moving water, and geothermal energy (Etim, 2023).

Statement of the problem

The importance of energy usage to humanity and the economy of a nation cannot be over-stated or over-emphasized. Our lives today, depend almost entirely on the use of energy from simple things like lighting for us to see, fans during heat, cooking, warming or refrigeration of our food, charging of phones and to more complex things like powering our automobiles, ironing and washing our clothes, use of heavy-duty equipment at work, etc. Indeed, man cannot live today without the use of energy.

Nigeria as a country depends on hydropower as our primary source of energy which is supplemented with gas. However, this source of energy is insufficient and epileptic. The national energy policy of Nigeria whereby energy is nationalized and centralized is a major bottle neck to the development of the power sector. This has led to the abundance of the usage of Generators as alternate source of energy usage. Asides the use of generators, other alternatives like wind, solar, etc, are being explored by residents as cheaper sources of energy usage.

The use of solar power has therefore become increasingly popular among some residents in the country especially those residing in Big Qua Town, Calabar Municipality of Cross River State. The environmental impact of solar usage on residents of Big Qua Town is therefore a source of concern to the researcher who has decided to investigate the environmental impact of solar energy usage among residents of Big Qua Town in Calabar Municipality, Cross River State of Nigeria.

Purpose of the study

The main purpose of this study is to investigate the environmental impact of solar energy usage on residents of Big Qua Town, Calabar Municipality in Cross River State.

Research Question

The research question raised to guide this study was:

1. Is there any environmental impact of solar energy usage on residents of Big Qua Town, Calabar Municipality in Cross River State?

Significance of the study

The academic environment of the University community will find the results of this research useful, as it will not just stimulate academic research in this area but also make use of the findings for future purposes. The residents in the local community of Big Qua, the entire city of Calabar, Cross River State and indeed the Country can also learn a lot from this research with respect to power usage in this Country.

Methodology

The research design adopted for this study is the survey research design because it is very useful for opinion and attitude studies as it depends basically on questionnaires and interviews for a means of data collection. Additionally, the survey research design is economical in the sense that a study of representative samples will permit inferences from generalization on populations that could be too expensive to study, like that of this particular study.

The area of study is the Big Qua Town in Calabar Municipality, which is an ancient and historical town in the City of Calabar. Big Qua Town is located in Calabar Municipality, Cross River State, Nigeria. The coordinates of Big Qua Town is Latitude: 4.9719772 and Longitude: 8.332116.

There is no concrete data on its population but the United Nations population projections for Calabar Municipality in 2022 is 631,000; a 4.3% increase from 2021 (macrotrends.net). Since Big Qua Town is one of the ten political wards in Calabar, Municipality, the estimated population could be a tenth of that of Calabar which is estimated at 63,100.

The proportionate random sampling technique was used for this study with a purposive sample of 0.5% of estimated population which is 316. Since the estimated population of Big Qua town in Calabar Municipality is given as 63,100, then 0.5% percent of this figure will be 315.5 or approximately 316 residents which was used for this study, made of males and female respondents, randomly selected.
The instrument used for this study is a self-structured questionnaire design based on a modified four-point Likert-type scale known as Impact of Solar Energy Usage Questionnaire (ISEUQ), which is a 10-point questionnaire with two sections. The first section seeks for their Bio-data, while the second section had five questions for each of the 2 variables of Environment Impact and Energy Usage, all of which seeks information from the residents on the environmental impact of solar energy usage among them.

Results and Discussion

The independent variable in this hypothesis is environmental impact (low, moderate and high), while the dependent variable is energy usage of Big Qua Town residents. To test this hypothesis, the solar energy needs of Big Qua Town residents, from environment low, moderate, and high were compared using One-Way Analysis of Variance (ANOVA). The result of the analysis is presented in Table 1.

The result on Table 1 revealed that the calculated F-value of 8.897 is statistically significant at .05 level since the p-value of .000 is less than .05 (or $p<.05$) with 2 and 313 degrees of freedom. With this result the null hypothesis was rejected. This result therefore implied that, there is significant environmental impact of solar energy usage on residents of Big Qua Town. Since environmental impact had a significant influence on the solar energy usage on residents of Big Qua Town, a post hoc analysis was employed using Fishers Least Significant Difference (LSD) multiple comparison analysis. The result of the analysis is presented in Table 2.

The result of the analysis in Table 2 showed that residents of Big Qua Town whose solar energy usage was low were significantly different in the solar energy usage of residents of Big Qua Town from those whose solar energy usage was either moderate or high. Also, residents of Big Qua Town whose solar energy usage was moderate were significantly different from those who were high in their solar energy usage.

Table 1: Summary data and one-way ANOVA of the influence of environmental impact on the energy usage of residents of Big Qua Town, Calabar (N=315)

Environmental impact	N	$\bar{x}$	SD		
Low– 1	99	35.1774	3.07375		
Moderate– 2	138	36.6732	3.19092		
High – 3	78	36.4000	2.88209		
Total	315	36.1269	3.12121		
Source of variance	SS	Df	Ms	F Ratio	Sig of F
Between group	166.773	2	83.386	8.897	.000
Within group	3739.757	313	9.373		
Total	3906.530	315			

* Significant at .05 level, df= 2, 313.

Table 2: Fishers Least Significant Difference (LSD) multiple comparison analysis of the influence of environmental impact on the energy usage of residents of Big Qua Town, Calabar LSD

(I) Environmental impact	(J) Environmental impact	Mean Difference (I-J)	Std. Error	Sig.
Low	Moderate	-1.49578(*)	.36993	.000
	High	-1.22258(*)	.38803	.002
Moderate	Low	1.49578(*)	.36993	.000
	High	.27320	.36911	.460
High	Low	1.22258(*)	.38803	.002
	Moderate	-.27320	.36911	.460

* The mean difference is significant at the .05 level.

Conclusions/Recommendations

Based on the results of the study it was concluded that environmental impact of solar energy usage has significant impact on residents of Big Qua Town, Calabar Municipality in Cross River State. The study also reveals that the positive aspects of environmental impact of solar energy usage far outweighs the negative environmental impact that may be associated with solar energy usage.

Recommendations

On the basis of the findings of this study, the major recommendation made is that more persons should be encouraged to use solar energy as it is a cheaper energy source, more economical, safer and more environmentally friendly than other energy sources.

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