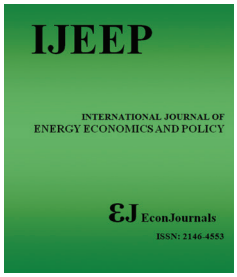


International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2021, 11(3), 468-476.

Analysis of Factors Influencing Households' Preference Level for Solar Energy in Urban Areas of Southwest Nigeria

Olaniran Anthony Thompson[1], Babatunde Oluseyi Ajiboye[2]*, Akin Daniel Oluwamide[1], Olumide Ojo Oyenike[3]

[1]Department of Agricultural and Resource Economics, Federal University of Technology, Akure, Nigeria, [2]Landmark University, Omu-Aran, Kwara State, Nigeria, [3]Department of Forest Economics and Extension Service, Research Fellow, Forestry Research Institute of Nigeria.
*Email: ajibotun@gmail.com

Received: 29 May 2020 **Accepted:** 6 January 2020 **DOI:** https://doi.org/10.32479/ijeep.10001

ABSTRACT

If sustainable development goals (SDGs) seven of affordable and clean energy will be achieved, access to clean energy such as solar energy needs dedicated attention. The study assessed respondents' perception of solar energy and identified factors influencing their preference level in urban areas of Southwest Nigeria. Data were obtained from four hundred and eighty solar energy users and four hundred and eighty non-solar energy users leading to total of nine hundred and sixty respondents' through a multi-stage sampling technique. Descriptive statistics, 5-likert scale type and tobit regression model were used to analyze the data collected. The respondents agreed that solar energy is the most appropriate source of energy compared to fossil fuel with mean score of 3.83. Price stability (0.83) attribute of solar energy is one of the reasons that makes it preferred by the respondent. A unit increase in household income will lead to 0.0879592 preference for solar energy in the study area. The study recommends that government at all levels should sensitize the households on the usage of solar energy in Nigeria to achieve the goal seven of SDGs.

Keywords: Clean Energy, Solar Energy, Perception, Tobit Regression Model, Nigeria
JEL Classifications: Q1, Q2, Q3 P28

1. INTRODUCTION

A large proportion of the world's population mostly the developing countries like Nigeria generate the energy they use from solid fuels and most of these fuels are known to pose a real threat to human health (Perera, 2018). According to World Health Organization (WHO), more than 40% of the world's population relies on polluting fuels (WHO, 2012). Particularly in the developing countries, approximately three billion people are using polluting crude oil, natural gas, solid fuels such as biomass, charcoal and animal waste for their daily purposes (Langbein et al., 2017). These fuels are combusted in poorly designed and inefficiently resulting in emission of noxious gases and products of incomplete combustion especially in the urban areas (Makonese et al., 2017), which are the major human source of Greenhouse Gases (GHG) and spurs climate change by releasing carbon dioxide into the atmosphere (Perera, 2018).

Also, the global share of the population with access to clean energy and technologies reached 61% in 2017, up from 57% in 2010. Despite this progress, close to 3 billion people still rely primarily on inefficient and polluting energy systems. If Sustainable Development Goals (SDGs) seven of affordable and clean energy will be achieved, access to clean energy such as solar energy needs dedicated attention. To reach universal access to clean energy by 2030, the annual rate of clean energy access needs to accelerate to 3%. If the current trajectory continues, 2.3 billion of the global population would remain without access to clean energy in 2030 (Perera, 2018).

In turn, due to the recent concerns about the negative externalities of the use of traditional fuels on the environment and health, household fuel transition from dirty fuels towards clean fuels in the developing countries has received growing research attention (Muller and Yan, 2018). Access to clean, affordable and efficient energy has become a challenge for the majority of the low to medium income households in developing countries (Kimemia and Annegarn, 2012; Makonese et al., 2017). These challenges coupled with the degradation of global environment caused by the Greenhouse Gas (GHG) emissions and the prediction of the depletion of the fossil fuel resources by scientists have all encouraged the global community to search for alternative sustainable and environmentally friendly energy resources (Kurnia et al., 2016). Amidst other alternative energy sources, solar energy has emerged and earned more attention across the world because solar energy is considered the most sustainable clean and renewable environment friendly energy source (Demirbas, 2010), and have been adopted by a large population of the developed world.

However, depending on the price of fossil fuels, solar energy is relatively more expensive than the fossil fuels in Nigeria, due to the high costs of installation (Dioha et al., 2012; Ajala et al., 2015), and they will have to be marketed at higher prices (Sivashankar et al., 2016). The need for rapid deployment of solar energy technologies has not received the political attention it deserves in Nigeria. High entry costs of solar energy solutions, a lack of consumer awareness of their benefits, financing gaps for producers seeking to enter the market, slow progress in the innovation of solar energy, and lack of infrastructure for solar energy production and distribution have together kept widespread solutions to this challenge out of reach.

Access to clean and renewable energy technologies has the potential to save millions of lives each year. Household air pollution resulting from the use of crude oil and natural gas to generate electricity, and the use of generator that emit GHG alone is responsible for some hundreds of thousand death annually in Nigeria (Federal Ministry of Health, 2018). Hence, the need to know the perception and the preference level of solar energy in urban area of Southwest Nigeria. This is with the aim of guiding the policy maker to know what attracts the respondents to use solar energy and the preference level of solar energy in Nigeria. This will reduce the degradation of global environment caused by the Greenhouse Gas (GHG) caused by use of crude oil and natural gas to generate electricity and reduce the use of generator that emits GHG using fossil fuels.

2. MATERIALS AND METHODS

2.1. Study Area

The study was conducted in Ekiti, Ondo, Osun and Oyo State. The four States are made up of 97 Local Government Areas (LGAs) (i.e. Ekiti has 16, Ondo State has 18, Osun has 30 and Oyo State has 33 LGAs). The population of the four States is 14,646,260 (i.e. Ekiti is 2,384,212, Ondo is 3,460,877, Osun is 3,416,959 and Oyo is 5,384,212). The four States are in the Southwest Zone of Nigeria (National Population Commission (NPC), 2019). Ekiti State is bounded by Kwara and Kogi States in the North, Osun State in the West, Edo State in the East and Ondo State in the South. The State is situated entirely within the tropics. It is located between longitudes 40̊ 51́ and 50̊ 45́ North of the Equator. It enjoys tropical climate with two distinct seasons. These are the rainy season (April-October) and the dry season (November-March). The temperature ranges between 21°C and 28°C while the relative humidity is over 75%. The mean annual total rainfall ranges from 1600 mm to 1800 mm. An important aspect of vegetation of the State is the prevalence of the tree crops. The major tree crops include: Cocoa, kola, oil palm and citrus (Ekiti State Ministry of Information, Culture and Tourism, 2018). Ondo State is bounded by Ogun State to the West, Ekiti and Kogi State to the North, Edo and Delta States to the East and the Atlantic Ocean to the South. Geographically, the State lies between longitude 4° 3' and 6° East of the Greenwich Meridian and latitude 5° 45' and 8° 15' North of the equator. The mean annual temperature ranges from 21°C to 29°C with relatively high humidity. The State is characterized by raining season (April to October) and dry season (November to March) (Ondo State Ministry of Information, 2019).

Osun State is bounded in the North by Kwara State, in the East partly by Ekiti State and partly by Ondo State, in the South by Ogun State and in the West by Oyo State. The State lies on 319 m above sea level. The climate is tropical in the State. When compared with winter, the summers have much more rainfall. This climate is Aw according to the Köppen-Geiger climate classification. The average annual temperature in the State is 26.1°C | 79.0°F. About 1241 mm | 48.9″ of precipitation falls annually. Oyo State is an inland State in Southwest Nigeria, with its capital in Ibadan. It is bounded in the North by Kwara State, in the East by Osun State, in the South by Ogun State and in the West partly by Ogun State and partly by the Republic of Benin. Oyo State covers approximately an area of 28,454 km^2. The Climate is equatorial, notably with dry and wet seasons with relatively high humidity. The dry season lasts from November to March while the wet season starts from April and ends in October. Average daily temperature ranges between 25°C (77.0°F) and 35°C (95.0°F), almost throughout the year. Agriculture is the main occupation of the people of Oyo State. The climate in the State favours the cultivation of crops like maize, yam, cassava, millet, rice, plantains, cocoa, palm produce and cashew (Oyo State Ministry of Information, 2019). An important aspect of vegetation of the four States is the prevalence of the tree crops. The major tree crops in the four States include: Cocoa, kola, oil palm and citrus. While the arable crops are yam, cassava and maize. The map of the study area is shown in Figure 1.

2.2. Data Collection and Sampling Procedure

A multi-stage sampling procedure was used in the selection of respondents. The first stage involved the selection of Ekiti, Ondo, Osun and Oyo State for the study. The second stage involved the purposive selection of capital cities of each State for the study because most of the emission of GHG takes place in the cities where there is urbanization influence on both consumption and production (Yonghong et al., 2017). These capital cities are: Ekiti State is Ado-Ekiti, Ondo State is Akure, Osun State is Osogbo and Oyo State is Ibadan. The third stage involved the purposive selection of 120 households using solar energy by snowball technique and random selection of 120 non-user households from

Figure 1: Map of the study area

Source: NPC, 2019

each of the capital city. This led to a total of 960 respondents divided into 480 solar energy users and 480 non-users.

2.3. Nature and Source of Data

Primary data were used for this study. Primary data were obtained through the administration of well-structured questionnaire. The questionnaire was used to obtain relevant information on numbers of variables such as: socio-economic profile of the selected solar energy users and non-users such as age of consumers, household size, education, gender and occupation, willingness to pay criteria, their knowledge on solar energy and estimated annual income.

2.4. Data Analytical Procedure

Descriptive statistics comprising of frequency, mean and percentage were used to describe the socio-economic characteristics of the respondents. 5-likert scale type was used to determine the perception of solar energy users' and non-users' in the study area. Respondents were asked to respond to statements relating to the economic attraction of solar energy usage, using Strongly Agreed (SA), Agreed (A), Indifferent (I), Disagreed (D) and Strongly Disagreed (SD). The responses were scored as 5,4,3,2 and 1 for SA, A, I, D, and SD respectively. The mean from each statement were obtained and used to classify the responses on each statement into SA (>4.5), A (3.5-4.4), I (2.5-3.4), D (1.5-2.4), SD (<1.5). The grand means for all the statement were calculated to be able to place the responses on a scale that enable a conclusion to be drawn on what the perception of the respondents is on solar energy.

Tobit Regression model was used to estimate the preference level of respondents for solar energy in the study area. The level of preference was measured using a scale of 1-5 (not preferred = 1, least preferred = 2, indifferent = 3, preferred = 4, most preferred = 5) based on if the consumers prefer the products or not. The following attributes were measured using the above scale: price, heat intensity, renewability, accessibility, easy to light up, price stability.

The tobit regression model is state thus:

$$Y_i^* = X_i \beta + U_i \quad (1)$$

$$U_i = N(0, \delta^2)$$

Where

Y_i = the dependent variable that was used in examining the preference level of consumers for solar energy.

$Y_i^* = y_i$ if $0 < y_i < 1$ (for those that prefer based on solar energy attributes)

$Y_i^* = y_i$ if $y_i = 0$ (for those that do not prefer)

X_i = vector of consumers' characteristics relevant in explaining the levels of preference for solar energy.

β = vector of parameters to be estimated

U_i = normally distributed error term

The independent (explanatory) variables that were used in examining the preference level of consumers for solar energy in the study area were as specified below:

X_1 = Age of Consumer (years)

X_2 = Consumption of clean (Solar) energy (years)

X_3 = Marital Status (married = 1, 0 otherwise)

X_4 = Gender of the consumer (male = 1, female = 0)

X_5 = Year of Formal Education (years)

X_6 = Household size (number of persons)

X_7 = Estimated Annual income (₦)

X_8 = Main Occupation of consumer (Public Sector = 0, Private Sector = 1)

X_9 = Price of products (₦/Square m^2)

X_{10} = Familiarity with GHG (1 = Yes, No idea = 0)

X_{11} = Familiarity with climate change (1 = Yes, No idea = 0)

X_{12} = Knowledge of solar energy (1 = Yes, No idea = 0)

X_{13} = Membership of Environmental Association

U_i = Error term

3. RESULTS AND DISCUSSION

3.1. Socioeconomic Characteristics of the Respondents

Table 1 presents the socioeconomic characteristics of the respondents. The table revealed that 55.0% (264) of the solar energy users were within the age bracket of 31 and 40 years while 61.7% (296) of the non-users were within 51 and 60 years. The mean age of solar energy users was 44.3 years and that of the non-users was 58.7 years. This implies that most of the users of solar energy were younger, hence they are expected to be agile and the need for renewable energy to ensure their productivity. This is in line with the findings of (John, 2016) that in developing Countries, active economy working class appreciates innovation of renewable energy. Sex distribution of the respondents shows that 72.9% (350) of the solar energy users were male and 27.1% (130) of them were female, while 65.0% (312) of the non-users were male and 35.0% (168) of them were female. This reflects that men are conscious of the need for alternative energy with respect to electricity in Nigeria. Since they fend for the family, therefore, they need to be productive which can only be possible with availability of innovations and technologies that will enhance energy sustainability like solar

Table 1: Socioeconomic characteristics of respondents

Variables	Solar energy users		Non-users	
	Frequency	%	Frequency	%
Age (Years)				
<20	-	-	-	-
21-30	30	6.3	26	5.4
31-40	264	55.00	80	16.6
41-50	68	14.1	44	9.2
51-60	104	21.7	296	61.7
Above 60	14	2.9	34	7.1
Total	480	100.0	480	100.0
Sex				
Male	350	72.9	312	65.0
Female	130	27.1	168	35.0
Total	480	100.0	480	100.0
Marital status				
Single	30	6.3	12	2.5
Divorced	42	8.8	2	0.4
Widow	110	22.8	4	0.8
Married	298	62.1	462	96.3
Total	480	100.0	480	100.0
Years of formal education				
1-5	-	-	16	3.3
6-10	38	7.9	182	37.9
>10	442	92.1	282	58.8
Total	480	100.0	480	100.0
Household size				
<5	466	97.1	242	50.4
5-10	14	2.9	238	49.6
Total	480	100.0	480	100.0
Awareness of solar energy				
Yes	480	100	480	100
No	0	0	0	0
Total	480	100	480	100
Main occupation				
Public sector	198	41.2	303	63.1
Private sector	282	58.8	177	36.9
Total	480	100	480	100

Source: Computed from Field Survey Data, 2020

energy. Majority (62.1%) (298) of the solar energy users and 96.3% (462) of non-users were married while the remaining 37.9% of solar users and 3.7% of non-users are either single, divorced or widow.

Most of the respondents of both solar energy user 92.1% (442) and non-users 58.8% (282) have spent above 10 years studying in a formal educational institution. The mean years of schooling of solar energy user was 17.4 years and non-ser was 12.2 years. This implies that most of the respondents had formal education. This may be attributed to the fact that the study was carried out among the urban populace where majority of the populace were highly educated and these set of people were also willing to respond to the research questionnaires. Education has always played a huge role in determine the preference for technology and consequently the welfare of the people (Obayelu et al., 2014). It is expected that education would provide people with opportunities to access information and understand the benefits of solar energy. This corroborates the fact that high level of education will raise the preference of the benefit that solar energy inherits (Yuan, 2011; Hast et al., 2015). This could account for the reason why the mean year of schooling of solar energy users was more than that of the non-users in the study area.

Again, most (97.1%) (466) solar energy users and 50.4% (242) of non-users had household size <5. The mean household size for users of solar energy was four persons per household while that of the non-user was six persons per household suggesting an urban moderate family size (Obayelu et al., 2014). Again, as shown in Table 1, all the respondents both the users and non-users were aware of solar energy in the study area. Since the study area are the urban cities and State capital, therefore, solar energy innovation and technology is not new in the study area. According to Olayinka et al. (2014), in Nigeria, most citizens leaving in the urban cities are aware of solar energy revolution. Table 1 further revealed that 58.8% of the solar energy users are working in the private sector and 63.1% of non-users works in the public sector. This buttress the findings of Salman, (2019) that renewable energy is mostly appreciated by those who works in the private sector in Africa. Since they must source for alternative energy that is cheaper and that will enhance their productivity.

From Figure 2, 30.8% of the solar energy users earned between ₦201,000 ($558.33) and ₦300,000 ($833.33) monthly while 12.9% earned above ₦501,000 ($1,391.67). The mean estimated income per month for users of solar energy was ₦221,256.12 ($614.60).

Figure 3 revealed that 40.1% of the non-users earned between ₦101,000 ($280.56) and ₦200,000 ($555.56) monthly and 10.6% earned above ₦501,000 ($1,391.67). The mean estimated income per month for non-users of solar energy was ₦141,098.75 ($391.94). This shows that the solar energy users earn more than non-users, which implies that they have the financial endowments to afford solar energy. This is in line with the finding of Andrea, (2019) that most users of renewable energy in the developing Countries are middle and upper-class citizens who have the financial capacity to afford it.

3.2. Distribution of Respondents by Perception of Solar Energy

The respondents' perception on the benefits, values and the environmental advantages of using solar energy were generally positive. Drawing inference from the class boundaries of means as shown in Table 2, the respondents agreed that solar energy is the most appropriate source of energy when compared to fossil fuel with mean score of 3.83. This could be because solar energy is renewable and very easy to maintain compare to fossil fuel and natural gas which is responsible for more than 75% electricity in Nigeria. Although, the respondents were indifferent that solar energy was easily accessible compared to fossil fuel with mean score of 2.55. This could be because solar energy technology is relatively new in the study area. Hence, is expensive and the technology is not yet perfected, therefore, many households are skeptical about the energy technology.

Again, with the mean score of 2.44, the respondents were indifferent in their perception about solar energy been faster than fossil fuel when compared. This could because most households make use of solar energy for electrical appliances with minimal load, because the technology is just emerging in Nigeria, therefore, the level of trust is highly minimal (Akinboro et al., 2012). The

Figure 2: Estimated monthly income of solar energy users in the study area

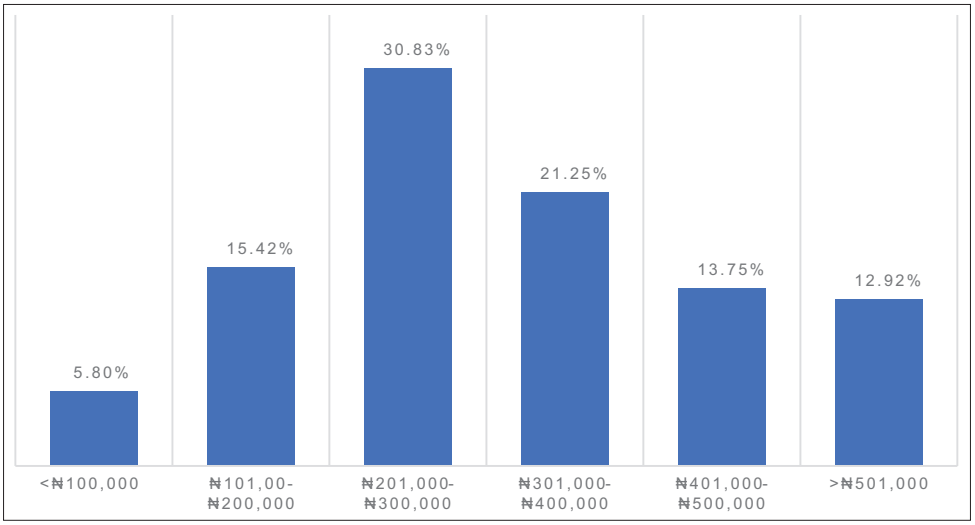
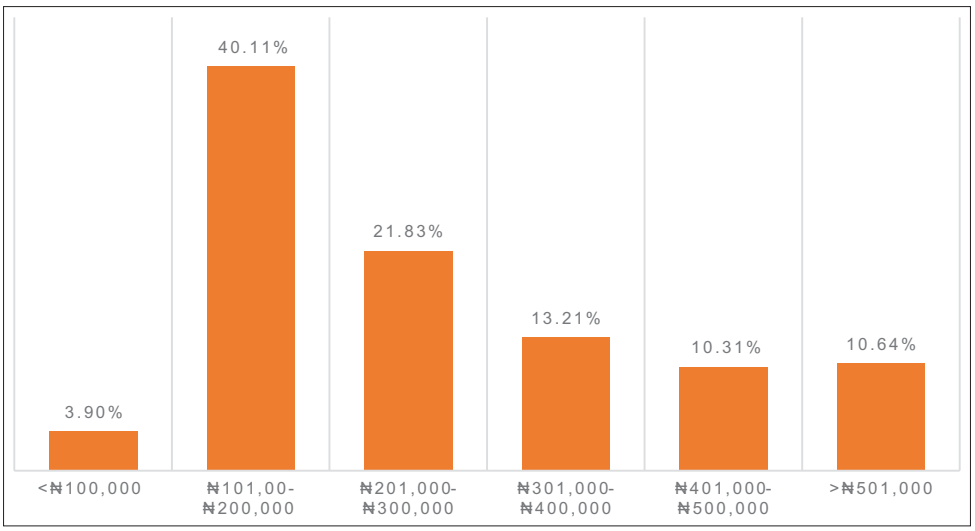


Figure 3: Estimated monthly income of non-users in the study area



respondents also agreed that solar energy is an important source of energy and supply of solar energy is reliable with mean scores of 4.18 and 3.51 respectively. Since the emergence of solar energy in Nigeria, it has served as good source of energy for many households in the urban cities. Many have abandoned their generators and making use of solar energy as an alternative means of generating electricity. The respondents agreed that solar energy production can be done in a sustainable manner with the mean score of 3.97. This could because solar energy is a renewable energy unlike fossil fuel and natural gas.

Equally, the respondents strongly agreed (4.53) that solar energy is environmentally friendly (Not emitting GHG). The implication of these is that consumers are very much concerned about their health, their choice of energy, place high value on clean energy and are likely to prefer the products. This in line with the findings of Gracia et al. (2011) who reported that preference level for clean and renewable energy is influenced by consumers perception on the benefits from using the clean and renewable energy. However, the respondents were indifferent (2.80) that solar energy is cheaper than fossil fuel when compared. The cost of installing solar energy in Nigeria is relatively high, therefore, many who are interested can not afford it. This could likely account for the indifferent perception of the respondents with respect to the affordability of solar energy.

3.3. Respondents' Preference for Solar Energy to Electricity and Generator

The result in Table 3 revealed a greater percentage of the respondents preferred solar energy (81.5%) to fossil fuel in the study area. Hence, this buttress the findings of Oyedepo, (2012) that Nigerians prefer solar energy to fossil fuel, but the government at all levels needs to support them to shift from fossil fuel to solar energy.

3.4. Respondents Preference Level for Solar Energy Based on Selected Attributes

Table 4 shows the preference level for solar energy based on selected attributes (affordability, heat intensity, renewability, emission, price stability, ease to light up and accessibility). It was revealed that the product is mostly preferred by the respondents based on its renewability with preference index of 0.91. This is

Table 2: Respondents perceptions on solar energy consumption

Perception statement	Strongly agree (5)		Agree (4)		Indifferent (3)		Disagree (2)		Strongly disagree (1)		Mean score	Inferences based on mean class
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%		
Solar energy is the most appropriate source of energy when compared to fossil fuel.	350	36.5	302	31.5	130	13.5	144	15.0	34	3.5	3.83	Agreed
Solar energy is easily accessible compared to fossil fuel.	90	9.4	204	21.3	150	15.6	214	22.3	302	31.4	2.55	Indifferent
Solar energy is faster than fossil fuel.	40	4.2	158	16.5	240	25.0	260	27.1	262	27.3	2.44	Disagreed
Do you think solar energy is an important source of energy?	402	41.9	362	37.7	162	16.9	34	3.5	-	0.0	4.18	Agreed
Is the supply of the solar energy reliable?	196	20.4	340	35.4	222	23.1	162	16.9	40	4.2	3.51	Agreed
Do you think solar energy production can be done in a sustainable manner?	298	31.0	408	42.5	184	19.2	70	7.3	-	0.0	3.97	Agreed
Do you think solar energy is environmentally friendly?	562	58.5	346	36.1	52	5.4	-	0.0	-	0.0	4.53	Strongly agreed
Is solar energy cheaper than fossil fuel	122	12.7	202	21.0	210	21.9	214	22.3	212	22.1	2.80	Indifferent

Source: Computed from Field Survey Data, 2020

Table 3: Distribution of respondents' based on the preference for renewable energy

Preference	Frequency	%
Preferred	782	81.5
Not Preferred	178	18.5
Total	960	100

Source: Computed from Field Survey Data, 2020

one of the inherent attributes of solar energy. It makes it different from the fossil fuel that can be used up and not renewable. This is one of the reasons that makes it desirable as energy. Followed by its emission attributes with preference index of 0.87, this is an attribute that shows that solar energy does not emit GHG like the fossil fuel that is commonly use in Nigeria. So, with the use of solar energy, environmental pollution is averted. Price stability (0.83) attribute of solar energy is one of the reasons that makes it preferred by the respondent. This refers to the stability in the cost of installation of solar energy appliances in Nigeria. The cost of installation of solar energy per square meter is stable over time. It does not fluctuate like the price of fossil fuel which is subject to fluctuation in foreign exchange.

Ease to light up attributes with the preference index of 0.78 is the quality of easy to operate attributes of solar energy appliances. For example, lighting solar energy streetlight is very easy. Therefore, operating solar energy appliances is very easy. The heat intensity attributes (0.73) is one of the reasons why the respondents prefer solar energy to fossil fuel. This implies that using solar energy does not lead to emission of heat like the fossil fuel. Findings indicate that solar energy attributes have a positive effect on consumers' utility. This is in line with the findings of Gracia et al. (2011) that clean energy acceptance by the consumers is influenced by its positive attributes. However, solar energy product is least preferred because of its affordability and for being not easily accessible with an index of 0.45 and 0.48. This means that respondents would consider changing to solar energy if it will be available in a wider range and affordable (Lloyd. 2015).

3.5. Determinants of Respondents' Preference for Solar Energy

As shown in Table 5, the determinants of preference for solar energy was analyzed using tobit regression model. Income and price of the product were significant at 1%, year of education and

Table 4: Distribution of respondents preference level based on selected attributes of solar energy

Selected attributes	MP (5)		P (4)		I (3)		LP (2)		NP (1)		Preference index
	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%	
Affordability	68	7.1	116	12.1	174	18.1	232	24.2	370	38.5	0.45
Heat intensity	258	18.5	388	40.4	144	15.0	76	16.3	94	9.8	0.73
Renewability	628	62.7	250	26.0	72	7.5	10	1.0	0	0.0	0.91
Emission	462	48.1	384	40.0	84	8.8	30	3.1	0	0.0	0.87
Price stability	432	45.0	304	31.7	152	15.8	62	6.5	10	1.0	0.83
Ease to light up	370	38.5	318	33.1	146	15.2	78	8.2	48	5.0	0.78
Accessibility	104	10.8	132	13.8	206	21.5	118	12.3	400	41.7	0.48

MP: Most preferred, P: Preferred, I: Indifferent, LP: Least preferred, NP: Not preferred, %: Percentage, F: Frequency

Table 5: Tobit estimates of the preference level for solar energy

Variables	Coefficient	Z-Value	SE
X_1 Age of respondents	−0.0959402	−0.23	0.050091
X_2 Years of consumption of solar energy	0.1061804	2.98	0.0419291
X_3 Marital status	0.201095	0.89	0.0490577
X_4 Gender	−0.093917	−0.72*	0.0389976
X_5 Year of education	0.1909668	0.97**	0.0781134
X_6 Household size	0.0995086	−0.61*	0.0098827
X_7 Monthly income	0.0879592	1.09***	0.0309410
X_8 Main occupation	0.0969416	0.43	0.0289408
X_9 Price of the product	−0.0929461	−2.92***	0.0209173
X_{10} Familiarity with GHG	0.0315713	−0.42	0.0500237
X_{11} Familiarity with climate change	0.1031613	0.93**	0.0482519
X_{12} Knowledge of renewable energy	0.1019182	−0.54	0.0881726
X_{13} Member of environmental association	0.0902611	−0.63	0.0947146
Constant	1.091793	2.18***	0.1867219
Number of observations	202		
Log likelihood	−29.929938		
LR Chi^2 (13)	91.03		
Pseudo R^2	0.8194		
Prob>Chi^2	0.0000		

Source: Computed from Field Survey Data, 2020 ***Significant at 1%, **Significant at 5%, *Significant at 10%

familiarity with climate change were significant at 5%. Household size and gender were significant at 10%. With respect to household income, implies that a unit increase in household income will lead to 0.0879592 preference for solar energy in the study area. This means that income is a major determinant of solar energy consumption among the households in the study area. It shows that as households' disposable income increases, more money may be devoted to the purchase and consumption of solar energy. Numerous studies point to income as the major driver behind the uptake of clean energy. This is in line with the study by Ariyo et al. (2018) carried out in Nigeria that increase in disposable income induces households to choose electricity and solar energy over wood and kerosene. Again, Baiyegunhi and Hassan, (2014) revealed in their study that in rural Nigeria, the transition from dirty fuel to clean fuel is critically influenced by increasing disposable income. All these studies seem to corroborate the energy ladder concept, which emphases income in explaining the transition from 'inferior' traditional energy to "normal" clean modern energy (Muller and Yan, 2018).

The price of the product was statistically significant from zero at 1% level of significance and had a negative influence on preference level for solar energy. This indicates that a unit increase in the price of the product will lead to −0.0929461 decrease in the preference level for solar energy by the respondent. This is in line with studies by Gracia et al. (2011); Zhang and Koji, (2012); Kim et al. (2018) that an increase in price of clean energy significantly reduces the probability of using such energy.

At 5% level of significance, the coefficient of year of education had a positive and significant influence on the respondents' preference level for solar energy in the study area. The positive coefficient of 0.1909668 for the year of education implies that a unit increase in the year of education of the respondents will lead to 0.1909668 increase in preference level for solar energy in the study area. The study revealed that the literate tends to appreciate the use of clean energy than the illiterate. Also, the familiarity with climate change had a positive and significant influence on respondent's preference level. The positive coefficient of 0.1031613 for the respondents in the study implies that a unit increase in the knowledge of climate change probably contribute to the increase in preference level for solar energy in the study area. This result also agrees with the findings of Sivashankar et al. (2016) who established that familiarity with climate change has a positive influence on respondents' preference level for clean energy.

Household size also plays an important role in energy choices (Israel, 2002; Abebaw, 2007; Zhang and Koji, 2012) findings revealed that there is negative association of household size with per capita energy consumption. Household size of respondents had a negative coefficient of 0.0995086 and it is statistically significant at 10%. This means a unit increase in the household size will reduce their preference for solar energy which is regarded as a clean energy. This is in line with the finding of Baiyegunhi and Hassan, (2014) indicate that larger households prefer non-clean energy over clean modern solar energy. One possible reason is that household size is often larger in poorer households that cannot afford modern clean energy.

Gender was statistically significant at 10% significant level with a negative coefficient. The negative coefficient of −0.093917which was in favour of the female gender means female headed household are more likely to prefer clean energy as their source of energy. This corresponds with findings of Brew-Hammond, (2010); Kowsari and Zerriffi, (2011) who stated that female-headed households prefer modern clean energy to fossil fuel. This may be attributed to the fact that women are often responsible for household cooking and thus they are directly affected by the air pollution emitted from the burning of the fossil fuel.

4. CONCLUSION

This study assessed households' perception and factors that influence the preference level of solar energy in the Southwest Nigeria. Sex distribution of the respondents shows that 72.9% (350) of the solar energy users were male and 27.1% (130) of them were female, while 65.0% (312) of the non-users were male and 35.0% (168) of them were female. The mean years of schooling of solar energy user was 17.4 years and non-ser was 12.2 years. The respondents agreed that solar energy is the most appropriate source of energy when compared to fossil fuel with mean score of 3.83. High percentage of the respondents preferred solar energy (81.5%) to fossil fuel in the study area. It was revealed that the product is mostly preferred by the respondents based on its renewability with preference index of 0.91. However, solar energy product is least preferred because of its affordability and for being not easily accessible with an index of 0.45 and 0.48. The determinants of preference for solar energy was analyzed using tobit regression model. From the result, income and price of the product were significant at 1%, year of education and familiarity with climate change were significant at 5%. Household size, gender and main occupation were significant at 10%.

The study recommends that sensitization and awareness campaign of solar energy should be intensified. Respondents should be made aware of the benefits of solar energy while sensitizing them about the ill-effects of using fossil fuel, fostering a sense of personal environment responsibility, greater motivation and commitment towards the protection of the environment through media, promotions product and technology demonstration, house-to-house canvassing, trade fairs, educational outreach, shows at educational institutes, and public places.

REFERENCES

Abebaw, D. (2007), Household determinants of fuelwood choice in Urban Ethiopia: A case study of Jimma Town. The Journal of Developing Areas, 41(1), 117-26.

Ajala, O.E., Aberuagba, F., Odetoye, T.E, Ajala, A.M. (2015), Biodiesel: Sustainable energy replacement to petroleum-based diesel fuel a review. ChemBioEng Reviews, 2, 145.

Akinboro, F., Adejumobi, L.A, Makinde, V. (2012), Solar energy installation in Nigeria: observations, prospect, problems and solution. Transnational Journal of Science and Technology, 2(1), 23-35.

Andrea, B. (2019), Developing Countries are the New Leaders in Renewable. Hydroelectricity Plant-Pangue (Chile). Enel Green Power. Available from: https://www.enelgreenpower.com/stories/a/2019/01/developing-countries-and-renewable-energy-for-a-sustainable-future.

Ariyo, O.C., Okojie, L.O, Ariyo, M.O. (2018), Villagers willingness to pay for forest conservation in Ibadan, Oyo State, Nigeria. Asian Journal of Agricultural Extension, Economics and Sociology, 23(4), 1-14.

Baiyegunhi, L.J.S., Hassan, M.B. (2014), Rural household fuel energy transition: Evidence from Giwa LGA Kaduna State, Nigeria. Energy for Sustainable Development, 20, 30-35.

Brew-Hammond, A. (2010), Energy access in Africa: Challenges ahead. Energy Policy, 38(5), 2291-301.

Demirbas, A. (2010), Social, economic, environmental and policy aspects of biofuels. Energy Science Technology, 2, 75-109.

Dioha, I.J., Ikeme, C.H., Tijjam, N, Dioha, E.C. (2012), Comparative studies of ethanol and kerosene fuels and cooking stove performance. Journal Natural Sciences Research, 2, 34-38.

ESMICT. (2018), Ekiti State Ministry of Information Culture and Tourism Quarterly Bulletin. Vol. 10. ESMICT. p9-14.

FMH. (2018), Federal Ministry of Health Annual Report. Vol. 45. p56-62.

Gracia, A., Barreiro-Hurlé, J, Pérez y Pérez, L. (2011), Consumers' Willingness ToPay for Biodiesel in Spain. International Congress of the European Association of Agricultural Economists. Zurich, Switzerland: ETH Zurich.

Hast, A., Alimohammadisagv, B., Syri, S. (2015), Consumer attitudes towards renewable energy in China-The case of Shanghai. Sustainable Cities and Society, 17, 69-79.

Israel, D. (2002), Fuel choice in developing countries: Evidence from Bolivia. Economic Development and Cultural Change, 50(4), 865-890.

John, A.M (2016), Developing Countries and the Renewable Energy Revolution. Australia: School of Management in Sydney. p23.

Kim, G., Lee, H, Yoo, S. (2018), Willingness to pay for substituting coal with natural gas-based combined heat and power in South Korea: A view from air pollutants emissions mitigation: A contingent valuation study. Sustainability, 10, 1554.

Kimemia, D.K, Annegarn, H.J. (2012), Productive uses of basic energy and fuel transitions in Urban South Africa. EER, 2, 103-112.

Kowsari, R., Zerriffi, H. (2011), Three-dimensional energy profile: A conceptual framework for assessing household energy use. Energy Policy, 39(12), 7505-7517.

Kurnia, J.C., Jangam, S.V., Akhtar, S., Sasmito, A.P, Mujumdar, A.S. (2016), Advances in biofuel production from oil palm and palm oil processing wastes: A review. Biofuel Research Journal, 3(1), 332-346.

Langbein, J. (2017), Firewood, smoke and respiratory diseases in developing countries the neglected role of outdoor cooking. PLoS One, 12(6), 13711.

Lloyd, P. (2015), A pilot test of ethanol gel as a paraffin replacement for low income urban environment. Journal Energy of South Africa, 25(3), 20-30.

Makonese, T., Ifegbesan, A.P, Rampedi, I.T. (2017), Household cooking fuel use patterns and determinants across Southern Africa: Evidence from the demographic and health survey data. Energy and Environment, 2017, 1-20.

Muller, C, Huijie, Y. (2018), Household fuel use in developing countries: Review of theory and evidence. Energy Economics, 70, 429-439.

NPC. (2019), National Population Commission. Vol. 4. Annual Report. p10-15.

Obayelu, O.A., Agboyinu, O.M, Awotide, B.A. (2014), Consumers' perception and willingness to pay for organic leafy vegetables in urban Oyo state, Nigeria. European Journal of Nutrition and Food Safety, 4(2), 127-136.

Olayinka, O.S., Adaramola, M.S., Oyewola, O.M, Fagbenle, R.O. (2014), Solar energy applications and development in Nigeria: Drivers and barriers. Renewable and Sustainable Energy Reviews, 32, 294-301.

OSMI. (2019), Ondo State Ministry of Information Quarterly Bulletin. Vol. 14. OSMI. p12-21.

OSMI. (2019), Oyo State Ministry of Information Quarterly Bulletin. Vol. 35. OSMI. p23-31.

Oyedepo, S.O. (2012), Energy and sustainable development in Nigeria: The way forward. Energy, Sustainability and Society, 2(15), 5-14.

Perera, F. (2018), Pollution from fossil-fuel combustion is the leading environmental threats to global pediatric health and equity: Solutions exist. International Journal of Environmental Resource Public Health, 15, 16.

Salman, Z. (2019), Renewable Energy Prospects in Africa. Available from: https://www.ecomena.org/renewable-energy-africa.

Sivashankar, P., Weerahewa, J., Pushpakumara, G., Galagedara, L. (2016), An estimation of the willingness to pay for biodiesel: A pilot study of diesel consumers. Bio-based and Applied Economics Journal, Italian Association of Agricultural and Applied Economics, 5(1), 1-19.

World Health Organization. (2012), World Health Organization. Burden of Disease from Household Air Pollution for 2012. Geneva, Switzerland: World Health Organization.

Yonghong, L., Chaochao, G., Yingying, L. (2017), The impact of urbanization on GHG emissions in China: The role of population density. Journal of Cleaner Production, 157, 299-309.

Yuan, X., Zuo, J, Ma, C. (2011), Social acceptance of solar energy technologies in China End users' perspective. Energy Policy, 39, 1031-1036.

Zhang, J., Koji, K. (2012), The determinants of household energy demand in Rural Beijing: Can environmentally friendly technologies be effective? Energy Economics, 34(2), 381-388.