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Household Energy Consumption in Bauchi State, Nigeria

Abubakar Hamid Danlami[1,*], Shri Dewi Applanaidu[2], Rabiul Islam[3]

[123]*School of Economics Finance and Banking, COB UUM, 06010 Sintok Kedah, Malaysia*

Abstract: This study was conducted with the major aim of conducting descriptive and exploratory analysis on the socio-economic characteristics of households in Bauchi state and their pattern of energy choice and consumption. A total sample of 539 household responses were analyzed which were selected using cluster area sampling. The analysis indicates that the average monthly household income is USD 220 and the average monthly firewood consumption per a household is about 35 bundles. Moreover, about 70% of the respondents argued that they use firewood as their main source of cooking fuel. For the lighting source of energy, 65% of the households argued that they use electricity as their main source of lighting. Additionally, the correlation analysis indicates that income has a positive relationship with the quantity of energy consumption, while there is a negative relationship between price of a particular source of energy and its consumption. The study suggests that there is a need of a good policy that will reduce the households much dependence on firewood to other cleaner source of energy.

Key words: firewood; cooking; lighting

1. Introduction

Energy is one of the most important aspects of household life. It is a commodity that is vital for the existence of modern household living (Eakins, 2013). In fact the total welfare of a household depends on the type and the pattern of the household's energy utilisation. The household energy consumption pattern in Bauchi state can be categorised into three major dimensions; cooking, lighting and cooling purposes. For satisfying the needs of cooking, the various sources available include; fuel-wood, kerosene, gas and electricity, plus elements of plant residues and animal dung which are used in some parts of the rural areas of the state. For lighting purpose, the various choices mainly include; electricity, petroleum/diesel (used for fuelling generators), kerosene, candles and traditional lamps as well as firewood, mostly based on socio-economic status of a household (Barness & Floor, 1996). Furthermore, for the purpose of drinks and space cooling, the various energy sources available consist of mainly electricity and petroleum or diesel (gas) power generator.

Of all the above categories of fuel sources; electricity, liquefied petroleum gas (LPG) and kerosene are regarded to be either cleaned (i.e. in the case of electricity and gas) and/or transitional (i.e. in the case of kerosene) energy sources (Yamamoto et al., 2009), while the traditional biomass fuel which include fuel-wood, animal dung and plant residues are not cleaned energy which can lead to numerous economic, social, health and environmental, problems (Jan et al., 2012).

The use traditional lamp as the main source of lighting is a treat to the health and the life of the users, this is because such traditional lamp produces high rate of carbon monoxide that is harmful to human health, that is why in most of the rooms whereby such lamps are being used, there exist black dust in ceilings and the walls closer to the lamp. In the same vein, the use of fuel-wood for cooking purpose is totally not environmentally friendly. It has negative impacts on the atmosphere and peoples' lives (Nlom & Karimove, 2014). Apart from deforestation, desertification and soil erosion, the use of fuel wood has a very low thermal efficiency and the smoke is also hazardous to human health, especially to women and children who mostly do the cooking in homes (ECN, 2003). Acute respiratory infections (ARI) in children are one of the leading causes of infant and child morbidity and mortality (Emmelin & Wall, 2007; Schirnding et al., 2002). Studies have found associations between biomass fuel use and lung cancer. A 30 year old woman cooking with straw or wood has an 80% increased chance of having lung cancer later in life (Hong, 1991; WHO, 1991).

The underlying rational here is to encourage households to shift from the use of non-cleaned energy sources to the adoption of cleaned energy sources (Ritche et al., 1981). This is because there are so many benefits in using a cleaned energy. It has been widely argued, moving towards the use of cleaned fuels is an important option to improve

standard of living for households that rely heavily on biomass (Lee, 2013). It is the key factor to improve the mode of living for rural population (Ganchimeg & Havrland, 2011). Moreover, encouraging households to switch to cleaned energy would lead to the consumption of less fuel per meal and less time spent gathering fuel, which could be used in other activities such as attending school and other income generating activities (Yamamoto et al., 2009). Cleaned energy provides easy access to education, health care and household resources. Children who do not have to collect bio fuels can attend school (Wilkinson et al., 2007; Smith et al., 2005). Switching to cleaned fuels could also free up time for women to engage in income-generating pursuits (Wilkinson et al., 2007).

To attain these benefits, a very important and effective policy which provides access to cleaned energy is required (Farsi et al., 2007 in Nlom & Karimove, 2014). However, such effective policy also depends on a good research conducted to investigate and explore households' energy consumption pattern in relevant area (Nlom & Karimove, 2014). This study is conducted with the major aim of exploring socio-demographic features of households and their pattern of energy choice and consumption in Bauchi state, Nigeria; to assess the correlation between the energy consumption and the socio-demographic characteristics of households in Bauchi state.

The remaining part of the paper is as follows: section two consists of review of related literature, section three consists of methodology. Section four discussed the results and findings of the study. The last section consists of conclusions and policy implications of the study.

2. Literature Review

This section examines and highlights the factors that influence the level of household fuel choice and consumption. Each of these factors is expected to relate with the quantity of fuel consumption of households either positively or negatively. Below is the explanation of different categories of factors influencing household energy choice and consumption.

2.1. Economic Factors

These are factors that serve as a measure of economic status of the household which can influence the households' fuel consumption decision. For instance, studies have established that there is a positive relationship between income and adoption of cleaned energy (Ozcan et al., 2013; Couture et al., 2012; and Osiolo, 2010). Poorer households especially in developing countries tend to adopt firewood, plant residues, animal dung and other un-cleaned energy sources, whereas wealthier households tend to adopt energy from more cleaned sources.

A relationship also exists between the type of occupation of the household head and the nature of the energy source to be adopted by the household. Empirical studies conducted by Eakins (2013) and Heltberg (2005) proved that those in white collar jobs (executives, big entrepreneurs) adopt cleaned energy, while those in blue collar jobs (such as farming, trading) tend to adopt firewood and other biomass fuels. Home ownership which is one of the indicators of the economic status of households affects their decision on the type of energy sources to adopt. Those who live in their owned house tend to adopt cleaned energy source (Couture et al., 2012; Laureti & Secondi, 2012). Price of energy has a negative relationship with energy consumption. When the price of a particular energy source is high, households switch to other alternative fuel available. This is in line with law of demand and also has been established by previous studies (Nlom & Karimove, 2014 and Jingchao & Kotani, 2011).

2.2. Socio-Demographic Factors of Households

The type and composition of socio – demographic factors of households influence their fuel switching and consumption behaviour. For instance Mensah and Audu (2013) found that households tend to adopt cleaner energy when the head of the household is female. Age of the household head was found to have a negative relationship with the adoption of cleaned energy (Mensah & Audu, 2013; and Suliman, 2010). Households adopt less cleaned energy source when the head is older. Level of education of the household head has a positive relationship with cleaned energy adoption. The higher educated is the household head, the more he realises the negative impact of un-cleaned energy and therefore the less it will be adopted (Eakins, 2013 and Laureti & Secondi, 2012). The number of a household's members (i.e household size) affects the household's energy consumption decision, the larger the size of a household, the lesser the adoption of cleaned energy (Ozcan et al., 2013; Mensah & Audu, 2013).

2.3. House Characteristics

The characteristics of the building in which the households leave can also affect their energy

choice behaviour. For instance, the location of the home in which the households live have serious impact on their energy consumption decision. The households that are located in urban areas adopt cleaner energy than their rural counterparts (Eakins, 2013; Ozcan et al., 2013). In addition, the type of the house (i.e. nature of the building) exacts some influence on household energy consumption behaviour. For instance, Eakins (2013) and Ozcan et al. (2013) empirically found that living in detached house have significant positive relationship with the adoption of gas, electricity and liquid fuel. The sizes of the residence in which households live also influence their energy consumption behaviour. Most of the previous studies such as; Couture et al. (2012), Laureti and Secondi (2012) and Song et al. (2012) found that the larger the size of the building, the higher the adoption of fuel wood, all things being equal. Furthermore, the number of rooms in the house is one of the building characteristics which influence households' energy consumption choice. For instance Eakins (2013) and Herltberg (2005) found this variable to have a positive significant relationship with the household use of Liquefied Petroleum Gas (LPG). Share of dwellings (i.e. more than one household living in the same building) is one of the factors which also shape the energy consumption behaviour of households (Couture et al., 2012).

3. Data and methodology

Because this paper is a study of households at micro level, this section contains the description of the study samples and the methods used in data gathering.

3.1. Sample Size

In this study, the total sample size was determined based on Dillman (2011). The formula for determining a good representative sample is:

$$S = \frac{NP(1-P)}{(B/C)^2\,(N-1) + P(1-P)}$$

Where:

S= required sample size.

N= the population size = 769,960

P= the population proportion expected to answer in a particular way (the most conservative proportion is 0.50).

B= the degree of accuracy expressed as a proportion (0.05).

C= the Z statistic value based on the confidence level (in this case 1.96 is chosen for the 95% confidence level)

Therefore, the sample size can be determined as:

$$S = \frac{(769{,}960*0.5)(1-0.5)}{(0.05/1.96)^2(769{,}960-1)+(0.5)(1-0.5)} = \frac{192490}{501.067+0.25}$$

$$S = \frac{192490}{501.317} = 384$$

The sample size above also commensurates with the sample size recommended by social science researchers. For instance, Roscoe (1975) give a rule of thumb for selecting a good sample size to be larger than 30 and less than 500 for most researches. And that in case of multivariate studies, the sample size should be at least 10 times as large as the number of variables. While, Bartlett et al. (2001) gave a rule of thumb for the accurate sample size of at least 5 to 10 times larger than the number of variables. However, for the purpose of data collection for this study, a total of 750 questionnaires were distributed instead of the pre-determined sample number of 384 samples. This was to avoid a problem of non response rate. According to Jeff (2011) since it is not every selected sample that will likely response, there is a need for a researcher to increase the sample size to avoid non response bias. Babbie (1995) argued that at least 50% rate of response is necessary for reporting and analysis (cited in Watson, 1998). Finally about 548 filled questionnaires were returned back, which is more than 70% of the total number of the issued questionnaires.

3.2. Sampling Technique

For the purpose of this study, cluster area sampling method was adopted. According to Rao (2009) Area Sampling is a special type of cluster sampling whereby samples are grouped and clustered on the basis of geographical location areas (Valliant et al., 2013; Sekaran, 2003). The reason for adopting this method of sampling is that though the sampling frame for the various clusters of Bauchi state is available and was obtained from the office of Nigerian National Population Commission, there is no available frame containing the list of all households living in Bauchi state. Hence in this situation, area sampling is one of the most suitable techniques of data collection. As argued by various scholars that the underlying practical motivation for using area sampling is the absence of complete and accurate list of the universal elements under study since it does not depend upon the population frame (Valliant et al., 2013; OECD, 2007; Sekaran, 2003). Moreover, Sauders et al. (2009) argued that in the case of cluster sampling, the full list of clusters

forms the sampling frame and not the list of individual elements within the population.

The sampling technique used in this study is the multistage cluster sampling. In the first stage, the whole of the study area was divided in to three groups (clusters) based on the geo-political zonal categorization of the study area, the various categories are; Bauchi south, Bauchi central and Bauchi north. In the second stage, two clusters (Bauchi south and Bauchi north) were selected randomly out of the three clusters.

In the third stage, these two clusters were further categorized in to two sub clusters; urban and rural areas. Then a total of ten (10) wards were randomly selected from the urban areas while a total of thirteen (13) wards were selected randomly from the rural areas. This gives a total of twenty-three selected wards used as the sampling wards. In the fourth stage, six communities were selected randomly from each of the selected wards of urban areas which made a total of sixty (60) communities from the urban areas. On the other hand, another six communities were randomly selected from the selected wards of the rural areas making a total of seventy-eight (78) communities used from the rural areas. This gives a total of one hundred and thirty-eight (138) sampled communities used in the study. In the last stage, six households were systematically selected from each of the selected communities of the urban areas making a total of three hundred and sixty (i.e. 60*6 = 360) households selected from the urban areas. On the other hand, five (5) households were selected systematically from each of the selected communities of the rural areas making a total of three hundred and ninety (i.e. 78*5 = 390) households selected from the rural areas. Though finally, a total of 548 households returned the filled questionnaires out of which 9 questionnaires were discarded.

4. Results and Findings

This section contains the findings of this study. Since this study is a descriptive and exploratory analysis, the tools that were used to analyse the data; are the various descriptive statistics, frequencies, percentages and correlation analysis.

4.1. Summary of Descriptive Statistics

This section provides information about the descriptive statistics. The major descriptive statistics are the mean, standard deviation, minimum and maximum. Table 1 exhibits the values of the summary statistics:

Table1: *Summary of Descriptive Statistics of Variables*

VARIABLES	N	mean	SD	min	max
gender	538	0.874	0.33	0	1
age	536	36.43	11.7	23	60
marital status	528	0.739	0.44	0	1
household size	536	7.725	6.04	2	30
location	537	0.538	0.50	0	1
home size (ft^2)	536	52.42	19.3	20	110
number of rooms	536	6.515	3.81	2	23
Cfuel main source	539	0.443	0.81	0	3
Hrs of electricity	519	27.30	27.8	0	97
Price of firewood	483	76.67	35.3	30	220
Price of kerosene	361	126.6	27.1	45	200
Home appliances	535	15.37	13.1	0	57
home ownership	535	0.213	0.41	0	1
years of education	536	14.21	6.17	0	22
Lfuel main source	532	0.438	0.67	0	2
firewood quantity	449	34.23	17.1	4	90
Income (USD)	536	224.0	180	78	600

Source: Authors, 2016

Table 1, shows that the monthly average consumption of firewood is about 35 bundles, this implies that on average every household in Bauchi state uses more than one bundle of firewood everyday, which is a clear reflection of high rate of firewood use in the state. Furthermore, the Table indicates that the monthly average income of a household is little bit more than USD200, with the maximum value of USD600. This implies that most of the household in Bauchi state belong to the poor income group. In fact Bauchi state is the third poorest state in Nigeria (NBS, 2012). Furthermore, the table indicates that the average firewood price per bundle is about ₦75 (about $0.40). Furthermore, it indicates that on average, the household size in Bauchi state constitutes about eight members per household. This number approximately is tally to the estimated average household size in Bauchi state, given by Uneze et al. (2013). The table shows that the average weekly hours of electricity supply is only 27 hours, this clearly reflects the nature of inadequate supply of electricity in the area, which is one of the factors that likely contributes to high rate of biomass fuel use as the main source of energy by households in Bauchi state. Table 1 further shows that the average years of school experience by the heads of households in the study area is 14 years, representing a schooling experience up to the Diploma/NCE levels of education. Similarly, the reported average number of rooms in the building in which each household lives is six. This number constitutes bedrooms, rest room, sitting rooms and fallows. Additionally, the number of energy use devices possesses at home such as; bulbs, fans,

ACs, televisions, radios among others, shows an average value of 15 pieces of these items which is clearly a reflection of low rate of modern energy use by households in the study area. Lastly, the table shows that the average age of household head in Bauchi state measured in terms of years is 36 years, which falls within the age group of working population.

4.2. Socio-Economic Characteristics of Households in Bauchi State and Their Pattern of Energy Consumption

The objective of this study is to explore and describe the socio-economic characteristics of households in Bauchi state, Nigeria and their pattern of energy consumption. In this section, the study explored the socio-economic characteristics of households in Bauchi state and their pattern of fuel consumption, based on the study samples. Table 2 indicates the socio-demographic and economic characteristics of the respondents:

Table 2: *Socio-Economic Characteristics of Households in Bauchi State*

Characteristics	Freq	(%)	CUM
Gender			
Male	470	87.36	87.36
Female	68	12.64	100
Age			
16 – 30	187	34.89	34.89
31 – 45	229	42.72	77.61
46 – 60	97	18.10	95.71
Above 60	23	4.29	100
Marital Status			
Single	138	26.14	26.14
Married	390	73.86	100
Level of Education			
Non formal education	55	10.26	10.26
Primary School	27	5.04	15.30
Secondary	95	17.72	33.02
Diploma/NCE	191	35.63	68.66
B.Sc./HND	124	23.13	91.79
Postgraduate	44	8.21	100
Occupation			
No standard job	59	11.09	11.09
Farmer	68	12.78	23.87
Teacher	106	19.92	43.80
Banker	17	3.20	46.99
Lecturer	18	3.38	50.38
Medical practitioner	37	6.95	57.33
Businessman	99	18.61	75.94
Others	128	24.06	100
Monthly Income (USD**)**			
150 and below	277	53.37	53.37
151 - $300	98	18.11	71.48
301 - $450	73	13.10	84.59
451 - $600	56	10.02	94.61
Above 600	32	5.39	100
Household Size			
1 – 10	424	79.22	79.22
11 – 20	94	17.44	96.66
21 and above	18	3.34	100

Source: Authors, 2016

Table 2 shows that majority of the respondents (87%) are males. This is because based on the culture of people in the study area, normally males occupy the position of household head, even in a situation when the father (the head) has died, it is the younger brother of the deceased or the first born in the family not the mother that emerges as new head of the family. Because the belief is that, men are stronger than women economically, socially and educationally. Therefore, a woman emerges as a household head only by chance when there is no able man in the family to look after the affairs of the family. Furthermore, the Table 2 shows that most of the respondents (61 %) are within the age of middle adulthood stage (31 – 60 years). This is because on average, the normal marriage age for males (who are mostly the family head) begins from 25 years and above. The table further indicates that about 75% of the respondents are married. Due to the fact that married people are regarded as responsible for overseeing the family affairs. The remaining 25% are regarded as single person comprising the divorced, widowed and separated. Regarding the family size, most of the respondents (80%) argued that the size of their family members is within the range of 1-10, the range in which the number of the average family size in Bauchi state reported earlier by Uneze et al. (2013) falls (i.e. eight) and this study found the average size of a household to be 8 (see Table 1). In addition, the categories of the education level attainment shows that those that attended school up to the Diploma/NCE level has the highest rate (35%) followed by those with the degree certificate (23%). Those who claimed that they did not attend a formal school at all constitute about 10% of the respondents. Only 8% of the respondents claimed to have attended school at a postgraduate level. Regarding the occupation of the respondents, of all those that chosed a stated category, teaching job (at primary or secondary levels) obtained the highest proportion (about 20%). This is because teaching job at either primary or secondary school levels is one of the easy to find jobs for both semi-professional (Diploma/NCE) and professional (Degree and above) workers. About 11% of the

respondents argued that they don't have a standard job, they are more of casual workers. Additionally, the 24% of the respondents which constitutes the other occupation category as specified by the respondents themselves comprises; tailoring, butcher, mechanic, welding, building construction, civil servant, businessman, journalist, sheep and cattle rearing. Others are; carpenter, porter, sewing, blacksmith, commercial driver, prison service and wood cutter. Lastly, on average, most of the respondents (53%) argued that they usually earned a monthly income that is below $150. This clearly indicates the high rate of poverty in the state especially in the rural areas of the state.

Furthermore, among the factors that can shape the household pattern of energy consumption and switching are the characteristics of the building in which the household live. Table 3 contains the information of the home characteristics of the households:

Table 3: *Households' Home Characteristics in Bauchi State*

Characteristics	Freq	(%)	CUM
Home Ownership			
Self owned home	421	78.69	78.69
Non self owned home	114	21.31	100
Number of Rooms			
1 – 5	305	56.90	56.90
6 – 10	112	20.90	77.80
11 – 15	106	19.54	97.34
16 and above	13	2.43	100
Home Size (ft^2)			
1 – 24	35	6.53	6.53
25 – 49	138	25.75	32.28
50 – 74	300	55.97	88.25
75 – 99	27	5.04	93.29
100 and above	36	6.72	100
Home Location			
Urban Area	289	53.82	46.18
Rural Area	248	46.18	100

Source: Authors, 2016

Table 3 shows that about 79% of the respondents, argued that they live in their self owned home, this is especially in rural areas and some of the urban areas whereby most of the houses are simple and traditional, mostly made of up mud, such kind of houses are easy to possess or built. Furthermore, majority of the respondents (about 57%) claimed that the number of rooms in their home is within the range of 1 to 5 rooms. These include; bedrooms, sitting rooms, and any other type of rooms that are usually found at homes. On the size of plot in which the home was built, majority of the respondents (56%) argued that the size of the plot in which their homes was built is within the range of 50 – 74 sq feet. This implies that households in Bauchi state live in a relatively large house. Lastly on the location of the respondents, 53% argued that they live in urban areas while the remaining 47% live in rural areas of the state.

However, the information on the pattern of household fuel source, quantity of energy consumption and the amount of fuel expenditure is shown in Table 4:

Table 4: *Household Energy Consumption Pattern in Bauchi State*

Characteristics	Freq	(%)	CUM
Main cooking fuel			
Firewood	378	70.65	70.65
Kerosene	114	21.31	91.96
Electricity	12	2.24	94.21
Gas	31	5.79	100
Main Source of Lighting fuel			
Traditional	53	9.96	9.96
Semi-electrical	127	23.87	33.83
Electricity	352	66.17	100
Average firewood consumption monthly(bundle)			
1 – 19	62	13.81	13.81
20 – 39	287	63.92	77.73
40 – 59	43	9.57	87.53
60 and above	57	12.69	100
Average kerosene consumption monthly (litre)			
1 – 15	99	46.70	46.70
16 – 30	84	39.62	90.57
31 – 45	15	7.08	93.40
46 and above	14	6.60	100
Average monthly expenditure on electricity (USD)			
9 and below	366	86.52	86.52
10 - 19	47	11.11	97.63
20 - 29	4	0.95	98.58
30 and Above	6	1.42	100
Number of Energy use devices at home			
zero	10	1.87	1.87
1 – 10	243	45.42	47.29
11 – 20	151	28.22	75.51
21 – 30	54	10.09	85.60
Above 30	77	14.39	100

Source: Authors, 2016

Table 4, exhibits the pattern of household energy consumption behaviour in Bauchi state. Based on

the responses from the selected samples, majority of the respondents (more than 70%) argued that their main fuel source for cooking is firewood. This is not surprising, but reflects the clear picture of the situation in Bauchi state whereby the majority of households in the state especially rural areas adopt firewood as the main source of cooking fuel. This is also tally with the information provided by Akpan et al. (2010). Furthermore, 21% of the respondents argued that they use kerosene as the major source of fuel for cooking, about 6% of the respondents use gas as the main cooking fuel source, and it is only less than 3% of the respondents claim to be using electricity as their main source of cooking fuel, mainly in the urban areas of the state. This pattern of main cooking fuel adoption is mostly due to the culture, availability and affordability. On the main source of lighting, about 10% of the respondents argued that they rely majorly on traditional source of lighting such as; traditional lamp, kerosene and charcoal. Another category of respondents (24%) argued that they rely mostly on semi-electric source of lighting like; battery torch light and rechargeable lanterns to source light for home use. However, the majority of the respondents argued that they rely mostly on the available electricity as their main source of lighting. This implies that most of households in Bauchi state despite the interruption in the supply of the electricity rely mostly on electricity as their main source of lighting especially urban dwellers.

4.3. Correlation Analysis of Factors Influencing Household Energy Consumption in Bauchi State, Nigeria

In this section, a correlation analysis was conducted in order to explore the nature of the correlation that exists among variables used in this study. Usually, a negative value indicates negative relationship between variables and a positive value indicates positive relationship between variables. Table 5 exhibits the correlation values for variables in this study:

Table 5: *Variables Correlation Matrix*

	AGE	EDU	HHS	INC	RUM	LEC	PFW	HPS	FWQ	PKR	KRQ	XEC	HSZ
AGE	1.00												
EDU	-0.05	1.00											
HHS	0.29	-0.09	1.00										
INC	0.28	0.26	0.19	1.00									
RUM	0.19	-0.09	0.42	0.12	1.00								
LEC	-0.03	0.25	-0.06	0.19	-0.08	1.00							
PFW	0.10	-0.13	0.01	0.01	-0.01	-0.07	1.00						
HPS	0.05	0.03	0.05	0.16	0.10	0.14	-0.02	1.00					
FWQ	0.09	-0.07	0.21	0.06	0.22	0.05	-0.13	-0.01	1.00				
PKR	0.06	-0.08	-0.06	0.01	-0.01	-0.16	0.15	0.04	-0.22	1.00			
KRQ	0.24	-0.01	0.05	0.12	0.15	-0.08	0.01	0.06	0.04	-0.07	1.00		
XEC	-0.09	0.19	-0.08	0.08	-0.15	0.11	-0.05	0.13	-0.06	-0.05	0.09	1.00	
HSZ	0.19	0.12	0.26	0.27	0.39	0.17	0.03	0.12	0.09	-0.04	0.11	0.03	1.00

Source: Authors, 2016

Note: AGE=Age; EDU = Education; HHS = Household size; INC = Income; RUM = Number of rooms; LEC=Hours of electricity supply; PFW = Price of firewood/bundle; HPS = Home appliances; FWQ = Firewood quantity; PKR= Kerosene price per Littre; KRQ = Kerosene quantity; XEC = Monthly expenditure on electricity; HSZ = Home size.

Table 5 indicates the nature and magnitudes of correlations that exist between the socio-economic characteristics of households in Bauchi state and the quantity of energy consumption by households in the state. For instance, the correlation matrix exhibits that there is a negative relationship between quantity of firewood and the price of firewood (r = -0.13), firewood quantity and level of education attainment (r = -0.07), price of kerosene and the quantity of kerosene (r = -0.07), hours of electricity and the kerosene quantity (r = -0.08) as well. Furthermore, negative relationships were found between monthly expenditure on electricity and variables like; household size, price of firewood and price of kerosene (with the correlation values; -0.08, -0.05, -0.05). All these sings conform to a priori expectations.

On the other hand, the Table 5 indicates that there is a positive relationship between firewood quantity and the household size (r = 0.22), kerosene quantity and the variables such as; household size, income and firewood price (with the correlation values; r =0.05, 0.08 and 0.01). Additionally, positive relationships were found to exist between monthly expenditure on electricity and other variables such as; education, income and kerosene quantity. The values of the correlation coefficients are; 0.19, 0.08 and 0.09, which are clear supports for a priori expectations.

5. Conclusions

This study conducted and exploration and descriptive analysis of the socio-economic characteristics of households and the pattern of their energy consumption (cooking and lighting fuel consumption) in Bauchi state, Nigeria. The study explored that the average monthly income of a typical household in Bauchi state is about USD 225. The study found that the majority of households in Bauchi state use firewood as their main source of cooking fuel. On the other hand, most of the households use electricity for lighting. Furthermore, it was found that there is a positive relationship between income and consumption of energy by households. Similarly, the same positive relationship was found to exists between household size and the consumption of firewood. On the other hand, the price of a particular energy

source has a negative relationship with its consumption. Therefore, there is a need for government to discourage the high rate of firewood use as the main source of cooking fuel by embarking on the policies that will ensure the switch away of household firewood fuel to other cleaner source of cooking fuel like electricity and gas.

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