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Enhancing Household Dominant Energy Choice For Cooking And Lighting In Urban Areas Of Benue State

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ABSTRACT
This study analyses the factors influencing households' energy choice. Theoretically, the study has its foundation from energy ladder and energy stack models. The study analysed a sample of 384 households using cross sectional data from the three urban areas of Benue State. The study employed the seemingly unrelated regression to analyse the factors influencing household energy choice. It also used the pattern of energy consumption among the energy consumers in the study area. Energy products considered in the study are electricity, kerosene, petrol, Liquefied Petroleum Gas (LPG) and fuel wood. The factors examined include energy prices, consumers' income (proxied by total energy expenditure), educational level of energy consumers, household size, household ownership, geographical location of the household and the nature of occupation of the household head. The result of the analysis show that price of the energy product, prices of other related energy products, income of the consumer (total energy expenditure), occupation of the consumer, level of education, size of household, geographical location of household and owning a personal house all affected urban household energy demand in Benue State. Demand for electricity was significantly affected by its price, price of fuel wood, total energy expenditure and educational level of consumers; demand for kerosene was significantly affected by its price, educational level of consumers, total energy expenditure and household size; demand for petrol was significantly affected by price of fuel wood and total energy expenditure; demand for LPG significantly affected by price of electricity, price of fuel wood and total energy expenditure; and Demand for fuel wood significantly affected by price of electricity, price of fuel wood, total energy expenditure, household size and ownership of a household. On the basis of these results, it can be suggested that government should encourage the use of modern and efficient energy sources by embarking on policies that increase the purchasing power of energy consumers.
Keywords: Energy Supply, Electricity, Energy Choice, Energy Consumers, Household

1. INTRODUCTION

The growing demand for energy services and the quest for better standard of living have enhanced growth of modern energy sources. Inadequate modern energy sources deprive the poor of opportunities for improved standard of living. Modern sources of energy like electricity and Liquefied Petroleum Gas (LPG) use energy efficient technologies that require energy saving appliances that have positive links with health and productivity. The consumption of firewood is worsened by the widespread use of inefficient cooking methods that are hazardous to human health, especially to women and children who mostly do the cooking in homes. The use of firewood for cooking contributes to the causes of some major health problems in the developing countries due to indoor air pollution. The World Health Organization

(WHO) estimates that about 1.5 million people per year die prematurely from indoor pollution due to the use of solid fuels. This is equivalent to 4,000 deaths per day (Bruce et al, 2000).

In Nigeria, the problems relating to fuel wood as energy source has been an issue of concern for more than three decades. Efforts at encouraging households to make substitution that will result in more efficient energy use and less adverse environmental, social, and health impacts are advocated. Many policies have been implemented by public authorities to decrease household wood-energy consumption and to substitute it by alternative conventional fuels. But despite all the policies, the rate of consumption of wood-energy (and other biomass fuels) and its attendant negative environmental and health impacts are still alarming.

The main energy sources in Benue State include electricity, kerosene, petrol, Liquefied Petroleum Gas (LPG) and fuel wood. Among these energy sources, the consumption of fuel wood which is a rural practice seems to have now gained acceptance in urban areas in a manner to which its demand is leading to the harvest of both dry and wet wood.

The household energy demand and substitution are as a result of confluence of various factors including income, price, education, household size, ownership of a house, nature of occupation of a the household head and the geographical location of the household among others. Access to and cleaner energy remains the major policy issue. Focus in energy policy discussion is always on securing a sustainable environment, efficient use of energy, better health and social benefits which are associated with interventions that enhance energy choice. Such policy discussions require an analysis on household energy choice performance. Information on the factors influencing household energy choice is limited. More so, there is no study in Benue State on both household energy choices in urban and rural areas. This study aimed at providing information on energy sources that are dominantly used in Benue State for cooking and lighting and on the factors affecting choice of such energy sources.

2.1 Conceptual Framework

A household's energy choice consumption decision can be understood by analyzing its decision in a constrained utility maximization framework where it maximizes energy utility subject to a set of economic and non-economic constraints (Fig. 1). The information that households have on various energy products influences their energy choice and energy substitution decisions. This information is affected by economic and non-economic factors. Economic factors include market price of energy and household income. Non-economic factors may include a set of household characteristics such as educational level of household head, household size, house ownership, nature of occupation and location of residence.

The energy choice and substitution models are applied to various energy products like electricity, kerosene, petrol, LPG and fuel wood. The application of this model would bring an understanding of how various factors influence the energy choice and energy substitution. The outcome of this behavior may improve economic development.

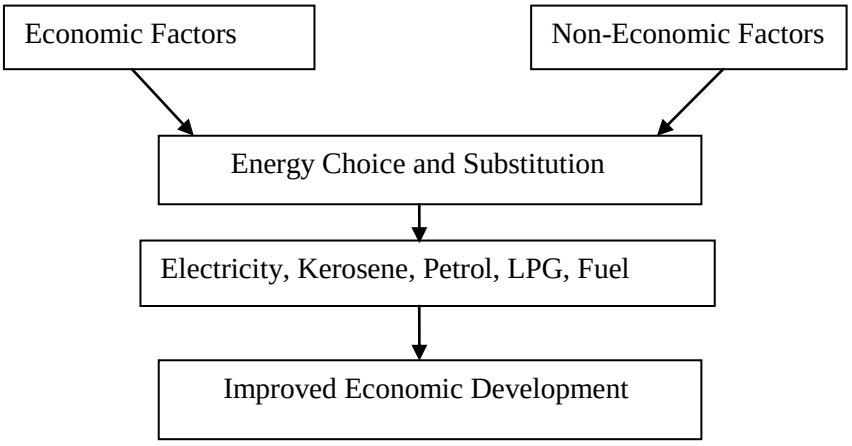

Figure 1: Conceptual Framework. Source: Author, 2021

2.2 Theoretical Framework

Household fuel choice can be explained using the Energy Ladder model which argues that households with low levels of income rely on biomass fuels, such as wood and dung, while those with higher incomes consume energy that is cleaner and more expensive, such as electricity. Those households in transition—between traditional and cleaner (and more efficient) energy sources—consume what are called transition fuels, such as kerosene and charcoal (Heltberg, 2005). This is explained in the Figure 2.

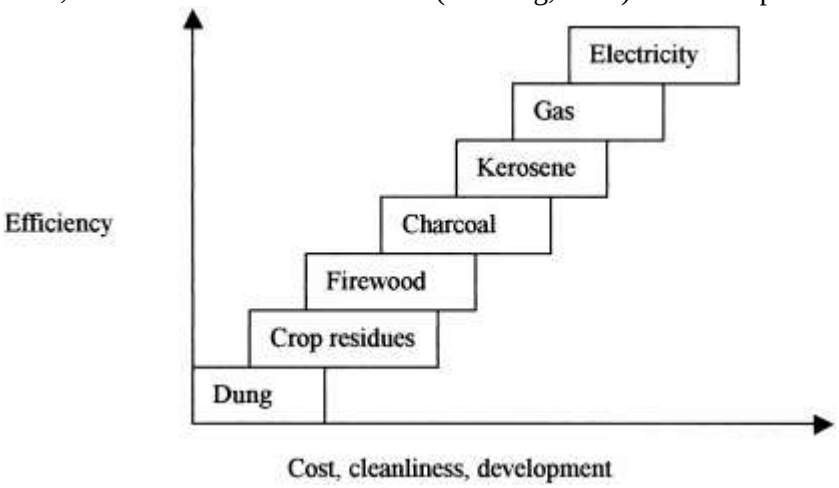

Fig. 2: Energy Ladder

More recently, it has been argued that households in developing countries do not switch to modern energy sources but instead tend to consume a combination of fuels, which may include combining solid fuels with non-solid fuels as sources of energy. Thus, instead of moving up the ladder step by step as income rises, households choose different fuels from a range of fuels. They may choose a combination of high-cost and low-cost fuels, depending on their budgets, preferences, and needs (World Bank, 2003). This led to the concept of fuel stacking (multiple fuel use), as opposed to an energy ladder (Masera et al., 2000; Heltberg, 2005).

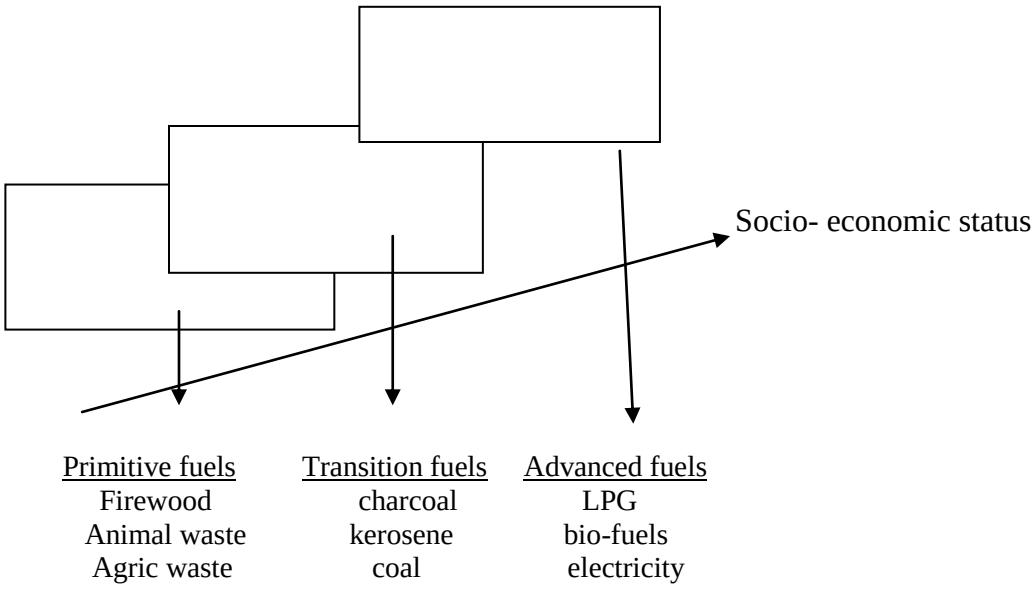

Fig. 3: Energy Mix Theory.
Source: Masera, Saatkamp and Kammen (2000)

2.3 Empirical Review

Economic and non-economic (hybrid) factors influencing the choice of cooking fuels in Ghana were investigated by Karimu (2015). The dataset used for the study was the fifth round of the Ghana Living Standards Survey (GLSS 5, 2005/06) conducted in the year 2005/06. A sample size of 8,262 was used for the analysis. The multinomial probit model was estimated and he found that, both economic and non-economic factors influenced household choice for the various fuels.

Effects of increase in the price of gasoline and income of its consumers from 1998 to 2010 were evaluated in 2015 by Arzaghi and Squalli. Method of analysis used by the researchers was random effects model. The result of the study showed that a unit increase in the price of gasoline decreased the demand for gasoline by 5% in the short run and by 25% in the long run. On the other hand, a unit increase in the income of gasoline consumers led to an increase in the demand for gasoline by 16% in the short run and by 81% in the long run.

Examining household energy consumption in Ogun State, Olasunanmi and Ogunjobi (2015) used primary data on socio- economic characteristics of household head, expenditure on energy and non-energy sources. These were collected from 150 respondents using stratified random sampling technique. Descriptive statistics and multinomial logit were used for data analysis. Descriptive statistics was used to analyze socio economic characteristics of household head and to determine the share of each energy source on total expenditure on energy. Multinomial Logit and Tobit regression models were employed for the analysis of the determinants of fuel choice, the determinants of energy consumption. The determinants of fuel choice (solids) are prices of wood and kerosene and family size squared significantly and positively influenced the choice of fuels while prices of wood, kerosene and electricity determined the monthly household's expenditure on fuels. The effect of family size on the choice of fuels was negative and nonlinear.

Analysing the factors determining the choice of cooking energy in Ondo state, Nigeria, Adeyemi and Adereleye (2016) used random sampling technique to sample 409 households in the study area. The data used for the study were obtained with the use of well structured questionnaires. Descriptive statistics and multinomial logit were employed for the analysis. Descriptive analyses show that the energy sources available for the use in the study area are kerosene (45%), firewood (43%) and cooking gas (12%). The analysis shows further that 63.7% of the rural populace and 22.9% of people in urban areas utilize fuel wood for cooking in the study area. The results of the multinomial logit show the household income, level of education, household size, occupation of the respondent, nature of the dwelling house and ownership of the dwelling house are the significant factors influencing fuel choice. In order to encourage households to make fuel substitution that will result in more efficient energy use and less adverse environmental, social, and health impacts, a promotion of higher level of education and a promotion of general economic development could be effective instruments.

Abdullahi, Musa, Idi, Adamu & Yusuf (2017), empirically examined socio-economic factors that influence households' likelihood of energy consumption in Nigeria. The 2013 demographic health survey dataset for Nigeria was adopted and multinomial logistic regression was conducted in analyzing the factors affecting households' decision for energy demand. Result of the analysis revealed that demographic characteristics, economic status, public awareness and social variables are strong determinants of households' energy choice in the country and conformed to the propositions of Energy Ladder Hypothesis. The researchers recommended policy implications

for decision making toward ensuring access to affordable, sustainable and efficient energy in Nigeria.

The study by Abdul- Hakim and Ibrahim (2017) aimed at determining household's socio-economic factors associated with energy choice in Kano metropolis, Nigeria. A clustered sampling technique was adopted to categorize the study area into different residential zones on the basis socio-economic status. Thereafter, a systematic random sampling technique was used to select households at specific intervals. Chi-square test and Cramer's V statistic were used to test the association between the household's socio-economic factors and choice of energy. Results from the Chi-square test reveal that household socio-economic factors such as geo-political zone of the household head, income, education of the household head and wife were found to be significantly associated with the choice of energy. However, results from Cramer's V reveal that the level of literacy attained by the house wives has the strongest impact. The study concluded that wives with higher educational qualification prefer modern energy because they have a better taste and may be conscious of the negative impact of using biomass energy for cooking. The study recommended that the rates and costs of electricity, gas and kerosene should be carefully monitored to enable all classes of households to use them sustainably. Secondly, the public should be enlightened on the safety use of modern energy sources as well as the implication of using unclean sources energy.

To assess the prevalence of and factors associated with the use of cooking fuels, and attitudes and barriers towards use of liquefied petroleum gas (LPG), Obianuzu, Tochi, Olorunfem, Ayesha, Casmir, Esezobor et al (2018) used a cross-sectional, population-based survey in 519 households in Lagos, Nigeria. The researchers used a structured questionnaire to obtain information regarding choice of household cooking fuel and the attitudes towards the use of LPG. Descriptive statistics showed that kerosene was the most frequently used cooking, followed by charcoal and LPG. Higher level of education, higher income and younger age were associated with LPG and kerosene use. Fuel expenditure on LPG was significantly lower than for kerosene. Findings suggested that misinformation and beliefs regarding benefits, safety and cost of LPG are important barriers to LPG use. An educational intervention program could be a cost-effective approach to improve LPG adoption and should be formally addressed through a well-designed community-based intervention study.

Ghulan, Syeda & Salix (2018) investigated the household energy demand and explored the factors that determine household energy demand for different forms of energy consumption in district Muzaffarabad of the state of Azad Jammu and Kashmir, Pakistan. By using Linear Approximate Almost Ideal Demand System (LA-AIDS), the study estimated Marshallian price and expenditure elasticities of demand for four kinds of energy components including both rural and urban households. Using primary data LA-AIDS estimation indicated that demand for all forms of energy are price inelastic. Cross price relations indicated that electricity is a substitute for LPG, wood and fuel whereas LPG and fuel are complements. Electricity has most inelastic own-price elasticity which shows that households in Muzaffarabad are insensitive to changes in the price of electricity.

Adamu, Adamu, Ade and Ake (2020) reviewed various energy sources for household consumption and examine the implications of their dependence on traditional energy sources as well as the energy ladder model as a concept widely used by scholars in describing the role of income in determining energy use and choices. It further explains the consumption behaviour of households in relation to the major assumptions of the model. The paper posited that the dependence on energy sources at the lowest rung of the energy ladder by most households in

Nigeria was accentuated by rising poverty level consistent with the energy ladder hypothesis but disagreed with the notion of complete fuel substitution given that most households tend to have a mix of energy sources for their activities.

3.0 METHODOLOGY

3. 1 Research Design

The type of design utilized for this work is a survey research design. The method that was used in collecting primary data needed for the study is a structured questionnaire. A sample of three hundred and eighty four households was considered enough by the researcher to produce reliable and accurate information on the subject matter. A multi stage sampling technique was used in arriving at the sample size. Primary data collected was mainly on energy prices, households' energy demand, households' energy expenditure, and other households attributes. Methods of data analysis considered for purposes of achieving the objectives of the study were Seemingly Unrelated Regression.

3.2 Sample Size and Sampling procedure

The population of the study therefore consists of all households from, Makurdi, Gboko and Otukpo townships. These local governments' headquarters are selected because of their status as urban centres of the state (Benue State Urban Development Board, 2017). They are also among the high energy consuming local governments of Benue state (Akighir & Nomor, 2013). According to National Bureau of statistics (2018), the average number of persons per household in Benue state is 5.3. The estimated populations of Makurdi, Gboko and Otukpo towns as of 2018 are 600,635, 478,241 and 280,830 respectively (NPC 2018). Therefore, the expected number of households in each of the selected urban centres of Benue state is equal to the total population of the urban centre divide by 5.3 persons, (NBS, 2018).

The Krejcie and Morgan (1970) formula for sample size determination was used

$$S = \frac{X^2NP(1-P)}{d^2(N-1)+X^2P(1-P)} \quad \text{.....(1)}$$

Where

S= Required Sample Size

X= Z Value (that is 1.96 for 95% confidence level)

N= Population Size

P= Population proportion expressed as decimal (assumed to be 0.5 (50%), since this would provide the maximum sample size.

d= Degree of accuracy expressed as proportion (0.05)

Thus, imputing the values, we have

$$S = \frac{1.96^2 * 271941 * 0.5(1-0.5)}{0.05^2(271941-1)+1.96^2 * 0.5(1-0.5)} = \frac{261172.1364}{680.8104} = 383.6195 \approx 384$$

A three-stage sampling process was used in selecting the respondents. Identification of urban areas of the state was carried out in the first stage. In the second stage, settlement areas or wards in each of the urban areas was identified while random selection of households within the wards was the third stage of the procedure.

3.3 Data Collection and Instrument

Primary data on respondents' background information, energy prices, energy demand, energy expenditure together with other households attributes were collected from respondents through structured questionnaires for the year 2019. The five energy products are fuel wood, kerosene, LPG, electricity, and petrol. Information on them was recorded in different measurement units.

Kilowatt hour (kwh) is for electricity, liter (Lit) is for petrol and kerosene, while kilogram (kg) is for LPG and fuel wood. The study considered price, income, household size, occupation of households' heads, geographical location of households, educational level of households' heads and ownership of a house as main determinants of energy demand in a household. In place of income total household expenditure has been used as a proxy.

The questionnaire was validated by experts to ensure that they capture the objective of the study. Cronbach Alpha Coefficient which is a measure of internal consistency of instruments was used in the pilot study. The analysis yielded an alpha coefficient of 0.8941. This indicated the high reliability of the instrument since the coefficient was more than 0.5. Thus the instrument was validated as reliable instrument for data collection and empirical analysis.

3.4 Model Specification

Almost Ideal Demand System (AIDS) developed by Deaton and Muellbauer (1980) was specified in this study. According to this model, the budget share of an energy product is a function of energy prices and consumers' income (total energy expenditure). The final specification including socio-demographic variables (level of education, household size, nature of occupation, ownership of a house and geographical location) becomes:

$$w_i = \alpha_i + \sum_{j=1} \gamma_{ij} \ln p_j + \beta_i \ln(X / P) + Demographics + \varepsilon_t \quad \text{.....(2)}$$

Where:

w_i = shares of household expenditure on fuel *i* in total energy expenditure

p_j = price of fuel *j*.

α, β, γ = parameters to be estimated

X= the total expenditure in all categories of energy

In the model:

It is expected that since total energy expenditure and the socio-demographic variables are important factors in energy consumption, they would have a positive and significant effect on the demand for particular types of energy. Expenditure shares in each of the five energy goods were the dependent variables. Total energy expenditure, energy prices and the demographic variables were the independent variables. Since there are five energy sources, the model equation became a system of 5 equations which had to be estimated simultaneously. However, given that the dependent variables (share of goods in total expenditure) are dependent, the error terms (ε) were also expected to be correlated across the equations.

3.5 Method of Data Analysis

Descriptive method was used to show the pattern of household energy consumption among the energy consumers. Respondents of the study were distributed based on their socio-economic characteristics and their choice of energy for various activities. The Seemingly Unrelated Regression Analysis was used to estimate parameters of the LA-AIDS model. SUR technique is a generalization of a linear regression model that consists of several equations. Each equation is a valid linear regression on its own and can be examined separately. It helps to estimate equation by equation using standard ordinary least squares with a specific form for the variance covariance matrix.

2.0 ANALYSIS AND RESULTS

4.1: Descriptive Statistics

Table 1: Distribution of Households by Socio-economic Characteristics

Variable	Number of Households	Percentage of Households
Gender of Head		
Male	327	85.16
Female	57	14.84
Total	384	100.00
Age of Respondents		
20-29	25	6.51
30-39	51	13.28
40-49	88	22.92
50-59	149	38.80
60 and above	71	18.49
Total	384	100.00
House ownership		
Family	91	23.70
Personal	107	27.86
Rented	128	33.33
Free	32	8.33
Subsidized	26	6.77
Total	384	100.00
Educational Level		
No Formal	54	14.06
Primary	69	17.97
Secondary	119	30.99
Tertiary	142	36.98
Total	384	100.00
Household Size		
< 5	74	19.27
5-7	271	70.57
8-10	34	8.85
11 and above	5	1.30
Total	384	100.00
Occupation		
Farming	64	16.67
Trading	52	13.54
Artisan	55	14.32
Civil Service	97	25.26
Others	116	30.21
Total	384	100.00

Source: Author's Field work, 2019; Figures in parentheses are percentages

Table 4.1 shows that over seventy per cent of the respondents are males. Indeed, 92 (57.50%) of Age distribution of the respondents showed that the sample is composed of more of those between 50-59 years, followed by those between 40-49 years and then by those who are 60 years

and above. This indicates that the decisions over which fuel to use for cooking and lighting in a household are taken by adults. Table 1 also indicates that majority of the heads of households have tertiary education (36.98%). Households were grouped on the basis of number of persons in the household (Table 4.1). The modal households' size is between 5 - 7 persons per household. This is in line with the official household size of 5.0 given by NBS (2006).

The occupational profile of respondents in Table 1 showed that 97 (25.26%) and 64 (16.67%) of all the respondents are civil servants and farmers respectively. The results also indicated that, up to 116 (30.21%) of all the respondents fall in various other occupations. It can be concluded based on the table that the main occupation in Benue State urban areas is civil service. This is in line with the educational status of respondents which showed that majority of the respondents have tertiary education, followed by secondary education. Results also showed that 128 (33.33%) of all the respondents live in rented apartments, while 107 (27.86%) of the respondents live in personal houses. Living in personal house allows for independent decisions on the types of energy products to be used for various purposes. Based on the table we can conclude that majority of the household heads are living in rented houses. This is followed by those that are living in personal houses, then those living in family houses. Living in personal houses creates an opportunity for use of any type of energy product.

Table 2: Distribution of Respondents by Choice of Cooking and Lighting Energy

Energy Types for Cooking	Number of Households	**Percentage of Households**
Kerosene	52	13.50
LPG	48	12.50
Fuel wood	284	74.00
Total	384	100.00
Energy Types for Lighting		
Electricity	260	67.71
Kerosene	53	13.80
Petrol	71	18.49
Total	384	100.00

Source: Author's Field work, 2019; Figures in parentheses are percentages

The energy highest in use as main source of energy for cooking was fuel wood (74.00%) while the least used was LPG (12.50%). For purposes of lighting, electricity is the main energy source for lighting in the urban areas of Benue State (67.71%). This is followed by petrol (18.49%) and then kerosene (13.80%). The reasons for this result might be that most of the household in the urban areas are personally owed; therefore, there might be enough space for the use of fuel wood for cooking. Secondly, electricity as an energy source for lighting is cheaper and cleaner compared to petrol.

4.2 Determinants of Household Energy Demand

The structural parametric coefficients of five equations along with their standard errors (in parenthesis) as well as significant levels are presented in Table 3.

Table 3: Factors that influence Household Energy Demand

Variable	Electricity	Kerosene	Petrol	Gas (LPG)	Wood
Price of Electricity	0.7332** (0.0798)	-0.350 (0.2008)	-0.22120 (0.2155)	-1.2800** (0.3538)	0.5922** (0.1797)
Price of Kerosene	-0,1858 (0.1752)	0.8291 (0.4407)	0.0663 (0.4730)	-0.8005 (0.7764)	-0.0820 (0.3945)
Price of Petrol	-0,2581 (0.2724)	-0.1826 (0.6849)	0.2929 (0.7351)	-1.7423 (1.2067)	0.2266 (0.6131)
Price of LPG	-0.1059 (0.2042)	-0.2289 (0.5134)	-0.6104 (0.5511)	1.1159 (0.9047)	0.7296 (0.4597)
Price of Fuel Wood	-0.1515** (0.0160)	-0.1267** (0.0403)	-0.4135** (0.0432)	-0.3042** (0.0709)	1.0610** (0.0360)
Expenditure	0.7151** (0.0130)	0.7230** (0.0331)	2.1193** (0.0355)	1.4717** (0.0582)	-0.4108** (0.0295)
Education	0.0157** (0.0093)	-0.0976** (0.0234)	0.0167 (0.0251)	-0.0361 (0.0412)	-0.0074 (0.0209)
Household Size	0.0100 (0.0060)	0.0908** (0.0152)	-0.0086 (0.0.0163)	-0.0286 (0.0268)	-0.0626** (0.0136)
Occupation	0.0020 (0.0675)	-0.0298 (0.0190)	-0.0206 (0.0204)	0.0006 (0.0335)	0.0215 (0.0170)
House Ownership	-0.0022 (0.0062)	0.0009 (0.0154)	-0.0205 (0.0165)	-0.0219 (0.0271)	0.0358** (0.0137)
Geographical Location	0.0178 (0.0108)	0.0233 (0.0272)	0.0518 (0.0292)	0.0576 (0.0479)	0.0231 (0.0243)
Constant	2.5075 (2.1650)	-0.0835 (5.4433)	-8.9234 (5.8430)	4.5678 (9.5909)	2.5023 (4.8731)
R2	0.9391	0.7285	0.9509	0.7653	0.7472

Source: Own calculations from field survey, 2019; ** are significance levels at 5%; standard errors are in parentheses.

Factors determining households' demand for energy goods in Benue State, is shown in table 3. Demand for the energy goods considered (that is, petrol, electricity, LPG, kerosene and fuel wood) were significant at 5 percent level of significance.

Petrol

The price of petrol had an insignificant effect on its demand at 5percent level. The expenditure estimates for petrol was found to be positive, suggesting that an increase in the price of petrol would lead to increase in the quantity demanded. This is not consistent with the work of Huang and Huang (2009), which found petrol to be an essential good. This may be so due to the fact that in Nigeria, because electricity supply is not stable in households and organizations use petrol to generate electricity in the home and to run businesses as well as fuel cars. Therefore increase in the price of petrol increases the budget share allocation to it by households as well as increase the quantity bought.

Electricity

The expenditure estimates for electricity is positive and inelastic at 0.7332 but insignificant at $p<0.05$. This implies that an increase in the price of electricity would reduce the quantity demanded very small.. This is also consistent with the results of Babatude and Enehe, (2011),

Filippini and Pachauri, (2004), Labandeira et al, (2006),they found that when prices of electricity increase, it results in little or no change in the quantity of electricity consumed. This is so because households' demand for electricity is due to the multiple services it performs. In the household electricity is needed to operate electrical and cooking appliances.

Liquefied Petroleum Gas (LPG)

The expenditure estimate for LPG is inelastic and positive at 1.1159 but significant at $p<0.05$. This suggests that a 1 percent increase in the price of gas will increase the quantity demanded. This is inconsistent with the results derived by Nnaji et al, (2012), They found that increase in the price of LPG reduces the quantity demanded. Other factors aside the price of gas that influences its demand is the price of fuel wood and it is significant at 5 percent. In addition the cleanliness of LPG further promotes the use of it in many households.

Kerosene

Households' demand for kerosene is insignificant at $p<0.05$. The expenditure estimates suggests that an increase in the price of kerosene increases the quantity demanded of it by less than 1 percent. This suggests that among the income groups considered some households will actually increase the quantity consumed of the product while others will revert to the use of fuel wood. On the other hand households that increase the quantity consumed also increase the number of meals cooked per day, as well as increase cooking foods that take longer time to prepare. Other factors influencing the demand for kerosene are income and geographical location. The results show that movement into white collar job will reduce demand for kerosene.

Fuel wood

The demand for fuel wood is significant at $p<0.05$. Expenditure estimates for fuel wood shows that an increase in its price increases the quantity demanded of it by more than 1 percent. Other factors influencing the demand for fuel wood were household size significant at $p<0.05$ and owning a personal house significant at $p<0.05$ level of significance. This result is consistent with that of Labandeira *et al,* (2006). Owning a personal house contributed to the use of fuel wood Farsi *et al,* (2007) and Helrberg *et al,* (2000).

In summary, results showed that price of the energy product, prices of other related energy products, income of the consumer (total energy expenditure), occupation of the consumer, level of education, size of household, geographical location of household and owning a personal house all affected urban household energy demand in Benue State.

Demand for electricity was significantly affected by its price, price of fuel wood, total energy expenditure and educational level of consumers; Demand for kerosene was significantly affected by its price, educational level of consumers, total energy expenditure and household size; demand for petrol was significantly affected by price of fuel wood & total energy expenditure; demand for LPG was significantly affected by price of electricity, price of fuel wood and total energy expenditure; and demand for fuel wood was significantly affected by price of electricity, price of fuel wood, total energy expenditure, household size and ownership of a household. The values of R^2 recorded for all the energy products means that the variations in the values of the explanatory variables of the energy products' share equations were responsible for 94%, 72%, 95%, 77% and 75% of the variations of the quantity of electricity, kerosene, petrol, LPG and fuel wood demanded by consumers sampled in the study area, respectively.

3.0 CONCLUSION AND RECOMMENDATIONS

Dominant energy sources for cooking and lighting in the urban areas of Benue State were determined using descriptive statistics. Based on the result, it is concluded that the dominant energy source for cooking in Benue State is fuel wood while the dominant energy source for lighting is electricity. Factors that affect households' demand for different types of energy were also analyzed in this study. The results of SUR estimates led to the conclusion that demand for the energy products are affected by both economic and non-economic factors.

On the basis of these results, it can be suggested that government should encourage the use of modern and efficient energy sources by embarking on policies that increase the purchasing power of energy consumers. Non-governmental organizations and banks should also partner with the government to provide solar and wind energy to ensure adequate power supply. For use of efficient energy source for cooking, government is expected to invest in LPG infrastructure. This may ensure true and stable price of the energy product. Better supply distribution channel of petrol and kerosene is needed. This may be made possible through the joint efforts of government and private companies.

Education is another major factor that influences the use of modern energy. The general public should be educated especially on the effects of wood fuels and other biomass fuels. Giving information on the negative impacts of using such energy products and the benefits derived from the use of modern energy products is highly recommendable for achieving increased social development, increased productivity, reduced deforestation and improved human health.

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