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Rural Households' Demand for Domestic Energy in Odeda Local Government Area (LGA) of Ogun State, Nigeria

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ABSTRACT The nature of demand for domestic energy influences environmental conservation and sustainable development. This study determined the factors influencing expenditures on energy products by rural households. Data were collected from 130 randomly sampled households. Analysis was done with descriptive statistics and Tobit regression. Results show that the largest proportion of the respondents was using kerosene for cooking and lighting. Tobit regression results show that as household heads grow older, their demand for charcoal and kerosene significantly increased ($p<0.10$). Households that were using fuel wood for cooking were spending less on kerosene and electricity ($p<0.05$). Also, decision to use each of the energy types for cooking significantly increased the demand ($p<0.01$). It was recommended that efforts to address energy problem in the rural area should take cognizance of ensuring availability and affordability of cleaner energy sources.

INTRODUCTION

The present dimension of energy problem in Nigeria is not in any way warranted given enormous energy resources that the country is naturally endowed with. The welfare impact of unsteady access to modern sources of energy is aggravated by increasing poverty, despite several recently implemented economic reforms and widely applauded economics growth. Unfortunately, however, development of any economy is directly linked to steady access to clean sources of energy for both domestic and industrial uses (Dorf 1978; Adegbulugbe 2006). There is general consensus among policy makers that achievement of many MDGs is directly linked to rapid modernization of the energy sector. This is due to the fact that access to electricity is essential for efficient service delivery in other sectors of the economy such as health and education (Iwayemi 2008; Shaad and Wilson 2009).

In Nigeria, although petroleum products and electricity constitute the most widely used domestic energy sources, their regular availability is not guaranteed due to several institutional and political factors. Over the years, government's abject failure to address dilapidating state of old power generating infrastructure, perfected corrupt practices among government workers, targeted destruction and theft of key transformers have been responsible for the country's energy woes. Although Nigerian rural households rely more on biomass fuels than their urban counterparts, they are not completely shielded from adverse economic impacts of energy price and supply instability. It should be further emphasized that there is wide gap between access by urban and rural households to clean energy. About 73% of Nigerian population lacks access to electricity, although this may increase to about 90 percent for rural areas if properly disaggregated. Poor rural electricity supply attests to the failure of many rural electrification projects and lack of strong political will to permanent address the problem (Adenikinju 2005).

International Energy Agency (2006) noted that in order to meet households' energy needs, about 70 percent of rural households in sub-Saharan Africa rely on fuel wood, charcoal, kerosene or wood wastes. However, dependence on biomass energy sources constitute several environmental challenges that are associated with deforestation and land degradation (World Energy Council 1999; Faye 2002). It should also be noted that cooking energy represents the bulk of energy demand in Nigeria, although about 67 percent of the population uses unclean energy sources in form of fuel wood or charcoal. This

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raises several environmental concerns because of its inefficiency and contributions to indoor air pollution. Similarly, urban and rural households use kerosene as cooking fuel although it is sometimes adulterated with petrol or diesel and very expensive (Shaad and Wilson 2009).

Agarwal (1986) submitted that in the event of fuel scarcity in some third world countries, rural landlords can gather firewood and crop residues from their own property, while the landless must depend on wood from common lands or may be allowed to gather from other people's land in exchange for their labour. Smil (1990) found that hike in fuel prices compels shift from modern energy sources to traditional sources (fuel wood). It was noted that each family had to devote more time, labour and income to searching for and buying fuel wood.

A number of studies have also illustrated increasing reliance of poor households on diverse forms of coping and survival strategies which have resulted from domestic energy price hikes. Cecelski (1985) found that when there was not enough fuel wood, rural people shifted to alternative fuels such as cattle dung, crop residues, coconut husks, rice-hulls, millet stalks, dried herbs etc. Therefore, emerging energy crises are putting a lot of pressure on the forest. Economic concerns over climate change have revitalized political interest in renewable energy. Forests are affected by this renewed interest in various ways.

Adverse health implications of biomass fuel usage have also constituted some concerns to policy makers. Specifically, indoor air pollution that results from burning of biomass is responsible for some worrisome health hazards (Muchiri and Gitonga 2000). The World Health Organization (WHO) estimated that about 1.5 million annual premature deaths can be linked to indoor air pollution from the use of solid fuels (IEA 2006). Incidences of respiratory infections and cataracts in some rural areas have been linked to emitted smokes from biomass fuels (UNDP/ESMAP 2003).

Some empirical studies on domestic energy demand had focused on sources of energy and factors that are responsible for choices made by the households. Some authors such as Onyekuru and Eboh (2011) and Shittu et al. (2004) have found positive relationship between income and improved energy demand. Shittu et al. (2004) found household heads' age as an important factor that influenced demand for biomass fuel in Ogun state. Babanyara and Saleh (2010) found that rural-urban migration, poverty and hikes in price of kerosene were critical factors influencing demand for fuel wood in urban Nigeria. This study seeks to determine the nature of demand for energy products in rural area of Ogun state in order to inform some policy implications from the expected complementary or substitution relationships.

Objectives of the Study

This study seeks to fulfill the following objectives:

i. Determine the types of domestic energy and their major uses by rural households.
ii. Examine the determinants of energy expenditures among rural households.

MATERIAL AND METHODS

Study Area

The study was carried out in Odeda Local Government Area (LGA) which is one of the twenty LGAs in Ogun State, Nigeria. Odeda is located some 20 kilometers from Abeokuta. The council area has an extensive landmass mostly grassland with an area of 1263.45 square km and a population of 109,449 based on the 2006 population census (National Bureau of Statistics 2009). Households in Odeda are predominantly small scale farmers with some bias for growing food crops like cassava, yam, cocoyam, plantain, and maize.

Source of Data and Sampling Procedures

Primary data were used for the study. They were collected from cross-sectional survey of 130 households using structured questionnaires. A multi stage sampling procedure was employed in selecting the representative households. The first stage involved division of the local government area into the 10 existing wards. At the second stage, 13 households were randomly selected from each of these wards, making a total of 130 respondents.

Tobit Regression Model

Tobit regression method was used to examine the factors that influence demand for different domestic energy types. The choice of the model was informed by zero expenditure recorded by some households on the energy types. This makes parameter computation from conventional Ordinary Least Square (OLS) regression to be inefficient. Tobit model is implemented with Maximum Likelihood Estimation (MLE) and censoring at the lowest (zero) expenditure level. The models that were estimated in this study can be generally stated as:

$$Y_{ik} = \alpha_k + \beta_k \sum_{k=1}^{4} X_{ik} + v_k \qquad 1.$$

Where k represents the categories of energy sources and Y_{ik} represents the dependent variable. In the analyses, fuel wood model has log of fuel wood expenditure as the dependent variable, charcoal model has log of charcoal expenditure as the dependent variable, kerosene has log of kerosene expenditure as the dependent variable and electricity model has log of electricity expenditure as the dependent variable. Similarly, α_k represents the constant term and β_k are the estimated parameters for each of the models. X_{ik} are the explanatory variables. The included ones log age (years), log household size, log farm size (acre), log years of education, log per capita income (₦), sex of household head (male = 1, 0 otherwise), marital status (married = 1, 0 otherwise), households' means of transportation (vehicle = 1, 0 otherwise), house heads' primary occupation (farming =1, 0 otherwise), use fuel wood for cooking (yes = 1, 0 otherwise), use fuel wood for heating (yes = 1, 0 otherwise), use fuel wood for lighting (yes = 1, 0 otherwise), use charcoal for cooking (yes = 1, 0 otherwise), use charcoal for heating (yes = 1, 0 otherwise), use charcoal for lighting (yes = 1, 0 otherwise), use kerosene for cooking (yes = 1, 0 otherwise), use kerosene for heating (yes = 1, 0 otherwise), use kerosene for lighting (yes = 1, 0 otherwise), use electricity for cooking (yes = 1, 0 otherwise), use electricity for heating (yes = 1, 0 otherwise) and use electricity for lighting (yes = 1, 0 otherwise). v_k is the stochastic error term.

RESULTS AND DISCUSSION

Socio-economic Characteristics of the Respondents

Table 1 shows the distribution of the respondents' socio-economic characteristics. It reveals that 60.8 percent of the household heads were males. It also shows that majority of the respondents (64.5 percent) were older than 45 years, while only about 5.5 percent were younger than 35 years. The average age of all the respondents is 45 years. Also, 24.5 percent of the households had between 1 and 5 members, 67.7 percent had between 6-10 members, while 7.7 percent of had more than 10 members. Most of the respondents (63 percent) had no formal education, 27.7 percent had primary education, 18.5 percent had secondary education while only 6.9 percent had tertiary education.

Also, 72.3 percent of the household heads were married, 13.0 percent were divorced, 7.7

Table 1: Distribution of respondents' socio-economic characteristics

Socio-economic characteristics	*Frequency*	*Percentage*
Sex		
Male	79	60.8
Female	51	39.2
Age		
Below 35	5	5.5
35 -45	39	30
Above 45	86	64.5
Household Size		
1 – 5	32	24.5
6 – 10	88	67.7
Above 10	10	7.7
Education		
No formal education	63	48.5
Primary education	36	27.7
Secondary education	24	18.5
Tertiary education	9	6.9
Marital Status		
Married	94	72.3
Divorced	17	13.0
Widowed	10	7.7
Separated	9	7.0
Occupation		
Farming	60	46.1
Artisan	25	19.2
Trading	30	23.1
Salary earners	15	11.6
Monthly Income (₦)		
Below 10,100	8	6.1
10,100 <20,100	18	13.8
20,100 <30,100	17	13.1
30,100 –<40,100	58	44.6
Above 40,100	29	22.4

percent were widowed, while 7.0 percent were separated. This gives some indications that majority of household heads were married. Moreover, 46.1 percent of the household heads had farming as primary occupation, 19.2 percent were artisan, 23.1 percent engaged in trading, while 11.6 percent were salary earners. The high percentage of households that were engaged in farming was expected because of the rurality of the area. The table also reveals that 44.6 percent of the households earned between ₦30, 100 and ₦40, 100, while only about 6 percent earned below ₦10, 100 every month. The average household income in the study area was about ₦30,000.00.

Farm Ownership and Size

Table 2: Distribution of respondents by land ownership and farm size

Description	*Frequency*	*Percentage*
Own Land		
Yes	95	73.1
No	35	26.9
Farm Size		
None	35	26.9
< 1	25	19.2
1-2	54	41.5
>2	16	12.4

Table 2 shows the distribution of the respondents by land ownership and farm size. About 73.1 percent of the household heads owned a farm, while 26.9 percent did not. This shows that most of the household heads were engaged in farming activities as either primary or secondary occupation. The table also reveals that 26.9 percent of household heads had no farm, 19.2 percent had less than 1 acre, 41.5 percent had between 1 and 2 acres, while only 12.4 percent had more than 2 acres. This shows that those that cultivated between 1 and 2 acres were in the majority more so that average farm size was 1.3 acres.

Domestic Energy Types and Usage Patterns

Households' choices of energy types and their usage patterns are presented in Table 3. Majority of the respondents (53.1 percent) were using fuel wood for cooking, 15.4 percent were using it for heating while only 3.1 percent were using it for lighting especially during festive periods. Charcoal was used by 54.6 percent of the households for cooking. 17.7 percent for heating and 3.8 percent for lighting. Kerosene was the most widely used in the area as about 79.2 percent of the households used it for cooking, 74.6 percent used it for lighting and about 6 percent used it for heating. Electricity was the least used of the energy types in the study area. This could be attributed to the fact that respondents could not afford the high cost of electricity bill and also because of its erratic supply.

Table 4: Usage pattern of fuel for cooking purpose among households

User categories	*Frequency*	*Percentage*
Single fuel users	83	63.8
Fuel wood	33	25.4
Charcoal	14	10.8
Kerosene	35	26.9
Electricity	1	0.7
Multiple fuel users. *(two fuels)*	30	23.1
Fuel wood and charcoal	8	6.2
Fuel wood and kerosene	6	4.6
Fuel wood and electricity	0	0
Charcoal and kerosene	12	9.2
Charcoal and electricity	1	0.7
Kerosene and electricity	3	2.4
Multiple fuel users. *(three fuels)*	16	12.3
Fuel wood, charcoal and kerosene	12	9.2
Fuel wood, charcoal and electricity	1	0.7
Charcoal, kerosene, electricity	2	1.5
Kerosene, electricity and fuel wood	0	0
Multiple users *(four fuels)*	1	0.8
Fuel wood, charcoal ,kerosene and electricity	1	0.8
All users	130	100

Table 4 presents the categories of fuel usage by the households. It shows that majority of the

Table 3: Fuel types and mode of usage

Fuel types	*Cooking*		*Heating*		*Lighting*	
	Frequency	*Percentage*	*Frequency*	*Percentage*	*Frequency*	*Percentage*
Fuel wood	69	53.1	20	15.4	4	3.1
Charcoal	71	54.6	23	17.7	5	3.8
Kerosene	103	79.2	70	53.9	97	74.6
Electricity	10	7.7	8	6.2	95	73.1

rural households (63.8%), made use of only one type of fuel for cooking, out of which kerosene was the most predominant. Next to this is fuel wood. Electricity, however, is the least used by single fuel users for cooking. This can be attributed to high price and erratic nature of supply. Among multiple fuel users, two fuel users were most common and the combination mostly used was fuel wood and charcoal. Next to this was fuel wood and kerosene. Also, among the three fuel users, the combination frequently used was fuel wood, charcoal and kerosene. The least was charcoal, kerosene, and electricity. However, only 0.8 percent of the respondents used the four fuel types.

Determinants of Domestic Energy Expenditure/Demand

The regression analysis was carried out to identify the variables that significantly influence energy demand. This was done by estimating separate model for the four types of domestic energy.

Demand for Fuel Wood

The results of the analysis for fuel wood demand are presented in Table 5. The model produced a good fit because the Chi Square of the computed log likelihood statistics is statistically significant ($p<0.01$). The researchers therefore rejected the joint hypothesis that the estimated parameters are not statistically different from zero. Their decision can also be confirmed by the statistical significance of the computed sigma statistics ($p<0.01$). Among the included independent variables, marital status is with positive sign and statistically significant ($p<0.05$). This implies that married household heads had higher demand for fuel wood. This is expected because being married is likely to lead to higher family size which may increase volume of food cooked at once and ultimate demand for cooking energy.

Also, households that were using fuel wood for cooking have significantly higher fuel wood expenditure ($p<0.01$). This is expected because fuel wood is mainly used for cooking (Faye 2002;

Table 5: Tobit regression results of factors influencing demand for fuel wood

Variables	*Parameters*	*Standard error*	*t-value*	*Probability level*
Log of age	.7555758	1.865853	0.40	0.686
Log of household size	-.5006696	.9770452	-0.51	0.609
Log of farm size	.1138252	.6930018	0.16	0.870
Log of years of education	-.1917918	.2860623	-0.67	0.504
Log per capita income	-.826809	.6677685	-1.24	0.218
Sex of household head	-.0070738	.2537217	-0.03	0.978
Marital status	.6405963**	.3077046	2.08	0.040
Households' means of transportation	.3119289	.2428283	1.28	0.202
House heads' primary occupation	-.1653594	.2645229	-0.63	0.533
Use fuel wood for cooking	4.280754***	.3464179	12.36	0.000
Use fuel wood for heating	-.9288353**	.3608525	-2.57	0.011
Use fuel wood for lighting	1.706538**	.686667	2.49	0.014
Use charcoal for cooking	.3804776	.2445655	1.56	0.123
Use charcoal for heating	.0266223	.127997	0.21	0.836
Use charcoal for lighting	.5582464	.5304941	1.05	0.295
Use kerosene for cooking	-.5150091*	.3017534	-1.71	0.091
Use kerosene for heating	.905077***	.3229051	2.80	0.006
Use kerosene for lighting	-.5905817**	.2690603	-2.19	0.030
Use electricity for cooking	.3856241	.3106744	1.24	0.217
Use electricity for heating	-1.034466***	.3796406	-2.72	0.008
Use electricity for lighting	.0270051	.2727263	0.10	0.921
Constant	1.93111	4.637276	0.42	0.678
Sigma	.865679***	.0830611		
Log likelihood = -95.168696				
LR Chi-square(22) = 211.90				
Pseudo R^2 = 0.5268				

* Significant at 10 percent, ** Significant at 5 percent *** Significant at 1 percent

Table 6: Tobit regression results of factors influencing demand for charcoal

Variables	*Parameters*	*Standard error*	*t-value*	*Probability level*
Log of age	2.76365*	1.689215	1.64	0.105
Log of household size	1.356579	1.065034	1.27	0.205
Log of farm size	-.8440802	.6136094	-1.38	0.172
Log of years of education	.2621279	.2847819	0.92	0.359
Log per capita income	2.118095***	.9021162	2.35	0.021
Sex of household head	.4683312*	.2503262	1.87	0.064
Marital status	.1039682	.2634671	0.39	0.694
Households' means of transportation	-.0384548	.2149965	-0.18	0.858
House heads' primary occupation	.261251	.245636	1.06	0.290
Use fuel wood for cooking	.0897686	.218674	0.41	0.682
Use fuel wood for heating	.4132885***	.0991386	4.17	0.000
Use fuel wood for lighting	-1.374284**	.6843192	-2.01	0.047
Use charcoal for cooking	3.37951***	.263693	12.82	0.000
Use charcoal for heating	.1646755*	.0955236	1.72	0.088
Use charcoal for lighting	1.405828***	.529468	2.66	0.009
Use kerosene for cooking	.0022744	.2636838	0.01	0.993
Use kerosene for heating	-.6673656***	.2423226	-2.75	0.007
Use kerosene for lighting	.0987487	.2446039	0.40	0.687
Use electricity for cooking	-.7486227***	.2533185	-2.96	0.004
Use electricity for heating	-.4057466	.2936916	-1.38	0.170
Use electricity for lighting	.253067	.2479152	1.02	0.310
Constant	-16.65033***	5.777416	-2.88	0.005
Sigma	.890462***	.0772707		
Log Likelihood = -115.35192				
LR Chi-square (22) = 218.14				
Pseudo R^2 = 0.4860				

* Significant at 10 percent, ** Significant at 5 percent *** Significant at 1 percent

Babanyara and Saleh 2010; Shaad and Wilson 2009). However, those household heads that were using fuel wood for heating purposes have significantly lower expenditure ($p<0.05$), while those that were using it for lighting have significantly higher expenditure ($p<0.05$). In rural areas, use of fuel wood for lighting is not so common. The household heads that were using kerosene for cooking and lighting have significantly lower expenditure on fuel wood ($p<0.10$), while household heads that were using it for heating had significantly higher expenditure ($p<0.05$). These results are expected because those that were using kerosene for cooking are expected to spend less on fuel wood (Shaad and Wilson 2009). Also, household heads that were using electricity for heating have significantly lower expenditure on fuel wood ($p<0.01$).

Demand for Charcoal

The results for estimated model for charcoal demand are presented in Table 6. The model produced a good fit because the Chi Square of the computed log likelihood statistics is statistically significant ($p<0.01$). This shows that the joint hypothesis that the estimated parameters in the charcoal demand model are not statistically different from zero should be rejected. This statistical significance of the computed sigma ($p<0.01$) also supports this conclusion. Among the included explanatory variables, age of the household head is statistically significant ($p<0.10$) and with negative sign. This implies that demand for charcoal decreases as house heads get older. This can be explained from the viewpoint of charcoal scarcity in the villages and initial rigours of getting them fully ignited. Also, the coefficient of per capita income is positive and statistically significant ($p<0.05$). This implies that as per capita income increases, expenditures on charcoal increases. This also reflects that fact that wealthier households were demanding for charcoals. Male- headed households had significantly higher average per capita charcoal expenditure than their female counterparts ($p<0.10$).

Also, the parameter of fuel wood usage for heating is positive and statistically significant ($p<0.01$). This implies that households that were using fuel wood for heating have significantly higher average expenditure on charcoal. The results also indicate that households that were using fuel wood for lighting have significantly lower average expenditure on charcoal ($p<0.05$). However, households that were using charcoal for either cooking, heating and lighting have significantly higher average charcoal expenditure ($p<0.10$). In addition, those using kerosene for heating and electricity for cooking have significantly lower average charcoal expenditure ($p<0.01$).

Demand for Kerosene

Table 7 shows that the estimated Tobit model for kerosene demand produced a good fit for the data because the Chi square is statistically significant ($p<0.01$). The table shows that age is statistically significant ($p<0.10$) with positive coefficient. This implies that as household heads grow older, their expenditures on kerosene increase. This can be explained from less rigours and ease of operating kerosene stoves. The parameter of usage of fuel wood for cooking is with negative sign and statistically significant ($p<0.05$). This implies that those households that were using fuel wood for cooking buy less of kerosene. Also, the parameters of using kerosene for cooking and lighting are with positive sign and statistically significant ($p<0.01$). This implies that those households that were using kerosene for cooking and lighting spend more on it. These results are expected because cooking and lighting constitute the major uses for which kerosene is put in Nigeria. Except when it is scarce and expensive, some households have made an habit of cooking and lighting with kerosene. This becomes more pressing as fuel wood becomes scarcer in many Nigerian forests.

Demand for Electricity

Table 8 shows that the estimated model for electricity demand produced a good fit for the data because the Chi square is statistically significant ($p<0.01$). The results show years of education parameter is statistically significant ($p<0.10$). The negative sign implies that increasing years of education by 100 percent will reduce electricity expenditures by 45.91 percent.

Table 7: Tobit regression results of factors influencing demand for kerosene

Variables	*Parameters*	*Standard error*	*t-value*	*Probability level*
Log of age	1.098631*	.6545465	1.68	0.096
Log of household size	-.1819643	.5661028	-0.32	0.749
Log of farm size	.2986582	.3873866	0.77	0.442
Log of years of education	.1662075	.1726674	0.96	0.338
Log per capita income	.3681907	.4091684	0.90	0.370
Sex of household head	-.0956984	.1500725	-0.64	0.525
Marital status	.1179357	.1572052	0.75	0.455
Households' means of transportation	-.0670153	.1330969	-0.50	0.616
House heads' primary occupation	-.1706022	.1378612	-1.24	0.219
Use fuel wood for cooking	-.3267932**	.1376577	-2.37	0.019
Use fuel wood for heating	-.0158248	.0686301	-0.23	0.818
Use fuel wood for lighting	-.5751222	.4302036	-1.34	0.184
Use charcoal for cooking	.1405131	.1430223	0.98	0.328
Use charcoal for heating	-.0305129	.0682117	-0.45	0.656
Use charcoal for lighting	-.0395422	.3603942	-0.11	0.913
Use kerosene for cooking	.972772***	.1769164	5.50	0.000
Use kerosene for heating	.182953	.1481214	1.24	0.219
Use kerosene for lighting	.8511729***	.151122	5.63	0.000
Use electricity for cooking	-.1472644	.1581654	-0.93	0.354
Use electricity for heating	-.0981417	.1712401	-0.57	0.568
Use electricity for lighting	-.1121461	.1585653	-0.71	0.481
Constant	-2.144578	2.413908	-0.89	0.376
Sigma	.661305***	.044479		
Log likelihood = -133.2416				
LR Chi-square (22) = 107.47				
Pseudo R^2 = 0.2874				

* Significant at 10 percent, ** Significant at 5 percent *** Significant at 1 percent

Table 8: Tobit regression results of factors influencing demand for electricity

Variables	*Parameters*	*Standard error*	*t-value*	*Probability level*
Log of age	-.4104981	1.027868	-0.40	0.690
Log of household size	-.5807751	.9077922	-0.64	0.524
Log of farm size	.4458607	.6256388	0.71	0.478
Log of years of education	-.459191*	.2747115	-1.67	0.098
Log per capita income	-.8919063	.6353271	-1.40	0.163
Sex of household head	.3238506	.2429146	1.33	0.185
Marital status	.3195787	.2546385	1.26	0.212
Households' means of transportation	-.0041009	.2137547	-0.02	0.985
House heads' primary occupation	.07749	.2182599	0.36	0.723
Use fuel wood for cooking	-.614507***	.2240982	-2.74	0.007
Use fuel wood for heating	-.0686097	.1698987	-0.40	0.687
Use fuel wood for lighting	1.401462**	.6581484	2.13	0.035
Use charcoal for cooking	.1160768	.2286935	0.51	0.613
Use charcoal for heating	.0419345	.1063337	0.39	0.694
Use charcoal for lighting	-.2512089	.5901879	-0.43	0.671
Use kerosene for cooking	-.066622	.2842215	-0.23	0.815
Use kerosene for heating	-.218005	.2366838	-0.92	0.359
Use kerosene for lighting	-.1691871	.2354652	-0.72	0.474
Use electricity for cooking	.9799969***	.2482568	3.95	0.000
Use electricity for heating	-.2317301	.2655775	-0.87	0.385
Use electricity for lighting	2.812856***	.2747882	10.24	0.000
Constant	5.904416	3.74261	1.58	0.118
Sigma	1.025171***	.0764792		
Log likelihood = -167.78194				
LR Chi-square 2(22) = 148.60				
Pseudo R2 = 0.3069				

* Significant at 10 percent, ** Significant at 5 percent *** Significant at 1 percent

This is contrary to expectation but can be explained from the fact that actual expenditure on electricity will not reflect demand due to erratic nature of power supply. Also, households that were using fuel wood to cook have significantly lower expenditure on electricity ($p<0.01$), while those that were using electricity for cooking and lighting have significantly higher expenditures ($p<0.01$). These results, as expected have shown that usage of electricity for cooking and lighting will increase monthly electricity bills.

CONCLUSION

The type of energy used by majority of a population reflects the extent of economic development and civilization already attained. Specifically, the nature of domestic energy demand is vital for ensuring sustainable development and reduction of indoor environmental pollution. The results have shown that a lot should be done in ensuring that safer and cleaner sources of energy are available to rural households. Conventionally, availability, affordability and convenience of usage are critical issues to be taken into consideration when making choices among alternative energy sources that are available. There is the need for government's intervention in making kerosene available to rural poor. This is the source of energy that was mostly used. This effort will reduce pressure on the forest and also reduce time for fetching fuel woods.

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