Original Research Article

Comparative Analysis of Access, and Preferences of Rural and Urban Households for Cooking Energy, and the Determinants in Nigeria: A Case of Ogun State

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Abstract

This study identified and compared the use of cooking energy among rural and urban households in Ogun State, Nigeria using a sample of 300 households. Empirical results indicate that electricity and gas are the least sources of cooking energy in rural area (RA) while firewood and electricity are least in urban area (UA). The level of education of the respondents was a significant ($P < 0.05$) factor influencing the probability of using charcoal and electricity in the RA relative to firewood, while there is a tendency towards positivity using charcoal, kerosene and gas relative to firewood with household size in UA. In addition, distance to energy source ($P < 0.05$), and household income ($P < 0.01$) significantly determine energy use in UA. Probability of using charcoal, electricity was also found to be significantly ($P < 0.01$) influenced by occupation and price of the cooking fuel, respectively, in a negative direction. In the UA, both income and price significantly influence the use of gas while only price influences its usage in the RA. There is therefore the need for price reduction and promotion of interventions that will enable low income earner to use cleaner and environmentally friendly energy source.

Keywords: Energy ladder; energy efficiency; choice; renewable energy; non-renewable energy.

INTRODUCTION

Cooking energy has been described as "a necessary input for satisfying the basic human need of survival" (Balmer, 2007). It generally refers to the energy used in a household including animal dung, firewood, charcoal, kerosene, electric stoves, and liquefied petroleum gas. In general, households often use more than one source of cooking energy. These have been categorized by Bolaji (2012) as follows: traditional (dung, agricultural residues and fuel-wood), intermediate (charcoal and kerosene) or the modern sources (liquefied petroleum gas, biogas, ethanol gel, plant oils, dimethyl ether and electricity). Energy supports do not only help in the provision of basic needs such as cooked food, a comfortable living temperature, lighting and use of appliances but it also contributes to the economic growth. The volume and type of energy use in both rural areas (RA) and urban areas (UA) depends on many factors such as population size, lifestyle, economic status of the household, urbanisation, type of residence, age of the occupants, and literacy level (Nnaji et al., 2012).

Despite the abundant sources of renewable and non-renewable energy, Nigeria national energy supply is still largely dependent on fossil fuels and firewood (50.5%), petroleum products (41.3%), and hydroelectricity (8.0%) while solar, wind geothermal, coal and nuclear sources are largely ignored for the domestic energy needs (Omokaro, 2008; Akpu, 2012). While fossil fuels constituted 94% of exports from Nigeria in 2006, only a small fraction of this is available for domestic use and about 40% households are connected to the national electricity grid (Akpu, 2012). Proliferation of gasoline generators is common in all parts of Nigeria due to the epileptic nature of power supply from the national grid. Over 90% businesses and companies in Nigeria still use generators to generate power leading to high production cost of locally produced materials, environmental pollution, and increased greenhouse gases emission (Omokaro, 2008).

Access to safe and efficient energy is one of the major challenges facing many households today. In most developing countries, the household sector accounts for more than 90% of total energy consumption (MacCarthy et al., 2010). Lack of access to efficient energy in rural areas may affect and undermine health and limit the opportunity for education and development, and can increase family's poverty. An estimated 60% to 70% of Nigerians reportedly lack access to electricity (Oyedepo, 2012). Indeed, access to energy is important for socio-economic development because it increases productivity, income growth, education, and improves health (Nnaji et al., 2010). This is because cooking energy such as fuelwood is characterized by many health risks (respiratory, pulmonary and carcinogenic) associated with their regular usage (Nwofe, 2013). Moreover, the indoor air pollution associated with the use of biomass energy is said to be directly responsible for more deaths than malaria (Bukola, 2012). Findings also show that in Nigeria, children miss many school days because of firewood gathering due to overreliance on this source of energy (Joachim, 2010). When wood fuels are scarce, the time people spend collecting fuel reduces the time they devote to agricultural activities.

The cost of electricity indicates that there was an increase from ₦2.30/KWH to ₦11.75/KWH between 2000 to 2012 in Nigeria with only a very small percentage connected to the national grid (Shittu et al., 2004; Babanyara and Saleh, 2010; Sambo, 2010; Abdrazack et al., 2012; Oyekale et al., 2012; Audu, 2013). This has pushed up the percentage of households that use other sources of fuels for cooking (Taru et al., 2011; Ojo and Chuffor, 2013).

The popularity of the transition to charcoal was due to acute scarcity of firewood and kerosene as well as their exorbitant prices. Charcoal is formed when wood is burnt. It is used for cooking, ironing, blacksmith, gunpowder, art and medicine, as filter, catalyst, adsorbent, and for cultural costume. However, production of charcoal does affect vegetation since trees have to be felled. A sizeable percentage of low or middle income urban dwellers use charcoal to augment their domestic energy needs (Desalu et al., 2012). People use charcoal because of its low price, availability, and easy manipulation over domestic fuels, easy storage, absence of smoke, high temperature and portability. However, persistent use of charcoal for cooking may lead to increase in desertification, loss of farmland to erosion, and serious negative impact on the environment (Ngaira and Omwayi, 2012).

This study is conceptually based on crossing point between a household's socio-economic status and its choice of energy supply which is identified as "energy ladder", where changes in household income status drive energy consumption. This suggests an improvement in household socio-economic status and increases the opportunity to use more expensive energy sources (Smith, 1987; Holdren and Smith, 2000; Barnes and Floor, 1996). "Fuel switching or interfuel substitution" are the common terminology used for the process of moving up the ladder (Barnes and Qian, 1992; Hosier and Kipondya, 1993; Leach et al., 1992).

In many developing countries, there is advocacy on encouraging households to make substitutions for efficient and environment-friendly energy (Farsi et al., 2005). Yet many households still depend on energy sources which have negative impact on health. This suggests that further research is needed on the household energy choices, in both urban and rural areas. There are existing studies on cooking energy in Nigeria (Alabe, 1996; Shittu et al., 2004; Adeleke and Jerome, 2006; Onyekuru and Eboh, 2011; Olatunwo and Adewumi, 2012; Oyekale et al., 2012). However, these studies did not compare energy choice between rural and urban households. Therefore, this study will provide more insight on cooking energy and its distribution in Nigeria in addition to the existing findings.

The policy question being addressed by this study is what are the factors influencing rural and urban household cooking energy choice in Ogun State, Nigeria and the interventions necessary to ameliorate households' energy poverty? We therefore examined the various forms of cooking energy available and used by rural and urban households; determine the accessibility and preference for cooking energy among the respondents and examine the factors that influence the choice of cooking energy among the rural and urban households. The finding will provide information of factors that either motivate or discourage households on their cooking energy choices and provide a yardstick for evaluation of the implemented energy policies that address people's basic needs and the preservation of the environment.

MATERIALS AND METHODS

Description of the study area

The study was conducted in Odeda Local Government Area (LGA). The LGA is one of the twenty (20) existing Local Government Areas in Ogun State, Nigeria and has it headquarter in Odeda town located 20 km along Abeokuta-Ibadan road. It was created out of Egba Divisional council in October 1955 by the then Western Nigeria Government controlled by Late Chief Obafemi Awolowo. The council area has an extensive land mass, mostly grassland with an area of 1263.45 sqkm and a population of 109,449. According to the 2006 population census figure, this represents an annual growth rate of 10% with upward increase of 10,334 to that of 1991 population census figure of 99,115 people (NPC, 2006). The Local Government shares boundaries with Abeokuta South, Abeokuta North, Obafemi-Owode local government and Oyo State in the southwest, east, and north, respectively. Climatically, the local government area enjoys tropical climate and double maxima rainfall from April–July and September–October. Average temperature is about 32 °C but humidity can be as high as 95%. There are about 25–30 semi urban areas and 860 villages and hamlets in the local government area and the people are predominantly Egba who have their homesteads and farm land in the area but mostly reside in Abeokuta. Others are the Igedes, Ijesha and other minority groups. The people of Odeda Local Government are predominantly farmers who engage in small scale farming. The major food crops of the area include cassava, yam, cocoyam, plantain, maize, and vegetables whereas cocoa is the major cash crop. Major markets include: Olodo, Olugbo, Kila, Alabata and Osiele.

Sampling procedure

A multi-stage sampling procedure was employed in selecting the representative households. Stage one involved random selection of 5 wards out of 10 existing wards in Odeda LGA. In stage two, three rural wards and two wards in the urban were randomly selected. In the third stage, two (2) villages were selected from each three (3) rural wards making a total of six (6) villages from the rural, and two urban centres. In stage four, 20 households were randomly selected from each village making a total of 120 households from the rural areas. A total of 90 households were also randomly selected from each of the two urban centres making a total of 180 households for the study. The difference in sample size in rural and urban areas was due to the higher numbers of households residing in urban areas compared to the rural areas within the LGA.

Data collection

As the main source of data were used the primary data which were obtained with the aid of a structured questionnaire complemented by interview. The primary data collected include socio-economic characteristics of households, access and uses of various forms of cooking energy in the study area.

Analytical Methods

The study used descriptive statistics including tables, frequencies and percentages to describe the socio-economic characteristics of the respondents that influence various choices of household cooking energy, various forms of energy, households' preference and accessibility, and constraints of cooking energy in the study area. Multinomial Logit Model (MNL) was also used following Pundo and Fraser (2006), to estimate the factors believed to influence a household's choice of cooking fuel in rural and urban areas of Odeda Local Government. MNL describes the behaviour of consumers when they are faced with a variety of goods with a common consumption objective. The model assumes that the choice of household's cooking energy is based on the maximization of the utility derived from this energy.

For each of the alternatives j = 0, 1, 2, 3, the utility of individual "i" is expressed in the following form:

$$U_{ij} = U\left(x_{ij}, \varepsilon_{ij}\right) = v\left(x_{ij}\right) + \varepsilon_{ij} \tag{1}$$

Where v is a deterministic continuous function, is a random variable. It is assumed that the disturbance/random variable (ε_{ij}) is independent and identically distributed. And x_{ij} define a categorical variable which takes some alternatives according to the choices of individual *i*. The probability that individual *I* chooses an alternative can be defined by

$$P\left(Y_i = J\right) = \frac{\exp\left(\beta_j X_i\right)}{\sum_{J=0}^{J} exp\left(\beta_j X_i\right)} \tag{2}$$

Where P ($Y_i = J$) is the probability of choosing charcoal, kerosene, gas or electricity with firewood as the reference cooking fuel category, J is the number of fuels in the choice set, J = 0 is firewood, Xi is a vector of the predictor (exogenous) social factors (variables), βj is a vector of the estimated parameters.

When the logit equation above is rearranged using algebra, the regression equation is as follows

$$P_i = \frac{e^z}{1+e^z} = \frac{1}{1+e^{-z}} \tag{3}$$

$$Z = \ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \\ + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \mu \tag{4}$$

Z = log odds of fuel that confers the higher utility with respect to the other alternatives.

From equation (4) the quantity Pi / (1 – Pi) is the odds ratio

$$P_i = P_1, P_2, P_3, P_4,$$

P_0.........probability of using firewood. This was used as a reference fuel because we want to know the influence of using a particular cooking energy relative to the reference category and the use of firewood is least expected from the households in this era of energy-saving technology.
P_1.........Probability of using gas.
P_2.........Probability of using charcoal.
P_3.........Probability of using electricity.
$1 - P_i$...the alternative fuel which are gas and charcoal.
P_k.........P_2, P_3, P_4
μ..........Error term.

The independent variables include: X_1 = Marital status, X_2 = Educational level in years, X_3 = Household size (number), X_4 = Occupation (employed = 1, 0 otherwise), X_5 = Unit price of the energy in naira, X_6 = Distance to energy source, X_7 = Access of the energy (easily accessible = 1, otherwise 0), X_8 = Household income in naira. $\beta_1 - \beta_6$ are the coefficients corresponding to independent variables. We included the prices of market cooking fuels and household income because the variables are not the same for all households in all the study areas. The estimated coefficients represent change in the logit for a one-unit change in the explanatory variable while the other variables are assumed constant.

RESULTS AND DISCUSSION

Demographic and Socioeconomic Characteristics of Respondents

This comprises the personal attributes of the respondents including gender, age, level of education, occupation, total household size, marital status, employment status, income of respondents. Descriptive results in Table 1 show gender differences as central to the understanding of household cooking fuel choice in Nigeria. In both rural (RA) and urban areas (UA), cooking energy procurement was largely the responsibility of women rather than men. From the field observations, about 77% and 72% of the sampled respondents in rural and urban areas, respectively, were women. In RA, 50% of the respondents constituted the age group of 18–30 years and 2.5% were above 71 while in the UA, 51% constituted the age range of 18–30 years and 22% are above 70 years. The finding revealed that most of the respondents were within their economically active age category of below 60 years. In the RA, 77% of the household had a range of between 1–4 members, while in the UA, 59% had about between1–4 household members.

The results show that in the rural households, 94% respondents had an income range of ₦1,000–50,000, 5% had an income range of ₦51,000–₦100,000, and 1% had a range of ₦101,000–₦150,000, whereas in the urban ones, 84% had an income between ₦1000 –50,000, 9%had an income range of ₦51000–₦100000, and 2% had a range of ₦151,000–₦200,000 and 0.6% had an income range of ₦201,000–₦250,000. The results show that respondents in the UA had a high rate of income compared to the rural populace. About 28% respondents in the rural households were single, 64% married, and 8% widowed, whereas in the urban households, 32% were single, 64% married and 4% widowed. Thus the majority in both RA and UA were married. Analysis of the respondents' educational status showed that 9% respondents in the rural households have formal education, 20% have primary education, and 45% have secondary education and 28% have tertiary education, whereas in the urban ones, 3% have no formal education, 9% have primary education, 29% of the respondents have secondary education and 58% have tertiary education. This shows that the urban dwellers have more often higher education than those in the rural households. This is probably a result of the establishment of tertiary schools in the urban areas.

Table 1. Demographic and Socioeconomic Characteristics of Respondents

Characteristics	Rural	Urban		
Gender	Frequency (N = 120)	%	Frequency (N = 180)	%
Male	28	23.0	51	28.3
Female	92	77.0	129	71.7
Age				
18–30	60	50.0	91	50.6
31–50	45	37.5	67	37.2
51–70	12	10.0	18	10.0
>71	3	2.5	4	22.0
Household size				
1–4 members	92	76.7	107	59.4
5–8 members	23	19.2	68	37.8
9–12 members	5	4.2	5	2.8
Income				
₦1000–₦50000	113	94.2	152	84.4
₦51000₦100000	6	5.0	17	9.4
₦101000–₦150000	1	0.8	7	3.9
₦151000–₦200000	–	–	3	1.7
₦201000–₦250000	–	–	1	0.6
Marital status				
Single	33	27.5	58	32.2
Married	77	64.2	115	63.9
Widow	10	8.3	7	3.9

Characteristics	Rural	Urban		
Education				
Primary	24	20.0	16	8.9
Secondary	54	45.0	53	29.4
Tertiary	33	27.5	105	58.3
No education	9	7.5	6	3.3
Employment status				
Farming	23	19.2	12	6.7
Self employed	63	52.5	99	55.0
Private employed	11	9.2	28	15.6
Government	19	15.8	27	15.0
No employment	4	3.3	14	7.8

In the RA, 22% of respondents were involved in farming activities, 49% of them were into trading, 18% were civil servants and 12% of them were into other forms of occupation, whereas in the UA, 19% of respondents were involved in farming, 53% of them were into trading, 24% were civil servants and 9% of the respondents were into other occupations. Also observed in the study was the fact that the majority of the respondents were self-employed. About 53% of them were self-employed in RA and 55% were self-employed in the UA.

Accessibility and use of household cooking energy in the rural and urban areas

Table 2 shows the level of accessibility of household cooking energy in the study areas. There is a wide gap between access by urban and rural households to traditional cooking energy such as firewood. The result revealed that about 45% respondents have access to firewood as cooking energy in the RA compared to 11% in the UA. Contrary to our expectation, access by urban and rural households to clean energy supplies (electricity (28%) by rural households and 19% by the urban) is very close compared to gas which is highly accessible by 39% inthe UA and 19% in the RA. Table 3 on various forms of household cooking energy revealed that firewood dominates (65%) the rural cooking energy while kerosene dominates (85%) that of urban contrary to charcoal found in some countries such as Zambia as the most common source of cooking energy in urban areas (Solomon et al., 2015).

Preference for cooking energy with change in respondents' income

The results show that if the income level increased among rural households, about 2% will prefer firewood, 2% will prefer charcoal, 14% will prefer kerosene, 35% will prefer electricity, and 48% will prefer to use gas. On the other hand, in the urban households, 4% of the respondents will prefer firewood, 6% will prefer charcoal, 29% will prefer kerosene, 26% will prefer electricity and 36% will prefer gas. Indeed, increase in income will increase preferences for gas usage among rural household relative to urban dwellers.

Constraints of cooking energy in the study area

As shown in Table 4, 62% of rural household firewood users complained of smoke, 48% indicate that charcoal is difficult to use, 64% of kerosene users complained of high cost of kerosene, 63% complained of irregular electricity supply and 58% of respondents complained of scarcity of gas. Meanwhile, in the UA, 60% of respondents were faced with the problem of smoke generated from the use of firewood, 56% of respondents complained about difficulty in the use of charcoal, 59% were faced with high cost of kerosene, 64% were faced with irregular electricity supply, and 61% were faced with irregular supply of cooking gas.

Table 2. Accessibility Cooking Energy by Household

Category Energy Used	Rural						Urban					
	H.A		F.A		N.A		H.A		F.A		N.A	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Firewood	54	45.0	28	23.3	38	31.7	20	11.1	36	20.0	124	68.9
Charcoal	31	25.8	33	27.5	56	46.7	63	35.0	42	23.3	75	41.7
Kerosene	46	38.3	35	29.2	39	32.5	98	54.4	61	33.9	48	26.7
Electricity	33	27.5	35	29.2	52	43.3	35	19.4	48	26.7	97	53.9
Gas	23	19.2	27	22.5	70	58.3	71	39.4	35	19.4	47	26.1

Note: HA – highly accessible, FA – fairly accessible, NA – not accessible

Table 3. Forms of household cooking energy used and their preferences with increase in income in the rural and urban areas

Types of Cooking Energy	Energy Used			
	Rural		Urban	
	Frequency	%	Frequency	%
Firewood	78	65	20	11
Charcoal	38	32	133	74
Kerosene	67	56	153	85
Electricity	8	7	58	32
Gas	9	8	96	53
Energy Used	**Preferences for cooking energy if income is increased**			
	Rural		Urban	
	Frequency	%	Frequency	%
Firewood	2	1.7	7	3.9
Charcoal	2	1.7	10	5.6
Kerosene	17	14.1	52	28.8
Electricity	42	35.0	47	26.1
Gas	57	47.5	64	35.6
Total	120	100	180	100

Note: Energy used is a multiple choice question

Comparative determinants of the choice of cooking energy among the rural and urban households

Identifying appropriate policies to change in household energy utilization requires detailed analysis of the specific drivers of household energy choice (Solomon et al., 2015). Table 5 shows the results of the multinomial logit model used to analyse factors influencing cooking energy choices by respondents in the study area. In the RA, the estimated coefficient shows that the education of respondents using charcoal has a positive and statistically significant ($P < 0.05$) effect indicating that as education of the respondent increases there is higher likelihood for the household to use charcoal relative to firewood. This conforms with the expectation that the more educated a respondent is, the more he/she switches from local cooking energy (in this case firewood) to modernized form of energy (such as the charcoal). Charcoal is smokeless when compared to firewood causing inhalation of toxic substances (carbon monoxide) leading to diverse health problems such as breathing problems and finally death. The estimated coefficient for household size using electricity is negative and statistically significant ($P < 0.05$) indicating that as household size increases there is less likelihood for the household to use electricity relative to firewood. This conforms with the expectation that larger households will prefer

Table 4. Most Important Constraints of Using Various Household Cooking Energy

Challenges	Rural									
	Firewood		Charcoal		Kerosene		Electricity		Gas	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Smoke	74	61.7	35	29.2	15	12.5	_	_	1	0.8
Difficult to use	31	25.8	58	48.3	10	8.3	5	4.2	25	20.8
Costly	14	11.7	12	10.0	77	64.2	35	29.2	25	20.8
Irregular supply	1	0.8	7	5.8	7	5.8	75	62.5	_	_
Scarce	_	_	8	6.7	11	9.2	5	4.2	69	57.5
Total	120	100	120	100	120	100	120	100	120	100
Urban										
Smoke	108	60	16	8.9	15	8.3	_	_	14	7.8
Difficult to use	71	39.4	100	55.6	56	31.1	2	1.1	2	1.1
Costly	1	0.6	45	25.0	107	59.4	23	12.8	5	2.8
Irregular supply	_	_	15	8.3	2	1.1	115	63.9	110	61.1
Scarce	_	_	4	2.2	_	_	40	22.2	49	27.2
Total	180	100	180	100	180	100	180	100	180	100

Table 5. Result of the estimated Multinomial Logit Model for rural and urban households

Variables	Charcoal			Kerosene			Electricity			Gas		
	Estimated coefficient	Std error	p-value	Estimated coefficient	Std error	p-value	Estimated coefficient	Std error	p-value	Estimated coefficient	Std error	p-value
Rural												
Marital status	0.149	1.62	0.927	0.169	0.835	0.839	61.773	4460.164	0.989	–0.932	3.132	0.766
Education	2.24**	1.105	0.043	–0.359	0.364	0.324	40.157	11322.617	0.997	1.687	2.172	0.437
Household size	0.066	0.324	0.838	0.085	0.161	0.595	–0.800**	3715.264	0.400	0.414	0.465	0.373
Occupation	–0.225	0.573	0.695	0.312	0.335	0.352	–33.265	5479.278	0.995	–0.128	1.382	0.926
Unit price of the cooking energy	–0.001	0.001	0.453	0.000	0.000	0.339	0.018	4.533	0.997	–0.001**	4.493	0.250
Distance to energy source	0.079	0.939	0.933	–0.151	0.458	0.741	–4.152**	6875.807	0.420	0.186	1.631	0.909
Access to cooking energy	–2.195**	0.959	0.022	–1.491***	0.448	0.001	23.031	17789.411	0.999	15.945	0.000	0.791
Household income	0.000	0.000	0.564	0.000*	0.000	0.082	0.000	0.059	0.997	0.000	0.000	0.993
Urban												
Marital status	–0.946	0.994	0.341	33.717	14513.42	0.998	–1.411	1.808	0.435	0.833	1.037	0.422
Education	0.117	0.508	0.818	–24.603	12109.52	0.998	0.532	0.981	0.588	0.663	0.584	0.256
Household size	0.342	0.193	0.077	–6.259	8643.362	0.999	–0.326	0.397	0.413	0.114	0.192	0.552
Occupation	–1.327**	0.553	0.016	5.755	8375.654	0.999	–0.701	0.645	0.277	–0.731	0.572	0.201
Unit price of the cooking energy	0.000	0.001	0.416	–0.074	16.698	0.996	–0.002	0.001	0.202	–0.001***	0.001	0.016
Distance to energy source	–0.368	0.900	0.683	0.432**	53811.89	0.035	0.337	1.192	0.778	0.746	0.795	0.348
Access to cooking energy	2.468	0.692	0.000	22.497	0.000	0.000	4.755	1.156	0.000	4.068	.818	0.000
Household income	0.000	0.000	0.679	0.000	0.402	0.999	0.000	0.000	0.445	0.000***	0.000	0.004

*Note: Reference category is firewood, levels of statistical significance are denoted as ***, **, for P < 0.01, and P < 0.05, respectively*

to use firewood since it is comparatively cheaper when compared to sources such as electricity which at many times is not available in the study area. Our finding agrees with Pundo and Fraser (2006) that larger households may have extra and free labour for firewood collection.

The results of the urban respondents showed that there is a tendency towards positivity of household size using charcoal relative to firewood indicating that there is a higher likelihood for charcoal by households with a large number of people. This could be because of the difficulty at gathering and use firewood in the urban centres forcing force the household to switch to charcoal to meet the large household size.

The estimated coefficient of occupation of the respondents using charcoal is negative and statistically significant ($P < 0.05$) relative to those using firewood. Price of gas coefficient is negative and statistically significant ($P < 0.01$) indicating lower likelihood of respondents using gas relative to firewood. This is because people see gas as being expensive compared to firewood. Distance of the source of kerosene has a positive coefficient andis statistically significant ($P < 0.05$) indicating a higher likelihood of respondents using kerosene which can be obtained at a shorter distance in the urban area relative to firewood. The estimated coefficient of income of respondents using gas is positive and statistically significant ($P < 0.01$) indicating high likelihood by respondents at using gas relative to firewood in UA. Respondents in UA probably used gas because they see gas to be more efficient and faster than firewood. The influence of income on the use of gas may be attributed to improved socioeconomic status which drives the household upward on the energy ladder.

CONCLUSIONS AND RECOMMENDATIONS

This study reveals important factors that determine household cooking fuel choice. Level of education and household income have positive and significant influence in determining the probability of switching from firewood to charcoal and kerosene by rural households, whereas household size (on electricity), price of the cooking fuel (gas), distance to energy source (electricity), access to energy (charcoal and kerosene) have negative effects relative to firewood. In the urban areas, household size, distance to energy source and household income have positive and significant effect on probability of switching from firewood to charcoal, kerosene and gas respectively, while education of respondents and price of the cooking fuel have significant but negative effects on the probability of switching to charcoal and gas. The study also shows that firewood dominates (65%) the rural cooking energy while kerosene dominates (85%) that of urban in the study areas. The implications of this on the RA are enormous as this could be responsible for high rate of deforestation, soil erosion, declining agricultural productivity, and loss in the natural habitat for wildlife.

Following the findings of the study, the following recommendations are suggested to ease the problem faced by cooking fuel users in the study area. First, the price of gas needs to be subsidized so that both rural and urban dwellers in the study area can afford and use it. Second, education on the need to reduce household size through family planning will enable households to be able to switch from the use of traditional source to modern cooking energy such as electricity. Third, creation of jobs that will increase household income will make households to switch from firewood to clean cooking energy of their high preference observed as cooking gas in both rural and urban areas. Finally, the positive effect of income on cleaner fuel like kerosene, electricity and gas in the energy ladder relative to solid fuel such as firewood in the lower energy ladder calls for government and other stakeholders to promote interventions that will enable low income earner to use higher-quality, lower-emission liquid or gaseous fuels.

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