

ASSESSMENT ON SOURCES OF HOUSEHOLD ENERGY IN USE BY RURAL WOMEN IN PLATEAU STATE, NIGERIA

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Abstract

The study assessed sources of household energy in use by rural women in Plateau State, Nigeria.

The study used multi-stage, stratified and simple random sampling techniques to collect data from 376 rural women in Plateau State using a well-structured questionnaire. Data were analyzed using frequency, percentage, mean score and standard deviation. Results reveal that firewood, kerosene, animal dung, charcoal, groundnut shell, leaves/litters, saw dust, coconut shell, corn stalk, cooking gas and electricity were sources of household energy found in the study area however, firewood, kerosene, animal dung, charcoal, cooking gas and electricity were identified as household energy sources available for use in the study area by the respondents. The study further reveals that firewood ($x=2.85$; $x=2.76$; $x=2.86$), kerosene ($x=2.59$; $x=3.06$; $x=2.59$) and charcoal ($x=2.68$; $x=2.66$; $x=2.68$) were energy sources highly utilized in the northern, central and southern agricultural zones of the study area respectively. The study therefore, recommends that rural women in the study area should be tutored on how to use other free available household energy sources within their locality to reduce cost constraint on firewood, charcoal and kerosene.

Keywords: Sources, Household Energy, Rural Women, Plateau State, Nigeria

Introduction

Household energy is essential for human well-being and constitutes fuel sources used to meeting most basic household needs such as cooking, boiling, heating and

lighting. Energy is at the heart of most critical economic, environmental and social developmental issues facing rural communities (Olatinwo and Adewunmi, 2012). Many of the different sources of household energy in use in developing countries come under the category of “traditional”, which include biomass such as animal dung and agricultural residues (), as well as woodfuel (firewood, charcoal, twigs, leaves, litters and other wood derived fuels). It also constitutes the most important form of non-fossil energy used in households (World Bank, 2004).

Worldwide, more than three billion people depend on solid fuels to meet their most basic household energy needs; about 52% of this population is in developing countries, especially in the rural areas, depend on different types of household energy fuels for their cooking. Over half of these people live in India, China, Africa and Indonesia; however, the proportion of the population is highest in sub-Saharan Africa (WHO, 2006). In sub-Saharan African 90% of rural population relies on biomass as the primary source of energy especially fuelwood and charcoal for cooking, heating, boiling and lighting (Karekezi *et al.*, 2008; Wolde-Rufael, 2009); in China, a large proportion of households use coal instead (Chungsheng, 2010) and poor households in Asia and Latin America depend on fuelwood. Heavy dependence on biomass fuel as household energy is concentrated in, but not confined to, rural areas.

In Nigeria, the percentage of households using solid fuel is about 80 percent (Herbert and Bacon, 2003). In sub-Saharan Africa, Naether *et al.* (2007) noted that there is heavy reliance on biomass fuels as cooking fuel. Coal and biological materials (straw, fuelwood and biogas) are the dominant sources for household cooking and heating. Other forms of energy such as solar and wind power is in no way a serious source for rural household supply. Staton and Harding (2000) reported that cooking in any household involves the use of solid fuel and non solid fuel, however, the non-solid fuels consist of kerosene, liquefied petroleum gas (LPG), natural gas and electricity and are mostly used for lighting in rural areas NV(Torres-Duque *et al.*, 2008).

Agricultural production is the basis of rural economies. The rural people are involved in subsistence production, processing and storage of agricultural products (NBS,2005).Rural house holds form the major food producers in Nigeria. They produceover80%ofthefoodneedsofthecountry (Nabintaetal.,2007) and have little or no

access to electricity and petroleum products and therefore rely mainly on manual techniques and solar energy (Lukman,2003).Theruralpopulace does not have access to sustainable energy and therefore depend on biomass which include twigs, branches, animal residues, crop residues, fuel wood, charcoal, woods havings and saw dust (Lukman, 2003; NBS,2005; Nabintaetal, 2007; Akin,2008).

Nigeria is endowed with energy resources, the major ones being crude oil, natural gas, coal, tars and biomass. However, the use of solid biomass such as fuel wood is prevalent and constitutes a major energy source for most rural dwellers in Nigeria and plays an important role in meeting the house hold energy demand (). Currently, biomass accounts for over 50% (ECN,2003) of overall energy consumption in the country and is the dominant source of energy in the domestic sector. Solid biomass fuel (fuelwood and charcoal), account for over 80% of national energy consumption (Yahaya *et al.*, 2007; Nabinta *et al.*, 2008). The pattern of household energy consumption of any nation represents the status of its welfare, as well as, the stage of economic development of that nation, unchangeably as the economy develops, more and cleaner energy is consumed (Reddy, 2003).

Yahaya *et al.* (2007) claimed that women, children, as well as the men are forced to search further afield for household fuel. Rural households collect fuel from various sources: animals, forest land or open land surrounding their villages, local retailers, etc. while in many urban regions, these fuels have become traded goods. The energy carriers are used for multiple purposes, viz., cooking, water heating, lighting etc. Many households use firewood for both cooking and water heating while other households use kerosene and liquefied petroleum gas (LPG) for cooking, water heating is done with either firewood or electricity and lighting is with kerosene and sometimes they use candle (Laitner, 2000).

Coal and biomass fuel dominate household energy consumption (Chungsheng, 2010). Solid fuels (biomass) are consumed mostly by rural households because of their easy availability. In rural areas, although the use of LPG for cooking has grown rapidly, it still accounts for only about 6% of total household energy use (Ouedraogo, 2006). Laiter (2000) reported that traditional biomass fuels appear to be the second most important source of household energy for cooking because of their relative affordability. Biological

matters such as fuelwood and agricultural waste are the dominant source of household fuels in rural areas.

The primary household energy resource to which African villagers have affordable, ready access is biomass either as fuelwood or biomass waste from farming, also referred to as farm waste or farm residue (World Bank, 2004). Fuels are mostly used for cooking, and the predominant cooking fuel is firewood, which accounted for 74% of all cooking fuel. The next most important cooking fuels are farm residue, followed by kerosene and charcoal (Sokona *et al.*, 2003). The most commonly used energy source for lighting is kerosene, which is reported as the secondary energy source in rural areas and the primary energy for lighting, followed by dry cell batteries, and candles. In some areas, grid electricity is the secondary source of household energy for lighting. Kerosene is clearly the dominant lighting technology of the poor. The exceptions are where households also relied heavily on energy from dry cell batteries, which might reflect a reliance on flashlights consistent with a pastoralist nature of the population (Turkenburg, 2002).

A lot of variations in household energy consumption are closely related to differences in income, access to energy sources, structures of local economy and geographic/climatic conditions. Many developing countries have a large rural population mainly engaged in traditional agricultural production. Ouedraogo, (2006) noted that the prevalence of solid fuel and kerosene use was higher in the rural areas than urban areas while the use of gas, electricity and agricultural waste was higher in the rural areas. The choice of cooking fuel in rural areas is mostly influenced by age, education, wealth, income, availability of fuel, kitchen location and awareness of the harmful effects of smoke from solid fuel which are all modifiable. The study, therefore, identifies sources of household energy available for use by rural women in Plateau State and determines level of household energy consumption among rural women in the study area.

Methodology

The study was conducted in Plateau State. Plateau State is the twelfth largest [State](#) of [Nigeria](#). It is located in the North Central part of Nigeria and its capital is [Jos](#). It is bordered by [Bauchi State](#) to the North East, [Kaduna State](#) to the North West, [Nasarawa State](#) to the South West and [Taraba State](#) to the South East. Plateau State is located in [middle belt](#)

[region of Nigeria](#). It has a land area of 26,899 square kilometers. The State has an estimated projected population of about 4.655 million people in 2017 (NPC, 2006). It is located between latitude 8°24'N and longitude 8°32' and 10°38' east. The altitude ranges from around 1,200 meters (about 4000 feet) to a peak of 1,829 meters above sea level in the [Shere Hills](#) range near [Jos](#).

Plateau State falls under the northern guinea savannah. It has tall perennial dominated open woodland, with a rainfall of 1020 - 1270mm/ annum (Plateau State Government, 2012). Plateau State has a near temperate climate with an average temperature of between 18 and 22°C. [Harmattan](#) winds have the coldest weather and the warmest temperatures which occur in the dry season. Plateau State is subdivided into seventeen (17) LGAs namely: [BarkinLadi](#), [Bassa](#), [Bokkos](#), [Jos East](#), [Jos North](#), [Jos South](#), [Kanam](#), Kanke, Langtang North, [Langtang South](#), [Mangu](#), [Mikang](#), [Pankshin](#), [Qua'an Pan](#), [Riyom](#), [Shendam](#), [Wase](#) and has three agricultural zones namely: the Central, Southern and Northern zones. It has over forty ethno-linguistic groups (Plateau State Government, 2012).

The population of this study comprised all rural women in the three agricultural zones (Northern, Central and Southern zones) of Plateau State. The total sample size for the study was selected using multi-stage, stratified and simple random sampling techniques. The first stage involved purposive selection of one (1) LGA from each of the agricultural zones of the State. In each of the LGAs selected from among the zones, two (2) districts were purposively selected. Two (2) villages were selected from the districts using simple random sampling technique. The final stage involved simple random selection of households from the villages by proportional allocation of 10% (0.10) across board; a total sample population of three hundred and eighty four (384) respondents was selected for the study.

Data for this study were collected through the use of a semi-structured questionnaire alongside interview schedule (individual and Focused Group Discussion). Out of the three hundred and eighty four (384) copies of questionnaire distributed, three hundred and fifty seven (357) copies were retrieved and used for the analysis. Data collected were analyzed using descriptive statistics such as frequency distribution; percentages and mean score were used to analyze the objectives.

Objective one measured sources of household energy available for use to rural women in the different agricultural zones of the study area. This was achieved by asking the women to indicate with a tick the sources of household 'found in their locality (A)', 'used by the household (B)', 'collected from the bush (C)' and 'purchased from the market (D)'. Sources of household energy assessed include: animal dung, charcoal, coconut shell, corn stalk, cooking gas, electricity, firewood, groundnut shell, kerosene, leaves/litters and saw dust. Any source with percentage score of 50 was regarded household energy in that locality.

Objective two concentrated on level of household energy consumption among the respondents in the different agricultural zones of the study area. This was accomplished by asking the respondents to indicate the level at which the different sources of fuel energy were utilized in their individual house holds using a four point Likert-type scale of " Highly utilized(4)", "Moderately utilized(3)", "Lowly utilized(2)" and " Not utilized(1)". The values were added to obtain ten (10) which was further divided by 4 to obtain a mean of 2.5. Any mean value that is equal or greater than 2.5 was accepted as 'utilized' while a mean score of less than 2.5 was regarded as 'not utilized'.

Results and Discussion

Sources of household energy available for use to rural women in Plateau State

Results in Table 1 show that firewood (90.0%), kerosene (76.7%) and charcoal (54.3%) were the sources of household energy available for use to the respondents in the northern agricultural zone; although, coconut shell (56.1%), cooking gas (51.1%), electricity (54.4%) and saw dust (50.6%) were found available in this zone, these sources were not much utilized. Entries in Table 2 reveal that firewood (90.5%), kerosene (83.5%), animal dung (66.2%), charcoal (52.1%) and cooking gas (51.4%) were household energy sources available for use to the respondents in the central agricultural zone of the study area. This entails that some energy sources that were found in this zone were not utilized; these include electricity (59.3%), groundnut shell (65.6%) and corn stalk (81.6%).

Correspondingly, in the southern agricultural zone of the study area; firewood (90.3%), kerosene (80.1%) and charcoal (53.1%) were household energy sources

available for use to the respondents nonetheless; animal dung (51.1%), cooking gas (58.3%) and electricity (56.8%) were found available yet not utilized (Table 1). This therefore suggests that several household energy sources were found available in the study area such as firewood; kerosene, animal dung, charcoal, groundnut shell, corn stalk, cooking gas and electricity but firewood; kerosene and charcoal were available for use were the common sources of household energy available for use in the study area. The finding is in agreement with Nabinta et al. (2007) who stated that most households in Nigeria relied on firewood, charcoal, agricultural waste as sources of cooking energy. Naehar, Leader and Smith (2007) reiterated that rural communities in Africa depend mainly on the use of traditional fuels like wood, dung, leaves, twigs, corncobs, charcoal, and other biomass fuels for cooking purpose.

Table 1: Percentage Scores of Sources of Household Energy available for use to the Women (n= 357)

Energy Sources	ZONES											
	Northern				Central				Southern			
	A	B	C	D	A	B	C	D	A	B	C	D
Animal dung	15.6	4.4	4.4	-	88.8	66.2	62.1	5.9	51.1	42.2	40.3	2.9
Charcoal	57.8	54.3	18.3	30.6	71.6	52.1	29.6	36.1	64.6	53.1	24.0	33.4
Coconut shell	56.1	31.7	22.2	10.0	37.3	9.5	-	5.3	47.1	21.0	11.5	7.7
Cooking gas	51.1	30.0	-	30.0	65.6	51.4	-	51.4	58.3	44.2	-	44.2
Corn stalk	38.8	20.6	8.3	5.6	81.6	34.9	30.1	5.3	40.2	21.9	13.3	5.2
Electricity	54.4	35.0	-	30.0	59.2	44.4	-	42.6	56.8	40.0	-	36.2
Firewood	96.1	90.0	35.6	78.9	95.3	90.5	85.8	47.9	95.7	90.3	82.4	41.2
G/nut shell	27.2	17.2	8.3	15.0	65.6	45.5	21.3	8.3	46.5	31.4	14.8	11.7
Kerosene	83.3	76.7	-	77.2	84.6	83.5	-	85.8	84.1	80.1	-	81.5
Leaves/litters	16.7	-	-	-	29.6	22.5	20.7	8.3	23.0	10.1	11.0	4.0
Saw dust	50.6	20.8	14.4	18.9	38.5	24.8	14.2	11.8	45.1	22.8	14.3	15.4

Source: Field Survey, 2020

Note: A: Energy sources found in the locality

B: Energy sources used by household

C: Energy sources collected from the bush

D: Energy sources purchased by household

* Available sources of household energy ($\geq 50.0\%$)

Level of Household Energy Consumption among Rural Women

Results on level of household energy consumption reveals that in the northern agricultural zone of Plateau State, firewood ($x=2.85$), charcoal ($x=2.68$) and kerosene ($x=2.59$) were highly utilized (Table 2). However, energy sources such as animal dung ($x=1.27$), coconut shell ($x=1.59$), con stalk ($x=1.49$), groundnut shell ($x=1.44$) and sawdust ($x=1.43$) were not utilized by the respondents. In the central zone results in Table 2 shows that firewood ($x=2.76$), charcoal ($x=2.66$) and Kerosene ($x=3.06$) and animal dung ($x=2.64$) were highly utilized on the other hand, coconut shell ($x=1.591$), leave and litters ($x=1.27$, groundnut shell ($x=1.76$) and sawdust ($x=1.58$) were not utilized by the respondents. In the southern zone firewood ($x=2.86$), kerosene ($x=2.83$) and charcoal ($x=2.68$) were highly utilized while coconut shell ($x=1.48$), con stalk ($x=1.57$) and sawdust ($x=1.51$) were not utilized by the respondents (Table 2). This indicates that firewood, Kerosene and charcoal were energy sources highly utilized in the study area, while coconut shell, groundnut shell and saw dust were not utilized.

Firewood, charcoal and kerosene were highly utilized suggesting high preference for these household energy sources among rural households in the study area, despite the fact that these energy sources were sometimes purchased (Table 1). This suggests the free availability of wood (firewood and charcoal) might be a factor and kerosene is used for dual purposes (for lighting and kindling/starting off of firewood or charcoal) in rural communities. This corroborates with the report of Ouedraogo (2006) which noted that amid the traditional household energy sources, firewood is preferred conceivably because of its relative thermal efficiency when used in traditional stoves. World Bank (2004) affirmed that all over the developing world, the free availability of firewood from nature makes it the primary fuel source for domestic purposes. In rural areas, the main cooking fuel generally is wood, if it is available (ESMAP, 2003).

Table 2: Level of Household Energy Consumption among Rural Women in Plateau State

Energy sources	Northern		Central		Southern	
	Mean	SD	Mean	SD	Mean	SD
Animal dung	1.27	0.662	2.64*	0.816	2.36	0.739
Charcoal	2.68*	0.887	2.66*	1.024	2.68*	0.956
Coconut shell	1.59	0.790	1.51	0.901	1.48	0.846
Cooking gas	2.05	1.144	2.47	1.189	2.26	1.167
Corn stalk	1.49	0.789	2.15	0.888	1.57	0.839
Electricity	2.46	1.260	2.35	1.222	2.41	1.241
Firewood	2.85*	1.262	2.76*	1.104	2.86*	1.183
Groundnut shell	1.44	0.921	1.76	1.016	2.06	0.969
Kerosene	2.59*	1.237	3.06*	1.053	2.83*	1.145
Leaves and litters	2.47	0.556	1.27	0.658	2.23	0.607
Sawdust (wood shavings)	1.43	0.750	1.58	0.798	1.51	0.474

Source: Field Survey, 2016 *Highly Consumed (Cut-off mean, ≥ 2.50)

Level of Household Energy consumption

- 4 Highly utilized (HU) (MS 2.50 and above)
- 3 Moderately utilized (MU) (MS 2.00 - 2.49)
- 2 Lowly used (LU) (MS 1.500 - 1.99)

Conclusion and Recommendations

Findings of the study indicate that firewood, kerosene, animal dung, charcoal, groundnut shell, leaves/litters, saw dust, coconut shell, corn stalk, cooking gas and electricity were household energy sources found in the study area however, firewood, kerosene, animal dung, charcoal, cooking gas and electricity were identified as household energy sources available for use in the study area by the respondents. The study further reveals that firewood, kerosene and charcoal were energy sources highly utilized in the study area, while coconut shell, groundnut shell and saw dust were not utilized. The study recommends that rural women in the study area should be encouraged to use other free available household energy sources within their locality to reduce cost constraint on firewood, charcoal and kerosene.

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