Environmental Technology & Science Journal
Vol. 9 Issue 2 June 2018

Analysis of Households Domestic Cooking Energy Preference in Minna, Niger State

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Access to and type of energy used by households in urban areas is majorly determined by the effect of urbanization. It mounts pressure on the modern urban services, facilities including energy and this leads to acute shortages and price fluctuations because many poor urban households will be lacking access to modern energy carriers. Urbanization alters both production and consumption structures which affects energy access and usage among urban households. Acute shortages and frequent energy price fluctuation as parts of the problems in Minna have compelled households to adopt various methods in energy utilization. This paper analyses households' domestic cooking energy preferences in the face of energy poverty in Minna. The study used multistage sampling method where the study area was delineated into 28 neighbourhoods. Descriptive statistics was employed in the analysis using Statistical Package for Social Sciences (SPSS). Electricity, gas, kerosene, charcoal and fuel wood used with variety of cooking technologies were observed. 88.5% of the households indulge in cooking energy stacking or fuel switching in varying number and patterns as coping strategy. Out of the households that stack cooking energy, 51%, 12.7% and 2.3% stack two, three and four additional cooking energy types respectively. Among the low level energy sources which include charcoal and fuel wood, kerosene is the most used cooking energy fuel because it is easy to use against charcoal and fuel wood users who adopt them because of affordability and availability respectively. The study concludes that lack of access to regular electricity and petroleum products supply is the main rationale for energy stacking. It recommends among others, stacking and using efficient cooking energy type and technology and also improving modern energy access. In spite of the varying alternatives, households' preference of domestic cooking energy is influenced by factors of availability and affordability.

Keywords: Cooking, Energy, Households, Preferences, Poverty, Stacking

Introduction

Due to unprecedented rate of urbanization, domestic energy poverty occurs because of inadequacies in energy infrastructure for modern energy delivery and inability of households to pay for the desired energy. One of the commonest domestic energy needs is energy for cooking. The inconsistencies in accessing modern energy carriers such as electricity and Liquefied Petroleum Gas, compels most urban dwellers to resort to other cooking energy sources in order to cope with energy poverty (Ohadugha, 2018).

In Minna, the capital of Niger State being the acclaimed "Power House" of the nation due to the existence of Shiroro, Kainji and Jebba Hydro-Electric Dams of Nigeria located therein (Niger State Statistical Year Book-NSSYB, 2011), varying categories of vehicles laden with wood fuels are a common sight. This implies that the trade is thriving as a result of epileptic and inadequate modern energy supply. Modern energy including electricity and Liquefied Petroleum Gas (LPG) as well as Kerosene use are not encouraged since their reliability in terms of access is not assured, their high cost and infrastructural inadequacy (Ohadugha, 2018).

Domestic energy poverty occasioned by acute shortages and frequent instability in price have compelled households in Minna,

to adopt energy type and utilization coping methods. Energy poverty which is an expression of lack of energy especially electricity tends to affect households economic status negatively. As observed by Sanusi (2008) in Kubwa, Nigeria, about 60% of businesses have been affected as a result of poor electricity supply situation and as an implication has aggravated such business operators' energy poverty status. Aggravating also households' energy poverty status is the inaccessibility to refined petroleum products especially Kerosene and LPG which play major roles among urban households. Lack of stable access to these products especially kerosene, makes the price to be high in Minna (Ohadugha, 2018). Most of the urban households resort to various other sources with or without knowledge of their implications as coping strategies. Therefore the study analysed households cooking preferences in the face of domestic cooking energy poverty in Minna.

Study Area

Minna is the headquarters of Chanchaga Local Government Area and the capital of Niger state in Nigeria as shown in figures 1 and 2. It lies between Latitude 9º 33' and 9º 40' North of the Equator and Longitudes 6º 29' and 6º 35' East of the Greenwich Meridian on a geological base of an undifferentiated basement complex of mainly gneiss and magnetite (Max Lock, 1979).

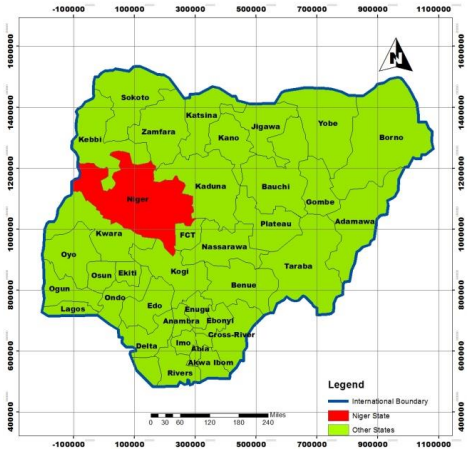

Figure 1: Map of Niger state in Nigeria
Source: URP Department, FUT Minna, 2016.

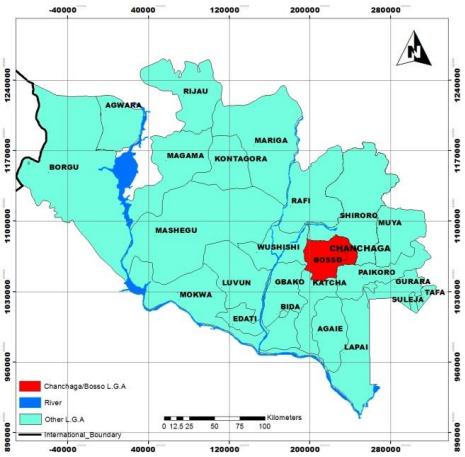

Figure 2: Local Govt Areas in Niger State.
Source: URP Department, FUT Minna, 2016.

With the creation of the Federal Capital Territory, Minna as depicted in figure 3 has become enhanced in all her developments as more people are attracted to the town. The state with an area of about 76,363km^2 is the acclaimed 'power state' of Nigeria with three hydroelectricity dams. Ironically, electricity supply has been epileptic with no neighbourhood having a light index of 1 in spite of being the power generating house of Nigeria (Ohadugha, 2017).

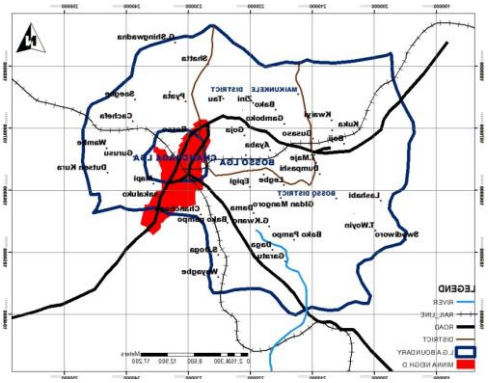

Figure 3: Minna in Bosso/Chanchaga Local Government Areas
Source: URP Department, FUT Minna, 2016.

Literature Review

Energy Access

Achieving universal access to modern energy with greater efficiency and increased renewable energy use is among the objectives of the United Nations Sustainable

Energy for All initiative. Energy access is defined by Masud *et al.* (2007) as the provision of quality and reliable modern energy supplies optimally sufficient when and as needed, as well as the individual's power to pay for such supplies quantitatively and qualitatively necessary for their daily use. Access to energy entails the availability of adequate and timely energy as well as that being reliable, qualitative, affordable, legal, convenient and safe, for all the household, community and productive services requiring energy (Energy Sector Management Assistance Programme - ESMAP, 2014). Al-amin (2014) added that it involves the production and distribution of modern energy services which requires exploring and developing resources, raw materials transformation as ends or means to ends and also moving them to the final consumers' irrespective of location. It also implies ensuring the ability of the end users to procure (Al-amin, 2014) and efficiently use these services at a reasonable price for their various needs with consideration to their respective budgetary constraints (Masud *et al.*, 2007).

According to the United States Energy Poverty Action (US EPA, 2007), energy access is important for economic development and fundamental to improving quality of life. Energy poverty is still found everywhere in the developing economies. In spite of Sanusi (2008) stating that modern energy services are germane to both human and economic development, World Data Bank (2012) observed that electricity is still not accessed by over 1.3 billion people and 2.6 billion people are lacking clean cooking facilities globally.

In Nigerian, despite the preponderance of various sources of energy in the country, the energy sector is still under-developed based on the fact that, majority of the people still lack access to affordable and reliable energy (Oyedepo, 2012). As opined by Iwayemi (2008), in meeting the energy needs of its people, Nigerian energy sector probably is not among the most efficient. This is buttressed by the persistent disequilibrium in both electricity and petroleum products market, especially kerosene and Premium Motor Spirit (PMS).

However, the inadequacy in generating electric power likewise poor distribution network in the country has subjected a large proportion of the citizenry to adopt coping strategies for their domestic needs (Ohadugha, 2018). Sambo (2005) asserted that for cooking especially, household sector depends maximally on fuel wood and minimally on electricity and kerosene in many countries. Like any form of energy, Sanusi (2008) stated that the presence of electricity is important for productive services, for development of most community services and preservation of the environment, particularly forest resources that could be used for cooking in the absence of accessible and dependable electricity supply. Most discouraging is the supply and distribution of petroleum products in Nigeria. Kerosene is inaccessible to many for their domestic needs in terms of availability and affordability. Where it is available, it is sold at exorbitant prices. Inadequate and poor condition especially, of energy infrastructure truncates regular supply of electric energy to the people (Ohadugha, 2018). Also is the inadequacy in the number of public owned petroleum products depots and vehicular transportation for storage and distribution to all corners of the country (Ohadugha, 2018). This encourages price increase and consequently subjects the poor to adopt traditional energy sources such as fuel wood for their energy needs.

Energy Poverty

The inability of households to take care of the basic human needs occasioned by inadequate income or the lack of access to such, as posited by Masud *et al*. (2007) is part of the difficult and persisting aspects of humanity. In the light of inaccessibility to electricity, energy poverty situation is worsened when energy expenditure is high. Energy expenditure increases with income although the rate is less proportional (World Energy Outlook(WEO), 2002). As poor households continue spending larger part of their income on energy, it gets to a point

where they begin to be conservative on their energy consumption.

In developing countries like Nigeria, Bamiro and Ogunjobi (2015) observed from their study in Ogun state, Nigeria that in household's total expenditure; the share of energy expenditure is 23%. This indicates high level of domestic energy poverty. Also, the drive to alleviate poverty in developing countries like Nigeria, has been persistently halted by the alarming rate of population growth and dwindling resources to such an extent that the environment that sustains man has been assaulted (Emmanuel 1996; Okafor, 1985).

Energy Services

Energy is one of the basic human life necessities for attending to socio-domestic and industrial needs. Of all the forms of energy, electricity is very important as it offers services that are germane to economic and human development. Sanusi (2008) observed that electricity insecurity will contribute to resource depletion where domestic cooking is dependent on fuel wood, charcoal and other forest-based energy sources. Oyedepo (2012) found out that in Nigeria, cooking accounts for 91%, of households' energy consumption.

On many occasions, the state of the nation is affected by the petroleum products supply inadequacy. Consequently as the prices go up, people will be forced to adopt various energy sources. Compounding the predicaments of the masses, infrastructures were and are still vandalized in Nigeria to date. Recently for instance, oil and gas infrastructure such as pipelines and oil installations are currently being blown up and vandalized thus leading to artificial scarcity of energy and consequently forcing the masses to adopt other cooking means in meeting their energy needs (Momodu, 2013).

Households' with low income cannot afford the supposed major sources of cooking energy which are Kerosene and LPG. As a consequence, the domestic energy consumption pattern by households in Nigeria changed and has great adverse impact on the socio-economic characteristics of the poor (Ogwumike *et al*., 2014). The relationship of poverty and energy can be described with reference to the quality and quantity of energy used. In general, most poor households use biomass fuels because of affordability as they do not have sophisticated energy appliances such as gas and electric cookers (Ogwumike, *et al.,* 2014). As indicated by researches, households' domestic energy consumption substantiates the energy ladder. This suggests consumption of cheap and less conventional energy such as biomass, of lesser price and quality than the convenient energy types such as LPG and electricity while moving up the income ladder and or habits change overtime (Sathaye & Meyer 1990; Smith, 1994; UNCHS, 1991). However, as inflation rate has altered the situation, households rely on other means to beat its effect. In the recent past, petroleum products pump price increase in the early 2012 has decreased kerosene patronage among the middle and low income groups for increased and high charcoal consumption (Sathaye & Meyer, 1990).

As the modern energy supply is unstable and unreliable likewise the demand of fuel wood which is soaring in both urban and rural setting as poor man's basic energy source, households are at risk of daily energy use for their need. Ohadugha (2018) noted that 38.8% of households in Minna are at health risk of using low level cooking energy types such as kerosene, charcoal and fuel wood. The supposed alternative cooking energy source of electricity and LPG becomes inaccessible to low income households and thus influence households' domestic energy consumption preference in Minna. Lack of modern energy supply also affects the environment and the households as increased consumption of low level energy for cooking is continuous on daily basis.

Methodology

In this study, the multi-stage sampling technique involving 28 neighbourhoods was

adopted. Using Adams *et al.*, (2007) sample size formula, $n_o = Z^2_{a/2} \frac{p(1-p)}{d^2}$, four hundred questionnaires were administered to households on the bases of the proportion of the individual neighbourhood's population that make up the total neighbourhoods.

Data Collection and Method of Analysis
Having identified the sampling units, face to face administering of the questionnaires to the respondents (households) was done. Equally, 14 observatories were randomly selected to monitor the daily electricity supply situation. The questionnaires were retrieved on administration. Physical data capturing using digital camera was used to capture information such the households cook energy and technology type. Also used were relevant materials such as Census Priority Table sourced from National Population Commission and Library materials. STATDATA PRO *plus* tool was employed majorly as a statistical software for descriptive analysis both in determining and analysing the household energy characteristics.

Data Analysis and Discussion

Primary Cooking Energy Types

These are the preferred cooking energy options at the households' disposal. The primary domestic cooking energy options observed in the study area are electricity, gas, kerosene, charcoal and fuel wood. These are used with variety of cooking technologies.

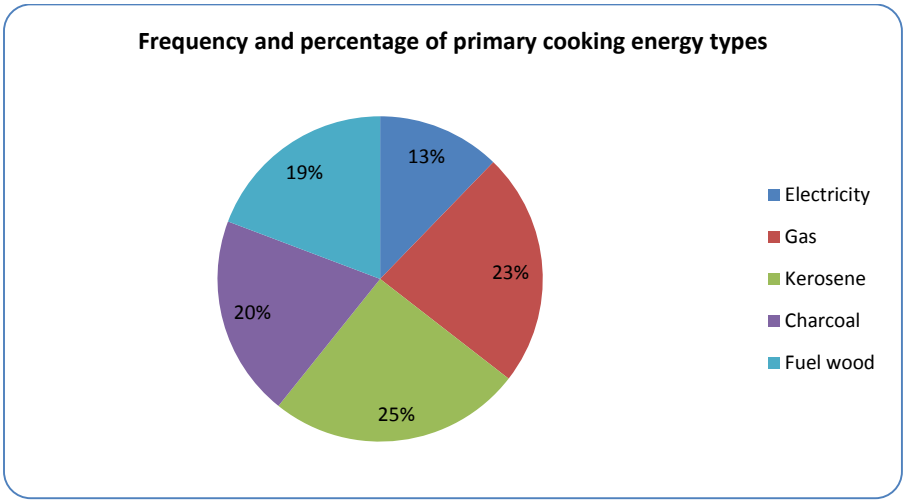

Figure 5: Primary domestic cooking energy
Source: Author's field work, 2016.

The prevailing households' primary cooking energy types in the study area are illustrated in Figure 5. It portrays that kerosene is the energy type mostly used for cooking representing 25% of the households in the study area. This is closely followed by gas (LPG) which represents 23%, charcoal and fuel wood users each represent 20% and 19% respectively while electricity is 13%. This implies that kerosene and wood fuel (fuel wood and charcoal) which are low level cooking energy types are used by 64% of the households as their primary cooking energy in the study area. Modern cooking energy (electricity and LPG) are used by 36% of the households. This result implies that 64% of the households in the study area are using cheaper and unclean fuel for cooking.

Cooking Energy Technology
This study revealed the various cooking technologies prevailing among the households in the study area. They include gas and electric appliances, kerosene efficient stove (Plate I), charcoal efficient (Plate II) and wood efficient stoves (Plate III).

Plate I: Kerosene pressure stove


Plate II: Charcoal efficient stove


Plate III: wood efficient stove

Contextually and as a result of their initial uptake cost, the study discovered local versions of the adopted cook coping methods in the wake of domestic cooking energy poverty which includes the Nigerian fabricated iron charcoal stove called *'Abacha stove'* in local parlance (Plate IV) and iron or stone wood stoves (Plates V and VI).


Plate IV: Iron charcoal stove


Plate V: Iron wood stove


Plate VI: Stone wood stove
(Abacha stove)
Source: Author's field work, 2016.

Equally used by the households are local versions of efficient charcoal and wood stoves as depicted in Plates VII and VIII.

Plate VII: Local charcoal efficient stove

Plate VIII: Local wood efficient stove

Domestic energy stacking

Stacking of various cooking energy forms stem from the incidence of unreliable and unaffordable primary cooking energy type supplies which are usually the cleaner and modern energy. The findings in Figure 6 revealed that 88.5% of the households indulge in cooking energy stacking or fuel switching in varying number and patterns while about 11.5% do not. Out of the households that stack cooking energy, 51%, 12.7% and 2.3% stack two, three and four additional cooking energy types respectively. It implies the inadequacy or lack of access to their primary domestic cooking energy.

Factors for the Choice of Cooking Energy

Accounting for the choice of cooking energy, Table 1 shows the reasons respondents adduced to the choice of a particular primary cooking energy.

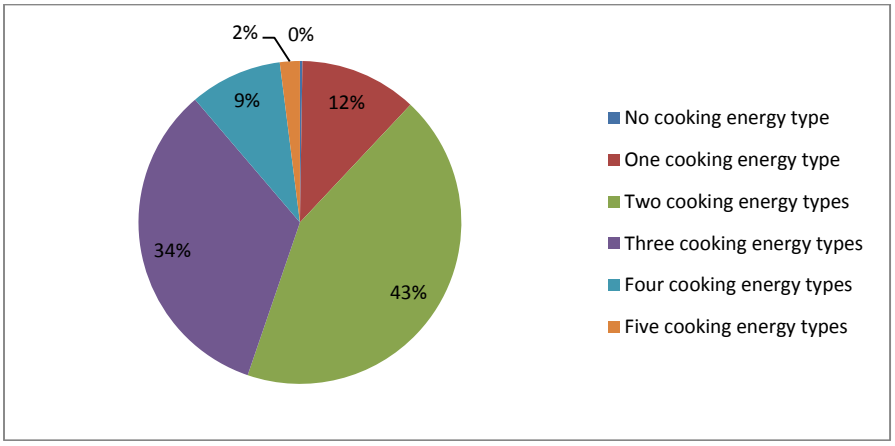

Figure 6: Frequency of cooking energy stacking
Source: Author's field work, 2016.

Table 1: Factors influencing the choice of primary cooking energy type in percentage

Factors	Energy Types						
	Electricity	Gas	Kerosene	Charcoal	Fuel wood	Total	%
Cheap	12	7	20	41	38	118	29.5
Available	17	22	28	16	22	105	26.25
Easy to use	13	8	37	12	8	78	19.5
Durable	0	9	2	3	1	15	3.75
Safe	0	2	6	0	0	8	2
Cultural Preference	0	0	0	1	5	6	1.5
Clean	7	24	0	0	0	31	7.75
Low uptake cost	0	0	1	3	0	4	1
Fast	1	21	5	4	1	32	0
Household size	0	0	0	0	1	1	0.26
Others	0	0	1	0	1	2	0.5

Source: Author's field work, 2016.

In spite of electricity being a clean energy type, the research discovered that 14.3% of the households using it as their primary cooking energy adopt it because it is a clean energy type. The remaining households who use it for its availability, cheapness and being easy to use are represented by 32.7%, 24.5% and 26.5% respectively. This implies that 85.7% of the households using electricity for cooking are least aware of it being a clean energy type which influenced their choice of other cooking energy types. Also, 32.7% of the households use electricity because it is usually available to them.

Similarly, gas as a clean energy is adopted as primary cooking energy by 25.8% of the households. Some other gas using households represented by 23.7% and 22.6% use it because it is available and fast respectively while 18.3% adduced their reason to the choice of gas because it is easy to use. The survey indicates that 7.5% of the households use it because to them, it is cheap. The findings suggest that as much as 74.2% of the gas using households do not subscribe to its use as a clean energy form. Apart from kerosene being the most used cooking energy source in general, it is the most sought among the low level energy sources which include charcoal and fuel wood. Its choice by the 25% of the households as their primary cooking energy type is because it is easy to use against charcoal and fuel wood users who adopt them because of affordability and availability respectively. From the foregoing, it can be deduced that the major determinants of cooking fuel choice by households are cheapness (affordability) 29.5% and availability 26.3% as fallout of domestic cooking energy poverty.

Conclusion and Recommendations

The major determinants of cooking fuel preference by households in the study area are affordability and availability. Energy stacking does not have a definite pattern as all options at their disposal based on affordability and availability are stacked. Besides promoting access to electric power being a very important dimension to consider in enhancing households' access to energy, the findings suggest the importance of enhancing households' income, education and modern energy supply. Equally in trying to meet up with domestic cooking energy demand, the preference of traditional energy sources in the absence of modern energy is relied on as 88.5% of the households indulge in cooking energy stacking. The study concludes that availability and affordability are major determinants of cooking energy preference in Minna.

Improving modern energy access especially electricity in terms of availability and affordability and enlightening energy consumers to be more proactive in improving and adopting sustainable energy use are basic recommendations emanating from the study. Also, encouraging efficient cooking energy stacking is recommended because of pollution to meet up with basic domestic cooking energy needs in the face of unreliable and inconsistent modern energy supply.

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