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ANALYSIS OF HOUSEHOLDS DOMESTIC COOKING ENERGY POVERTY COPING STRATEGIES IN MINNA, NIGER STATE.

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Abstract
One of the effects of urbanization is the pressure it mounts on urban households' livelihood facilities which includes energy. This leads to an inflation situation where the energy demand outweighs supply in terms of availability and affordability. Domestic energy poverty occasioned by acute shortages and frequent price fluctuation have compelled households in Minna, especially those in low and medium income categories, to adopt various coping methods in energy utilization. This study seeks to analyze households coping strategy in the face of domestic cooking energy poverty in Minna. Energy access, poverty and services formed the conceptual bases for the study. The study adopted multistage sampling method where the study area was delineated into 28 neighbourhoods to reach the sampling dements. Data on energy characteristics of the households were generated while 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 poor accessibility to regular modern energy (Electricity, Liquefied Petroleum Gas, Kerosene) supply is the main rationale for energy stacking as coping method and recommends improving modern energy access in terms of availability and affordability.

Keywords: Coping strategy, Energy, Households, Poverty, Stacking

Introduction

The access to and type of energy used by households in urban areas is majorly determined by the effect of population and urbanization as it mounts pressure on the modern urban services, facilities including energy. Urbanization alters both production and consumption structures which affects energy access and usage among urban households (Karekezi, Kimani and Onguru, 2008). 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 as

food ranks first in man's basic needs. The inconsistencies in accessing modern energy carriers, compels most urban dwellers to resort to other cooking energy sources in order to cope with the energy poverty.

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, 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, Liquefied Petroleum Gas (LPG) and Kerosene are not steadily utilized for cooking since their reliability in terms of access is not assured, their high cost and infrastructural inadequacy.

Domestic energy poverty occasioned by acute shortages and frequent price fluctuation have compelled households especially those in low and medium income categories 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 and as an implication has aggravated such business operators' energy poverty status. Similarly, the inaccessibility to refined petroleum products especially Kerosene and LPG which play major roles among urban households also aggravates households' energy poverty status. The issue is there availability and affordability which sometimes are scarce making the prices to be high in Minna. Most of the urban households resort to various other sources with or without knowledge of their implications as coping strategies. Basically, wood fuel is one of the cheap energy forms consumed domestically in Minna as an alternative to inconsistent modern energy supply in terms of their availability and affordability (Morenikeji *et al.*, 2006). Therefore the study seeks to determine the energy situation and household energy characteristics which will facilitate the analysis of households coping strategy in the face of domestic cooking energy poverty in Minna.

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 9° 33' and 9° 40' North of the Equator and Longitudes 6° 29' and 6° 35' East of the Greenwich Meridian on a geological base of an undifferentiated basement complex of mainly gneiss and magnetite (Maxlock, 1979).

Figure 1: Map of Niger state in Nigeria

Figure 2: Local Govt Areas in Niger State.
Source: Urban and Regional Planning 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 where electricity is generated for the country. 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. Liquefied Petroleum Gas (LPG) is occasionally scarce leading to hike in price.

Figure 3: Minna in Bosso/Chanchaga Local Government Areas
Source: Urban and Regional Planning Department, FUT Minna, 2016.

Literature Review

Energy Access

United Nations Sustainable Energy for All (SE4All) Initiative has among its objectives achievement of access to modern energy universally with greater efficiency in energy and increased renewable energy use. Energy access jointly 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 power of individuals to pay for such supplies quantitatively and qualitatively necessary for their day to day 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). Thus it entails the production and distribution of modern energy services that requires exploring and developing resources, raw materials transformation as ends or means to ends, such as electricity and processed natural gas, and also moving them to the final consumers' irrespective of location. It also implies ensuring the ability of the end users to procure (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 E.P.A. 2007) important for economic development and fundamental to improving quality of life is energy access. Energy

poverty is still found everywhere in the developing economies. As stipulated in the World Bank Group (2013) Report, 20% of the global population representing higher than 1.2 billion people mostly undeveloped countries residents, still lack electricity access globally. In spite of modern energy services being germane to both human and economic development, still electricity is not accessed by over 1.3 billion people and 2.6 billion people are lacking clean cooking facilities globally.

However, as a measure of economic development level of a particular society, energy must be available to all in that specific society. As an example, in France, United Kingdom and USA as advanced economies, the greatest percentage of their population accesses cost effective and affordable energy supply as a result of their technology advancement. Unlike in a developing country like Nigeria, large proportion of its populace has low purchasing power and necessary energy infrastructures are not in place suggesting inaccessibility to choice energy sources by majority of the people (Momodu, 2013).

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

However, the inadequacy in generating electric power likewise poor distribution network in the country has subjected a large chunk of the citizenry to adopt coping strategies especially fuel wood use for their domestic needs. 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 purchasing power. 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. 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. This encourages their 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 (economy, health) is high. Energy expenditure increases with income although the rate is less proportional (World Energy Outlook - W.E.O, 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. Regular and adequate energy supply for all purposes are inevitable for keeping socio-economic life going. 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, for household energy consumption, cooking accounts for 91%.

On many occasions, the state of the nation is affected by the petroleum products supply inadequacy. Also, shielding from deregulation, the prices of energy sources often rise above the poor's ability. The Federal Government of Nigeria (FGN) in the bid to improve its revenue and lower subsidization level made upward deregulation of the petroleum products prices. Consequently as the prices go up, people will be forced to adopt fuel wood as their energy source. Equally falling out of government's insensitivity to 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 still forcing the masses to adopt fuel wood in meeting their energy needs (Momodu, 2013).

This state of the economy has jeopardised households in their daily energy use in trying to attend to needs. Rural populace and 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. 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 and they do not have sophisticated

energy appliances such as gas and electric cookers (Ogwumike, *et al.*, 2014). It also has environmental effect as biomass consumption has been on the increase for households cooking energy used day in day out.

Household domestic energy consumptionas indicated by researches substantiate the energy ladder suggesting the consumption of cheap and less conventional energy such as biomass, of quick price and quality (kerosene) tha a costlier and highly 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 biomass to beat its effect (Sathaye and Meyer, 1990). In the recent past according to Desai, A.V. (ed), 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. The major factors influencing the use of any kind of energy by urban households include availability and affordability of the energy, cultural preference and income among others.

Methodology

In this study, the multi-stage sampling technique involving 28 neighbourhoods was adopted. Using Adams *et al.*, (2007) sample size formula, $n_o = Z^2_{\alpha/2} \frac{p(1-p)}{d^2}$, four hundred households were administered questionnaire to based on the proportion of the individual neighbourhood's population that make up the total neighbourhoods as shown in Figure 4

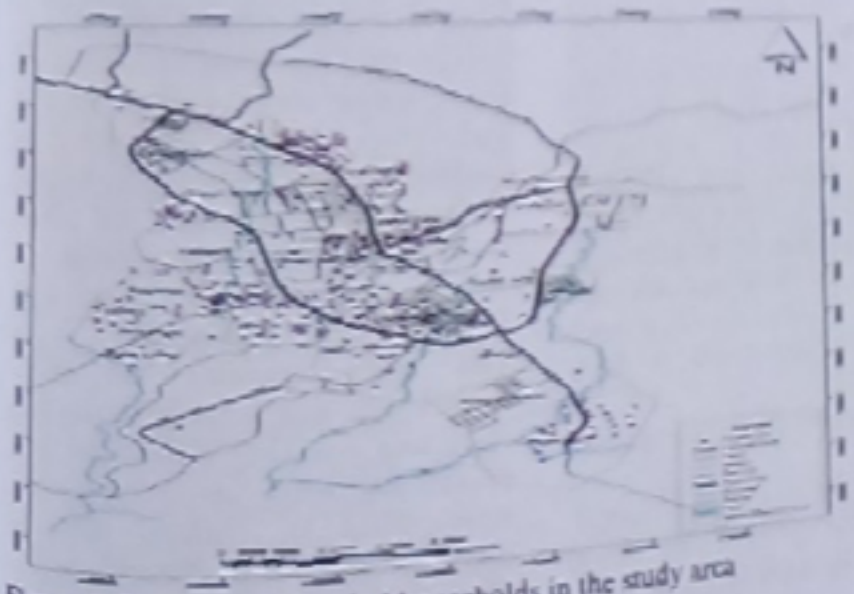

Figure 4: Dot map of sampled households in the study area
Source: Author's field work, 2016.

Data Collection and Method of Analysis

Semi structured questionnaire, physical data capturing using digital camera and hand-held GPS instruments were employed for data collection. Also used were relevant materials sourced from National Population Commission, Google Earth Images and Library materials. STATDATA PRO *plus* tool was employed majorly as a statistical software for descriptive and inferential analysis both in determining and analysing the household energy characteristics.

Data Analysis and Results Presentation

The elements of household energy characteristics examined are the various types of primary energy forms and technology used, incidence of cooking energy stacking and factors influencing the choice of energy type used.

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.

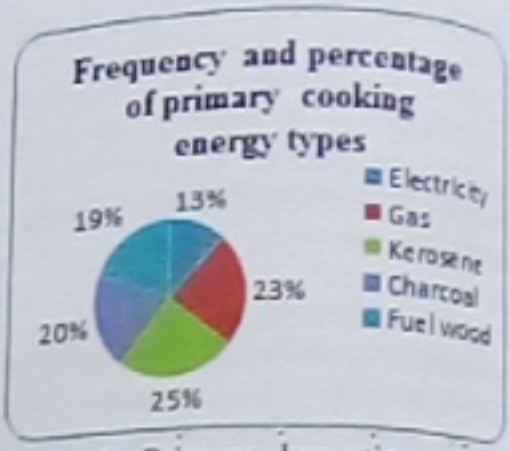

Figure 5: Primary domestic cooking energy
Source: Author's field work, 2016.

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) are used by 64% of the households as their primary cooking energy in the study area because of domestic cooking energy poverty. Modern cooking energy (electricity and LPG) are used by 36% of the households.

Cooking Energy Technology

This study revealed the cook technologies that households in the study area use. 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
Source: Author's field work, 2016.

Plate I: Kerosene pressure stove
Plate II: Charcoal efficient stove
Plate III: wood efficient stove
Source: Author's field work, 2016.

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
Source: Author's field work, 2016.

Domestic energy stacking

Stacking of various cooking energy forms stem from the incidence of unreliable and unaffordable modern energy supply. 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 above 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 primary domestic cooking energy.

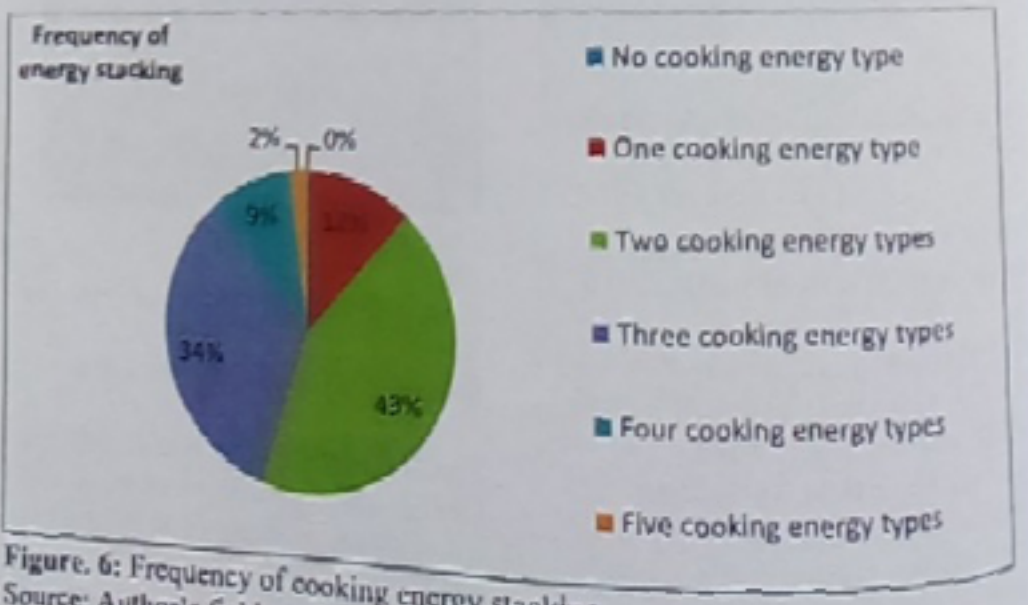

Figure. 6: Frequency of cooking energy stacking
Source: Author's field work, 2016.

Factors Influencing Households Choice of Cooking Energy Type

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

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

Factors	Energy Types						
	Electricity	Gas	Kerosene	Charcoal	Fuel wood	Total	%
Cheap	12	7	20	41	34	114	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 choice by households in the study area are affordability and availability. Energy stacking do not have a definite pattern as all options at their disposal are based on affordability and

availability. Besides promoting access to electric power being a very important dimension to consider in enhancing households' access to energy, it is important to enhance households' income, education, and modern energy supply. Moreover in trying to meet up with domestic cooking energy demand, the use of traditional energy sources as coping strategies in the absence of modern energy is relied on as 88.5% of the households indulge in cooking energy stacking. The study concludes that poor accessibility to regular modern energy supply is the main rationale for energy stacking as coping method. Improvement in 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. In the face of unreliable and inconsistent modern energy supply, the paper recommends the stacking of efficient cooking energy to check pollution.

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