



Household Energy Consumption Pattern in Offa City, Kwara State Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author EKOK designed the study, wrote the protocol, and wrote the first draft of the manuscript. Author OAA managed the literature searches, analyses of the study performed the analysis of results and the two authors managed the editing process. All authors read and approved the final manuscript.

Case Study

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ABSTRACT

This paper examined the household energy consumption patterns in different apartments of various households. An assessment of the energy sources in Offa Kwara State, Federal Republic of Nigeria was undertaken with the intention to gauge their consumption patterns.

Analysis to see result of financial gain, monthly earning and unit size on quantities of energy sources usage was done on modal statistical method and percentage analysis.

The analysis on age range, energy resources in the selected areas and consumption patterns were based on descriptive statistics. Systematic sampling was applied to sample 800 households. Well structured questionnaire with oral interview and measuring equipment were used to obtain and evaluate our data.

The findings enveloped that 20% of the respondents were above 45 years old on average and about 80% had a household size of 1 - 6 members. The major city relies on charcoal as their source of energy. The calculable average daily charcoal usage for cooking, and kerosine for lamp consumption ranged between 1.2 - 33.8 kilogram and 0.5 - 50.2 litres. The common annual financial gain of the respondents varies between \$100 – \$1000 U.S.A. currency (17,000Naira - 170,000Naira Federal Republic of Nigeria

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currency), that shows that majority of those people live average lifestyle in favour of low cost of living. Maximum quantities of kerosene and charcoal consumed by respondents area unit are 33.8litres and 50.2kg respectively so their relationships are significant at 3.3 % financial monthly budget.

Solar energy systems need to be developed and upgraded as power station for constant electricity supply for use in the city of Offa with efficient management and utilization. This will reduce monthly budget on energy consumption and improve welfare of all households in Offa Kwara State, Nigeria.

Keywords: Managing energy consumption; pattern; evaluate; wards; local government area (L.G.A.); sources of energy; cost of living; standard of living.

1. INTRODUCTION

Energy could be a basic demand in human life, however most individuals within the north central region of Federal Republic of Nigeria do not have enough access to all sources of energy for running household due to economic, ecological, accessibility and purchasing power. Nigerians' economy has for over 2 decades now, been plagued by perennial energy crises, which manifest in at least four ways: erratic electric power supply, acute shortages of petroleum products on several occasions, sharp increase on the cost of energy commodities and frequent conflict between the populace, led by the labour movement, and the Federal Government on what should constitute appropriate prices of petroleum and other energy supplying commodities (CBN, 2000). Energy is inputted into the assembly of products and services within the nation's business, transport, agriculture, health, and education sectors, and this meagerly restricts social-economic growth and adversely affects the standard of life. Consumption of energy is increasing sharply in Nigeria's mega cities with respect to increasing human population and higher living custom with negative impacts on the setting. The pattern of energy usage in Federal Republic of Nigeria specifies the selection of energy that is incredibly necessary in our energy state of affairs that indicate that additional intensive exploitation of our energy resources is needed if we tend to address future demands [1,2].

Offa Kwara State of Federal Republic of Nigeria consists of 12 wards chosen during this study. Offa city in Kwara State is a city located in central Nigeria with a population of about 90,000 inhabitants. The vegetation in Offa is savannah vegetation and the city is noted for its weaving and dyeing trade, using vegetable dyes made from locally grown indigo and other plants. Offa is well known for cultivation of sweet potatoes and maize which also formed part of the favourite staple foods of the indigenes in the town. There is presence of pipe borne water, partial electricity supply, General Hospital, and to a lesser extent the presence of telecommunications [3].

Offa in one of her eulogy is being addressed as the home of sweet potatoes. Cattle, goats and sheep are also raised in the environs. The key religions practised in the town are Islam, Christianity and Traditional religions. The prominent knighted chiefs of Offa include Esa, Ojomu, Sawo and Balogun, and It lies in coordinates 8° 9'N and 4° 43' E and incorporates an expanse of thirty one,400 sq. kilometres. The city is split into twelve wards [3]. Tertiary institutions in the town include the Federal Polytechnic Offa, established in 1992, the Kwara State College of Health Technology (established 1976 [4]), and the Nigeria Navy

School of Health Sciences. There are also two private universities and a polytechnic whose constructions are near completion.

The pattern of family energy consumption represents the state of welfare and furthermore, the state of economic development. Nigerians are usually confronted with inadequate energy generation and distribution, improper rating of family fuels, constant increase within the worth of obtainable ones while there is no corresponding increase in average family financial gain [5].

Studies have shown that in Nigeria, most households depend on electricity for lighting and domestic cooking. The ideal unit of electricity consumption in major standard household monthly consumptions range from 220-350 watts therefore, 1 watt of electricity costs 12.91 Naira. Electricity supply in major 12 wards in Offa Local Government Area is not readily constant and this calls for alternative consumption of other energy sources due to inadequate supply of electricity.

Previous studies indicated a high dependence of Fakai district of Sokoto state and Oshogbo in Osun state, both in Federal Republic of Nigeria on firewood and kerosene with qualitative consumption in twelve villages to the range of 105.7–195.0kg and 2.50–12.73 litres respectively, while in Bauchi State of Nigeria, fuel wood was found to be the dominant fuel source, contributing between 52.45% and 88.62% of the household budget [6,7,8,9].

Household energy consumption can be defined as the energy consumed in homes to meet the needs of the householders (www.unescap.org). Energy consumption is the amount of energy consumed by individual consumers. Household energy can be categorized according to usage, which includes charcoal, fuel wood, kerosene, electricity, biomass, animal dung, crop residues and gas etc.

Energy potency means the manner that may minimize the quantity of energy required to supply services. The activity approach entails ever-changing ways in which we tend to do things [9]. The negative environmental impacts related to the generation of energy also will be reduced if we tend to use energy with efficiency[2,3]. With increasing disposable income and changes in life styles, households tend to move from cheapest to least convenient fuel (biomass) to more convenient and normally more expensive ones (charcoal, kerosene) and eventually to the most convenient and usually most expensive type of energy (LPG, natural gas, electricity). The key determinant of energy demand in the household sector includes; price of fuel and appliances, disposable income of household, availability of fuel and appliances and cultural practices [9].

The aim of this study was to determine the energy consumption pattern of Offa local Government Area, Kwara State of Nigeria in order to identify various sources of energy available for domestic use, whether the existing energy consumption trends are eco-friendly and beneficial to the welfare of the community and to determine effect of some socio economic factors (household size and income) on quantities of fuels consumed in 12 wards of Offa Local Government Area.

2. MATERIALS AND METHODS

The materials used in the study included questionnaires, digital weighing machine (Cap. 120kg), Measuring cylinders (graduated in ml), Digital measuring machine (Liters) Program (Microsoft Excel), Statistical Models; Statistical percentile. Guided interviews were

conducted on the respondents using research assistants who understood the native language, and interpretation or translation of native languages of the pre-occupant literate, semi illiterate and illiterate respondents. Electricity, gas, kerosine, petrol and charcoal were respectively measured to confirm the quantities claimed to be consumed by the respondents.

The population for the study consisted of all 12 wards under local government Offa Kwara State. Average quantities with respect to number of household samples were selected from Offa city to ensure adequate representation. Simple random sampling method was adopted in order to select 12 wards in area of Offa local government. A sample of 65 households was chosen from 10 wards, and 75 from wards making a total of 800 households. The reason for this is not far-fetched, it is based on the fact that the two wards from which 75 households were selected as sample make up the center of the town. Therefore, 13 households were sampled with respect to type of apartment per household in ten wards while 15 households were sampled with respect to type of apartment per household in the two wards with 75 households each.

Descriptive statistics such as frequency distribution, percentages were used to analyze the level of availability of energy source(s), problems associated with energy usage by the household and accessibility of the energy source with respect to purchasing power on side of cost of living by individual household. The computation of energy use was done using Microsoft excel. The quantities of energy resources consumed per household in relation to the conditions that warrant energy consumption patterns such as income level, cheapness and availability, were emphasized.

3. RESULTS

3.1 Demographic Features

65 respondents were chosen from 10 wards and 75 respondents from two wards in the local Government Area and their ages range from 25 years and above. The cumulative data on ages range show that the highest percentage obtained was 92% for 36 – 45 years and 20% for age range of 46-60years while those between 25-35years were the least with 15%. Most of the respondents indicated that their major occupations percentage as follow; 32% were civil servants, 19% public were servants, 37% engaged were self employed, and 12% were factory workers.

The largest household size was in the range of 1 to 8, (32.0%), while the least of 47.2% was in the range of 1 to 3. It is generally believed that large family size is an advantage in trading and skill work (entrepreneurship) activities for self reliance.

3.2 Energy Usage

Charcoal is the highest in terms of the proportion of the number of households consuming it in the study area. The ratio of household consuming Charcoal is the highest followed by kerosine, electricity and gas at the aggregate level. This implies that the use of Charcoal is mostly common in the study area (Table 1).

Table 1 shows the results of the field survey of the available energy sources (kerosine, Electricity, Gas, Petroleum and Charcoal) within the study area, also represented graphically

are figures for multiple bar charts of available conventional and renewable energy within 12 wards based on type of accomodation per household studied. Fig. 1 and Table 1 are the percentages of energy (kerosene, Electricity, Gas, and Charcoal) consumed as against household size in their respective apartments and incomes. Table 2 is the summary of data analysis based on monthly budget on energy source with respect to accessibility, scale of preference and standard of living collected in the 12 wards of Offa Local Government Area.

Table 1. Average Quantity per households on monthly budget (Field survey 2014)

Household Apartments	Kerosine (Litres)	Petroleum (Litres)	Electricity (Units)	Charcoal (Kg)	Gasoline (kg)	Income per Month (Naira)	2 times cooking frequency	3 times cooking frequency
4 bed room apt	15	33	350	17.5	12.5	150,000	59%	41%
3 bed room apt	10	15	300	17.5	12.5	120,000	60%	40%
2 bed room apt	6	10	250	9	12.5	65,000	71%	29%
1 bed room apt	2.8	7	120	4	6	35,000	73%	27%
Single room apt	1.5	4	40	2.20	3	15,000	83%	17%
Total	33.8	69	1060	50.2	46.5			
Average cooking frequency							69%	31%

Table 2. Energy consumption pathern population (Field survey 2014)

Energy Sources	Numbers of household	Accessibility Level	Lighting consumption rate	Domestic cooking consumption rate
Charcoal	780	700	0	750
Kerosine	792	620	772	480
Electricity	648	420	786	786
Gas	98	25	0	52
Petroleum	120	310	88	0

Quantity of energy consumptions shown in Table 1 indicated proportionality of different energy sources with respect to their measuring units on monthly basis.

Financial commitment is the ultimate relationship in Table 1 and Fig. 1 with correspondence statistical modal analysis in Fig. 1 respectively. Therefore, quantity of energy consumption in all apartments varies according to their monthly budget for energy consumption depending on availability and low cost of charcoal over kerosine for domestic cooking likewise on consumption of kerosine over petroleum for lighting.

Household preference for a particular energy source is a function of several factors such as price, access, familiarity with the energy source, reliable supply, effectiveness etc. According to the findings (survey and oral interview) compiled on household's preference for cooking fuels, accessibility stands out to be the major reason for a particular fuel to be the most preferred energy source. 500 out of 800 households attribute their preference to low cost and monthly income. Of all factors, accessibility, familiarity and effectiveness are the major factors, although price is also a major factor (Fig. 1).

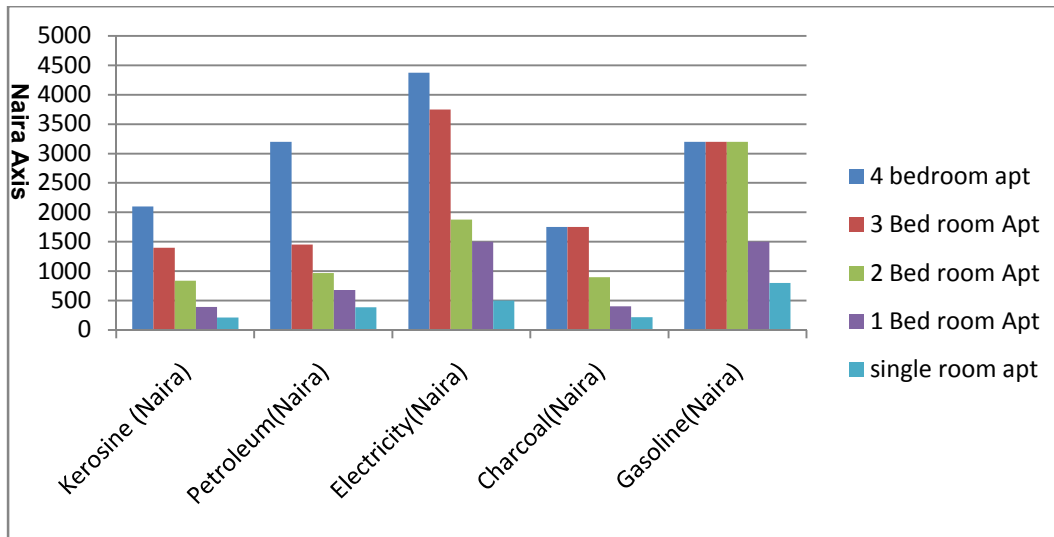


Fig. 1. Average Price per household on monthly income budget

Summary of Households Income

The data also show that the overall expenditure on Table 1 is 385,000 Naira whereas energy income is 40,555 Naira per month which accounts for about 11.53% of the average overall household expenditure. The expenditure share is 15.4%. This implies that energy budget is significant in the study area.

4. DISCUSSIONS

Among the commercial fuels, kerosene is popularly used as supplement for electricity for lighting as a result of power failure from Nigeria Power Holding Company on daily basis. Also, charcoal is a supplement to electricity in terms of domestic cooking.

The highest frequency of cooking is two times a day (69.0%), followed by those who cook three times a day (31.0%) with open charcoal stoves usually employed for domestic cooking, which is an indication of the pattern of energy usage.

The respondents preference for the usage of available energy is in the order of charcoal > kerosine > Electricity > gasoline. The economic lifestyle of most households is average, therefore they usually rationalise cooking and light system as a result of power failure from Power Holding Company. In line with the Table 3, 11% of the households engaged the use

of petroleum products for power plants/ generator to generate light in various homes while 96.5% use kerosene for lighting, and 20% used rechargeable lamp for lighting respectively.

It is estimated that the average monthly consumption of charcoal and kerosene are 50.2kg and 32.32 litres respectively. The cost of kerosene in the area varies from 140 Naira to 160 naira (0.92USD- 1.0USD) per litre as at 2013 November to January 2014 which necessitate choice of charcoal over kerosine on the high price advantage. The monthly income of respondents as revealed 15,000 Naira to 200,000 Naria (\$95 - \$1400) as a result of high commitment with average income. It is difficult to increase budget on energy source that is otherwise preferred as cheapest energy source in cooking and lighting. Therefore, each household rationalise frequent cooking, which suggests the use of charcoal as primary energy source.

Table 3. Energy consumption pattern in percentage (Field survey 2014)

Energy Sources	Numbers of household	Accessibility Level	Lighting consumption rate	Domestic cooking consumption rate
Charcoal	99.7%	87.5%	0%	93.75%
Kerosine	99%	77.5%	96.5%	60%
Electricity	81%	52.5%	98.25%	98.25%
Gas	12.25%	3.125%	0%	6.5%
Petroleum	15%	38.75%	11%	0%

Based on the results of these analyses, charcoal is considered as the cheapest source of energy and so accessible to all households. It could be suggested that household size has significant influence on quantities of charcoal consumed in all wards in Offa Local Government Area, Kwara State of Nigeria which confirms the position of Sanda et al. (1991). From the information gathered from the respondents in the city, charcoal supply to the city area was consistent in supply and distribution to all streets, market and sales outlets. The results of these analyses suggest that household income has little influence on the quantities of charcoal consumed. It is observed that majority of the citizen of Offa collect charcoal from nearby charcoal merchant, hence its level of consumption may not be influenced by level of income of respondents.

5. CONCLUSIONS

The findings of this study show that household size and income earning had significant impact on the quantities of charcoal and kerosene consumed, while household income had more significant influence on Standard of living depending on income earned by individual household and it also has significant influence on cost of living which determined household low budget on energy consumption. Charcoal seems to be the major source of fuel consumed in the Local Government Area because of its low cost, availability and affordability more than other sources of energy. More importantly, electricity is not readily available due to inadequate supply.

6. RECOMMENDATIONS

Since our energy requirements would continue to grow with increase in living standard, industrialization and other socio-economic factors, the Offa city required more than

133KWATT power station for efficient power distribution. Government will have to be involved in upgrading electricity power station in Offa to improve the use of electricity source for cooking and lighting in various households. Solar energy systems are to be adopted as alternatives or complementary to electricity power supply in all local government for consistence development (though the adoption of solar energy system is not a consequence of this work. Updating of present systems seems the most urgent thing to do). This is due to the enormous financial requirements for conducting popularization and demonstration projects which will introduce the new systems to Offa city. This new power technology should be developed for efficient energy resources management and utilization.

The citizens of Offa city Kwara State should be conservative and customize the management of energy consumption and be aware of the hazards in energy sources and improved ways of using kerosine, charcoal and petroluem products for better energy utilization.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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