



Domestic Energy Consumption Survey in Taraba State of Nigeria

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Abstract

A survey of the consumption pattern of energy sources such as fuel wood, kerosene, gas, biomass, electricity and charcoal as consumed by households in rural, semi-urban and urban areas of Taraba State has been carried out. A total of 2000 household heads (200 from each area) were randomly selected and interviewed using a structured questionnaire. The study looked at the energy preference in locations and the level of income of respondents in such locations. It was discovered that in the urban, semi-urban and rural areas of Taraba State, approximately 89% used fuel wood, 7% uses kerosene, 1% gas, 2% uses charcoal and 1% electricity respectively for their domestic activities. The main reason for the low number of respondents using gas was that of its high cost and its state of being inflammable. The low patronage of electricity in a semi-urban center compared to urban was attributed to the epileptic nature of power supply in the zone. The energy options preferred by most respondents in Taraba state are fuel wood, electricity and kerosene while the energy source that is predominantly used for cooking is fuel wood and it cuts across both income levels and educational status. The survey revealed that biomass is not been used in domestic activities.

Keywords; Energy sources, Consumption pattern, Fuel wood, Kerosene, Electricity, Rural areas, Urban areas.

Introduction

Since the inception of the industrial revolution which has largely been described as a revolution in power availability, energy has become a very important production factor. However, its availability is a crucial pre-requisite for development.

Botkin and Keller (1998) contended that human population impacts negatively on the environment. This

is to say that there can be no long-term solution to our environmental problems unless the human population in Nigeria and Taraba state in particular stops growing at its present rate. As long as the human population in Nigeria continues to grow at the present rate of 3.5% per annum (NPC, 2006), it is doubtful that our environmental resource including energy source such as

petrol, wood and coal can be made sustainable.

This paper is intended to investigate the domestic energy trend in urban, semi-urban and rural areas of Taraba state, Nigeria. To survey and examine the pattern and levels of energy consumption for households and their attitudes towards alternative energy sources.

Expected benefits of the survey include the followings:

- The survey study will serve as a data bank for the State Government in terms of information on domestic energy consumption patterns in Taraba state.
- The study may provide a basis for increasing the demand for alternative energy sources that are environmentally friendly and sustainable.
- The study might lead to a formation of a legal framework that will regulate the present indiscriminate destruction of the state forest reserves.

Materials and Method

Data Collection and Sampling

Techniques

The energy consumption survey was carried out in ten local government areas of Taraba, (October 2007 – December 2008). A total of 2,000

copies of the questionnaire were distributed with 200 copies for each of the local government areas. The questionnaire consists of three sections and sought information on both the person, the material use for a particular energy source, the quantity used per week or month and the current energy prices of kerosene, gas, electricity, biomass, charcoal and firewood per kilograms was determined. The monthly bills were the basis for estimating electricity consumption. Data on other fuels, households were asked how much of each they consume in a day and each figure thereafter used in elevating their weekly or monthly equivalent values. The survey covers four local government areas in the Northern Senatorial Zone and three local government areas in each of the Southern and Central Senatorial Zones covering a total of ten local government areas namely: Jalingo, Zing, Lau, Karim Lamido, Gassol, Gashaka, Sardauna, Wukari, Takum and Ibi. The technique utilized in this study was the sampling technique. The samples collected from urban, semi-urban and rural settlements were analyzed separately. A sample of two towns in each of the ten local government areas was selected for the study made. These are Jalingo: Jalingo and Mayo Dasa, Lau: Lau and Garin Dogo, Zing: Zing and Yakoko, Karim-Lamido: Karim-Lamido and Jen Pettel, Gassol: Mutum Biyu and Tella, Gashaka:

Serti and Jantari, Sardauna: Gembu and Nguroje, Wukari: Wukari and Bantaji, Ibi: Ibi and Gindin Waya and Takum: Takum and Kwarnbai village. Using the population samples as a respondent for the carefully structured questionnaire was to allow us clearly observe the energy consumption trend for households residing in urban, semi-urban and rural settings of the state. We also want to see whether there is a shift to the use of alternative energy sources as we move from rural towards urban setting. Some data for the study were collected by means of a questionnaire. The administration and retrieval of the questionnaire was through direct personal contact with the respondent.

Results and Discussion

A statistical percentage and frequency distribution tally was used in analyzing the data collected in the study. In this section, the specific energy consumption of households per month for rural, semi-urban and urban areas of Taraba state are presented along with their energy equivalent in Giga Joules (GJ).

The percentage frequency table shows clearly, responses to the various questions raised in the sections (ACB) of the questionnaire by people in their respective areas. This statistical method has proved to be reliable as used by Alabe (1996). The result obtained revealed that

most of them (43%) were between the ages of 31-40 yrs while those who were 50 or more years formed the least population. Also majority of the respondents were those from monopoly type of family (92%) and were predominantly male (88%). In addition, a large population (77%) was observed to possess one level of western education or the other. About 54% was found to be civil servant while 26% and 20% were found to be farmers (subsistence farmers) and businessmen (small scale) respectively. The results further revealed that only 9% are high income earners (GL. 13 and above). In fact, most of the respondents (76%) were low income earners (GL 1-6). However, people who earn high income are more likely to use alternative fuel sources in preparing their meals. As income increases, household may substitute fuel wood for other more modern energy sources like kerosene, gas and electricity. However, it should be noted that rise in income does not show an increase in enlightenment as regards to benefits and uses of alternative source of energy (Alabe, 1996). Moreover, fuel wood is cheaper (a bundle fuel wood cost N100) and can cook three days meal for an average family size of seven) than the other alternatives, so any increase in income of the consumer may only make him extend his use of fuel wood to areas he would not afford hitherto. Furthermore, in

Taraba State the medium and high income earners are very much willing to adopt the use of alternative energy sources so long as they can be made efficient, reliable, affordable and sustainable. But reverse is the case

for farmers and the low income earners who are still hesitant in changing from the traditional energy (fuel wood) to other alternative sources.

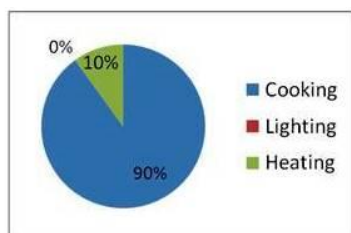


Figure 1.1: Energy source per activity for fuel wood

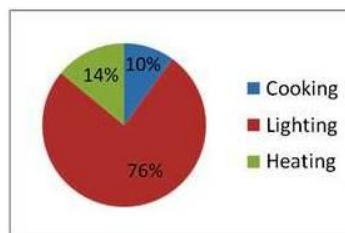


Figure 1.2: Energy source per activity for kerosene

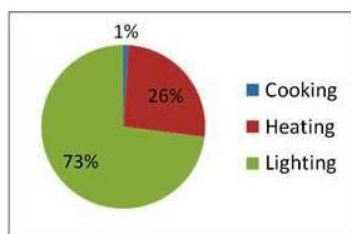


Figure 1.3: Energy source per activity for Electricity

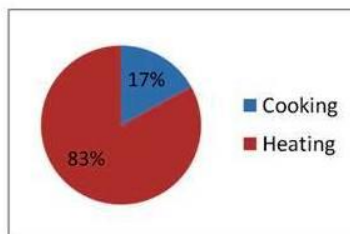


Figure 1.4: Energy source per activity for Charcoal

Table 1: Energy sources consumption/month/household

Location	Electricity	Fuel wood	Kerosene	Charcoal	Gas
Jalingo	875	241.28	14.80	33.6	18.52
Zing	25.0	138.8	9.86	20.16	0.0
Lau	0.0	138.4	3.28	16.8	0.0
K. Lamido	0.0	152.24	6.41	11.76	0.0
Gashaka	0.0	189.28	11.59	10.08	0.0
Gassol	0.0	133.12	4.93	8.4	0.0
Sarduna	180	124.8	8.22	16.80	0.0
Wukari	500	141.96	11.22	13.44	13.8
Takum	687.5	223.6	13.152	26.88	15.92
Ibi	187.5	226.72	6.58	21.84	0.0
G/mean	268.0	171.08	9.0042	17.98	16.08

Table 2: Cost Comparative Table

Energy source	Unit cost/kg	Average monthly cost
Fuel wood	N6.15	N1483.87
Kerosene	N143.25	N2120.10
Charcoal	N20.00	N672.00
Gases	N116.34	N2153.81
Biomass	0.00	0.00
Electricity	N4.00 - N6.00	N1518.00

Table 2 indicates a cost comparative figure on the different energy options that are surveyed in this study for Jalingo metropolis. For a low income earner (GL. 1-6) that uses fuel wood, kerosene, charcoal, gases and electricity at a time for instance will have to spend about 19%, 27%, 9%, 29% and 19% of his income on energy consumption whenever he chooses to use any of the options. A medium-income (GL 7-12) making the same choice will have to spend about 6%, 9%, 3%, 9% and 6% respectively. For the high-income earner, the percentage goes lower irrespective of whatever choice of energy option he uses. A similar lead is obtained for other locations like Zing, Lau, Wukari, Takum etc.

Energy use per activity by respondent

From the survey results, it was observed that in the urban, semi-urban and rural areas of Taraba State, approximately 82% used fuel wood, 7% uses kerosene, 1% gas, 2% uses charcoal and 1% electricity respectively for their domestic activities. The survey revealed that

biomass is not been used in domestic activities. It was further *observed* that most respondents (89%) use fuel wood for cooking while only 11% use it for heating. The results revealed that none use fuel wood for lighting.

Kerosene consumption on the other hand, was mainly 76% for lighting purposes, 10% cooking and 14% for heating. The low percentage usage in domestic cooking could be attributed to the cost of kerosene (N70 – N80) per liter as pump price and (N120 – N140) per liter in the black markets. Oral interviews conducted in Lau, Karim Lamido, Ibi, Gassol and Gashaka indicate that reasons advanced for the high patronage of fuel wood is that of its availability and affordability. The cost of fuel wood is still within the reach of the low income earners. Kerosene, gas, charcoal were used for cooking in few household as indicated in fig 1.1, 1.2, 1.3 and 1.4. For instance, only 1 household uses electricity for cooking in Jalingo out of the 195 respondents and none in the other locations (fig 1\3). Respondents in Jalingo, Takum

and Wukari use it for heating compared to the usage of fuel wood in (fig 1.1). Heating in the context of this research refers to the use of the five energy sources for the purpose of warming a room, boiling water or drying of some household items.

From the survey results, gas consumption is highly restricted to the educated class/the high-income earner categories of respondents in the sample areas. This is because of the delicate nature of using natural gas which is highly inflammable and also lack of awareness. The survey shows that gas consumption in all the sampled area of study was used for cooking only. The main reasons for the low number of respondents using gas was that of safety, availability and affordability i.e. its high cost and its state of being inflammable. As indicated in table 4.4, none of the respondents uses gas for heating and lighting. Some of the reasons for the use of gas in domestic cooking are; it is clean, cooks faster (efficient) and apparently less heat waste in the course of cooking. Electricity a popular source of energy used mainly for lighting 73%, cooking 1% and heating 26% (fig 1.3). The study revealed that in the semi-urban (Zing, Gashaka, Sarduna, and Ibi) no respondents' uses electricity for domestic cooking and heating and in the rural areas (Lau, Gassol & Karm-Lamido) there was no electricity supply. However, findinfrom the

study conducted by Umaru and Wamakko (1999) in Sokoto metropolis indicate a similar trend between 1992 and 1993. This means that none of the respondents was using electricity for cooking in the periods mentioned. The study further revealed that in Jalingo metropolis the average monthly electricity consumption for households stands at 875 kw/h (approximately N4812.5) PHCN, 2008, being and urban centre. The semi-urban (Zing, Gashaka, Sarduna, Ibi) has a monthly average consumption of about 130.83kw/h (N719.6) (Lau, Gassol, Karim-Lamido) which is a typical rural areas do not spend their income on electricity due to lack of unavailability of power supply.

The low patronage of electricity in a semi-urban center compared to urban was attributed to the epileptic nature of power supply in the zone. The high electrical consumption in Jalingo may not be far from the fact that it is a state capital while Wukari and Takum are local government headquarters. Nigeria has over 500MW of generating capacity and its total national demand is less than 300MW (EIA, 2007). However, supply is irregular because of lack of spare parts and absence of a good maintenance culture among other things (Alabe, 1988). This trend coupled with high distribution costs has restricted the use of electricity to most urban centers in Nigeria. In

order to determine the significance of relationship between energy options preferred and the location of respondents, the chi-square test of

significance was calculated for respondent's energy preference in the area studied.

Table 3: Chi-square values for Energy options preferred by Respondents

Location	Energy sources					Total	χ^2
	Fuel wood	Kerosene	Charcoal	Gas	Electric		
Jalingo	10	5	9	3	168	195	194.75**
Zing	60	20	36	1	83	200	135.61**
Lau	139	41	0	0	20	200	139.2**
K. Lamido	160	10	0	8	19	197	108.9**
Gashaka	138	17	0	1	44	200	78.2**
Gassol	162	28	0	1	5	196	17.6**
Sardauna	96	20	14	0	68	198	6.73*
Wukari	35	5	10	1	138	189	100.5**
Takum	20	9	11	3	150	193	218.6**
Ibi	99	14	7	28	47	195	165.72**
Total	919	169	87	46	742	1963	

χ^2 = Value (P = 0.05) = 55.758: df = 36

* = Not significant

** = Significant

Results on Table 3 show the calculated value of χ^2 at level of significance, P = 0.05 for the survey areas. This results shows that there is significant relationship in the choice of energy options in Jalingo, Zing, Lau, Karim Lamido, Gashaka, Gassol Wukari, Takum and Ibi since the calculated value of χ^2 is greater than the critical value. However, there is no significant relationship between location of respondents and their preferred energy options in Sardauna, because the calculated value of χ^2 is less than the critical value.

Based on results of Table 3 which indicate that there is significant relationship between preferred energy options, and location for the surveyed areas and bearing in mind that this is a combination of urban, semi-urban and rural communities, findings of Alabe (1996) that fuel wood seems to be the major source of energy in both rural and urban areas agrees with the results of this study.

Reasons for change in preference of Energy options

To determine the level of significance of relationship between reasons for change in energy preference and

location of respondents, the chi-square test of significance was calculated for respondent's reasons for change in preference for energy options in the survey areas. Reasons

for change in preference of energy options include availability, affordability, safety and efficiency (Table 1.2e).

Table 4: Chi-Square values for Reasons for change in preference of Energy Use

Locations	Reasons				Total	χ^2
	Availability	Affordability	Safety	Efficiency		
Jal/ingo	116	58	9	12	195	45.86**
Zing	121	36	13	30	200	1.63*
Lau	108	30	12	50	200	13.98*
K. Lamido	131	26	10	30	197	0.72*
Gashaka	120	27	17	36	200	6.68*
Gassol	110	26	8	52	196	22.0*
Sardauna	151	23	10	14	198	14.62*
Wukari	128	21	18	22	189	11.56*
Takum	128	41	8	16	193	10.4*
Ibi	145	18	3	29	195	13.74*
Total	1258	306	108	291	1963	

$\chi^2 = \text{Value (P = 0.05) = 40.12, df 27}$

* Not significant,

** Significant

Fuel wood seems to be the major sources of fuel in Taraba state. This is because of its availability and affordability. The other sources of energy, kerosene, charcoal, gas and electricity are not readily available due to inadequate supply whereas biomass and charcoal are readily used for domestic activities. However, with enlightenment the trend might change. The fears of danger associated with the use of natural gas and its resultant cost scare people away from patronizing it. Also the recent privatization of the downstream sector of the petroleum

industry has made kerosene out of reach for the community. As at present, the pump price is between N80 – N120 per liter (2010) and can be as high as N160:00 per litre in the black markets. Power supply from power holding company of Nigeria (PHCN) since 1999 – 2010 has been so epileptic and exorbitant. Bills are sent to customers at the end of every month. This was the same reason why most respondents do not use electricity for domestic cooking and heating but rather prefer to use fuel wood since it is available and affordable. The survey

further revealed that most respondents are aware of the negative environmental effects of falling trees and are willing to adopt fuel wood substitutes. However, household choices of fuel are affected by availability and affordability even among the high income earners in Taraba State.

Conclusion

It is shown that no state/nation can develop economically without giving due attention to its energy consumption and supplying pattern (World bank/UNDP 1983). The study has revealed that wide ranges of energy sources were utilized by the respondents with some of them switching from one source to the other during the study period. The consumption pattern of these surveyed energy sources are almost the same in house of civil servants as well as of those of farmers. A relationship was also observed between education and family size on the other hand and energy sources utilized. Respondents who were not educated but having polygamy families had greater affinity for fuel wood than other sources. Conversely, kerosene and gas were mostly consumed by those who were educated and having monogamy families.

The energy options preferred by most respondents in Taraba state are fuel wood, electricity and kerosene while the energy source that is predominantly

used for cooking is fuel wood and it cuts across both income levels and educational status. One interesting development however, was the desire and willingness shown by most of the respondents to use kerosene if its price and supply were to be improved and stabilized. This will reduced fuel wood consumption, irritating smoke hazards, frequent failing of trees and consequently our forest would be reserved to prevent environmental degradation.

Recommendations

- In the light of the above findings, the followings are recommended.
- Taraba state government should intensify advocacy on the use of alternative energy source such as solar, biomass, wind.
- The state government should a matter of urgency design an aggressive afforestation programme back up by a strong workable legal framework.
- A more efficient and improve wood stoves should be promoted, especially in the rural areas where access to fuel such as electricity, gas and kerosene may continue to constraint.
- Women are to be involved in the planning of household energy issues for getting a

more realistic scenario of the end users of household energy.

References

- Alabe, M. (1988). “*Reliability Assessment of Sample and Delta Power Stations*”, M.Sc., Thesis. Ahmadu Bello University, Zaria, Nigeria.
- Alabe, M. (1996). Household Consumption Patterns in Northern Nigeria; *Journal of Energy for Sustainable Development*. Vol.2, No. 5, Bayero University, Kano, Nigeria.
- Botkin, D. B. and Keller, E. A. (1998). *Environmental Science: earth as a planet*. 2nd ed, New York: John Wiley and Sons Inc. p. vii, 308, 313, Gl. 1-18.
- EIA, (2007), Nigerian energy Data and Analysis oil, Gas, Electricity and Coal
- Daily Sun (2006). Energy Column, October 30, 2006, pp 45.
- NPC (2006), *Census 2006*. <http://www.population.gov.ng/index.php/80-publications>
- PHCN (2008). Power Holding Company; Monthly Report, Jalingo District. Nigeria.
- Umaru, B. F. and Wamakko, M.M. (1999). Domestic energy consumption pattern in Sokoto Metropolis. *Nigerian Journal of Renewable Energy*, Vol. 7. Nos. 1 & 2 pp. 35-40.
- World Bank/UNDP (1983). “Nigeria: Issues and crisis in energy sector”. Report of the joint UNDP/WB Energy sector assessment program, New York: World Bank and UNDP.