SOCIO-ECONOMIC EFFECTS OF HOUSEHOLD ENERGY USE IN KATSINA STATE, NIGERIA

BY

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JULY, 2014.

DECLARATION

I declare that the work in this Thesis entitled "Socio-Economic Effects of Household Energy Use in Katsina State, Nigeria" is a record of my own research work under the supervision of Dr.I.Jaro Musa and Dr. I.A. Abdulhamed. The information derived from the literatures has been duly acknowledged in the text and a list of references provided. No part of this work has been submitted for the award of degree in any other University.

Yahaya SANI _____ Signature _____ Date

CERTIFICATION

This thesis entitled "ASSESSMENT OF SOCIO-ECONOMIC EFFECTS OF HOUSEHOLD ENERGY USE IN KATSINA STATE, NIGERIA" by Yahaya SANI, meets the regulations governing the award of the degree of Master of Science in Environmental Management of Ahmadu Bello University and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to my beloved parents.

ACKNOWLEDGEMENT

All praise is due to Almighty Allah the most exalted. We praise Him and seek His help and forgiveness. May Allah bestow His mercies and blessings upon prophet Muhammad (S.A.W) and upon his good and pure family.

My heartfelt gratitude goes to my beloved parents, may Allah have mercy upon them and may He continue to guide and protect them, amen.

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ABSTRACT

It has become increasingly evident that socio-economic variables are the strongest predicators of energy use. Income, education, occupation and location have now become measures used in this study. A survey involving questionnaire administration and energy consumption monitoring in selected household was carried out. The total estimated figure of the sampling area for this study was 1,556,997. Thus, this study was in line with Krejcie and Morgan (1970) who recommended that for a population size of between 250,000 and 3000 million a sample size of 384 should be taken. The stratified random sampling method was applied in the study area. Two (2) levels of stratification method were used in selecting settlements (i.e urban and rural) for this study in the study area. Purposive sampling method was used to select the streets and houses for the administration of questionnaire. Analysis was carried out on data collated from the study and monitoring within delineated strata to get a representative generalised result for the study area. An average of 66.7 percent of household heads prefer biomass fuel against 33.3 percent preference of fossil fuel for cooking and heating in Katsina state. Data collected within component strata indicates higher use of wood at 23.9kg in Baure rural area of Daura senatorial zone, the lowest 18.1kg fuel wood consumption per household per day in Katsina urban area of Katsina senatorial zone. In contrast substantial use of cooking gas at 1.44kg/household per day in Katsina urban area of Katsina senatorial zone against nil recorded in all the three rural areas (Rimi, Baure and Sabuwa. The use of kerosene on the other hand cut across all the strata at 1.4, 0.6, 0.85, 0.53, 1.0 and 0.53 litres for urban Katsina, Funtua (rural), urban Daura, Baure (rural), urban futua and Sabuwa (rural) respectively. The use of electricity at 61.2% put it as the most preferred for lighting. Pattern of energy use indicates switch between season, with highest being as switch from kerosene to fuel wood in dry season in the study area. While most of these energy sources are noted to be adequately supplied demand is usually high in dry season except electricity whose supply is determined by prevailing situation on the upstream sector i.e generation and transmission form the power plants. The federal government deregulation policy on petroleum products has impacted negatively on the demand and supply of household energy in the study area. Average expenditure of N347.83 per day household for cooking, heating and lighting amounting to a sizeable percentage of income of most household heads (energy finances) was recorded. The situation within strata indicates average expenditure of N470.00 per household per day in Katsina urban area. It is followed by Funtua and Daura urban areas with N455.00 and N445.00 respectively for rural areas, Rimi is recorded with an average daily energy expenditure of N252.00. it followed by Sabuwa and Baure with N240.00 and N225.00 respectively. The amount may be little but when compared to the perceive earning of some respondents represent large chunk of their income. Low level of awareness of the effect of burnt energy on environment amongst others is adduced for the trend. It is recommended that the antidote to low rate of adoption of modern energy sources in the study area is the enlightenment of people and provision of subsidy on energy sources by government and relevant intervention agencies.

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CHAPTER ONE: BACKGROUND OF THE STUDY

1.1 INTRODUCTION

The importance of energy at the global level can never be over emphasized, from the primitive ages when stones were used to ignite fire to present day of the use of nuclear energy. Energy has long been recognized as an essential component in meeting basic human needs, in stimulating and supporting economic growth and in enhancing the quality of life in human settlement (Musa, 2011). Sambo (1992) defined energy as the capacity of a physical system to perform work. Energy exists in several forms such as heat, light, chemical, mechanical, electrical and other forms. The Standard International (S.I) unit of energy is joules (J) or Newton/meter (N/m). According to Enger and Smith (2004) if the flow of energy through organisms or societies ceases, they stop functioning and begin to disintegrate. If societies are to survive they must continue to expand energy, though some organisms and societies could be more energy efficient than others.

Energy sources can be grouped into two main categories, i.e renewable and non-renewable energy sources. The non renewable sources are essentially fossil fuels like petroleum oil, gas and coal. According to Enger and Smith (2004), the formation of fossils fuels takes millions of years and is finite in availability; they are formed as a result of accumulation of energy rich organic molecules produced by organisms as a result of photosynthesis. Considering the time it takes to be formed and its finite nature, rational use of energy should be paramount. This source constitutes about 90 percent of world commercially traded energy (OPEC Fund for International Development, 2011).

Renewable energy sources on the other hand replenish themselves or are continuously present as a feature of solar system. For example, in plants, photosynthesis converts light energy into chemical energy. This energy is stored in the organic molecules of plants as wood, starch, oils

or other components. Any form of biomass plant, animal, algae or fungus can be traced back to the energy of the sun (Pickering and Owen, 1995).

Garba (1999) described biomass as organic carbon based material that reacts with oxygen in combustion and natural metabolic process to release heat. The initial material, he said may be transformed by chemical and biological processes to produce immediate bio-fuels such as methane gas, ethanol or charcoal. The resources of Nigeria can be identified as wood, forage, grasses and shrubs as well as waste materials from animals, forestry, agricultural, municipal and industrial activities. Plant biomass can be converted to produce solid briquettes which can then be utilized as fuel for household use. Sambo (1992) estimated the biomass resources of Nigeria as been about 8×10^3mj. He cited solar, geothermal and tidal energy as other forms of renewable energy.

The amount of energy consumption is influenced by the level of development and as such varies from one country to another. Researches have shown that the industrialized nations used most of the world's energy, while less developed nations used much less; this is supported by the findings of Enger and Smith (2004) which stated that the industrialized nations use energy equally within three sectors i.e residential, transportation and industrial as against the predominant use of energy for residential purposes (cooking and heating) by less developed countries. The authors further reported that the amount of energy required for commercial and residential use varies from country to country. The researchers claimed that though a country with high GDP uses a large amount of energy, a lower percentage of its energy per capita, is used for residential and commercial needs than does a less developed country. They went further to explain that while 30 percent of energy used in North America is for residential and commercial purposes, in some developing nations 90 percent is used in residential sector.

In Nigeria findings have shown that most of the energy consumption is for residential purposes mostly for cooking, heating and lighting. Olajide and Odugbenro (1999) identified household sector as the largest energy consumer in the economy, accounting for about 90 percent of the traditional fuels, especially fuel wood and 25 percent of the commercial energy.

Silviconsult (1991), which also identified the use of kerosene, liquefied petroleum gas (LPG), fuel wood and Sorghum stalk (*kara*) computed a higher use of biomass over fossil fuels in Northern Nigeria. Adegbulugbe (1995) specifically identified liquefied petroleum gas (LPG), fuel wood, charcoal and electricity as the major fuels for urban use in Nigeria. They concluded that dependence on biomass fuels is rapidly giving way to the use of fossil fuels. Economy, differences in technology, climate, population, family size, e.t.c. may be adduced for the change in pattern between these two studies, and same reasons may have influenced the seeming change in consumption pattern to higher use of biomass fuels. Obueh (2000) reported that biomass meets about 80 percent of domestic energy demand in Nigeria.

The household has been defined, relevant to household use energy is the definition by silviconsult (1991) that the 'household' as it relates to energy consumption refers to those who live and eat together (Silviconsult,1991). They further defined household energy consumption as the amount of energy that is spent on various appliances used within household. For broader use the definition could include all fuel types in the household. Silviconsult (1991) used per capita consumption of energy as a means of estimating fuel wood demand amongst others. Their findings was confirmed in Cline-Cole (1987) who said that there is a negative relationship between the size of the household and fuel wood consumption, arguing that large household use fuel wood more efficiently than small households. They concluded that population growth may not necessarily produce corresponding increase in consumption.

Pattern of energy use at household level varies according to educational level of the user, rural-urban dichotomy, cultural background, purchasing power, climate as well as availability and distance of the energy sources and of course government policy. All these are determining factors on the rate of supply which may also modify energy demand. All these factors influence the level and pattern of energy consumption in the developed and developing countries Hassan(2008).

Survey of energy use in Northern Nigeria by Silviconsult (1991) identified that households whose heads have little or no formal education consume more wood than those with some background of formal education. The reason could be that modern knowledge has motivated people to the use of less energy and less health risky energy sources than the traditional wood commonly used. They found out that fuel preference also affects the pattern of energy use, and that *Anogeissus leiocarpus (marke)* tree species was the most preferred for cooking due to it's burning speed, convenience and relative cost. On the issue of seasonality, the same study identified that 85 percent of the household use more wood during the cold season for heating and lighting, while 25 percent use charcoal, kerosene, gas and electricity. The study therefore identified cold season as a motivating factor for more consumption of energy in the household especially for heating. The factors responsible for the use of energy (fuel wood) and the nature of the studies are good motivations for the author to embark upon another study to assess the socio-economic effect of household energy in Katsina State.

1.2 STATEMENT OF THE RESEARCH PROBLEM

Energy poverty is one of the biggest obstacles to sustainable economic growth and development in the world. Millennium Development Goals (MDGs) report revealed that worldwide, 2.5 billion people rely on traditional biomass such as fuel wood, charcoal, or crop residues for cooking, agro-processing and heating and over 1.4 billion people lack access to electricity (OPEC Fund for International Development, 2011).

The inhabitants of Katsina state are faced with challenges of high cost of kerosene and cooking gas, occasioned by the deregulation policies of the federal government. This situation coupled with erratic power supply has precipitated increased demand of fuel wood for household use. The consequences of this situation had accelerated deforestation in an already arid area with fragile ecological basis (Yusufu, 1995).

The major environmental problems related to energy production, distribution and consumption are deforestation, air and land pollution. Excessive fuel wood consumption arises due to population growth, low technical efficiency (using traditional three stones stove) and lack of adoption of other sustainable cooking methodologies. These contribute to deforestation which is a very serious issue, because of the important roles forestry resources play in the ecosystem. They serve as sinks for carbon dioxide, maintain diverse plants and animals life as well as regulate the flow of water. Loss of forestry resources leads to soil erosion, desert encroachment and loss of soil fertility (Abubakar and Babangida, 2011).

Forest Management Evaluation and Coordinating Unit (FORMECU) in 1991 gave out a consultancy work to "Silviconsult" to carry out a study on domestic energy use in Katsina state. They investigated mainly four (4) energy sources i.e. Wood fuel; Sorghum stalks (*Kara*), Kerosene and gas. They found out that cost, low income and poverty have forced majority of the people to use fuel wood and sorghum stalk. Another study by Hassan (2008),

in which he analyzed the utilization level of household energy in Katsina metropolis. He found out that households utilized different type of energy sources; wood fuel, sorghum stalk, kerosene, sawdust, electricity and charcoal within the houses. He discovered that an average consumption of 0.3kw/capita/day of electricity, 1.5kg of wood consumption, 0.14 litres of kerosene, 0.05kg 0f sorghum stalk and 0.04kg of charcoal was consumed per day per capita in Katsina metropolis. Moreover Musa (2011) examined fuel wood trading and consumption rate in some urban communities of the savanna region of Nigeria. He found out that Katsina urban community has the highest consumption rate of 21.9kg. It was followed by Bauchi and Zaria urban communities with 19.9kg and 19.6kg respectively, while the lowest is Minna urban community with 12.1kg per activity per day.

The fact that silviconsult (1991) studied types and sources of household energy use when Katsina state had a population of 3 million while Hassan (2008) concentrated on utilization level of household energy in Katsina metropolis. Musa (2011) identified source and type of energy use (fuel wood) but only focused on the urban communities. From the foregoing, it is evident that all these studies have concentrated on utilization, types and sources of energy use in household. Therefore, no study to the knowledge of the author has significantly attempted to determine the socio-economic effects of household energy use in Katsina state as a whole. This study will try to fill the existing gap in knowledge. Katsina state currently has an estimated population figure of about 7 million. The population of the state has increased tremendously from 3 million (NPC 1991) to 5.7 million (NPC 2006). It is therefore, to be expected that the number and size of households have increased as well, more businesses using different types of energy have been established.

This study is set to answer the following questions:

1. What are the types of energy utilized in the household in Katsina State?
2. What are the consumption rates of the household energy use in Katsina state?
3. What are the consumption rates of the household energy use between season in Katsina state?
4. What are the socio-economic effects of household energy use in Katsina State?

1.3 AIM AND OBJECTIVES

The aim of this research is to examine the economic and social effects of household energy use in Katsina state, while the objectives of this study are to:

i. identify the types of household energy use in Katsina State

ii. determine the rate of consumption of household energy in the state.

iii. determine the rate of consumption of household energy between seasons in the state.

iv. examine socio-economic effects of household energy in Katsina State.

1.4 RESEARCH HYPOTHESIS

Based on the aim and objectives of the study, the hypothesis below is to be tested:

H_0 There is no significant difference in consumption rates of household energy in Katsina State.

H_1 There is significant difference in consumption rates of household energy in Katsina State.

1.5 JUSTIFICATION OF THE STUDY

Energy has long been recognized as an essential component in meeting basic human needs, in stimulating and supporting economic growth and in enhancing the quality of life in human settlement (Musa, 2011). The importance of energy at household level can never be over emphasized. Household energy refers to as the energy that is spent on various appliances within the household, it therefore includes all the fuel used in the household.

It because of the vital role that energy plays at the household level the researcher sees the need and picked interest to assess the economic and social effects of household energy use in Katsina State as a whole. It is hoped that the research will draw the attention of the concerned authorities, stakeholders and interested groups on the socio-economic effects and energy utilization for sustainable development.

1.5 SCOPE OF THE STUDY

The study intends to assess the socio-economic effects of household energy use for lightening, heating and cooking. The types of energy use that will be covered in the study include, wood fuel, kerosene, sawdust, gas and electricity. This study was conducted in Katsina state. The state is made up of 34 Local Government Areas. For the purpose of this study, six (6) LGAs were selected out of 34 LGAs. Two (2) LGAs (i.e urban and rural) were selected from each senatorial zones in the state. The selected local government areas represent urban and rural areas in the state. The selected local government areas area, Katsina, Daura and Funtua which represent urban areas while Rimi, Baure and Sabuwa represent rural areas in the state.

CHAPTER TWO: LITERATURE REVIEW

2.1 OVERVIEW OF ENERGY ENERGY USE

The amount of energy consumption is influenced by the level of development and as such varies from one country to another. Researches have shown that the industrialized nations used most of the world's energy, while less developed nations used much less; this is supported by the findings of Enger and Smith (2004) which stated that the industrialized nations use energy equally within three sectors i.e residential, transportation and industrial as against the predominant use of energy for residential purposes (cooking and heating) by less developed countries. They further reported that the amount of energy required for commercial and residential use varies from country to country. They said this because though a country with high GDP uses a large amount of energy, a lower percentage of its energy per capita, is used for residential and commercial needs than does a less developed country. They went further to explain that while 30 percent of energy used in North America is for residential and commercial purposes, in some developing nations 90 percent is use in residential sector. They Also talked about variation in residential energy use between countries and regions. They recognised that energy in residential sector to the tune of about 75 percent is expended on air conditioning, refrigeration, water heating, space heating as well as internet issues in North America. This contrasts sharply with about half of residential energy in Africa being used toward cooking they explained.

Like other less developed countries, most of the energy consumed in Nigeria is in the residential, and it is mostly for cooking, heating and lighting. Olajide and Odugbenro (1999) identified household sector as the largest energy consumer in the economy, accounting for about 90 percent of the traditional fuels, especially fuel wood and 25 percent of the commercial energy.

Silviconsult (1991), which also identified the use of kerosene, LPG, fuel wood and Sorghum stalk (*kara*) computed a higher use of biomass over fossil fuels in Northern Nigeria. Adegbulugbe *etal* (1995) specifically identified liquefied petroleum gas (LPG), fuel wood, charcoal and electricity as the major fuels for urban use in Nigeria. They concluded that dependence on biomass fuels is rapidly giving way to the use of fossil fuels. Economy, differences in technology, climate, population, family size, e.t.c. may be adduced for the change in pattern between these two studies, and same reason s may have influenced the seeming change in consumption pattern to higher use of biomass fuels. Obueh (2000) reported that biomass meets about 80 percent of domestic energy demand in Nigeria. Apart from the above mentioned factors that affect the household energy utilization level and consumption rate, other factors like; occupation (nature of work), educational level and urban-rural dichotomy are also additional factors in Katsina state.

2.2 HOUSEHOLD ENERGY CONSUMPTION

The household has been variously defined, but of relevance to energy is the definition by McGraham and Kaijser (1994) that the 'household' as relates to energy to energy analysis refers to those who live and eat together. As is the practice, the world over, the household is situated in residence. The residential compound in Northern Nigeria is usually defined by an enclosed residence through a single entrance (*zaure* in most indigenous houses or a gate in divided urban houses). It may contain several households. The independent fuel buying and using units as those people cooking from a single stockpile of fuel wood. For broader use the definition could include all fuel types in the household.

Silviconsult (1991) used per capita consumption of energy as a means of estimating fuel wood demand amongst others. They agreed with Cline-Cole (1987) that there is a negative relationship between the size of the household and fuel wood consumption, arguing that large

households use fuel wood more efficiently than small households. They concluded that population growth may not necessarily produce corresponding increase in consumption. In this survey per capita consumption of energy was used as a means of estimating fuel wood demand amongst others. The survey recorded 489,929 and 120,203 households for urban and rural Katsina against an estimated population of 3,559,369 and 948,579 for urban and rural accordingly. The study also estimated wood consumption as 1.741kg wood per capita, 0.10 litre of kerosene per capita and 0.08kg of gas per capita at the time of survey.

Even though the above mentioned studies show that; there is negative relationship between population growth and energy consumption. But increase in population leads to increase in the number of household. Therefore as a result of the population increase, number of households in Katsina State also increase which may affect the consumption level of energy use in the household.

2.3 HOUSEHOLD ENERGY: ENVIRONMENTAL AND HEALTH PERSPECTIVES

Concern over alarming rate of environmental degradation globally, has been topical issue to government and key players in the field of environmental science in recent times. Consequences of large scale deforestation and environmental pollution are manifesting in form of soil erosion, land degradation and loss of bio-diversity and local climate change resulting from global warming. Doig (1999) predicted that,

> Although not seen on a daily basis, over a number of years the impacts of global warming will felt in different parts of the world. Some authorities claim that recent natural disasters around the world have been due partly to global warming whose main effect is to raise global temperatures, thereby increasing drought in some places and creating floods in others

Reports of widespread flood in pats of Europe and America between the year 2006-2007 (BBC-World, 2007) and early seizure of rains in parts of Northern Nigeria in the year 2007, could be affirming of the above prediction whose author further explained that the global warming is caused by the release of green house gases like carbon dioxide, methane and nitrate into the atmosphere some of which come from our kitchens as a result of fuel burning.

Biomass resources are able to suck up excess carbon from energy related activities, replenishing the atmosphere with the oxygen need for our health. However, when forests are cleared and burnt for fuel this function is lost and the environment is worse for it. If just two-third of the estimated 9.6 billion hectares of forest and woodlands in Nigeria are maintained, rather than cleared or just left to decay, it could absorb over 50 percent of the carbon dioxide emissions from burning fossil fuel and dung in the homes of more than 70 million rural dwellers in Nigeria (Obueh, 2000).

An effort to address these issues gave birth to the internationally drawn up protocol referred to as Kyoto convention in 1997, which looked into the impact of environmental pollution on climate change. Bates (1999) argued that every time fuel is burnt, green house gases which are the main cause of global warming are released, along with health damaging pollutants. The reduction of these pollutants could be of more benefit than the overall control of the effect of the green house gases on the environment because people's health are more directly affected by emission of these damaging pollutants than those emitted away from home in place like power plants, industries e.t.c, she concluded.

Neira (2006) quoting the World Health Organization (WHO), gave a figure of 1.5 million deaths mostly among children and women per year as a result of indoor air pollution. The World Health Organization (WHO) in 1997 reported that the greatest burden of air pollution exposure occurs in kitchen of the developing world.

Bruce and Doig (2000) reported the following health problems associated with household energy emitting smoke; lower respiratory infection, chronic obstructive lung disease, carbon monoxide poisoning, lung cancer, low birth weight, tuberculosis and eye problems. They also mentioned other hazards like burns from open fires and kerosene, and poisoning to children drinking kerosene in stored soft drink bottles.

Obueh (2006) however, confirmed that symptoms suggestive of acute respiratory infection and chronic obstructive lung were reduced for people in household using an improved wood cooking stoves (Egaga stove) compared to three stones open fire at 32 percent and 68 percent respectively in Niger-Delta area of Nigeria. Still McCarty (2006) asserted that, although breathing carbon monoxide is dangerous, inhaling particulate matter is probably the single most important health related constituent with wood smoke.

The researcher seems to agree with the conventional wisdom which shows that some diseases like lower respiratory infection, chronic obstructive lung diseases, carbon monoxide poisoning e.t.c are associated with the gases emitted as a result of household energy use. While this claim may be true, it is necessary to comment that not much work has been done to back up this claim. However, the household energy users in Katsina State may also experience same effect.

2.4 HOUSEHOLD ENERGY AND WOMEN

The role of women in traditional set-up as anchor in the stability of the household is well known, thus their importance in household related matter is paramount. The UNDP (2000) agreed that energy and women are linked in many diverse ways. These linkages vary spatially, over time, across classes, between urban and rural areas and between countries. Some of these variations are common to women, men, children of a given area, class or country.

One of the factors that influence the nature of linkages between energy and women is resource base. Survival and lives of most people in developing world depend on biomass resources base used primarily for cooking. Since this resources base is being depleted, time and effort required to meet minimum household energy needs have increased. The time women in traditional African setting spend in gathering energy for household use is enormous (UNDP, 2000). According to Obueh (2006) women in the Niger-Delta area of Nigeria are seen for the most part of the afternoon carrying enormous bundles of fuel wood on their head after a full day's drudgery of wood gathering. Some of these woods weigh up to 70kg. Back home she spends another six hours exposed to smoke as she chops up and cooks the firewood on an inefficient 3-stone open fire. The scenario reported above has its root in scarcity of the most used fuel available (wood). The UNDP (2000) identified the greatest consequence of energy scarcity as depression in human productivity especially women's and this is because when survival of the family becomes the goal, there is no opportunity to develop human potential and talents. It is further observed that even where biomass energy are easily available women feel impacts of having to collect fuel wood in form of cuts, bites in addition to water haulage in some instances. When the aforementioned burden is added to another report of the WHO (2006), that, rural women and children in developing countries are exposed to indoor air pollution by the use of biomass fuel in traditional stoves that are little more than shielded from poorly ventilated kitchen it will be seen that women in developing countries and to some extent the roughly 400 million women world wide are more vulnerable than men to environmental degradation. Further revelation by the UNDP (2000) that of the 1.3 billion people living on less than one dollar (US$)a day, 70 percent are women, and the literacy rates for women in developing countries is less than 30 percent than that of men makes the position of women in the household quite ironic considering their role as anchors for stability.

When the condition of women is viewed in the context of another UNDP (2000) report that though the survival of the family in literal as well as economics term may depend on the skill with which a women manages her household, she has little or no economic decision making power and her time and her work is of very low status, the situation of the women will seem precarious.

In an attempt to address this issue the UNDP (2000), stated that in spite other importance of biomass energy in developing countries, the role of human energy and particularly women's energy must be recognized. It further observed that energy can be vital entry point or lever for improving the position of women in the household and society. This statement, seemingly is a corroboration of the 1999 united nations fourth world conference in Beijing, China, that called on governments to support the development of equal access for women to sustainable technologies and could come handy in solving the women's dilemma.

According to Misana (2001) enhancing women's access to affordable and clean energy would go a long way towards reducing the drudgery they face, allow them to use their time and energy for other purposes. This could lead to improved health, education, nutrition and economic status not only for women but for their families as well. The author also observed that though the energy sector has evolved as a capital intensive, expert dominated centralized sector, the women can play an important role in decentralizing the sector. They can do this by endangering the salvation of the energy sector in the long run, leading to longer term perspectives and investment, and a better fit between, energy sources, energy quality and end use i.e by focusing on renewable energy sources there by keeping with the underlying philosophy of sustainable energy. The author concludes by observing that though alone this feat may not be attained individually, together the women power cold go along way in achieving the objectives.

The women right advocacy or pressure group can help in advancing the calls for fair treatment of women in energy and other related matters. Misana (2001) reported that a group of energy experts and activists pushed for greater attention to women needs in South Africa, in spite of frustration they were able to call national attention to women's energy concern and then South African minister for energy introduced policies to address pat inequalities based on race and gender. The author also cited examples of efforts by women like the battery operated lamps project by rural women in Bangladesh, development of efficient post-harvest agricultural processing like fish smoking e.t.c, in Ghana as well as the Upesi stoves work by Kenyan women among others. Women as stakeholders and end users of household energy, involving and enlighting them in energy issue in Katsina state will help in rational use of household energy in the state.

2.5.0 SOME MOTIVATING FACTORS FOR HOUSEHOLD ENERGY CONSUMPTION PATTERN

Pattern of energy use at household level vary according to educational level of the user, climate, rural-urban dichotomy, cultural background, purchasing power as well as availability and distance of the energy source and of course government policy, which sometimes dictates the rate of supply which may also modify energy demand. All these factors overall could influence population distribution, while the population dynamics itself ultimately affect energy consumption pattern.

2.5.1 Education and Seasonality As It Affects Energy Consumption

Survey of energy use in Northern Nigeria by Silviconsult (1991) identified that household whose head's have little or no formal education (western education) consume more wood than those with some background of formal education. The reason could be that modern education has motivated people to the use of cleaner and less health risky energy sources than traditional

wood commonly used. Fuel preference also affects the pattern of energy use, hence in the same study, *Anodeisus leiocarpus (marke)* tree specie was the most preferred for cooking due to its burning speed, convenience and relative cost. On the issue of seasonality, the same study identified that 85 percent of household use more wood during cold season for heating and lighting, while 25 percent use of charcoal, kerosene gas and electricity. This study therefore identified cold season as motivating factor for more consumption of energy in the household especially for heating.

2.5.2 Cultural Beliefs and Energy Consumption

Cultural and traditional beliefs also affect the energy consumption pattern. Nierkik (1998) reported that electricity was initially rejected in west Rand of South Africa, because people believed that the coming of electricity will chase their ancestral spirits. However, later awareness that electricity and traditional fire can co-exist and the linkage of their ancestors maintained resulted in change in habit by the people, and clamour for electrification followed. Similarly, outcome of interview to some people in Katsina recently, revealed that food cooked with fuel wood is better tasted than that from kerosene and gas.

2.5.3 Socio-Economic, Demand and Supply Factor

According to Sepp (1991) availability of different energy sources, different household size and cooking habits, available cooking technology, energy price in relation to household mean income, determines private household consumption pattern. The author cited sited example of fuel wood and charcoal consumption is being directly related to its availability. The writer also linked energy consumption pattern with development level and explained that one should expect that with average household's income raising the use and of fuel wood and charcoal will be immediately reduced. However, in reality cost of buying new equipments for modern energy sources make people continue to use the traditional cheap energy.

2.5.4 Urban-Rural Energy Dichotomy

Khennas (1998) asserted that urban areas are responsible for the bulk of household energy consumption especially the conventional energy (electricity, petroleum products e.t.c) and is also true for traditional forms of energy such as biomass. Biomass fuel not only provides energy for poor rural population but also to people with higher incomes. In both cases, the fuels come from rural areas and the employment and income generated is crucial for rural populations. Considering the importance of traditional energy consumption in urban areas and the flow between urban and rural areas, policies aimed at reducing biomass consumption in urban areas will have a tremendous impact on the livelihood of rural population. The writer observed that a decrease in biomass energy consumption in urban areas may mean less pressure on forests in the short term. However, if people in rural areas find that they cannot sell wood for profit they may turn to other sources of income such as agriculture, for which land previously used for forestry may be acquired. Consequent loss of income from selling fuel could also increase the number of people moving from rural areas towards the towns, where it has been shown that each person will need to buy more fuel. Silvicinsult (19991) reported that urban users consume about 32 percent more wood than rural users.

2.5.5 Effects of Deregulation on Energy

It has become common knowledge that each time there is widespread scarcity of petroleum products; the government passes the blame to something or someone else. It is either due to major pipeline damage by vandals, militants attacks on major flow station, or sabotage by shylock importers.

Interestingly too, each persistent scarcity is accompanies by authorities to increase the pump prices of the petroleum products. Thus, the appropriate pricing of petroleum products, since

1991, has become major thesis for government's endless upward review of the price of fuel, especially Petroleum Motor Sprit (PMS) or petrol. In December 1993, the pump price of PMS rose from 70 kobo per litre to N3.25k. at the same time, the price of kerosene, another essential –by product of crude oil, was moved from 50 kobo to N2.75k while the cost of diesel increased to N3.00k per litre. Barely a year after the late General Abacha's Administration in 1994, adjusted the price again to N5.00k per litre of petrol; N3.00k per litre of kerosene and N3.50k per litre of diesel.

But General Abacha led regime also established the Petroleum Trust Fund (PTF) to manage the extra revenue arising from the increase. With it PTF was receiving N2.32k per litre from the sale of petroleum consumed on polity between October 1994 and June 1999 when the agency was scrapped by the chief Obasanjo's Administration. That regime met pump price of fuel at N11.00k per litre.

In December 1999, the Obasanjo administration, barely six months after its inauguration, jerked up the price of fuel from N11.00k per litre to N20.00k, despite organised deregulation in the polity's down stream sector. For a start, the price of fuel went down by N5.00k per litre. But it could go up or down depending on the prices of crude oil in the international market. Organised labour and civil society say deregulation is un accepted (Eme and Nnadozie, 2007).

Deregulation, which means allowing market forces to determine the price has been a long battle between the government and organised labour. The battle dates back to 2003, when the government made the first move at full deregulation policy and its implication on the governance in Nigeria.

In a popular parlance to deregulation means to do away with regulations concerning financial markets and trades. Ernest and Young (1988) posit that deregulation and privatization are

elements of economic reform programmes charged with the ultimate goal of improving the overall economy though properly spelt out ways.

For example, freeing government the bondage of continuous financing of extensive projects which are best suited for private investment by the sale of such enterprises; encouraging efficiency and effectiveness in resources utilization, reducing government borrowing while raising revenue; prompting healthy market competition in a free market environment; improving returns from investments and broadening enterprises share ownership thus engendering capital market development (Izibilli and Aiya, 2007).

Put differently, deregulation in the economic sense means freedom from government control. According to Akinwumi (2005), deregulation is the removal of government interference in the running of a system. This means that government rules and regulations governing the operation of the system are relaxed or held constant in order for the system to decide its own optimum level through the forces of supply and demand (Udo, 2009).

The campaign by the Federal Government for deregulation of the down stream sector especially products marketing and distribution started in February, 2001 but was stilthly resisted by labour and coalition of civil society organizations. With much persuasion enlightment and promises of what should accrue from the deregulation programme, the government began a partial deregulation in 2002 leaving only the price of petroleum regulated. Deregulation of the own stream, according to the protagonist of deregulation would bring out only lower prices following competition by marketers but other benefit.

But, as the organised labour mobilises for a showdown with government, the Presidential Starring Committee on the Global Financial Crisis, when made the recommendation to the President, has been expounding reasons the deregulation policy has to stay. A member of the

committee, Mazi Sam Ohuabumwa claimed the moved would "help the economy and benefit manufacturers directly or indirectly". (Alamutu, 2009).

The committee had noted that in its recommendation to the government that over N600 billion being spent on subsidy on petroleum products was not yielding desired result, rather only few people were benefiting from it at the expanse of the Nigerian masses.

> Today, we have a stipulated price that does not reflect the central price. Part of the money we are paying today as subsidy is fraud. It is inefficiency that we are using national funds to pay for. Can you imagine that in 2008, Nigeria spent N680 billion in subsidizing so-called oil? This is twice the budget of a nation. That would have been helpful if we had used it to built hospitals, roads, universities and schools, manufacturers would have gained from it (Alamutu 2009)

The then minister of finance, Dr. Mansur Mukhtar and petroleum counterpart, Dr. Rilwan Lukman, who announced the government's position while addressing journalists in Abuja in March 2008, said that the government could no longer sustain the subsides in view of decline in its revenue and huge infrastructure gap.

They argued that subsides did not benefit average Nigerian and that government found out that they (subside) encouraged inefficiency and corruption in the petroleum industry. This huge fiscal burden we cannot continue to meet. We have found out that we are really subsidizing inefficiencies, fraud and racketeering in the whole production chain and in that context basically given the competing needs for scarce resources, government felt we need to do something. At the moment there is reality we have to face; we have not made any budgetary provisions for subsidizing these inefficiencies in the system (Alamutu, 2009) they declared.

Ohuabunma said deregulation would encourage competition, which would ultimately bring down the price of petroleum products.

> under the new dispensation, importation of petroleum products would be put on open licence for any operation that wants to venture into it, as against selecting a few firms to do so, they bring about competition in the market and force price dowm (Ohuabunma, 2007).

In the wake of this development, Pat Utomi, former Presidential candidate and other experts within the power and energy team of his Shadow Cabinet met to articulate a common position on it. Tunde Akinleye, spokesman for the group, gave an insight into their deliberations.

> we commend the federal government for this albeit balated step which we feel is in the right direction to break the cartel which has had effective control of the importation of petroleum products over last few years and has worked hard to maintain this an average for patronage and corruption for successive governments over the years (Alamutu, 2009 pp 19) he told the magazine.

As genuine as these excuses seem to be in the proponents' of deregulation thinking, followers of the deregulation trends in the country in the past have remained unconvinced. For this critics, rather than affect the lives of the average common populace in Nigeria positively, the policy has been synonymous with fuel hikes.

Table 2.1: Fuel price increase versus political regimes

Date	Price Per Litre	Regime
December 19,1989	60 kobo	Gen. Babangida
March 6, 1991	70 kobo	Gen. Babangida
November 8, 1993	N5.00k	Shonekan
November 22, 1993	N3.25k	Gen. Abacha
October 2, 1994	N11.00k	Gen. Abacha
December 20, 1998	N25.00k	Gen. Abubakar
January 6, 1999	N20.00k	Gen. Abubakar
June 1, 2000	N35.00K	Obasanjo
June 8, 2000	N25.00k	Obasanjo
June 13, 2000	N22.00k	Obasanjo
June 20, 2003	N40.00k	Obasanjo
September, 2004	N48.00k	Obasanjo
April 11, 2005	N52.00k	Obasanjo
May 28, 2005	N75.00k	Obasanjo
June 25, 2007	N70.00k	Yar'adua
January 15, 2009	N65.00k	Yar'adua
January 7, 2012	N95.00k	Jonathan

Adopted from Oghu (2009)

The Trade Union Congress, which is the umbrella body of senior workers, is in view that the government is in sincere with the people. The President-General of the body, Mr. Peter Esele, told the Nation that Nigerians have been over paying for fuel in the last three months he said (then):

> we should have been paying about N55.00k per litre PMS. The extra N15 million by 30 million litres consumed daily by Nigerian, will give N45 million. If you multiply N450 million by 30 days, it will give you N13.5 billion. Nigerians consumers have been over paying N13.5 a month for the last three months... (Ogbu 2009)

According to the template of Petroleum Products Pricing and Regulatory Agency (PPPRA) on January 6, 2009, the landing cost of imported petrol was N41.35k, and when N13.20k margin is added, the recommended price would be N54.55 against the pump price of N65.00k leaving an excess of N14.95k, thus justify Esele's point.

The implication of the policy according to critics of this policy, is that subsidy would no longer apply to petroleum products and Nigerians would be at the mercy of manipulation by market forces and the dashing of out of our national patrimony, the refineries, to local and international looters in the guise of privatisation. Also, the policy will worsen the economic situation in the polity. That is, will lead to hikes in transport fare, prices of food and services, closure of local industries and job losses and unemployment, deepen poverty level and poor standard of living of most Ktsina state populace and Nigerians at large.

Obueh (2006) reported that the deregulation policy of Nigerian government on petroleum products has affected the availability, use and consumption pattern of energy. Before 2003, when the government accelerated its deregulation policy, kerosene sold for N35.00 per litre, later it reached N64.00. at the peak of the crisis up to date the a litre of kerosene is sold above N100.00 especially in the informal market which is the main source of purchase of the product. This has necessitated fuel switching to biomass among all classes of energy users at household level.

2.5.6 Energy-Population Dynamics

Recent increase in world population is associated with what is known as demographic transition. In such transition the population moves from a pre-industrial balance of high mortality and high fertility to a post-industrial balance of low mortality and low fertility. The demographic transition currently underway in developing countries is attributed to improved public health facilities and advances in medical technology resulting in increase in life expectancy from 40-50 years accomplished within 15 years (UNDP, 2000). The implication of the foregone scenario is increased demand for energy for more people and at very alarming close interval of years. Sen, (1994) summarised the world population growth thus:

> it took the world population millions of years to reach the first billion, then 123 years to get the second, 33 years to get the third, 14 years to get the fourth, 13 years to get the fifth

The UNDP (2000) in its energy-population analysis observed that population levels influence the magnitude of energy demand in a straight forward way. The larger the population, the more the total energy, depending on the per-capital energy consumption.

2.6.0 SOME COOKING, HEATING AND LIGHTING DEVICES AND THEIR FUEL SOURCES

Electricity generated source of energy to the household is one of the best option in obtaining clean and convenient energy for cooking, heating and lighting. However, recurrent energy crisis bedevilling the Power Holding Company of Nigeria (PHCN) resulting in erratic supply of this resource, to homes in Nigeria is exorbitant cost of cooking stoves like micro wave cookers e.t.c has made this facility unattractive to most Nigerians. In light of revelations by Adegbulugbe (1995), that electricity, biomass and fossil fuel resources are the major fuels for

urban use in Nigeria, the onus will seem to fall on the use of biomass, a renewable energy and fossil fuel a non renewable and their appropriate cooking, heating and lighting devices.

2.6.1 Biomass fuel

Biomass fuel is obtained directly from wood, agricultural wastes, briquettes and indirectly from charcoal as well as from fermentation of animal waste in slurry form resulting in biogas.

2.6.2 Fuel wood and Stoves

UNDP (2000) described wood as an irreplaceable fuel in many countries for a foreseeable future. It however, diagnosed inefficient use of wood in cook stoves as a threat to global ecological conservation. The report identified 3-stone cook stove widely use in parts of the world including Nigeria as inefficient and proposed proposed energy stoves like those made of clay with chimney, built sometimes on spot or moveable. Such stoves it said are capable of reducing fire wood consumption by two-third i.e to $0.2m^3$ from $0.6m^3$ per person per day.

Komuhangi (2006) reported that GTZ an international NGO in collaboration with the Ugandan government, community based NGO's and private sectors promoted the use of 'Lerena rocket stoves' for households and institutions in Uganda. The stove made of cheap available materials, was reputed to have more than 30 percent efficiency than traditional three-stone fire stove.

Garba (1999) also reported the development of improved wood stove made of clay, rice and millet chaff, cow dung, fine sand and ash by Sokoto Energy Research Centre, Nigeria. Previously EEC/FGN (1992) in conjunction with stove makers from Niger Republic fabricated and disseminated a number of wood efficient stoves named 'nagari' with burning efficiency of about 30 percent in Katsina state, Nigeria. The problem with 'nagari', is the material used due to its tendency to loss heat.

Garba (1999) also reported the fabrication of a saw dust stove. The stove (metal) designed in the form of a hollow cylinder with a small side opening uses unprocessed saw dust as its fuel. However briquetting of saw dust is of more efficiency than this device.

2.6.3 Biogas

Garba (1999) described a biogas plant as consisting of a digester, where organic matters ferment, and a gas holder where the gas (essentially methane) produced is stored for use in a burner. Digesters can be constructed into of a brick metal material and are classified into small, medium and larger scale. He identified the small digester (capacity of $4m^3$ to $20m^3$) as appropriate for the household i.e based on an individual requirement of $0.3m^3$ of biogas for cooking, heating and lighting in a day. He further explained that a biogas burner uses atmospheric pressure form of combustion for the biogas supplied from a conduit to nozzle, and jet out of nozzle and eventually burns in the presence of secondary air. Biogas is used based on the same principle both for cooking and heating in a burner or for lighting in a lamp made for such use.

2.6.4 Methanol stoves

Methanol is a gasified fuel derived from biomass. Obueh (2006) reported development of a clean cook methanol stove. The project supported by local and international organizations went into full scale pilot study of 300 methanol stoves in the year 2002, and was carried out in Niger-Delta area of Nigeria. The methanol fuel used for the stove was packed in a canister for use and refill. The breakthrough is expected to provide clean fuel amongst the densely closely packed households in the area.

2.7 FOSSIL FUEL

The price of oil continues to rise, mainly due to high demand placed on them by the industrialized nations. Recently the price of a barrel sold for about one hundred dollars in the international market (Daily Trust, 5th November, 2007). Most developing nations cannot afford this, especially in Nigeria, where the government deregulation policy is hinged on removal of subsidy on petroleum products. If wood were to be replaced by oil in the developing nations to save our forests, the amount involved will be colossal. The UNDP (2000) estimated that fire wood consumption in the Sahel region, including Nigeria is at least 16 million cubic metres per year, corresponding to $0.06m^3$ per person per year. If wood were to be replaced by oil products, more than 2.5 million tonnes of oil will be imported every year (on assumption that oil is used twice as efficient as wood) i.e almost three times the Sahel current consumption.

The scenario depicted above gives us the only option of efficient and sustainable use of biomass energy sources, and perhaps with complementary consumption use of the fossil fuel especially for those with economic power to do so. In instances where fossil fuel use is practiced a lot of energy efficient kerosene stoves are also available.

Smith (2006) summed up the fossil fuel use scenario as thus;

> This is not to say that the growing risk of global climate change is due to the stoves of poor, far from it! To slow down global warming, it is world's use of fossil fuels that needs to be addressed. However, since small efficient stoves are responsible for both high green house emission and health damaging pollutants (incomplete combustion) there is scope for introducing improved stoves and fuels that reduce both risks at once

2.8 MODERN ENERGY EMPOWERMENT

According to Rehfuers and Bruce (2006) up to 4000 deaths a day may be prevented by providing the world's poor with access to modern energy. Klingshirn (2006) defined modern energy as a reduction of the consumption of fuel and resulting purchase costs and/ or time for fuel gathering by approximately 50 percnt as well as significant empowerment in door air quality.

Rehfuers and Bruce (2006) further reported that the United Nations has called for an addition to Millennium Development Goals (MDGs), to pave way for actualising the rest of the millennium goals by stating that;

> By 2015 to reduce the number of people without effective access to modern cooking fuels by 50 percent, and make improved cook stoves widely available (Rehfuers and Bruce, 2006)

Despite the fact most of the reviewed literature were conducted in temperate regions, there is less literature for the tropical region.

CHAPTER THREE: STUDY AREA AND METHODOLOGY

3.1.0 STUDY AREA

3.1.1 Location:

Katsina state covering an area 23,938 sq km is located between latitude $11^0$08'N and $13^0$22' and longitude $6^0$52'E and $9^0$20E. The state is bounded by Niger Republic to the north, by Jigawa and Kano to the east, by Kaduna state to the south and by Zamfara state to the west. Katsina state forms part of the extensive plains known as the High Plains of Hausaland.(Katsina Diary, 1989).

3.1.2 Relief and Geology:

The state is composed of undulating plains which generallyrise gently from 360m in the northeast around Daura, to 600m around Funtua in the southwest. Generally, the state has two geological regions. The south and central parts of the state are underlain by crystalline rockd of Basement Complex (from Funtua to Dutsinma), but in the northern parts cretaceous sediments overlap the crystalline rocks.

The Katsina-Daura plains lie at a lower base level than other parts of the state. Southwards of the Katsina-Daura plains, is the flat of gently undulating surface which is the end result of yers of erosion action on the surface rock. In areas around Funtua and Dutsinma, there are numerous Quartzite and Granite hills which rise 6200m above the surrounding plain. These hills are probably the result of intrusion of older granites into the basement complex which have undergone long periods of denudation (Katsina Dairy, 1989).

3.1.3 Climate:

The state can be classified into two zones climatically tropical continental and semi-arid continental. The south of the state (from Funtua to Dutsinma) belongs to the tropical continental with total annual rainfall figures ranging from 1000mm around Funtua to over 800m around Dutsinma.

The north of Katsina state (from around Kankia to extreme northeast) has total rainfall figure ranging from600-700mm annually. Generally, climate varies considerably according to months and seasons.

They are: a cold dry (harmattan) season from December to February; a hot dry season from March to May; a warm wet season from June to September, a less marked season after rains during the months of October to November, characterized by decreasing rainfall and a gradual lowering of temperature. (Katsina Dairy, 1989).

3.1.4 Vegetation:

The southern half of the state belongs to the Northern Guinea Savannah Zone, while the north belongs to the Sudan Savannah Zone. The vegetation in the south thus consists of broadleaved species with tall tussocky grasses of guinea affinities, mixed up with fine leafy species of thorny trees with continuous short and feathery grass cover.

The northern districts consist of trees that grow long tap roots and thick barks that make it possible for them to withstand the long dry season and bush fires. The grass cover here too has durable roots which remain underground after stalks are burnt away or wilted in the dry season only to germinate with the first rains.

The existing vegetation in Katsina state is a function of human interference and degradation. Exploitation of the vegetation has been largely for fuel wood, cultivation, grazing and fire.

The degradation has been exacerbated in recent years as a result of decreasing rainfall since 1965 by about 30 percent and especially after the drought of the early 1970s.

There is an afforestation programme in the state which is geared towards the establishment of plantation, woodlots, shelterbelts and trees on farmlands. Trees planted under the programme, which has supported by the European Economic Commission (EEC) and the Federal Government include Azadirachta Indica (Neem), Acadia species and Eucalyptus. Seedlings, cattle wire and extension services are also provided free to farmers in the northern part of the state. (EEC/FGN, 1992)

3.1.5 Ecological Problems:

The state suffers from the perennial ecological problems of drought, desertification and menace of pest invasion. These are experienced mostly in the northern part of the state. The marked fall in the level of underground water has also compounded the problem of sustaining the ecological balance in some part of the state.

Erosion is also experienced particularly at the northern fringes which are under the threat of wind erosion as a result of desert encroachment. Gully erosion is also present in Kayauki (Batagarawa LGA). Kusa and Gurbin Baure (Jibia LGA) and Dan-Rimi (Malumfashi LGA).

Drought is a product of drier climatic change which manifested itself conspicuously in the early 1970s as a result of the decline of mean annual rainfall in the northernmost state of Nigeria since 1965. Desertification on the other hand, though partly accounted for by drier climatic conditions, is largely as a result of man's devastation of vegetation for various reason leading to soil degradation and desert encroachment.

The increasing menace of pest invasion is probably due to this climatic change, and desertification, which have brought about condition favourable to the breeding of pests.

Thorough ground geophysics is required to determine the cause of underground water in-accessibility in parts of the state and explore easily procurable underground water spots. (EEC/FGN, 1992).

3.1.6 Ethnic Composition, Languages, Culture and Arts:

Katsina state is predominantly Hausa-Fulani state. Most people speak only Hausa. A great majority of the people are settled cultivators and traders. But there is a considerable number of nomadic cattle Fulanis, whose males rear livestock, while the females hawk locally prepared fermented milk in towns and villages.

A sizeable number of migrants from southern Nigeria, especially the Yoruba and Igbo, are found and they dwell mostly in towns. There are many traditional cottage/craft industries which produce a wide range of highly qualitative, beautiful and aesthetically important products like Ashoke and whips.

On sallah days, the palaces Emirs of Katsina and Daura attract both local and foreing tourists who come to watch colourful durbar. (Dairy of Katsina, 1989).

3.1.7 Population Structure and Distribution:

According to the 2006 population census figures, Katsina state has a population of 5,801,584 persons (FGN, 2007). Out of this figure, about 49 percent are manles and 51 percent females.

Table 3.1: Population of Katsina state

S/No.	Local Government	Population
1	Bakori	149,516
2	Batagarawa	189,059
3	Batsari	207,874
4	Baure	202,941

5	Bindawa	151,002
6	Charanchi	136,989
7	Danmusa	113,190
8	Dandume	145,323
9	Danja	125,481
10	Daura	224,884
11	Dutsi	120,902
12	Dutsinma	169,829
13	Faskari	194,400
14	Funtua	225,156
15	Ingawa	169,148
16	Jibia	167,435
17	Kafur	209,360
18	Kaita	182,405
19	Kankara	243,259
20	Kankia	151,395
21	Katsina	318,132
22	Kurfi	116,700
23	Kusada	098,348
24	Mai'adua	201,800
25	Malumfashi	182,891
26	Mani	176,301
27	Mashi	171,070
28	Matazu	113,814

29	Musawa	170,006
30	Rimi	154,092
31	Sabuwa	140,679
32	Safana	185,207
33	Sandamu	136,944
34	Zango	156,052

Source: FGN, 2007

On the average, there are 189 persons living per square km in terms of the density of population. Seasonal migration takes place, especially of able bodied males in the dry season to the southern part of the state in search of part time jobs. This is known as '*chi rani'*.

In drought years, many more people tend to migrate southwards from the northern part of the state on either temporary or permanent basis to avoid the consequence of the drought menace. Indeed, the southern part of the state receives migrants from both within and outside the state.

3.1.8 Pattern of Human settlement:

The state has no problem of urban primacy. The urban, semi-urban and nodal villages which more or less approximate to the present headquarters of the thirty-four local government areas are evenly spread and are surrounded by other rural settlements.

These two types of settlements form close knit economic, cultural, administrative and historical inter-relationship. Furthermore, each has a fairly long historical link with Katsina city which has subsequently served as the headquarters of Katsina emirate, then of Katsina province, and now the capital of Katsina state. (Dairy of Katsina, 1989).

3.1.9 Agriculture:

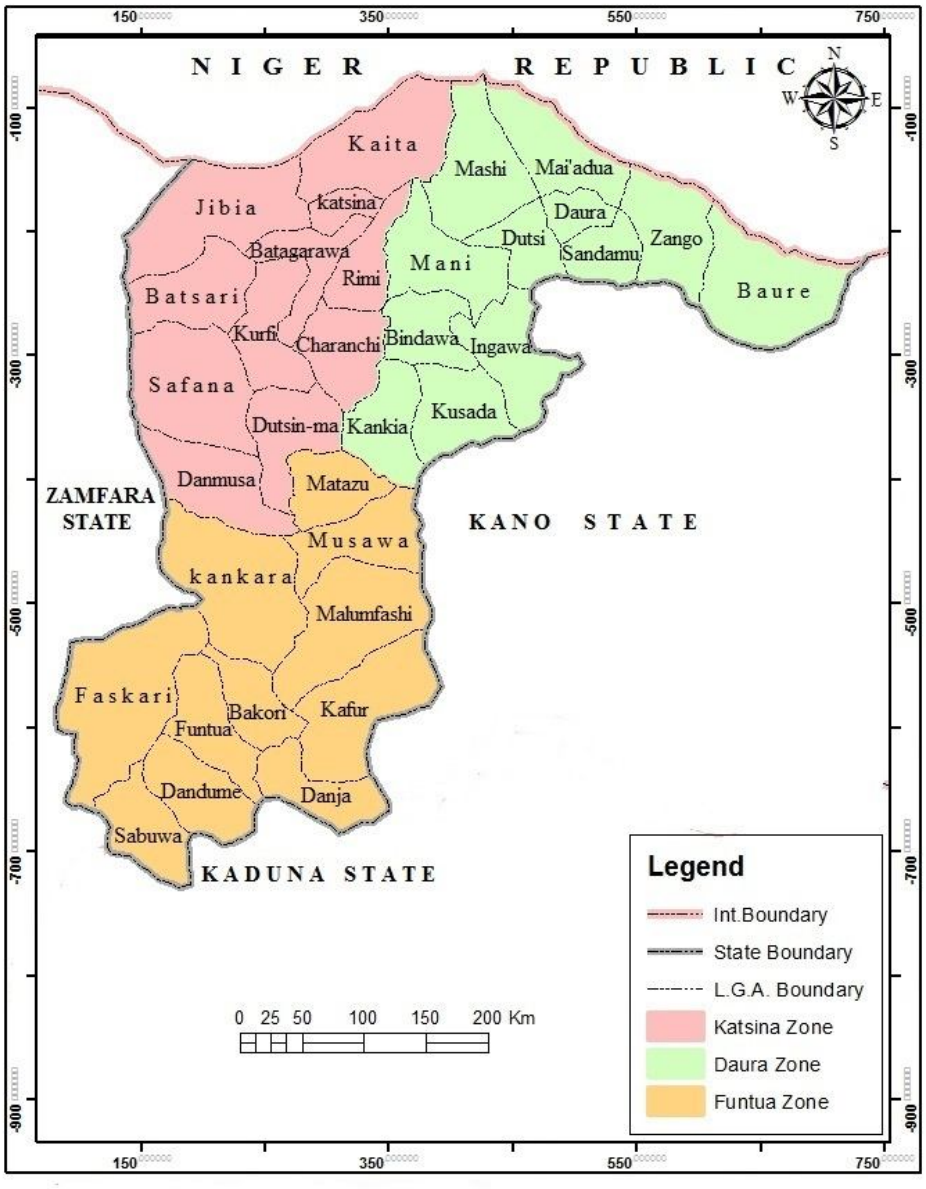
Agriculture is the backbone of the state's economy as 75 percent of its people are farmers. Katsina state is blessed with abundant agricultural land and a wide range of crops are grown. These include guinea corn, millet, maize cow pea, cotton and groundnut to mention but a few.

In addition, the state possesses a large livestock population mainly made up of cattle, goats and sheep and poultry. Apart from providing food and meat for human consumption, these agro livestock products have the potential for providing raw materials that could serve a wide range of industries including food processing, animal and poultry food, textile, pharmaceuticals, as well as hide and skin industries. The government encourages agro livestock production by providing extension service, pesticide sprays, subsidized chemical fertilities and veterinary services to contain both plants and animal diseases and promote abundant agro livestock production. (dairy of Katsina, 1989).

3.1.10 Forestry:

Both public and private forestry abound in Katsina state. These include; the established plantation, orchards, woodlots, shelter belts and trees on farmlands. Supported by EEC and the Federal Government, trees planted amongst other include Acacia species, Eucalyptus and Azadirachta Indica (neem). Moreover, seedlings cattle wire fencing and extension services are provided free to farmers in the northern, more arid part of the state.

Runka forest reserve in the northwestern part of the state is the largest reserve. People utilize the forest in various ways as source of fuel wood, wild fruits/vegetables, pasture for livestock, herbs for treatment of disease and for hunting. (EEC/FGN, 1992).



Source:- NASA/NOA Spot Image 2014.

Fig. 3.1: Katsina state showing three senatorial districts

3.2.0 METHODOLOGY

3.2.1 Reconnaissance Survey

A reconnaissance survey was conducted round 34 Local Government Areas in Katsina state. These include; Bakori, Batagarawa, Batsari, Baure, Bindawa, Chanranchi, Danmusa, Dandume, Danja, Daura, Dutsi, Dutsinma, Faskari, Funtua, Ingawa, Jibia, Kafur, Kaita, Kankara, Kankia, Katsina, Kurfi, Kusada, Mai'adua, Malumfashi, Mani, Mashi, Matazu, Musawa, Rimi, Sabuwa, Safana, Sandamu and Zango. This assisted in the choice of Local Government Areas where the study was conducted.

Although the study area is relatively homogenous in terms of cultural and religious affiliation, there is disparity of varying degrees in the socio-economic status, urbanisation and population distribution. For ease of data acquisition and analysis as well as for getting a representative picture of the happenings in the study area, it was deemed fit to stratify the study area. The study area was stratified into zones based on the three already existing senatorial districts in the state (i.e Katsina, Daura and Funtua senatorial zones). One settlement was selected from each stratum (urban, and rural areas), adopting Katsina State Rural Water Supply and Sanitary Agency (RUWASSA 2001) format which stratified the entire state into urban and rural areas.

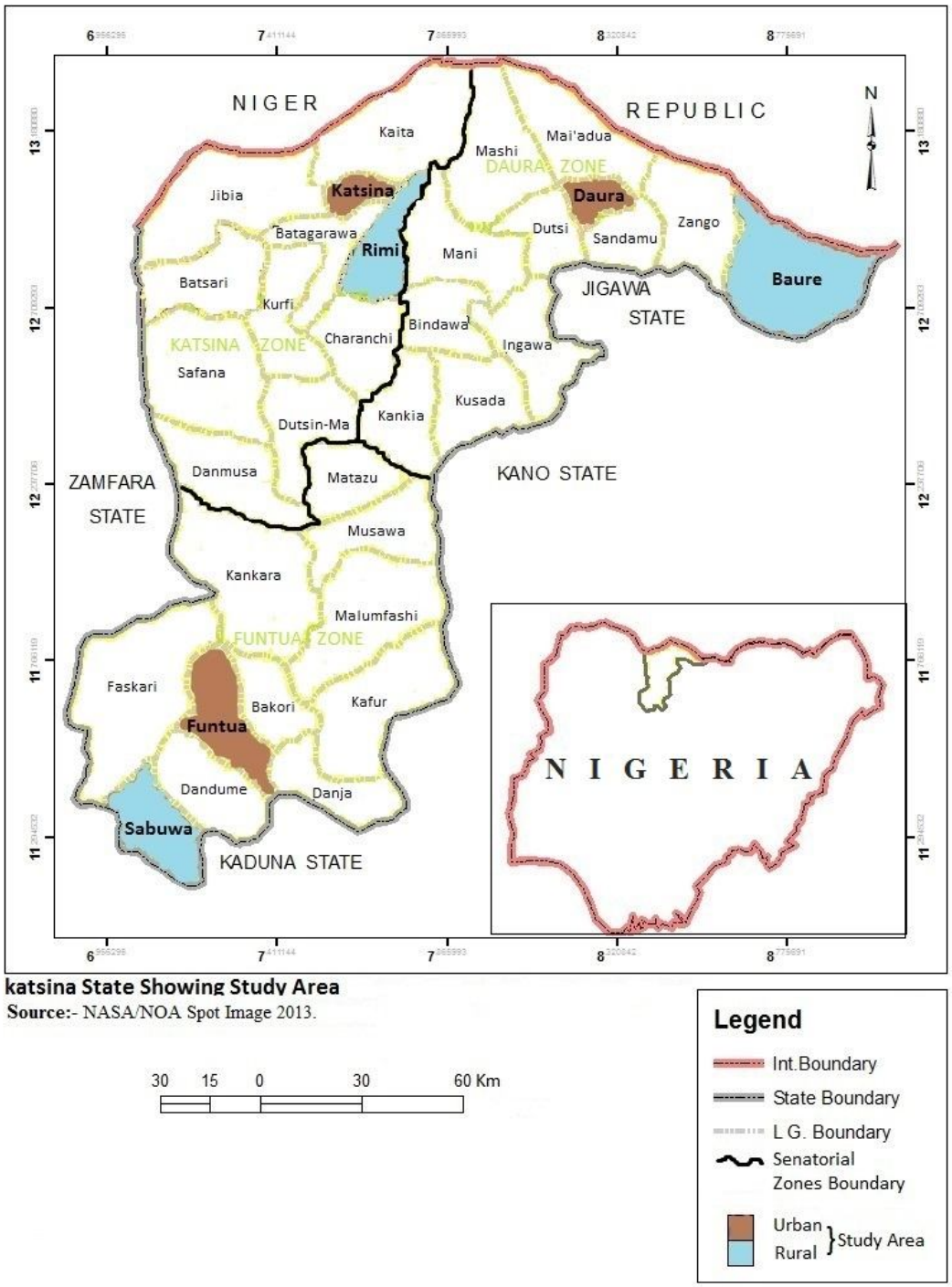
The data on the number of households was not available at Katsina state office of the National Population Commission (NPC) at the time of the researcher's visits. For estimate of the houses in the study area an average of six persons per household standard estimate by World Health Organization (WHO) in its National Programme on Immunization (NPI) field guide, 2001 as currently used by the Katsina State Primary Health Care Development Agency was adopted. The resulting stratra could be described as thus:

As explained above, the breakdown of the population and number of households for the study area is illustrated in table 3.2

Table 3.2 Population and household data in the sampling areas

SENATORIAL ZONE	**STRATUM**	**SAMPLING AREAS**	**ESTIMATED POPULATION**	ESTIMATED NUMBER OF HOUSEHOLD
Katsina Central	A	Katsina	391263	65210
	B	Rimi	189,533	31588
Katsina North	A	Daura	276607	46101
	B	Baure	249617	41602
Katsina South	A	Funtua	276942	46157
	B	Sabuwa	173035	28839

Stratum A: represent urban areas while Stratum B: represent rural areas (RUWASSA 2001)



katsina State Showing Study Area

Source:- NASA/NOA Spot Image 2013.

Figure 3.2: Showing sampling area

3.2.2 Types of Data:

The questionnaire was designed to address issues that eventually led to achieving the aim and objectives of the study. The types of data involved in the study include; type of household energy use, sources of household energy use, quantity of household energy use, cost of household energy use, socio-economic characteristics of respondents and the socio-economic and cultural factors that affect household energy use in Katsina state.

3.2.3 Sources of Data

3.2.3.1 Primary Sources:

This was obtained through the administration of three hundred and eighty four questionnaires [in line with Krejcie and Morgan (1970)]. The questionnaire was designed to elicit information from households. The information included the type and source of energy, quantity purchase for daily use, cost of daily or weekly purchases, consumption rate, socio-economic effects of the household energy use and problems encountered that eventually led to achieve the aim and objectives of the study.

3.2.3.2 Secondary source:

Secondary information was obtained from Forestry Department, Ministry of Agriculture and Natural Resources, Katsina state Agricultural and Natural Resources, Katsina State Agricultural and Rural Development Authority (KTARDA), books , journals, magazines, internet, news papers, articles, maps and other relevant write-ups that provided information that assisted in the development of study area and literature review.

3.2.3 Sample size and sample technique:

The total estimated figure of the sampling area for this study was 1,556,997(see table 3.2). thus, this study was in line with Krejcie and Morgan (1970) who recommended that for a population size of between 250,000 and 3000 million a sample size of 384 should be taken. The stratified random sampling method was applied in the study area. Two (2) levels of stratification method were used in selecting settlements (i.e urban and rural) for this study(see table 3.2). Purposive sampling method was used to select the streets and houses for the administration of questionnaire, where the heads of the household were interviewed directly.

Two field assisstants (a male and a female) in each senatorial zone were trained and engaged for the survey. The nature of data collected by these surveyors consists essentially of questionnaire administration and monitoring of energy use. The surveyors were paired i.e male and female. Ea ch team conducted survey in two strata (i.e urban and rural) within a senatorial zone (Katsina, Daura and Funtua zones). Interview conducted with retailers, wholesalers and other stakeholders on energy use was done by the researcher.

Questionnaire administration was carried out on the basis of 2 days per household. The exercise lasted for two (2) weeks, ensuring that about 27 households were covered by day. In addition to questionnaire administration involves energy use monitoring was conducted on the basis of 7 days per household. This involves one day orientation and persuasion as well as questionnaire administration, and two days (48 hours) for energy consumption monitoring. A 100 kg weighing scale was used to weigh energy; wood, sawdust and gas (LPG), while a 100 ml plastic bottle was used to quantify kerosene usage.

Data was collected over a period of two (2) weeks. The number of houses surveyed was reflected of the estimated percentage households in the study area per stratum. To end this stratum A (urban) which has 60.42 percent of sampled households has 232 copies of

questionnaires and stratum B (rural) with 39.58 percent has 152 copies of questionnaires. At the end of the exercise 384 copies of questionnaires were served to the household heads.

To determine the proportion of the respondents, mathematical method for determination of respondents was used.

$$\frac{nx384}{N}$$

Where n= population of each selected LGA

N= total population of the selected LGAs in the study area.

The 2006 population census figure is projected to 2013 and used in this work since population is not static, hence varies across localities. The projection is done using Katsina state population growth rate of 3%, using the formula:

$$Pn=Poe^{rn}$$

Where:

Pn = population in the later period

Po = population in the earlier period

N = time interval between two periods

r = rate of growth

e = exponential sign

Table 3.3 illustrates the questionnaire distribution format using the above method in the research.

Table 3.3: Questionnaire Distribution Format

SENATORIAL ZONE	STRATUM	SAMPLING AREA	2006 CENSUS FIGURE	ESTIMATED POULATION FIGURE	ESTIMATED NUMBER OF HOUSEHOLD	PROPORTION OF SAMPLED POPULATION
Katsina	Urban	Katsina	318,132	391,263	65,210	96
(central)	Rural	Rimi	154,094	189,533	31,588	47
Daura	Urban	Daura	224,884	276,607	46,101	68
(North)	Rural	Baure	202,941	249,617	41,602	62
Funtua	Urban	Funtua	225,156	276,942	46,157	68
(South)	Rural	Sabuwa	140,679	173,035	28,839	43
		TOTAL	**1,265,884**	**1,556,997**	**259,497**	**384**

3.2.4 METHOD OF DATA ANALYSIS

Measure of central tendency (mean, mode and median) tool was employed to determine the quantity of different sources and types of household energy use and their rate of consumption in the area. Tables were used and summarized and presented the different types and sources of household energy. Percentage computations and table methods were used to present information on economic and social effects. Central measure tendency (mean) was used to determine rate of consumption. Chi- square to determine the stratum that has high rate of consumption.

Methodology for calculation of the consumption of electricity for household use was arrived at as thus; the total megawatt per hour (mwh) supply for a day was summed up and divided by 24 to get average daily supply. The daily supply for two weeks was summed and the average supply was 7.3mwh. Based on Dayo (2008) report that 50 percent of total final

energy is utilised in the residential sector, 3.65mwh of electricity is assumed to consumed in household in Katsina State.

Therefore; Half of 7.3mwh=3.65mw X 1000000w = 3650000w

3650000w divided by the estimated number of household for the study (i.e 259497)

3650000 ÷ 259497 = 14.07w

CHAPTER FOUR: RESULTS AND DISCUSSIONS

4.0 INTRODUCTION:

In this chapter an attempt has been made to assess the socio-economic effects of the household energy use in Katsina state. The results of the data analysed are presented and discussed systematically to address the objective of the study. A micro-analysis of cross tabulated variables was made per stratum and eventually for the study area. This paved the way for in-depth analysis and generalization of results in the entire study area. To this end, the objectives pursuant to the main aim of the work were achieved

4.1 Socio-economic Characteristics of Respondents

These socio-economic attributes include sex, age, marital status, age, education background, occupation, income, type of the household and size of the households. They are presented in table while discussion follows.

4.1.1 Gender of Respondents

Majority of respondents were male while there were few females. This is presented in table 4.1

Table 4.1 Gender Characteristics of Respondent

Data within each stratum														
Gender	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=96)		Rural (N=47)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Male	81	84	35	74	52	76	51	82	58	85	39	91	316	82
Female	15	16	12	26	16	24	11	18	10	15	4	9	68	18
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**199**	**384**	**100**

Table 4.1 reveals that 84% of the respondents were males and 16% were females in urban Katsina senatorial zone while 74% were males and 26% were females in rural katsina senatorial zones. In Daura senatorial zone 76% were males and 24% were females in urban area. While 85% of the respondents were males and 15% were females. In rural area of the Funtua zone result shows that 91% of the respondents were males as against 9% were females. Cumulative data for the entire state shows that 82% of the respondents were males as against 18% of them were females.

This greater gender variation is in line with the religious and cultural ethics in the study areas where males function as household's head except in some areas where females function as household's head either as widows or divorcees.

4.1.2 Age of respondents

Age is an important criterion in accessing the socio-economic effects of household energy because adult people are more likely to engage in energy issues then dependent age group.

Table 4.2 Age of Respondents

Data within each stratum														
Age (Year)	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=96)		Rural (N=47)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
21-30	19	19	6	13	11	16	21	34	15	22	7	16	78	20
31-40	23	24	13	28	18	27	17	27	22	32	11	26	104	27
41-50	35	36	21	45	23	34	21	34	23	34	19	44	142	37
51-60	12	13	5	10	9	13	3	5	5	7	4	9	38	10
Above 60	8	8	2	4	7	10	0	0	3	5	2	5	22	6
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source: *Field Work*

According to table 4.2 in Katsina zone urban area 19% age between 21-30 as against 13% in rural area of the zone 24% of age group between 31-40 years in urban area as against 28% in rural area 36% of age group between 41-50 years as against 45% in the rural area, 13% of the age group between 51-60 years in urban area as against 10% of respondents of age group 51-50 years in rural areas, 8% of the age group above 60 years in urban area as against 7% in the same age group in rural of Katsina senatorial zone.

In Daura senatorial zone, the result shows that 16% of the respondents were between age group of 21-30 years in urban area as against 34% in the rural area, 27% of the respondents were between 31-40 years in urban area which also coincide with 27% of the respondents in the rural area of the same age group, 34% of the respondents were between 41-50 years age group as against 34% of the respondents in rural area of the same age group, 13% of the respondents in the urban area of Daura senatorial zone were between age group of 51-60 years as against 5% of the respondents of the same age group in rural area of Daura senatorial zone 10% of the respondents in the urban area of Daura zone were between 60 years and

above while 6% of the respondents were found in the rural area of the same age group in Daura senatorial zone.

In Funtua senatorial zone according to table 4.2 reveals that 22% of the respondents were between age group of 21-30 years in urban area while 16% of the same age group in rural area 32% of the respondents were between age group of 31-40 years in urban Funtua zone while 26% of them in rural area of the same age group. 34% of the respondents were between age group of 41-50 years in urban area while 44% of them from the same age group were found in rural area of Funtua zone. 7% of the respondents were between age group of 51-60 years in urban area while 9% of the respondents of the same age group were found in rural area. 5% of the respondents were between 60 years and above in the Funtua urban area which also correspond with 5% of the respondents of the same age group in rural area of the Funtua zone.

Table 4.2 shows that the cummulative data for the entire state were, 20% of the respondents were between age group of 21-30. 37% of them were between 31-40 years. 37% of the respondents were between age group of 41-50 years. 10% of the respondents were between age group of 51-60 years and 6% of the respondents were between 60 years and above.

This result confirms that age group between 41-50 years mostly partake in energy utilization in all the senatorial zones and across urban and rural areas in the state.

4.1.3 Educational Characteristics of Respondents

Educational status sometimes reflects the energy utilization pattern of people. Table 4.3 analyses the result for this study.

Table 4.3 Education Characteristics of Respondents

Data within each stratum														
Educational Status	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=96)		Rural (N=47)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Primary	17	18	12	26	9	13	7	11	11	16	12	28	68	18
Secondary	32	33	9	19	22	32	19	31	10	15	6	14	98	25
OND/NCE	25	26	7	15	18	27	18	29	22	32	8	18	98	26
Degree	22	23	5	10	13	19	2	3	18	27	2	5	62	16
No formal education	0	0	14	30	6	9	16	26	7	10	15	35	54	14
Total	**96**	**100**	**43**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source: *Field Work*

Table 4.3 shows educational status of respondents in the study area. In Katsina senatorial zone 0% of the respondents had no formal education in the urban area while 30% of them had no formal education in the rural area the same senatorial zone 18% of the respondents had primary education while 27% in the rural area 33% of the respondents had secondary education in urban area of Katsina senatorial zone while 19% in the rural area of the same zone 26% had either ND or NCE in the urban area while 15% had in the rural area, 23% had university degree and above in the urban area while 10% had university degree and above in rural are of Katsina senatorial zone.

In Daura zone, 9% of the respondents had no formal education in the urban area while 11% had in the rural area, 32% had secondary education in the urban area, 31% in rural area 27% had either OND or NCE in urban area, 29% had either OND or NCE in rural area 19% had university degree and above in the urban area 3% had university degree and above in rural area of Daura senatorial zone.

Table 4.3 shows that in Funtua senatorial zone of Katsina state; 10% of the respondents in urban area had no formal education, 35% had no formal education in the area. 16% ha primary education in the rural area, 28% had primary education the rural area, 15% had secondary education in the urban area, 14% had in the rural area, 32% had either OND or NCE education in the urban while 18% had in the rural area, 27% had university degree and above in the urban area while 5% of the respondents had in the rural area of Funtua senatorial zone.

Table 4.3 reveals the cumulative educational data for Katsina state that, 14% of the respondents had no formal education, 18% had primary education, 26% had secondary education, 26% also either OND or NCE education while 16% had university degree and above.

Furthermore, table 4.3 shows that majority of rural respondent had no formal education in contrast to urban respondents with no formal education were few. There were very few people with university degree and above in rural areas while urban areas had high number of respondents with university degree and above.

4.1.4 Occupational Characteristics of Respondents

Occupations determine the level of income of a personal, thus there is a link between occupation of people and energy utilization and consumption. See table 4.4 for the analysis.

Table 4.4: Occupational Characteristics of Respondents

Data within each stratum														
Education	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=96)		Rural (N=47)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Civil service	46	84	8	17	32	47	12	19	30	44	9	21	13	36
farming	12	13	21	45	17	25	31	50	23	34	21	49	125	33
Trading	21	22	7	15	10	15	13	21	9	13	7	16	67	17
Driving	4	4	3	6	5	7	6	10	2	3	3	7	23	6
Others	13	13	8	17	4	6	0	0	4	6	3	7	32	8
Total	**96**	**100**	**43**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source: *field work*

Table 4.4 reveals that in katsina senatorial zone 48% of the respondent were civil servant in urban areas 17% in rural area 13% were farmers in urban and 45% were farmers in rural area 22% of the respondents in urban area of the senatorial zone were traders 15% were also traders in rural area of the same zone. 45% were driver in urban while 6% were driver in rural area. The result also shows others (including vulcanizes, artisans and unskilled labourers) have constituted 13% in the urban area and 17% in the rural are of katsina senatorial zone.

Table 4.4 also reveals that in Daura senatorial zone, 47% of the respondent in the urban area were civil servant., 19% in rural area. 25% were traders in urban, 50% in rural 15% were traders in urban, 21% were also traders in rural 7% were drivers in urban while 10% in rural others (artizen) constituted 6% of respondent in urban area while N.7 in rural area of Daura senatorial zone.

Furthermore, table 4.4 shows that in Funtua senatorial zone, 44% of the respondent in urban area were civil servant, 21% in rural were civil servant also 34% were farmer in urban 49 were also farmer in rural area 13% were traders in urban 16% were also traders in rural area.

3% were driver in urban and 7% were also drivers in rural areas other (tailors, artisans) constituted 6% in the urban area and 7% in the rural area of Funtua senatorial zone.

Table 4.4 also reveals the cumulative occupational date for katsina state this study that, 36% of the respondents were civil servant 33 were farmers 17% were traders 6% were drivers and other constituted 8% of respondents in the state.

Table 4.4 shows that most of the respondents in rural areas were farmers while few farmers in urban areas Also, the rural respondents have few civil service occupants. This difference can be as a result of Katsina urban area being a state capital with concentration civil servant. Also Daura and Funtua urban areas show high concentration of civil service occupants being them as senatorial zonal headquarters in the northern and southern part of the state respectively. There a lot of ministerial and agencies zonal offices located within.

4.1.5 Income of Respondents

Income is a major determinant of standard of living, hence household energy has correlation with standard of living. Table 4.5 presents the findings.

Table 4.5: Income of Respondents

Data within each stratum														
Income (N)	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=96)		Rural (N=47)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
<18000	-	-	20	43	7	103	25	40.3	11	16.2	15	34.9	78	20.8
18000-28000	14	14	10	21	10	14.7	17	27.4	18	26.5	11	25.6	80	20.8
29000-38000	17	18	9	19	12	17.6	9	14.5	15	22.1	8	18.6	70	18.3
39000-48000	36	38	5	11	21	30.9	7	11.3	10	14.7	4	9.3	83	21.6
49000-above	29	30	3	6	18	26.5	4	6.5	14	20.5	5	11.6	73	19.0
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source: *field work*

Table 4.5 indicates that in Katsina senatorial zone 0% of the respondents were found earning less than N18,000 in a month in urban area, 43% were found earning less than N18,000 in rural area 18% were earning between 29,000-38,000 in urban, 19% were earning 29,000-38,000 in rural 38% in urban, 11% in rural were earning between 39,000-48,000 30% in urban, 6% in rural were earning N49,000 and above in the senatorial zone.

In Daura senatorial zone, the table reveals that, 10.3% of the respondents in urban area and 40.3% in rural area were earning less than N18,000 14.7% in the urban and 27.4% in the rural were earning between N18,000 – N28,000 17.6% in the urban and 14.5% in the rural were earning between N29,000 – N38,000 in a month. 30.9% in the urban and 11.3% in the rural areas where earning between N39,000 – N48,000 in a month and 36.5 in the urban and 6.5% in the rural were earning N49,000 and above in the senatorial zone.

In Funtua senatorial zone the findings shows that 16.2% in urban and 34.9% in the rural were earning less than N18,000; 26.5% in the urban and 25.6% in the rural were earning between N18,000 – N28,000 in a month; 22.1% in the urban and 18.6% in the rural were earning between N29,000 – N38,000, 14.7% in the urban and 9.3% in the rural were earning between N39,000 – N48,000 and 20.5% in the urban and 11.6% in the rural were earning N49,000 and above in a month in the senatorial zone.

Furthermore table 4.5 shows that the cumulative data for Katina state in the study, 20.3% were earning less than N18,000, 30.8% were earning N18,000 – N28,000, 18.3% were earning N29,000 – N38,000, 21.6% were earning between N39,00 – N48,000 and 19.0% were earning N49,000 and above in a month in Katsina State.

Table 4.5 indicates that monthly earning of the respondents living in urban areas of the state is relatively higher when compared to the earning of the rural respondents. This difference can be as a result of the nature of urban areas having a lot of economic activities mainly of secondary and tertiary economic activities while in rural areas consist mainly of primary economic production.

4.1.6 Household size of Respondents

More often, the family size of respondents determine the quantity of energy to be consumed in a house usually large family are expected to cook several times in a day, hence demand for energy. See table 4.6 for the analysis.

Table 4.6: Household size of the Respondents

Data within each stratum														
No. of person	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=96)		Rural (N=47)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
0-5	37	38.5	5	10.6	23	33.8	4	6.5	24	35.3	7	16.3	100	26.0
6-10	24	25.0	7	14.9	20	29.4	7	11.3	17	25.0	8	18.6	83	21.6
11-15	11	11.5	9	19.1	11	16.2	14	22.5	18	26.5	3	7.0	66	17.2
16-20	14	14.6	12	25.6	9	13.2	16	25.8	7	10.3	10	23.3	68	17.7
21 above	10	10.4	14	29.8	5	7.4	21	33.9	2	2.9	15	34.8	67	17.5
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**45**	**100**	**384**	**100**

Source: *field work*

Table 4.6 shows that in Katsina senatorial zone, 38.5% 0f respondents in urban and 10.6% in rural had between 0-5 people per household, 25.0% of respondents in urban and 14.9% in rural had between 6-10 people per household, 11.5% of respondents in urban and 19.1% in rural had between 11-15 persons per household, 14.6% in urban and 25.6% in rural had between 16-20 persons per household, 10.4% in urban and above per household in Katsina senatorial zone.

The findings revealed in Daura senatorial zone that, 33.8% of respondent in the urban area and 6.5% in the rural had between 0-5 persons per household, 16.2% in the urban and 22.5% in the rural had household size of between 11-10 persons per household, 13.2% in the rural and 25.8% in the rural had family size of 16-20 persons per household, 7.4% in the urban and 33.9% in the rural had family size of 21 person and above in Daura senatorial zone.

In Funtua senatorial zone, table 4.6 shows that; 35.3% of respondents in urban and 16.3% in the rural had family size of between 0-5 person per households; 25.5% in the urban and 18.6% in the rural had family size of 6-10 persons per household; 26.5% in the urban and

7.0% in the rural had family size of 11-15 persons per household; 10.3% in the urban and 23.3% in the rural had family size of between 16-20 persons per household.

Furthermore table 4.6 reveal that the cumulative household size in katsina state that 26% of the respondents had between 0-5 person per household; 21.6% had between 6-10 persons per household; 17.2% had between 11-15 persons, 17.7% had between 16-20 persons and 17.5% had family size of 21 persons and above in Katsina state.

Comparatively, urban areas had high number of small household size than the rural areas.

4.2 TYPES OF HOUSEHOLD ENERGY USE

Table 4.7 is a summary of types of household energy source in the study area. The main types of energy identified in this study are; electricitry, fuel wood, liquefied petroluen gas (LPG), saw dust and kerosene.

Table 4.7: Types of Household Energy Use

Data within each stratum														
Energy sources	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=68)		Rural (N=43)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Electricity	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuel wood	44	45.8	29	61.7	38	55.9	49	79	35	51.5	29	67.4	224	58.3
Gas	12	12.5	-	-	5	7.4	-	-	9	13.2	-	-	26	6.8
Saw dust	8	8.4	-	-	6	8.8	-	-	6	8.8	-	-	20	5.2
Kerosene	32	33.3	18	38.3	19	27.9	13	21	18	26.5	14	32.6	114	29.7
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source: *field work*

Table 4.7 reveals responses on the types of household energy use for cooking and heating. 45% of respondents in Katsina urban area use fuel wood as type of energy use in household

while 61.7% of respondents in Rimi (rural) use fuel wood. 12.5% of respondents in Katsina urban area use gas as type of household energy use while 0% (nil) of respondents from Rimi (rural) use gas as type of household energy for cooking and heating. 8.4% of respondents in Katsina urban use saw dust while 0% (nil) of respondents use saw dust in Rimi (rural) area as type of household energy. 33.3% of respondents in Katsina urban use kerosene as type of household energy while 38.3% of respondents use kerosenein Rimi (rural) area of Katsina senatorial zone.

Table 4.7 reveals responses on the types of household energy use for cooking and heating. 55.9% of respondents in Daura urban area use fuel wood as type of energy use in household while 79% of respondents in Baure (rural) use fuel wood. 7.4% of respondents in Daura urban area use gas as type of household energy use while 0% (nil) of respondents from Baure (rural) use gas as type of household energy for cooking and heating. 8.8% of respondents in Daura urban use saw dust while 0% (nil) of respondents in Baure (rural) area use saw dust as type of household energy. 27.9% of respondents in Daura urban use kerosene as type of household energy while 21.0% of respondents use kerosene in Baure (rural) area of Daura senatorial zone.

Table 4.7 reveals responses on the types of household energy use for cooking and heating. 51.5% of respondents in Funtua urban area use fuel wood as type of energy use in household while 67.4% of respondents in Sabuwa (rural) use fuel wood. 13.2% of respondents in Funtua urban area use gas as type of household energy use while 0% (nil) of respondents from Sabuwa (rural) use gas as type of household energy for cooking and heating. 8.8% of respondents in Funtua urban use saw dust while 0% (nil) of respondents in Sabuwa (rural) area use saw dust as type of household energy. 26.59% of respondents in Funtua urban use kerosene as type of household energy while 32.6% of respondents use kerosene in Sabuwa (rural) area of Funtua senatorial zone.

4.3 CONSUMPTION OF HOUSEHOLD ENERGY WITHIN EACH STRATUM

4.3.1 Household Energy Consumption Per Source

The main sources of energy for cooking and heating and lighting identified and quantified in this study are electricity, fuel wood, kerosene, Gas and sawdust. Table 4.3 illustrates the findings.

Table 4.8: Average daily household energy consumption in Katsina urban of Katsina senatorial zone.

Energy Source	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Total	Mean
Fuelwood (kg)	17.3	16.7	18.2	19.0	16.9	21.1	17.7	126.9	18.1
Sawdust (kg)	7.1	6.7	6.3	7.3	5.7	6.2	7.2	46.5	6.6
Kerosene (litre)	1.2	1.5	1.3	1.3	1.5	1.4	1.4	9.6	1.4
Gas (kg)	1.34	1.54	1.47	1.35	1.55	1.50	1.37	10.1	1.44

Source:*FieldWork*

Table 4.8 reveals daily household energy consumption in Katsina urban area of Katsina senatorial zone. In day1 17.3kg of fuel wood was consumed and recorded. In day 2 16.7kg of fuel wood, in day 3 18.2kg of fuel wood was consumed. In day 4 19.0kg of fuel wood was recorded. In day 5 16.9kg of fuel wood was consumed. In day 6 21.1kg of fuel wood was consumed. In day 7 17.7kg of fuel wood was consumed and recorded. A total of 126.9kg of fuel wood was consumed within the seven days with an average of 18.1kg of fuel wood was consumed and recorded in Katsina urban area.

In day1 7.1kg of saw dust was consumed and recorded. In day 2 6.7kg of sawdust was recorded, in day 3 6.3kg of sawdust was consumed. In day 4 7.3kg of sawdust was recorded. In day 5 5.7kg of sawdust was consumed. In day 6 6.2kg of sawdust was consumed. In day 7 7.2kg of sawdust was consumed and recorded. A total of 46.5kg of sawdust was consumed within the seven days with an average of 6.6kg of sawdust was consumed and recorded in Katsina urban area.

In day1 1.2litres of kerosene was con summed and recorded. In day 2 1.5litres of kerosene was consumed, in day 3 1.3litres of kerosene was consumed. In day 4 1.3litres of kerosene was recorded.

In day 5 1.5litres of kerosene was consumed. In day 6 1.4litres of kerosene was consumed. In day 7 1.4litres of kerosene was also consumed and recorded. A total of 9.6litres of kerosene was consumed within the seven days with an average of 1.4litres of kerosene was consumed and recorded in Katsina urban area.

In day1 1.34kg of gas was consumed and recorded. In day 2 1.45kg of gas was consumed, in day 3 1.47kg of gas was consumed. In day 4 1.35kg of gas was recorded. In day 5 1.55kg of gas was consumed. In day 6 1.50kg of gas was consumed. In day 7 1.37kg of gas was consumed and recorded. A total of 10.1kg of gas was consumed within the seven days with an average of 1.44kg of gas was consumed and recorded in Katsina urban area (see plate 1)



Plate 1: A gas cooking stove using liquified petroleum gas (LPG) as fuel in Katsina urban area

Table 4.9 Average daily household energy consumption in Rimi rural area of Katsina senatorial zone.

Energy Source	Pay 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Total	Mean
Fuel wood (kg)	21.3	22.3	19.9	19.7	20.8	21.7	19.3	145	20.7
Sawdust (kg)	-	-	-	-	-	-	-	-	-
Kerosene (litre)	0.7	0.8	0.7	0.5	0.7	0.6	0.8	4.6	0.65
Gas (kg)	-	-	-	-	-	-	-	-	-

Source:*FieldWork*

Table 4.9 reveals daily household energy consumption in Rimi (rural) area of Katsina senatorial zone. In day1 21.3.3kg of fuel wood was consumed and recorded. In day 2 22.3kg of fuel wood, in day 3 19.9kg of fuel wood was consumed. In day 4 19.7kg of fuel wood was recorded. In day 5 20.8kg of fuel wood was consumed. In day 6 21.7kg of fuel wood was consumed. In day 7 19.3kg of fuel wood was consumed and recorded. A total of 145kg of fuel wood was consumed within the seven days with an average of 20.7kg of fuel wood was consumed and recorded in Rimi rural area of Katsina senatorial zone.

Table 4.9 also reveals daily consumption of kerosene in Rimi rural area of Katsina senatorial zone.In day1 0.7litres of kerosene was consumed and recorded. In day 2 0.8litres of kerosene was consumed, in day 3 0.7litres of kerosene was consumed. In day 4 0.4litres of kerosene was recorded. In day 5 0.7litres of kerosene was consumed. In day 6 0.6litres of kerosene was consumed. In day 7 0.8litres of kerosene was also consumed and recorded. A total of 4.6litres of kerosene was consumed within the seven days with an average of 0.65litres of kerosene was consumed and recorded in the area.

Liquified petroleum gas (LPG) and sawdust were not found and recorded in Rimi (rural) area of Katsina senatorial zone.

Table 4.10 Average daily household energy consumption in Daura urban area of Daura senatorial zone.

Energy Source	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Total	Mean
Fuel wood (kg)	20.7	22.3	24.1	20.9	21.3	23.2	21.2	153.7	21.9
Sawdust (kg)	5.1	5.7	4.9	6.0	5.3	6.2	5.9	39.1	5.6
Kerosene (litre)	0.9	1.1	1.1	0.8	0.9	0.8	0.7	6.2	0.89
Gas (kg)	0.8	0.9	0.7	1.1	0.8	1.0	0.8	6.1	0.87

Source:*FieldWork*

Table 4.10 reveals daily household energy consumption in Daura urban area of Daura senatorial zone. In day1 20.7kg of fuel wood was consumed and recorded. In day 2 22.3kg of fuel wood, in day 3 24.1kg of fuel wood was consumed. In day 4 20.9kg of fuel wood was recorded. In day 5 21.3kg of fuel wood was consumed. In day 6 23.2kg of fuel wood was consumed. In day 7 21.2kg of fuel wood was consumed and recorded. A total of 153kg of fuel wood was consumed within the seven days with an average of 21.9kg of fuel wood was consumed and recorded in Daura urban area of Daura senatorial zone.

In day1 5.1kg of saw dust was consumed and recorded. In day 2 5.7kg of sawdust was recorded, in day 3 4.9kg of sawdust was consumed. In day 4 6.0kg of sawdust was recorded. In day 5 5.3kg of sawdust was consumed. In day 6 6.2kg of sawdust was consumed. In day 7 5.9kg of sawdust was consumed and recorded. A total of 39.1kg of sawdust was consumed within the seven days with an average of 5.6kg of sawdust was consumed and recorded in Daura urban area (see plate 2)



Plate 2: A sawdust stove using sawdust as fuel in Daura urban area

.In day1 0.9litres of kerosene was con summed and recorded. In day 2 1.1litres of kerosene was consumed, in day 3 1.1litres of kerosene was consumed. In day 4 0.8litres of kerosene was recorded. In day 5 0.9litres of kerosene was consumed. In day 6 0.8litres of kerosene was consumed. In day 7 0.7litres of kerosene was also consumed and recorded. A total of 6.2litres of kerosene was consumed within the seven days with an average of 0.89litres of kerosene was consumed and recorded in Daura urban area.

In day1 0.8kg of gas was consumed and recorded. In day 2 1. 1.1kg of gas was consumed, in day 3 1.1kg of gas was consumed. In day 4 0.8kg of gas was recorded. In day 5 0.9kg of gas was consumed. In day 6 0.8kg of gas was consumed. In day 7 0.7kg of gas was consumed and recorded. A total of 6.1kg of gas was consumed within the seven days with an average of 0.87kg of gas was consumed and recorded in Daura urban area.

Table 4.11 Average daily household energy consumption in Baure rural area of Daura senatorial zone.

Energy Source	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Total	Mean
Fuel wood	22.1	25.3	24.2	25.1	22.7	24.7	23.2	167.4	23.9
Sawdust	-	-	-	-	-	-	-	-	-
Kerosine	0.5	0.4	0.6	0.5	0.7	0.4	0.6	3.7	0.53
Gas	-	-	-	-	-	-	-	-	-

Source:*FieldWork*

Table 4.1reveals daily household energy consumption in Baure (rural) area of Katsina senatorial zone. In day1 22.1kg of fuel wood was consumed and recorded. In day 2 25.3kg of fuel wood, in day 3 24.2kg of fuel wood was consumed. In day 4 25.1kg of fuel wood was recorded. In day 5 22.7kg of fuel wood was consumed. In day 6 24.7kg of fuel wood was consumed. In day 7 23.2kg of fuel wood was consumed and recorded. A total of 167.4kg of fuel wood was consumed within the seven days with an average of 23.9kg of fuel wood was consumed and recorded in Baure rural area of Daura senatorial zone (see plate 3).



Plate 3: A common wood stove *'murhu'* with fuel wood as fuel in Baure LGA (rural area of Daura senatorial zone)

Table 4.11 also reveals daily consumption of kerosene in Baure rural area of Daura senatorial zone.In day1 0.5litres of kerosene was consumed and recorded. In day 2 0.5litres of kerosene was consumed, in day 3 0.6litres of kerosene was consumed. In day 4 0.5litres of kerosene was recorded. In day 5 0.7litres of kerosene was consumed. In day 6 0.4litres of kerosene was consumed. In day 7 0.6litres of kerosene was also consumed and recorded. A total of 3.7litres of kerosene was consumed within the seven days with an average of 0.63litres of kerosene was consumed and recorded in the area.

Liquified petroleum gas (LPG) and sawdust were not found and recorded in Baure (rural) area of Daura senatorial zone.

Table 4.12 Average daily household energy consumption in Funtua urban area of Funtua senatorial zone.

Energy Source	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Total	Mean
Fuel wood	22.9	23.7	21.3	21.6	23.6	22.9	21.1	157.1	22.4
Sawdust	4.7	5.0	5.2	4.9	4.7	5.1	4.8	34.9	4.99
Kerosine	1.1	1.3	0.9	1.2	0.8	0.8	0.9	7.0	1.0
Gas	1.2	0.9	1.1	1.0	0.8	0.8	0.9	6.7	0.96

Source:*FieldWork*

Table 4.12 reveals daily household energy consumption in Funtua (urban) area of Funtua senatorial zone. In day1 22.9kg of fuel wood was consumed and recorded. In day 2 23.7kg of fuel wood, in day 3 21.3kg of fuel wood was consumed. In day 4 21.6kg of fuel wood was recorded. In day 5 23.6kg of fuel wood was consumed. In day 6 22.9kg of fuel wood was consumed. In day 7 21.1kg of fuel wood was consumed and recorded. A total of 151.7kg of fuel wood was consumed within the seven days with an average of 22.4kg of fuel wood was consumed and recorded in Funtua urban area of Funtuaa senatorial zone.

In day1 4.7kg of saw dust was consumed and recorded. In day 2 5.0kg of sawdust was recorded, in day 3 5.2kg of sawdust was consumed. In day 4 4.9kg of sawdust was recorded. In day 5 4.7kg of sawdust was consumed. In day 6 5.1kg of sawdust was consumed. In day 7 4.8kg of sawdust was

consumed and recorded. A total of 34.9kg of sawdust was consumed within the seven days with an average of 4.99kg of sawdust was consumed and recorded in Funtua urban area.

In day1 1.1litres of kerosene was consumed and recorded. In day 2 1.3litres of kerosene was consumed, in day 3 0.9litres of kerosene was consumed. In day 4 1.2litres of kerosene was recorded. In day 5 0.8litres of kerosene was consumed. In day 6 0.8litres of kerosene was consumed. In day 7 0.9litres of kerosene was also consumed and recorded. A total of 7.0litres of kerosene was consumed within the seven days with an average of 1.0litres of kerosene was consumed and recorded in Funtua urban area (see plate 4).



Plate 4: Lighted kerosene stove with kerosene as fuel in Funtua LGA (urban area of Funtua of Funtua senatorial zone

In day1 1.2kg of gas was consumed and recorded. In day 2 10.9kg of gas was consumed, in day 3 1.1kg of gas was consumed. In day 4 1.0kg of gas was recorded. In day 5 0.8kg of gas was

consumed. In day 6 0.8kg of gas was consumed. In day 7 0.9kg of gas was consumed and recorded. A total of 6.7kg of gas was consumed within the seven days with an average of 0.96kg of gas was consumed and recorded in Funtua urban area.

Table 4.13 Average daily household energy consumption in Sabuwa (rural) area of Funtua senatorial zone.

Energy Source	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Total	Mean
Fuel wood	23.4	25.0	22.7	23.6	22.3	24.1	21.3	162.4	23.1
Sawdust	-	-	-	-	-	-	-	-	-
Kerosine	0.5	0.7	0.4	0.5	0.6	0.5	0.5	3.7	0.53
Gas	-	-	-	-	-	-	-	-	-

Source: *Field Work*

Table 4.13reveals daily household energy consumption in Funtua (rural) area of Funtua senatorial zone. In day1 23.4kg of fuel wood was consumed and recorded. In day 2 25.0kg of fuel wood, in day 3 22.7kg of fuel wood was consumed. In day 4 23.6kg of fuel wood was recorded. In day 5 22.3kg of fuel wood was consumed. In day 6 24.1kg of fuel wood was consumed. In day 7 21.3kg of fuel wood was consumed and recorded. A total of 162.4kg of fuel wood was consumed within the seven days with an average of 23.1kg of fuel wood was consumed and recorded in Sabuwa rural area of Funtua senatorial zone.

Table 4.13 also reveals daily consumption of kerosene in Sabuwa rural area of Funtua senatorial zone.In day1 0.5litres of kerosene was consumed and recorded. In day 2 0.7litres of kerosene was consumed, in day 3 0.4litres of kerosene was consumed. In day 4 0.5litres of kerosene was recorded. In day 5 0.6litres of kerosene was consumed. In day 6 0.5litres of kerosene was consumed. In day 7 0.5litres of kerosene was also consumed and recorded. A total of 3.7litres of kerosene was consumed within the seven days with an average of 0.53litres of kerosene was consumed and recorded in the area.

Liquified petroleum gas (LPG) and sawdust were not found and recorded in Sabuwa (rural) area of Funtua senatorial zone.

4.3.2 Average Household Energy Consumption per Source per Day

Table 4.14 is a summary of average household energy consumption per source per day.

Table 4.14: Average Household Energy Consumption per Source per Day.

Average Expenditure within Stratum							Average consumption for Katsina State
Energy Source	**Katsina Senatorial Zone**		**Daura Senatorial Zone**		**Funtua Senatorial Zone**		
	Urban	Rural	Urban	Rural	Urban	Rural	
Electricity(w)	-	-	-	-	-	-	14.07
Fuel wood (kg)	18.1	19.9	21.9	23.9	22.4	32.2	21.6
Saw dust(kg)	6.6	-	5.6	-	4.99	-	5.7
Kerosene (l)	1.4	0.65	0.89	0.53	1.0	0.53	0.83
Gas (kg)	1.44	-	0.87	-	0.96	-	1.09

Source: Field Work

The chi-square calculated for contingency table 4.14 is 21.36 and is greater than the tabulated figure of 7.81. Alternatively P value is 0.000 which is less than 0.05. We therefore conclude that the results contained in the tble differ significantly at 0.05 level of significance.

This study as shown in table 4.13 recorded 14.07w consumption of electricity per day for household use in the state. This was deduced from the average 7.3 mwh supplied to the state by Power holding Company of Nigeria (PHCN). This deduction is based on Dayo (2008), findings that the residential sector accounts for more than half of the total final energy consumed in Nigeria. Hence, 50 percent of 7.0 mwh is 3.65mwh which is divided by the estimated number of household in the study.

Inadequacy of satisfactory data from consumption meters where available in households and non available of it in other houses has made this analysis of electricity consumption per strata unattainable.

The study also recorded 21.6kg consumption of fuel wood per household per day 5.7kg of saw dust, 0.83 litres of kerosene and 1.09 kg of gas per household per day in Katsina state.

4.3.2 Energy Consumption versus Rural-Urban Dicotomy

Disparities in household energy use exist between rural and urban populations. This study reveals that the household energy consumption in the urban and rural areas demonstrates various characteristics. In rural areas biomass mainly of fuel wood constitute a major portion of total household energy consumption, while in urban areas kerosene and LPG (cooking gas) were also consumed.

4.3.3 Energy Consumption Between Seasons

Since energy consumption vary between seasons (silviconsult 1991) and the data from monitoring was not possible for dry season considering the time span for the research, respondents' account of energy use between the two season as presented in table 4.14

Table 4.15: Energy Consumption Between Seasons.

Data within each stratum														
Energy Source consumption	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=96)		Rural (N=47)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Rainy season	23	24.8	11	23.4	19	28.0	18	29.1	18	26.4	9	20.9	98	25.5
Dry season	55	57.3	29	61.7	31	45.6	34	54.8	42	61.8	31	72.1	222	57.8
No difference	18	18.7	7	14.9	18	26.4	10	16.1	8	11.8	3	70	64	16.7
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source: *field work*

Table 4.15 shows unanimously of more use of energy in dry season than the wet season within each stratum and cumulatively for the study area. Thus a majority of respondents use more energy for cooking and heating during the dry season than they use in the rainy season. 57.8% of the 384 respondents in the study area stated that they use more energy in dry season than the rainy season. 25.5% consume more energy in the rainy season while 16.7% did not see any difference in the level of their energy consumption between the two seasons.

The reason for more demand for energy in the dry than the rainy season might not be unconnected with the fact that in addition to normal cooking, lighting and water heating, additional energy is used for space heating in the cold season in the rainy season fewer days are cold enough to warrant space heating due to the high temperature experienced during the season in Katsina state.

4.3.4 Preference of Household Energy Source For Cooking and Heating Within Seasons

Table 4.16 and 4.17 are summaries of energy source preference in the study area for two seasons under study. In some cases the energy sources indicated are used singularly in households, while in some households it is used as the main choice but supplemented with other sources depending on the situation at hand.

Research findings, through interview with energy source marketers reveal that during rainy season (Table 4.16) in most homes that use fuel wood, kerosene is used to augment the burning of wood due to wetness. This is practiced mostly inn household where wood is purchased in bits. In some homes the wood is abandoned for the use of kerosene in stores for cooking and heating in the rainy season due to difficulty in getting dry wood.

Table 4.16: Household Energy Preference in wet Season

Data within each stratum														
Energy sources	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=68)		Rural (N=43)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Electricity	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuel wood	44	45.8	29	61.7	38	55.9	49	79	35	51.5	29	67.4	224	58.3
Gas	12	12.5	-	-	5	7.4	-	-	9	13.2	-	-	26	6.8
Saw dust	8	8.4	-	-	6	8.8	-	-	6	8.8	-	-	20	5.2
Kerosene	32	33.3	18	38.3	19	27.9	13	21	18	26.5	14	32.6	114	29.7
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source: *field work*

Table 4.17 Respondents Preference for Energy Source (Dry season)

Data within each stratum														
Energy sources	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=68)		Rural (N=47)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Electricity	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuel wood	59	61.5	37	78.7	48	70.6	53	85.5	44	64.7	35	74.5	276	71.9
Gas	12	12.5	-	-	4	5.9	-	-	7	10.3	-	-	23	5.9
Sawdust	7	7.3	-	-	2	2.9	-	-	5	7.4	-	-	14	3.7
Kerosene	18	18.7	10	21.3	14	20.6	9	14.5	12	17.6	8	25.5	71	18.5
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source: *field work*

Table 4.16 and 4.17 reveal a preference in energy use indicating higher use of wood in dry season than the rainy season (71.9% against 58.3%) and a corresponding higher use of kerosene in the rainy season than the dry season (29.7% as against 18.5% respectively). It also reveals 6.8% and 5.2% preference of gas and sawdust respectively for wet season on one hand and 5.9% and 3.7% preference for gas and sawdust respectively on the other hand in Katsina state.

When view within each constituent strata a switch in energy use between four (4) sources i.e. kerosene, Gas, wood and sawdust is observed. A micro analysis of the situation showed use of kerosene in the rainy season to the use of wood in dry season some house hold access the strata (urban and rural) the switch in use of Gas and sawdust were only observed in urban areas (Katsina, Daura and Funtua). The switch from kerosene to wood in the house hold in the cold season could be explained by the ease use of wood in dry season in dry and it is cheapness compared to kerosene.

4.3.5 Household Energy Source For Lightening

Table 4.18 Respondents' preference for energy source for illumination.

Data within each stratum														
Energy sources	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=96)		Rural (N=47)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Electricity	72	75.0	18	38.3	54	79.4	29	46.8	40	58.8	22	51.2	235	61.2
Battery (Dry cell)	10	10.4	7	14.9	7	10.3	11	17.7	9	13.3	12	27.9	56	14.6
Kerosene	9	9.4	19	40.4	4	5.9	13	21.0	13	19.1	7	16.3	65	16.9
Candle	5	5.2	3	6.4	3	4.4	9	14.5	6	8.1	2	4.6	28	7.3
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source: field work

Table 4.18 reveals that 61.2% of the respondents in the study area use electricity supply either from the PHCN or personal generating sets as their energy source for lighting. Other energy use for lighting include 14.6% use of battery lamp (dry battery) of various types, like touch lights and other lantern (see plate 5), these include the china made and local types popularly referred to as "*Obasanjo ya gaza*" (literally means Obasanjo is incapable of giving light) in the study area 16.9% of respondent in the study area use kerosene as their source for lighting. Devices that use kerosene as fuel for lighting in the study area include bush lamp (see plate 6) in the area. 7.3% of respondents use candles as their source of energy. Results with each stratum showed 75.0%, 79.4% and 58.8% for Katsina, Daura and Funtua (urban areas) respectively use of either public power supply from the PHCN or personal electricity generating set. This perhaps could be a significant percentage of the respondents and inhabitants of the urban areas can afford to use personally own generating device for lighting due to their nature of occupation, educational background. On the other hand 38.3%. 46.8% and 51.2% of rural areas (Rimi, Baure and Sabuwa respectively also use electricity supply)

this perhaps could also be attributed to the fact that all these rural areas in the state are already linked up with the National Grid of the Power Holding Company of Nigeria (PHCN).



Plate 5: A dry battery light device

Table 4.18 reveals that a trend of kerosene use with all the stratum and the use of dry cells (1.5 volts) to cut across all the strata and its use as first choice energy is attributed to its ease of use and cheapness.



Plate 6: A common bush lamp with kerosene as fuel

4.3.6 HOUSEHOLD SUPPLY IN KATSINA STATE

Results of interview with different energy source marketers indicated that supply of energy sources is affected by some factors, amongst which are seasonality and Irregular nature of availability of these resources. The energy source supply scenario as gathered from stakeholders is summarized below.

1. **FUEL WOOD:** fuel wood is available in katsina state almost everywhere and at any time. However, the distance from which the material is transported to the consumption areas in the state is posing a great stress to the sellers which are reflected in the cost.
2. **SAW DUST:** this energy source abounds in saw mills and in most cases free of charge.

3. **KEROSENE:** there is an epileptic nature of the supply from Nigerian national petroleum corporation (NNPC) both at NNPC's own mega stations and independent marketers across the state records of supply by NNPC through it is mega station in katsina, funtua and Daura showed a total supply of 2,347,390 litres, 1,9,7,6, 470, litres and 1,879,460 litres respectively in 2012. The commodities is not regular supplied to retailers, which suggest a negative trend on the supply network.
4. **GAS:** there are many outlets where the commodity is sold in the urban areas of katsina state. It is availability, however, hinges on prevailing situation on the downstream sector of the NNPC and supply networks mustly from kano, Kaduna and zinder (niger republic).
5. **ELECTRICITY:** the electricity supply to katsina state is epileptic and near comatose going by the average of 8 hour availability per day at the period of this study. This was deduced from the average 75.03mwh supplied to the state (August 2012 – July 2013) by the power holding company of Nigeria with outages in odd times, making it is availability unpredictable and sometimes non useful in households especially when provided late in the night.

4.3.7 EFFECT OF DEREGULATION OF PETROLEUM PRODUCTS ON HOUSEHOLD ENERGY SUPPLY

Much has been said on the impact of government's deregulation policy in the petroleum sector on the economy this study sought people's opinion on the issue, especially as it affect household energy demand and supply. The result is presented in Table 4.18.

Table 4.18: Government Deregulation Policy on Petroleum Products As It Affects Household Energy Supply.

Table 4.19: Effects of Deregulation Policy on petroleum Products

Data within each stratum														
RESPONDENTS	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=96)		Rural (N=47)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Negative effects	87	906	25	53.2	54	79.4	32	51.7	56	82.4	22	51.2	276	71.9
Positive effects	9	9.4	12	25.5	8	11.8	10	16.1	9	13.2	9	20.9	57	14.8
No Idea	0	0	10	21.3	6	8.8	20	32.2	3	4.4	12	27.9	51	13.3
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source:*fieldwork*

Response on how deregulation affect users varied and are numerous. However. Such comments are increased price of commodity are termed negative while experience like ease access to the commodity are categorized as positive impacts. Results in table 4.19, revealed that 71.9% of the cumulative opinion by respondent indicates that the policy has a negative impact on the supply of house hold energy in katsina state. 48% of the respondents believed it impacted positively on house hold energy supply, while those who think it has no effect on any kind constitute 13.3%.

Furthermore, table 4.19 shows that within the stratum high percentages of those who experienced the negative impact of the policy coming from urban strata, katsina (90.6%), Daura (79.4%) and Funtua (82.4%). This might not be unconnected with the fact that most respondents in the urban areas have high educational background and the incidence of high use of fossil fuel in the study area emanates from urban area. Note that, fossil fuel (kerosene and Gas) are those affected by the deregulation policy at household level. On the other hand the incidence of those who have no Idea of how the policy affects them is reflective of how to average level of educational background of respondents in the study area. The bottom-line however is that majority of the respondents in the entire study area have experienced the negative impact of the policy on their household energy source demand and supply.

From the forgoing, and considering the myriad of supply constraints enumerated earlier the energy supply scenario of katsina state is best described as unfulfilled demand. Bhatra (1994) in his assessment of unfulfilled demand stated that:

> Frequently, the consumption of energy does not reflect demand because of supply constraints, transmission and distribution problems and adverse conditions of income distribution and purchasing power (Bhatia, 1994)

4.3.8 Consistency in the use of preferred energy source

Table 4.20 illustrates the consistency of the respondents in the use of the preferred source of energy for cooking, heating and lighting.

Table 4.20: Consistency in the Use of Preferred EnergySource

Data within each stratum														
Energy sources	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=96)		Rural (N=47)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Consistency use	68	70.8	34	72.3	52	76.5	57	92	59	86.8	41	95.3	311	81
Inconsistency used	28	29.2	13	27.7	16	23.5	5	8	9	13.2	2	4.7	73	19
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source: field work

To give credence to accounts of energy use preference as discussed previously, the respondents were asked if they are consistent or not in their energy source use (see table 4.20). Responses to this questions suggest an affirmation of the consistency in preferred source. This is adduced from 81% of consistency in use against 19% account of

inconsistency. This further buttresses the incidence of low energy source switch among respondents in the study area, as presented in analysis 4.16 and 4.17.

4.4 INTERPLAY OF ECONOMIC VARAIBELS AND HOUSEHOLD ENERGY USE

4.4.1 Cost of energy

Table 4.21 and 4.22 illustrate the cost of purchasing all types of energy sources for cooking and heating as well as for lighting and other household expenditure respectively

Table 4.21: Average Daily Expenditure of Household Energy

Average Daily Expenditure within Stratum							**Cummulative**
Energy Source for	**Katsina Senatorial Zone**		**Daura Senatorial Zone**		**Funtua Senatorial Zone**		**Average Daily Expenditure in Katsina State**
	Urban	Rural	Urban	Rural	Urban	Rural	
Lighting (N)	150.00	100.0	145.00	85.00	150.00	90.00	120.00
Cooking/heating (N)	320.00	152.00	300.00	140.00	305.00	150.00	341.75
Total	**470.00**	**252.00**	**445.00**	**225.00**	**455.00**	**240.00**	**347.83**

Source: field work

Table 4.22: Average Monthly Expenditure of Other Household Responsibility

Average Monthly Expenditure within Stratum							**Cummulative**
Household Expenditure	**Katsina Senatorial Zone**		**Daura Senatorial Zone**		**Funtua Senatorial Zone**		**Average monthly Expenditure in Katsina State**
	Urban	Rural	Urban	Rural	Urban	Rural	
Feeding (N)	15000	6,5000	17,000	9000	15,500	8000	11,833.33
House Rent (N)	21,000	7,000	13,000	4000	14000	5,5000	10,750.00
School Fees (N)	18,500	8000	17,800	7,800	19,000	6,600	12,950.00

Source:fieldl work

The result is taken and used as a basis for assessing the average expenditure per household per day within each stratum and cumulative average for the state as whole. The user account will be more reflective of actual expenditure in the households, because it is not always that the fuels used in household are purchased, sometimes they are sourced from personal farms (especially in the rural stratum) or taken free of charge in plantations or acquired illegally from government forests. Equally, energy sources from PHCN are not adequately billed. Either the consumer underplays, overpays or sometimes evades payment.

Based on the evidence in table 4.21 and 4.22 above, the average expenditure of household on energy in Katsina state for lighting, cooking and heating is approximately N348 per day. This translates to N10,440 per month. When this is view against respondents accounts on their income per month (see table 4.5) which revealed that 20.3% of the respondents earn less than N18,000. This implies that more than 50% of their monthly income is expended on household energy alone. 20.8% of the respondents in the state earn monthly income between N18,000 and N28,000 for N18,000, N10,000 is 58% of N18,000 and it is 37.3% of N28,000 this implies that respondents with monthly income between N18,000 and N28,000 58% and 37.3% of their monthly income respectively is expended on household energy alone. Income group of between N29,000 – N38,000 represent 18.3% of the respondents in the state N10,440 represents 36.1% and 27.5% of their income is expended on household energy alone. Income group of between N39,000 – N48,000 represent 21.6% of the respondents. Thus, N10,440 represent 26.8% and 21.8% of N39,000 and N48,000 respectively. It also implies that respondents within the group (21.6%) spend between 26.8% and 21.8% of their monthly income on household energy. Respondents that earn from N49,000 and above represents 19.0% and N10,440 represents 21.4% of N49,000. This also implies that 21.4% of this income group is the highest percentage spend on household energy alone while some respondents within the group may spend less depending on their income above N49,000.

Considering other expenditures incumbent on the households head like feeding , house rent bill and school fees of children which consume average of N11,833.33, N10,750.00 and12,950.00 monthly respectively (see Table 4.22 and fig. 4.1)among others, the energy sector could be said to have consumed more than its fair share of the scarce capital especially within the income group of less than N18,000 and those between N18,000 – N28,000 such a scenario would seem to be daunting on the economy of the state.

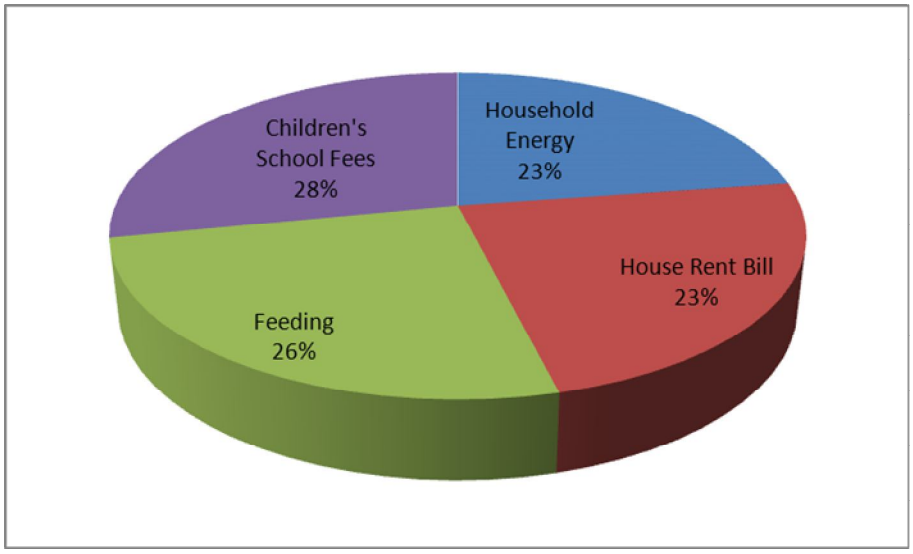


Fig. 4.1: Average Monthly Expenditure of Household Energy in Relation to Other Household Responsibility

Result with the stratum reveal an average expenditure of N470.00, N445.00 and N455.00 for Katsina, Daura and Funtua urban areas respectively. In the rural stratum the result shows that an average expenditure of N252.00, N225.00 and N240 for Rimi, Baure and Sabuwa rural areas respectively. This implies an average expenditure on household energy of N459.00 per day in the urban areas, against N249.00 in the rural areas. This expenditure difference must be connected with the fact that respondents living in urban areas of the state earn higher monthly income and hence have higher purchasing power than those living in the rural areas.

4.4.2 Financing Energy

Table 4.23 illustrates how energy is used in household is financed in the study area.

Data within each stratum														
Household Energy funding	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=96)		Rural (N=47)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Financed by household head only	88	91.7	44	93.6	65	91.2	57	91.9	64	94.1	41	95.3	359	93.5
Financed jointly with other relations	8	8.3	3	6.4	3	8.8	5	8.1	4	5.9	2	4.7	25	6.5
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source: field work

Analysis of table 4.23 above puts the responsibility of energy finance in the study area on household head, who in most cases is a male, except in a few cases where female widows head the family 93.5% of respondents stated that they as household heads are the main financers of energy source purchase, only 6.5% of the respondents get assistance on this matters from other family members, and most of such assistance come from grown up children of the household head.

4.4.3 Consistency in Financing Household Energy

Table 4.24 illustrates the consistency in funding of energy by the household heads.

Data within each stratum														
Household energy funding	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=96)		Rural (N=47)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Always able	89	92.7	29	61.7	62	91.2	40	64.5	63	92.6	27	62.8	310	80.7
Not always able	7	7.3	18	38.3	6	8.8	22	35.5	5	7.4	16	37.2	74	19.3
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Responses to the issue on consistency in funding in table 4.24 is not season specific because respondents gave the same answer for the two season under the study 80.7% of respondents stated that they are always able to fund the energy source requirement for cooking, heating and lighting in their respective households, while 19.3% of the respondents for the entire study area stated that they are not always able to fund the purchase of the resources.

Within the strata, urban stratum recorded with higher percentages of being able to fund their energy requirement. The result shows that 92.7%, 91.2% and 92.6% for Katsina, Daura and Funtua urban areas. This result conforms with the high economic status attributed to the urban inhabitants, for rural stratum the table reveals that 38.3%, 35.5% and 37.2% for Rimi, Baure and Sabuwa rural areas were not always able to fund the resources this conforms with the poverty level of rural areas in contrast with the urban communities.

Response relating to remedies in event of inability to fund the resources include purchase of energy source on loan, borrowing money to purchase required fuel and in extreme cases, respondents claim they reduce their cooking circle from the traditional three times a day to twice or once a day to economise the use of the scarce resources.

4.4.4 Other Economic Factors Affecting Household Energy use

4.4.4.1 Income and Energy Switch

Another economic variable investigated in this study is the issue of increase or decrease in income as it affects energy source use switch in households. Table 4.25 and 4.26 illustrate the results of investigation.

Table 4.25 Energy Switch Pattern in Times of Increase in Income

Data within each stratum														
Switch pattern	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=96)		Rural (N=47)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Move to higher energy level	63	65.6	19	40.4	42	61.8	26	41.9	45	66.2	17	39.5	221	57.6
Move to lower energy level	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Remain as before	33	34.4	28	59.6	26	38.2	36	58.1	23	33.8	26	60.5	172	42.4
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source: field work

Table 4.25 reveals that the majority of the household in Katsina State (57.6%) will switch to a higher energy source in event of increase in their income, while 42.4% will remain with their present source. No respondent admitted he will move down ladder.

Within the rural and urban strata the result reveals that urban stratum recorded with higher percentages of 65.6%, 61.8% and 66.2% for Katsina, Daura and Funtua urban areas respectively. To move to higher energy sources. The reason for this obviously is because the

higher ladder for energy use source coke using gas and electric cooking stoves. In rural areas table 4.25 recorded rural areas with the higher percentages of remain in the energy ladder as before with 59.6%, 58.1% and 60.5% for Rmi, Baure and Sabuwa rural areas respectively. This is also conform with the slow rate of cultural innovation diffusion in rural areas. They respondents preferred to use culturally accepted energy sources for household use which in most cases fuel wood even if their income increase.

Table 4.26: Energy Switch Pattern in Times of Decrease in Income

Data within each stratum														
Switch pattern	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=96)		Rural (N=47)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Move to higher energy level	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Move to lower energy level	44	45.8	12	25.5	23	33.8	13	21.0	21	30.9	11	25.6	124	32.3
Remain as before	52	54.2	35	74.5	45	66.2	49	79.0	47	69.1	32	74.4	260	67.7
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source: field work

Majority of the respondents, in event of decrease in income (table 4.26) opt to remain with their present energy source (67.6%), while 32.3% will move to lower energy level. The result within stratum data reveals that higher percentages in rural strata (74.5%, 79.0% and 74.4% for Rimi, Baure and Sabuwa rural areas) of those who will remain with their present energy source. This is obviously because most of rural inhabitants use the lowest ladder of energy in most cases which is fuel wood.

4.5.4.2 Purchasing Power and Pattern of Purchase

Another economic variable investigated in this study is the pattern of energy source purchase. In most instances the purchasing power of the household head determines whether purchases his energy requirement in large quantity and stockpiles or he purchases in bits the result of investigation is illustrated in table 4.27.

Table 4.27: Manner of Energy Purchase

Data within each stratum														
Manner of Energy Purchase	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=96)		Rural (N=47)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
In bits	51	53.1	37	78.7	42	67.8	48	77.4	40	58.8	28	65.1	246	64.0
Large stockpile	45	46.9	10	21.3	26	32.2	14	32.6	28	41.2	15	34.9	138	36.0
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source: field work

An analysis of table 4.27 shows that 64% of respondents in the study area purchase their energy requirement in bit while 36% provide in large stockpile. The implication here is that majority of the people in the study area do not have the economic power to purchase large quantity of energy source, rather they purchase in bits due to low capital at their disposal at a particular time.

Table 4.27 reveals that within urban stratum, Daura urban area is recorded with the highest percentages of purchase in bits. It is followed by Funtua and Katsina with 67.8%, 58.8% and 53.1% respectively. Some of the reasons given by some respondents in urban areas is the fact that LPG (cooking gas) and kerosene are commonly used there is inflammable and so large stockpile could constitute danger in the households.

Within the rural stratum, Rimi is recorded with the highest percentage, it is followed by Baure and Sabuwa with 78.8%, 77.4% and 65.1% respectively. And this is simply due to low economic power as confirmed by respondents in follow up questions on this issue.

4.4.4.3 Purchasing Power and the use and Type of Stove

Table 4.28 illustrates the proportion of those who use the stove they desired adn those that are constrained to use stoves available.

Table 4.28: Purchasing Power and the Use and Type of Stove

Data within each stratum														
Types of Stove in use	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=96)		Rural (N=47)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Constrained to use it	38	39.6	30	63.8	28	41.2	22	35.5	18	26.5	14	32.6	150	39.0
Use it willingly	58	60.4	17	36.2	40	58.8	40	64.5	50	73.5	29	67.4	234	61.0
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source: field work

Stove brings ease in cooking or hardship depending on types. Majority of the cooks in the study area are women traditionally, they are confronted with this problem daily. The type of stove in use itself could be a reflection of the household economic status. To this end the women (housewives) were asked whether the stove they use is the one they desire or they are constrained to use it. The efficiency of stove they use is not season specific as was revealed in the answers to administered questionnaires, hence the issue as presented in table 4.28 is not season specific.

61% of respondents stated that they use the stove provided to them for cooking willingly, while 39% are constrained to use the available stove in the study area since they cannot afford their desired stoves and fuel requirement attached.

Within the stratum, the table revealed that in urban areas, Funtua having the highest percentage of using stove willingly, it is followed by Katsina and Daura with 73.5%, 60.4% and 58.8% respectively. And within the rural stratum Sabuwa is recorded with the highest percentage of 67.4% and it is followed by Baure and Rimi with 64.5% and 36.2% of the respondents using their stove willingly.

4.5 SOCIO-CULTURAL FACTORS FOR ENERGY PREFERECE

Rehfuers and Bruce (2006), in their remarks on the call for additional Millennium Development Goal (MDG) that involve reducing the number of people without access to modern energy by half by the year 2015, stated that task is enormous considering that between now and 2015 access to cleaner fuels will need to be extended to be 485,000 people daily. And reaching this target would still leave 1.5 billion people cooking with solid fuels (mainly of biomass) and being exposed to harmful pollutants in ten years time.

Earlier analysis on table 4.5 and 5.6 on the trend in energy use for cooking and heating in the study area, showed a high trend of solid fuel use at 6.5% and 58.1% of fuel use for rainy season. The dry season had 5.2% of sawdust use and 66.7% of fuel wood use, totalling 71.9% use of solid fuel of dry season. By this figure Katsina state may fall within the 1.5 billion people estimated to fall in those cooking with solid fuel and facing the attendant consequence of harmful pollutants. The socio-cultural factors for this trend is investigated in this study and the results are presented in this section.

4.6.1 Educational Level Versus Energy Type Preference

The educational level of those who prefer biomass energy source (i.e fuel wood and saw dust as discovered in this study was examined as a pull factor for their preference for the biomass energy or fossil energy source. The result is presented in table 4.29.

Table 4.29: Educational level versus Household Energy Type Preference

Data within each stratum														
Educational level	Katsina Senatorial Zone (N=92)				Daura Senatorial Zone (N=86)				Funtua Senatorial Zone (N=73)				Commulative data for Katsina State	
	Urban (N=57)		Rural (N=35)		Urban (N=35)		Rural (N=51)		Urban (N=38)		Rural (N=35)		(N=251)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
No formal education	-	-	1	37.1	6	17.1	16	31.3	7	18.4	13	37.2	55	21.9
Primary certificate	11	19.3	9	25.8	7	20.0	6	11.8	9	23.7	11	31.4	53	21.1
Secondary certificate	23	40.3	7	20.0	12	34.3	15	29.4	7	18.4	5	14.3	69	27.5
OND/NCE	14	24.6	4	11.4	8	22.9	14	27.5	12	31.6	6	17.1	58	23.1
University degree and above	9	15.8	2	5.7	2	5.7	-	-	3	7.9	-	-	16	6.4
Total	**57**	**100**	**35**	**100**	**35**	**100**	**51**	**100**	**38**	**100**	**25**	**100**	**251**	**100**

Source: Field work

Table 4.29 indicates that those with post secondary education constitute 29.5% of those who prefer biomass fuel as against a combined percentage of 70.5% of those with secondary education, primary education or no formal education consisting of 21.1% primary education, 27.5% secondary education and 21.9% of no formal education consequently, how level of western education could be adduced as a pull factor for biomass energy preference in dry season in Katsina state. The data in the rainy season did not deviate much from the cold season so the data above could present both seasons those that preferred the fossil-fuel (Gas

and Kerosene) were subjected to a similar analysis are presented in table 4.18%. The responses for the rainy season did not differ much from day season on the issue, so table 4.18 above is an adequate representation for both seasons. The table reveals that those with low level of western education constitute a combined percentage of 13.58% (i.e 2.3 and 11.28% for normal education and primary certificate respectively while 86.5% of those with medium to high level of western education prefer fossils which in most cases is liquid or gasified. The highest percentage of fossil fuel users in the study area are those with post secondary certificate, a combined percentage of 64.62% ie 30% and 34.62% of those having either OND, NCE and University degree and above respectively. The situation above suggests that appreciable knowledge of western education could be a motivating factor socially for fossil fuel consumption.

4.5.2 Occupation/Nature of Work in relation to Energy type preference

The study also attempted a search on a possible link between nature of work of people and their fuel preference for household energy use. The result is presented in table 4.29 and 4.30.

Table 4.30: Occupation in Relation to Biomass Energy Type Preference

Data within each stratum														
Occupation	Katsina Senatorial Zone (N=92)				Daura Senatorial Zone (N=86)				Funtua Senatorial Zone (N=73)				Commulative data for Katsina State	
	Urban (N=57)		Rural (N=35)		Urban (N=35)		Rural (N=51)		Urban (N=38)		Rural (N=35)		(N=251)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Civil service	20	35.1	2	5.7	14	40.0	6	11.7	23	60.5	4	11.4	69	27.5
Farming	12	21.0	19	54.3	12	34.3	31	60.8	13	34.2	21	60.0	108	43.0
Trading/ business	13	22.8	5	14.3	4	11.4	8	15.6	2	5.3	4	11.4	36	14.3
Driving	3	5.3	2	5.7	3	8.6	6	11.9	-	-	3	8.6	17	6.8
Others	9	15.8	7	20.0	2	5.7	-	-	-	-	3	8.6	21	8.4
Total	**57**	**100**	**35**	**100**	**35**	**100**	**51**	**100**	**38**	**100**	**25**	**100**	**251**	**100**

Source: Field work

An analysis of table 4.30 suggest a high preference for biomass energy among the farmers at 43.0% in Katsina state. On the other hand 27.5% representation for civil servant 14.3% for trader and businessmen, 6.8% represents drivers and 8.4% represents others (which include artisan, vulcanizers and unskilled labourers in the state. Consequently the use of fossil and electricity operates in an opposite direction as illustrated in tables 4.17 and Table 4.18.

Table 4.31: Occupation versus fossil fuel preference as household energy

Data within each stratum														
Occupation	Katsina Senatorial Zone (N=92)				Daura Senatorial Zone (N=86)				Funtua Senatorial Zone (N=73)				Commulative data for Katsina State	
	Urban (N=39)		Rural (N=12)		Urban (N=33)		Rural (N=11)		Urban (N=30)		Rural (N=8)		(N=133)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Civil service	26	66.7	6	50.0	18	54.5	6	54.5	7	23.3	5	62.5	68	51.2
farming	-	-	2	16.7	5	15.2	-	-	10	33.4	-	-	17	12.8
Trading/ business	8	20.5	2	26.7	6	18.1	5	45.5	7	23.3	3	37.5	31	23.3
Driving	1	2.6	1	8.3	2	6.1	-	-	2	6.7	-	-	6	4.5
Others	4	10.2	1	8.3	2	6.1	-	-	4	13.3	-	-	11	8.2
Total	**39**	**100**	**12**	**100**	**33**	**100**	**11**	**100**	**30**	**100**	**8**	**100**	**133**	**100**

Source: Field work

Unlike the preference of biomass energy where those who practice white collar type of job (senior civil servant) and big businessmen and traders scored high at a percentage of 51.2% for civil servant and 23.3% of traders and businessmen. The farmers, drivers and others (which include artisans and vulcanizers) preference of fossils fuel on the other hand constitutes 12.8%, 4.5% and 8.2% respectively. The low preference of this category of workers for less fossil fuel could be due to the fact that farmers have more access to biomass than fossil fuel due to the nature of their work, same goes to drivers and others (artisans, vulcanizers etc) whose low income could be an additional reason. The nature of work of medium senior civil servant and big businessmen could be said to be a motivating factor for

their preference for fossil fuel, because of the urban nature of their work and the relatively high purchasing power at their disposal (see table 4.31).

4.5.3 Influence of other Socio-Cultural Attitudes and Practices on Household Energy Preference

4.5.3.1 Fixed habit

Another socio-cultural issue tacked in this research is the people's tenacity to hold on to a particular energy source. The research sought the opinion of household heads to know if they are ready to accept alternative fuel types to the one they use presently. Table 4.21 is the result of the survey.

Table 4.32: Tenacity of Users to Particular Energy Source

Data within each stratum														
Willing to adopt innovation	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=68)		Rural (N=43)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Willing to adopt other, even exotic	85	88.5	18	38.3	52	76.5	21	33.9	54	79.4	12	27.9	242	63.0
Not wiling	11	11.5	29	61.7	16	23.5	41	66.1	14	20.6	31	71.1	142	37
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source: Field work

Table 4.32 shows that 63.0% are willing to accept other fuel types in Katsina state. This score is indicative of willingness of the majority of the household head to adopt modern energy sources for cooking, heating and lighting if made available. From the foregoing it will be worth a trial to educate 37% who stated that they are not willing to accept alternative energy

sources to the one they use presently. The reason for their tenacity might be not be unconnected to the fact that if the energy source is exortic it could be among their customs.

Within stratum data indicated a high score of 88.5%, 76.5% and 89.4% for urban areas (Katsina, Daura and Funtua respectively) of those willing to adopt. This suggests that the high level of literacy in urban areas is responsible for the willingness of the household heads adopt changes, while high percentages of unwillingness in the rural areas (61.7%, 66.1% and 72.1% for Rimi, Baure and Sabuwa respectively) is indicative of low level of awareness in the rural areas.

4.6.3.2 Assumed Influence of Taste

Another factor investigated is the belief that some particular energy sources used as fuel for cooking in homes affect the taste of the cooked food. Table 4.33 illustrates the respondents acceptance of this belief.

Table 4.33: The effect of energy source on taste of cooked food

Data within each stratum														
Energy source and taste of food	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=68)		Rural (N=43)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
A particularly energy sources affects taste	56	58.3	27	57.4	41	60.3	48	77.4	51	75.0	21	48.8	244	63.5
No effect on food	14	14.6	12	25.5	12	17.6	8	12.9	8	11.8	10	23.3	64	16.7
I don't know	26	27.1	8	17.1	15	22.1	6	9.7	9	13.2	12	27.9	76	19.8
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source: Field work

Table 4.33 reveals that over 63% of the respondents believe that the type of energy sources affect the taste of food cooked with it, while 16.7% are emphatic that no energy source affects the taste of food cooked. This minority does not discriminate in the choice of fuel for cooking in the ground. 19.8% of the respondents do not have any idea on the issue. The 63.5% that believe that energy type affect food taste suggest that taste in relation to fuel used in cooking is a socio-cultural push/pull factor for energy type preference in the study area. The within stratum data reveals that Funtua urban having the highest percentage of the respondents who believe energy source affects the taste of cooked food with 75.0%. it is followed by Daura and Katsina with 60.3% and 58.3% respectively. In the rural areas Baure is recorded having the highest percentage of 77.4 of these that believe in energy source affects taste of cooked food. It is followed by Rimi and Sabuwa with 57.4% and 48.8% respectively.

4.5.3.3 Gender and Stove Purchase

Gender issue was treated in this part of the research and this relates to the purchase of stove, the main ingredient in fuel use and determinant of fuel type and energy to be used, and it cost determines its purchase and some extent the lifespan. However, the gender that actually acquires the stove is also a factor of the choice. Table 4.34 illusrates the gender that is most responsible for actual purchase of stoves in the study area.

Table 4.34: Stove Purchase

Data within each stratum														
Stove Purchase	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=68)		Rural (N=43)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
By household head	30	31.3	9	19.1	17	25.0	15	24.2	19	27.9	6	13.9	96	25.0
By housewife	66	68.7	38	80.9	51	75.0	45	75.8	49	72.1	37	86.1	288	75.0
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source: Field work

Table 4.34 indicate the socio-cultural practice of stove purchase by housewives. This is evident from 75.0% record of stove purchase by housewives against 25.0% purchase by household heads who in most cases are male.

The stratum situations shows a unanimity of this practice among all strata. Since the type of stove purchased and the use determine the type of fuel use and level of efficiency, it could be concluded that the purchase o stove is an additional burden the women add to their routine cooking and nursing of children with their low economic power. This burden is enormous considering the fact that most of the women in the study area are in purdah.

4.7 PEOPLE'S AWARENESS OF THE EFFECT OF ENERGY USE ON THE ENVIRONMENT

Table 4.35illusrates the respondents awareness of the effect of the type of energy used on the environment of the area.

Table 4.35: Effect of energy sources on the Environment of katsina State

Data within each stratum														
Awareness of the effect of energy sources on environment	Katsina Senatorial Zone (N=143)				Daura Senatorial Zone (N=130)				Funtua Senatorial Zone (N=111)				Commulative data for Katsina State	
	Urban (N=96)		Rural (N=47)		Urban (N=68)		Rural (N=62)		Urban (N=68)		Rural (N=43)		(N=384)	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Aware	54	56.3	9	19.1	33	48.5	20	32.2	35	51.5	7	16.3	158	41.1
Unaware	42	43.7	38	80.9	35	51.5	42	67.8	33	48.5	36	83.7	226	58.9
Total	**96**	**100**	**47**	**100**	**68**	**100**	**62**	**100**	**68**	**100**	**43**	**100**	**384**	**100**

Source: Field work

Researchers have linked household energy with environmental pollution. One of such is Bates (1999) who reported that burnt fuels for cooking and heating in households partly constitute to green house gases released into the atmosphere. This study investigated the rate of awareness of respondents on the household energy as it affects the environment.

Table 4.35, indicates that only 41.1% of the respondents in the study area are aware of the effect of burnt fuel in households on environment against a 58.9% who are unaware of this. This suggest low level of awareness of environmental science, especially in relation to household energy and pollution.

The situation within the strata indicates similar pattern of higher percentages of awareness in urban areas than in the rural areas. Katsina is recorded having the highest percentage of 56.3% it is followed by funtua and Daura with 51.5% and 48.5% respectively. This translate high level of awareness in the urban areas than rural areas.

A follow up question to this issue relates to the effect of users' energy source on the environment of Katsina state. This question was answered by those who are aware of the impact. The response varied and is not amendable to tabulation. However, a synthesis of the

answers showed that smoke and disappearance of woody vegetation in many part of the study area are the most sighted effect of household energy use on the environment of the state.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 SUMMARY OF FINDINGS

This study found an average per capita consumption of kw/capital/day of electricity, average household consumption of fuel wood of 21.6kg, 0.83 litres of kerosene 1.09kg of gas, 0.57kg of saw dust in Katsina state. Most of these energy sauce are noted to be adequately supplied except electricity which has a very low supply. The federal government deregulation policy on petroleum products has impacted negatively on the demand and supply of household energy in the study area.

Data collected within component strata indicates higher use of wood at 23.9kg in Baure rural area of Daura senatorial zone, the lowest 18.1kg fuel wood consumption per household per day in Katsina urban area of Katsina senatorial zone. Incontrast substantial use of cooking gas at 1.44kg/household per day in Katsina urban area of Katsina senatorial zone against nil recorded in all the three rural areas (Rimi, Baure and Sabuwa. The use of kerosene on the other hand cut across all the strata at 1.4, 0.6, 0.85, 0.53, 1.0 and 0.53 litres for urban Katsina, Funtua (rural), urban Daura, Baure (rural), urban futua and Sabuwa (rural) respectively. While most of these energy sources are noted to be adequately supplied demand is usually high in dry season except electricity whose supply is determined by prevailing situation on the upstream sector i.e generation and transmission form the power plants.

The most preferred energy source for cooking and heating in the study area is fuel wood at 66.7% and 58.1% for dry and wet season respectively. The use of electricity at 61.2% put it as the most preferred for lighting. Pattern of energy use indicates switch between season, with highest being as switch from kerosene to fuel wood in dry season in the study area.

Average expenditure of N347.83 per day household for cooking, heating and lighting amounting to a sizeable percentage of income of most household heads (energy finances) was recorded. The situation within strata indicates average expenditure of N470.00 per household per day in Katsina urban area. It is followed by Funtua and Daura urban areas with N455.00 and N445.00 respectively for rural areas, Rimi is recorded with an average daily energy expenditure of N252.00. it followed by Sabuwa and Baure with N240.00 and N225.00 respectively. The amount may be little but when compared to the perceive earning of some respondents represent large chunk of their income.

Majority (5.7 percent) of household heads indicated willingness to switch to higher energy types with increase in income while 67.7% would remain with present energy types in the event of decrease in income. Situation within the strata reveals that those who would move up the energy ladder in the event of increase in income is higher in Katsina urban area at 65.6% followed by Funtua urban area, Daura urban area with 66.2% and 61.8% respectively. While in the event of decrease in income those who would move dowm the ladder as higher in Katsina urban of Katsina senatorial zone with 45.9% as against 79%, 74.5%, 74.5% in Baure, Rimi and Sabuwa rural areas respectively opting to remain with their present energy source.

5.2 CONCLUSION

The preference of biomass for cooking and heating in the state in 64.6% and 71.9% of the household in wet and dry season respectively is high and signifies low adoption of modern energy type, with its attendant consequences on biodiversity, the low number of household heads who are aware of the effect of burnt energy on the environment arguably is a pull factor for this trend. Additionally, the nature of work and educational level of household heads could be pull factors for the preference of either biomass or fossil fuel on the energy switch between seasons suggests a weak correlation between energy source switch and

seasonality in the study area. However, the near unanimity in respondents' readiness to move to a higher energy in the energy ladder with increase in income implies that the meagre economic base in most household is a consumption pattern in the katsina state.

Prevailing attitude in the study area, like tenacity and consistency in use of chosen energy type, identified as full factors for energy type preference, with proper planning could be used as tool for energy use efficiency and adoption of modern energy. This could be achieved by enlightenment on advantage of modern energy sources, through mass media and various extension outlets in the state. When this is followed by appropriate subsidy on introduced energy by the government and relevant intervention agencies, a possible adoption may be sustained by the usual tenacity and consistency of household heads as discovered in this study. Effort at attaining this feat could be further strengthened, if special emphasis is given to reorientation of women on the issue, that is taking into cognizance the fact that 75% of stoves used in the study area are purchased by them and they are the end users of household energy sources as revealed in this study.

5.3 RECOMMENDATIONS

The state government should create an enabling environment for development of infrastructures necessary for production of bio fuels for household use. This will ensure the economic utilization of the biomass resources that abound in the area, rather than the present inefficient use of unprocessed biomass. To this end government should seek the partnership and expertise of relevant energy research institute in the country for the production of the following resources, to be initially subsidised to users and eventually to be deregulated and taken up by commercial interests:-

A- Biomass briquettes

B- Methanol fuel

C- Biogas fuel

Secondly, measures should be taken by authorities concerned to allow the present subsidy on kerosene as obtained in the Katsina NNPC mega station trickle down to the ordinary people by curbing the excesses of corrupt official who connive with touts to make the resources in-accessible to the people.

Thirdly, government or relevant intervention agencies should provide subsidy on materials for making efficient wood stoves by local blacksmiths. This would allow users to buy the product at affordable rate than the common inefficient but cheap stoves (Murhu) and keep the blacksmith in business as well. This will engender a multiplier effect on the economy of the households and the marketers. Such action could guard against possible extinction of introduced efficient stoves like the case of "Nagari wood efficient stove by EEC/FGN project in the early '90s.

Fourthly, lectures on efficient use of energy as well as advantages in the use of modern energy in households should be incorporated into the curriculum of secondary and tertiary schools in the area to stimulate the 'catch them young' syndrome.

Fifthly, advancements reached in solar energy for cooking, heating and lighting should be disseminated amongst the populace for possible adoption, considering the abundance of sunlight in the area. Here, the activities of NGOs both local and international will come handy.

Finally, research should be carried out on the possibility of integrating the production of methanol fuel using appropriate biomass resources, (by expansion or modification) into the present production line of the multi-million Naira Katsina Neem Seed Processing Plant, for household use.

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APPENDIX I: QUESTIONNAIRE

DEPARTMENT OF GEOGRAPHY,

AHMADU BELLO UNIVERSITY, ZARIA

Dear Respondent,

I am a student of the above named department undertaking a study. This questionnaire is designed to elicit information on the assessment of socio-economic effects of household energy use in Katsina state, Nigeria and you are one of the carefully selected respondents. The exercise is purely an academic work and all information will be treated confidentially.

Thank you for your assistance.

Please information or tick in the appropriate boxes to the following questions.

Questionnaire No.:_____

SENATORIAL ZONE: Katsina[ ] Daura [ ] Funtua [ ]

STRATUM: Urban [ ] Rural [ ]

NAME OF SETTLEMENT_____

SECTION A: DEMOGRAPHI/SOCIO-ECONOMIC DATA

1. Sex: (a) Male [ ] (b) Female [ ]
2. Age of household head: (a) 21-30yrs [ ] (b) 31-40yrs [ ]
   (c) 41-50yrs [ ] (d) 51-60yrs [ ]
   (e) above 60yrs [ ]
3. Size of household (a) 0-5 [ ] (b) 5-9 [ ]
   (c) 10-15 [ ] (d) 16 and above [ ]
4. Educational level of household head:
   (a) Primary [ ] (b) Secondary [ ]
   (b) OND/NCE[ ] (d) University degree or above [ ]
5. Occupation: (a) Civil servant [ ] (b) Business [ ]
   (c) Farmer [ ] (d) Others (specify) _____

6. What is the level of your income per month?

   (a) 5000-10,000 [ ] (b) 11,000-15,000 [ ] (c) 16,000-20,0000 [ ]

   (d) 21,000-25,000 (e) Above [ ]

7. Household energy financed by financed by household head only (Yes) or (No). If no state relationship of the co-financier to the household head:_____

   _____

SECTION B: HOUSEHOLD ENERGY CONSUMPTION DATA, SOCIO-ECONOMIC AND CULTURAL DATA (FOR HOUSEHOLD HEAD)

Respondents should provide information on household energy only i.e excluding commercial and industrial.

8. What kind of fuel do you use for lighting?

   (a) Kerosene [ ] (b) electricity [ ]

   (c) Others (specify)_____

9. How regularly?

   (a) Daily [ ] (b) Weekly [ ]

   (b) Monthly [ ] (d) Others [ ]

   reasons_____

10. What kind of fuel do you use for water heating?

    (a) Kerosene [ ] (b) electricity [ ] (c) fuel wood [ ]

    (a) Sawdust [ ] (d) gas [ ] (e) sorghum stalk [ ]

    (f) others (specify)_____

11. How regularly?

    (c) Daily [ ] (b) Weekly [ ]

    (d) Monthly [ ] (d) Others [ ]

reasons_____

12. What kind of fuel do you use for cooking?

(b) Kerosene [ ] (b) electricity [ ] (c) fuel wood [ ]

(b) Sawdust [ ] (d) gas [ ] (e) sorghum stalk [ ]

13. How regularly?

(e) Daily [ ] (b) Weekly [ ]

(f) Monthly [ ] (d) Others [ ]

reasons_____

14. Can you adopt other types that are more efficient and reasonably priced though might be exotic to your environment.

Yes [ ] No [ ]

15. In times of scarcity of the energy source in use in your household, what do you do?

_____

16. Are you always able to fund the purchase of your energy source?

Yes [ ] No [ ]

If no what do you do in such circumstances:_____

_____

17. In event of increase in present income, what energy type(s) would you adopt?

(a) Fuel wood [ ] (b) Kerosene [ ] (c) Gas[ ]

(d) Electricity [ ] (e) Sawdust [ ]

18. In event of decrease in your present income (God forbid), what energy type(s) would you adopt?

(a)Fuel wood [ ] (b) Kerosene [ ] (c) Gas[ ]

(d) Electricity [ ] (e) Sawdust [ ]

19. Has energy deregulation policy on petroleum products affected the energy consumption pattern in your household?

Yes [ ] No [ ]

If yes how?_____

20. What is the average expenditure spent on the following expenses of energy use per week in the household?

		<N1000	N1000-N3000	>N4000
(a)	Cooking	[ ]	[ ]	[ ]
(b)	Lighting	[ ]	[ ]	[ ]
(c)	Heating	[ ]	[ ]	[ ]

21. What is the average expenditure spent on the following expenses per week in the household?

		N1000-N3000	N3001-N5000	N>50000
(a)	Feeding	[ ]	[ ]	[ ]
(b)	Domestic water	[ ]	[ ]	[ ]
(c)	School fees	[ ]	[ ]	[ ]
(d)	Medical expenses	[ ]	[ ]	[ ]

SECTION C: WOMEN AND ENERGY CONSUMPTION DATA

(To be answered by women in the household)

22. How many women share cooking tasks in the household?_____

23. If cooking is shared is it within days or between days:_____

24. Is the stove(s) you are using the one you desire or you are constrained to use it?_____

25. If constrained what would you prefer in ideal situation?_____

_____

26. Who bought the stoves in your household?_____

27. What are the average hours do the household members stay outside house per day?

(a) 0 hr [ ] (b) 1-5 hrs [ ] (c) Above 6 hrs [ ]

28. Which season do you consume more energy?

(a) Rainy season [ ] (b) Dry season [ ]

29. Some energy type(s) like:

(a)Fuel wood [ ] (b) Kerosene [ ] (c) Gas[ ]

(d) Electricity [ ] (e) Sawdust [ ]

affect the taste of cooked food so I don't use them.

30. If yes how?_____

SECTION D: HOUSEHOLD ENERGY AND ENVIRONMENTAL ISSUES

31. Are you aware of the effect of some energy types on the environment?

Yes [ ] No [ ]

APPENDIX II: MONITORING AND EVALUATION FORM

This form should accompany questionnaire in selected household for monitoring and numbered accordingly.

Questioonaire No.:_____

Stratum: Urban [ ] Rural [ ]

Senatiorial Zone: Katsina [ ] Daura [ ] Funtua [ ]

MEASUREMENT OF ENERGY CONSUMPTION

Energy type	Weight before use	Weight after use	Remark (energy consumed)