RESIDENTIAL ELECTRICAL ENERGY CONSUMERS' PERSPECTIVES ON EFFECTIVE ELECTRICITY DEMAND MANAGEMENT IN KOGI STATE, NIGERIA

BY

IBITOYE, Daniel Damilola
M.TECH/SSTE/2018/8634

DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION
FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

MAY, 2023

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A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL, FEDERAL UNIVERISITY OF TECHNOLOGY MINNA, NIGERIA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF TECHNOLOGY (MTECH) IN INDUSTRIAL AND TECHNOLOGY EDUCATION (ITE) ELECTRICAL /ELECTRONIC TECHNOLOGY

MAY, 2023

DECLARATION

I hereby declare that this thesis titled: "**Residential Electrical Energy Consumers' Perspectives on Effective Electricity Demand Management in Kogi State, Nigeria**" is a collection of my original research work and it has not been presented for any other qualification anywhere. Information from other sources (published or unpublished) has been duly acknowledged.

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IBITOYE, Daniel Damilola
M.TECH/SSTE/2018/8634
FEDERAL UNIVERSITY OF TECHNOLOGY
MINNA, NIGER STATE, NIGERIA

SIGNATURE/DATE

CERTIFICATION

The thesis titled: “**Residential Electrical Energy Consumers’ Perspectives on Effective Electricity Demand Management in Kogi State, Nigeria**” by: IBITOYE, Daniel Damilola (M.Tech/SSTE/2018/8634) meets the regulations governing the award of the degree of (M.Tech) in Industrial and Technology Education, of the Federal University of Technology, Minna and it is approved for its contribution to scientific knowledge and literacy presentation.

Dr. T. M. Saba ……………………
MAJOR SUPERVISOR Signature & Date

Dr. A. B. Kagara ……………………
CO - SUPERVISOR Signature & Date

Dr. T. M. Saba ……………………
HEAD OF DEPARTMENT Signature & Date

Prof. A. I. Gambari ……………………
DEAN, SCHOOL OF SCIENCE AND Signature & Date
TECHNOLOGY EDUATION

Engr. Prof. O. K Abubakre ……………………
DEAN, POSTGRADUATE SCHOOL Signature & Date

DEDICATION

This project is dedicated first to God Almighty who saw me through the period of my master’s degree, my wife, Dr Marvellous Ibitoye, and to my parents, Mr and Mrs Ibitoye who have been pillars of support to me.

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ABSTRACT

The study analysed the residential electrical energy consumers' perspective on effective electricity demand management in Kogi State Nigeria. Six research questions were answered and ten null hypotheses were tested at 0.05 level of significance. The study adopted sequential explanatory research design. The population of the study comprised all 136,105 households connected to the national grid in Kogi State Nigeria. A 78 item questionnaire developed by the researcher and validated by three experts was used for data collection. The reliability coefficient of the instrument was determined through Crombach's Alpha correlation coefficient and the result of the reliability was 0.793 for the entire item. The sub-score for the items in each cluster were: 0.704 for the attitude of households towards electricity consumption, 0.796 for electrical energy saving practices utilized by households and 0.878 for the awareness level of the households on electricity conservation. Mean, standard deviation, percentage, t-test, ANOVA and regression were used for testing the research questions and hypothesis respectively. Levenes' test of homogeneity of variances and Tukey's post-hoc test were used to establish the direction of the differences. The analysis of the data was interpreted in relation to real limits of numbers of the scaling points. The findings on the attitude of the residents revealed that they have good attitude towards electricity conservation with a grand mean of 3.09. While on the types of appliances utilized by households, the findings showed that there were 1973 incandescent bulbs, 907 energy saving bulbs, 809 phones, 561 televisions and 457 standing fans and these were the top five most utilized appliances among households in Kogi State. On the energy savings practice utilized by residents, the findings showed that respondents occasionally practiced electrical energy savings methods in their households with a grand mean of 3.07. On the awareness level of the residents, the findings showed that 39.56% of the respondents were highly aware, 27.60% were aware, 16.44% were slightly aware and 16.40% were not aware of ways through which electricity conservation can be achieved. There was no significant difference in the mean responses of 1-5, 6-10, and 11 and above people in a household, on their awareness level on electricity conservation. Also, there was no significant difference between the mean responses of male and female on their awareness level on electricity conservation. There was significant difference on the attitude and awareness level of the remaining eight hypotheses. Based on the findings, it was recommended among others that: Residents should be well informed by the State Government on the need to use efficient electric appliances/equipment to avoid electrical energy wastages, also, Abuja electricity distribution company should ensure the supply and installation of prepaid meters to all residents in Kogi State Nigeria, and Government should prioritize the need to organize energy saving awareness publicity and rally for resident to be aware of ways by which they can save energy.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Electricity is an important component for the development of any economy. It is essential to all human activities and, indeed is critical to social and economic development. Access to electricity is particularly crucial to human development as it is indispensable for certain basic household activities, such as lighting, refrigeration and the running of household appliances, and cannot easily be replaced by other forms of energy (International Energy Agency (IEA), 2018). According to Medlock (2009) the exceptional economic growth and major improvements in standards of living in general over the last few decades have mainly come about because of the replacement of the work force with mechanical power that operate majorly on electricity through technological progress. Electricity is the fastest growing source of final energy demand, and over the next 25 years it continues to outpace energy consumption as a whole (IEA, 2018). Electricity demand management is an important measure that can help to ensure electrical energy is not wasted.

Electricity demand management can be defined as the judicious and effective use of electrical energy to maximize profits and minimize costs, thereby enhancing competitive position in a global economy (Saba *et al.,* 2016a). Electrical energy efficiency and conservation is an intentional action taken to reduce electrical energy consumption by utilizing more efficient equipment, devices and processes (Mahdi, 2018). It is also described as a modification of consumers' demand for electricity through various methods like financial incentives and behavioural change through education (Chiu *et al.*, 2013). The aim of demand-side management is to encourage the consumer to use less energy (Government of Western Australia, 2012). This could be through utilization of energy saving appliances, finding alternatives to the use of electricity or doing activities that will prevent energy wastage like putting off the security light during the day and putting off appliances that are not needed; like fan, fridge, bulbs and others. At household level, people consume electricity in different ways, which include; lighting, powering of appliances, heating, cooling, and cooking.

Households can consist one or more living together. According to Haviland (2003) a household consists of one or more people who live in the same dwelling and share meals. It may also consist of a single family or another group of people. Households utilize electricity for services, such as lighting, powering of appliances, heating, cooling, and cooking. Therefore, the use of electric appliances and its stock are major determinants of demand for residential electricity. The consumers' use of electrical appliances depends on their income, price of electricity, housing unit structure, number of family members and weather. Changes in the pattern of household electricity demand have resulted from changes in income and lifestyle in the households (Mensah & Adu, 2013). Large variations in household electricity demand may exist between low and high-income groups within a country (Mensah & Adu, 2013). Attitude of households towards energy management can affect their intention to save energy (Gao *et al.*, 2017). This shows that attitude of households is a factor, and is responsible for energy consumption behaviour. It can be speculated that if households consider energy saving behaviour important and valuable, they will hold positive attitude to ensure that energy saving activities are practiced in the homes.

Attitude is the household's degree of readiness to perform conservation behaviour depending on their preference towards conservation and the information they have about it (Wang *et al.*, 2016). Attitude can be influenced by many factors, including family size, income, and education. To change consumer behaviour, there must be an understanding of the various factors that are important to the behaviour requiring change (UKEssays, 2018). Some of the attitudes of residential households towards energy consumption and management include; dominant use of incandescent light bulbs (Yellow Bulbs), commercial activities in residential areas simultaneous use of multiple appliances in the house, leaving appliances on when not in use, cooking with heating equipment, multiple use of inefficient heating equipment, purchase of second-hand appliances, setting appliances on standby mode, leaving sockets on and leaving security bulbs on during the day. The types of electrical appliances used by household can influence energy consumption and management.

The electricity consumption of a household can be affected by the electrical energy consumed by each appliance and the amount of time each appliance is in use. According to Chou and Truong (2019) there are four categories of appliances based on their pattern of use; Continuous appliances; Standby appliances; Cold appliances; and Active appliances. Continuous appliances, such as Wi-Fi routers and burglar alarms, draw a continuous constant amount of power. Standby appliances, in particular consumer electronic equipment such as televisions and sound system sets. They have three basic modes of operation: in use; on standby; or switched off. Standby use occurs when an appliance is not in use but is still consuming power (Cogan *et al.,* 2016). Appliances can be on standby even when they appear to be switched off and the only certain way to prevent them drawing power is to disconnect their power supply for example, Television and Air conditioner. Cold appliances, such as fridges and freezers, are in continuous use however they do not draw a constant amount of power. Instead their power consumption cycles between zero and a set power level which is under thermostatic control. Active appliances are those which are actively switched on or off by the householders and are clearly either in use or not in use. Active appliances have no standby mode and when switched off their power consumption is zero. Examples of active appliances include lights, kettles, pumping machines ceiling fan and electric showers. The level of awareness of households on energy management practices can affect their level of electricity consumption.

Awareness level affects the electrical energy consumption behaviour of households (Kang *et al.*, 2012). Saving electricity may look like a difficult task due to the nature of electricity, which remains invisible right from its discovery and perhaps due to consumers' attitude and behaviour. Yet it can become a very easy issue if the consumer gains basic knowledge on what electricity is, how it is consumed and, more importantly how energy is wasted. This will drive consumers to pay more attention to unnecessary use of electricity and most probably change their everyday behaviour (Thogersen & Gronhoj, 2010). Awareness of electrical energy conservation and efficiency is an all-important element of electrical energy management practices, as lack of awareness may be the barrier for electrical energy wastages (Malik & Ayop., 2020). Awareness helps to change attitudes by encouraging users to seek out ways to save energy and also changes behaviours, making sure that energy users take energy-saving actions and continue to use and maintain energy saving equipment after it has been installed. Without the knowledge by the consumers on electrical energy management practices, it will be difficult to provide electricity users with better electrical energy conservation programmes. Awareness of electrical energy conservation and efficiency is an essential ingredient of electrical energy management practices, as lack of awareness is the main barrier for electrical energy wastages (Ting *et al*., 2010). The other determinants that can influence household electricity consumption are among others; number of households, age of household member, level of education, income of household, and gender.

The relationship between the number of households and electricity consumption shows that; an increase in the number of households will result in more consumption of electricity in the household. Leahy and Lyons (2015) studied the electricity consumption of single and double households in Ireland. By comparison, they found that a single-person household consumes 26.2% of electricity while double or two persons household consume 26.3% electricity per week. Yohanis *et al*. (2008) studied the relationship between the number of households and electricity consumption in apartments in Northern Ireland. The results showed that the apartment lived with four people or more people are used to consume highest average annual electricity consumption. There was no obvious difference between houses lived with two people and three people in average annual electricity consumption. The ages of the household is also a determinant of electricity consumption.

The ages of household members can mean that their priorities will differ and this can influence the kind of electrical appliances they will want to utilize at different times. According to Yohanis *et al.* (2008) the ages of different members of the family will have influence on household electricity consumption, and electricity consumption is relatively high when the age of the family member is 50-65. They further noted that electricity consumption is relatively lower, when the age of family member is less than 50 years old or above 65 years old. Leahy and Lyons (2015) pointed out that electricity consumption of household where ages of the family member is between 45 and 64 was significantly higher than that of 35-44 years old. Household electricity consumption decreased significantly when age of the family member is more than 64 years old. Mcloughlin *et al.* (2015) found out that household electricity consumption of family where age of the member is 18-35 was less than 36-55. The researchers believed that this middle-aged family has more children and rooms, which makes the consumption of electricity high. The educational level of the household is another determinant of electricity consumption.

The educational level of the family member has influence on electricity consumption. According to Karatasou *et al.* (2018) household electricity consumption decreased significantly as the level of education increased. The family members with higher degree of education consumed less electricity than the family members with low education level. However, Ogwumike *et al.* (2014) stated that the educational level of family members had significant impact on energy consumption. According to Taale and Kyeremeh (2019) households headed by educated people could be more committed to electricity conservation due to their awareness about the consequences of higher electricity generation on fossil fuel consumption and environmental pollution. Income is a determinant of electricity consumption since more money would mean more appliances can be bought which may lead to more energy consumption.

The income of householder is a determinant of electricity consumption. According to Yohanis *et al.* (2008) the households with higher annual incomes consume more electricity than the low income families. One possible reason was that higher income families tended to have a large area of housing and household appliances. This led to more electricity consumption. However, efficiency of home appliances and electronic devices is also vital to energy saving. Wealthy families have ability to buy smart appliances and install related home power management systems, some poor families can only afford energy saving bulb. The Gender of Household heads can also impact the rate of energy consumption.

The gender of the household head may affect the likeliness of adoption of conservation measures in the household. Some studies have found out that, compared to male-headed households, female-headed households incur higher cost on electricity due to their higher demand for electricity services whereas others also showed that female-headed households consume less electricity compared to male-headed households. (Murtagh *et al*., 2013).

Energy consumption at residential level is on a high side. This could be due to lack of awareness on energy management, type of appliances used by households, and poor energy management behaviours. Poor energy management practice such as leaving security light on, leaving appliances on when not needed, the use of more appliances, utilizing energy efficient appliances, and leaving appliances on standby mode. The Nigerian Electricity Regulatory Commission (NERC) (2014) considered that lighting alone could reduce between 3GW and 4GW electricity consumption through utilization of energy saving bulbs. There is need for households to practice energy management, so as to ensure the available energy is well utilized rather than wasted.

1.2 Statement of the Research Problem

The development of any state depends to a large extent on availability of electricity. The aim of electricity conservation is such that households only use electricity when necessary and avoid wasting it (Painter, 2021). Using only the required amount of electricity can be achieved by putting on appliances like bulbs, fans, and TV, only when they are needed. Also, switching off unused appliances instead of putting them on standby mode. When households have the right attitude towards electricity conservation, there will be more energy saving behaviour among them and this will lead to conservation of the available electricity. An importance of electricity conservation in households is the reduction in electricity bill. According to Energy Sage (2021) residential electricity rates fluctuate, but have risen steadily in the last decade

Advocating energy-saving behaviour is an important issue for society. There is need to pay more attention to household electricity conservation behaviour (Guo *et al*., 2018). According to Saba et al, (2016a) the attitude of households towards electricity consumption result into using appliances that requires a lot of electricity like non- power saving bulbs, leaving security lights on during the day and opening the door or window when the air conditioner is on. With the increased availability of domestic appliances, the domestic electricity expenditure now assumes a sizable share of the total domestic expenditure. The available data on Nigeria for electricity consumption by sector revealed that it is the residential sector that consumes by far the most energy with a total consumption of 57.8% of the total electricity demand (Nigerian Energy Support Programme, 2015). The high rate of consumption in residential buildings highlights the need for electricity conservation.

Against this backdrop, there is a need to analyse the residential electrical energy consumers' perspective on effective electricity demand management, as it relates to their attitude towards electricity consumption, the types of appliances they utilize, their energy savings practices and their level of awareness on electricity conservation. Therefore, the problem of this study posed a question, which is; what are the perspectives of residential electricity consumers on electricity demand management?

1.3 Aim and Objectives of the Study

The main aim of this study was to analyse residential electrical energy consumers' perspectives on effective electricity demand management in Kogi State, Nigeria. Specifically, the objectives of this study determined:

1. The attitude of households towards electricity consumption.
2. The electrical appliances used by households that lead to electricity consumption.
3. The electrical energy savings practices utilized by households.
4. The awareness level of households on electricity conservation.
5. The relationship between determinants of electricity consumption in residential houses.
6. Effective electricity saving measures needed by residents of Kogi State, Nigeria.

1.4 Significance of the Study

The outcome of this research work which will be published in journals, if properly implemented would be beneficial to the following; policy makers, electricity distribution companies, household energy users, the Kogi State government, and the society.

The policy makers will benefit from this study, as the findings of the study will guide the policy makers to formulate workable policies that can practically be applied to enhance the stability of electricity and reduce energy wastages, which will then contribute immensely to the economic development of the state and the nation at large.

The electricity distribution companies will also benefit from the study, as the study will provide them with the statistics on factors that contributed to the high or low consumption of electricity among households, thereby helping them to know the amount of power to be purchased from the electricity generating companies and distributed accordingly. The result will help electricity distribution companies on settling pricing issues, as the knowledge of what determines the rate of power consumption among households will help in the allocation of bill for power consumption. It will also help them understand the urgency of the installation of prepaid meters in all residential buildings to ensure electricity users do not under-pay for what was consumed.

The household energy users will also benefit from the study, as the result of the study, which will be published in journals, will bring about awareness on electricity utilization and conservation, thereby making the consumers save more electricity which in turn makes it more available, and save more money in purchasing electrical energy units.

The State government will benefit from this study, as the findings of the study will guide them on ways to create awareness and sensitization so that the residents of Kogi State will be equipped with sufficient knowledge of energy conservation, which will put an end to energy wastages and enhance economic growth in the State.

The society at large will be of immense benefit from this study as the findings will bring about awareness and the recommendation will result in improved supply of electricity through proper utilization of electricity, which in turn helps in the development of the society through industrialization. Electricity is a major driver of industrialization.

1.5 Scope of the Study

The study covered the attitude of households towards electricity consumption, types of appliances utilized by household, the electrical energy savings practices utilized by households and the level of awareness of households on electricity conservation. The income of households, the ages of households, educational level of households, number of people in a household and the gender of households were tested, to know their effect on the attitude of households towards electricity consumption and awareness level of households on electricity conservation. The study excluded student apartments and hostels since some students did not meet up with some of the demographic classifications such as age and income. Also, the study found out information from heads of households, which was difficult to ascertain from a hostel.

1.6 Research Questions

The following research questions guided the study:

1. What are the attitudes of households towards electricity consumption?
2. What are the types of electrical appliances used by households that leads to electricity consumption?
3. What are the electrical energy savings practices utilized by households?
4. What is the awareness level of households on electricity conservation?
5. What is the relationship between factors that lead to electricity consumption?
6. What are the effective electricity saving measures needed by residents of Kogi State, Nigeria?

1.7 Hypotheses

The following null hypotheses guided the study and were tested at 0.05 level of significance:

HO_1 There is no significant difference in the mean responses of low, middle and high income earners on their attitude towards electricity consumption.

HO_2 There is no significant difference in the mean responses of households of ages 18-39, 40-64, 65 and above, on their attitude towards electricity consumption.

HO_3 There is no significant difference in the mean responses of Primary/Secondary School Certificate holders, ND/NCE holders, HND/Degree holders and Postgraduate Degree holders on their attitude towards electricity consumption.

HO_4 There is no significant difference in the mean responses of households with 1-5 people, 6-10 people and 11 and above on their attitude towards electricity consumption.

HO_5 There is no significant difference between the mean responses of male and female households on their attitude towards electricity consumption.

HO_6 There is no significant difference in the mean responses of low, middle and high income earners on their awareness on electricity conservation.

HO_7 There is no significant difference in the mean responses of households of ages 18-39, 40-64, 65 and above, on their awareness on electricity conservation.

HO_8 There is no significant difference in the mean responses of Primary/Secondary School Certificate holders, ND/NCE holders, HND/Degree holders and Postgraduate Degree holders on their awareness on electricity conservation.

HO_9 There is no significant difference in the mean responses of households with 1-5 people, 6-10 people and 11 and above on their awareness on electricity conservation.

HO_{10} There is no significant difference between the mean responses of male and female households on their awareness on electricity conservation.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1. Theoretical Framework

Two theories provide useful framework for this study, they include the theory of planned behaviour, and information processing theory

2.1.1 Theory of planned behaviour

Theory of planned behaviour was developed by Ajzen (1991) and now it is the most popular theory on the study of individual's behaviour in a wide range of fields, especially pro-environmental behaviour. According to this theory, individual's behaviour intention is decided by attitude towards this behaviour, subjective norm and perceived behaviour control. While attitude refers to individual's feelings (negative or positive) to perform a specific behaviour. Subjective norm refers to individual's perceived social pressure from others who are important to him that thinks he should or should not perform the behaviour. Perceived behaviour control refers to the perceived ease or difficulty of conducting the behaviour.

It was further asserted by Ajzen (1991) that the theory considers attitude as the first important variable to affect individual's behaviour intention. The more individual holds positive attitude towards the behaviour, the more likely they will tend to conduct this behaviour. Subjective norm is the second important variable to affect individual's behaviour intention according to the theory. People tend to comply with the expectations or viewpoints of some important people. An individual's behaviour intention might be based on the approval or disapproval of some people that are important to the individual. The higher the subjective norm an individual perceived, the more likely it becomes to perform a behaviour.

The theory of planned behaviour is suitable for energy saving behaviour in household settings as it helps to explain how households can adopt energy conservation through the transformation of their attitude. Subjective norm explains how households' attitude can be transformed as a result of external influences from friends and influential people. If people realize that it is required of them to save energy in their households, they will perceive pressures and this can result in a change in their intention to save energy. A positive Attitude towards energy saving can positively affect individual's intention to save energy in households. Also, it can be speculated that if individuals consider the energy saving behaviour in their households as significant and valuable, they will hold positive attitude to ensure that energy saving activities are practiced in their homes.

2.1.2. Information processing theory

The development of Information processing theory and its broadening over the years was contributed by Miller (1956). The idea base of the theory is that people process the received information like computers rather than being stimuli-responsive. It explains how they perceive information from their surroundings, operate and integrate it with their memory‘s available information, and use it as the basis for decision making and performance. Miller (1956) further highlighted that a general model of Information processing theory comprises of three components; first the sensory memory, where the short-lived information gathered by people‘s sensors are filtered and information only thought-to-be relevant and important move on the working memory. Second, is the working memory (short memory) where the maintenance of information is through rehearsals or repetition (organization of information). The third component is the unlimited spaced long-term memory which maintains a crucial factor of how well-organized information is.

The main assumptions that underline the information processing theory include; first, a series of processing systems such as short-term memory, perception, and attention used to process available information from the environment. Second, is a systematic way perception, attention and short-term memory alter information. Third, information processing in people resembles that of a computer.

Information processing theory highlights how energy conservation among households can be achieved through awareness. Electricity conservation awareness can be developed via a learning process when stimuli of the conservation awareness are sent via appropriate method where relevant information must be provided. When the right information is passed as to how important it is to conserve energy and the ways to save energy, it is believed that the households will process such information and act on it. This will eventually result into energy conservation.

2.2. Conceptual Framework

The schematic conceptual framework in Figure 2.1 presents a pictorial view of how the determinants led to electricity consumption and how they can affect the level of electricity conservation. Two dependent variables which are the attitude of the household and the type of electrical appliances used by the households were tested using the five determinants which are income, age, educational qualification, number of households, and gender, to show their effect on electricity conservation. The framework shows that when any of income, age, educational qualification, number in households, and gender is influenced or changed, it resulted to a change in the attitude and types of electrical appliances used by households. This also affects the energy management practices of the households.

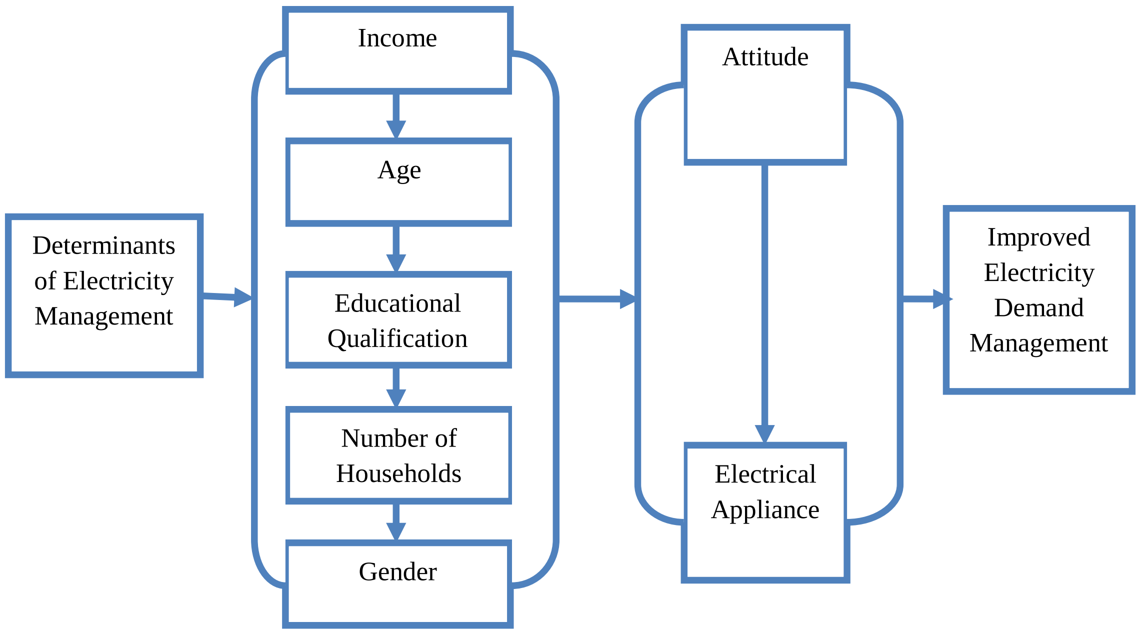

Figure 2.1: Energy Management Framework developed by researcher.

2.2.1. Electricity demand management

Electricity generation consists of a mix of hydro and thermal power with the thermal generation being based primarily on gas (Energy Commission of Nigeria, 2012). The demand for electric power is increasing at a high rate particularly in urban areas. With an estimated yearly economic growth rate of between seven per cent and 13 per cent, as well as an urbanization rate of 3.8 per cent, Nigeria's electricity demand has been projected to grow from 15 GW in 2016 to 41 GW by 2018 and 88 GW by 2020 respectively (Ikpe & Torritti, 2018). However, these estimates seem to take into account linear economic and population growth only, without the cost constraints currently facing the Nigerian electricity network, especially in terms of connecting rural areas (Ikpe & Toritti, 2018). The Nigerian government estimates that at least half of the population is not connected to the electricity grid and most of those not connected are in rural areas (Presidency of Federal Republic of Nigeria, 2010). The Nigerian government estimates that in order to achieve the goals of its latest development plan (Vision 2020) of making Nigeria one of the 20 largest economies in the world by 2020, it will require an installed electricity generating capacity of at least 40 GW by 2020. The installed capacity peaked in 2010 (31 GW), but was down to 21 GW in 2012.

Energy demand management, also known as demand-side management (DSM) or demand-side response (DSR) is the modification of consumer demand for energy through various methods such as financial incentives and behavioural change through education (Chiu *et al.*, 2013). Energy demand management entails actions that influence the quantity or patterns of use of energy consumed by end users, such as actions targeting reduction of peak demand during periods when energy-supply systems are constrained. Peak demand management does not necessarily decrease total energy consumption but could be expected to reduce the need for investments in networks and/or power plants. Sustainable energy is a form of energy that meet our today's demand of energy without putting them in danger of getting expired or depleted and can be used over and over again. (Rasaq, 2019).

The aim of demand-side management is to encourage the consumer to use less energy during peak hours, which is when energy demand is highest, or to move the time of energy use to off-peak times which is when energy demand is low, such as night-time and weekends (Government of Western Australia, 2012). Peak demand management does not necessarily decrease total energy consumption, but could be expected to reduce the need for investments in networks and/or power plants for meeting peak demands. An example is the use of energy storage units to store energy during off-peak hours and discharge them during peak hours (Wei-Yu *et al*., 2012).

DSM can also be referred to as wide-ranging actions that aim to reduce demand for electricity (Summerbell *et al.*, 2017). Traditionally, objectives associated with DSM were generally restricted to efficiency and conservation programmes. Hence, the measures were mainly focused on energy efficiency, including more efficient light bulbs (Ikpe & Toritti, 2018). With time DSM objectives encompassed programs emphasizing price response as well as automated reductions in energy at peak times (Bradley *et al*., 2013).

Corresponding measures include Demand Response (any reactive or preventative method to reduce, flatten or shift peak demand) and load management (advance or delay appliance operating cycles by a few seconds to increase the diversity factor of the set of loads). For utilities, both reducing and shifting electricity demand implies avoiding or delaying building additional generation capacity. In some situations, this would avoid or defer electricity price increases that would otherwise be imposed on customers to finance new investments in system capacity. Industrial plants are often targeted for DSM as they are able to reduce overall demand by adopting efficiency measures. Several household users can also shift consumption away from peak demand over relatively long time periods, depending on the processes used (Ikpe & Toritti, 2018).

In practice, challenges around DSM implementation consist of lack of awareness about energy efficiency in consumers and insufficient auditing. For example, several industrial and commercial companies still have not carried out energy audits to collect reliable information on their current operations (Ikpe & Toritti, 2018). While this may be due to a failure by management to appreciate the potential benefits of energy efficiency, some companies miss skilled personnel able to perform audits (United Nations Industrial Development Organization (UNIDO, 2015). DSM has been seen as an aid to deficient power supply in developing countries, balancing demand and supply is a recurrent problem in the Nigerian electricity market. Interruptions in electricity supply are frequent and pose continuous stress to the grid. Issue with balancing electricity demand and supply in Nigeria is not new and found different solutions over the years (Ikpe & Toritti, 2018).

The Nigerian Electricity Regulatory Commission has regulatory leadership on DSM matters and has, thus far, developed two main programs. The Nigerian Electricity Regulatory Commission (2014) considered that lighting alone could reduce between 3GW and 4GW electricity consumption at peak time through bulb replacement. Peak demand was 4.1 GW on average in 2014, but was forecasted to increase to 14.63 GW in following years. In 2016, the Nigerian Electricity Regulatory Commission decided to widen publicity on energy saving DSM with regards to the benefits of using Compact Florescent Lamps, which are expected to decrease peak loads by up to 60%. In addition to lighting, the main DSM policy in Nigeria consists of rolling out electricity meters and smart meters for future DSM programmes. Currently, the metering level in Nigeria is about 50% of the customer population (Oseni, 2015).

With regards to DSM for industrial users, for high energy consumer sectors (transport, power sector, agriculture) DSM technologies will be progressively introduced, including peak load management when possible. Compared with the current level, it is foreseen that energy efficiency and DSM will increase by at least 20% by 2020 and 50% by 2030 (Federal Republic of Nigeria, 2016). Historically, a fraction of the residential sector in Nigeria has owned flexible demand and stand-by generation assets. For instance, middle and higher income Nigerian households own diesel generators to offset interruptions in electricity supply (Ikpe & Toritti, 2018). More recently, diesel stand-by generation, which has high capital costs, high fuel running costs, high levels of noise and localized pollution, has been increasingly replaced or supplemented by small-size electricity storage (Azoumah *et al.*, 2011).

Similarly, in order to offset power outages, the commercial and industrial sectors have historically been using privately operated petrol or diesel generators to meet their own demand. According to the Union of Concerned Scientists, (UCS 2012), in the United State of America, "during the time of the energy crises in the 1970s, the federal government passed the Public Utility Regulatory Policies Act (PURPA), hoping to reduce dependence on foreign oil and to promote energy efficiency and alternative energy sources." This act forced utilities to obtain the cheapest possible power from independent power producers, which in turn promoted renewable energy and encouraged the utility to reduce the amount of power they need, it then pushed forward, the agendas for energy efficiency and demand management (UCS, 2012). Electricity Demand Management is aimed at conservation of electrical energy and reduction of Peak loads.

Conservation and peak demand reduction programs aim to reduce total energy demand or shift demand from peak to off-peak periods without substantially affecting the consumer. This is mainly done through the use of incentives and consumer education (UCS, 2012).

2.2.2 Residential household

The residential sector accounts for one-fifth of global energy consumption, resulting from the requirements to heat, cool, and lighting of residential buildings (Brounen *et al*., 2013). A household consists of one or more people who live in the same dwelling and share meals. It may also consist of a single family or another group of people, the household is the basic unit of analysis in many social, microeconomic and government models, and is important to economics and inheritance (O'Sullivan & Steven, 2013). A building can be seen as residential building when significant portion of the floor area is used for dwelling purposes (Saba *et al.* 2016a). Residential building uses electrical energy equipment and appliances such as electrical heater, cooker, lighting bulbs, washing machines, refrigerator and other items. These consume significant amount of energy while items such as radio, television and computer use less energy and, therefore, account for a small percentage of total residential consumption (Saba *et al.* 2016a).

In the United Kingdom, a household is defined as "one person or a group of people who have the accommodation as their only or main residence and for a group, either share at least one meal a day or share the living accommodation, that is, a living room or sitting room" (UK Government, 2019). People can be considered a household if they are related: full- or half-blood, foster, step-parent/child, in-laws and a married couple or unmarried (UK Government, 2019). A householder is the "person (or one of the people) in whose name the housing unit is owned or rented (maintained)." According to the United States Census (2010) if no person qualifies, any adult resident of a housing unit is considered a householder. The U.S. government formerly used "head of the household" and "head of the family", but those terms were replaced with "householder" in 1980 (United States Census, 2010).

In social work, a household is defined as a residential group in which housework is divided and performed by householders, care may be delivered by one householder to another, depending upon their respective needs, abilities, and disabilities (Pierson & Thomas, 2012). The energy demand of the Nigerian residential household sector consists of demand from rural and urban areas. Over the years, an increase in per capita gross domestic product (GDP), improved lifestyle, and increase in population have led to an increase in the energy demand of the Nigerian residential sector. The energy mix of the sector comprises traditional solid biomass (fuel-wood and charcoal), electricity, kerosene, and LPG (Emodi *et al.*, 2017). The total commercial energy consumption of the sector has been varying over the years and has increased at a Compound Annual Growth Rate (CAGR) of 1.93%, from 101 Petajoules (PJ) in 1990 to around 148 PJ in 2010 (Energy Commission of Nigeria, 2010). Households use energy to satisfy different services such as cooking, lighting, heating and for operating appliances like refrigerators, fans, air conditioners and televisions (TVs) (Ibitoye, 2013). Electricity access in the rural area is still low with only about 41% of the households electrified (Nigerian Bureau of Statistics (NBS), 2016). Access to clean cooking equipment is even lower. Only about 3.5% of rural households have access to modern cooking fuels (NBS, 2016). Few households depend on transition fuels like kerosene and the majority rely on traditional biomass for cooking. However, electricity access has improved substantially over the years in urban areas with 86% of urban households now electrified while only 8.5% have access to modern cooking fuels (NBS, 2016).

The energy requirements for cooking are diverse in the Nigerian residential sector. Fuelwood, charcoal, kerosene, LPG, and to some extent electricity are used for cooking (NBS, 2016). Fire wood is the predominant fuel for cooking especially in the rural areas of Nigeria according to Ibitoye (2013). It is usually collected from the forests around the villages in rural areas whereas, in the urban areas, they are purchased from the local vendors which sell them at a price that is very insignificant when compared to other cooking fuels like kerosene and LPG (Ibitoye, 2013). The high dependence on fuelwood for cooking has resulted in the depletion of many forests in Nigeria and has destroyed many natural ecosystems according to Gujba *et al*. (2015).

2.2.3 Determinants of electrical energy usage

The determinants of electrical energy usage are discussed in this section of the research.

2.2.3.1 ***The income of a household:*** The income of a household is a determinant of electricity consumption. According to Yohanis *et al.* (2008), the households with higher annual incomes consume more electricity than the low income families. One possible reason was that higher income families tended to have a large area of housing and household appliances. This led to more electricity consumption. However, efficiency of home appliances and electronic devices is also vital to energy saving. Wealthy families have ability to buy smart appliances and install related home power management systems, some poor families can only afford energy saving bulb.

Income stimulates electricity demand and hence should generally exert a significant positive effect on household electricity expenditure (Taale & Kyeremeh, 2019). Specifically, a number of studies investigating the effect of income on household energy expenditure have found significant positive link between the two variables. For example, Wei *et al*. (2014) found a significant positive relationship between income and the share of electricity in total energy expenditure whereas Salari and Javid (2017) found a significant positive relationship between income and household electricity expenditure. Santamouris *et al.* (2017) examined the relationship between annual electricity cost and income, and found that wealthy households spent almost 38 percent extra on electricity per floor area than poor households. Hussain and Asad (2012) studied the determinants of household electricity expenditure in Pakistan and found that income significantly affects the variance in electricity expenditure. Contreras *et al.* (2019) investigated the factors affecting household electricity consumption. In contrast to basic economic theory, this study found a significant negative relationship between electricity consumption and household income, reflecting that electricity is an inferior good. Moreover, Alberini *et al.* (2011) established that income has no statistically significant effect on household electricity consumption or associated cost. A similar result is reported by Wallis *et al.* (2016) who observed that when size of floor area was introduced, income became negative whereas without it, income was positive albeit insignificant.

2.2.3.2 ***Age of household member*:** The ages of household members can influence electricity usage. According to Yohanis *et al.* (2008) the ages of different members of the family will have influence on household electricity consumption and electricity consumption is relatively high, when the age of the family member is 50–65. Electricity

Consumption is relatively lower, when the age of family member is less than 50 years old or above 65 years old. Leahy and Lyons (2015) pointed out that electricity consumption of household where ages of the family member is between 45 and 64 was significantly higher than that of 35-44 years old. Household electricity consumption decreased significantly when age of the family member is more than 64 years old. Mcloughlin *et al.* (2015) found that household electricity consumption of family where age of the member is 18–35 was less than 36–55. The researchers believed that the middle-aged family has more children and rooms, which makes the consumption of electricity high.

Some studies observe a linear relationship, some reveal a non-linear relationship and others found no significant link between age and electricity consumption. Salari and Javid (2017) and Krishnamurthy and Kriström (2015) found a significant positive relationship between the age of household head and expenditure on electricity. Jones *et al.* (2015) also posit that electricity expenditure tend to be very high in households in which the responsible economic person is aged roughly between 50 and 65 years. In addition, Yohanis *et al.* (2008) found that households led by persons aged 50 to 65 years consumed the highest amount of electricity while those with heads aged above 65 years consumed less, and argued that this could be attributed to the fact that the former had higher incomes, bigger houses, and a greater number of appliances. In contrast, Kavousian *et al.* (2013) found that households with responsible economic persons older than 55 years and between 19 to 35 years had lower electricity consumption compared to other households. The authors explained that older people tend to be mindful about electricity wastage and also tend to use fewer electrical gadgets whereas household members between 19 and 35 years are more likely to be in fulltime employment and thus spend less time at home (Jones *et al.*, 2015).

2.2.3.3 ***The educational level of the family member:*** The educational level of the family member has influence on electricity consumption. According to Karatasou *et al.* (2018) household electricity consumption decreased significantly as the level of education increased. The family members with higher degree of education consumed less electricity than the family members with low education level. Empirical evidence on the relationship between education and household electricity consumption are varied and inconclusive, from the perspective of demand side management, households headed by educated people could be more committed to electricity conservation due to their awareness about the consequences of higher electricity generation on fossil fuel consumption and environmental pollution According to Taale and Kyeremeh (2019). Generally speaking, the more knowledgeable people become about the environmental effects of high electricity use, the clearer their opinion will become and the stronger their commitment to conserving energy will be.

Households headed by highly educated people may be able to purchase energy-efficient electrical appliances compared to poor households who may depend on sub-standard electrical appliances because of poverty (Gyamfi *et al*., 2018). For instance, Prete *et al.* (2017) advanced that education reduces household expenditure on electricity as educated people tend to have smaller family sizes, which by itself can have massive impact on overall electricity consumption. Meanwhile the energy ladder theory maintains that education plays a key role in the transition towards modern energy services, of which electricity is an integral part. Nonetheless, some studies Bedir *et al.* (2013) have also established that education does not affect household electricity consumption, indicating that the relationship between household electricity consumption and years of education can go either way. In other words, households led by people with low or no formal education may use more electricity due to more time spent at home as a result of unemployment while those headed by educated people may demand less due to exposure to information on electricity conservation practices and adoption of energy-efficient appliances (Bedir *et al.*, 2013).

2.2.3.4 ***Number of households:*** The relationship between the number of households and electricity consumption has been studied by many scholars. The majority of literatures showed that the number of households has a positive impact on electricity consumption. With the increasing number of households, household electricity consumption will also increase. Leahy and Lyons (2015) studied the electricity consumption of single and double people in Ireland. By comparison, they found that a single apartment have less than 19% of the electricity consumption per week. Yohanis *et al*. (2008) studied the relationship between the number of households and electricity consumption in apartments in Northern Ireland. The results showed that the apartment lived with four people or more people are used to consume highest average annual electricity consumption. And there was no obvious difference between houses lived with two people and three people in average annual electricity consumption (Leahy & Lyons, 2015).

Households with a composition of parents and their children (dependent children) have been observed to be more likely to conserve energy than households with just couples or loners who are found to be less willing to adopt energy conservation measures (Wang *et al*.,2016). Family size is related to higher in-home energy consumption and are more likely use more appliances. Household composition size is evidenced to affect energy conservation behaviour (Wang *et al*., 2016). More dependent children in a family lead to the more intense use of electric appliances and consequently more adoption of energy efficiency activities and appliances. Other studies found that household size (couples, loners, and family with children) do not perform consistently in other equations, where for instance households with couples were found to spend more on insulation other than storm windows and doors measure than other households (Mfaume, 2018).

2.2.3.5 ***Gender of household:*** With respect to the effect of gender of household head on electricity expenditure, some studies have found that, compared to male-headed households, female-headed households incure higher cost on electricity due to their higher demand for electricity services whereas others also show that female-headed households consume less electricity compared to male-headed households. Gender of the reference person affects the likeliness of adoption of conservation measures in the household. Studies done give out mixed results on the effect of gender in conservation issues where some researchers found that women care more about energy saving than men (Murtagh *et al*., 2014), while studies found that gender does not influence electricity conservation, Mutua and Kimuyu (2015) in a study to find which gender uses more electricity and cares more on energy conservation, found that women are the largest consumers of electricity mainly due to their primary or full responsibility of home chores such as cooking and ironing clothes. Women were also found to care more on energy conservation, and it was also found that for many who cared more on conservation were the one paying for electricity bills, although in some household electricity bills were paid by the main wage earner who was a man (Murtagh *et al*., 2014). Women were found to have a wider influence in energy use and conservation because despite men‘s awareness on the possibilities of energy saving it is the women who decide what is to be done due to women‘s primary contribution in domestic labour (Murtagh *et al*., 2014). Other studies found gender to be insignificant energy in conservation activities (Wang *et al*., 2016).

Households headed by males are more ordered and disciplined and hence make relatively efficient use of energy in comparison to those headed by females according to Nazer (2016). He also found that households headed by men spend less on electricity compared to those headed by female. Contrarily, a number of studies have also established that female household headship is often associated with more cautiousness about household expenditures and energy consumption than male household headship. Permana *et al.* (2015) observed, from their analysis of residential dwellings in Indonesia, that when the decisions about energy and control of energy consumption in the household were solely made by a woman, energy consumption tended to be the lowest. When wives were the dominant decision makers, energy consumption was reduced by 630MJ, compared to men. According to Alkon *et al.* (2016) living in a household in which the head is a female is associated with lower household energy expenditure. Other studies have also found similar results and suggested that this could be explained by increased awareness about the environmental effects of electricity generation as well as sensitivity to energy cost among females. For instance, Wang (2016) advanced that the significant inverse relationship between female household headship and energy expenditure could result from the fact that women are more motivated than men to engage in energy conservation behaviours both to reduce expenditure and pollution.

Also, Carlsson-Kanyama and Linden (2017) established that men consumed between 14 and 21 percent more of electricity than women. In their view, men tend to have more disposable income, spend more time engaged in leisure pursuits and use more appliances than women. Similarly, Rahut *et al.* (2016) established that households headed by females spent more on energy compared to those with male heads, thus contrasting the widely held notion that female-headed households tend to consume less energy because of their general conserving attitudes. Whereas Seebauer and Wolf (2017) showed that sex of household head does not significantly affect variations in household electricity consumption, a significant positive link has also been established between household electricity consumption and female-male ratio in households.

2.2.4. Attitude of residents on electricity consumption

Attitude is the household's degree of awareness in performing conservation behaviour depending on preference and information of the people towards conservation (Wang *et al.*, 2016). Evidence from the literature suggests that positive attitude encourage motivation and adoption of energy efficiency measures. Environmental caring attitude of the household and perception on their contribution to the problem can drive them into conservation activities (Murtagh *et al*., 2014). Positive environmental attitude encourages the acceptance and practice of conservation activities, and the perceived greater problem seriousness foster efficiency strategies support (Wang *et al*., 2016). Findings indicate that a positive attitude towards the environment hints the adoption of energy conservation activities; although it is argued that energy conscious attitude is not always positively related to energy conservation behaviour. This is the fact because it may lead to good intentions but things such as lack of knowledge on energy conservation, the effect of behavioural change and institutional factors may hinder the good intentions to be realized. Households which had pro-environmental attitude and energy awareness explained the reason to why they did not change their behaviour towards conservation activities, positioning energy conservation possible if there were financial factors that force behaviour change, therefore, suggests an extrinsic motivation for behavioural change (Murtagh *et al*., 2014).

Attitude can be influenced by many factors, including family size, income, and education. To change consumer behaviour, there must be an understanding of the various factors that are important to the behaviour requiring change (UKEssays, 2018). Understanding what consumers know and what governs their choices is vital. Stern (2000) described four causal variables that influence behaviour which were attitudinal factors, contextual factors, personal capabilities, and habits or routines. Attitudinal factors are the first causal variable, and include general environmental and non-environmental predisposition and attributes, behaviour specific norms and beliefs, and perceived costs and benefits of action. Contextual factors are the second causal variable, and include laws and regulations, supportive policies, social norms and expectations, material costs and rewards, available technology and advertising.

These variables are found in the social, economic, and physical environment, with which energy consumers act and can be called external factors which also is the perception of the contextual factors that has the influence on the behaviour (Li *et al*., 2019). Personal capabilities are the third causal variable, and include financial resources, behaviour specific knowledge and skills, social status, and literacy. Consumer demographics can indicate personal capabilities (Liu *et al*., 2022) and are often used in segmentation for targeted behaviour interventions. The final causal variable is habit or routine. This is an important causal variable because residential electricity use is a behaviour which is regularly repeated and therefore difficult to change.

Some of the attitudes of residential households towards energy consumption and management include: dominant use of incandescent light bulbs (Yellow Bulbs), wanting to own private water boreholes, commercial activities in residential areas simultaneous use of multiple appliances in the house, leaving appliances on when not in use, the use of heating equipment for cooking, multiple use of inefficient heating equipment, purchase of second hand appliances, setting appliances on standby mode, leaving sockets on, leaving security bulbs on during the day, leaving electric stove on even when water is already boiling, washing clothes that are not really dirty because of availability of washing machine and allowing water tank to overflow while pumping before putting off the Pumping machine.

2.2.5 Electrical appliances used in residential households

Generally, households electrical appliance include the following: pressing iron, hotplate/electric cooker, bread toaster, fridge, tube television, radio, DVD player, space satellite decoder, standing fan, ceiling fan, incandescent lighting bulbs, air conditioner, pumping machine, computer system, telephones/ handsets, water heater, electric kettle, microwave, deep freezer, stabilizer, electric blender, juicer, grinding machine, electric bell, rechargeable lamps, washing machine, CCTV, vacuum cleaner, hair clippers.

The electricity consumption of a household can be affected by the electrical energy consumed by each appliance and the amount of time each appliance is in use. According to Chou and Truong (2019) there are four categories of appliances based on their pattern of use: Continuous appliances; Standby appliances; Cold appliances; and Active appliances. Continuous appliances, such as clocks and burglar alarms, draw a continuous constant amount of power. Standby appliances, in particular consumer electronic equipment such as televisions and set-top boxes, have three basic modes of operation: in use; on standby; or switched off. Standby use occurs when an appliance is not in use but is still consuming power (Cogan *et al.*, 2016). Appliances can be on standby even when they appear to be switched off and the only certain way to prevent them drawing power is to disconnect their power supply for example, Television and Air conditioner. Cold appliances, such as fridges and freezers, are in continuous use however they do not draw a constant amount of power. Instead their power consumption cycles between zero and a set power level which is under thermostatic control. Active appliances are those which are actively switched on or off by the householders and are clearly either in use or not in use. Active appliances have no standby mode and when switched off their power consumption is zero. Examples of active appliances include lights, kettles, pumping machines ceiling fan and electric showers (Chou & Truong 2019).

2.2.6 Awareness of electrical energy users in residential households

Awareness level affects the electrical energy consumption behaviour of households according to Kang *et al.* (2012). From a survey to measure the effect of awareness on energy consumption, as carried out by Kang *et al*. (2012) the reports states that "the first test was conducted, when submitting the survey, the respondents were provided with information on energy conservation and encouraged to inculcate energy-saving practices." A month after the first test, the second test was performed with the same respondents, and the result shows that they were motivated to perform responsible actions toward the environment when they have sufficient knowledge about it and other relevant issues.

Awareness of electrical energy conservation and efficiency is an all-important element of electrical energy management practices, as lack of awareness may be the barrier for electrical energy conservation (Malik & Ayop., 2020). Awareness helps to change attitudes, thus encouraging users to seek out ways to save energy and also changes behaviours, making sure that energy users take energy-saving actions and continue to use and maintain energy saving equipment after it has been installed. Without the knowledge by the consumers on electrical energy management practices, it will be difficult to provide electricity users with better electrical energy conservation programmes. Awareness of electrical energy conservation and efficiency is an essential ingredient of electrical energy management practices, as lack of awareness is the main barrier to electrical energy conservation (Ting *et al*., 2010). Information diffusion is an effective communicative ways of activating electrical energy conserving behaviour. Awareness is the extremely important foundation for success in electrical energy management practices.

Awareness helps in changing attitudes of people, thereby encouraging users of electricity to look out for ways to save electrical energy and also help in positive behavioural changes towards electrical energy (Saba *et al.*, 2016a). It ensures that the users of energy take action on electrical energy saving and habits to keep and continue to maintain electrical energy saving appliances/equipment when being installed. It is certain that the first step towards behavioural change is raising awareness, as awareness is the seed of tomorrow change without which there will be no accurate action to conserve energy (Kano, 2013). Lack of awareness or knowledge is always a barrier to energy conservation and efficiency. People will not be able to take steps to conserve energy if they are not properly informed on ways energy can be conserved and the importance of conserving energy. Yen and Wai (2010) observed that employees or staff awareness on electrical energy conservation plays a crucial role in reducing utility bills and is a solution to energy savings.

There are several ways which information can be used to change resident's behaviour toward the use of electrical energy, such as public enlightenment campaign on television and radio. According to Saba *et al.* (2016b) the enclosure of pamphlets that carry information on electrical energy conservation on utility bills, and the use of appliance carrying electrical energy-consumption labels can help in creating awareness on electrical energy management. The reason for information dissemination is to increase the resident's knowledge of electrical energy conservation. Electrical energy savings worth several billions of Naira may be realized through public enlightenment campaigns on electrical energy conservation. Awareness will certainly help the consumers to be aware of the financial and environmental impact of wasteful energy practices (Nwofe, 2014).

Electrical energy management practice awareness among consumers is very essential. Building can be well designed and equipped with super green technology features, but if the users of that structure, lack awareness of energy management, the building itself would not operate efficiently and energy will be wasted (Nwofe, 2014). Awareness is the first and a reliable step among other electrical energy conservation techniques (Saba *et al.*, 2016a). Some households' daily practices that shows the level of awareness of residential households in energy management include: Switching off the lights when not in use to save energy, removing lamps when lighting level is high to save energy, regular usage of natural day lighting helps in energy saving, regulating the light to illumination level needed using dimmer saves energy, usage of task lighting saves electricity, lowering light fixtures saves energy, utilization of minimum wattage lamp to provide required light saves energy, replacing incandescent bulb with more efficient bulb saves energy, over loading refrigerator waste energy, closing of doors and windows while A.C is on save energy, switching off the A.C. when not in use to save energy, ironing of many cloths at once, the use of split A.Cs instead of window types to save energy, ensuring seal of oven door is well tight, avoiding frequent opening of refrigerator, regular cleaning of cooker plate, pre-heating of oven for long time will waste energy, switching off refrigerator while nothing is inside to save energy and covering of all food stored in the refrigerator to save energy.

2.2.7. Barriers to electricity demand management

The barriers to effective electricity demand management include, Social system barriers of entrenched social practices, common conventions and existing relations and infrastructures, economic market failure barriers of a lack of information on the risks and benefits of alternative solutions, psychological barriers of feelings of incapacity to make a difference, information overload and a lack of direct feedback. In addition, importation of used appliances, insufficient research materials on energy efficiency, inefficient metering system, low electricity pricing, proliferation of inefficient equipment, desire to minimize cost, low income, unwillingness to practice energy efficiency and the use of faulty appliances. Listed below are other barriers of household electrical energy management.

2.2.7.1 ***Low level of awareness:*** The lack of or limited awareness of the potential of energy efficiency is likely the most important obstacle to wide-scale adoption of energy efficiency measures and technologies in the country generally, and particularly in the buildings sector (Akinbami & Lawal, 2010). This is a by-product of two major issues. One is inadequate information infrastructure to raise the level of awareness of the potential of energy efficiency (including costs and benefits) as well as the available technologies and proven practices. The other issue is a lack of an overall energy demand management policy. If there were an energy demand management policy, this would probably have necessitated the need to develop a databank on the proven measures and technologies that promote rational energy utilization which would be available to the public for effective implementation of the policy (Akinbami & Lawal, 2010).

2.2.7.2 ***Lack of incentives and motivation*****:** Even when there is a desire to adopt energy efficiency measures, the structure of the electric energy supply may be a bottleneck. Due to an unreliable supply of electricity in Nigeria, the motivation to adopt any conservation measure or technology is limited. In addition, a general lack of incentives, such as tax rebate or low customs and excise duties on imports of improved energy efficient technologies, hinders both the importers and consumers (Saba *et al.,* 2016b).

2.2.7.3 ***Inappropriate energy pricing*****:** Pricing is an important tool to promote efficient use of energy. However, the energy pricing regime in Nigeria is still perceived to be below the marginal opportunity cost (MOC), a result of the government monopoly of the electricity sector and the use of energy supply solely as a social service (provision of energy far below production cost through government subsidies) in order to achieve political objectives. Successive governments have upheld the culture of energy subsidies in the country (Akinbami & Lawal, 2010). Energy price inflation is a vital factor as households have shown a significant relationship between price and conservation behaviour where with higher energy prices people tend to conserve more (Mutua & Kimuyu, 2015). Many households are interested in cost minimization which is a fundamental decision-making tool when purchasing and operating different electric appliances and consuming electricity by considering recurrent costs (Gerarden *et al*., 2015). Although energy price inflation is expected to encourage energy conservation behaviour but this is not always the case, some studies have found that some households ignore the purchase of energy efficient appliances because they can be more expensive at the time of purchasing, forgetting that they are less-expensive when in use (Wang *et al*., 2016).

2.2.7.4 ***Policy and regulations*:** Pricing and regulations which includes tax credits and subsidy influence household conservation decision and behaviour. For instance the adoption of subsidy policy for efficient appliances in China affects the household's purchasing decision where many people opt into purchasing energy efficient appliances (Wei *et al*., 2016), and may be used to remove or decrease inefficient electrical appliances from the market (Gerarden *et al*., 2015). Energy efficiency of some vulnerable and poor households has been improved by favourable government policies through programs that target such consumers (Hamilton *et al*., 2016). For instance, the three-tiered residential pricing rate structure was made to be followed by residential consumers wherein Zhejiang province the price was set at 0.538 RMB if the household consumes less than 2760 kWh per year (Wei *et al*., 2016).

Policies to increase awareness to the public such as the intervention to increase the level of training that are related to conservation activities are of vital importance (Mutua & Kimuyu, 2015). Since awareness on conservation measures increases the household's adoption probability. Some studies found that policies can also negatively affect energy conservation behaviour when the subsidy policies lead to low energy prices because it discourages efficient use of such resources (Wei *et al*., 2016). Policies and regulations so far have provided a fruitful contribution to energy conservation although there are challenges such as the challenge posed by inattentive people who exhibit reluctance to be guided by policies and regulations (Kažukauskas & Broberg, 2016).

2.2.7.5 ***Inadequate skilled manpower and technical know-how*****:** There is a limited and inadequate human resource capacity to carry out energy audit studies and projects in general, and to design energy efficient buildings in particular, in Nigeria. Energy engineers are rather few in the country (Akinbami & Lawal, 2010). Coupled with this is the fact that few professionals in the building sector have training on energy-efficient building designs. These may have been borne out of a sense of non-need for such skilled manpower due to a long persistent culture of inappropriate energy pricing in the country. However, the era of low energy pricing is gradually fading away. Provision of the required skilled manpower entails specialized training which most Nigerian tertiary institutions are not providing presently. Consequently, it is necessary to review the educational curricula in tertiary institutions to close this gap. There is a general dearth of skilled manpower and adequate technical know-how on how to carry out technical energy conservation measures in the country (Akinbami & Lawal, 2010).

Another barrier is the cost of efficient energy appliances**.** The desire to minimize initial cost force many consumers to purchase cheap and inefficient appliances. For instance, the cost of energy saving bulbs in the Nigerian market is about N1200 compared to an incandescent bulb which cost about N100. Many consumers will prefer to go for the cheaper ones not minding the long-term benefit of using efficiency bulbs (Oyedepo, 2012). Low income is also a barrier to energy conservation**.** A new report by The World Poverty Clock shows Nigeria has overtaken India as the country with the most extreme poor people in the world (Kazeem, 2018). Many are not able to afford the cost of efficiency appliances which are sometime more expensive than the less efficient ones.

2.2.8 Ways of reducing electrical energy consumption in residential households

Development of Adequate Database, Research, Development, Demonstration and Dissemination (R,D,D and D),Awareness Campaign/Outreach Program, Legislative and Regulatory Support Measures are ways to reduce electrical energy consumption in households (Akinbami & Lawal, 2010).

2.2.8.1 ***Development of adequate database:*** Energy efficiency improvement programs aim to reduce unnecessary energy costs through identification and elimination of inefficiencies (Akinbami & Lawal, 2010). This requires the collection and proper analysis of relevant data, which can help to indicate whether or not there is need for improvement in energy use. For the data acquisition activity, the building sector should be compartmentalized into various sub-sectors in which the electricity use can be adequately monitored and analysed. Such sub-sectors may include the building envelope, which could be further compartmentalized into lighting system, cooling system and building materials. The databank should also include other energy conscious building parameters and energy efficient devices and measures.

2.2.8.2 ***Research, development, demonstration and dissemination (R, D, D and D)*****:** Funding of research is needed in tertiary institutions and appropriate research institutes in order to develop building designs that allow for a longer period of use of passive energy than obtained presently. The research activity should also be extended to building materials for physiological comfort, ceiling and roofing materials that will prevent or minimize heat gains in the different parts of the country. Of course the R,D,D and D should also include external designs that provide sufficient shade, reduce solar radiation reflections into the building and thereby reduce demand for active energy services in the building. These may include shade trees and green facades (Akinbami & Lawal, 2010).

2.2.8.3 ***Awareness campaign/outreach programme*****:** There is the need for the electric utility, federal ministries and agencies involved in energy and housing matters and the building private sector to reach out to the public, including: investors, professionals, planners, and decision makers through various campaign programs such as seminars, conferences, workshops, radio/television talks and programs. The campaign should be taken to the grassroots in order to educate every stakeholder in the buildings sector on the needs for, benefits of, and options for energy conservation in the sector (Saba *et al.,* 2016a).

2.2.8.4 ***Legislative and regulatory support measures*****:** To promote energy conservation in the country, there is need for adequate legislative and regulatory backing. This will involve the institutionalization of standards and codes, as well as incentives and motivation that will enhance the national promotion of energy conservation. For the buildings sector, various professionals and all other stakeholders will have to be involved in the legislative and regulatory processes for meaningful and functional legislative measures and regulatory practices (Akinbami & Lawal, 2010).

Other ways of reducing energy consumption in residential households are; by using energy saving bulbs, switching off appliances not in use, putting security bulbs off during the day, switching off sockets when not in use, using energy efficient appliances, replacing old appliances with efficient ones, use of natural light during the day, avoid frequent opening of the refrigerator, avoid frequent opening of the oven, repairing inefficient appliances using appropriate components, putting pumping machines off as soon as tank is full, by putting electric stove off once water is boiled, putting off AC instead of leaving it on standby mode, general use of prepaid meter, increasing the cost of electricity, the government promoting the use of energy efficient appliances.

2.3. Review of Related Empirical Studies

Saba *et al*. (2016a) conducted a study on level of electrical energy management practice awareness among residents in Niger state, Nigeria. The study investigated the level of electrical energy management practices awareness among residents in Niger State, Nigeria while the objectives of this study were to determine the level of electrical energy management practices awareness in the use of lighting system among residents in Niger State, Nigeria, the level of electrical energy management practices awareness in the use of cooling and heating systems among residents in Niger State, Nigeria, and the level of electrical energy management practices awareness in the use of electric motors among residents in Niger State, Nigeria. The study adopted Cross Sectional Survey Research Design.

The population of the study was made up of 191,416 heads of households in residential buildings that are connected to the distribution network in 25 Local Government areas of Niger State. The sample for the study consisted of 1,290 heads of households in residential buildings, drawn through Multistage Sampling Techniques. Three research questions were formulated to guide the study. The instrument used for data collection was a structured questionnaire. Statistical Package for Social Sciences (SPSS version 19) was used for data analysis. Mean and Standard Deviation were used to answer the research questions. The finding of the study showed that, residents in Niger State were somehow aware of electrical energy management practices in lighting, cooling and heating systems and the use of electric motors. It was therefore recommended amongst others that Electricity Management Board in collaboration with Energy Commission of Nigeria and Center for Energy Efficiency and Conservation should jointly organize public enlightenment campaigns to promote awareness on electrical energy management practices in lighting.

The study reviewed is related to the present study in terms of resident's awareness on electricity management and population sample. The study differs from the present study in terms of research design, geographical area and population. The study focused on the level of electrical energy management practices awareness among residents in Niger State, while the present study discussed the perspective of electrical energy consumers on effective electricity demand management. The study focused solely on awareness of consumers on energy management while the present study captured awareness and other variables like attitude of the consumer and the type of electrical devices used by the household consumers.

Saba *et al.* (2016b) conducted a study on technology approach to electrical energy management in small and medium enterprises in Niger state, Nigeria**.** The study investigated technology approach to electrical energy management in small and medium enterprises (SMEs) in Niger State, Nigeria. The objectives of the study were to investigate the extent of usage of technological devices for improving electrical energy efficiency in SMEs in Niger State and the maintenance practices of electrical equipment/appliances as adopted for the improvement of electrical energy efficiency in SMEs in Niger State. The design of the study was a cross sectional survey. The target population of the study was made up of 574 technical staff (365 private health centres/hospitals, 138 hotels/guest houses, and 71 woodwork industries) that are connected to the distribution network in 25 Local Governments in Niger State. The sample for the study consisted of 288 respondents drawn through Multistage Sampling Techniques. Two research questions and one hypothesis were formulated to guide the study. The instrument used for data collection was a structured questionnaire. Statistical Package for Social Sciences (SPSS version 19) was used for data analysis. Mean and Standard Deviation were used to answer the research questions, while z-test was used to test the hypothesis.

The finding of the study showed that, SMEs in Niger State used electrical energy efficiently when utilising washing machines and split air conditioning. However, they used fluorescent lamp with electronic ballast, dimmer switches and occupancy sensors at a medium extent, while, occupancy sensors to cut off air-conditioner in unoccupied room and Automatic day light dimming were used at low extent. Electrical equipment/appliances maintenance practices that were rarely adopted are; regular checking of power factor and correction of power factor. Based on the findings of this study, the following recommendations were made: Technical staff of SMEs should cultivate positive maintenance culture towards electrical equipment, appliances and devices and SMEs owners should invest more on efficient technology devices in other to reduce the rate of electrical energy usage in SMEs.

The study reviewed is related to the present study in that the both studies focused on energy management techniques. The studies identified energy management techniques that can be adopted for energy efficiency. The study differ from the present study in terms of, research design, geographical area and population. The study focused on technology approach to electrical energy management in small and medium enterprises (SMEs) in Niger State, Nigeria, while the present study discussed the perspective of electrical energy consumers on effective electricity demand management. The study focused solely on non-residential electrical energy consumers while the present study focuses on residential energy consumers.

Akinola *et al*. (2017) conducted a research on c. The study compared the residential household energy consumption pattern of densely and sparsely populated dwellers on the basis of income level classification with a view to ensuring functional distribution of energy. This study identified and evaluated the various households' energy choices, quantities and costs of domestic energy consumption and provided a database for documentation. Primary data were collected through a well-structured questionnaires administered on households.

Direct and personal observations were used to corroborate same information obtained from the questionnaires used to present more accurate information in the paper. Data obtained were analysed using both independent and paired t-tests conducted at 5 and 10% levels of significance in the annual energy consumption between the low and high income earners in the visited areas respectively. The research revealed that, the densely populated area remained the larger consumer of energy content of 827,411.20 MJ (63%) against the sparsely populated areas with 486,267.60 MJ (37%), while on the basis of households' income level; the energy consumed by the low income earners (790,719.30 MJ) is significantly higher than the high income earners (522,959.49MJ). The study established that, fuel wood was the poor man's energy source (6.5%) as well as charcoal (11.2%) majorly used in sparsely populated areas with high demand. Kerosene consumption

(29.6%) was positively and significantly influenced by income and population in both locations while, Liquefied petroleum gas (LPG) (44.9%) and electricity (7.8%) were used mainly in the densely populated areas. However, the results implied that, there was a positive link between income and choice of energy consumption by households that showed the low income earners consumed more energy than the high income earners due to their cooking frequency and unit energy purchase index.

The study reviewed is related to this present study in terms of income as a factor that influences energy consumption and the target population of the study which were household energy users. The study differs from the present study in terms of geographical area. The study focused on residential household energy consumption in Ekiti State Nigeria, while the present study analysed the perspective of electrical energy consumers on effective electricity demand management in Kogi State. The study also defers from the current study in terms of research design adopted, while the study used survey research design, the current study adopted sequential explanatory design. Also, the study accessed energy consumption in households with electrical energy and heat energy, while the present study only focused on electrical energy.

Danlami (2017) conducted a research on determinants of household electricity consumption in Bauchi state, Nigeria. This study assessed the factors that influenced the amount of household consumption of electricity in Bauchi state, Nigeria. For the purpose of data collection for this study, a total of 750 questionnaires were distributed instead of the pre-determined sample number of 384 households. This was to avoid a problem of non response rate. Finally about 548 filled questionnaires were returned back, which is 70% of the total number of the issued questionnaires. OLS regression model was estimated to examine the impact of the household's socio-economic and demographic characteristics on their electricity use and consumption.

The result indicated that level of education of the household heads living in the urban areas of Bauchi State, price of firewood and number of devices at home, have positive significant impact on the household use of electricity. On the other hand, marital status was found to have a negative impact on the electricity expenditure, the households that are headed by a married person have less consumption on electricity than otherwise. However, the factors that were found to have insignificant relationship with the household electricity consumption are; gender, household size, number of rooms and home size. Therefore, the study recommended policies that ensure increase in the level of education and turning some rural areas into urban areas will encourage adoption and use of electricity as a main source of household energy thereby reducing the rate of using traditional biomass energy. The study recommended policies that ensure increase in the level of education and turning some rural areas into urban areas will encourage adoption and use of electricity as a main source of household energy thereby reducing the rate of using traditional biomass energy.

The study reviewed is related to this present study in terms of the factors that influence household energy consumption such as level of education, number of household and income. The study differs from the present study in terms of research design. The study adopted the use of questionnaire alone while the current study used both questionnaire and interview. The geographical area and population also differed in the current study. The study focused determinants of household electricity consumption in Bauchi state, Nigeria, while the present study analysed the perspective of electrical energy consumers on effective electricity demand management. The study did not cover energy conservation but only focused on the determinants of energy consumption while the current study analysed the determinants of electrical energy consumption and also ways of reducing consumption with the aim of improving energy conservation.

Mfaume (2018) conducted a research on Household Perception towards Electricity Conservation in Urban Tanzania. It was seen from the study that lack of awareness on the necessity and practices of electricity conservation caused electricity to be wasted every day in the households. The study investigated the households' perception towards electricity conservation in urban Tanzania. To achieve this purpose, the extent to which the households were aware on electricity conservation was investigated, and the extent of household perception towards electricity conservation activities was examined. Also, factors that affect household perception towards electricity conservation were also examined.

This study employed the convergent parallel mixed method design. Cross-sectional data from Morogoro and Dar-es-salaam regions that included three municipal districts (Morogoro, Kinondoni, and Ilala) was used, which was collected by the use of questionnaires on 231 households. Data was analysed by adopting the data transformation design, utilizing the Microsoft Excel and SPSS for descriptive analysis, and the Probit regression to determine factors that influence household perception towards electricity conservation. Results showed that 58.4% of the households were aware and 89.4% had positive perception towards electricity conservation activities. The study also revealed the influencing factors towards electricity conservation. The positive influencing factors to household perception towards electricity conservation were land ownership, attitude, convenience, dwelling type, educational attainment and spill-over effect. Negative factors that significantly influence electricity conservation activities included family size, tenancy, occupation, electricity price inflation, and policy and regulations. The study recommended that policies that compliment household access to vital information about their everyday electricity usage, knowledge about electricity efficient appliances, and programmes that target social groups especially women are to be commenced. This goes in along with policies that will help in efficient appliances identification such as the efficient appliance labelling policies.

The study reviewed is related to this present study in terms of awareness on electricity conservation. The study differs from the present study in terms of geographical area and population. The study focused on household perception towards electricity conservation in urban Tanzania, while the present study analysed and discussed the perspective of electrical energy consumers for effective electricity demand management. The study also defers from the current study in terms of research design, the research design adopted for this study was convergent parallel mixed method design while the present study employed the sequential explanatory research design.

2.4 Summary of Literature Review

Energy management is aimed at reducing the amount of energy used to the barest minimum. This can be achieved through influencing the attitude of energy users, with a positive attitude, energy conservation can be achieved. Awareness or consumer education is also an important step in ensuring energy management. With the right information on the importance of energy management, and how it can be practiced, energy users will be able to conserve energy easily.

Literature on theoretical framework and conceptual framework of the study centred on theory of planned behaviour and information processing theory. A lot of related empirical studies were reviewed which guided the researcher in selecting the appropriate research design, the method of data analysis for this study and the approach to report the findings of the study. Some of the related empirical studies adopted descriptive survey research design and one adopted mixed method research design. Specifically, using questionnaire and interview for data collection. The review of related literature revealed that studies have been conducted on energy management. However, only few studies have analysed the perspective of residential electrical energy consumers on effective demand management, but not in Kogi State, in the context of the attitudes and awareness level of households on electricity conservation as they are influenced by income, age, educational qualification, number in household and gender. Much studies have also not been conducted on how to estimate the types of appliances utilized by households and their capacities, with the aim of estimating their daily energy usage.

Consequently, this study sought to fill this gap by analysing the effect of income, age, educational qualification, number in households and gender on the attitude, types of appliances utilised and awareness of residential electricity consumers toward electricity demand management in Kogi State Nigeria. The study also aims to expand literatures on the perspective of residents of Kogi State on electricity demand management. The consequence of this study is that if the right practices are adopted by residential electricity consumers, it will ensure the reduction of electricity wastages.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Design

In carrying out this study, a mixed - method research design was used. Specifically, the study adopted sequential explanatory research design. According to Muhaimin *et al* (2019) mix method study, sequential explanatory design incorporates quantitative data, supported by qualitative data, to accomplish the goals of the study. One of the importance of mixed-method research is that results can be shown (quantitatively) and explained why it was obtained (qualitatively). The sequential explanatory research design was adopted in order to support and corroborate the quantitative data.

Quantitative data was obtained from the use of questionnaire to seek information from household members while qualitative data was obtained from interviews with members of household on residential consumers' perspective for effective electricity demand management in Kogi State. The households were interviewed and their responses were used to support the questionnaire data since the questionnaire is the main source of primary data.

3.2 Area of the Study

The study was carried out in Kogi State, which has a total land area of 27,747 Km^2 (FRN, 2020). Kogi lies approximately along latitude 7^0 N and 6^0 E and is bordered by the states of Nassarawa to the northeast; Benue to the east; Enugu, Anambra, and Delta to the south; Edo, Ondo, Ekiti, and Kwara to the west; and Niger to the north. Abuja Federal Capital Territory also borders Kogi to the north.

The area was of interest to the researcher because of the inadequate electricity supply in the state. Kogi State, being one of the four states serviced by Abuja Electricity Distribution Company, experience insufficient electricity supply.

3.3 Population of the Study

The target population for this study comprised all 136,105 households serviced by Abuja Electricity Distribution Company (AEDC) in Kogi State. According to AEDC (2021) there are 136,105 households serviced by the company in four service areas in Kogi State, given by 34,000 households in Lokoja service area, 35,191 in Kabba service area and Kogi west, 32,152 in Okene service area and Kogi central and 34,762 in Idah service area and Kogi East. There are several building types in Kogi State due to the different social class of people who live there. Some of the buildings are no longer connected to power source due to disconnection by the power providers while some are still connected. The choice of heads of households was so that they can answer the questions as they were expected to have adequate knowledge of their household’s electricity usage. Experts in electrical technology and engineering were interviewed to propose electrical energy savings measures needed in households in Kogi State. Table 3.1 and 3.2 shows the distribution of population across the service areas in Kogi State.

Table 3.1

Population distribution by Service Areas in Kogi State.

S/N	Service Area	Population
1	Idah	34,762
2	Lokoja	34,000
3	Kabba	35,191
4	Okene	32,152
Total		**136,105**

(AEDC, 2021).

Table 3.2:

Population distribution of Electrical/Electronics Lecturers in Kogi State

S/N	Institution	Population
1	Federal Polytechnic Idah	8
2	Kogi State Polytechnic Lokoja	15
Total		**23**

(Seep Appendix A. Page 118)

3.4 Sample and Sampling Techniques

The sample size for the population was 441. The sample was drawn through multistage sampling technique. The sample distribution were 106 households in Lokoja service area, 105 households in Okene service area, 115 households from Kabba service area and 115 households from Idah service area as they responded to the questionnaire. 60 household heads were also interviewed and their responses were used to support the questionnaire responses. The interview sample were 15 household heads from Lokoja service area, 15 household heads from Idah service area, 15 from Kabba service area and 15 from Okene service area. 15 experts were interviewed to propose electrical energy saving measures for residential houses in Kogi State. Table 3.3, 3.4 and 3.5 show the samples for the research.

Table 3.3

Sample Distribution Across Service Areas in Kogi State.

S/N	Service Area	Sample Size
1	Idah	115
2	Lokoja	106
3	Kabba	115
4	Okene	105
Total		**441**

Table 3.4

Sample distribution for Interview of Electrical Experts in Kogi State.

S/N	Institution	Sample
1	Federal Polytechnic Idah	6
2	Kogi State Polytechnic Lokoja	9
Total		**15**

Table 3.5

Sample Distribution for Households Interviewed Across Service Areas in Kogi State.

S/N	Service Area	Sample Size
1	Idah	15
2	Lokoja	15
3	Kabba	15
4	Okene	15
Total		**60**

3.5. Instrument for Data Collection

The instrument for data collection was a questionnaire constructed by the researcher titled: Residential Consumer's Perspective for Effective Electricity Demand Management Questionnaire (RCPEEDMQ) and interview. The RCPEEDMQ was divided into two sections, A and B. Section A was used to elicit information on the personal data of the respondents. Section B contained 78 questionnaire items that was further divided into four sub-sections in line with the research questions. The sub-sections elicited responses regarding: 1. the attitude of households towards electricity consumption, 2. the electrical appliances used by households that lead to electricity consumption, 3. the electrical energy savings practices utilized by households and 4 the awareness level of households on electricity conservation. Research questions 1,2,3 and 4 used both questionnaire and interview. The questionnaire had a four-point rating scale of Strongly Agree (SA =4), Agree (A=3), Disagree (D=2) and Strongly Disagree (SD=1) was used for research question 1 while Always (A=4), Occasionally (OC=3), Rarely (R=2) and Never (N=1) was used for research question 3 and Highly Aware (HA=4), Aware (A=3), Slightly Aware (SA=2) and Not Aware (NA=1) for Research question 4. Research question 2 involved calculation of daily energy usage by households through collection of data which included: appliances utilized, number of individual appliances, power of each appliance, and average number of hours each appliances were used per day. Daily energy usage (watt hour) is the product of capacity of appliance (watt), number of appliance and time of usage (hour). Research question 5 was done through SPSS, by analysing of the relationship between the determinants as they affect electricity consumption. Research question 6 involved the use of interview alone. The interview elicited responses from the respondents on ways through which residents of Kogi State can conserve energy.

3.6 Validation of the Instrument

The research instrument was validated by three experts. An odd number of experts were chosen to give no room for deadlocks in suggestions offered to the researcher about the instrument by the experts. The three experts who are Electrical/Electronic lecturers from Industrial and Technology Education department, Federal University of Technology Minna. A letter was written requesting for the validation of the instrument. The validates examined the adequacy of content, logical sequence and suitability of the technical terms that were used, as well as made corrections in the grammatical expressions where necessary after which they signed the validation certificate that was attached. Their corrections and suggestions were incorporated in the final draft of the instrument. There were some grammatical corrections made during validation, also, some of the items were found unsuitable for the work. The rating scale was changed from a 5 point scale to 4 point rating scale. A total of 15 items were added to the questionnaire and interview while 12 were removed.

3.7 Reliability of the Instrument

The face validated instruments were pilot tested using 30 households in Niger State. The choice of Niger State was informed by the fact that the State is close but not part of the area of the study. The coefficient of internal consistency of the instrument was calculated using Cronbach's Alpha. Statistical Package for Social Sciences SPSS version 23 was used to compute the reliability coefficient of each three clusters from three research questions. The reliability coefficients obtained for all the sections were as follows: Cluster A, 0.704; Cluster B, 0.796; and Cluster C, 0.878 (The clusters A, B, and C represent questionnaire items under each research questions) The Cronbach Alpha value for the instrument was 0.793. This result showed that the instrument was reliable and therefore considered appropriate for use.

3.8 Method of Data Collection

The research instrument was administered to the respondents with the help of 16 research assistants, 4 each from Lokoja, Kabba, Okene and Idah. The research assistants were informed of the requirements of the administration of the questionnaire. The research assistants were trained on how to get data through the use of questionnaires and interviews after which they were used for the distribution and retrieval of the questionnaire. The training involved all sixteen assistants and they were taught on how they will carry out the tasks. The research assistants were required to allow the respondents a space of one to two days after distributing the questionnaires, upon the expiration; they retrieved and collated the questionnaires while the researcher retrieved them from the research assistants. The researcher personally carried out the interviews for the experts since the people interviewed were not many. The researcher visited Federal Polytechnic Idah and Kogi State Polytechnic Itakpe to conduct the interview on the electrical lecturers. 60 household heads were interviewed in order to get qualitative data to support the use of questionnaire while electrical experts were interviewed to propose electrical energy savings measures needed in households in Kogi State.

3.9 Method of Data Analysis

Data collected from the respondents were analysed using mean, standard deviation, percentage, t-test, ANOVA and regression. Mean and standard deviation were used to answer the research questions 1, and 3, computation of power consumption was used for research question 2 while percentage was used for research question 4, research question 5 was analysed using regression, interview was used to answer research question 6. Thematic analysis was used to analyse the interview. The analysis was done through transcription of the interview contents, after which coding was done in order to get a general perspective of the interviewees. The analysis was concluded by grouping similar themes which were used in the final report. The null hypotheses 5 and 10 were tested at

0.05 level of significance using t-test, Hypotheses 1,2,3,4,6,7,8 and 9 were tested using ANOVA. Due to the need to apply computer to enhance speed and accuracy, all statistical calculations was done using the Statistical Package for the Social Sciences (SPSS) version 23. In order to determine the agreement level of the items of the research questions, the mean ratings of respondents were interpreted using real limits of numbers. Real limits are boundaries located exactly half-way between adjacent categories used to define continuous variables in a research (Foster *et al.*, 2018). The real limits of numbers that was used in this study are shown in Table 3.6.

Table 3.6
Rating Scale

S/N	Scale	Research Question 1	Research Question 3	Research Question 4
1	3.50-4.00	Strongly Agree	Always	Highly Aware
2	2.50-3.49	Agree	Occasionally	Aware
3	1.50-2.49	Disagree	Rarely	Moderately Aware
4	0.50-1.49	Strongly Disagree	Never	Not Aware

(Saba *et al.*, 2016a)

Decisions were made based on the mean score interpreted based on the concept of real lower and upper limits of numbers as shown in Table 3.6. The mean scores were used to ascertain the exact point or location of a response. Standard deviation was used to decide on the closeness or otherwise of the respondents to the mean in their responses. Any item with a standard deviation less than 1.96 indicated that the respondent were not too far from the mean or from one another in their responses and any item equal or above 1.96 indicated that the respondents are too far from the mean. Decisions on the hypotheses were based on comparing the significant value with ($P < .05$) level of significance. Where the significance value was equal or greater than ($P > .05$) level of significance, the hypothesis was upheld, while when the value was less than ($P < .05$) the hypothesis was rejected. Levenes' test of homogeneity of variances was carried out to test the similarities; in view of the fact that one of the assumptions of One-way ANOVA is that the variances of the groups must be similar. If the significant value is greater than 0.05 then there is homogeneity of variances and the assumptions of homogeneity of variances is met. However, if the Levenes' F statistics is significant and less than 0.05 then there were no similar variances and it will be necessary to refer to the test of equality of means table instead of the ANOVA Table. Tukey Honest Significant Difference (HSD) test for multiple comparisons were used where significant mean differences existed in other to locate the group responsible for the rejection of the null hypothesis. The Tukey HSD Post-hoc test is the generally accepted way of carrying out post-hoc test on one-way ANOVA. The Tukey HSD uses a wider interval to compare all pair of differences in a table, $P < 0.05$ levels, to ensure that there is no risk greater than 5% in any of the comparisons are significant when they are not.

CHAPER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Demographic Presentation

The Demographic variables of this research are presented in the Tables 4.1 to 4.5. The tables show the frequency distribution of respondents based on their income, age, educational qualification, number of households, and gender.

Table 4.1
Frequency Distribution Showing Responses of Respondents Based on Their Income.

Income Distribution	Frequency	Percent %
Low Income	178	41.9
Middle Income	223	52.5
High Income	24	5.6
Total	425	100.0

Table 4.1 represent the income distribution of respondents. The table shows that 178 respondents belong to the low income group which represent 41.9% of the entire sample population while 223 respondents belong to the middle income which represent 52.5% of the entire sample population and 24 respondents belong to the high income group which represents 5.6% of the total sample.

The age distribution of the respondents is presented in Table 4.2

Table 4.2
Frequency Table Showing Responses of Respondents Based on Their Age.

Age Distribution	Frequency	Percent %
18-39	206	48.5
40-64	213	50.1
65 Above	6	1.4
Total	425	100.0

Table 4.2 represents the age distribution of respondents. The table shows that 206 respondents belong to the 18-39 age group which represents 48.5% of the entire sample population while 213 respondents belong to the 40-65 age group which represents 50.1% of the entire sample population and 6 respondents belong to the 65 and above group which represents 1.4% of the total sample.

The educational level of the respondents is presented in Table 4.3

Table 4.3
Frequency Distribution Showing Responses of Respondents Based on Their Educational Qualification.

Educational Level Distribution	Frequency	Percent%
Primary/Secondary	47	11.1
ND/NCE	160	37.6
HND/Bachelor's Degree	187	44.0
Postgraduate	31	7.3
Total	425	100.0

Table 4.3 represents the educational qualification distribution of respondents. The table shows that 47 respondents belong to the Primary/Secondary school Certificate group which represents 11.1% of the entire sample population while 160 respondents belong ND/NCE group which represents 37.6% of the entire sample population, 187 respondents belong to the HND/Bachelor Degree group which represents 44% and 31 respondents have Postgraduate Degree which represents 7.3% of the total sample.

The number of households of the respondents is presented in Table 4.4

Table 4.4
Frequency Distribution Showing Responses of Respondents Based on Number of Households.

Number of Household	Frequency %	Percent %
1-5	238	56.0
6-10	175	41.2
11 Above	12	2.8
Total	425	100.0

Table 4.4 represents the distribution of respondents based on number of households. The table shows that 238 respondents are between 1-5 in their households which represents 56.0% of the entire sample population while 175 respondents are between 6-10 in their households which represents 41.2% of the entire sample population, and 12 respondents are 11 and above in their households which represents 2.8% of the total sample.

The gender distribution of the respondents is presented in Table 4.5

Table 4.5
Frequency Table Showing Responses of Respondents Based on Gender

Gender	Frequency	Percent %
Male	215	52
Female	210	48
Total	425	100.0

Table 4.5 represents the distribution of respondents based on gender. The table shows that 215 respondents are Males which represents 50.6% of the entire sample population and 210 respondents are Females which represents 49.4% of the total sample.

4.2 Research Question 1

What are the attitudes of households towards electricity consumption?

The responses of the respondents on their attitude towards electricity consumption are shown is Table 4.6

Table 4.6
Mean Responses of Households on Their Attitude Towards Electricity Consumption.

SN	**Attitudes**	$\bar{X}$	**SD**	**RMK**
1	It is important to practice energy efficiency during all human activities	3.60	.57	SA
2	Saving energy is important to me	3.69	.49	SA
3	When buying a new appliance, energy efficiency is the most important decision-making factor	3.41	.71	A
4	When home, I take actions to conserve energy	3.41	.68	A
5	I am not willing to conserve energy at home if it comes at any cost to my comfort	2.80	.97	A
6	I have a moral obligation to reduce my energy usage	3.02	.88	A
7	Reducing my energy consumption will have a strong, positive impact on my personal finances.	2.94	1.02	A
8	I will switch appliances off than set them on standby mode	3.30	.88	A
9	I am too busy to be concerned with my energy usage	2.44	1.05	D
10	It would be too much of an inconvenience to my lifestyle to reduce my energy usage	2.99	2.76	A
11	There is very little I can do personally to conserve energy in my home	2.93	3.43	A

12	I will rather open my window than use fan or air conditioner during cold weather	2.95	1.05	A
13	I believe I have a voice in helping to impact energy policies	2.93	.96	A
14	Electrical energy efficiency is vital to our national economy	3.21	.90	A
15	There is a culture of energy efficiency in my area	2.70	.98	A
	GRAND MEAN	**3.09**	**1.16**	**A**

KEY: $\bar{X}$ = Mean of Respondents; SD = Standard Deviation of Respondents; SA = Strongly Agree; A = Agree; D = Disagree; RMK -= Remark.

Table 4.6 showed means and standard deviations on the attitude of respondents towards electricity consumption. The respondents mean items 3,4,5,6,7,8,10,11,12,13,14, and 15 are within the range of 2.70 - 3.42 which showed that the respondents tried to keep their consumption at minimum. This implied a positive attitude towards electricity conservation. Similarly, the table showed that the mean response of items 1 and 2 are within the range of 3.61 - 3.70 which showed that respondents strongly agreed that it is important to practice energy efficiency during all human activities. The table however showed that the mean response of item 9 (2.44) disagreed that they are too busy to be bothered about energy conservation. This also hinges towards the earlier assertion that the respondents have a positive attitude towards energy conservation. The grand mean (3.09) of the total responses showed that the respondents showed positive attitude towards energy consumption, and are willing to conserve energy as long as they have the capacity to. The standard deviation for 13 items out of the 15 items are less than 1.96, which in turn mean that the respondents mean scores were not too far from each other and were close to one another in their responses. This adds to the reliability of the mean. The result of the interview is shown in Figure 4.1.

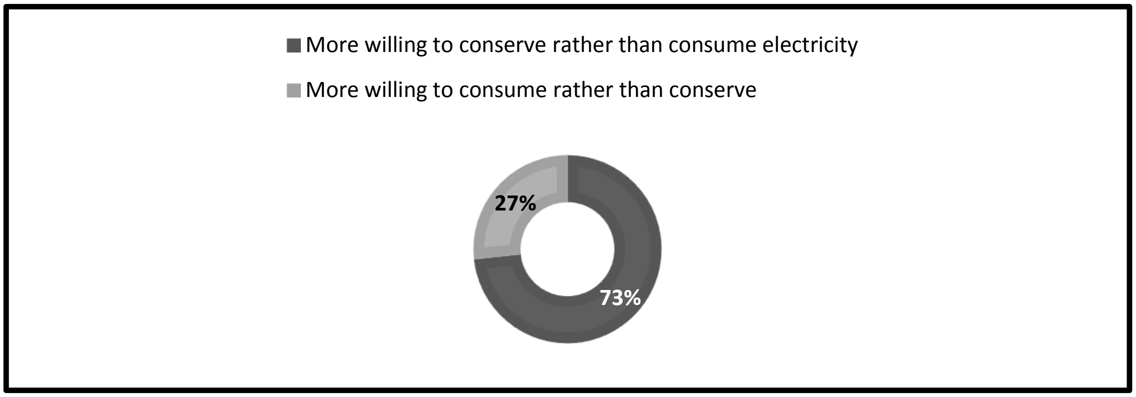

Figure 4.1: Pie Chart Representation of Households' Interview on Their Attitude Towards Electricity Consumption.

The result from the interview showed that 11 out of 15 which represents 73.3% of the respondents that were interviewed on their attitude towards electricity consumption indicated that they are willing to conserve energy even if it comes at any cost. They said saving energy is important because they believe it costs less money to save energy than to waste it since they use prepaid meter. 10 of the respondents (67%) also chose efficiency over cost when buying electrical appliances because of durability, but 4 respondents (26.7%) said they are not concerned with conservation because of the poor electricity supply in their area, "we use it very well whenever we see it". Overall, the interview results is tandem with the questionnaire as 73.3% of the respondents showed positive attitude towards electricity conservation. See interview questions in Appendix B page 120

4.3 Research Question 2

What are the electrical appliances used by households that leads to electricity consumption?

The responses of the respondents on the kind of appliances utilized, capacity of the appliances and the average time they are used daily are shown is Table 4.7

Table 4.7
The Appliances Used By Households and the Daily Energy Consumed By the Appliances

Items	Total Capacity of Appliance (W)	Total Number of Appliances	Time in Hour (h)	Daily Energy Usage (kWh)
Pressing Iron	307200	313	293	90009.6
Hotplate/Electric Cooker	250000	217	355	88750
Bread Toaster	32000	32	36	1152
Fridge	154520	256	1288	199021
Television	47670	561	1650	78655
Radio	8655	201	851	7365.4
DVD player	2282	169	671	1531.2
Space satellite decoder	2600	104	400	1040
Standing fan	31875	457	1919	61168.1
Ceiling fan	20500	281	1133	23226.5
Incandescent Lighting bulbs (Yellow)	35820	1973	2374	85380
Energy saving bulbs	10150	907	1873	19010
Air conditioner	24000	24	72	1728
Pumping machine	118400	88	148	17523.2
Computer system	6856	184	640	4387.8
Telephones/ Hand Sets	5490	809	1743	9569
Water heater	22400	32	40	896
Electric kettle	212400	217	213	45241
Microwave	12400	23	12	148.8
Deep freezer	171200	160	676	115731
Electric blender	30700	89	44.5	1366
Juicer	7200	24	24	173

Grinding machine	31192	17	24	749
Electric bell	576	32	176	101
Rechargeable Lamps	4020	241	649	2609
Washing machine	59200	56	44	2605
CCTV	280	16	56	15.68
Vacuum cleaner	11200	7	4	49
Hair clippers	936	64	28	26
TOTAL	**1,590,530**	**7,554**	**17,436.5**	**859,254.28**

Table 4.7 showed that bulbs are the most used appliances among the residents of Kogi state. It revealed that there were 1973 incandescent bulbs, 907 energy saving bulbs, 809 phones, 561 televisions, 457 standing fans ,and they are the top five most utilized appliances among households in Kogi State. The total capacities of the five most used appliances are 35820W, 10,150W, 5,490W, 47,670W, 31,875W respectively. The least utilized appliances are Vacuum cleaner, CCTV, Electric bell, and Air Conditioner with just 7, 16, 17, and 24 in number respectively, with a power consumption of 11,200W, 280W, 576W and 26,800W. The result of the interview is shown in Figure 4.2

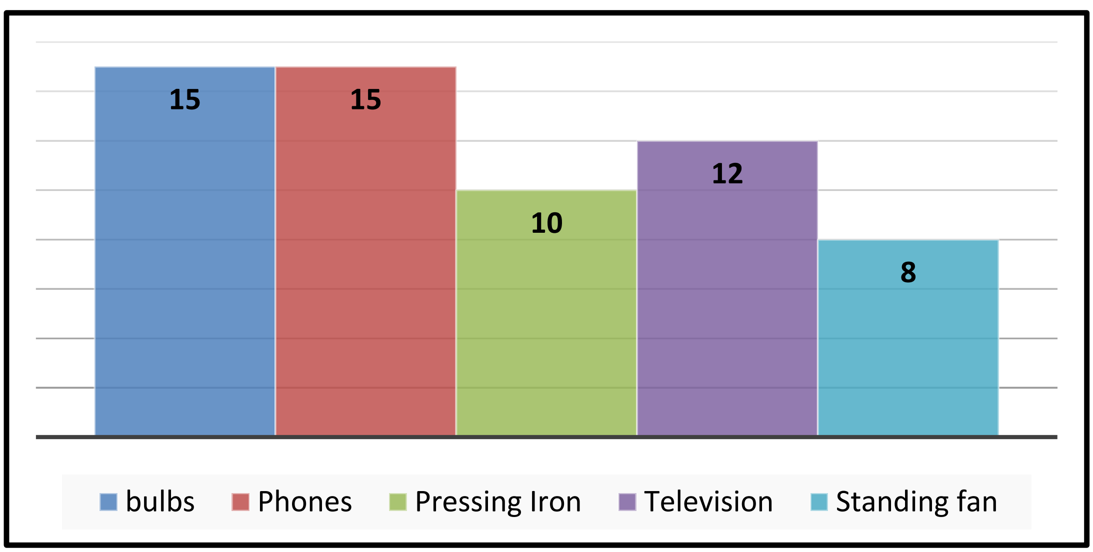

Figure 4.2: Bar Chart Representation of Households' Interview on the Appliances Used in Their Homes.

The result from the interview revealed that all of the respondents 15 (100%) utilized bulbs and phones, 10 (67%) utilize pressing iron, 12 (80%) utilize television and 8 (53.3%) utilize standing fans. This is in line with the questionnaire result that showed that bulbs phones, television and standing fan are the most utilized appliances.

4.4 Research Question 3

What are the electrical energy savings practices utilized by households?

The responses of the respondents on their electrical energy savings practices are shown is Table 4.8.

Table 4.8
Mean Responses of Households on Their Electrical Energy Savings Practices.

SN	Electrical energy savings practices	$\bar{X}$	SD	RMK
1	Remember to turn off fans when no one is in room	2.70	.47	O
2	Replacing old appliances with energy efficient ones	3.32	.76	O
3	Turning off all appliances at the switch (reducing standby power)	3.52	.69	A
4	Turning off lights when they are not needed	2.73	.54	O
5	Keeping the windows and doors closed when the air conditioner is on	3.16	1.24	O
6	I keep air conditioner free of obstructions	2.20	1.08	R
7	Ensuring seal of oven door is well tight	2.76	1.04	O
8	Switching off refrigerator while nothing is inside	2.92	.85	O
9	Replacing incandescent bulbs with energy saving bulbs	3.28	.91	O
10	Regular cleaning of cooker plate	3.24	1.01	O
11	Avoiding frequently opening of refrigerator	3.43	.87	O
12	Utilize natural lighting during the day	3.39	.83	O
13	Boiling only the needed quantity of water	3.34	.91	O
14	I avoid using fan and air conditioner at the same time	2.93	.97	O
15	I clean lamp luminaries regularly	3.17	.93	O
	Grand mean	**3.07**	**0.87**	**O**

KEY: $\bar{X}$ = Mean of Respondents; SD = Standard Deviation of Respondents; A = Always; O = Occasionally; RMK -= Remark.

Table 4.8 showed means and standard deviations on the electrical energy savings practices utilized by households. The mean items of 1, 2, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, and 15 are within the range of 2.70 - 3.43, which showed that the respondents occasionally practiced electrical energy savings methods in their households, while the mean responses of item 3 is within the range of 3.52 meaning that respondents always turn off all appliances at the switch in their households. Item 6, with a mean response of 2.20 showed that the respondents rarely keep air conditioner free of obstructions. The grand mean (3.07) of the total response showed that respondents occasionally practiced electrical savings practices utilized in their households. The standard deviations of 15 items ranges between 0.47 - 1.24. Each of the items are less than 1.96, which indicated that the respondents mean scores were not too far from each other and were close to one another in their responses. This adds to the reliability of the mean. Figure 4.3 shows the representation of the respondents' views during the interview.

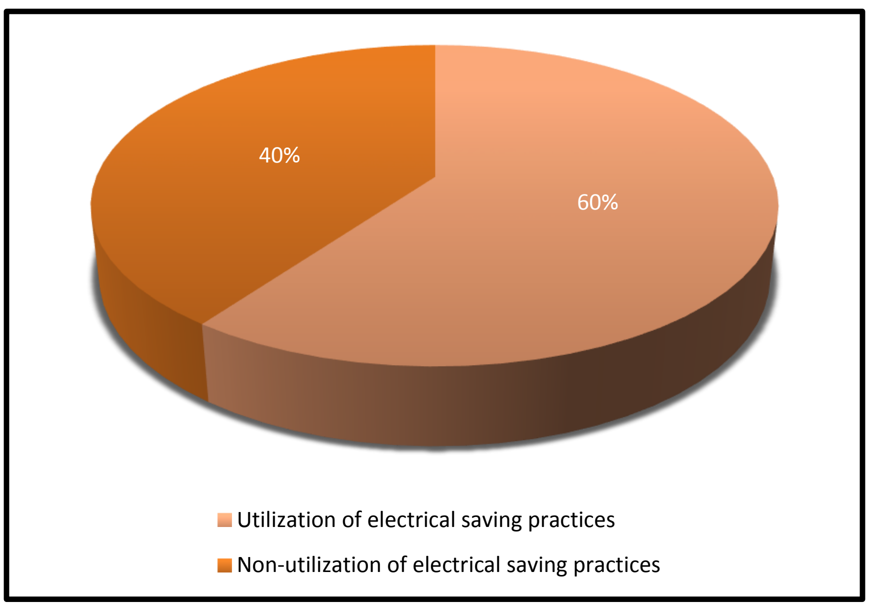

Figure 4.3: Pie Chart Representation of Households' Views on Their Energy Saving Practices.

The result from the interview showed that 9 out of 15 respondents (60%) that were interviewed on the electrical saving practices utilized in their homes suggested they practice energy saving methods. When asked to mention some of the things they do that save energy, some said they switch off all appliances when they are not in use, others said all security bulbs are switched off from 6am and put back on between 6 and 8pm. One person said he changed all the bulbs in his house from 100W to 15W LED bulbs. About 5 people (33%) said they do not practice energy saving activity in their homes. One said his fan is always on, another said he does not remember to put off his security lights during the day, some said boil water in excess because they are used to it. Overall, about 60% of the respondents showed that they practice energy saving activities in their homes

4.5 Research Question 4

What is the awareness level of households on electricity conservation?

The responses of the respondents on their level of awareness towards electricity conservation are shown is Table 4.9

Table 4.9
Mean Responses of Households on Their Awareness Level Towards Electricity Conservation

SN	Awareness level of households on electricity conservation	HA %	A %	SA %	NA %
1	Switching off the lights when not in use saves energy	80.90	14.80	2.80	1.40
2	Removing lamps when lighting level is high saves energy	40.70	30.10	14.80	14.40
3	Regular usage of natural day lighting helps in energy saving	54.70	20.90	15.90	8.50
4	Regulating the light to illumination level needed using dimmer saves energy.	34.50	31.30	6.60	27.60
5	Usage of task lighting saves electricity	35.10	30.10	18.10	16.70
6	Lowering light fixtures saves energy	35.60	34.80	18.10	11.50
7	Utilization of minimum wattage lamp to provide required light saves energy.	43.90	30.10	16.60	9.40
8	Replacing incandescent bulb with more efficient bulb saves energy	45.40	25.20	13.60	15.80

9	Over loading refrigerator waste energy	29.90	23.30	28.40	18.40
10	Closing of doors and windows while A.C is on save energy	41.10	20.70	17.70	20.50
11	Switching off the A.C when not in use saves energy	51.20	18.90	17.20	12.70
12	Ironing of many cloths at once helps to saves energy	24.10	29.40	27.20	19.30
13	Use of split A.Cs instead of window types saves energy	26.60	36.90	16.50	20.00
14	Ensuring seal of oven door is well tight saves energy	30.40	35.80	19.10	14.80
15	Avoiding frequently opening of refrigerator door saves energy	41.60	32.50	20.80	5.20
16	Regular cleaning of cooker plate saves energy	23.90	25.40	28.60	22.10
17	Pre-heating of oven for long time waste energy	40.00	30.10	21.90	8.00
18	Switching off refrigerator while nothing is inside saves energy	40.90	29.20	18.10	11.80
19	Covering of all food stored in the refrigerator saves energy	23.10	24.90	21.90	30.10
	Average Total	**39.56**	**27.60**	**16.44**	**16.40**

KEY: HA = Highly Aware; A = Aware; MA = Moderately Aware; Slightly Aware (SA) and Not Aware (NA).

Table 4.9 showed that 80.9% and 14.8% of the respondents are highly aware and aware respectively that switching off the lights when not in use saves energy while 2.8% and 1.4% of the respondents are slightly aware and not aware respectively that switching off the lights when not in use saves energy. The table further revealed that minority of the respondents 23.1% and 24.0% are highly aware respectively, that covering of all foods stored in the refrigerator saves energy, while 14.8% and 14.4% of the respondents are slightly aware and not aware respectively that removing lamps when lighting level is high saves energy. In the same vein, 29.9% and 23.0% of the respondents are highly aware that over loading refrigerator waste energy, while 28.4% and 18.4% of the respondents are slightly aware and not aware respectively that over loading refrigerator waste energy. Overall, the table showed that 39.56% of the respondents are highly aware, 27.60% are aware, 16.44% are slightly aware and 16.40% are not aware of ways through which electricity conservation can be achieved while excessive consumption and waste is reduced. Figure 4.4 is a representation of the respondents' views during the interview.

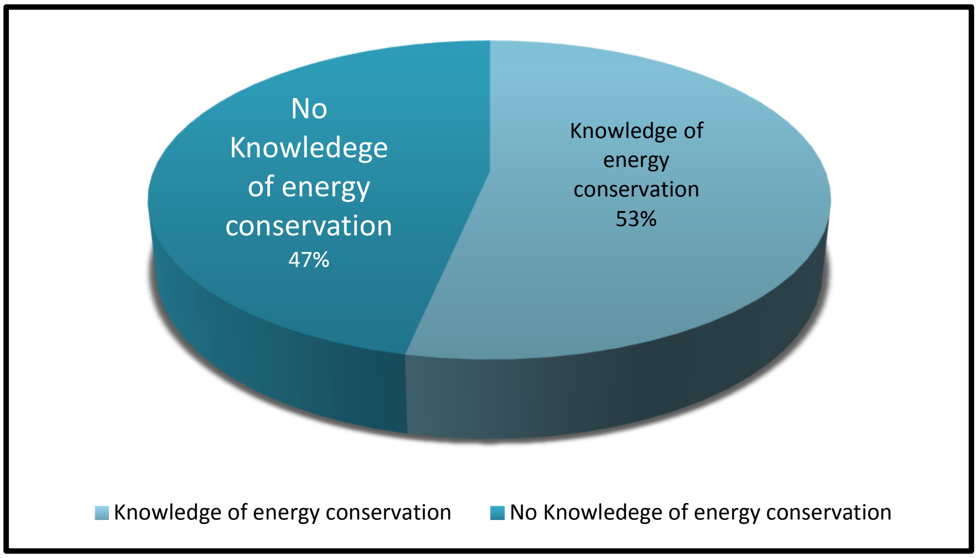

Figure 4.4: Pie Chart Representation of Interview Responses of Households on Their Level of Awareness on Electricity Conservation

The result from the interview revealed that 8 out of 15 (53%) respondents that were interviewed on their awareness on electricity conservation showed that they have knowledge of ways to conserve energy. When asked if he thinks over loading the fridge would waste energy, he said "of course it will, because the more the fridge is work-loaded, the more energy it would need to preserve the food" while some do not think so, a respondent said she observed that it takes longer time to freeze if the freezer is packed and sometimes it can lead to wastage. When asked if she thinks closing the doors and windows when the A.C is on, saves energy a respondent said "of course it should, because the energy required would be trapped inside the house" while 5 (33%) said they do not know since they do not have AC. Overall, about 53% of the respondent showed they are aware of ways to conserve electrical energy, while the remaining 47% were not aware.

4.6 Research Question 5

What is the relationship between determinants of electricity consumption in residential houses?

The relationship between factors that leads to electricity consumption is shown is Table 4.10.

Table 4.10
The Relationship Between Factors That Lead to Electricity Consumption

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	4.040	.441	-	9.159	.000
Income	-.172	.129	-.526	-1.329	.216
Age	.088	.150	.218	.589	.570
Educational Qualification	.028	.097	.098	.290	.779
Number of Households	-.141	.118	-.308	-1.189	.265
Gender	-.214	.121	-.500	-1.762	.112

Table 4.10 showed the relationship between the factors which affect electricity consumption. The table showed that the income, age, educational qualification, gender, and number of households of the respondents with the ranges of significant value 0.112 - 0.779 are greater than 0.05, meaning that there is no significant relationship between the factors that affect electricity consumption. The regression model and ANOVA table is presented in Appendix F (page 138).

4.7 Research Question 6

What are the effective electricity saving measures needed by residents of Kogi State, Nigeria?

The respondents' views on ways to ensure energy conservation among residents of Kogi State Nigeria are shown in Table 4.11

Table 4.11
Presentation of Experts' View on Ways to Ensure Energy Conservation

S/N	Experts' Views	Number in support	Percentage (%)
1	Use of power savings bulbs	15	100
2	Switching off appliances when not in use	15	100
3	Use of prepaid meter	15	100
4	Use of energy saving appliances like TV, Fridge and Air conditioner	8	53
5	Utilizing alternative energy for security lightings	4	27
6	A switch should not be used for many lights	4	27
7	Task forces should be created to check bypassed meters	8	53
8	Fines should be placed on all electricity defaulters who bypass their meters	8	53

Table 4.11 showed the percentage of experts who have the same views on ways to ensure electricity conservation among residents of Kogi State, Nigeria. Interview was used for this research question and from the interview conducted the experts have similar views on practical ways to ensure that residents save electricity. From the interview, 100% of the experts were of the view that the use of power savings bulbs was a way of saving electricity at home. Other views that had 100% support were; switching off appliances when not in use, and the use of prepaid meters. Eight people which represents 53% of the entire sample highlighted that Fridges, TVs and even Air conditioners now have energy savings types which can be used by residents at home. 27% of the experts were of the view that alternative energy can be used as security lights, also, switches should only power one bulb

at home so that only the needed bulb will be put on at a time. On the ways to make residents accountable for electricity conservation, 53% said task forces should be created to check bypassed meters, and fines should be placed on all electricity defaulters who bypass their meters.

4.8 Hypothesis One

Ho1. There is no significant difference in the mean responses of low, middle and high-income earners on their attitude towards electricity consumption. ($P<.05$).

The result of the One-way ANOVA of mean scores of the respondents on the significant difference between the low, middle, and high income earners on their attitude towards electricity consumption in Table 4.12. Levenes test of homogeneity of variances for the data was 0.321 (see appendix F page 138 for homogeneity of variances). Therefore, the assumption on homogeneity was met. Since the value is greater than the significant level of ($P<.05$), therefore, ANOVA can be used for analysis.

Table 4.12
One-Way ANOVA of Mean Scores of Responses of Low, Middle and High Income Earners on Their Attitude Towards Electricity Consumption.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.879	2	.439	1.359	.026
Within Groups	136.500	422	.323		
Total	137.379	424			

Table 4.12 showed that there was a significant difference ($P<.05$) in the mean responses of low, middle and high income earners on their attitude towards electricity consumption. These data revealed that hypothesis $F(2, 422) = 1.359$, $P= .0258$. The mean and standard deviation for low income earners are 3.79 and 0.57 respectively, the mean and standard

deviation for middle income earners are 3.60 and 0.58 respectively and the mean and standard deviation for high income earners are 3.59 and 0.41 respectively. The P value of 0.026, is less than the significant value (P<.05). This showed that there were significance differences between the mean scores of the low, middle and high income earners on the attitude of respondents towards electricity consumption. (Appendix F, page 138. Post Hoc Turkeys HSD test) showed that there were significant differences in the responses of low and high income earners P= 0.024 and low and medium income earners P=0.033 but there was no statistical significant differences in the mean responses of medium and high income earners. (P = 0.264). The result showed that there is a difference between the mean attitude of high and middle income earners compared to the low income earners. This could be as a result of high income earners having the ability to afford more appliances as compared to the low income earners.

4.9 Hypothesis Two

Ho₂. There is no significant difference in the mean responses of households of ages 18-39, 40-64, 65 and above, on their attitude towards electricity consumption

The analysis of the result of the One-way ANOVA of mean scores of the respondents on the significant difference in the ages 18-39, 40-64,65 and above on their attitude towards electricity consumption is shown in table 4.13. Levenes test of homogeneity of variances for the data was 0.782 (see appendix F, page 138 for homogeneity of variances). Therefore, the assumption of homogeneity was met. Since the value is greater than the significant level of (p<.05). Therefore, ANOVA can be used for analysis.

Table 4.13
One-Way ANOVA of Mean Scores of Responses of Households of Ages 18-39, 40-64, 65 and Above, on Their Attitude Towards Electricity Consumption

Sources	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.731	2	.866	2.693	.019
Within Groups	135.647	422	.321		
Total	137.379	424			

Table 4.13 showed that there were significant differences (P<.05) in the mean response of households of ages 18-39, 40-64, 65 and above, on their attitude towards electricity consumption. These data support the hypothesis F (2, 422) = 2.693, P = .019. The mean and standard deviation for the ages 18-39 are 3.65 and 0.58 respectively, while the mean and standard deviation for the ages 40-64 are 3.56 and 0.56 respectively, and the mean and standard deviation for the ages 65 and above are 4.00 and 0.00 respectively. The P value of 0.019, less than the significant value (P<.05). This showed that there was a significant difference in the mean scores of the ages 18-39, 40-64, and 65 and above on their attitude towards electricity consumption. (Appendix F, page 138. Post Hoc Turkeys HSD test) showed that there was a significant difference between the mean responses of ages 18-35 and 40-65, (P= 0.027), there was also significant difference between 46-64 and 65 and above (P=0.014) but there was no significant difference between 18-35 and 65 and above (P= 0.288). The result also showed that there is a significant difference between the mean responses of ages 40-65 (P=0.046). Age group 40-65 tend to consume more electricity than the rest of the group.

4.10 Hypothesis Three

Ho3 There is no significant difference in the mean responses of Primary/School Certificate holders, ND/NCE holders, HND/Degree holders and Postgraduate degree holders on their attitude towards electricity consumption.

The result of the One-way ANOVA of mean scores of the respondents on the significant difference in primary/school certificate holders, ND/NCE holders, HND/Degree holders, and postgraduate degree holders on their attitude towards electricity consumption in Table 4.14. Levenes test of homogeneity of variances for the data was 1.034 (see appendix F, page 138 for homogeneity of variances). Therefore, the assumption of homogeneity was met. Since the value is greater than the significant level of ($p<.05$), therefore, ANOVA can be used for analysis.

Table 4.14
One-Way ANOVA of Mean Scores of Responses of Primary/Secondary School Certificate Holders, ND/NCE Holders, HND/Degree Holders and Postgraduate Degree Holders on Their Attitude Towards Electricity Consumption.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.382	3	1.794	5.722	.001
Within Groups	131.997	421	.314		
Total	137.379	424			

Table 4.14 showed that there were significant differences ($P<.05$) in the mean response of the respondents. These data revealed that $F(3, 421) = 5.722$, $P = .001$ since the P value of .001 is less than the sig value of ($P<0.05$). The mean and standard deviation of primary/school certificate holders were 3.53 and 0.75, the mean and standard deviation of ND/NCE holders were 3.56 and 0.56 respectively, while the mean and standard deviation

of HND/Degree holders were 3.60 and 0.56 respectively and the mean and standard deviation of postgraduate degree holders are 4.00 and 0.00 respectively. (Appendix F, page 138 Post Hoc Turkeys HSD test) showed that there was no significant difference between the mean responses between Primary/School Certificate holders and ND/NCE (P= 0.988), Primary/School Cert and Bachelors (P= 0.884) but there is a significant difference between the mean responses of Primary /School Certificate and Postgraduate (P= 0.02). This showed that lower education certificate holders consumed more electricity and higher education can influence the attitude of households towards electricity consumption.

4.11 Hypothesis Four

Ho4. There is no significant difference in the mean responses of households with 1-5 people, 6-10 people and 11 and above on their attitude towards electricity consumption.

The result of the One-way ANOVA of mean scores of the respondents on the significant difference in households with 1-5 people, 6-10 people and 11 and above on their attitude towards electricity is shown in Table 4.15. Levenes test of homogeneity of variances for the data was 0.463 (see appendix F, page 138 for homogeneity of variances). Therefore, the assumption of homogeneity was met. Since the value is greater than the significant level of ($p<.05$), therefore, ANOVA can be used for analysis.

Table 4.15
One-Way ANOVA of Mean Scores of Responses of Households With 1-5 People, 6-10 People And 11 and Above on Their Attitude Towards Electricity Consumption

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.173	2	.086	.266	.017
Within Groups	137.206	422	.325		
Total	137.379	424			

Table 4.15 showed that there was a significant difference (P<.05) in the mean responses of the respondents. These data revealed that F (2, 422) = .266, P = .017. The mean and standard deviation for 1-5 people are 3.62 and 0.59 respectively, the mean and standard deviation for 6-10 people are 3.60 and 0.55 respectively while the mean and standard deviation for 11 above are 3.50 and 0.52 respectively. (Appendix F, page 138 Post Hoc Turkeys HSD test). This showed that there were significant differences between the mean responses of 1-5 people and 6-10 (P= 0.948), also there is no significant difference between 6-10 and 11 and above (P= 0.827) but there is a significant difference between 1-5 and 11 and above (P= 0.025). This suggests that energy consumption is higher in households of more than 11 people compared to lower numbers of households. The more the number of households, the more electricity is consumed.

4.12 Hypothesis Five

Ho$_5$. There is no significant difference between the mean responses of male and female households on their attitude towards electricity consumption.

The result of the t-test on the significant difference between the mean responses of male and female households on their attitude towards electricity consumption is presented in Table 4.16.

Table 4.16
Independent Samples t-test Results of Responses of Male and Female on Their Attitude Towards Electricity Consumption

GROUPS	N	df	Mean	SD	Sig.(2-tailed)	Remark
Male	215	423	3.61	0.49	0.01	S
Female	210		3.60	0.64		

Table 4.16 showed that there were significant differences (P<.05) between the mean response of male and female on their attitude towards electricity consumption. These data support the hypothesis with df = 423, and 2-tail = 0.01. The mean and standard deviation for male are 3.61 and 0.49 respectively while the mean and standard deviation for female are 3.60 and 0.64 respectively. Hence, hypothesis 5 was rejected which means that gender can affect the attitude of households towards electricity consumption. Males and females do not have the same attitude towards electricity consumption.

4.13 Hypothesis Six

Ho_6. There is no significant difference in the mean responses of low, middle and high income earners on their awareness on electricity conservation.

The result of the One-way ANOVA of mean scores of the respondents on the significant difference responses of low, middle and high income earners on the awareness of electricity conservation is shown on Table 4.17. Levenes test of homogeneity of variances for the data was 1.042 (see appendix F, page 138 for homogeneity of variances). Therefore, the assumption of homogeneity was met. Since the value is greater than the significant level of (p<.05), therefore, ANOVA can be used for analysis.

Table 4.17
One-Way ANOVA of Mean Scores of Responses of Low, Middle and High Income Earners on Their Awareness on Electricity Conservation

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	15.510	2	7.755	26.488	.000
Within Groups	123.549	422	.293		
Total	139.059	424			

Table 4.17 showed that there was a significant difference ($p<.05$) in the mean responses of the respondents. The data revealed that $F(2, 422) = 26.488$, $P = .000$. The mean and standard deviation of low income earners on their awareness level are 3.54 and 0.73 respectively, while the mean and standard deviation of middle income earners on their awareness level are 3.67 and 0.33 respectively and the mean and standard deviation of high income earners on their awareness on electricity conservation are 3.93 and 0.48 respectively. Appendix F, page 138 Post Hoc Turkeys HSD test showed that there was a significant difference between the mean responses of low and middle income (P=0.000), there was also a significant difference between low income and high income (P=0.026) but there is no significant difference between the mean responses of medium and high income on their awareness on electricity conservation (P=0.058). This suggests that middle and high income earners are more aware. Income can influence the awareness of households on electricity conservation.

4.14 Hypothesis Seven

Ho_7. There is no significant difference in the mean responses of households of ages 18-39, 40-64, 65 and above, on their awareness on electricity conservation.

The result of the One-way ANOVA of mean scores of the respondents on the significant difference between the ages 18-39, 40-64,65 and above on their awareness towards electricity conservation is shown in Table 4.18. Levenes test of homogeneity of variances for the data was 0.392 (see appendix F, page 138 for homogeneity of variances) therefore, the assumption of homogeneity was met. Since the value is greater than the significant level of ($p<.05$), therefore, ANOVA can be used for analysis.

Table 4.18
One-Way ANOVA of Mean Scores of Responses of Households of Ages 18-39, 40-64, 65 and Above, on Their Awareness on Electricity Conservation

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.211	2	.606	1.854	.018
Within Groups	137.848	422	.327		
Total	139.059	424			

Table 4.18 showed that there were significant differences ($P<.05$) in the mean response of the respondents. These data support the hypothesis $F(2, 422) = 1.854$, $P = .018$. The mean and standard deviation for the ages 18-39 are 3.70 and 0.53 respectively, the mean and standard deviation for the ages 40-64 are 3.80 and 0.62 while the mean and standard deviation for the ages 65 and above are 4.00 and 0.00 respectively. Appendix F, page 138 Post Hoc Turkeys HSD test showed that there was no significant difference between ages 18-39 and 40-64 ($P=0.245$), but there was a significant difference between ages 18-39 and 65 and above ($P=0.024$), also, there was a significant difference between ages 40-64 and 65 and above ($P=0.013$). The result suggests that households within ages 18-39 are less aware of ways to ensure electricity conservation compared to households within ages 40-64 and above 65 years old.

4.15 Hypothesis Eight

Ho8. There is no significant difference in the mean responses of Primary/Secondary School Certificate holders, ND/NCE holders, HND/Degree holders and Postgraduate degree holders on awareness on electricity conservation.

The result of the One-way ANOVA of mean scores of the respondents on the significant difference between primary/school certificate holders, ND/NCE holders, HND/Degree holders, and postgraduate degree holders on their attitude awareness of electricity conservation in Table 4.19. Levenes' test of homogeneity of variances for the data was 1.217 (see appendix F, page 138 for homogeneity of variances) therefore, the assumption of homogeneity was met. Since the value is greater than the significant level of ($P<.05$), therefore, ANOVA can be used for analysis.

Table 4.19
One-Way ANOVA of Mean Scores of Responses of Primary/Secondary School Certificate Holders, ND/NCE Holders, HND/Degree Holders and Postgraduate Degree Holders on Their Awareness on Electricity Conservation.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	17.914	3	5.971	20.752	.000
Within Groups	121.144	421	.288		
Total	139.059	424			

Table 4.19 showed that there was a significant difference ($P<.05$) in the mean response Primary/Secondary School Certificate holders, ND/NCE holders, HND/Degree holders and Postgraduate degree holders on their awareness on electricity conservation. These data support the hypothesis $F(3, 421) = 20.752$, $P = .000$. The mean and standard deviation of Primary/Secondary School Certificate holders are 3.19 and 0.97 respectively, the mean and

standard deviation of ND/NCE holders are 3.78 and 0.41 respectively, the mean and standard deviation of HND/Degree holders are 3.82 and 0.52 respectively while , the mean and standard deviation of Postgraduate degree holders are 4.00 and 0.00 respectively. (Appendix F, page 138 Post Hoc Turkeys HSD test) showed that there was no significant difference between the mean responses between HND/Bachelors Certificate holders and Postgraduate (P=0.355), ND/NCE and Bachelors (P= 0.843) but there is a significant difference in the mean responses of Primary/Secondary certificated and NCE/ND (P=0.000), Primary/Secondary certificated and HND/Degree (P=0.000), Primary/Secondary certificated and Postgraduate (P=0.000). This showed that higher education can influence the awareness of households towards electricity conservation. The higher the educational level, the higher the level of awareness.

4.16 Hypothesis Nine

Ho9. There is no significant difference in the mean responses of households with 1-5 people, 6-10 people and 11 and above on their awareness on electricity conservation.

The result of the One-way ANOVA of mean scores of the respondents on the significant difference households with 1-5 people, 6-10 people and 11 and above on their awareness on electricity Table 4.20. Levenes test of homogeneity of variances for the data was 0.213 (see appendix F, page 138 for homogeneity of variances). Therefore, the assumption of homogeneity was met. Since the value is greater than the significant level of ($p<.05$), therefore, ANOVA can be used for analysis.

Table 4.20

One-Way ANOVA of Mean Scores of Responses of Households With 1-5 People, 6-10 People, and 11 and Above on Their Awareness on Electricity Conservation.

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1.174	2	.587	1.796	.167
Within Groups	137.885	422	.327		
Total	139.059	424			

Table 4.20 showed that there was no significant difference ($p<.05$) in the mean response of households with 1-5 people, 6-10 people and 11 and above on their awareness on electricity conservation. These data support the hypothesis $F(2, 422) = 1.796$, $P = .167$. The mean and standard deviation for 1-5 people are 3.77 and 0.61 respectively, the mean and standard deviation for 6-10 people are 3.71 and 0.54 respectively. The mean and standard deviation for 11 people and above are 4.00 and 0.00 respectively. The P value of 0.167 greater than the significant value ($P<.05$), showed that there was no significance differences between the mean scores of the primary/school certificate holders, ND/NCE holders, HND/Degree holders, and postgraduate degree holders on their awareness of electricity conservation. Therefore, the null hypothesis is retained.

4.17 Hypothesis Ten

Ho_{10} There is no significant difference between the mean responses of male and female households on their awareness on electricity conservation.

The result of the t-test on the significant difference between the mean responses of male and female households on their awareness on electricity conservation Table 4.21.

Table 4.21
t-test of Mean Scores of Responses of Male and Female Households on Their Awareness on Electricity Conservation.

Groups	N	df	Mean	SD	Sig.(2-tailed)	Remark
Male	215	423	3.84	0.45	0.17	NS
Female	210		3.67	0.67		

Significant at P<0.05 NS = No Significance

Table 4.21 showed that there was no significant difference (p<.05) in the mean response of the respondents. The data revealed that df = 423, and 2-tail = 0.17. The mean and standard deviation for male on their attitude towards electricity consumption are 3.61 and 0.45 while the mean and standard deviation for female on their awareness on electricity conservation are 3.67 and 0.67 respectively. Hence, hypothesis 10 was retained which means that there was no significant difference between the mean scores of male and female on their awareness on electricity conservation.

4.18 Findings

1. The findings from research question one showed that respondents have the right attitude towards electricity consumption. The following were the attitude disposed by the respondents in managing electricity consumption, such as switching off all appliances when not in use, buying energy-saving electrical appliances, and maintaining energy efficiency culture as a requisite to sustainable energy, national development and growth. Similarly, the respondents believed that reduction of energy usage is their responsibility and are willing to conserve energy in their respective home at any cost.
2. The findings from research question two showed that incandescent bulbs are the most used appliances among the residents of Kogi state. With a total of 1973

incandescent bulbs. This indicates that there is a minimum of 4 incandescent bulbs in one residential building. energy saving bulbs, phones, television and standing fan are behind incandescent bulbs as the second, third, fourth and fifth most utilized appliances having a total number of 907, 809, 561, and 457 respectively. The least utilized appliances are Vacuum cleaner, CCTV, Electric bell, and Air Conditioner with just 7, 16, 17, and 24 in number respectively.

3. In research question three, the findings revealed that the respondents occasionally practiced energy conservation as they occasionally replace old appliances with efficient ones, close the doors and windows when air conditioner is on, they avoid frequent opening of refrigerator, and turn off security lights during the day. Similarly, the findings showed that respondents always turn off appliances when not in used and rarely keep air conditioner free of obstructions.
4. The findings from research question four revealed that the respondents are aware of ways for conserving electricity. The results showed that the respondents are aware that switching off lights when not in use saves energy, switching off AC when not in use saves energy, and replacing yellow bulbs with energy saving ones saves energy. The result also showed that the respondents are aware that usage of natural day lights saves energy. They however seem not to be aware that covering of food stored in the refrigerator saves energy.
5. The findings from research question five showed that there was no relationship between the factors that lead to electricity consumption among the respondents.
6. The findings from research question six revealed that the ways of saving energy are: the use of energy saving appliances, utilizing energy saving appliances and

putting off appliances that are not in use will help to save energy. Also ensuring all residents use prepaid meter. With prepaid meter, residents are made to pay for what they use and this will prevent them from wasting the energy they bought. The findings also suggested that task forces should be created to check bypassed meters and that fines should be placed on all electricity defaulters who bypass their prepaid meters.

7. The findings from hypothesis one revealed that there was a significant difference in the mean responses of low, middle and high income earners on their attitude towards electricity consumption. This suggests that income has an effect on the attitude of household towards electricity consumption.
8. The findings from hypothesis two revealed that there was a significant difference in the mean responses of households of ages 18-39, 40-64, 65 and above, on their attitude towards electricity consumption. This suggests that age has an effect on the attitude of household towards electricity consumption.
9. In hypothesis three, the findings showed that there was a significant difference in the mean responses of Primary/School Certificate holders, ND/NCE holders, HND/Degree holders and Postgraduate degree holders on their attitude towards electricity consumption. This suggests that education have effects on attitude of households towards electricity consumption
10. The findings from hypothesis four revealed that there was a significant difference in the mean responses of households with 1-5 people, 6-10 people and 11 and above on their attitude towards electricity. This suggests that number of households have effects on the attitude of household towards electricity consumption.

11. In Hypothesis five, the findings showed that here was a significant difference between the mean responses of male and female households on their attitude towards electricity consumption. This suggests that gender does have effects on the attitude of household towards electricity consumption.
12. The findings from hypothesis six revealed that there was a significant difference in the mean responses of low, middle and high income earners on their awareness on electricity conservation. This suggests that income can influence the awareness level of household towards electricity conservation.
13. The findings from hypothesis seven revealed that there was a significant difference in the mean responses of households of ages 18-39, 40-64, 65 and above, on their awareness on electricity conservation. This suggests that age can influence the awareness of household towards electricity conservation.
14. In hypothesis eight, the findings showed that there was a significant difference in the mean responses of Primary/Secondary School Certificate holders, ND/NCE holders, HND/Degree holders and Postgraduate degree holders on their awareness on electricity conservation. This suggests that educational level has effect on the awareness of household towards electricity conservation.
15. The findings from hypothesis nine revealed that there was no significant difference in the mean responses of households with 1-5 people, 6-10 people and 11 and above on their awareness on electricity conservation. This suggests that number in household does not have effect on the awareness of households towards electricity conservation.

16. The findings from hypothesis ten revealed that there was no significant difference between the mean responses of male and female households on their awareness on electricity conservation. This suggests that gender does not have effect on the awareness of households towards electricity conservation.

4.19 Discussion of Findings

The findings of research question one revealed the attitude of respondents towards electricity consumption. The findings are in line with the study of Saba *et al.* (2016b). The authors' findings indicate that the respondents in the study had a favorable attitude towards using alternative methods for conserving electricity. Specifically, the SMEs in Niger State were observed to efficiently use electrical energy in washing machines and split air conditioning. However, their usage of fluorescent lamps with electronic ballasts, dimmer switches, and occupancy sensors was only moderate. The utilization of occupancy sensors to deactivate air-conditioners in unoccupied rooms and automatic daylight dimming was found to be low. Additionally, maintenance practices related to electrical equipment and appliances, such as regular power factor checks and correction, were rarely used. The attitude of the respondents is also in agreement with Murtagh *et al*., (2014), who asserted that positive environmental attitude encourages the acceptance and practice of conservation activities, and the perceived greater problem seriousness foster efficiency strategies support. Similarly, Wang *et al*. (2016) indicated that a positive attitude towards the environment hints the adoption of energy conservation activities; although it is argued that energy conscious attitude is not always positively related to energy conservation behaviour.

The findings of research question two revealed that incandescent bulbs are the most used appliances among the residents of Kogi state. With a total of 1973 incandescent bulbs, it indicates that there is a minimum of 4 incandescent bulbs in one residential building. Energy saving bulbs, Phones, Television and Standing fan are behind incandescent bulbs as the second, third, fourth and fifth most utilized appliances having a total number of 907, 809, 561, and 457 respectively. The total capacities of the five most used appliances are 35820W, 10,150W, 5,490W, 47,670W, 31,875W respectively. The least utilized appliances are Vacuum cleaner, CCTV, Electric bell, and Air Conditioner with just 7, 16, 17, and 24 in number respectively, with a power consumption of 11,200W, 280W, 576W and 26,800W. The result from the interview which aims to support the questionnaire shows that majority of the respondents utilize bulbs, pressing iron, television, standing fans and phones. This is in line with the questionnaire result that showed that bulbs phones, television and standing fan are the most utilized appliances.

The findings are in line with Chou and Truong (2019) who posited that there are four categories of household appliances based on their pattern of use: Continuous appliances; Standby appliances; Cold appliances; and Active appliances. Continuous appliances, such as clocks and burglar alarms, draw a continuous constant amount of power. Standby appliances, in particular consumer electronic equipment such as televisions and set-top boxes, have three basic modes of operation: in use; on standby; or switched off. Standby use occurs when an appliance is not in use but is still consuming power (Cogan *et al.*, 2016). Active appliances are those which are actively switched on or off by the householders and are clearly either in use or not in use. Active appliances have no standby mode and when switched off their power consumption is zero. Examples of active appliances include lights, kettles, pumping machines, ceiling fan and electric showers. Active appliances are the mostly used in homes.

The findings of research question three showed that the respondents occasionally replaced old appliances with efficient ones, while also occasionally closing of the vent when air conditioner is on, avoiding frequent opening of refrigerator, cleaning of lamp luminaries and usage of natural light during the day. The findings are supported by Nwofe (2014) and Saba *et al.*, (2016a) who opined that households' daily practices of energy saving approaches include: Switching off the lights when not in use to save energy, removing lamps when lighting level is high to save energy, regular usage of natural day lighting helps in energy saving, regulating the light to illumination level needed using dimmer saves energy, usage of task lighting saves electricity, lowering light fixtures saves energy, utilization of minimum wattage lamp to provide required light saves energy, replacing incandescent bulb with more efficient bulb saves energy, over loading refrigerator waste energy, closing of doors and windows while A.C is on save energy, switching off the A.C. when not in use to save energy, ironing of many cloths at once, the use of split A.Cs instead of window types to save energy, ensuring seal of oven door is well tight, avoiding frequent opening of refrigerator, regular cleaning of cooker plate, pre-heating of oven for long time will waste energy, switching off refrigerator while nothing is inside to save energy and covering of all food stored in the refrigerator to save energy.

The findings of research question four showed that 39.56% of the respondents are highly aware, 27.60% are aware, 16.44% are slightly aware and 16.40% are not aware of ways through which electricity conservation can be achieved while excessive consumption and waste is reduced. Respondents are aware on the ways of conserving electricity. The results showed that the respondents are aware that removing of lamps when lighting level is high saves energy, usage of natural day lights, regulation of light illumination, usage of task lighting, usage of minimum wattage lamp, and switching of household electrical appliances when not in use. The findings are supported by Saba *et al*. (2016a). The findings of the authors showed that, residents in Niger State were somehow aware of electrical energy management practices in lighting, cooling and heating systems and the use of electric motors. Yen and Wai (2010) observed that awareness on electrical energy conservation plays a crucial role in reducing utility bills and is a solution to energy savings. There are several ways which information can be used to change resident's behaviour toward the use of electrical energy, such as public enlightenment campaign on television and radio.

In research question five, the findings revealed that there is no relationship between the factors that lead to electricity consumption. The factors are numbers of people in household, educational qualifications, gender, age, and income. The finding is supported by Akinola *et al*. (2017) and Taale and Kyeremeh, (2019) who stated that income stimulates electricity demand and hence should generally exert a significant positive effect on household electricity expenditure (Taale & Kyeremeh, 2019). Mcloughlin *et al.* (2015) found that household electricity consumption of family where age of the member is 18-35 was less than 36–55. The authors believed that the middle-aged family has more children and rooms, which makes the consumption of electricity high. Households headed by educated people could be more committed to electricity conservation due to their awareness about the consequences of higher electricity generation on fossil fuel consumption and environmental pollution (Taale & Kyeremeh, 2019). In another study, Mutua and Kimuyu (2015) aimed to find out which gender uses more electricity and cares more on energy conservation. The authors found that women are the largest consumers of electricity mainly due to their primary or full responsibility of home chores such as cooking and ironing clothes.

The findings of research question six revealed that the ways by which electrical energy can be conserved among residents are: the use of energy saving appliances, utilizing energy saving appliances and putting off appliances that are not in use will help to save energy. Also ensuring all residents use prepaid meter, with prepaid meter, residents are made to pay for what they use and this will prevent them from wasting the energy they bought. These findings are supported by Saba *et al*, (2016a) who highlighted that Some households' daily practices that showed the level of awareness of residential households in energy management include: Switching off the lights when not in use to save energy, removing lamps when lighting level is high to save energy, regular usage of natural day lighting helps in energy saving, regulating the light to illumination level needed using dimmer saves energy, usage of task lighting saves electricity, lowering light fixtures saves energy, utilization of minimum wattage lamp to provide required light saves energy

In addition, Akinbami and Lawal (2010) posited that there is the need for the electric utility, federal ministries and agencies involved in energy and housing matters and the building private sector to reach out to the public, including: investors, professionals, planners, and decision makers through various campaign programs such as seminars, conferences, workshops, radio/television talks and programs. The campaign should be taken to the grassroots in order to educate every stakeholder in the buildings sector on the needs for, benefits of, and options for energy conservation in the sector.

The findings on hypothesis one revealed that there was a significant difference in the mean responses of low, middle and high income earners on their attitude towards electricity consumption. This suggested that income has some influence on the attitude of household towards electricity consumption. This is in line with the findings of Taale and Kyeremeh (2019) who asserted that income can stimulate electricity demand and hence should generally exert a significant positive effect on household electricity expenditure. This highlights a negative attitude towards conservation, since it bids to reduce consumption of electricity. Also, Salari and Javid (2017) found a significant positive relationship between income and household electricity expenditure. Santamouris *et al.* (2017) examined the relationship between annual electricity cost and income, and found that wealthy households spent 38 percent extra on electricity per floor area than poor households. These data suggested that wealthy households have negative attitude towards electricity conservation. Yohanis *et al.* (2008), also stated that although the households with higher annual incomes consume more electricity than the low income families.

One possible reason was that higher income families tended to have a large area of housing and household appliances. This led to more electricity consumption. However, efficiency of home appliances and electronic devices is also vital to energy saving. In contrast to these findings, Yohanis *et al*, (2008) highlighted that wealthy families have ability to buy smart appliances and install related home power management systems, which highlights a positive attitude towards electricity conservation. Also, Alberini *et al.* (2011) established that income has no statistically significant effect on household electricity consumption.

The findings on hypothesis two revealed that there was significant difference in the mean responses of households of ages 18-39, 40-64, 65 and above, on their attitude towards electricity consumption. This suggests that age has influence on the attitude of household towards electricity consumption. This findings is supported by different researchers. Leahy and Lyons (2015) pointed out that electricity consumption of household where ages of the family member is between 45 and 64 was significantly higher than that of 35-44 years old. Household electricity consumption decreased significantly when age of the family member is more than 64 years old. Mcloughlin *et al.* (2015) found that household electricity consumption of family where age of the member is 18–35 was less than 36–55. Electricity Consumption is relatively lower, when the age of family member is less than 50 years old or above 65 years old. The researchers believed that the middle-aged family has more children and rooms, which makes the consumption of electricity high.

The findings on hypothesis three revealed that there was a significant difference in the mean responses of Primary/School Certificate holders, ND/NCE holders, HND/Degree holders and Postgraduate degree holders on their attitude towards electricity consumption. This suggests that education has some impacts on the attitude of households towards electricity consumption. The findings revealed that households with higher educational level have better attitude towards electricity conservation than households will a lower educational level. This could be as a result of the exposure to knowledge that education brings as the findings showed that households with Postgraduate degree have positive attitude than lower educational levels.

This is in line with the findings of other authors. According to Karatasou *et al*. (2018) there is a correlation between education level and household electricity consumption. Their research found that as the level of education increased, household electricity consumption decreased significantly. Family members with higher degrees of education tended to consume less electricity compared to those with lower education levels. This suggests that households with higher education levels generally have a positive attitude towards electricity consumption. Taale and Kyeremeh (2019) also support the idea that educated individuals are more likely to be committed to electricity conservation. They argue that households led by educated people are more aware of the consequences of high electricity generation, such as increased fossil fuel consumption and environmental pollution.

Nonetheless, Bedir *et al.* (2013) established that education does not affect household electricity consumption, indicating that the relationship between household electricity consumption and years of education can go either way. In other words, households led by people with low or no formal education may use more electricity due to more time spent at home as a result of unemployment while those headed by educated people may demand less due to exposure to information on electricity conservation practices and adoption of energy-efficient appliances (Bedir *et al.*, 2013).

The findings on hypothesis four revealed that there was a significant difference in the mean responses of households with 1-5 people, 6-10 people and 11 and above on their attitude towards electricity. This suggests that number of households have effects on the attitude of household towards electricity consumption. The findings is supported by other researchers who highlighted that the number of people leaving in an apartment can increase their electricity consumption. Leahy and Lyons (2015) studied the electricity consumption of single and double people. By comparison, they found that a single apartment have less than 19% of the electricity consumption per week. A higher energy consumption highlights negative attitude towards energy conservation. This could be as a result of the difficulty in making many people conserve energy as compared to a fewer people. A household of more than ten people may have different perception about conservation and because of the diverse views, it affects the attitude of the entire household.

Households with a composition of parents and their children (dependent children) have been observed to be more likely to conserve energy than households with just couples or loners who are found to be less willing to adopt energy conservation measures (Wang *et al*., 2016). In contrast to the findings, Yalcintas and Kaya (2017) posited that household size is an important factor for evaluating residential electricity consumption. Residences with large sizes tend to consume more electricity; however, they may be more energy efficient. Being energy efficient shows a positive attitude towards energy conservation.

The findings of hypothesis five shows that there was a significant difference between the mean responses of male and female households on their attitude towards electricity consumption. This suggests that gender have effects on the attitude of household towards electricity consumption. The findings is supported by researchers, who have found that households headed by males are more ordered and disciplined and hence make relatively efficient use of energy in comparison to those headed by (Nazer, 2016). The author also found that households headed by men spend less on electricity compared to those headed by female.

Contrarily, a number of studies have also established that female household headship is often associated with more cautiousness about household expenditures and energy consumption than male household headship. Permana *et al.* (2015) observed, from their analysis of residential dwellings, that when the decisions about energy and control of energy consumption in the household were solely made by a woman, energy consumption tended to be the lowest. When wives were the dominant decision makers, energy consumption was reduced, compared to men. According to Alkon *et al.* (2016) living in a household in which the head is a female is associated with lower household energy expenditure.

The findings on hypothesis six revealed that there was a significant difference in the mean responses of low, middle and high income earners on their awareness on electricity conservation. This suggests that income can influence the awareness level of household towards electricity conservation. Awareness of electrical energy conservation and efficiency is an all-important element of electrical energy management practices, as lack of awareness may be the barrier for electrical energy conservation. The findings suggest that a high income earner has a tendency to be more aware of ways to ensure electricity conservation than a low income earner. This could be as a result of access to knowledge and information through formal education, seminars, informative materials like newspaper or journals and internet services. The lack of or limited awareness of the potentials of energy efficiency is likely to be the greatest obstacle to wide-scale adoption of energy conservation measures and technologies in Nigeria (Akinbami & Lawal, 2010).

These findings are in line with Wang (2016) who posited that household income can affect the awareness level of people. Awareness helps in changing attitudes of people, thereby encouraging users of electricity to look out for ways to save electrical energy and also help in positive behavioural changes towards electrical energy (Saba *et al.*, 2016a). With a low income, there is more limited access to knowledge. Knowledge is key awareness. A high income earner has more access to knowledge and opportunities whether through the internet or TV, or social media. All these sources of information are costly to utilize and puts the low income earner at disadvantage which leads to a low level of awareness on energy conservation.

The findings on hypothesis seven revealed that there was significant difference in the mean responses of households of ages 18-39, 40-64, 65 and above, on their awareness on electricity conservation. This suggests that age have effects on the awareness of household towards electricity conservation. The findings is supported by Low *et al*, (2020) who posited that when age increases, there is an increase in the awareness of people, and more measures will be practiced. The researchers found that increase in age will produce increase in awareness level as lower aged people tended to be less aware on ways to ensure safety compared to middle aged and upper aged people. Also, Olanipekun and Iyinola (2020) posited that the age of the respondents is a determinant of the level of awareness. Stating that younger people tend to have more interpersonal interaction regarding energy conservation with others and mainly because of their exposure to the internet and other social platforms, but lacks energy saving action because of their attitudes. The communication with others could help them find more ways to conduct energy saving, but their attitude might impede their behavioural intentions of energy saving. More so, regarding the questions on energy awareness and green power, the variation is small and lacks a clear pattern, senior citizens between 60 and 70 years old are more aware of energy consumption, but less likely to purchase green power (Brounen *et al.*, 2013). Also, Yagita and Iwafune (2021) stated that the older the person is, the less likely she or he is to adopt energy conservation strategies because: (i) the housing of the elderly is generally older with decayed insulation, (ii) the elderly diminished physical ability for conservation improvements, (iii) they have fewer years of formal education and lack of energy know-how.

The findings of hypothesis eight revealed that there was a significant difference in the mean responses of Primary/Secondary School Certificate holders, ND/NCE holders, HND/Degree holders and Postgraduate degree holders on their awareness on electricity conservation. This suggests that educational level has effect on the awareness of household towards electricity conservation. The level of education is a factor in determining the level of awareness of households on energy conservation. This could be as a result of exposure since higher education defines a higher exposure. The methods of energy conservation can be thought in schools which brings level of education to the fore among the determinants of awareness level of energy conservation. This findings is in line with the findings of Low *et al*, (2020) who posited that education background affects awareness. Individuals with pre-university or tertiary levels of education may be able to access more information from a variety of sources and therefore possess more knowledge compared with individuals with lower levels of education.

In contrast, Olanipekun and Iyinola (2020) suggested that for respondents with different educational qualification, there seems to be no significant differences in their level of awareness. This might be because there are lack of courses concerning energy consumption and conservation in Nigeria's current education system. Also, this could be attributed to the attitude and behaviour that were being exhibited by various individuals. This implied that educational levels does not necessarily mean that energy will be conserved but the attitude and behaviour of individuals needs to be reviewed. As a result, it is necessary to upgrade the educational system in Nigerian tertiary institutions to strengthen energy saving measures. Also, Broumen *et al*, (2020) suggested that the level of education is unrelated to awareness of energy conservation. This could be as a result of energy conservation not being regarded as a general knowledge despite its importance to national development and growth.

The findings of hypothesis nine revealed that there was no significant difference in the mean responses of households with 1-5 people, 6-10 people and 11 and above on their awareness on electricity conservation. This suggests that number in household does not have effect on the awareness of households towards electricity conservation. The number of people in a household living in an apartment does not determine their awareness on electricity conservation. This shows that irrespective of the number in a household, there is equal access to information and knowledge on electrical energy conservation methods. The internet is accessible by all household groups to search for the needed knowledge and so are other sources of information and awareness which are formal education, newspaper and magazines, publicity/awareness materials, workshops/seminars, and public announcements. People of all households can access information in order to get adequate knowledge on ways to save electricity irrespective of how many they are in their households.

In contrast to the findings, Wang *et al*, (2016) suggested that households with a composition of parents and their children (dependent children) have been observed to be more likely to conserve energy than households with just couples or loners who are found to be less willing to adopt energy conservation measures. Leahy and Lyons (2015) studied the electricity consumption of single and double people. By comparison, they found that a single apartment have less than 19% of the electricity consumption. Also, Yohanis *et al*.

(2008) studied the relationship between the number of households and electricity consumption in apartments. The results showed that the apartment lived with four people or more people are used to consume highest average annual electricity consumption. A higher energy consumption highlights lack of awareness towards energy conservation.

The findings of hypothesis ten revealed that there was no significant difference between the mean responses of male and female households on their awareness on electricity conservation. This suggests that gender does not have effect on the awareness of households towards electricity conservation. This could be as a result of equal access to knowledge between both genders. Information is a major source of knowledge and awareness. There is also no discrimination as far as informative and enlightenment sources are concerned. Both male and female genders have access to formal education, internet, journals, seminars and workshops. There are a lot of materials on how to conserve energy online in which both genders can access and save energy in their homes. These findings are supported by Olanipekun and Iyinola (2020) who suggested that there is no significant difference in the level of awareness between the genders of respondents. Gender is found to be insignificant in conservation activities (Wang *et al*., 2016).

In contrast, Mutua and Kimuyu (2015) in a study to find which gender uses more electricity and cares more on energy conservation, found out that women are the largest consumers of electricity mainly due to their primary or full responsibility of home chores such as cooking and ironing clothes. Women were also found to care more on energy conservation, and it was also found that for many who cared more on conservation were the one paying for electricity bills, although in some household electricity bills were paid by the main wage earner who was a man (Murtagh *et al*., 2014). Women were found to have a wider influence in energy use and conservation because despite men‘s awareness on the possibilities of energy saving it is the women who decide what is to be done due to women‘s primary contribution in domestic labour (Murtagh *et al*., 2014).

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Electricity consumption from residential sector represents a very high percentage of the total electricity demand in Nigeria. Residential energy users consume electricity as a result of the kind of appliances they utilize, their attitude towards electricity conservation, their knowledge and awareness on electricity conservation and the energy saving practices employed at home. This study was carried out in order to ascertain the attitude of household electricity users towards electricity conservation, the types of appliances households utilize that lead to energy consumption, the energy savings practices being utilized by households and the awareness level of households on electricity conservation. Based on the findings, residents largely had positive attitude towards energy conservation. Some of the appliances utilized by households are lighting bulbs, TV, fan, pressing iron, and fridge. Households occasionally performed energy savings in their homes by switching off lights during the day, boiling only the needed quantity of water unplugging electrical appliances when not needed.

As long as households fail to save energy, there will continue to be wastages which will in turn lead to energy being insufficient for use. If the households always perform energy savings in their homes, there will be reduction of loss to a barest minimum. The shortage and wastages is also having negative impact to the environment. The study revealed that 39.56% of the residents of Kogi State, Nigeria are highly aware of ways to save electricity, while 16.40% are not aware. There is an urgent need to sensitize and educate residents of

Kogi State Nigeria on practical ways to save electricity, so as to mitigate the wastages brought due to lack of sufficient knowledge.

One of the ways to conserve energy at home is the use of energy saving appliances. Most electrical appliances now have energy saving types, such as bulbs, television, fridge, air conditioner and fan. Another way of ensuring energy conservation is for AEDC to provide all residents with prepaid meters, with prepaid meter, residents are made to pay for what they use and this prevent them from wasting the energy they bought. It is therefore of importance to adopt all these steps to ensure energy is conserved by residential consumers.

5.2 Recommendations

The following recommendations were made in line with the findings:

1. The Kogi State government should organize workshops and seminars to educate the people on energy saving practices.
2. Residents should be well informed through multimedia, social media, and other sources of information dissemination on the need to use efficient electric appliances/equipment and automatic control systems to avoid electrical energy wastages.
3. The State government should prioritize the need to organize energy saving awareness publicity, for residents to be aware of energy savings methods.
4. AEDC should ensure the supply and installation of prepaid meters to all residents of Kogi State Nigeria.
5. Kogi State Government in conjunction with AEDC should establish and empower task forces to check for bypassed loads and arrest anyone found doing such.

5.3 Contribution to Knowledge

This study provides insights into the attitudes, behaviours, and practices of residential electricity users in Kogi State, Nigeria, towards energy conservation. The findings reveal a positive attitude among residents and shed light on the types of appliances commonly utilised and the energy-saving practices employed in households. This knowledge can serve as a basis for designing targeted interventions and educational campaigns to further promote electricity conservation among residents.

Also, the study highlights the urgent need for awareness and education initiatives to increase residents' knowledge about practical ways to save electricity. By identifying the level of awareness among residents, particularly in relation to electricity conservation, the study emphasises the importance of sensitising and educating the population. Implementing strategies such as promoting the use of energy-saving appliances and providing prepaid meters can contribute to reducing energy wastage, ensuring sustainable growth, and safeguarding the Nigerian economy.

5.4 Suggestions for Further Research

1. The replication of this study "analysis of residential electrical energy consumers' perspective on effective demand management in Kogi State Nigeria" is suggested in other states of the federation.
2. Assessment of the effect of marital status on the electricity consumption of residents of Kogi State Nigeria.
3. Assessment of the effect of family size on the attitude of residents towards electricity conservation in Kogi State Nigeria.

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APPENDIX A

FIELD ACKNOWLEDGEMENT LETTER/POPULATION OF THE STUDY

DEPARTMENT OF ELECTRICAL/ELECTRONIC ENGINEERING
FEDERAL POLYTECHNIC, IDAH
PMB 1037, IDAH, KOGI STATE, NIGERIA

OUR REF: **FPI/EEE/ADM.67/230** DATE: 31/08/2021

Postgraduate Coordinator,
Department of Industrial and Technology Education,
Federal University of Technology,
Minna.

Sir,

ACKNOWLEDGEMENT

This is to acknowledge the presence of Mr. IBITOYE DANIEL DAMILOLA with Registration Number Mtech/SS/TE/2018/8634, in the Department of Electrical/Electronic Engineering, Federal Polytechnic, Idah on the research topic: ***''Analysis of Residential Electrical Energy Consumer's Perspective on Effective Electricity Demand Management in Kogi State Nigeria''.***

Thank you.

Yours faithfully,

Engr.Dr. A. Abuh
HOD, Electrical Engineering.

HEAD OF DEPARTMENT
ELECTRICAL/ELECTRONIC ENGI...
FEDERAL POLYTECHNIC, ...

KOGI STATE POLYTECHNIC, LOKOJA

SCHOOL OF ENGINEERING

DEPARTMENT OF ELECTRICAL/ELECTRONICS ENGINEERING

(ITAKPE CAMPUS)

(Office of the Head of Department)

Phone: 08038571719, 08050741858.
E-mail: onipejohn@yahoo.com

Our Ref:

Your Ref:

Date: 5th August 2021

The Postgraduate Coordinator,
Industrial and Technology Education Department,
School of Science and Technology Education,
Federal University of Technology, Minna.

Re: Mr. Ibitoye Daniel Damiliola (MTech/SSTE/2018/8634)

This is to certify that the bearer, Mr. Ibitoye Daniel Damilola, who is a Master student in your Department, was in Kogi State Polytechnic, Lokoja (Itakpe Campus) today, 5th August, 2021, for interview and administration of questionnaire in respect of his research titled "Analysis of Residential Electrical Energy Consumers' Perspective on Effective Electricity Demand Management in Kogi State, Nigeria".

In accordance with your request, he was given the needed assistance which enabled him to carry out his field work within the Polytechnic community.

Be assured of our continuous cooperation whenever it is required.

Thank you.

5/8/2021

Engr. J. A. Onipe,
Head of Department,
Elect. and Elect. Engineering.

APPENDIX B

LETTER OF VALIDATION

Department of Industrial and Technology Education,
School of Science and Technology Education,
Federal University of Technology Minna.
Niger State, Nigeria.
March 13, 2021.

Dear Prof/Dr

REQUEST TO VALIDATE RESEARCH QUESTION

I am a Masters degree student in the Department of Industrial and Technology Education in the Federal University of Technology Minna, Niger State. I am currently undergoing a research thesis titled: **Analysis of Residential Electrical Energy Consumers' Perspectives on Effective Electricity Demand Management in Kogi State, Nigeria.**

I am requesting for your help to please validate he attached draft copy of the questionnaire instrument to be used for the study. Please sir, kindly examine the draft and vet for their clarity on the instruction to respondents, adequacy of the items and relevance to the current study. Your comments and suggestion shall be greatly appreciated to enhance the quality of the final instrument. A copy of the research questions and hypotheses postulated for this study is also attached for your necessary inputs and comments you deem necessary.

Thank you for your contribution. God bless you.

Yours sincerely,

IBITOYE, Daniel Damilola.

VALIDATION CERTIFICATE

This is to certify that the research instrument titled: **Analysis of Residential's Electrical Energy Consumers Perspectives on Effective Electricity Demand Management Questionnaire** was validated by:

Expert's Name: Dr. Usman, G. A.

Institution: FUT Minna

Department: ITE

Signature: 30-03-021

Expert's Name: Dr E. Raymond

Institution: FUT Minna

Department: I.T.E

Signature: 30/03/2021

Expert's Name: Dr S A Owodunni

Institution: FUT.

Department: ITE

Signature: 30/3/2021

ANALYSIS OF RESIDENTIAL ELECTRICAL ENERGY CONSUMER'S PERSPECTIVE ON EFFECTIVE ELECTRICITY DEMAND MANAGEMENT (AREECPEEDM).

Instruction: Please complete this questionnaire as faithfully as possible and sincerely tick [√] the column that best represents your perception about each item. Your response will be used only for the purpose of this research.

SECTION I: Personal Data:

STATUS OF RESPONDENTS

Households	**Income**	
	Low income (less than ₦30,000 monthly)	[ ]
	Middle income (₦30,000 to ₦210,000 monthly)	[ ]
	High income (more than ₦210000 monthly)	[ ]
	Age	
	18-39	[ ]
	40-64	[ ]
	65 and Above	[ ]
	Educational Qualification	
	Primary/Secondary School Certificate	[ ]
	ND/NCE Certificate	[ ]
	HND/Barchelors Degree	[ ]
	Postgraduate Degree	[ ]
	Number of Household	
	1-5	[ ]
	6-10	[ ]
	11 and above	[ ]
	Gender	
	Male	[ ]
	Female	[ ]

SECTION II

Instructions: Please read each statement carefully and respond by ticking [√] the option you consider appropriate. The options are:
Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD)
Always (A), Occasionally(O), Rarely (R) and Never (N)
Highly aware (HA), Aware (A), Slightly Aware (SA) and Not Aware (NA).
Fill in your number of item, the capacity of the item and the average time the item is used for Research question 2

Research Question I: What are the attitudes of households towards electricity consumption?

S/N	Items	Responses			
		SA	**A**	**D**	**SD**
1	It is important to practice energy efficiency during all human activities				
2	Saving energy is important to me				
3	When buying a new appliance, energy efficiency is the most important decision-making factor				
4	When home, I take actions to conserve energy				
5	I am not willing to conserve energy at home if that comes at any cost to my comfort				
6	I have a moral obligation to reduce my energy usage				
7	Reducing my energy consumption will have a strong, positive impact on my personal finances.				
8	I will switch appliances off than set them on standby mode				
9	I'm too busy to be concerned with my energy usage				
10	It would be too much of an inconvenience to my lifestyle to reduce my energy usage				
11	There is very little I can do personally to conserve energy in my home				
12	I will rather open my window than use fan or air conditioner during cold weather				
13	I believe I have a voice in helping to impact energy policies				
14	Electrical energy efficiency is vital to our national economy				
15	There is a culture of energy efficiency in my area				

Research Question II:
What are the electrical appliances used by households that leads to electricity consumption?

S/N	Electrical Appliances	Number of Items	Capacity (Watts)	Average use Hours per day
1	Pressing Iron			
2	Hotplate/Electric Cooker			
3	Bread Toaster			
4	Fridge			
5	Television			
6	Radio			
7	DVD player			
8	Space satellite decoder			
9	Standing fan			
10	Ceiling fan			
11	Incandescent Lighting bulbs (Yellow)			
12	Energy saving bulb			
13	Air conditioner			
14	Pumping machine			
15	Computer system			
16	Telephones/ Hand Sets			
17	Water heater			
18	Electric kettle			
19	Microwave			
20	Deep freezer			
21	Electric blender			
23	Grinding machine			
24	Electric bell			
25	Rechargeable Lamps			
26	Washing machine			
27	CCTV			
28	Vacuum cleaner			
29	Hair clippers			

Research Question III:
What are the electrical energy savings practices utilized in your household?

S/N	Electrical energy savings practices	Responses			
		A	O	R	N
1	Remember to turn off fans when no one is in room				
2	Replacing old appliances with energy efficient ones				

3	Turning off all appliances at the switch (reducing standby power)				
4	Turning off lights when they are not needed				
5	Keeping the windows and doors closed when the air conditioner is on				
6	I keep air conditioner free of obstructions				
7	Ensuring seal of oven door is well tight				
8	Switching off refrigerator while nothing is inside				
9	Replacing incandescent bulbs with energy saving bulbs				
10	Regular cleaning of cooker plate				
11	Avoiding frequently opening of refrigerator				
12	Utilize natural lighting during the day				
13	Boiling only the needed quantity of water				
14	I avoid using fan and air conditioner at the same time				
15	I clean lamp luminaries regularly				

Research Question IV:
What is the awareness level of households on electricity conservation?

S/N	Awareness level of households on electricity conservation	Responses			
		HA	A	SA	NA
1	Switching off the lights when not in use saves energy				
2	Removing lamps when lighting level is high saves energy				
3	Regular usage of natural day lighting helps in energy saving				

4	Regulating the light to illumination level needed using dimmer saves energy.				
5	Usage of task lighting saves electricity				
6	Lowering light fixtures saves energy				
7	Utilization of minimum wattage lamp to provide required light saves energy.				
8	Replacing incandescent bulb with more efficient bulb saves energy				
9	Over loading refrigerator waste energy				
10	Closing of doors and windows while A.C is on save energy				
11	Switching off the A.C when not in use saves energy				
12	Ironing of many cloths at once helps to saves energy				
13	Use of split A.Cs instead of window types saves energy				
14	Ensuring seal of oven door is well tight saves energy				
15	Avoiding frequently opening of refrigerator door saves energy				
16	Regular cleaning of cooker plate saves energy				
17	Pre-heating of oven for long time waste energy				
18	Switching off refrigerator while nothing is inside saves energy				
19	Covering of all food stored in the refrigerator saves energy				

Analysis of Residential Electrical Energy Consumers' Perspective on Effective Electricity Demand Management Interview

Research question I

What are the attitudes of households towards electricity consumption?

Interview questions

1. Is saving energy important to you? How important is it?
2. Do you rate efficiency over cost when buying electrical appliances?
3. Are you willing to conserve energy at home if that comes at any cost?
4. Would you rather put your TV and other appliances off or on standby mode?

Research question II

What are the electrical appliances used by households that leads to electricity consumption?

Interview questions

1. What are the dominant electrical appliances you use that leads to electricity consumption?
2. How long do you put on your fan daily
3. Do you rely solely on electric cooker? How long do you use it per day

Research question III

What are the electrical energy savings practices utilized in your household?

Interview questions

1. What are the electrical energy savings practices utilized in your household?
2. Do you turn off appliances when they are not in use?
3. Do you keep your security lights on during the day?
4. Do you boil only the needed quantity of water?
5. Do you try to avoid frequent opening of the refrigerator?

Research question IV

What is the awareness level of households on electricity conservation?

Interview questions

1. What is your awareness level on electricity consumption? Do you think you have sufficient knowledge on energy saving or conservation?
2. Mention some of your regular practices that can conserve energy
3. Do you think that overloading the fridge wastes energy?
4. Do you think that closing the doors and windows when the AC is on saves energy?
5. Do you think that covering the food in the refrigerator saves energy?

Research Question VI

What are the effective electrical energy saving measures needed by residents of Kogi State Nigeria?

Interview questions

1. What are the effective electrical energy saving measures needed by residents to ensure electrical energy conservation?
2. In what ways can residents be held accountable to ensure energy conservation?

APPENDIX C

CROMBACH ALPHA RELIABILITY STATISTICS

Research Question One
[DataSet1] C:\Research Question1/Desktop\Ma Thesis\My Reliability data set 1.sav
Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	30	100.0
	Excluded[a]	0	.0
	Total	30	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.704	15

Item Statistics

	Mean	Std. Deviation	N
ITEM1	2.6333	.66868	30
ITEM2	2.1333	.86037	30
ITEM3	2.1333	.81931	30
ITEM4	2.0000	.90972	30
ITEM5	2.7000	.83666	30
ITEM6	1.9667	.71840	30
ITEM7	2.6333	.71840	30
ITEM8	2.4000	.72397	30
ITEM9	1.9333	.73968	30
ITEM10	2.0667	.73968	30
ITEM11	1.9667	1.03335	30
ITEM12	2.2000	.92476	30
ITEM13	2.0000	.69481	30
ITEM14	1.8667	.73030	30
ITEM15	2.3333	.88409	30

Item-Total Statistics

ITEM No	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
ITEM1	29.3333	21.264	.466	.816	.605
ITEM2	28.8333	20.489	.431	.707	.603
ITEM3	28.8333	23.661	.032	.900	.663
ITEM4	28.9667	23.826	-.008	.875	.673
ITEM5	28.2667	25.513	-.193	.563	.695
ITEM6	29.0000	23.241	.119	.766	.649
ITEM7	29.3333	23.264	.116	.387	.649
ITEM8	28.5667	22.461	.233	.724	.634
ITEM9	29.0333	21.344	.394	.739	.612
ITEM10	28.9000	20.300	.561	.936	.588
ITEM11	29.0000	18.276	.593	.954	.565
ITEM12	28.7667	18.737	.624	.912	.565
ITEM13	28.9667	20.792	.522	.889	.597
ITEM14	29.1000	22.369	.244	.622	.633
ITEM15	28.6333	23.826	-.003	.345	.671

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
30.9667	24.585	4.95833	15

Research Question Three

[DataSet1] C:\Research Question3/Desktop\Ma Thesis\My Reliability data set 1.sav
Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	30	100.0
	Excluded[a]	0	.0
	Total	30	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.796	15

Item Statistics

	Mean	Std. Deviation	N
ITEM1	1.5667	.56832	30
ITEM2	2.0000	.78784	30
ITEM3	2.9667	.76489	30
ITEM4	2.0333	.61495	30
ITEM5	1.8667	.73030	30
ITEM6	1.9000	.84486	30
ITEM7	2.1333	.81931	30
ITEM8	2.2333	.81720	30
ITEM9	2.1667	.79148	30
ITEM10	2.4333	.72793	30
ITEM11	2.1333	.77608	30
ITEM12	2.0333	.66868	30
ITEM13	2.0333	.66868	30
ITEM14	2.5000	.90019	30
ITEM15	3.2333	.67891	30

Item-Total Statistics 3

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
ITEM1	30.6667	21.126	.260	.882	.664
ITEM2	30.2333	20.116	.293	.911	.660
ITEM3	30.2667	21.030	.170	.984	.676
ITEM4	30.2000	21.200	.217	.926	.669
ITEM5	30.3667	17.826	.721	.863	.601
ITEM6	30.3333	20.161	.255	.824	.665
ITEM7	30.1000	22.438	-.039	.951	.705
ITEM8	30.0000	19.310	.394	.889	.645
ITEM9	30.0667	18.547	.533	.944	.625
ITEM10	29.8000	20.648	.246	.649	.666
ITEM11	30.1000	17.610	.705	.922	.599
ITEM12	30.2000	20.993	.223	.969	.668
ITEM13	30.2000	20.855	.246	.945	.665
ITEM14	29.7333	19.168	.359	.668	.650
ITEM15	29.0000	23.862	-.229	.513	.718

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
32.2333	22.806	4.77554	15

Research Question Four

[DataSet1] C:\Research Question4/Desktop\Ma Thesis\My Reliability data set 1.sav
Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	30	100.0
	Excluded[a]	0	.0
	Total	30	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.878	19

Item Statistics

	Mean	Std. Deviation	N
ITEM1	1.4333	.50401	30
ITEM2	1.9667	.80872	30
ITEM3	1.8667	.81931	30
ITEM4	2.0000	.87099	30
ITEM5	2.1333	.73030	30
ITEM6	2.6333	.71840	30
ITEM7	2.7333	.73968	30
ITEM8	2.6667	.95893	30
ITEM9	2.6000	.96847	30
ITEM10	2.4000	.77013	30
ITEM11	2.5000	.90019	30
ITEM12	2.6333	.92786	30
ITEM13	2.8667	.81931	30
ITEM14	2.4333	.89763	30
ITEM15	1.7667	.97143	30
ITEM16	2.8333	.69893	30
ITEM17	2.9000	.84486	30
ITEM18	2.7000	.91539	30
ITEM19	3.0667	.82768	30

Item-Total Statistics 4

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
ITEM1	44.7000	64.079	.324	.	.845
ITEM2	44.1667	65.247	.080	.	.855
ITEM3	44.2667	63.237	.233	.	.849
ITEM4	44.1333	62.395	.276	.	.848
ITEM5	44.0000	66.621	-.017	.	.857
ITEM6	43.5000	61.776	.412	.	.841
ITEM7	43.4000	59.283	.625	.	.833
ITEM8	43.4667	56.533	.658	.	.829
ITEM9	43.5333	57.223	.600	.	.832
ITEM10	43.7333	63.995	.191	.	.850
ITEM11	43.6333	57.826	.607	.	.832
ITEM12	43.5000	56.879	.658	.	.829
ITEM13	43.2667	57.030	.747	.	.826
ITEM14	43.7000	60.976	.368	.	.844
ITEM15	44.3667	62.102	.255	.	.850
ITEM16	43.3000	58.838	.711	.	.830
ITEM17	43.2333	56.392	.776	.	.824
ITEM18	43.4333	58.116	.573	.	.834
ITEM19	43.0667	62.754	.268	.	.848

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
46.1333	66.947	8.18212	19

APPENDIX D
FIELD IMPLEMENTATION LETTER

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGERIA.
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION
DEPARTMENT OF INDUSTRIAL AND TECHNOLOGY EDUCATION

Vice Chancellor:
PROF. ABDULLAHI BALA, FSSSN
B. Agric (ABU), M. Sc (Reading), Ph.D (London)

Head of Department:
DR. I. Y. UMAR, MTRCN, MTEPAN.
B. Tech, M.Tech (Minna), Ph.D (SWU-China)
E-mail: umaryakubu@futminna.edu.ng

P.M.B. 65, Minna
Telephone: +2348066059717
E-mail: ite@futminna.edu.ng
Website: www.futminna.edu.ng

*Your Ref:*____________________

*Our Ref:*____________________ *Date:*____________________

....
....
....
....

Sir/Ma,

TO WHOM IT MAY CONCERN

The bearer Ibitoye Daniel Damilola with Registration Number M.Tech/ MTech/SSTE/2018/8634 is A Master student of Industrial and Technology Education Department.

He is carrying out a research titled: Analysis of Residential Electrical Energy Consumer's perspective on Effective Electricity Demand Management in Kogi State Nigeria

He needs your assistance to enable him carry out his field work.

We will appreciate your anticipated co-operation.

Thank you.

25/6/2021

Dr. E. Raymond
Postgraduate Coordinator, ITE.

APPENDIX E
DETAILED ANALYSIS SHOWING THE NUMBER OF RESPONSES, MEAN AND PERCENTAGE RESPONSES OF THE RESPONDENTS

Table 1: Mean, Standard Deviation, and Percentage Responses of Households on Their Attitude Towards Electricity Consumption

S/N	Attitudes Of Households Towards Electricity Consumption	SA N (%)	A N(%)	D (%)	SD N(%)	MEAN	SD	DECISION
1	It is important to practice energy efficiency during all human activities	276(64.9)	131(30.8)	18(4.2)	0(0)	3.60	.57	SA
2	Saving energy is important to me	302(71.1)	117(27.5)	6(1.4)	0(0)	3.69	.49	SA
3	When buying a new appliance, energy efficiency is the most important decision-making factor	227(53.4)	154(36.2)	39(9.2)	5(1.2)	3.41	.71	A
4	When home, I take actions to conserve energy	214(50.4)	180(42.4)	23(5.4)	8(1.9)	3.41	.68	A
5	I am not willing to conserve energy at home if that comes at any cost to my comfort	128(30.1)	124(29.2)	135(31.8)	38(8.9)	2.80	.97	A
6	I have a moral obligation to reduce my energy usage	132(31.1)	208(48.9)	49(11.5)	36(8.5)	3.02	.88	A
7	Reducing my energy consumption will have a strong, positive impact on my personal finances.	150(35.3)	161(37.9)	56(13.2)	58(13.6)	2.94	1.02	A
8	I will switch appliances off than set them on standby mode	226(53.2)	127(29.9)	48(11.3)	24(5.6)	3.30	.88	A
9	I'm too busy to be concerned with my energy usage	89(20.9)	104(24.5)	138(32.5)	94(22.1)	2.44	1.05	D
10	It would be too much of an inconvenience to my lifestyle to reduce my energy usage	98(23.0)	124(29.2)	152(35.8)	51(12.0)	2.99	2.76	A
11	There is very little I can do personally to conserve energy in my home	88(20.7)	138(32.5)	128(30.1)	71(16.7)	2.93	3.43	A
12	I will rather open my window than use fan or air conditioner during cold weather	176(41.4)	105(24.7)	94(22.1)	50(11.8)	2.95	1.05	A
13	I believe I have a voice in helping to impact energy policies	144(33.9)	150(35.3)	92(21.6)	39(9.2)	2.93	.96	A
14	Electrical energy efficiency is vital to our national economy	202(47.5)	142(33.4)	52(12.2)	29(6.8)	3.21	.90	A
15	There is a culture of energy efficiency in my area	114(26.8)	118(27.8)	146(34.4)	47(11.1)	2.70	.98	A

Table 2: Mean, Standard Deviation, and Percentage Responses of Households on Their Energy Saving Practices

S/N	Electrical energy savings practices	A N (%)	O N (%)	R N (%)	N N (%)	MEAN	SD	DECISION
1	Remember to turn off fans when no one is in room	272(64.0)	31(7.3)	26(6.1)	90(21.2)	2.70	.47	O
2	Replacing old appliances with energy efficient ones	210(49.4)	147(34.6)	64(15.1)	4(0.9)	3.32	.76	O
3	Turning off all appliances at the switch (reducing standby power)	350(82.4)	46(10.8)	15(3.5)	14(3.3)	3.52	.69	A
4	Turning off lights when they are not needed	323(76.0)	93(21.9)	4(0.9)	5(1.2)	2.73	.54	O
5	Keeping the windows and doors closed when the air conditioner is on	272(64.0)	31(7.3)	26(6.1)	90(21.2)	3.16	1.24	O
6	I keep air conditioner free of obstructions	239(56.2)	55(12.9)	68(16.0)	45(10.6)	2.20	1.08	R
7	Ensuring seal of oven door is well tight	247(58.1)	69(16.2)	54(12.7)	43(10.3)	2.76	1.04	O
8	Switching off refrigerator while nothing is inside	253(59.5)	122(28.7)	24(5.6)	26(6.1)	2.92	.85	O
9	Replacing incandescent bulbs with energy saving bulbs	224(52.7)	124(29.2)	49(11.5)	28(6.6)	3.28	.91	O
10	Regular cleaning of cooker plate	245(57.6)	87(20.5)	46(10.8)	41(9.6)	3.24	1.01	O
11	Avoiding frequently opening of refrigerator	273(64.2)	84(19.8)	47(11.1)	21(4.9)	3.43	.87	O
12	Utilize natural lighting during the day	241(56.7)	133(31.3)	28(6.6)	23(5.4)	3.39	.83	O
13	Boiling only the needed quantity of water	240(56.5)	113(26.6)	37(8.7)	29(6.8)	3.34	.91	O
14	I avoid using fan and air conditioner at the same time	220(51.8)	107(25.2)	64(15.1)	34(8.0)	2.93	.97	O
15	I clean lamp luminaries regularly	200(47.1)	124(29.2)	76(17.9)	25(5.9)	3.17	.93	O

Table 3: Mean, Standard Deviation, and Percentage Responses of Households on Their Awareness

S/N	Awareness level of households on electricity conservation	HA N(%)	A N(%)	SA N(%)	NA N(%)	MEAN	SD	DECISION
1	Switching off the lights when not in use saves energy	80.90	14.80	2.80	1.40	3.7529	.57269	HA
2	Removing lamps when lighting level is high saves energy	40.70	30.10	14.80	14.40	2.9718	1.06361	A
3	Regular usage of natural day lighting helps in energy saving	54.70	20.90	15.90	8.50	3.2282	4.87960	A
4	Regulating the light to illumination level needed using dimmer saves energy.	34.50	31.30	6.60	27.60	2.5259	1.10393	A
5	Usage of task lighting saves electricity	35.10	30.10	18.10	16.70	2.6882	1.43228	A
6	Lowering light fixtures saves energy	35.60	34.80	18.10	11.50	2.6376	2.08131	A
7	Utilization of minimum wattage lamp to provide required light saves energy.	43.90	30.10	16.60	9.40	3.1212	1.24744	A
8	Replacing incandescent bulb with more efficient bulb saves energy	45.40	25.20	13.60	15.80	3.1724	1.10637	A
9	Over loading refrigerator waste energy	29.90	23.30	28.40	18.40	2.4482	1.14807	SA
10	Closing of doors and windows while A.C is on save energy	41.10	20.70	17.70	20.50	3.0147	1.18520	A
11	Switching off the A.C when not in use saves energy	51.20	18.90	17.20	12.70	3.1353	1.09077	A
12	Ironing of many cloths at once helps to saves energy	24.10	29.40	27.20	19.30	2.2824	1.12866	SA
13	Use of split A.C instead of window types saves energy	26.60	36.90	16.50	20.00	2.3012	1.06957	SA
14	Ensuring seal of oven door is well tight saves energy	30.40	35.80	19.10	14.80	2.5165	1.02755	A
15	Avoiding frequently opening of refrigerator door saves energy	41.60	32.50	20.80	5.20	3.0147	.88913	A
16	Regular cleaning of cooker plate saves energy	23.90	25.40	28.60	22.10	2.1306	1.15273	SA
17	Pre-heating of oven for long time waste energy	40.00	30.10	21.90	8.00	3.0012	.96984	A
18	Switching off refrigerator while nothing is inside saves energy	40.90	29.20	18.10	11.80	3.0928	1.01992	A
19	Covering of all food stored in the refrigerator saves energy	23.10	24.90	21.90	30.10	2.1026	1.51810	SA

APPENDIX F

ANALYSIS OF HYPOTHESES

Hypothesis one

Descriptive

Mean response

Income	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
0-31000	178	3.7917	.56779	.04256	3.5059	3.6739	2.00	4.00
32000-210000	223	3.6009	.58309	.03905	3.5239	3.6778	2.00	4.00
211000-ABOVE	24	3.5899	.41485	.08468	3.6165	3.9668	3.00	4.00
Total	425	3.6008	.58422	.02761	3.5528	3.6613	2.00	4.00

Test of Homogeneity of Variances

Mean Response

Levene Statistic	df1	df2	Sig.
0.321	2	422	.131

ANOVA

Mean Responses

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.879	2	.439	1.359	.026
Within Groups	136.500	422	.323		
Total	137.379	424			

Multiple Comparisons

Tukey HSD

(I) INCOME	(J) INCOME	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0-31000	32000-210000	-.01101*	.05716	.024	-.1455	.1234
	211000-ABOVE	-.20178*	.12367	.033	-.4927	.0891
32000-210000	0-31000	.01101*	.05716	.024	-.1234	.1455
	211000-ABOVE	-.19077	.12218	.264	-.4781	.0966
211000-ABOVE	0-31000	.20178*	.12367	.033	-.0891	.4927
	32000-210000	.19077	.12218	.264	-.0966	.4781

Mean Responses

Tukey

INCOME	N	Subset for alpha = 0.05
		1
0-31000	178	3.7917
32000-210000	223	3.6009
211000-ABOVE	24	3.5899
Sig.		.137

Means for groups in homogeneous subsets are displayed

a. Uses Harmonic Mean Sample Size = 57.950.

Hypothesis Two

Descriptives

Mean Responses

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
15-39	206	3.6456	.58071	.04046	3.5659	3.7254	2.00	4.00
40-64	213	3.5587	.56014	.03838	3.4830	3.6343	2.00	4.00
65 ABOVE	6	4.0000	0.00000	0.00000	4.0000	4.0000	4.00	4.00
Total	425	3.7347	.38022	.02761	3.5528	3.6613	2.00	4.00

Test of Homogeneity of Variances

Mean Response

Levene Statistic	df1	df2	Sig.
0.782	2	422	.094

ANOVA

Mean Responses

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.731	2	.866	2.693	.019
Within Groups	135.647	422	.321		
Total	137.379	424			

Multiple Comparisons

Tukey HSD

(I) AGE	(J) AGE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
18-39	40-64	.08695*	.05540	.027	-.0434	.2173
	65 ABOVE	-.35437	.23481	.288	-.9066	.1979
40-64	15-39	-.08695*	.05540	.027	-.2173	.0434
	65 ABOVE	-.44131*	.23470	.014	-.9933	.1107
65 ABOVE	15-39	.35437	.23481	.288	-.1979	.9066
	40-64	.44131*	.23470	.014	-.1107	.9933

Mean Responses

AGE	N	Subset for alpha = 0.05
		1
40-64	213	3.5587
15-39	206	3.6456
65 ABOVE	6	4.0000
Sig.		.061

Means for groups in homogeneous subsets are displayed
a. Uses Harmonic Mean Sample Size = 17.025

Hypothesis Three

Descriptives

Mean Responses

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
PRIMARY/SECONDARY	47	3.5319	.74749	.10903	3.3124	3.7514	2.00	4.00
ND/NCE	160	3.5625	.55726	.04405	3.4755	3.6495	2.00	4.00
HND/ DEGREE	187	3.5989	.55319	.04045	3.5191	3.6787	2.00	4.00
POSTGRADUATE	31	4.0000	0.00000	0.00000	4.0000	4.0000	4.00	4.00

Test of Homogeneity of Variances

Mean Response

Levene Statistic	df1	df2	Sig.
1.034	3	421	.091

ANOVA

Mean Response

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.382	3	1.794	5.722	.001
Within Groups	131.997	421	.314		
Total	137.379	424			

Multiple Comparisons

Tukey HSD Post hoc

(I) EDUCATIONAL QUALIFICATION	(J) EDUCATIONAL QUALIFICATION	Mean Difference (I-J)	Std. Error	Sig.
PRI/SEC	ND/NCE	-.03059	.09290	.988
	HND/BARCHELORS	-.06702	.09136	.884
	POSTGRADUATE	-.46809*	.12956	.002
ND/NCE	PRI/SEC	.03059	.09290	.988
	HND/BARCHELORS	-.03643	.06030	.931
	POSTGRADUATE	-.43750*	.10988	.000
HND/BARCHELORS	PRI/SEC	.06702	.09136	.884
	ND/NCE	.03643	.06030	.931
	POSTGRADUATE	-.40107*	.10858	.001
POSTGRADUATE	PRI/SEC	.46809*	.12956	.002
	ND/NCE	.43750*	.10988	.000
	HND/BARCHELORS	.40107*	.10858	.001

Mean Rseponses

Tukey

EDUCATIONAL QUALIFICATION	N	Subset for alpha = 0.05	
		1	2
PRI/SEC	47	3.5319	
ND/NCE	160	3.5625	
HND/BACHELORS DEGREE	187	3.5989	
POSTGRADUATE	31		4.0000
Sig.		.911	1.000

Means for groups in homogeneous subsets are displayed

a. Uses Harmonic Mean Sample Size = 61.414

Hypothesis Four

Descriptives

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1-5	238	3.6176	.58895	.03818	3.5424	3.6929	2.00	4.00
6-10	175	3.6000	.54667	.04132	3.5184	3.6816	2.00	4.00
11 ABOVE	12	3.5000	.52223	.15076	3.1682	3.8318	3.00	4.00
Total	425	3.5725	.56922	.02761	3.5528	3.6613	2.00	4.00

Test of Homogeneity of Variances

Mean Response

Levene Statistic	df1	df2	Sig.
0.463	2	422	.079

ANOVA

Mean Responses

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	.024	1	.024	.194	.667
Within Groups	1.632	13	.126		
Total	1.657	14			

Multiple Comparisons

Tukey HSD

(I) NUMBER OF HOUSEHOLD	(J) NUMBER OF HOUSEHOLD	Mean Difference (I-J)	Std. Error	Sig.
1-5	6-10	.01765	.05678	.948
	11 ABOVE	.11765*	.16870	.025
6-10	1-5	-.01765	.05678	.948
	11 ABOVE	.10000	.17015	.827
11 ABOVE	1-5	-.11765*	.16870	.025
	6-10	-.10000	.17015	.827

Mean Responses

Tukey

NUMBER OF HOUSEHOLD	N	Subset for alpha = 0.05
		1
11 ABOVE	12	3.5000
6-10	175	3.6000
1-5	238	3.6176
Sig.		.686

Means for groups in homogeneous subsets are displayed

a. Uses Harmonic Mean Sample Size = 61.414.

Hypothesis Five

T-test

Group Statistics

	Categoryofrespondent		Statistic	Bootstrap[a]			
				Bias	Std. Error	95% Confidence Interval	
						Lower	Upper
ATTITUDE	Male	N	215				
		Mean	3.6000	-.0635	1.8956	339.4000	346.9954
		Std. Deviation	0.48798	-.41785	1.01035	3.5484	3.6796
		Std. Error Mean	0.3328				
	Female	N	210				
		Mean	3.6140	.0421	1.5735	337.5387	343.7569
		Std. Deviation	0.64296	-.22973	1.19803	3.5125	3.6875
		Std. Error Mean	0.4437				

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

GROUPS	N	Df	Mean	SD	Sig.(2-tailed)	Remark
Male	215	423	3.61	0.49	0.01	S
Female	210		3.60	0.64		

Hypothesis Six

Descriptives

Mean Responses

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
0-31000	178	3.5393	.72962	.05469	3.4314	3.6472	1.00	4.00
32000-210000	223	3.6667	.32874	.02201	3.8894	3.9761	2.00	4.00
211000-ABOVE	24	3.9327	.48154	.09829	3.4633	3.8700	3.00	4.00
Total	425	3.7129	.57269	.02778	3.6983	3.8075	1.00	4.00

Test of Homogeneity of Variances

Mean Response

Levene Statistic	df1	df2	Sig.
1.042	2	422	.087

ANOVA

Mean Responses

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	15.510	2	7.755	26.488	.000
Within Groups	123.549	422	.293		
Total	139.059	424			

Multiple Comparisons

Tukey HSD

(I) INCOME	(J) INCOME	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
0-31000	32000-210000	-.39341*	.05438	.000	-.5213	-.2655
	211000-ABOVE	-.12734*	.11766	.026	-.4041	.1494
32000-210000	0-31000	.39341*	.05438	.000	.2655	.5213
	211000-ABOVE	.26607	.11624	.058	-.0073	.5395
211000-ABOVE	0-31000	.12734*	.11766	.026	-.1494	.4041
	32000-210000	-.26607	.11624	.058	-.5395	.0073

Mean Responses

Mean

INCOME	N	Subset for alpha = 0.05	
		1	2
0-31000	178	3.5393	
211000-ABOVE	24	3.9327	
32000-210000	223		3.6667
Sig.		.415	1.000

Means for groups in homogeneous subsets are displayed

a. Uses Harmonic Mean Sample Size = 57.950

Hypothesis Seven

Descriptives

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
15-39	206	3.7039	.52701	.03672	3.6315	3.7763	2.00	4.00
40-64	213	3.7934	.61778	.04233	3.7100	3.8769	1.00	4.00
65 ABOVE	6	4.0000	0.00000	0.00000	4.0000	4.0000	4.00	4.00
Total	425	3.8324	.57269	.02778	3.6983	3.8075	1.00	4.00

Test of Homogeneity of Variances

Mean Response

Levene Statistic	df1	df2	Sig.
0.392	2	422	.08

ANOVA

Mean Responses

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1.211	2	.606	1.854	.018
Within Groups	137.848	422	.327		
Total	139.059	424			

Multiple Comparison

Tukey HSD

(I) AGE	(J) AGE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
18-39	40-64	-.08954	.05585	.245	-.2209	.0418
	65 ABOVE	-.29612*	.23670	.024	-.8528	.2606
40-64	18-39	.08954	.05585	.245	-.0418	.2209
	65 ABOVE	-.20657*	.23659	.013	-.7630	.3499
65 ABOVE	15-39	.29612*	.23670	.024	-.2606	.8528
	40-64	.20657*	.23659	.013	-.3499	.7630

Mean Responses

Tukey

INCOME	N	Subset for alpha = 0.05	
		1	2
18-39	206	3.7039	15-39
40-64	213	3.7934	40-64
65 ABOVE	6	4.0000	65 ABOVE
Sig.		.286	Sig.

Means for groups in homogeneous subsets are displayed

a. Uses Harmonic Mean Sample Size = 17.029

Hypothesis EIght

Descriptives

Mean Responses

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
PRI/SEC	47	3.1915	.96995	.14148	2.9067	3.4763	1.00	4.00
ND/NCE	160	3.7813	.41470	.03278	3.7165	3.8460	3.00	4.00
HND/ DEGREE	187	3.8289	.52119	.03811	3.7537	3.9041	2.00	4.00
POSTGRADUATE	31	4.0000	0.00000	0.00000	4.0000	4.0000	4.00	4.00

Test of Homogeneity of Variances

Mean Response

Levene Statistic	df1	df2	Sig.
1.217	3	421	.061

ANOVA

Mean Responses

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	17.914	3	5.971	20.752	.000
Within Groups	121.144	421	.288		
Total	139.059	424			

Multiple Comparisons

Tukey HSD

(I) EDUCATIONAL QUALIFICATION	(J) EDUCATIONAL QUALIFICATION	Mean Difference (I-J)	Std. Error	Sig.
PRI/SEC	ND/NCE	-.58976*	.08900	.000
	HND/BACHELORS DEGREE	-.63739*	.08753	.000
	POSTGRADUATE	-.80851*	.12412	.000
ND/NCE	PRI/SEC	.58976*	.08900	.000
	HND/BACHELORS DEGREE	-.04763	.05777	.843
	POSTGRADUATE	-.21875	.10527	.162
HND/BACHELORS DEGREE	PRI/SEC	.63739*	.08753	.000
	ND/NCE	.04763	.05777	.843
	POSTGRADUATE	-.17112	.10402	.355
POSTGRADUATE	PRI/SEC	.80851*	.12412	.000
	ND/NCE	.21875	.10527	.162
	HND/BACHELORS DEGREE	.17112	.10402	.355

Mean Responses

Tukey

EDUCATIONAL QUALIFICATION	N	Subset for alpha = 0.05	
		1	2
PRI/SEC	47	3.1915	
ND/NCE	160		3.7813
HND/BACHELORS DEGREE	187		3.8289
POSTGRADUATE	31		4.0000
Sig.		1.000	.109

Means for groups in homogeneous subsets are displayed

a. Uses Harmonic Mean Sample Size = 61.414

Hypothesis Nine

Descriptives

Mean Responses

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1-5	238	3.7731	.60848	.03944	3.6954	3.8508	1.00	4.00
6-10	175	3.7086	.53679	.04058	3.6285	3.7887	2.00	4.00
11 ABOVE	12	4.0000	0.00000	0.00000	4.0000	4.0000	4.00	4.00
Total	425	3.8272	.57269	.02778	3.6983	3.8075	1.00	4.00

Test of Homogeneity of Variances

Mean Response

Levene Statistic	df1	df2	Sig.
0.213	2	422	.057

ANOVA

Mean Responses

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.174	2	.587	1.796	.167
Within Groups	137.885	422	.327		
Total	139.059	424			

Mean Responses

Mean

NUMBER OF HOUSEHOLD	N	Subset for alpha = 0.05
		1
6-10	175	3.7086
1-5	238	3.7731
11 ABOVE	12	4.0000
Sig.		.103

Means for groups in homogeneous subsets are displayed

a. Uses Harmonic Mean Sample Size = 32.172

Hypothesis Ten

Descriptives

Mean Responses

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
MALE	215	3.8372	.44983	.03068	3.7767	3.8977	2.00	4.00
FEM	210	3.6667	.66587	.04595	3.5761	3.7573	2.00	4.00
Total	425	3.7522	.57269	.02778	3.6983	3.8075	1.00	4.00

t-test

Group Statistics

			Statistic	Bootstrap[a]			
				Bias	Std. Error	95% Confidence Interval	
	Categoryofrespondent					Lower	Upper
ATTITUDE	Male	N	215				
		Mean	3.8372	-.0421	0.0368	301.1410	385.0361
		Std. Deviation	0. 449838	-.41341	1.01104	3.7767	3.7121
		Std. Error Mean	0.02778				
	Female	N	210				
		Mean	3.6667	.0421	0.04595	317.0354	343.7569
		Std. Deviation	0.665876	-.31971	1.13513	3.4319	3.8512
		Std. Error Mean	0.02778				

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Groups	N	Df	Mean	SD	Sig.(2-tailed)	Remark
Male	215	423	3.84	0.45	0.17	NS
Female	210		3.67	0.67		

Research Question 5

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.230[a]	.053	.042	.45746

a. Predictors: (Constant), GENDER, NUMBER OF HOUSEHOLD, INCOME, AGE, EDUCATIONAL QUALIFICATION

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	4.913	5	.983	4.695	.150[b]
	Residual	87.685	419	.209		
	Total	92.598	424			

a. Dependent Variable: Remember to turn off fans when no one is in room

b. Predictors: (Constant), GENDER, NUMBER OF HOUSEHOLD, INCOME, AGE, EDUCATIONAL QUALIFICATION

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	4.040	.441		9.159	.000	3.881	4.396
INCOME	-.172	.129	-.526	-1.329	.216	-.008	.198
AGE	.088	.150	.218	.589	.570	-.157	.048
EDUCATIONAL QUALIFICATION	.028	.097	.098	.290	.779	-.222	.071
NUMBER OF HOUSEHOLD	-.141	.118	-.308	-1.189	.265	-.150	.011
GENDER	-.214	.121	-.500	-1.762	.112	-.054	.123

a. Dependent Variable: Remember to turn off fans when no one is in room