UNIVERSITY OF CAPE COAST

# ENERGY CONSERVATION AND AWARENESS PRACTICES OF HOUSEHOLDS IN THE CAPE COAST METROPOLIS

BY

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# DECLARATION

## Candidate's Declaration

I hereby declare that this thesis is the result of my original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature……Date……

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## Supervisor's Declaration

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Supervisor's Signature……Date……

Name: Dr. Abrefa Danquah Jones (PHD)

## ABSTRACT

This study explored energy conservation and awareness practices of households in the Cape Coast Metropolis. With the emergence of the contradictions between energy supply and demand, considerable attention has been paid to the residential household energy consumption with increasing research in this field. Concurrent Mixed method was adopted to assess the efficient use of electrical energy in the Cape Coast metropolis, examine the level of electrical energy conservation awareness among people of Cape Coast metropolis, determine energy-saving practices among people of Cape Coast, determine the socio-demographic factors that influence an individual's choice of energy-efficient appliances and to assess variability in energy conservation practices among households in the Cape Coast metropolis. Simple random sampling was used to select 396 respondents for the quantitative while 5 stakeholders were interviewed for the qualitative aspect of the study. The study concluded that the level of energy conservation awareness among households in the cape coast metropolis is low and that households engaged in their own perceived energy-saving practices. Variables such as years of schooling of household heads, expenditure, income, number of household members below 18years, and hours power goes off daily had direct relationship with households choice of electrical appliances. The study showed that there is a great level of variability existing between social strata and conservation practice of households with respect to the use of appliance such as fridge/freezer. The effect of social strata on the use of television, lightbulbs and fan was low although statistically, there is significant variation in the use of these appliances among households and across various social strata. Based on the findings of the study, it was recommended that education on energy conservation should be intensified until households become more conversant with the term 'energy conservation' and also, policies on energy conservation should be made well known to the public.

## KEY WORDS

Energy

Conservation

Consumption

Awareness

Households.

Practices

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God bless you.

## DEDICATION

I dedicate this work to my mother and my whole family

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# CHAPTER ONE

# INTRODUCTION

## Background to the Study

Ideas about energy keep on developing and cropping in new contexts, and therefore, there is no abstract definition for energy (Sefton, 2015). However, the term "energy" as used in modern interpretations can be defined as the ability to produce change or do work. Ranging from solar energy which is free from the sun and helps to grow foods for human consumption to electrical energy used by almost every device in our homes and also for industrial purposes, energy is crucial in almost all facets of human life. Naturally existing is classified into non-renewable and renewable energy. For instance, renewable energy is those that can be regenerated or renewed naturally to keep up with consumption. Examples include, hydro, geothermal, solar and wind. On the other hand, non-renewable energy cannot be replenished or replaced by natural means at an enough or faster pace to keep up with consumption. Some non-renewable energy include natural gas, oil and coal. However, per this study, emphasis will be placed on renewable energy. Global energy-related carbon dioxide (CO2) emissions according to (Adib, 2019), increased with an estimated value of 1.7% in 2018 due to increased fossil fuel consumption and this has harmful effects on the environment. As a result of the harmful effects on the environment, the effective utilization of renewable energy sources has become very critical across the world to ensure a lessening of the emissions of harmful greenhouse gases and also to ensure the security of energy supply (Adib, 2019). Globally, several countries have appreciatively accepted the importance of renewable energy, and as a result, many countries such as the United States, China, India, Singapore and other developed economies have

adopted for several years, the use of hydroelectricity, wind energy, solar energy, and even thermal energy. These varieties underscore renewable energy but not limited to, geothermal energy, tidal energy, among others. Kerosene was used to light lamps in houses, food was cooled in iceboxes and wood-burning was used to warm rooms before electricity generation began in about 100 years ago. As said by [Energy Information Administration (EIA, 2009)], the principle of electricity was gradually understood starting with Benjamin Franklin's kite experiment in Philadelphia and later, electric light bulbs were invented by Thomas Edison.

Further development in electricity concerning the generation, transmission and alternating current (AC) is credited to Nikola Tesla during the end of the nineteenth century (EIA, 2009) this helped in transmitting electricity over longer distances as compared to direct current which was used before then. The introduction of alternating current electricity was used to bring indoor lighting to homes in replacement of kerosene lamps. Noting from the works of Commerford (2011), the world's population is postulated to will rise by about 45 per cent in the next 90 years with about 10 billion people. Therefore it is possible that electricity production would have to sustainably meet this future demand.

The utilisation of hydropower is pertinent in the power generation nexus. Globally, the hydropower generation still remains the leading source of electricity [World Energy Resources (WER, 2016)]. Generating electricity through the use of hydropower in both developed and developing countries stems from almost identical technologies with little diversity. Here, turbines connected to generators are spun with flowing water (under intense gravity) to

produce electricity (EIA, 2009). Hydropower contributed about 5.8% of U.S. electricity generation in 2007 (EIA, 2009). Also, a report published in 2005 by the Bureau of Reclamation from the U. S. Department of the Interior classified electricity which has its source from water (that is, hydro-electric power) as a form of renewable energy. A report established that countries like Brazil, Republic of Congo and Norway had 90% of their energy from hydro-electric power. Although the first hydro-electric plant in the United States was on the Fox River in Wisconsin, China had the largest hydro-electric plant which could generate more than a billion watts of electricity on the Gorges Dam. As far back as 2002, hydropower contributed 32% of Africa's primary energy needs, the second-highest after oil (41%) (Kalitsi, 2002). Out of the total amount of energy gained from hydropower, 23% was in North Africa, 25% was distributed to West Africa, and 51% was shared among South, Central and East Africa (Kalitsi, 2002). In Ghana, although about 75% of the electricity supplied was hydro-generated in 2002 (Asumadu-Sarkodie and Owusu, 2016), thermal-generated electricity is currently the leading source of the overall electricity supplied. Thermal contributes 59.8% while hydro contributes 39.9% and with solar contributing 0.3% of the total electricity generated in Ghana (Energy Supply and Demand Outlook – Energy Commission, 2020)

Achieving goal seven (7) of the sustainable development program requires the overall development of the energy sector. Lambert, Heddeghem, Vereecken, Colle, and Pickavet (2012) demonstrated in their study that telecommunication networks (telcos), domestic premise equipment and office networks are fast-growing, at an annual rate of 10 per cent. This rate in 2012 was reported as the global electricity consumption with an increasing rate from

1.3 per cent in 2007 to 1.8 per cent in 2012. The rise in energy consumption has been dramatic as a result of increasing population growth and economic development. Consequently, these fast-paced developments have become a significant concern, particularly in developing countries (Commerford, 2011).

In the face of this fast-paced energy consumption, there is evidence to demonstrate a significant relationship amid energy consumption and economic progress (Schwartz, Wei, Morrow et al., 2017; Shaari, Hussain and Ismail, 2012). Table 1. below indicates a consistent annual increase in population and its equivalent increase in electricity demand in Ghana.

**Table 1: Annual Population Growth Against Electricity Demand in Ghana**

| Year | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Population (millions) | 24,170,940 | 24,779,619 | 25,387,712 | 25,996,450 | 26,607,645 | 27,224,473 | 27,849,205 | 28,481,945 | 29,121,465 | 29,767,102 | 30,417,856 |
| Electricity Demand (peak load) MW | 1263 | 1391 | 1520 | 1658 | 1791 | 1853 | 1757 | 1997 | 2077 | 2371 | 2613 |

Source: Strategic Planning and Policy Directorate - Energy Commission, 2020

Studies have indicated that hydro-electric power has got pros and cons just as any other resource. That is, aside from water being a clean and renewable resource in itself, the construction and maintenance of hydro-electric facilities requires the employment of several people including engineers, contractors, administrators, cleaners as well as the construction of Dams aid tourism and recreation. For instance, the Akosombo Dam in Ghana serves as a tourist site from which revenue is generated for the country aside from the job employment it has created for Ghanaians. However, sometimes the creation of Dams and reservoirs lead, to large areas getting flooded and as a result, people lose their homes and are forced to relocate. Also, habitats for animals are disrupted as well due to the construction of large dams and reservoirs.

In Ghana, the increase in electricity consumption with its associated cost cannot be neglected. The high energy debt incurred, however, may be associated with Ghana's transition from hydro-electric power to thermal plants in generating electricity. In effect, the interplay between the economy of energy consumption, high-energy debt and environmental quality must be balanced. This balance can be actualised by designing and implementing countermeasures to impel high domestic and industrial energy usage (Verma, Jaiswal, and Wani, 2012).

Domestic or residential energy use includes household, which accounted for 15 per cent of aggregated global energy use in 2006 (Verma et al., 2012). Even at this rate, the diversity in the type and use of energy at the domestic level was variant amongst countries irrespective of their economic development level.

In 2016, the average monthly usage of electricity in domestic appliances (light, refrigerator, iron, fans, television, and so on) in Ghana, was 129.6 kWh and 153.8 kWh in urban and rural areas respectively [Ghana Energy Commission (GEC, 2016)]. Furthermore, their report fractioned electricity consumption in this wise; Coastal regions (158.9 kWh), Savannah areas (123.6 kWh) and the Forest areas (151.9 kWh). Per the Ghanaian economic growth in 2013, the service sector remains the largest with a rate of 8.9 %, followed by the industrial sector (7.0 %) and agricultural sector (5.2 %) (ISSER, 2014). According to Nkrumah (2016), energy demand in Ghana is increasing at a rate faster than the supply available, leading to a deficit in the primary energy sources. This increase in energy demand appear to be due to the increase in household demand, mainly for electrical energy for various domestic services. This gap between energy demanded and energy supplied could be associated with the growth in the service sector of the economy which rely heavily on power to provide various services according to [Ghana Energy Commission (GEC, 2013)] as cited by Asumadu-sarkodie and Owusu (2017).

The gap concerning the energy demand and supply plunged the country into energy crises. Consequently, the socio-economic wellbeing of many individuals and groups of people, including students, large/small-scale industries was affected (Ibrahim, Aryeetey, Asampong, Dwomoh and Nonvignon,2016). A classic example is a possible effect on students' health and mental well-being, who depend on modern energy-driven appliances such as smartphones, laptops, tablets, and other domestic usages. Students need some of these gadgets as much as internet connectivity to achieve utmost productivity on campus. Notwithstanding, most of these appliances are usually electrical

appliances, and therefore, they are highly dependent on electricity supply to function.

In a situation where the amount of electricity available for supply does not meet the amount of electricity demand, with all things being equal, prices of electricity, as well as electrical appliances and gadgets, would increase. Also, with the shortage in electricity supply due to high electricity demanded in a country, there is a high possibility for the country to experience frequent power outages until the amount of electricity supplied meets the amount of electricity demand by the populace. As this happened to be the situation in Ghana, Ghana's government embarked on energy conservation and efficiency policies to minimize electricity consumption and push for the use of energy-efficient appliances to help address the issue of increasing demand for electricity. However, this intervention appears to have not resolved the situation totally. Hence, there is the need to consider other means of addressing this challenge.

**Statement of the Problem**

In Ghana, the government implemented several programs and projects to shrink electricity consumption, especially among households, and advocate using energy-efficient home appliances. These programs to regulate energy falls under, the Legislative Instrument 1815 in 2005 (Energy Efficiency Standards and Labelling Regulation) (Nkrumah, 2016). For instance, the regulation required manufacturers, importers and retailers of electric home appliances, to label the appliances they sold in the Ghanaian market, indicating their efficiency levels and ensuring that the appliances meet the efficiency standards of the regulation. Again, the efficiency lighting project which was also implemented

in 2007 enabled the Energy Commission as set out by the government to collect incandescent lamps and replace with Compact Fluorescent lamps.

The efficient lighting project saved Ghana 124 megawatts of electricity which was equivalent to about $300million according to Eberhard, Rosnes, Shkaratan and Vennemo (2011). Furthermore, through the energy efficiency regulation (LI 1932, 2008), the government prohibits the ingress of used or second-hand home appliances which includes used television sets, refrigerators, freezers, and others which are considered to be the result of high household demand for power [Ghana Energy Commission, (GEC, 2010)]. Again, as part of government's interventions to promote efficient use of energy, government discounted new and electricity efficient refrigerators and freezers to enable persons with used or second-hand refrigerators to discard these old products and purchase the new efficient ones.

Although the government has shown concerns and implemented some measures to curtail the increasing demands for electricity through laid down policies and other measures of discounting some electrical appliances such as refrigerators and freezers in Ghana, the country has still not been able to achieve her aim of reducing electricity demand to meet the amount supplied yet. It seems the remedy, the use of quality home appliances, is not yielding the expected results, which is a reduction in electricity consumption in the country. This problem is prevalent because, places such as the Cape Coast metropolis in the Central region, continues to experience frequent power outages in recent time. According to literature, places of high industrial activities are expected to experience power outages due to the high demand of electricity for various activities in such places [International Energy Outlook, (IEO, 2016)]. However,

Cape Coast, which is not an industrial area, has been experiencing power outages seemingly as frequent as the other industrialized cities in Ghana over the years. With the residential sector leading in energy consumption in Ghana, it is essential to take a critical look at the individual contributions of various households to the increasing demand for electrical energy and develop appropriate measures to encourage energy conservation through energy-saving practices among individual members. Moreover, although some research has been done on electricity in Ghana, not much had been done compared to other developed countries such as the USA. Few studies had been conducted on the use of electricity in Ghana such as Alhassan (2017); Kyeremeh (2018) emphasized on the electricity consumption and in the end, recommends electricity conservation. Very few studies have discussed individual households' contributions to either electrical energy consumption or conservation in Ghana. Therefore, this study sought to analyse the efficient use of electrical energy in the Cape Coast metropolis.

**Research Questions**

i. To what extent are households in the Cape Coast Metropolis sensitized on energy conservation practices?
ii. What are the conservation practices in use by households in the Metropolis?
iii. What socio-demographic factors influence household's choice of electrical appliances in the Metropolis?
iv. Are households indifferent to the choice and use of electrical appliances in the Metropolis?

**Research Objectives**

Main Objective

This study's ultimate objective was to assess the efficient use of electrical energy in the Cape Coast metropolis.

Specific Objectives

Specifically, the objectives were;

i. Assessed the level of energy conservation awareness among households in the Metropolis.
ii. Examined conservation practices by households in the Cape Coast Metropolis
iii. Assessed socio-demographic factors influencing households choice of electrical appliances
iv. Analysed variability in energy conservation practices among households in the Metropolis.

**Hypothesis**

In line with the objectives set for this study, the following hypothesis was developed

i. **$H_0$:** There is no statistically significant difference in energy conservation practice among households in the Cape Coast metropolis

   **$H_1$:** Statistically, there is a significant difference in energy conservation practice among households in the Cape Coast metropolis
ii. **$H_0$:** There is no statistically significant relationship between income level and energy-saving practices among households in the Cape Coast metropolis

**$H_1$:** There is a statistically significant relationship between income level and energy-saving practices among households in the Cape Coast metropolis

iii. **$H_0$:** There is no statistically significant relationship between socio-demographic factors and choice of energy-efficient appliances among households in the Cape Coast metropolis

**$H_1$:** There is a statistically significant relationship between socio-demographic factors and choice of energy-efficient appliances among households in the Cape Coast metropolis

**Operational Definition of Energy Conservation**

Energy conservation is about maximizing energy needs with minimized energy consumptions (Nunoo et al, 2019). The term conservation as used in this study by the researcher refers to the resourceful use of electricity by households. The efficient use of electricity among households would be assessed based on the energy-saving practices adhered to by household heads or dominant electricity users in their homes.

**Significance of the Study**

The residential sector in Ghana had been identified as one of the major sectors leading to the increase in electricity consumption, which is the most accessible form of renewable energy in Ghana. However, Ghana is still faced with the challenge of meeting the demand. Although the government has embarked on some measures and policies to reduce the rate of increase in demand for electricity such as using energy-efficient appliances, this challenge has not been addressed due to factors such as constant population growth.

Therefore, this study considers the energy conservation practice of various households by looking at whether there are energy-saving practices used by households to conserve energy. Although some studies on energy conservation practice have been conducted in developed countries like the United States of America, little is known on electricity conservation practice of households in Ghana. Therefore, this study would be of benefit in providing strategies to assist in realizing opportunities for improving economic development in the Cape Coast metropolis and Ghana as a whole. The study sought to add to knowledge on the role of the household in electricity conservation in the Cape Coast metropolis. The research findings would be extremely useful to authorities, civil society groups, and development partners who would want to explore appropriate ways of improving electricity conservation within the Cape Coast metropolis and other places. Beyond these, the study would contribute to the literature on energy in the field of planning. It also sought to help deepen understanding and the awareness of electricity conservation among households.

**Limitation**

The study was conducted in the Cape Coast metropolis. This was a cross-sectional study which may be considered as a snapshot of events within a short period of time. Though some institutions are deemed the high consumption points in the metropolis per statistics, the study also considered communities other than the University of Cape Coast and other tertiary institutions within the Cape Coast metropolis. Further longitudinal research could be conducted with much focus on any of the various income strata such as either high income communities, middle income communities or low income communities only across the country.

**Delimitation**

Although there are several electricity users classes, this study focused on the residential end-user, with the household as elements for measurement. Several studies have been conducted on electricity consumption, however, this study focuses on the conservation aspect of electricity usage among households. This is because the issue of electricity availability or insufficient supply to meet the demanded is a global challenge of which Ghana is not exemption. Also, several studies conducted on households' consumption of energy have proven that if households conserved more energy, the gap between energy demand and energy available or supplied would be shortened. Due to the large population of households in the Cape Coast metropolis, nine (9) communities were randomly selected, with three (3) communities representing each of the metropolis' income level classes. In every household, several persons range from an individual to several other members, including children and the aged, classified as the dependent group. However, this study was conducted with either the household head or the household's dominant electricity user as unit of analysis.

**Organization of the Study**

The study contains a total of five chapters. The first chapter covers the introductory part of the study in which the background of the study is discussed. In the background, a brief history and pre-existing information about the phenomenon under study are discussed to assist audience of this study have a fair idea of what the work is about and what to expect later on. Again, Chapter one establishes the existing problem that is being addressed by the study and explains the reason and the need for which the study has been conducted. In this first chapter, the objectives for the study are stated to guide readers on what to

look out for as they read along. The second chapter covers the literature review on issues bothering on electricity consumption and conservation in Ghana. The study discusses energy conservation concerning energy-saving practices used by households. These factors influence households' choice of electrical appliances as well as the level of electricity conservation awareness among households. The study also provides a brief review of the theory of consumer behaviour and behavioural economics. The research methodology, which is the third chapter, deals with the methods and instruments used in conducting the study. It discusses the process through which the sampling size for the study was attained, the sampling techniques or procedures used to identify the respondents for the study, and the general proceedings through which the aims of the study have been achieved. The fourth chapter presents the discussions of the results and findings of the study. Results are presented in graphs, pie charts, and tables as the best fit for the findings. Findings from each analysis made are discussed subsequently based on the objective being addressed. The summary, conclusion, and recommendations from the study are captured in the final chapter of the report, chapter five. Chapter five is the final section in which the researcher establishes or takes a stand on states emphatically the facts obtained from the research results and whether the objectives of the study have been achieved. Based on the research outcomes, the researcher then makes suggestions or recommendations on how best-established challenges could be addressed and how best the existing opportunities that have been uncovered could be made use of to improve human lives.

# CHAPTER TWO

# LITERATURE REVIEW

## Introduction

The literature review delved into the study's theoretical aspect underscoring the Planned Behaviour Theory (PBT). This chapter further illustrates concepts which aid in the understanding of thematic areas like energy conservation and energy conservation practices, energy conservation awareness and information dissemination, energy conservation awareness in Ghana, determinants of energy conservation practices at the household level, socio-economic factors associated with energy-efficient appliances, willingness to conserve energy and energy efficiency policies in Ghana.

## Theoretical Review

The best predictive behaviour is by asking people whether they intend to do something. From the works of Ajzen (1991), this forms the fundamentals of the Theory of Planned Behaviour (TPB). In this theory, behavioural intention is measured by three determinants. These are attitudes, subjective norms, and perceived behavioural control. Attitude determinant is explained as the opinions of oneself about the behaviour, while subjective norm implies other people's opinions about the behaviour. Perceived behavioural control describes the belief in one’s ability to accomplish a task. That is, self-efficacy towards the behaviour. According to the theory, these three determinants predict a person’s intentions and predict behaviour. Variables such as demographic factors influence the behaviour of persons through these three determinants. Hence, the display of certain behaviour by an individual is determined by the person’s intentions to perform such behaviour. Furthermore, there is the consumer

behaviour factor. It includes the satisfaction experienced by groups or individuals derived from purchasing and using a product (Solomon, 2006). However, concerning consumer behaviour, the element of rationality cannot be overlooked. In economic terms, individuals maximise their choices which may offer them optimum utility in the long-run (CEEU, 2014). Even in the absence of perfect information, it is assumed that people will choose the option that results in the highest welfare based on the available information. Notwithstanding, behavioural economics recognizes that people do not always make choices that maximize their welfare, despite best intentions.

That is, faced with numerous simple and complex choices daily, and some people do not always have the time to assess all the available options for every given a choice. Sometimes there are so many choices that people procrastinate, and make no change, deferring the decision to a later date. However, Behavioural economics does not assume that people are irrational but rather focuses on understanding people's actions that consistently deviate from standard economic theory, examining and testing the biases and influences that impact peoples' behaviours and choices. A behavioural change is requisite to achieving energy conservation at the individual level. It is possible to serve a maximum number of electrical energy consumers by maintaining the electrical energy's proper use. Studies have shown that a significant amount of electricity is wasted or misused all over the world daily due to some unconscious human practices. Several pieces of literature show that it is possible to save electrical energy through behaviour change. Khan and Halder (2016) purport that domestic energy consumption is closely related to the consumer's energy-saving awareness, which is also related to selecting or choosing new efficiency

appliances. The efficient consumption of electricity contributes to the security of sufficient supply, saving energy, and reducing consumption cost. Electrical energy saving through behaviour change even without capital cost could be a great option to meet the increasing demand rather than increase electrical energy generation.

Public policy is, among other things, concerned with influencing people's decisions to ensure better outcomes, and by incorporating behavioural insights in policy and service delivery, there may be opportunities to improve the effectiveness and efficiency of public services. Behavioural insights have many potential policy applications and can be relatively simple, ranging from changing people's perception to improving the compliance rates for willingly adhering to rules and regulations and fully adopting energy conservation in the homes to ensure a positive outcome on energy security.

Improving efficiencies and outcomes with limited resources is a central theme to every organization's planning, and behavioural economics can contribute to better outcomes given expenditure parameters. This study proposes that behavioural economics can improve new policy development, enhance the delivery of existing policy and interventions, help avoid unintended outcomes and improve productivity. Behavioural considerations can be incorporated into the process aspects of the Energy commission's interactions with staff and alliances, households, businesses and organizations within the country to help make compliance easier and improve the adoption of energy-saving practices among households.

**Conceptual Review**

Household's energy conservation practices is grouped into four types such as Habit Adjustment (HA), Quality Threshold (QT), Efficiency Investment (EI), and Interpersonal Facilitation (IF). Habit Adjustment covers issues or habits such as switching off the light when leaving the room, turning off the television when not watching, ironing in bulk, and opening fridge ones to pick out all needed items at once, and so on.

Under Quality Threshold (QT), characteristics like the use of less electrical appliances, using air conditioners and fans moderately, and many others are the means of conserving electricity. Efficiency Investment (EI)covers persons' attitude to choosing energy conserving or saving appliances such as light bulbs or lamps, fridge/freezer, television, air conditioners, and other kitchen appliances such as blender, kettle, rice cooker or electric stove, toaster, washing machine and many more. Interpersonal Facilitation (IF) refers to a person's attitude of educating other people such as friends and family members on how to save energy (electricity), preventing others from wasting electricity, sharing his/her energy-saving experiences to encourage others to save energy, and also partaking in energy conservation actively. These are evident in the responses given by respondents and interviewees with regards to some conservation practices adopted by households in the Cape Coast metropolis and the reasons for such adopted practices. As discussed in details in the chapter four, some indicated that they use less electric appliances in order to minimize their energy consumption while others also indicated that they switch off appliances such as television and other gadgets such as bulb, especially when they are not in use, in other to minimize their energy consumption.

## Conceptual Framework

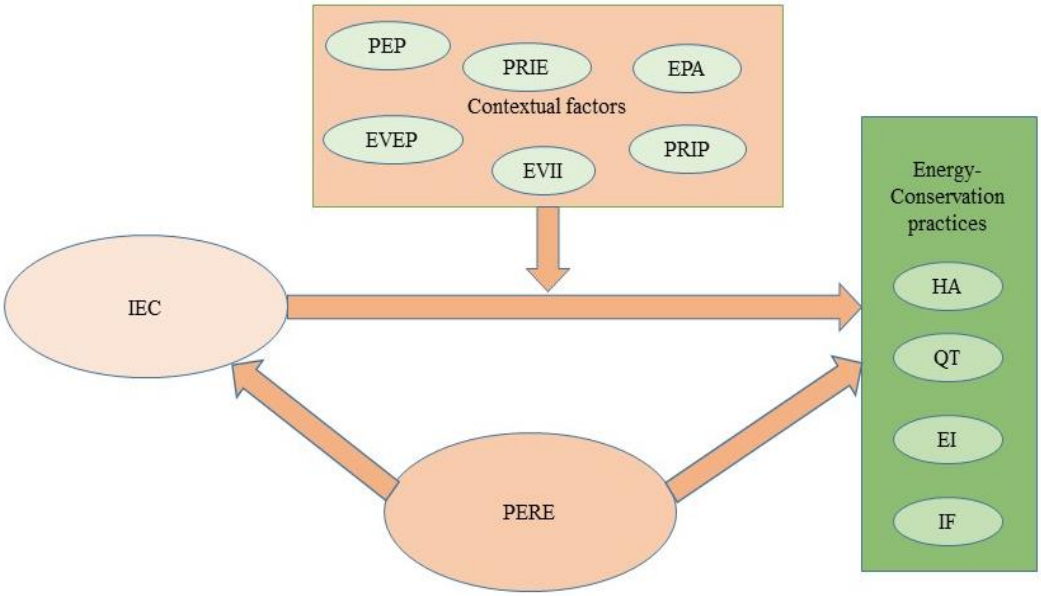



**Figure 1: A conceptual framework for energy conservation practices (ECP).**

Source: Modified after Yue, Long, Liu, & Chen, 2019.

| | |
|---|---|
| Habit adjustment (HA): Turning off the lights when one leaves the room | The popularization of energy conservation policy (PEP) |
| Quality threshold (QT): Buying fewer or using fewer electrical appliances | Execution and validity of energy conservation policy (EVEP) |
| Efficiency investment (EI): Choosing energy conservation types while buying lamps and home appliances | Execution and validity of information intervention (EVII) |
| Interpersonal facilitation (IF): advising friends, families, or colleagues about how to save energy | Price of energy (PRIE)<br>Price of energy conservation products (PRIP). |
| Perception of energy conservation results on economic savings (PERE) | Energy conservation product attributes (EPA) such as weight, size, longevity |

Source: Modified after Yue, Long, Liu, & Chen, 2019

## Empirical Review

### Why Energy Saving/Conservation?

With the enormous growth in world energy demand, countries around the globe in an attempt to meet up with energy demand in the coming decades are instituting various policies and strategies to help keep up with demand.

Levine, Koomey, Geller, et al. (1995), asserted that electricity consumption growth needed to be addressed by increasing electricity efficiency. In its 2009 annual report, the IEA reported that humankind stands a high chance of unsustainable energy supply in the coming decades due to climate change. This pronouncement is buttressed by [Advisory Group on Energy and Climate Change-UN (AGECC, 2010)], who reported that the supply, transformation, delivery and use of energy systems on the global scale contributes about 60% of total greenhouse gas emissions. This greenhouse gas emission may pose a huge threat to our planet's sustainability in the decades to come. According to Gyamfi, Diawuo, Kumi, et al. (2018), energy efficiency is globally considered a small cost, freely available resource that could improve energy supply security. However, Bishop (2010), reported that, not for savings by energy efficiency investments, energy use in developed countries would have doubled, as energy use in 2010 pegged around 20% higher than in 1974.

**Energy-Saving Practices**

Energy is needed in almost every aspect of human life. Globally, energy demand grew by almost 60% since 1990 (Bishop, 2010). In 2018, primary energy demand recorded its fastest growth ever, since 2010 of 2.9%, as carbon emissions from energy use also grew by 2.0% (Dudley, 2018). York and Kushler (2005), as cited by Goldman Reid, Levy et al. (2010), defined energy efficiency to capture three key assumptions: replacing consumer appliances with energy-efficient ones and reducing actual KWh being time-insensitive, and new energy appliances being energy efficient. Though the terms conservation and efficiency are sometimes used interchangeably, Goldman et al. (2010), asserted that consumer behavioural changes bring about conservation whiles

efficiency occur as a result of improvement in technologies. However, Lefkeli, Manolas, Loannou, et al. (2018), defines energy saving as *"the reduction in the amount of energy consumed in a process or system, or by an organization or society, through the economy, elimination of waste, and rational use"*. Consumer behaviour plays a huge role in energy conservation since they directly control their home appliances (Khan and Halder, 2016).

**Energy Saving Situation in Ghana**

Energy efficiency and conservation are very crucial in reaching the global climate goal and protecting energy resources globally. The National Energy Efficiency Action Plan (NEEAP, 2015), cited energy efficiency and conservation as the 'low hanging fruit' in protecting Ghana's available energy resources. In Ghana, the National Energy Board, established in 1985, was the first public entity tasked with propagating energy efficiency benefits. Energy efficiency promotion in Ghana hastened in the 1990s when the Ministry of Energy took over the mandate after the demise of the then National Energy Board (Dramani, 2013). Currently, the country's main energy sector institutions in charge of electricity comprise the Ministry of Energy, Ghana Energy Commission (GEC), Volta River Authority (VRA), Ghana Grid Company (GRIDCo), Public Utility Regulatory Commission (PURC), Electricity Company of Ghana (ECG), Northern Electricity Department (NED). They are made up of energy regulators, power generators, and distributors of power to the final consumer.

The ministry of Energy oversees the formulation and supervision of policies and programmes for the energy sector. The Energy Commission and PURC regulate the Electricity Supply Industry (ESI). The key distributors of

power to the final consumer are ECG and NED. ECG supplies power to the southern sector of Ghana. NEDCo supplies to the northern sector of Ghana while Enclave Power provides power to the Free Zones [Republic Of Ghana Energy Sector Strategy And Development Plan, (GESSD, 2010)]. Ghana was the first country to commit to the Sustainable Energy for All (SE4ALL) initiative since its inception by the United Nations Secretary-General in September 2011 (Monitoring, Evaluation and Reporting System for Ghana's SE4ALL Initiative – Consultancy Report, 2015). Among the three interlinked objectives that the initiative focuses on to achieve by the year 2030 is, to double the global rate of energy efficiency. Statistics on energy supplied and used in 2019 was 17887GWh including imports from Cote d'Ivoire. This comprised 40% (7252 GWh) hydro, 59% (10508GWh) thermal, and 1% import. Total energy consumed in 2018 was 15960GWh [Electricity Supply Plan for Ghana Power system, (ESPGPS, 2020)]. That is, the total annual energy consumption in 2019 increased by 12.07% (1927GWh), compared to that of 2018 [Electricity Supply Plan for Ghana Power system, (ESPGPS2020)]. According to Dramani, (2013), robust economic growth, rapid urbanization, increase in communities connected to the national grid, and increase in the customer population are some of the reasons that may have accounted for the huge increase in energy consumption.

Through the Energy Commission and other regulatory bodies, Ghana has been making conscious efforts to ensure high levels of energy efficiency and conservation. Many policies and programs have been rolled out and passed to support the implementation of these programs.

Ghana has enrolled appliance standardization programs. Under this, electrical appliances imported or manufactured for use in the country are checked to ensure that they meet certain minimum energy efficiency standards. Even though monitoring institutions face a challenge of people smuggling sub-standard appliances into the country, the GEC at the end of 2016 had seized 7,078 used refrigerating appliances and 568 used air conditioners confiscated [Ghana Energy Commission, (GEC,2016)].

The availability of efficient appliances, availability of good information for consumers on such appliances, and technical, commercial, and financial services are necessary conditions to develop and restructure energy markets for efficient appliances (Doucet, 2008). The Global Environmental Facility (GEF), United Nations Development Programme (UNDP), and the Multilateral Fund (MLF) supported the commission to promote Appliance Energy Efficiency and Transformation of refrigerator appliance market on a three-year contract which commenced in 2010 [Ghana Energy Commission, (GEC,2016)]. The programme sought to transform the electrical appliance market in Ghana from inefficient appliances to that of highly efficient appliances. One key component of the programme was a Refrigerator Rebate and turn-in Scheme (RRS). About 400GWh of electricity and 1.1MT carbon emissions were saved through the RRS [Ghana Energy Commission_ (GEC, 2016)].

Also, in ensuring energy efficiency through the restructuring of the energy market for efficient appliances and devices, the Energy Commission led the Compact Fluorescent Lamps (CFL) exchange program in 2007. About 6 million energy-efficient lambs were distributed, which led to 124MWh savings in peak load and reduced cost savings by USD 33 million annually [National

Energy Efficiency Action Plan, (NEEAP, 2015)]. The EC has also been using public awareness campaigns as a strategy to promote energy conservation. Through documentaries, flyers, workshops, and radio interviews, information on energy conservation is made known to the public.

**Energy-Saving Situation in Cape Coast**

From the results of a nationwide energy use survey conducted by the GEC in 2011 and first published in 2012, the average annual electricity consumption by electrical appliances per household (kWh) in Central Region stood as follows:

**Table 2: Average Annual Electricity Consumption of electrical appliances per Household (KWh)**

| Region | Electrical Appliances | | | | | |
|---|---|---|---|---|---|---|
| | Refrigerators | Lighting | Television | Fan | Iron | Other |
| Central | 876.6 | 233.0 | 116.9 | 112.3 | 51.1 | 43.8 |

Source: National Energy Statistics, 2017.

According to data from the Cape Coast metropolitan office of Electricity Company of Ghana, electricity demand in the metropolis which is classified into residential and non-residential, as at September 2019, stood at 4,829,916.05 kWh and 1,019,158.59 kWh respectively. In their quest to intensify energy-saving practices among households, energy institutions in Cape Coast have been embarking on energy-saving campaigns to educate households on energy conservation practices. The use of an energy-efficient bulb produces the same light output compared to a less efficient bulb, hence energy spent to produce the same level of energy service is reduced [The Secretary-General's Advisory Group on Energy and Climate Change-UN, (AGECC, 2010)]. However, Gadonneix, Nadeau, Kim, et al. (2013), cited financial constraints as a factor

that lead consumers to overemphasize the immediate cost of equipment and devices they use, making them select inefficient or less efficient equipment and devices. Moreover, Kwakwa and Adu (2016) asserted that elements such as demographical features, information, concern for the environment, dwelling characteristics, subjective norms, and perceived benefits are paramount in electrical energy conservation among households. Also, Werff and Steg (2015), reported that energy users are more likely to reduce their consumption when they develop strong personal norm because they feel morally obliged to perform such practice.

**Energy Conservation Awareness and Information Dissemination**

Many researchers have highlighted the role of consumer awareness in electrical energy conservation. It is reported that excessive electricity consumption is, caused by wasteful practice of users (Abbas, 2018). However, consumers put up these wasteful practices due to lack of knowledge or awareness on the use of energy and its related implications (Amos-Abanyie, Kwofie, and Asare, 2016). For Ouyang and Hokao (2009), people tend to be unconcerned about energy efficiency problems because of their ignorance of the relation between daily energy use and the contribution to environmental and socio-economic problems faced in the world today. This was buttressed by Abbas (2018) that, exposing energy users to some form of energy awareness campaigns enables them to relate their energy use with environmental and socio-economic problems and Yen, Shakar, and Wai (2010), who reported that energy wastage in Malaysian universities is caused by lack of energy awareness among users. The probability of increasing electricity conservation increases with information on energy conservation (Kwakwa, and Adu, 2016). The

information provides households awareness of energy consumption issues; hence for households to adopt energy-saving practices, information is necessary (Chong and Dubois, 2010).

Ofosu-Ahenkorah (2007), aside from eliminating consumer apathy towards electricity efficiency, also asserted that the massification of awareness concerning electricity use and the ability to control its usage is an effective means to implement energy efficiency policies. According to Khan and Halde, 2016), consumers' control of electrical appliances becomes inefficient when the consumer has little or no knowledge on how to control or operate such appliances. The best way to be electrical energy efficient is to be aware of how energy is used (Jaber, Mamlook and Awad, 2003). Energy efficiency campaigns and awareness creation is, therefore, an effective tool that can help ensure energy conservation among consumers [Ghana Energy Commission (GEC, 2016)]. However, Khan and Halde (2016), assert that consumer practice is paramount in energy conservation, and these practices are affected directly by attitudes and cultural tendencies of human beings.

**Energy Conservation Awareness in Ghana**

Among the reasons that evaluate energy awareness programs quite challenging to analysts are the many parameters involved in the correlation of the change in energy knowledge and other independent variables such as age, education, and socio-economic conditions (Jaber, Mamlook and Awad, 2003). Chong and Dubois (2010) found that the relationship between education and energy conservation practices is insignificant. However, Pootinga, Steg, Vleg, et al. (2003), empirically found that practical measures were more relatively accepted by respondents with a low level of education compared to respondents

with higher or average education level. On the other hand, Scoth (1997), found that education positively affects energy-saving practice. The characteristics of households (education, income, and age), characteristics of residence (renter/owner, size or number of rooms), economic factors, and the availability and quality of information are determining factors that affect energy conservation practice (Brohmann, Heinzle, Rennings, et al., 2009). It is, therefore, necessary to factor in practical patterns of consumers in developing energy conservation campaigns.

In Ghana, the government has implemented many programs to enhance public awareness of electrical energy conservation and energy conservation in general. The energy commission of Ghana classifies electricity consumers in Ghana into industrial, residential, non-residential and street lighting. Towards the intensification of energy conservation practices among energy users, energy awareness campaigns have been intensified across all the sectors or classifications of energy consumers. Communication strategies, including flyers, posters, and role-plays on television and radio have been used to educate consumers on the benefits of energy conservation (GEC, 2016). Sensitization was also done to Customs, Excise, and Preventive Service (CEPS) to ensure that inefficient appliances are not imported into the country (NEEAP, 2015). The compliance to the labelling regime has been very high, around 95%. Between June 2013 and October 2014, over 24000 used appliances have been ceased, regardless of some challenges encountered. The lamp replacement project in 2007 resulted in annual peak savings of 124MW [National Energy Efficiency Action Plan,(NEEAP, 2015)].

Per a survey conducted in 2007, average refrigerator consumed about 1200kwh per annum. However, as a result of new efficiency standards, this is limited to 650kwh per annum, resulting in potential savings of 550kwh/year per refrigerator, CO2 savings of 105000tons per annum [Ghana Energy Commission, (GEC,2016)]. These programs have helped improve on climate change mitigation, energy security, and economic sustainability. Gadonneix, Nadeau, Kim, et al., (2013), asserts that, though energy saved as a result of communication campaigns cannot be easily estimated, motivation and actions of customers can be monitored and these campaigns, when featured with humour and ambassadors, tend to yield more positive reaction among the public. Kwakwa and Adu (2017), concluded on the need to involve role models or influential family members in energy awareness campaigns, whiles emphasizing an appliance-specific aspect of energy conservation.

**Determinants of the variability in energy conservation practices among households**

The geographical location of the house has also been found to be another vital determinant of energy-saving practice. Scott (1997) observes a positive relationship between urbanization and diffusion of several energy-efficient technologies in Ireland. Furthermore, Walsh (1989) and Long (1993) observe that homeowners resident in warmer climates are statistically less likely to invest in energy conservation than families living in colder states. Studies on energy so far depict that, energy consumption and energy conservation are inversely related because, the higher the amount of energy consumed, the lesser the amount of energy conserved. And this is applicable, on the other hand, also where higher energy conserved implies less amount of energy is consumed.

Studies conducted on energy consumption all had varying conclusions because they were conducted at different places and environments and with different data (Danlami, 2015). He continued to say that the varying conclusions imply that the attitude of households towards energy consumption differs from one region to another region and also, factors needed in the determination of energy consumption may differ from one region to another (Danlami, 2015).

**Socio-economic Factors that Influence the Choice of Energy-Efficient Appliances**

The choice to utilise energy-efficient appliances may be demographically and socio-economically determined particularly at the household level. Factors such as household income, level of education of household head, household size, occupation, age, number of rooms among others positively impact the energy choices of a particular household (Nnaji et al., 2012; Song et al., 2012). Concerning age categories, younger household heads may adopt efficient ways to conserve energy better than older household heads (Mills et al., 2013; Mahapatra and Gustavsson, 2008).

Some researchers have concluded that a household income status is positively associated with an efficient energy investment (Schipper and Hawk, 1991; Scott, 1997; Poortinga et al., 2003). For example, low-income households are likely to consume fewer amounts of energy as a cost-saving measure. Consequently, these households may reduce their capacity to adopt conservation activity (Kasulis et al., 1981). In contrast to the possibilities surrounding low-come households, cost-saving measure amongst high-income households is less likely. This may occur in areas like retrofit investment Gamtessa (2013).

Additionally, it is worth noting that the intense use of energy-efficient appliances could require frequent replacement. A study by Curtis (1984) demonstrated that fast-paced energy-saving practices adopted by two (2) to four (4) members in a household impacts energy-saving expenditure that household sizes about these thresholds. Long (1993) study confirms this by concluding that large-size households negatively impacts on energy-saving practices.

Several studies suggest that energy-conserving practices may also be hooked on psychological variables (Abrahamse and Steg, 2011). Psychological factors are, therefore broken into attitude, perceived practice control, subjective norms, and residue effects for the analysis of household energy efficiency practices in current literature (Wang et al., 2011). Defining attitude as a psychological factor illustrates the level of people's awareness of electricity-saving practice. (Wang et al., 2011). Substantive awareness in individuals whose linkages are to energy-saving information and climate variability are inclined to purchase renewable energy products (Zografakis et al., 2010). Although attitudes as a determinant are important to energy conservation practices, households' knowledge of energy conservation cannot be neglected (Olsen, 1981).

**Willingness to Conserve Energy**

Several empirical and theoretical studies have tried to estimate the important drivers of preference for energy conservation. The impetus to conserve energy is diverse. Some crucial consideration is the socio-demographic variables (Steg, 2008; Nair, G. et al., 2010; Ameli and Brandt, 2014), environmental factors (Abrahamse and Steg, 2009; Frederiks et al., 2015) and practical factors (Martinsson et al., 2011; Trotta, 2018).

According to Martinsson, Lundqvist, and Sundström (2011), the gender of a consumer does not affect his or her willingness to conserve energy. On the other hand, Lindén, Carlsson-Kanyama, and Eriksson (2006) found that generally, women are found to be a bit more willing than men. This acclamation is consistent with Gaspar and Antunes (2011), who uncovered that women tend to enquire more on energy efficiency when purchasing an appliance. Additionally, to the works of Gaspar and Antunes (2011), Trotta (2018), concluded that men are less likely to buy energy-efficient appliances than women.

Wang, Zhang, Yin and Zhang (2011), found that in urban areas, age has a positive correlation with energy-saving practice. For Weber and Perrels (2000), elderly couples consume more energy than young families. Brandon and Lewis (1999) also found that households' age has a positive relation to household energy conservation. Sardianou (2005) in a study on household energy conservation patterns in Greece, found that the elderly are more energy-intensive users compared to younger consumers. Castaldi and Zoli (2012) concluded that young people tend to be more sensitive to energy use implications to the environment and are therefore more concerned with energy-saving practice.

Many studies have emphasized on income as one factor that influences consumer's attitude towards saving energy (Ritchie et al. 1981; Brandon and Lewis, 1999; Long, 1993). Scasny and Urban (2009), on the other hand, concluded that income level has a negative relation to energy-saving practice. Samuelson and Biek (1991) in their confirmatory factor analysis on attitudes towards energy conservation, found that respondents with low income tend to

be more sensitive to energy problems. Furthermore, Al-Ghandoor, Jaber, Al-Hinti, and Mansour (2009) also low-income earners have the propensity to adopt energy-saving practice. However, the works of Kasulis, Huettener and Dikeman (1981) contends the assumption that low-income earners are likely to adopt energy-saving practices and hence may not embrace more conservation practice. Schipper and Haawk (1991) as cited by Sardianou (2005) evidenced that households with higher income are more able to purchase energy-efficient appliances in that, they usually expand their appliance usage and in doing so usually replace existing inefficient appliances with new efficient ones.

Education influences people's conservative practice. Research has demonstrated that the correlation between environmental practice and knowledge may be positive (Wang et al., 2011). Other works have illustrated that people with low formal education are inclined to practical energy conservation measures than people with high formal education (Poortinga, Steg, Vleg, et al., 2003). On the other hand, Curtis, Simpson-Housely and Drever (1984); Sardianou (2007) found an insignificant influence of education on household energy-conservation practice. Moreover, Castaldi and Zoli (2012) in their empirical study on energy saving and its determinants cited household size and composition as another factor that influences household energy use. Households with more members lead to higher energy use expenditure and vice versa (Castaldi and Zoli 2012).

Other studies also explored on geographical location of households. Households in rural areas were found to have lower energy intensity than urban households (Harendeen., Ford, Hannon, 1981) as cited by (Castaldi and Zoli, 2012). Zografakis, Sifaki, Nikitaki, et al. (2010), in his literature, also illustrated

how the housing unit had become a significant determinant in the adoption of energy-saving practices among households.

**How Energy Efficiency Policies have been Embraced in Ghana**

.Researchers such as Mills and Sehleieh (2010); Zhou, Wang and Lv (2017); McNeil and Wilkie (1979), have all explored on energy-efficient appliances labelling. McNeil and Wilkie (1979) found that labelling energy-efficient appliances have some influence on consumer decision making in purchasing electrical appliances. In Sub-Sharan region, several countries, including Ghana, have successfully implemented many programmes geared towards improving energy efficiency. Regardless of some challenges encountered in implementing these programmes, the response from consumers has been quite positive. Before 2010, used inefficient refrigerators dominated Ghana's refrigerating appliance market. It constituted about 70% of the market share against 30% for new and efficient ones [Ghana Energy Commission, (GEC, 2016)]. As of 2016, efficient refrigerating appliances accounted for over 90% of the refrigerating appliance market. The success was achieved through customer compliance to the Refrigerator Efficiency Project implemented through the Energy Commission. The project targeted at reducing consumption of refrigerating appliances from 1200 kWh to 600 kWh. The program regardless of some challenges, was well accepted by consumers and willing dealers in the refrigerating appliance market. Beneficiaries had a reduction in their consumption by 385 kWh per year [Ghana Energy Commission (GEC, 2019)]. Gyamfi (2017), concluded on 'massive educational campaign' as a major attribute that contributed to this program's success.

# CHAPTER THREE

# RESEARCH METHODS

## Introduction

"The procedures and techniques applied to attain and analyse research data, including questionnaires, observations, interviews, and statistical and non-statistical techniques" are what is referred to as methods according to Saunders, Lewis and Thornhill (2009).

This chapter discusses into details, the procedures and the processes through which this study was conducted. The methods and techniques that were used for the study have been discussed under the following subheadings: research philosophy, research design, research approach, target population, study area characteristics, sources of data, sampling procedure, sample size, research instrument, data collection method, data management and analysis and ethical considerations.

## Research Philosophy

Research philosophy, as defined by Saunders, Lewis and Thornhill (2019) refers to the system of beliefs and assumptions about knowledge development. Saunders, Lewis and Thornhill (2019) argue that assumptions about realities (Ontological assumptions), human knowledge (what constitutes acceptable knowledge) as well as of values and ethics in one's life influences the decision of researchers on the type of philosophy adopted for a particular study. Some research philosophies include positivism, which entails working or studying observable social reality to formulate or generalise laws and theories. This was evident in the works of persons like Augusto Comte.

On the other hand, Interpretivist argues that humans, unlike the physical environment, produce or provide meanings to situations and circumstances, and therefore, there is the need to study such meanings to conclude. However, the philosophy of pragmatism was adopted in this study. According to Kelemen and Rumens (2008) as cited by (Saunders et al., 2019) pragmatism emphasises that concepts are only relevant where they support action. Pragmatist research begins with a problem and sets to provide practical solutions that may inform future practice. Hence, the philosophy underpinning this study is pragmatism.

The pragmatism philosophy is a philosophical view which was birthed out of the controversy between the positivists and the interpretivists. The positivists argue that reality should be analysed with quantifiable figures because that would be more objective and representative. On the other hand, interpretivists argue that reality should be analysed not with numbers or digits but the explanations from reality's reasons. As a result, the philosophy of pragmatism was birthed with the argument that the reality could be explained with numbers, which are an objective representation of reality and the reasons backing the numbers for explanations.

**Research Design**

According to Leedy (1997); MacMillan and Schumacher (2001) and Durrheim (2004) as cited in (Mafuwane, 2012), a research design is an action plan that bridges research questions to the implementation of the research strategy including the selection of subjects, research sites and the data collection procedures.

The research design for this study was the sequential explanatory case study design. This design allows researchers to find reasons to quantify analysis from a quantitative study through interviews, observations, and other qualitative approaches to explain reality cases.

**Research Approach**

Research approach may be defined as the plan and the procedure that explains the duration of the steps for research from broad assumptions or philosophy to detailed data collection methods, analysis, and interpretation. The mixed-method approach was employed in the conduct of this study. Specifically, the approach which is termed as the Concurrent Mixed-method was adopted. This research approach was adopted because it allowed the researcher to collect quantitative and qualitative data side-by-side or at the same time. Again, due to this method, the researcher was able to analyse both the qualitative and quantitative data concurrently. That is, both quantitative and qualitative methods were used side-by-side in conducting this research, where the quantitative approach addressed questions on 'what', 'when' and 'how' and the qualitative method also addressed the question 'why' by providing interpretations and reasons to the practices and choices of people on electric appliance uses.

**Target Population**

Saunders, Kitzinger and Kitzinger (2015) argue that population is a set of subjects whose particular qualities and characteristics aim to focus on. Vonk (2016) defines the target population as the group of people to whom the researcher wants his/her research results to apply to. Therefore, the target population for this study is the households in cape coast metropolis. However,

either the primary electrical energy user, the household head, or both will be selected from each household as respondents to the study.

## Study Area Characteristics

### Location and size

Cape Coast is the administrative capital of the Central Region. According to Ghana Statistical Service (2014) report as cited by (Animah, 2018) Cape coast metropolis is bounded by the Gulf of Guinea to the south, and the west by KEEA at the Iture Bridge. The metropolis is bounded to the east by AAK District and the north by Twifo Hemang Lower Denkyira District. The metropolis occupies a total land area of about 122 square kilometres with the furthest point at Brabedze, which is about 17 kilometres from cape coast.

### Climate

Cape Coast metropolis experiences high temperatures all year round and also has a double maximal rainfall. The metropolis record total annual rainfall value between 750 and 1000mm. The hottest temperatures are usually experienced in February and March, while the coolest temperatures are experienced in June, July, and August. Therefore the variations in climate experienced in the cape coast metropolis are influenced largely by rainfall and temperature (Ghana Statistical Service, 2014)].

### Population and Settlement

As cited by Animah (2018) form Ghana Statistical Service's 2014 report, Cape Coast has a total population of 169,894 of which 48.7% are males, and 51.3% are females. It has a population density of 162 persons per square kilometre and the current population growth rate in the Metropolis is 2.0%

which is less than the national annual growth rate of 2.2% [Ghana Statistical Service, (GSS, 2014)]. The Cape Coast metropolis is divided into two political constituencies such as the Cape Coast North and South constituencies. These two constituencies are divided by Accra-Takoradi highway. Although the Cape Coast North constituency appears to have larger land area coverage than the South constituency, the South constituency appears to be densely populated than the North constituency, whose populace is also sparsely distributed. The metropolis is predominantly urban with about 23.3% of its populace living in rural settlements and the majority (76.7%) living in the urban settlements. Most communities in Cape Coast metropolis by observation have developed along major roads in a linear pattern, especially in the north constituency. Cape Coast South constituency has communities along the coast densely populated due to the main occupation of the indigenes and the history behind Cape Coast's development. However, there are also communities which have developed linearly along major roads and have now expanded inwardly.

The cape coast metropolis has a housing stock of about 17,738 with an average of 7.9 persons in each house [Ghana Statistical Service, (GSS, 2014)]. Furthermore, over 58.2% of the houses in the cape coast metropolis are compound houses, 17% are separate dwelling units, while about 11.4% are flats/apartments. With regards to ownership of the houses within the cape coast metropolis, about 35.3% are usually owned by household members. In comparison, 35.6% of the houses are owned by private individuals or are rented out to the inhabitants. Again, about 19.8% of the households are owned by other relatives who are not part of the household, 5.6% are owned by government or public, and 0.8% of houses are owned through mortgage schemes.

In the construction of houses or buildings in the metropolis, the major construction materials used include cement blocks/concrete and earth/mud bricks for outer walls of buildings. Concrete constitutes about 77.2%, while mud bricks for 16.2% of materials. Again, 86.2% of cement forms the majority of materials used to construct building floors with only 5.7% of floor construction material for houses being mud [Ghana Statistical Service, (GSS, 2014)]. Furthermore, slate or asbestos was the main roofing material for houses in the metropolis, constituting about 61% of the general roofing materials. In relation to room occupancy, the single room had the highest percentage of about 26.4 of households occupy a single room with 10 or more members. Again in the cape coast metropolis, 28% of household members are household heads while 37.1% are children with 9.8% being spouses and 8.7% being grandchildren of the household heads. Also, as many as 36.1% of households are headed by males while about 22% of household heads are females. However, more female parents live in the households than the male parents do [Ghana Statistical Service, (GSS, 2014)].

Moreover, there are three (3) main sources of lighting in houses or dwelling units within the Cape Coast metropolis. They are electricity, kerosene and flashlight or torchlight. Of the three sources, electricity is the main source of lighting, constituting about 90.3% while kerosene forms 5.8% and torchlight has 1.8% of lighting sources used in the cape coast metropolis [Ghana Statistical Service, (GSS, 2014)].

**Economic Activities**

As the regional and administrative capital of the Central Region, Cape Coast, and its environs experience more economic activities than other areas

within the region. In the cape coast metropolis, about 54.7% of the total population who are 15yrs and above are economically active, and the remaining 45.3% are not [Ghana Statistical Service, (GSS, 2014)]. Within the 54.7% economically active group, about 90.7% were employed with 9.3% being unemployed due to the 2010 population census. Again, 73.3% of the economically inactive population are students whiles the remaining 11.3% comprise the disabled or persons who cannot work due to sickness and house duties performers. Also, about 59.1% of the unemployed population were first-time job seekers.

About 82.5% of the persons unemployed in the cape coast metropolis are engaged to service providers and sales workers. Also, 23.6% engaged in crafts and other related trade works while 13.2% are professionals and 6.8% are engaged in skilled agricultural, forestry, and fishing workers. About 47.0% of the population 15yrs and above are self-employed with 39.0% of the same population being employees or working for others. However, 5.5% of the population are self-employed with other employees working under their supervision while 3.5% are apprentices (that is persons learning new skills to be self-employed). Of all the employed categories, men remain the majority of the percentages except for the proportion of self-employed persons without employees and the domestic employees or house help population(GSS, 2014).

**Social Characteristics of Cape Coast Metropolis**

The people of the cape coast metropolis are of the Akan ethnic group in Ghana. Majority of the people of cape coast are Fantes, although there are people of other tribes also in the metropolis. The entire cape coast metropolis constitutes one traditional council which is headed by the Oguaa Omanhene

(that is the paramount chief). The language of the majority of cape coast inhabitants is Fante as they are Fantes. Again, although Muslims and Traditionalists are other significant religions in the metropolis, Christianity dominates most in the cape coast metropolis.

Furthermore, the cape coast metropolis is endowed with several schools from basic and high school, through to tertiary level. There are several clusters of high schools in the metropolis with many of such high schools being part of the country's most excellent high schools. There are several tertiary institutions as well including the University of Cape Coast, Cape Coast technical University, teacher training schools, and nursing training schools as well.

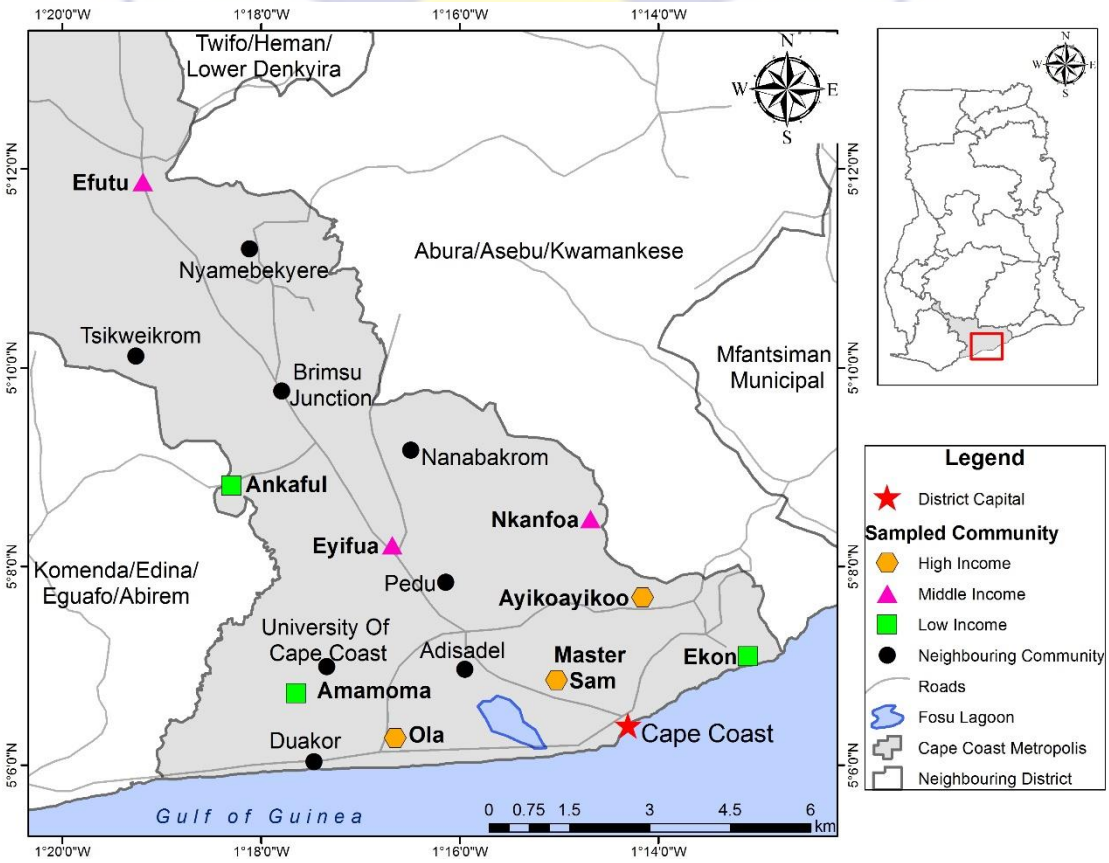



**Figure 2: Study Area Map of Cape Coast Metropolis**
Source: Author's Construct, 2019

**Sources of Data**

Primary data was collected by the researcher from the field by administering questionnaires to the 396 respondents from various households for the quantitative data. Again, in-depth interviews were conducted for some selected stakeholders from the Electricity Company of Ghana and assembly members who are community leaders and representatives of their various communities in the Local Government. And to further confirm the claims of the research findings from respondents and participants, non-participant observation was also adopted by the researcher whereby pictures of scenes relevant to the focus of this study were captured as evidence to observations made by convenience. Furthermore, some information was solicited from already existing documents such as books, archives of the University of Cape Coast, and published articles.

**Sampling Procedure**

Sample implies that a smaller group is formed as a representation of the entire population understudy for research (Yeboah, 2016). Sampling, according to Amedahe (2002) as cited by (Yeboah, 2016), enables the research to work with a rather reduced number of units in place of the larger targeted group and also allows a researcher to obtain data that are characteristic of the whole target population.

Although Cape Coast metropolis is divided into north and south constituencies, all communities within the metropolis have been categorized into three strata as the high income, middle income and low income communities. For the purpose of this study, 9 communities were selected using the lottery version of the simple random sampling procedure. A number was

automatically generated using the Randbetween command of Microsoft Excel. With the various communities being numbered objectively, 3 communities on which the count of the generated value fell were selected from each stratum of communities the cape coast metropolis. After the communities were identified, the total sample size of 396 was divided among the 9 communities and 44 households were identified as respondents from each selected community using convenience sampling method.

**Sample Size**

Out of the total population of 40,386 households in the Cape Coast metropolis [Ghana Statistical Service, (GSS, 2010)], a sample size of 396 households (Glenn, 1992) was selected to participate in the quantitative field data for this study.

- Household Pop. 40,386 [Ghana Statistical Service, (GSS, 2010)]
- Formula - (Glenn, 1992):

$$n = \frac{N}{1 + N(e)^2}$$

- n = sample size
- N = Population Size
- e = level of precision
- Quantitative Sample Size = 396

However, 5 stakeholders were interviewed for the qualitative aspect of the study. A stakeholder each was selected from the Electricity Company of Ghana-Cape Coast metropolitan area (ECG), Cape Coast metropolitan assembly and also one Assembly member each from the 3 classes of income earning categories with the metropolis. In all, a total of 401 respondents and participants were involved in conducting this study.

**Research Instruments**

An Interview schedule/Questionnaire was designed by the researcher and was later uploaded into the Kobo Collect Application through which the instrument was administered for the quantitative survey. In the questionnaire, questions were asked under various themes or sections. The first section of the instrument captured data on the demographics of respondents while the second section had questions addressing the level of awareness of electricity conservation among households in the metropolis. The third theme sort to discover the practices of households with regards to electricity conservation whiles the fourth theme asked questions relating the factors which impact household's choice of electrical appliances. In the final two sections, respondents were asked questions on their willingness to fully adopt electrical energy conservation in their daily lives and also their recommendations towards the concept of electricity conservation. Furthermore, interview guides were used for the in-depth interviews as well as pictures randomly taken as evidence of observations made within the data collection period for the study.

**Pre-testing & Pilot Test**

According to Churchill (2010) as cited by Gualandris and Kalchschmidt, 2014), primary data collection from field must not start without appropriate pre-testing of the instrument (Questionnaire). Pre-testing was done to check the consistency of questions and to avoid repetitions which may bore respondents and will also be time consuming. Also, pre-testing was done to check the wording of statements, instructions and the questions themselves. The pre-testing was done by screening the questions with academician off conservation field and the field of regional planning which are all under the

department of Geography and Regional Planning in the University of Cape Coast. After the screening, necessary changes were made where needed. After the questionnaire was developed, a pilot test was conducted in other to check the validity of questions in the face of respondents. During the pilot test, questionnaires were administered to 20 respondents through the convenience sampling technique at the Kwaprow village in Cape Coast metropolis.

**Data Collection Methods**

Other than the researcher, seven (7) members were by voluntary participation, trained to assist the researcher in field data allocation. Kobo collect Application was used to collect the quantitative field data while interviews were conducted and recorded with the help of a recorder. For the purpose of observation, scenes relevant to the study were captured with the help of a camera. Based on the available information obtained from the Planning department of the Cape Coast Metropolitan office, there are three (3) classes of communities in the Cape Coast metropolitan area. A total of nine (9) communities were selected within the community, having three (3) communities selected as a representation of each income class such as the high, middle and low income level classes.

Out of 401 respondents who were sampled for the survey, questionnaires were administered to 396 respondents who were either household head or primary electricity user in a household within the selected communities in the Cape Coast metropolis. Interviews were conducted for 5 stakeholders which includes an official from the Electricity Company of Ghana, Cape Coast metropolitan Assembly, and one community elder or Assemblyman each from the three income level classes.

**Data Management and Analysis**

The data analysis approach that was adopted for this study was the deductive analysis approach. Analysis such as multiple regression, correlation, T-test and others were used in analysing data for this study. Microsoft excel was used to clean gathered data and also processing the data for analysis. In order to analyse the data for the study, Statistical Package for Social Science was used to run most of the analysis while a few of the analysis was run using Stata. For the purpose of this study, results obtained from the analysis for the study is presented using graphs, and charts, as well as tables.

**Empirical and Analytical Model**

The Poisson regression model was used to explore the influence of social demographics factors and households choice of appliance on energy conservation. Let 'Y' be a random variable representing energy conservation among households. 'Y' follows a Poisson distribution with parameter ʎ if it takes integer values of y = 0, 1, 2…n and with probability function described as follows (Danquah, Kuwornu and Pappinen, 2013):

$p(y = k) = \frac{\exp(-\lambda)\lambda^k}{k!}$ for k= 0, 1, 2…,

The operation model for the above analyses is written as follows:

$$y = e^{\beta_0+\beta_1 Sex+\beta_2 Age+\beta_3 Strat+\beta_4 Marital+\beta_5 YrsofSch+\beta_6 YrsofResid+\beta_7 Exp+\beta_8 Inc+\beta_9 HHsz+\beta_{10} BeE+\beta_{11} NKwH+\beta_{12} Hphr} + \varepsilon$$

The y(s) in the models denote the count numbers of energy efficient appliances available in each household

**Table 3: Variables and their definition**

| Variable | Variable Definition | Measure | Hypothesized Sign | Mean | S.D |
|---|---|---|---|---|---|
| Sex | This measures the decision of a household head to choose an efficient appliance with respect to their assigned gender or social role | Male=0 Female=1 | + | .64 | .480 |
| Age | Age of household heads either de jury or de factor as provided by household heads | Years | + | 4.9874 | 2.60522 |
| Strat | Social stratification based on income levels | High Income=1 Middle Income=2 Low Income=3 | + | 2.000 | .8175 |
| Marital | Marital status of household head | Single=0 Married=1 Cohabitation=2 Separated=3 Widowed=4 Divorced=5 | + | 1.15 | 1.277 |
| YrsofSch | Number of years household heads have spent in formal education | Years | + | 1.4141 | 1.09091 |

**Table 3 continued**

| | | | | | |
|---|---|---|---|---|---|
| YrsofResid | Number of years a household has lived in the place of residence | Years | + | 18.417 | 100.4293 |
| Exp | Households daily overall expenditure | Cedis | + | 4.2399 | 3.02739 |
| Inc | Households monthly income | Cedis | + | 1.2197 | 1.41053 |
| HHsz | Household Size | | | 1.7298 | 1.12744 |
| BeE | Number of persons in the house below 18 years | Years | + | 1.879 | 2.2871 |
| NKwH | Amount of kilowatts consumed by households | Kilowatts | + | 52.134 | 107.0456 |
| Hphr | Number of hours power goes off in a day | Hours | + | 1.6995 | .83475 |

In this study, four variables were examined by the researcher. The variables include the following:

a) *Awareness* – Four items are considered under this variable. They are importance of electricity conservation, knowledge of policy, efficiency label, and information source.

b) *Energy saving practices* – This variable includes a scale of four (4) points, that is; sometimes, always, rarely, I don't/Not available.

c) *Choice* – This variable is measured on a scale of ten (10) points. The items considered under this variable includes efficiency, size, location, durability, weight, cost, appearance, affordability, income, reliability.

d) *Conservation Practice variation* – This variable includes 2 items. They are income and location.

For the purpose of this study, the dependent variables are the attitudes of households towards electricity conservation and their intentions to fully adopt the act of electricity conservation in their homes. Some other independent variables relate to the demographics of respondents such as income, education, age, occupation, gender, household size, location. The relationship between the dependent and independent variables were tested using SPSS.

Furthermore, in analysing the qualitative data for this study, information gathered from interviewees were transcribed and documented. The information from responses of participants in the interview was analysed manually. These are reported by quoting directly what respondents have quoted. Pictures captured for the purpose of this study have been shared with captions explaining each one as has been indicated.

**Ethical Issues**

Ethical issues among the social sciences which governs the study of research includes the issues of confidentiality, anonymity, privacy, informed consent and several others. Ethical issues, as used in this study, are sets of rules and guidelines governing the procedures involved in the conduct of a study or research. Among social scientists, some ethical considerations governing research include Anonymity which implies that in conducting a study, researchers must ensure to keep the identity of their respondents and or participants unknown so that the responds given or derived will not be associated to any individual respondent or participant. As required for all social

science research, the issue of confidentiality is also considered in this study. The researcher ensures every information gathered from respondents is not interfered with by any third party without proper permission. The researcher ensures that before any one participates in the study, the respondent or participant's permission is sort first in order to satisfy the ethical issue of informed consent. The privacy of respondents were also ensured such that if a respondent was not in a position to provide some information, the respondent or participant was allowed. These and other ethical issues guided the conduct of this study. This study ensured that most of the ethical norms in research among social scientists are considered and adhered ton in this study

# CHAPTER FOUR

## RESULTS AND DISCUSSION

This chapter discusses output or results obtained from analysis run for this study. These results are explained and their implications are as well indicated under this.

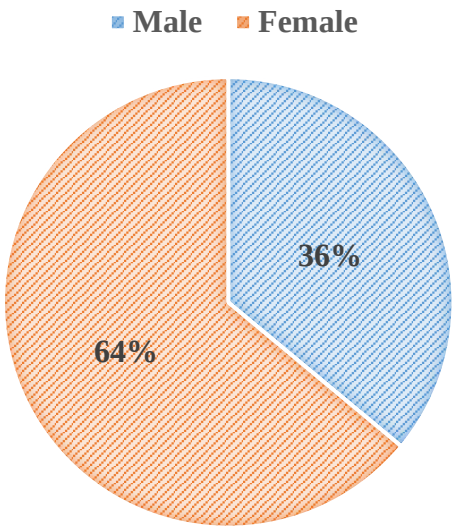



**Figure 3: Gender of the respondents**

**Source: Field Data, 2019**

Figure 3 above depicts the gender demographic of respondents for the study. Out of the 396 household heads that were interviewed for the study, 64% were females whiles males accounted for only 36%. This confirms data from the Ghana Statistical Service which indicated the dominance of females in Ghana's population distribution with respect to sex and the steady reduction of male-headed household heads since 1970. The country's sex ratio as at 2010 stood at 95.2 males to 100 females (2010 Population and Housing Census). However, the results of this study as shown in Figure 3 contradicts with data from Ghana's 2010 population and housing census which showed that about 65.3% of households in the country are headed by males. The sex distribution

in Figure 3 also implies that there are more female household heads in the metropolis who have assumed a role which is traditionally expected to be for men. This depicts great progress in the realisation of the Millennium Development Goal (3) of promoting gender equality and empowering women.

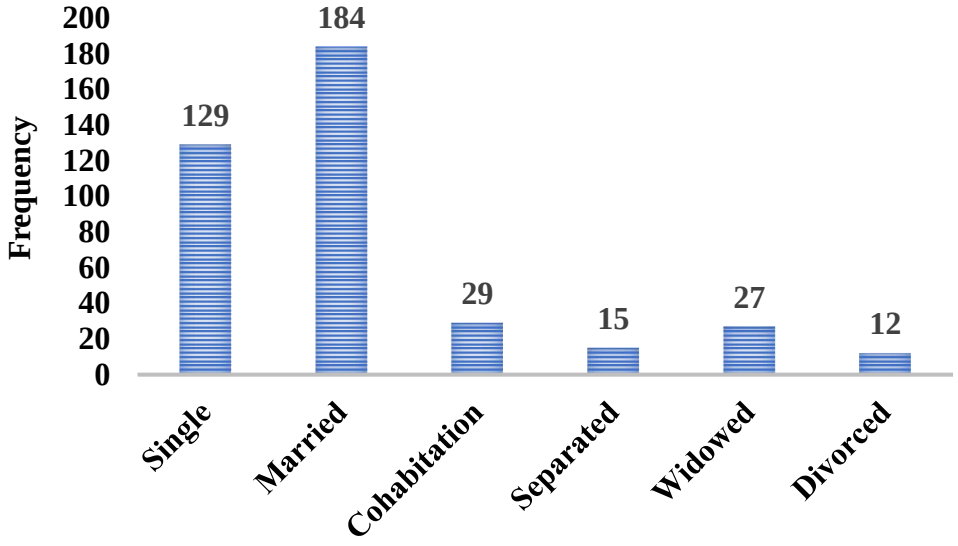



**Figure 4: Marital Status of respondents for the study**

**Source: Field Data, 2019**

Figure 4 above shows the marital status of respondents interviewed for the study. Results from the study showed that greater numbers of the household heads interviewed were married. From Figure 4, 129(32.6%) respondents were single, 184(46.5%) respondents representing were married, 29(7.3%) respondents were cohabitating, and 15(3.8%) respondents had married and separated. Widowed respondents were 27(6.8%), and respondents who have married and divorced were 12(3%). Results on marital status from the 2010 Population and Housing Census shows that, of the population aged 12years and older, 42% were single. This compared to findings from this study implies that there has been reduction in the number of singles by approximately 9%. Also, 42.9% of the population were married, compared to 46.5% of this study. This

implies an increase in married population by 3.6% which might be attributed to the reduction in the number of single population. Also, results from this study shows that, 13.6% of household heads interviewed were either separated, widowed, or divorced compared to 10.2% as reported in the 2010 population and housing census data by the Ghana Statistical Service.

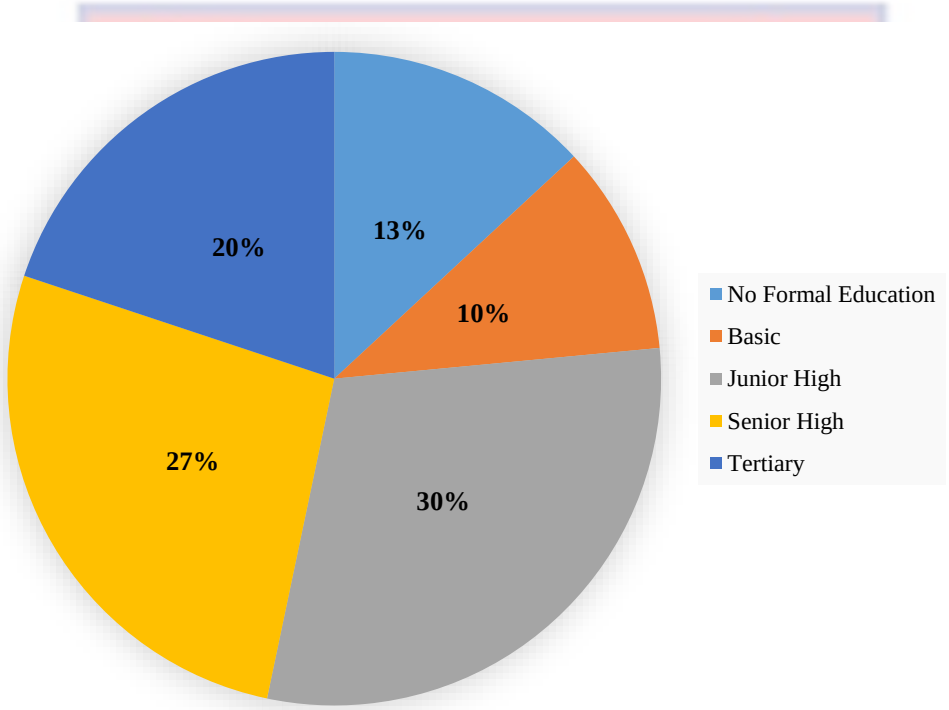



**Figure 5: Educational level of respondents within the communities.**

The researcher also sought to analyse the educational level of respondents in the various communities as one of the demographic characteristics selected for the study. Figure 5 above shows the educational level of respondents. Educational levels of respondents were categorized into the tertiary level, senior high level, junior high level, basic level, and respondents with no formal education. Results from Figure 5 indicates that 20% of the total respondents for the study have had formal education up to the tertiary level, 27% had formal education up to the senior high level, 30% had up to the junior high level, and 10% had formal education up to the basic level. Of all the 396

respondents interviewed, analysis in Figure 5 shows that 13% had no formal education.

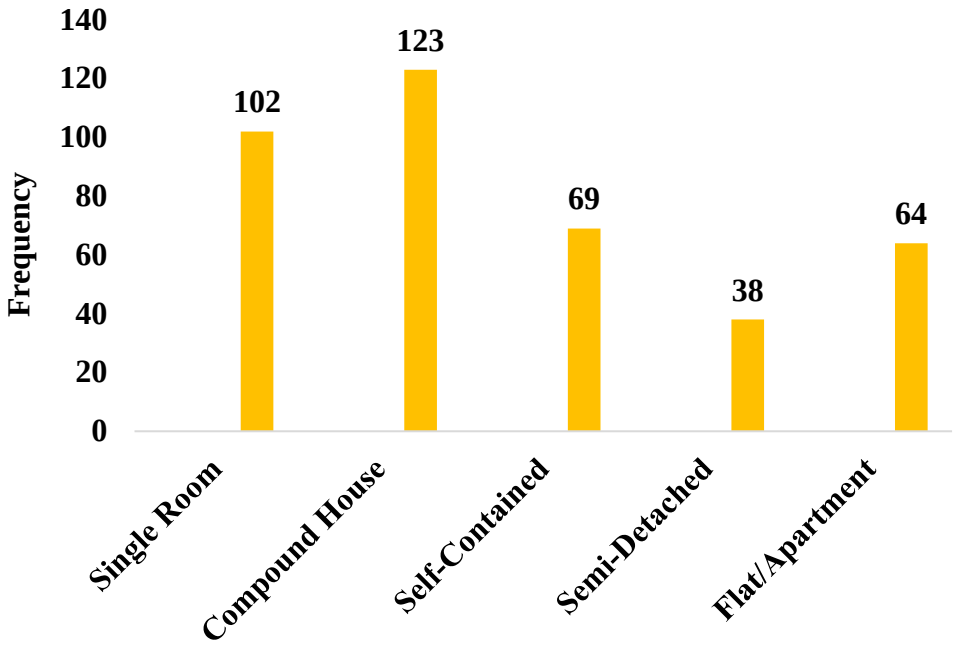



**Figure 6: Types of accommodation of the respondents**

The total respondents selected for the study lived in various household types ranging from single room, compound house, self-contained, semi-detached, to flat/apartments. Analysis on these types of accommodation of the respondents from the various communities is as shown in Figure 6 above. From figure 6 above, accommodation type selected by most respondents was Compound house. Also, 123 out of the 396 respondents for the study lived in compound houses. This was followed by respondents living in single rooms which totalled 102. 69 respondents lived in self-contained houses, 38 respondents lived in semi-detached houses, and 64 respondents lived in flat/apartments.

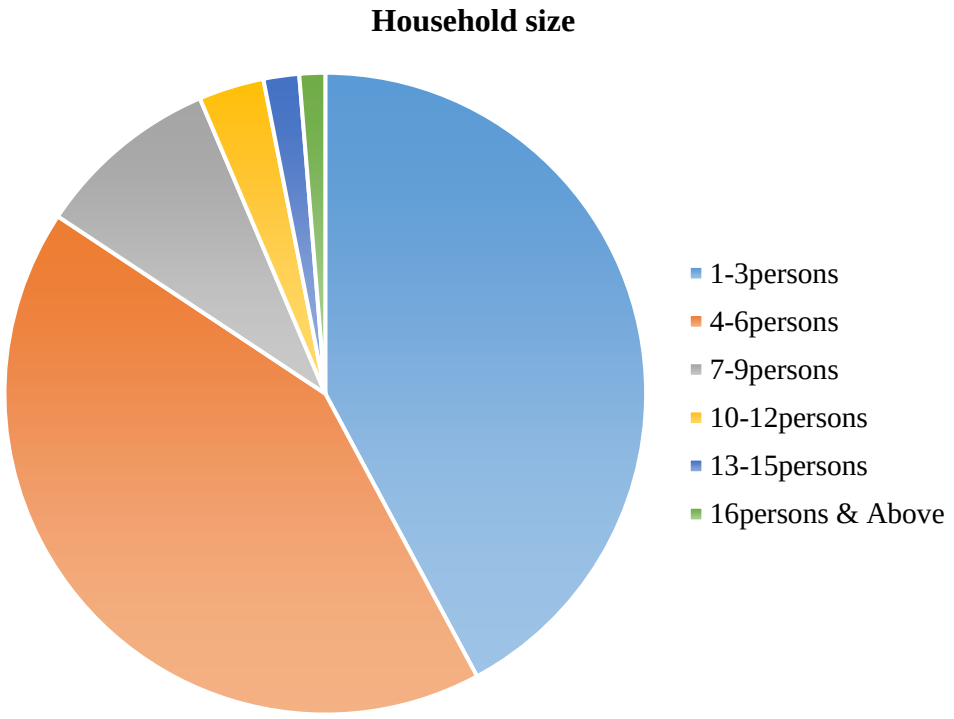



**Figure 7: Household size of respondents for the study**

**Source: Field Data, 2019**

Figure 7 above portrays analysis on the various household sizes of respondents selected for the study. Household sizes of respondents for the study were grouped into household sizes ranging from 1-3 persons, household sizes ranging from 4-6 persons, household sizes ranging from 7-9 persons, household sizes ranging from 10-12 persons, household sizes ranging from 13-15 persons, and household sizes with 16 and above persons. Analysis in figure 7 revealed that greater number of the respondents selected for the study had household sizes ranging from 1 to 6 persons. Also from the analysis, equal number of respondents (167 respondents) had household sizes ranging from 1-3 persons, and household sizes ranging from 4-6 persons. 13 respondents had household sizes ranging from 10-12 persons, 7 respondents had household sizes ranging from 13-15 persons, with only 5 respondents having household sizes above 15

persons, that is 16 persons and above. The average household size in Ghana stands at 4.4 per household (Population and Housing Census, 2010).

**Table 4: Age Distribution of Respondents**

| Variable | Frequency | Percentage (%) |
|---|---|---|
| **Age** | | |
| 18-22yrs | 14 | 3.5 |
| 23-27yrs | 65 | 16.4 |
| 28-32yrs | 66 | 16.7 |
| 33-37yrs | 51 | 12.9 |
| 38-42yrs | 47 | 11.9 |
| 43-47yrs | 41 | 10.4 |
| 48-52yrs | 36 | 9.1 |
| 53-57yrs | 24 | 6.1 |
| 58-62yrs | 16 | 4 |
| 63yrs & Above | 36 | 9.1 |
| Total | 396 | 100 |

Source: Field Data (2019)

Table 4 above shows the analysis of age as a demographic character of respondents selected for this study. Table 4 also shows the age distribution of household heads interview for the study. The results showed that only 3.5% of the respondents interviewed were below 23 years. Respondents with ages of 23 to 27 represented 16.4%(65), 16.7%(66) for 28 to 32years, 12.9%(51) for 33 to 37 years, 11.9%(47) for 38 to 42 years old respondents, 10.4%(41) for 43 to 47 years, 9.1%(36) for 48 to 52 years, 6.1%(24) for 53 to 57 years, 4.0%(16) for 58 to 62 years, and 9.1%(36) for respondents above 62 years. This implies that Cape Coast Metropolis have a youthful population, which conforms to that of the Country at large, per data from the 2010 Population and Housing Census (GSS). Also from

the analysis, a significant number of over 9.1% of the respondents had their ages above the formal retirement age of 60.

**Table 5: Socio-demographic characteristics of respondents**

| Variable | Frequency | Percentage (%) |
|---|---|---|
| **Occupation** | | |
| Unemployed | 47 | 11.9 |
| Self-employed | 241 | 60.9 |
| Public servant | 53 | 13.4 |
| Private institution | 24 | 6.1 |
| Other | 31 | 7.8 |
| Total | 396 | 100 |

Source: Field Data, (2019)

On Employment, results from Table 5 above shows that 47(11.9%) of the total respondents interviewed were unemployed, with the remaining 349 (88.1%) gainfully employed. 13.4% of the respondents were public servants whiles 6.1% were in private institutions. 7.8% of these respondents were engaged in other occupations. More than half of the respondents, 241 (60.9%) were self-employed. This complies with data from the Population and Housing Census, 2010, which reported that majority (64.8%) of Ghana's economically active population are self-employed out of which the private informal sector alone employs about 86.1% (GSS, Population and Housing Census, 2010).

**Table 6 : Socio-demographic characteristics of respondents**

| Variable | Frequency | Percentage (%) |
|---|---|---|
| **Monthly Income** | | |
| 200Ghc & Below | 115 | 29 |
| 201-700Ghc | 181 | 45.7 |
| 701-1200Ghc | 54 | 13.6 |
| 1201-1700Ghc | 24 | 6.1 |
| 1701-2200Ghc | 10 | 2.5 |
| 2201-2700Ghc | 5 | 1.3 |
| 2701-3200Ghc | 2 | 0.5 |
| 4201Ghc&Above | 5 | 1.3 |
| Total | 396 | 100 |

Source: Field Data, (2019)

Table 6 analyses the monthly income ranges of respondents from the various communities selected under the study. The shows that most of the respondents interviewed had their monthly incomes in the ranges of GH¢201 to GH¢700, representing 45.7 of the total respondents. A very significant portion of the respondents (29%) had their monthly income ranging from GH¢200 & below. This when analysed further on daily basis will leads to a daily wage lower than the current daily minimum wage of Ghana (i.e., 200/28 =Gh¢7.14 < 11.82). However, it should be noted that most of the respondents were self - employed which may be a contributing factor. The analysis also showed that 54 respondents representing 13.6% had their monthly incomes within the ranges of 701 -1200Gh¢. The remaining percentage covered monthly incomes ranging

from 1201-1700Gh¢ (6.1%), 1701–2200Gh¢ (2.5%), 2201-2700Gh¢ (1.3%), 2701-3200Gh¢ (0.5%), and 1.3% for 4201Gh¢ & above.

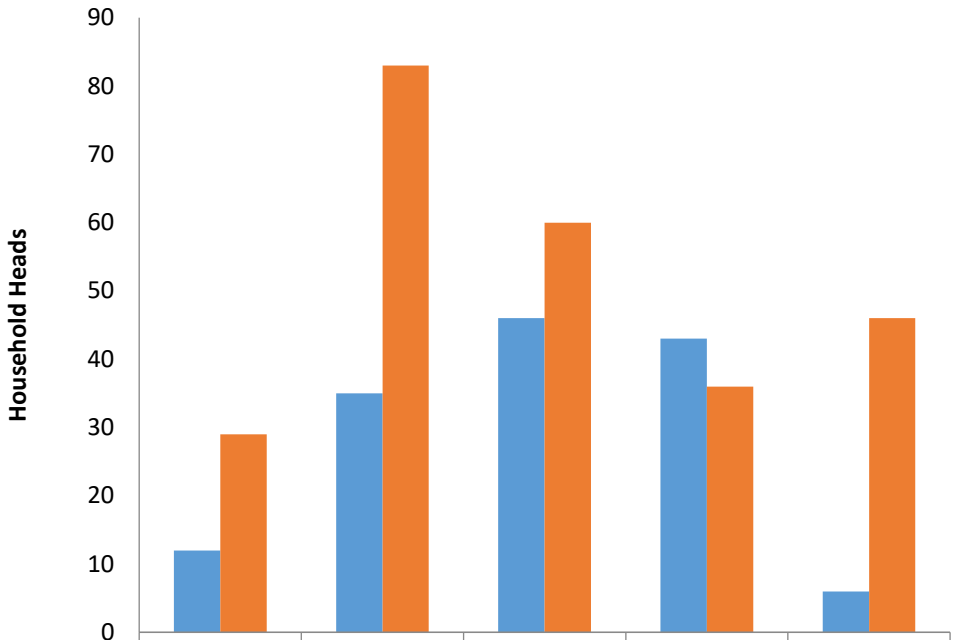
However, further analysis made on monthly income ranges of respondents as depicted in Table 7 below indicated that, of the 181 (45.7%) respondents who had their monthly incomes ranging from 201-700gh, self-employed respondents alone were 129. This represents 32.57% of the total household heads interviewed. Self-employed household heads again dominated with respondents with monthly incomes ranging from 200gh and below. Also from Table 7 below, none of the respondents who had their monthly incomes above 700gh was unemployed.

**Table 7: Monthly income and occupation of respondents**

| Monthly income (Gh¢) | Occupation | | | | |
|---|---|---|---|---|---|
| | **Unemployed** | **Self-employed** | **Public servant** | **Private institution** | **other** |
| 200 & Below | 29 | 70 | 2 | 4 | 10 |
| 201-700 | 18 | 129 | 12 | 13 | 9 |
| 701-1200 | 0 | 28 | 17 | 5 | |
| 1201-1700 | 0 | 5 | 13 | 1 | 5 |
| 1701-2200 | 0 | 2 | 5 | 1 | 2 |
| 2201-2700 | 0 | 3 | 2 | 0 | 0 |
| 2701-3200 | 0 | 0 | 1 | 0 | 1 |
| 4201 & Above | 0 | 4 | 1 | 0 | |

Source: Field Data, (2019)

Per figure 8 below, 46 out of the 52 respondents who had no formal education were females, whiles 6 were males. Respondents with basic education as their highest level of education consisted of 12 males and 29 females. Those who have had formal education up to the Junior High level were 35 males and 83 females. For Senior high school leavers, 46 were males whiles 60 were females. 43 males and 36 females have had formal education to the tertiary level.




| | Basic | Junior High | Senior High | Tertiary | No Formal education |
|---|---|---|---|---|---|
| Males | 12 | 35 | 46 | 43 | 6 |
| Females | 29 | 83 | 60 | 36 | 46 |

**Figure 8: Level of Education and sex of respondents**

**Source: Field Data, 2019**

Among the classes of communities considered under the survey, analysis in Table 8 below shows that, most of the household heads with tertiary level education (41 respondents) falls within higher income communities, with middle income communities also having quite a significant number, that is 23. More so, lower-income communities could also boast of 15 respondents who have had formal education to the tertiary level. Also, of the 13% respondents who had no formal education as seen in Figure 3.2 above, analysis in Table 8 showed that 14 of them were from high income communities, 15 from middle income communities, and 23 from lower income communities. In all, Ekon recorded the highest number of household heads with no formal education that is 11. This may be as a result of it being a fishing community which is usually characterized with low literacy level as buttressed by Maddox (2007).

**Table 8: Community and Highest Level of Education**

| Community | Highest Level of Education | | | | |
|---|---|---|---|---|---|
| | No Formal Education | Basic | Junior High | Senior High | Tertiary |
| Master Sam | 6 | 0 | 11 | 17 | 10 |
| Ola | 2 | 2 | 7 | 11 | 22 |
| Ayikoayiko | 6 | 3 | 14 | 12 | 9 |
| Efutu | 4 | 7 | 17 | 8 | 8 |
| Nkanfoa | 8 | 3 | 14 | 15 | 4 |
| Eyifua | 3 | 2 | 10 | 18 | 11 |
| Ekon | 11 | 13 | 9 | 8 | 3 |
| Amamoma | 5 | 5 | 20 | 8 | 6 |
| Ankaful | 7 | 6 | 16 | 9 | 6 |

Source: Field Data, (2019)

Table 9 depicts analysis of the type of apartments of respondents in communities selected under this survey. From the table, 18 respondents from the high income communities were living in single room apartments, 46 in compound houses, 22 in Self-contained, 9 in semi-detached, 36 in Flats, and 1 respondent living in an unspecified apartment (Other). Under the middle income communities, 27 were living in single rooms, 40 in compound houses, 30 in self-contained, 16 in semi-detached, and 19 in flats. With respect to lower-income communities, those living in single room apartments totalled 57, those in compound houses 37, those in self-contained 17, semi-detached 13, and 8 in flats.

**Table 9: Community and Type of Apartment**

| Community | Type of Apartment | | | | |
|---|---|---|---|---|---|
| | Single room | Compound house | Self - contained | Semi-detached | Flat |
| Master Sam | 6 | 19 | 5 | 2 | 12 |
| Ola | 4 | 9 | 15 | 5 | 11 |
| Ayikoayiko | 8 | 19 | 2 | 2 | 13 |
| Efutu | 11 | 13 | 6 | 9 | 5 |
| Nkanfoa | 11 | 18 | 9 | 1 | 5 |
| Eyifua | 5 | 9 | 15 | 6 | 9 |
| Ekon | 16 | 19 | 3 | 3 | 3 |
| Amamoma | 16 | 13 | 10 | 2 | 3 |
| Ankaful | 25 | 5 | 4 | 8 | 2 |

Source: Field Data, (2019)

**Energy-Saving Practices**

To ensure that responses generated in this research for all available variables are reliable for data analysis. Analysis was carried out using the Cronbach's Alpha (α) which is a common measure usually used to test the reliability of items on a Likert-type scale. Cronbach's Alpha (α) is the most common measure of scale reliability of constructs and a value greater than 0.700 is very acceptable (Cronbach, 1951). The reliability statistic run for this study indicated Cronbach's Alpha (α) value of 0.762 for all variables. Since this calculated reliable value is greater 0.700, the responses generated for all of the variables in this research becomes acceptable and very reliable for data analysis.

**Table 10: Energy Saving Practices among households**

| Practice | Output (%) | | |
|---|---|---|---|
| | Always | Sometimes | Rarely |
| TV | 29.80% | 61.60% | 8.60% |
| Lights | 33.90% | 63.50% | 2.60% |
| Fridge/Freezer | 40.60% | 35.20% | 24.2 % |
| Fan | 38.60% | 46.80% | 14.60% |

Source: Field Data, (2019)

The study sought to identify the energy saving practices of respondents. In doing so, the practices of respondents in the use of some selected household gadgets were analysed. The main consideration was on the frequency of which available appliances are used (under the Keys: Always, Sometimes, Rarely) and the rate at which they switch off these appliances to conserve energy when not in use. Appliances such as air conditioner, electric stove, toaster, electric oven, dispenser, and washing machine were used by relatively small portion of the total respondents for the study. Respondents with air conditioners formed only 1.8% (7) of the total sample, 2.5% (10) had electric stove, 5.3% (21) owned toasters, 1.5% (6) owned electric ovens, 0.3% (1) owned a dispenser, and 4.3% (17) owned washing machines. These appliances were mostly used by high-income households. However, appliances such as TV, Fan, Light and Fridge/Freezer recorded higher values pertaining to their availability and usage across all the three income classes. TV recorded 84.8% of the total respondents who owned it, 98.2% of them use light, 55.3% had fridge/freezers and fan recorded 79.8% of availability and usage.

From the analysis in Table 10 above, 29.8% of the respondents with TV always switch off their TV when not in use. 61.6% answered Sometimes, and 8.6% rarely switch off their TVs when not in use. On the use of Light Bulbs, 33.9% always off their lights, 63.5% do that sometimes, 2.6% rarely off their light. Also, 40.6% of respondents who use fridge/freezers plan for what they need before opening their fridge/freezer, 35.2% do that on some occasions, and 24.2% rarely practice such.

With respect to fans, 38.6% of the respondents always use fans only when they feel warm, 46.8% sometimes use fans even when they don't feel warm, 14.6% rarely considered warmth as their basis for using fan. Most of the stakeholders interviewed were able to touch on some energy-saving practices they practice in their homes. Some prominent among such practices were switching off appliances when not in use, switching on lights only in the evening, putting off fan and lights when leaving the office, using energy-efficient appliances, among others. Stakeholder 1 stated that,

> "*Officers in the various units are informed at management meetings to switch off appliances when leaving the office as a way of conserving electricity*".

On fridge/freezer appliance an interviewee from the Efutu community stated that,

> *"With my fridge for instance, sometimes if I think I wouldn't need the fridge maybe for two days, I will put some sachet waters in the freezer. And then for two days I can be in the house without putting my fridge on".*

During the study, it was revealed that energy regulatory institution (ECG) in Cape Coast metropolis have been embarking on education on energy conservation practises. Conservation practices are stipulated in brochures of the energy regulatory agencies which they use to educate households.

However, the study revealed that most respondents engaged in some perceived practices geared towards conservation which were not conservation practice, for instance a respondent from one of the low income communities stated that he always switch off the main meter for the household when leaving for work.

**Plate 1: A household meter switched off during daytime**

Source: Field data, 2020

Also, another stakeholder interviewed was able to educate his populace on switching off street lights during the day. Also, with aid of the assembly, he

was able to facilitate the purchase of energy-efficient bulbs in his locality by sending sellers of energy-efficient bulbs to his locality. In an interview session with a stakeholder, he indicated that education of households on conservation practices has been intensified by his outfit through consumption charts, brochures, radio programs, and at times to the communities on the use of STAR rated appliances. However, a major challenge of people hearing but not adhering to conservation measures was emphasized by many stakeholders interviewed. For this reason, many street lights were left on during the day. According to the Energy Sector Recovery Programme prepared by the Ministry of Energy (2019), a draft regulation on "Street Lighting" which was developed by the Energy Commission of Ghana is under consideration pending review and approval. The following images relates to bulbs left on during the day in some households and streetlights which were left on during the day in some of the communities:

**Plate 2: Images showing street lights left on during daytime**

Source: Field data, 2020

**Energy Conservation Awareness in Cape Coast Metropolis**

This aspect of the study tries to find out the level of awareness of household heads on electricity conservation. To help achieve this, household heads were first asked whether it is important to conserve electricity. The result indicated that, of the 396 total respondents interviewed, 97% answered in the

affirmative (Yes), whiles only 3% answered in the negative (No). This is represented in Fig. 9 below:

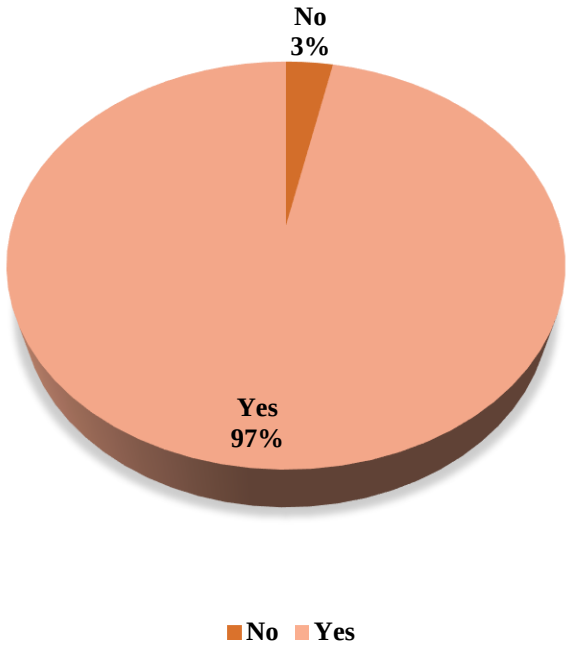



**Figure 9: Views on energy conservation**

**Source: Field Data, 2019**

Also in helping to ascertain the level of awareness of households on energy conservation, respondents were further probed to explain their perceived meaning of energy conservation. Majority of the respondents could not explain what energy conservation is about. From Table 11, 187 respondents representing 47.3% of the total respondents could not explain the meaning of energy conservation. As confirmed in 9 above, study revealed that most of the respondents who could not explain energy conservation regardless indicated that it is important to conserve energy, after the researcher had briefed them on what energy conservation is about. This implies that household heads in the Cape Coast Metropolis are not well-versed in the meaning of energy conservation which may be attributed to inadequate energy conservation campaigns in the metropolis. Increase in public knowledge and understanding

of what energy conservation is about will improve energy-saving practices among households. As opined by Amos-Abanyie, Kwofie, and Asare, (2016), consumers put up wasteful practices due to lack of knowledge or awareness on the use of energy and its related implications. Literature by researchers such as Poortinga, Steg, Vleg, et al, 2003; Wang, et al, 2011; and Brohmann, Heinzle, Rennings, et al, 2009, indicated that consumer education has some level of influence on energy saving practice. However, the remaining 52.7% respondents who were able to define energy conservation, 29.5% out of it defined it to be the use of available energy judiciously. The perceived meaning of energy conversation by 23% of the respondents was using energy only when needed. Quite a significant portion (0.3%) defined energy conservation as keeping energy without using it.

All stakeholders interviewed for the study demonstrated greater level of energy conservation awareness. Some of their definitions of energy conservation were:

- *"It is about how to make sure that our electrical energy does not go waste, as in its usage" (Stakeholder 1).*
- *"It is about how we will be able to use our electricity judiciously, as individuals" (Stakeholder 2).*

Each stakeholder was able to say something about what energy conservation is all about. Also, they all responded in the affirmative with respect to the question "Is energy conservation important". Stakeholder 2 stated in an interview session that,

> *"Poor conservation habit among consumers is one of the major factors that led the country into serious energy crises some time*

*ago. Poor conservation practice affects the country's energy stock and income of consumers…"*

To back the response of electrical energy conservation being very important to the consumer and the country at large, stakeholder 1 also stated that,

*"If you don't conserve, it affects your income. You see, when you look at the tariff, the band are such that, as you consume more, you pay more. It is not just for the fact that you are consuming more you pay more, but it is punitive. It is intentional, so that you use exactly what you need. And when you are entering a higher tariff band, it alerts you to check on things like not putting off gadgets when not needed".*

**Table 11: Households perceived meaning of Energy conservation**

| Energy Conservation Response | Frequency | Percentage |
|---|---|---|
| Don't Know | 187 | 47.3 |
| Using available energy judiciously | 117 | 29.5 |
| Using energy only when needed | 91 | 23.0 |
| Keeping energy without using it | 1 | 0.3 |

Source: Field Data (2019)

Also, the study sought to examine the level of awareness of households on energy efficiency labels. Data from Fig 10 indicates that, 60% of the respondents had not seen the energy efficiency label. Household heads with knowledge of energy efficiency label also accounted for 40% of the total respondents for the study. This implies that, most household heads will often not be inclined to buy energy inefficient appliances since most of them don't have knowledge on energy efficiency labels. Responses from respondents also

showed that many household heads even though had the Ghana energy efficiency label on their appliances; they did not know the exact purpose that it served.

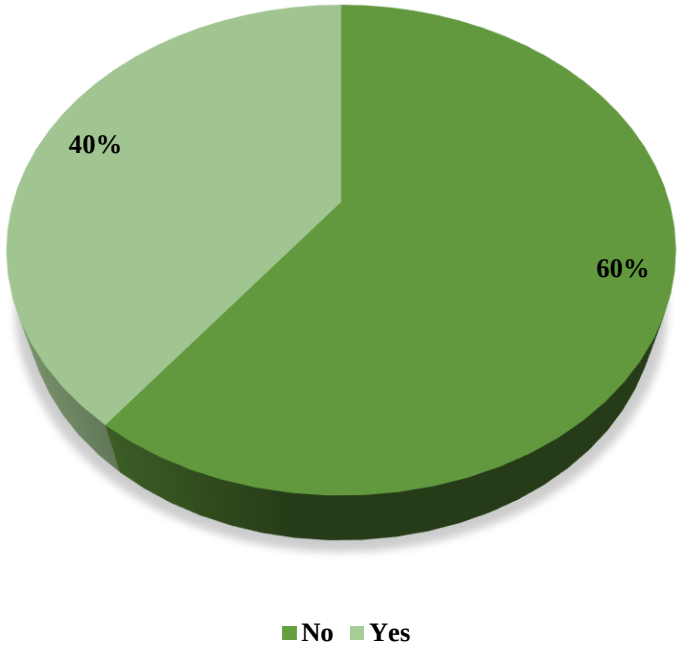



**Figure 10: Energy Efficiency Label**
**Source: Field Data, 2019**

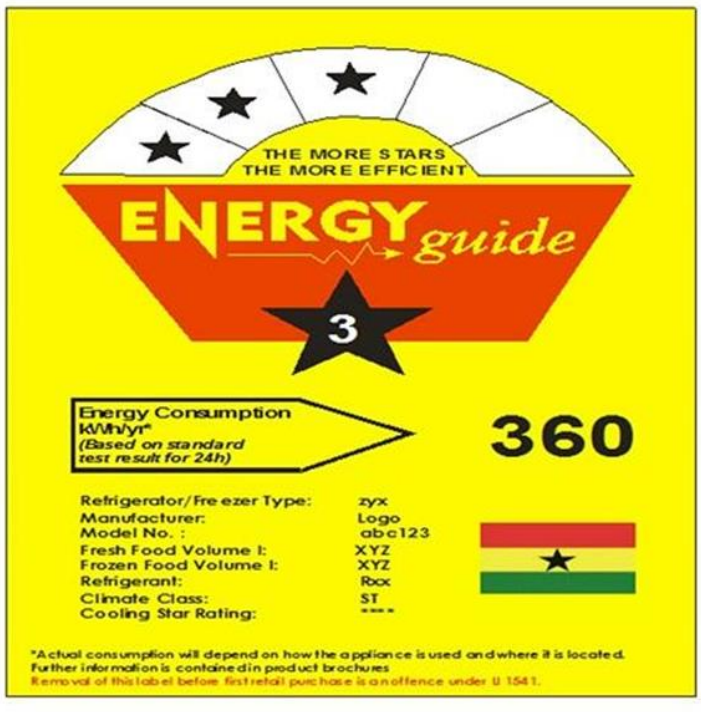



**Plate 3: Ghana energy efficiency label**
Source: Energy Commission, 2016

Table 12 below explains the level of awareness of household heads in the cape coast metropolis on the various conservation policies instituted by the Government in Ghana through the various energy regulating institutions. 11.4% of respondents selected 'ban on importation of second hand appliances' (L.I 1932) as one of the policies they know. However, only 11.6% (46 respondents) were aware of this policy. 6.8% out of the total respondents for the study stated 'Energy Efficiency level indication on appliances (L.I 1815 and 1958). 12.4% of the total household heads interviewed knew there are policies in place but could not mention any, whiles 71% stated that they have not heard of any policy on electricity conservation.

**Table 12: Energy conservation policy in Ghana**

| Electricity Conservation Policy | Responses | % of Cases | |
|---|---|---|---|
| | N | % | |
| No importation of Second-hand appliances | 46 | 11.4 | 11.6% |
| Energy Efficiency level indication on appliances | 27 | 6.7 | 6.8% |
| Haven't heard of any electricity conservation policy | 283 | 69.8 | 71.0% |
| There are policies but I don't know of any | 49 | 12.1 | 12.4% |

Source: Field Data (2019)

From Table 13, ECB of household heads were assessed based on the number of hours they use their electrical appliances per day. A total of 242 respondents representing 61.1% of the total sample of respondents use fridge/freezer. Majority of fridge/freezer users use their appliance for about 6hrs to 24hrs per day, where 36.4% use fridge/freezer 24hrs per day. During the interviews, most of the respondents who switch on their fridge/freezer 24hrs per day cited some reasons for their actions which included;

*"I use of my freezer for storing perishable goods and therefore can't switch it off",* (Respondent 1)

*"I use it for business (selling) so I have to leave it on throughout"*, (Respondent 2)

And to some, they have a perception that the constant switching on/off of their fridge/freezer will lead to a rise in its power consumption level. Furthermore, with the use of lightbulbs, majority of respondents representing 49.1% of the total respondents use fan for 6hrs to 11hrs daily and 63.6% respondents use light bulbs for 6hrs to 11hrs per day. Furthermore, only 3.4% use lightbulbs 24hrs daily. Again, only 4.5% of households with television use them 24hrs daily. It is worthy to note that, a respondent 1 from Ekon stated that,

*"For me, I don't switch on my bedroom light in the evening so l leave my television on throughout the night to serve as light."*

Also from Table 13, 136 (34.3%) household heads use their television for 6 to 11hrs daily. According to a nationwide survey conducted by the Energy Commission of Ghana in 2010 and as cited in the National Energy Statistics report, 2015, refrigeration, lighting, television, and fan appliances successively dominated the average monthly electricity consumption per household appliance in both rural and urban localities. For urban areas, average monthly electricity consumption for refrigerating appliances was 73.1 kWh, and that of lighting, television, and fan appliances was 21.8 kWh, 12.2 kWh, and 12.2 kWh respectively. In the rural areas, it was reported that refrigerating appliance accounted for 102.3 kWh, lighting appliance- 21.8 kWh, television – 10.7 kWh and fan appliance – 10.7 kWh. Analysis of all these appliances (Refrigeration,

lighting, fan, television) in Table 13 revealed that they are usually mostly for more than 6hrs per day, and a significant number used at the extreme of 24hrs daily. This implies that, such appliances have great influence on the monthly electricity consumption of those households.

**Table 13: Daily duration of appliance usage**

| Appliance | Frequency (%) | | | | |
|---|---|---|---|---|---|
| | **24Hrs** | **12-23Hrs** | **6-11Hrs** | **1-5Hrs** | **Less than 1Hr** |
| Fridge/Freezer | **36.4%** | 23.5% | 29% | 8.3% | 2.8% |
| Fan | 6.9% | 12.6% | **49.1%** | 29% | 2.4% |
| Light Bulb | 3.4% | 9.3% | **63.6%** | 22.4% | 1.3% |
| Television | 4.5% | 12.5% | **43.7%** | 37% | 2.3% |

Source: Field Data (2019)

**Table 14: Socio-economic factors influencing households' choice of energy-efficient appliances**

| Variable | Coefficient | Std. Errors | Z-Statistic | P>\|Z\| |
|---|---|---|---|---|
| Constant | 2.744928 | 0.0765641 | 35.85 | 0 |
| Sex | 0.0229382 | 0.0264546 | 0.87 | 0.386 |
| Age | -0.0001515 | 0.0009928 | -0.15 | 0.879 |
| Strat | -0.0331503 | 0.0190745 | -1.74 | 0.082 |
| Marital | -0.0568363*** | 0.0116376 | -4.88 | 0 |
| Yrs of sch | 0.0196351*** | 0.0027014 | 7.27 | 0 |
| Yrs of resid | -0.0003277* | 0.0001533 | -2.14 | 0.033 |
| Expenditure | 0.0008695*** | 0.0001097 | 7.93 | 0 |
| Income | 0.0001193*** | 0.0000127 | 9.37 | 0 |
| HHsize | -0.0013093 | 0.0050805 | -0.26 | 0.797 |
| BeE | 0.0199188* | 0.0098562 | 2.02 | 0.043 |
| NKwHH | -0.0223669 | 0.0123317 | -1.81 | 0.07 |
| Hphour | 0.033788* | 0.0153794 | 2.2 | 0.028 |
| Prob>chi2 | 0.0 | | | |

Significant levels: *P<0.05; **P<0.01; ***P<0.001; R=0.1219

Source: Field Data, (2019).

Variables such as marital status, years of schooling, years of residence, expenditure, income, household members below 18years as well as hours power goes off daily have influence on household choice of energy-efficient appliances. Suryawanshi and Jumle (2016) in their study concluded that, marital status, education, income, and monthly electricity bill have significant association with the level of energy conservation. Variables such as marital status, years of schooling, expenditure and income have stronger influence on households' decision to purchase and use energy-efficient appliances compared to the other variables including years of residence, household members below 18years, and hours power goes off daily. Again, marital status and years of residence per the findings of this study have strong inverse relationship with choice of energy-efficient appliances. This implies that the higher the number of years a particular household have lived in a particular residence, the lessor the chances of choosing energy-efficient appliances and the lesser the number of years a particular household have lived in a particular residence, the higher the chances of choosing energy-efficient appliances. This confirms findings by Ameli and Brandt (2014), which indicates that energy efficiency investments are more likely to be made when a household moves into a new dwelling place. Walsh (1989) on the other hand found that, the older the residence of a consumer, the more likely that household will engage in energy conservation. Home owners residing in older dwelling may tend to adopt greater conservation measures than those residing in newer dwellings, especially if older dwellings are in poor conditions and requires the installation of new appliances (Nair, Gustavsson, and Mahapatra, 2010) as cited by Frederiks, Stenner, and Hobman (2015).

Also from Table 14 above, years of schooling, expenditure, income, number of household members below 18years and hours power goes off daily have direct relationship or influence on households' choice of energy-efficient appliances. This implies that the higher the expenditure level of a household, the more likely they are to conserve electricity by choosing energy-efficient appliances and the lesser the expenditure level of a household, the less likely they are to conserve electricity through choosing energy-efficient appliances. Liu, Wang, Wei, Chi, & Ma (2020) opined that financial cost may significantly influence practical attitude. Consumers desire to reduce household expenditure contributes to the purchasing of energy-efficient appliances (Sun and Feng, 2011). This implies that, household choice of energy-saving appliances increase when a household is able to reduce expenditure in order to get more disposable income. According to Frederiks, Stenner, and Hobman (2015), household heads in full time employment tend to have more disposable income to spend on energy-efficient appliances than household heads in part-time or no employment. Research by Powers, Swan, and Lee (1992), suggested that household heads in full time employment tend to significantly make home improvements to conserve energy.

Also the higher the years of schooling of a household head the more likely it is for the household to conserve more energy through the purchasing of energy-efficient appliances. This finding supports that of Suryawanshi and Jumle (2016). This is because, such persons are likely to be more exposed and enlightened or more knowledgeable of energy conservation and its essence. However, according to Wang and Zhang (2014), no significant difference exists in the energy-saving practices of residents with different levels of education as

residents with higher levels of education do not always have better awareness of energy conservation.

Again, the study indicates that, households which have more members below 18years are more likely to choose energy-efficient appliances than households with lesser members below 18years. Presence of teenagers in households leads to a significant increase in residential electricity consumption. For instance, some respondents indicated that they are unable to conserve energy as they wish to do because their families, especially children are always home watching television and opening fridges almost every minute. Children are less likely to engage in energy conservation practices because are unlikely to understand the need for energy conservation and may therefore engage in 'wasteful' energy use (Samuelsson, 1990). Mcloughlin et al 2012; and Bortusch et al (2012) as cited by Laicane, Blumberga, rosa, and Blumberga, (2014) found that energy consumption is higher among households with more number of children than households who live alone or with less number of children.

Income is another variable with strong positive influence on energy conservation by choice of energy-efficient appliances. The study indicates that the more income a household earns, the more likely they are to conserve energy or choose energy-efficient appliances. This result confirms results from Ameli and Brandt (2014), who concluded that the probability to invest in energy-efficient appliances increases strongly with income. Asumadu-Sarkodie and Owusu (2016) also affirm the fact that energy development is closely linked with economic development. On the other hand, it counters result from Scasny and Urban (2009) that, negative relationship exists between energy-saving practice and income. However, not everyone may acquire appliances in the

same way as income rises (Shove, Pantzer, and Watson, 2012). Studies by Sardinou and Genoudi (2013) and Long (1993) also confirms that, similar to the findings from Stern and Gardner (1981), high income consumers prefer efficiency to curtailment measures. However, curtailment practices were found to be mostly influenced by motivation and environmental concern (Karlin, Davis, Sanguinetti, et al, 2014). This means that higher-income households are more reliant on efficiency than curtailment activities. As it was also argued by Poortinger et al (2003) that practical methods of energy conservation is least acceptable for high income consumers.

**Variability in Energy Conservation Practice among Households**

In assessing the level of variability in Energy conservation practices among households in Cape Coast metropolis, test of significance with a significance value level of 5% ($\alpha$=0.05) was used to analyse the strength of relationship between various variables. This was used to accept or reject the research hypothesis. A value less than or equal to 0.05 ($p < 0.05$) indicates a significant relationship between the variables whiles a value greater than 0.05 ($p > 0.05$) indicates no significant relationship between the variables (Herpen, 2018).

**Table 15: ANOVA results of choice of appliance**

| Households' Choice of Electric Appliance | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Variables** | | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** | **Effect Size** |
| **Age** | Between Groups | 112.884 | 2 | 56.442 | 8.638 | .000 | 0.042106 |
| | Within Groups | 2568.053 | 393 | 6.534 | | | |
| | Total | 2680.937 | 395 | | | | |
| **Monthly Income** | Between Groups | 48.242 | 2 | 24.121 | 12.851 | .000 | 0.061386 |
| | Within Groups | 737.644 | 393 | 1.877 | | | |
| | Total | 785.886 | 395 | | | | |
| **Household size** | Between Groups | 23.243 | 2 | 11.622 | 3.575 | .029 | 0.017912 |
| | Within Groups | 1274.392 | 392 | 3.251 | | | |
| | Total | 1297.635 | 394 | | | | |
| **Expenditure** | Between Groups | 27.051 | 2 | 13.525 | 1.479 | .229 | 0.007472 |
| | Within Groups | 3593.159 | 393 | 9.143 | | | |
| | Total | 3620.210 | 395 | | | | |
| **Hours Power stays Offa Day** | Between Groups | 5.793 | 2 | 2.896 | 4.225 | .015 | 0.021047 |
| | Within Groups | 269.447 | 393 | .686 | | | |
| | Total | 275.240 | 395 | | | | |
| **Schooling Years** | Between Groups | 40.263 | 2 | 20.131 | 18.407 | .000 | 0.08565 |
| | Within Groups | 429.818 | 393 | 1.094 | | | |
| | Total | 470.081 | 395 | | | | |
| **How many are below 18years?** | Between Groups | 16.409 | 2 | 8.205 | 1.573 | .209 | 0.007942 |
| | Within Groups | 2049.773 | 393 | 5.216 | | | |
| | Total | 2066.182 | 395 | | | | |
| **How long have you lived in this house? (Years)** | Between Groups | 10568.288 | 2 | 5284.144 | .523 | .593 | 0.002653 |
| | Within Groups | | 393 | 10110.478 | | | |
| | Total | | 395 | | | | |

Source: Field data 2019

*Note*.—MS = Mean squares, effect size = $\eta 2$

In order to assess the variation in some demographic factors that influence households' choice of electronic appliances, one-way ANOVA was used. From the ANOVA results in table 15 above, there is significant variation in the effects of variables such as age, monthly income, household size, and

years of schooling as well as the number hour's power stays off in a day on households' choice of electric appliances.

From table 15, the result shows that age has a significant effect on households' choice of electric appliances at a P<0.05 level for the three conditions [F (2,393) =8.638, p=0.00]. However, the effect of age on the choice of household choice of appliance is low at 0.042. This implies the choice of household appliance of an individual is minimally affected by age of an individual. This corresponds to the work of Brandon and Lewis (1999) as well as Mahapatra and Gustavsson (2008) who indicated in their works that age has a significant influence on households' choice of appliance.

Also, the result shows that there is statistically significant difference in the effects of monthly income on households' choice of appliances at a p<0.05 level for the three conditions [F (2,393) =12.851, p=0.00]. The effect size of monthly income on households' choice of appliance is indicated to be moderate at 0.061. This implies that in order for a particular household to choose any electronic appliance, the monthly income of the household is a significant factor of influence. Similar results were reported by Schipper and Hawk, 1991; Scott, 1997 and Poortinga et al., 2003 in their works where they confirmed that income has a positive effect on households' choice of appliances.

Again, there exists statistically significant variation in the influence of household size on the households' choice of electric appliances at a p<0.05 level for all the three conditions [F (2,392) =3.575, p=0.029]. The effect size of household size on choice of appliance from the data was low at 0.018. This implies that although household size influences' choice of appliances and the influence varies across households, the effect of its influence is low. This is

related to the works of Curtis (1984) and Long (1993) who also reported similar outcome in their works. Again, Castaldi and Zoli (2012) also confirmed in their work that indeed the size of a household also affects the appliances the household may choose.

However, the results on expenditure as a variable indicates that there is no statistically significant difference of household expenditure and the choice of electrical appliance ($p>0.05$) and with the three conditions [$F(2,393) = 1.479$, $p=0.229$]. The effect size computed was 0.007, which indicates an extremely low effect of expenditure on household choice of electrical appliance. This means that expenditure has no effect at all on choice of electric appliance that an individual households is likely to select. This however is in contrast to the work of Al-Ghandoor, Jaber, Al-Hinti, and Mansour (2009) who also indicates that expenditure has an influence on households' choice of appliance.

Moreover, duration of daily power outage was another variable considered for the ANOVA analysis. The study shows that there is statistically significant difference between duration for daily power outage and households' choice of electric appliance ($p<0.05$) and with the three conditions [$F(2,393) = 4.225$, $p=0.015$]. The effect size of daily power outage on choice of appliance among households was 0.021. This implies that the effect duration of power outage on a daily basis on households' choice of appliance is low, indicating that duration of daily power outage has no effect on household choice of electric appliances.

Years of schooling, which was another variable considered in this study, shows statistically significant difference in its influence on choice of appliance among households at a $p<0.05$ level for the three conditions [$F(2,393) = 18.407$,

p=0.00]. The effect size of this variable on households' choice of appliance is 0.086 which implies a moderate-high effect of years of schooling and households' choice of appliance. This therefore implies that, though the number of years of schooling varies among households, the number of years a household heads spends in schooling has a high effect on the households' choice of electric appliance. This relates to the work of Poortinga, Steg, Vleg, et al, (2003). However, Sardianou (2007) found an insignificant influence of education on household energy-conservation practices.

The study indicates that at p>0.5 level, there is no statistically significant variation in the influence of the number of household members below 18 years and the choice of electric appliance among households. This is so for the three conditions [F (2,393) =1.573, p=0.209]. The effect size was low at 0.008. This implies that although there is significant difference of number of household members below 18 years and households' choice of appliances, the influence does not vary among various households. This contrasts the works of Samuelsson, 1990 and Mcloughlin et al 2012 where the number of household members below 18years within a particular household is found have a significant effect on the household's choice of appliance and conservation practice as a whole.

The study indicates that at p>0.5 level, there is no statistically significant variation in the influence of a households years of residence and their choice of electric appliance. And this is so for the three conditions [F (2,393) =0.523, p=0.593]. The effect size was consequently seen to be extremely low at 0.003. This implies that the years of residence of household has influence on the households' choice of electric appliance, the influence does not vary among

various households. This contrasts with the works of Nair, Gustavsson, and Mahapatra (2010) and Ameli and Brandt (2014) where years of residence of a household is indicated to be an influence on the overall conservation practices of households in one way or the other.

**Table 16: ANOVA results of Social Stata and TV, Lightbulb, Fridge/Freezer**

Source: Field data 2019

*Note*.—MS = Mean squares, effect size = $\eta 2$

One-way ANOVA was conducted to compare the effect of social strata

| | SOCIAL STRATA | | | | |
|---|---|---|---|---|---|
| Variables | | Sum of Squares | df | Mean Square | F | Sig. |
| Off TV | Between Groups | 4.020 | 2 | 2.010 | 2.201 | .112 |
| | Within Groups | 358.917 | 393 | .913 | | |
| | Total | 362.937 | 395 | | | |
| Off lights | Between Groups | 2.591 | 2 | 1.295 | 3.690 | .026 |
| | Within Groups | 137.955 | 393 | .351 | | |
| | Total | 140.545 | 395 | | | |
| I plan for what I need before opening my Fridge/Freezer | Between Groups | 24.182 | 2 | 12.091 | 8.330 | .000 |
| | Within Groups | 570.455 | 393 | 1.452 | | |
| | Total | 594.636 | 395 | | | |
| I use the fan only when I feel warm | Between Groups | 7.106 | 2 | 3.553 | 3.015 | .050 |
| | Within Groups | 463.076 | 393 | 1.178 | | |
| | Total | 470.182 | 395 | | | |

on some energy-saving practices as a means of conserving electricity. The analysis of variance showed that the effect television usage had on social strata

was low and insignificant at p>0.5 level for the three conditions [F (2,393) =2.201, p=0.112]. The effect size was 0.011. This is in contrast to (Wientt, 2014) who indicated that the shorter the duration of television programs, the more likely it is for households to conserve energy by not switching on television for long hours.

The study also showed that there is statistically significant variation between lightbulb usage and social strata at p<0.05 for the three conditions [F (2,393) =3.690, p=0.026]. The result showed that social strata had a low effect size of 0.018 on the use of lightbulb. Amoah, Hughes, and Pomeyie (2018) confirms that investing in energy-saving lightbulbs is influenced by social strata which is measured per income levels.

The one-way ANOVA conducted, again indicated that at an effect size of 0.041, there is statistically significant variance between social strata and the practice of planning for what one needs before opening a fridge/freezer by a household. This is significant at p<0.05 for all the three conditions [F (2,393) =8.330, p=0.000]. The effect size was medium. This confirms the conclusion of Mcneil and Letschert (2005), who found a strong relationship between household income and refrigerator ownership in their study. Also, Khan, M. I. H., & Afroz, H. M., (2014) indicated that energy consumption is high when planning is not done before a fridge/freezer is opened.

Furthermore, there is statistically significant difference between the use of fan by households and social strata at p=0.05 for the three conditions [F (2,393) =3.015, p=0.050]. The effect size was small at 0.015. This relates to the work of He, Chen, and Wang (2019) in which they indicated that the use of fan

in place of air-conditioners is a more efficient way of saving energy and is also less expensive.

**Table 17: ANOVA results of Location and TV, Lightbulb, Fridge/Freezer and Fan**

**LOCATION**

| Variable | | Sum of Squares | df | Mean Square | F | Sig. | Effect Size |
|---|---|---|---|---|---|---|---|
| **Off TV** | Between Groups | 12.641 | 8 | 1.580 | 1.746 | .086 | 0.034831 |
| | Within Groups | 350.295 | 387 | .905 | | | |
| | Total | 362.937 | 395 | | | | |
| **Off lights** | Between Groups | 11.682 | 8 | 1.460 | 4.385 | .000 | 0.083118 |
| | Within Groups | 128.864 | 387 | .333 | | | |
| | Total | 140.545 | 395 | | | | |
| **I plan for what I need before opening my Fridge/ Freezer** | Between Groups | 47.955 | 8 | 5.994 | 4.243 | .000 | 0.080645 |
| | Within Groups | 546.682 | 387 | 1.413 | | | |
| | Total | 594.636 | 395 | | | | |
| **I use the fan only when I feel warm** | Between Groups | 23.955 | 8 | 2.994 | 2.597 | .009 | 0.050947 |
| | Within Groups | 446.227 | 387 | 1.153 | | | |
| | Total | 470.182 | 395 | | | | |

Source: Field data 2019

*Note*.—MS = Mean squares, effect size = $\eta 2$

From the table 17 above, the study showed in a one-way ANOVA result that, there is no statistically significant difference between television usage and the location of a household at p>0.05 level for the three conditions [F (8,387) =1.746, p=0.086]. This is at a small effect size of 0.035. This implies that the effect of television usage on conservation practice among households is medium at approximately 0.4. However, pertaining to television usage among households, there is no difference.

However, the study showed a statistically significant difference between lightbulb use and the location or community in which a household finds themselves. This is at $p<0.05$ for the three conditions [F (8,387) =04.385, p=0.000]. The effect size was high at 0.08. By observation, streetlights were found to be switched-on during daytime in almost all the communities. A collective effort from households is therefore needed to help solve this as it requires a high degree of personal sacrifice (Samuelson, 1990).

The study again indicated that there is a statistically significant variance between the location of a household and their conservation practice with respect to fridge/freezer appliance usage at $p<0.05$ for the three conditions [F (8,387) =4.243, p=0.000]. The study indicated that the location of a household has high effect size of 0.08 on the use of fridge/freezer appliances.

Moreover, there is a statistically significant difference between fan usage and the location of an individual household at $p<0.05$ level for the three conditions [F (8,387) =2.597, p=0.009] and there is a medium effect size of 0.051 on fan usage by the location of a household. This implies that the use of fan among households varies across geographic regions.

(Danlami, 2015) confirmed that location has an influence on energy conservation in the sense that, various studies conducted on energy conservation had varying results and concluded that varying results imply that the attitude of households towards conservation differ from one geographic region to another. This is also confirmed by Walsh (1989) and Long (1993) who also observed that households living in warmer climates are statistically less likely to invest in energy conservation than families living in colder states.

# CHAPTER FIVE

# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## Introduction

This chapter summarizes the findings made by this research and concludes on the findings with further recommendations on how energy

conservation practice could be addressed or improved upon in the Cape Coast metropolis.

**Summary**

Cape Coast metropolis has greater number of its population being females with about 46.5% married, and 32.6% of population being singles or never-married. The metropolis has more than 50% of its populace being Senior high and Junior high school graduates and about 19% only, tertiary graduates. Cape Coast has more than 50% of its populace being youth. This conforms to the national statistics and indicates that Cape Coast has a youthful population.

In the cape coast metropolis, findings from this study indicates that over 60% of the working class are self-employed individuals who are into trading and some other services and hence majority of them earn between GH¢201.00 to GH¢700.00 per month, with about 29% which is the second-highest of the record earning GH¢200.00 or below.

The study also provides evidence that in the cape coast metropolis, at the Basic, Junior high, Senior high, and No Formal Education level and classes, there are more females than males at each of these classes. However, at the tertiary education level, there are more males than females. This could be evidence of the high level of teenage pregnancy within the metropolis which renders these female teenagers to drop out of school after their junior high and secondary level education. Hence, their inability to continue into the tertiary level of education.

In order to conserve electricity in the cape coast metropolis, the study indicated that households resort to some energy-saving practices in their homes such as switching off their lights sometimes, usually during the day when there

is sunlight and switching off their television sets when they are engaged in something else even-though some respondents indicated that they rarely switched off such electricals like a light bulb because their rooms were dark, and others had their television on always because of their kids.

Also with 40.6% of respondents indicating that they always plan for what they need before opening their fridge/freezer to pick them and 24.2% rarely plan for what they need before opening their fridge or freezers. This means that 24.2% of the households open fridge/freezers as many times as they may need something from the freezer. Considering microwave and toaster for warming food and toasting bread, majority of households in Cape Coast, recording 65.7% and 71.4% respectively indicates that such appliances are used less often in order to save electricity.

Although a great number of the household population always used electric blender when cooking, majority of the populace of about 48.4% rarely use the electric blender when cooking but rather resort to the traditional methods of using an earthenware bowl or a grinding stone. For room cooling during high temperatures, appliances such as air conditioners and fans are usually used. For households who use air conditioners for room cooling, more than 57% of them use it always with 28.6% also using it more often, though not always. However, majority of fan users (61.4%) on the other hand, rather use it less often than always. This implies that they sometimes depend on the natural air outside the rooms when they feel warm. Notwithstanding, a significant portion of the population however depend on the fan always when they feel warm to cool their body temperature. It is also worth noting that over 52% of households who use

washing machines use it always for washing because it makes washing more easier to do and less tedious.

The study also sought to know the level of electricity conservation awareness among households in the Cape Coast metropolis. Upon this research, findings indicated that households agree and attest to the fact that it is important to conserve energy. However, although some of the respondents explained their perceived meaning of energy conservation to be 'the use of available energy judiciously' and 'the use of energy only when it is needed', majority of the respondents did not know what the term 'energy conservation' meant. Furthermore, this study provided evidence that about 60% of households in the Cape Coast metropolis had not seen (or had seen but do not know) the energy efficiency label of Ghana as at the time this study was being conducted.

Again the study showed that majority of the households in Cape Coast metropolis are not aware of any policies instituted by the government concerning electricity conservation although few households had fair ideas of some policies such as the ban on the importation of second-hand appliances such as freezers, refrigerators, air conditioners, microwaves, washing machines, etc.

The study also sought to assess whether there exists any variation in ECB among households within the Cape Coast metropolis. The findings of the study proves that there exists variations in the use of some appliances such as light bulbs, televisions, fridge/freezer, toaster, sound system, blender, microwaves and other electrical appliances. The study also provides evidence that there are variations in ECB per social strata within the metropolis with regards to some appliances including television, light bulb, and microwave.

The study shows that socio-economic factors such as marital status, years of schooling, years of residence, expenditure, income, number of household members below 18years as well as the number of hours power goes off daily have influence on households' choice of energy-efficient appliances. The study indicates that variables such as income, expenditure, number of household members below 18years, years of schooling and hours power goes off daily have a direct or positive influence on households' choice of energy-efficient appliances. The greater the expenditure, income, years of schooling, number of hours power stays off daily as well as the number of household members below 18years, the more likely it is for such households to choose energy-efficient appliances. However, the study indicated that variables such as marital status, and years of residence have an inverse relationship with choice of energy-efficient appliances.

Furthermore, the analysis of variance was used to assess the level variability among households with respect some the use of appliances such as television, lightbulb, fridge/freezer and fan. The result indicated that there is some level of variability among households pertaining to the appliances which were considered in the study.

**Conclusion and Recommendations**

Based on the findings, the study concluded that the level of energy conservation awareness among households in the cape coast metropolis is very low. Most households in the cape coast metropolis paid less attention to the efficiency level of the appliances they purchase, such that majority of households in the metropolis were not aware of the energy efficiency label of Ghana as well as any energy conservation policy in the country. Other

households also had the Ghana energy efficiency labels on their appliances, but did not know what those labels implied.

The study also showed that households had low knowledge on practices to conserve electrical energy. Most households in the Cape Coast metropolis engaged in some perceived energy-saving practices which were not captured under the laid down conservation practices by Ghana's energy regulatory bodies. Because the low level of energy conservation awareness within the cape coast metropolis, majority of households tend to adopt their perceived means of energy-saving practices rather than adhering to the laid down energy-saving practices laid down by the energy regulatory institutions (ECG). For instance, most users of Fridge/freezer appliances had the perception that, the more they on/off their appliances, the higher the energy consumed by such appliances. Again, other households also resorted to switching off their meter during the day and switching it on only in the evening. However, none of the respondents was able to mention any of the conservation practices on refrigerator appliances stipulated by the regulatory institutions. A recommended practice by the regulatory institutions on fridge/freezer appliance is to avoid putting pressure on the condenser to prevent more energy use. This can be done by avoiding frequent openings of a refrigerator, not placing uncovered liquids in the refrigerator (it absorbs undesirable flavours and give off vapours that add to compressor workload), dusting condenser coil every 3months (dust impairs its efficiency), and removing hard wrappers from foods before storing in the refrigerator. Also, on other common appliances such as TV, electric iron, and lights, the regulatory body in cape coast indicate that as a means of conserving energy, TVs can effectively be switched on by selecting specific programs

rather than leaving it on continuously. TV and radio cannot be switched on at the same time since listening will not be effective. Irons when overheated wastes energy and therefore should be avoided. After washing fabrics must be well folded – this makes them need only a 'quick press' when ironing. Also fabrics that require lower temperature must always be ironed first followed by those that require higher temperature. Also to conserve energy, irons must be turned off always when work is interrupted by a ringing door bell, and must be turned off 5 minutes or so before all cloths have been ironed so that the heat stored in the sole plate is utilized for the remaining fabrics. However, the study shows that households do not adhere to these laid down energy-saving practices.

Aside switching off light when not in use and when leaving for work, households were unaware of the fact that, in home decoration, lighter colours should be chosen for walls, ceilings, floors and furniture. Dark colours absorb light and will require high lamp wattage for a given level of illumination. Also, light coloured surfaces should be kept clean for maximum reflection.

All these conservation practices are stipulated in the brochures of the energy regulatory agencies which they use to educate households. However, households seemed unfamiliar with them.

The study also showed that, with respect to household choice of energy efficient appliances, some socio-demographic factors directly influences households decisions to purchase energy-efficient appliances. Of the socio-demographic factors examined under the study, years of schooling of household heads, expenditure, income, number of household members below 18years, and hours power goes off daily have a direct relationship with their choice of energy appliance.

Also, variables such as marital status and years of residence had a negative relationship with household choice of energy-efficient appliance. Age was found to have no influence on households in their choice of energy-efficient appliances. The study showed that there is a great level of variability with medium effect existing between social strata and conservation practice of households with respect to the use of appliance such as fridge/freezer. That is, planning before opening fridge/freezer appliances. On the other hand, the effect on social strata on the use of television, lightbulbs and fan is low although statistically, there is variance in the use of these appliances among households and across various social strata.

However, findings from the study also showed that there is a very strong difference in Energy Conservation Practice (ECP) of households in the various communities in the cape coast metropolis with respect to the use of lightbulbs and fridge/freezer appliances as a means of conserving energy among households and across geographic regions. And the effects of these appliances on conservation practice is very high. The research also revealed that location has moderate effect on the use of fan and a low effect on the use of television among households.

**Recommendations**

The study recommends that education on what energy conservation is about should be intensified until households become more conversant with the term ‘energy conservation’. This could be done through the use of media house such as radio stations, television stations, public address systems, as well as through the social media (Twitter, Instagram, Facebook), and community durbars. Policies on energy conservation should be made well known to the

general public. Considering the fact that the general literacy level of the country is low, energy policies should be explained in the simplest form to the understanding of households in order to improve awareness by the National Commission on Civic Education (NCCE) as well as the regulatory bodies.

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# APPENDICES

## APPENDIX A

## QUESTIONNAIRE
## UNIVERSITY OF CAPE COAST

## COLLEGE OF HUMANITIES AND LEGAL STUDIES

## FACULTY OF SOCIAL SCIENCES

## DEPARTMENT OF GEOGRAPHY AND REGIONAL PLANNING

Dear Respondents,

This instrument is part of a research work aimed at assessing energy conservation practice of households in Cape Coast Metropolis with focus on electricity. We will be very grateful to have you participate in this research by answering the following questions. Information solicited would be used purely for academic purposes and will also be treated with utmost confidentiality.

### INSTRUCTIONS TO RESPONDENTS

Read each question carefully and choose the appropriate answer by ticking the box beside the appropriate letter corresponding to the chosen item or by writing your response where needed.

Name of locality: …..……..

Location…….

**Section A: Socio demographic characteristics**

1. Sex :
   a. Male [ ] b. Female [ ]
2. Marital Status:
   a. Single [ ] b. Cohabitation [ ] c. Married [ ] d. Separated [ ]
   e. Divorced [ ] f. Widowed [ ]
3. Age:……..
4. Highest Level of Educational:
   a. No formal education [ ] b. Basic [ ] c. Junior High [ ] d. Senior High [ ] e. Tertiary [ ]

5. Years of schooling……
6. Type of apartment
   a. Single room b. Self-contained c. Semi-detached d. Compound house
   e. Flat/Apartment [ ] f. Other (specify)……..
7. Do you have your own meter?
   a. Yes [ ] b. No [ ]
8. How long have you lived in this house?
   a. 1-5 [ ] b. 6-10 [ ] c. 11-15 [ ] d. 16-20 [ ] e. >20 [ ]
9. Were you the first people to settle in this house?
   a. Yes [ ] b. No [ ]
10. How many rooms are in the house? .....
11. On the average how much do you spend daily in this household? .....
12. What is your main occupation?
    a. Public servant [ ] b. Private Company [ ]c. Self-employed [ ] e. Unemployed [ ]
13. Do you have other jobs you do besides your main occupation?
    a. Yes [ ] b. No [ ]
14. If Yes to Q12, please specify
    ……
15. Do you receive remittances?
    a. Yes [ ] b. No [ ]
16. What is your monthly income?
    .....
17. How many individuals are living in this household?
    ……
18. How many are
    a. Below 18years …… b. 18yrs & above……
19. How many of the household members are working? .....
20. What is your religious affiliation?
    a. Christian [ ] b. Islam [ ] c. Traditionalist [ ] d. No religion [ ] e. Other (Specify)……...

21. Which ethnic group do you belong to?
    a. Akan [ ] b. Ewe [ ] c. Mole Dagbani [ ] d. Ga-Dangme [ ]
    e. Other (Specify)……...

**Section B: Energy conservation awareness among households**

22. What type of electric energy do you use?
    a. Hydro-electric power [ ] b. Solar energy [ ] c. Wind energy [ ] d. Bio energy [ ]
    e. Thermal [ ] f. Don't know [ ]
23. Have you heard of energy conservation?
    a. Yes [ ] b. No [ ]
24. If "Yes", where did you hear it from?
    a. Media [ ] b. School [ ] c. Friends [ ] d. Parents [ ] e. Other relatives [ ] f. Others (specify)…….
25. What is energy conservation?
    a. Keeping energy without using it [ ]
    b. Using available energy judiciously [ ]
    c. Using energy only when needed [ ]
    d. Using energy intermittently [ ]
    e. Other (Specify)
    ……
26. Is it important to conserve energy?
    a. Yes [ ] b. No [ ] c. Not Sure [ ] d. Don't know [ ]
27. Have you seen the Ghana energy efficiency label?
    a. Yes [ ] b. No [ ]
28. Do you know of any energy conservation policy in Ghana?
    a. Yes [ ] b. No [ ]
29. If "Yes" to Q28, indicate with a tick those you know of
    a. No importation of second-hand appliances [ ]
    b. Manufacturers must indicate the energy efficiency level of every appliance with a number of stars [ ]
    c. I haven't heard any policies regarding electricity energy conservation [ ]

d. I know there are policies regarding electricity energy conservation but I don't know any [ ]

30. Will your knowledge about energy conservation influence your choice of appliance?
    a. Yes [ ] b. No [ ]
31. Will your knowledge about energy conservation influence your willingness to save energy?
    a. Yes [ ] b. No [ ]

**Section C: Behavioral differences in energy conservation among households**

32. Electricity saving behaviors from the households (S =voluntary behaviors to save electricity; H = habit)

| **Behavior** | **Always** | **Sometimes** | **Rarely** | **I don't / Not available** |
|---|---|---|---|---|
| **Off lights** | | | | |
| **Off TV** | | | | |
| **Off Computer** | | | | |
| **I use Air Condition to cool my room** | | | | |
| **I plan for what I need before opening my Fridge/Freezer** | | | | |
| **I use fan only when I feel warm** | | | | |
| **I use Electric Stove for cooking** | | | | |
| **I use Toaster for toasting** | | | | |
| **I use Electric Oven for baking** | | | | |
| **I use Microwave for heating food** | | | | |
| **I use Dispenser for cooling drinking water** | | | | |

| | | | | |
|---|---|---|---|---|
| **I use Washing Machine for washing** | | | | |
| **I use Blender when cooking** | | | | |
| **I use Sound System to project sound for entertainment** | | | | |
| **Other Appliances** | | | | |

33. Please indicate how many hours in a day do you use the following appliances?

| **Appliance** | **24Hrs** | **23Hrs -12Hrs** | **11Hrs -6Hrs** | **5Hrs - 1Hrs** | **<1Hr** | **Not Available** | **Don't know** |
|---|---|---|---|---|---|---|---|
| **Fridge/ Freezer** | | | | | | | |
| **Air conditioner** | | | | | | | |
| **Fan** | | | | | | | |
| **Light bulb** | | | | | | | |
| **Electric Stove** | | | | | | | |
| **Television** | | | | | | | |
| **Blender** | | | | | | | |
| **Microwave** | | | | | | | |
| **Electric Oven** | | | | | | | |
| **Kettle** | | | | | | | |
| **Computer** | | | | | | | |
| **Blender** | | | | | | | |
| **Toaster** | | | | | | | |
| **Phone** | | | | | | | |
| **Other(Specify) ……** | | | | | | | |

34. How many times do you iron in a week do you iron?

a. Once [ ] b. Twice [ ] c. Thrice [ ] d. Everyday [ ] e. Don't know [ ]

35. What type of light bulb do you use?

a. CFL [ ] b. LED [ ] c. Incandescent [ ] d. Don't know [ ]

36. Please indicate three energy saving practices you practice in your home
    a. ……..
    b. ……..
    c. ……..
37. Do you use electricity to cook?
    a. Yes [ ] b. No [ ]
38. If "No" to Q37, what alternative source of energy do you use in cooking?
    a. Gas [ ] b. Charcoal [ ] c. Firewood [ ] d. Other (specify) ……
39. Are there any social norms which influence your decision on how you use electricity?
    a. Yes [ ] b. No [ ] c. Don't know [ ]
40. Does your cultural values influence how you use electricity in your home?
    a. Yes [ ] b. No [ ] c. Don't know [ ]

**Section D: Household's choice of electrical appliances**

41. Please indicate the appliances available in your home

| **Appliance** | **(Available =1, Not available= 0)** | **Total Number** | **(In use=1, Not in-use=0)** | **Total Number** | **Brand (New=99, Second hand=00)** | **Efficiency Level (1,2,3,4,5)** |
|---|---|---|---|---|---|---|
| **Fridge/ Freezer** | | | | | | |
| **Air conditioner** | | | | | | |
| **Fan** | | | | | | |
| **Light bulb** | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Electric Stove** | | | | | | |
| **Television** | | | | | | |
| **Blender** | | | | | | |
| **Microwave** | | | | | | |
| **Electric Oven** | | | | | | |
| **Kettle** | | | | | | |
| **Computer** | | | | | | |
| **Blender** | | | | | | |
| **Toaster** | | | | | | |
| **Phone** | | | | | | |
| **Decoder** | | | | | | |
| **Washing Machine** | | | | | | |
| **Water Dispenser** | | | | | | |
| **Electric Iron** | | | | | | |

42. What is the size of your room? (For those who indicate that air conditioners are available in the home)

    ……..

43. Does your income influence your decision to purchase a particular kind of appliance?

    a. Yes [ ] b. No [ ]

44. Does your location have influence on the choice of appliance you purchase?

    a. Yes [ ] b. No [ ]

45. Did you consider the energy efficiency of an appliance when purchasing any?

    a. Yes [ ] b. No [ ]

46. What do you consider in choosing an appliance for your home?

a. Durability [ ] b. Income [ ] c. Energy efficiency [ ] d. Reliability [ ] e. Size [ ]

f. Weight [ ] g. Cost [ ] h. Appearance [ ] i. Affordability [ ] j. Brand [ ]

47. Which of the following is the topmost priority you lookout for when purchasing an electric appliance?
    a. Durability [ ] b. Income [ ] c. Energy efficiency [ ] d. Reliability [ ] e. Size [ ]

    f. Weight [ ] g. Cost [ ] h. Appearance i. Affordability [ ] j. Brand [ ]

    k. Country of origin [ ]

**Section E: Willingness of households to fully adopt electrical energy conservation**

48. Averagely, how much do you pay monthly for electricity? GH₵……
49. Approximately how many kilowatt-hours of electricity do you consume every month? ……..……...kWh
50. ASK RESPONDENT TO PROVIDE A COPY OF THE BILL FOR THE PAST 3-4 MONTHS AND RECORD THE MONTH, AMOUNT AND KWH CONSUMED. AT LEAST PLEASE GET ONE BILL. IF IT IS A COMPOUND HOUSE YOU MAY NOT GET THIS INFORMATION
    a. Month: ……Amount (GH₵): ……kWh consumed: ……..
    b. Month: …….... Amount (GH₵): …… kWh consumed: ……..
    c. Month: ……Amount (GH₵): …… kWh consumed: .....
51. What is your alternative source of power when electricity goes off?
    a. Generator [ ] b. Lantern [ ] c. Candles [ ] d. Battery torch light [ ] e. Solar lamp [ ] f. No alternative [ ] g. Other (specify)…….
52. On the average, how much do you spend on this alternative source of power during power outages in a month? GH₵…….

53. How necessary do you consider the current supply of electricity an issue worth discussing?
    a. Extremely necessary [ ] b. Very necessary [ ] c. Necessary [ ] d. Moderately Necessary [ ] e. Not Necessary [ ] f. Neutral [ ]
54. How would you rank the current supply of electricity to your home/ neighborhood?
    A. RELIABILITY (available at every time.):
        a. Excellent [ ] b. Very Reliable [ ] c. Reliable [ ] d. Moderately Reliable [ ]
        e. Not reliable [ ] f. Neutral [ ]
    B. QUALITY ( appropriate level of voltage and/or non-fluctuating or stable current):
        a. Excellent [ ] b. Very good [ ] c. Good [ ] d. Poor [ ] e. Very poor [ ]
    C. PRIOR NOTIFICATION GIVEN BEFORE AN OUTAGE
        a. Excellent [ ] b. Very Good [ ] c. Good [ ] d. Poor [ ] e. Very Poor[ ]
55. Do you think the appropriate authorities have done enough to solve or at least deal with the problems of providing reliable and quality electricity supply?
    a. Excellent [ ] b. Very Good [ ] c. Good [ ] d. Poor [ ] e. Very Poor [ ] f. Not sure [ ]
56. Do you play a role in the occurrence of power outages?
    a. Yes [ ] b. No [ ] c. Not sure [ ] d. Don't know [ ]
57. Averagely, how many times in a day does power go off, at least?
    a. Once [ ] b. Twice [ ] d. 3 times [ ] e. severally [ ] f. Not sure [ ]
58. On average, how many hours does it take when power goes off (on days that it does)?
    a. <1hr [ ] b. 1-2hrs [ ] c. ≥2hr-4hrs [ ] d. ≥4hrs-6hrs [ ] e. 12hrs [ ] f. 24hrs [ ]
59. Will your household be willing to pay higher for improved power service?
    a. Yes [ ] b. No [ ]
60. If "Yes" to Q59, how much more are you willing to pay?

a. 1-5% more [ ] b. 6-10% [ ] c. 11-15% [ ] d. 16-20% [ ] e. >20% [ ]

61. If "No" to Q59, briefly explain why? …….
62. What is the maximum amount your household will be willing to pay to use this service such that if it would cost more than this amount, your household would not be able to pay and hence you cannot have this uninterrupted electricity supply service? GH₵ …….. per kilowatt hours.
63. Have you received any education from ECG, CCMA on energy conservation?
    a. Yes [ ] b. No [ ]

**Section F: Recommendation**

64. What are some of the factors that hinders your ability to conserve energy?
    ……
    ……
65. Does the current state of electricity supply pose any challenges to your home?
    a. Yes [ ] b. No [ ]
66. If "Yes" to Q65, what challenges does the current state of electricity supply pose to your home?
    ……
    ……
67. What do you recommend should be done about the current state of electricity supply in the metropolis
    a. More education on energy conservation and saving practices in the home [ ]
    b. Government should subsidize the cost of electricity [ ]
    c. The energy efficiency of all appliances should be indicated on them [ ]
    d. Government should subsidize the cost of energy efficient appliances [ ]

e. Other, (Specify)

……

68. What do you think is the best way to increase electrical energy conservation among households in Cape Coast metropolis?

……

……

69. Through what practical ways do you suggest electricity could be conserved?

……

……

## APPENDIX B

## INTERVIEW GUIDE

An interview guide on the topic;

Energy conservation behavior of households in the Cape Coast metropolis

1. Please introduce yourself (Name of institution, department, position, duration of service/length of experience)
2. Any idea on the rate of electrical energy consumption in the Cape Coast metropolis?
3. Which sector leads in electrical energy consumption in the metropolis?
4. What is the source of electrical energy supplied in Cape Coast and which institution supplies it?
5. How do you consider the amount of electrical energy supplied in comparison to the amount demanded in the Cape Coast metropolis?
6. How important do you consider the issue of electrical energy conservation?
7. Are there any measures put in place to address issues concerning electrical energy conservation in the metropolis?
8. In instituting these measures, what are some of the challenges faced?
9. Are there measures put in place to help improve electrical energy conservation among households in the metropolis if need be?
10. How do you intend to achieve those measures (if there's any)?
11. Are there any laws or policies within the metropolis regulating electrical energy conservation (Give examples if there is any)?
12. Who pays for public electrical gadgets which are in used? (Example, streetlight)

13. Does the management/mismanagement of such public electrical gadgets have any significant influence of the amount of electricity demanded or consumed in the metropolis?