



## HOUSEHOLDS' COOKING ENERGY TRANSITION IN GOMBE METROPOLIS, NIGERIA: A QUALITATIVE RESEARCH APPROACH

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### ABSTRACT

Sustainable energy transition has the potentials to providing a lasting solution to the contending problem of climate change globally. This study investigated the current energy transition situation in Gombe Metropolis, Nigeria. The study used qualitative research method where data was obtained through two (2) sessions of focus group discussions (FGDs) and 5 key informant interviews (KIIs) with different households as well as energy vendors around the study area respectively. The data were analyzed using thematic method of analysis involving manual coding and themes generations. Result revealed on one hand that some of the households have started to adopt modern energy services for cooking while on the other hand some households have been using energy mix consisting solid forms of energy and modern energy services concurrently while some still rely heavily on solid forms of energy for their cooking energy requirements. It was found that energy access, affordability, cost, family size, income and education are the main factors influencing energy transition in the area. The study suggests that the government should provide easy access via feasible subsidies and also engage in public awareness campaigns on the dangers associated with reckless deforestation as well as environmental and health benefits of modern energy consumption for domestic cooking.

**Keywords:** Climate Change, Energy, Household, Transition, Sustainable

### INTRODUCTION

Energy is a fundamental component of modern life and is crucial for the well-being of households globally (Adrian, Purnomo, Enrici and Khairunnisa, 2023) Approximately 1.3 billion people worldwide lack access to electricity, while around 3 billion people heavily depend on solid fuels like firewood and charcoal for cooking and heating (Pangaribowo and Iskandar, 2022). In many African households, there is a significant reliance on fossil fuels and other hydrocarbon energy sources due to their availability and easy access in rural areas. Despite the abundant renewable energy potentials in Nigeria, the country still faces an energy crisis, which has substantial implications for achieving sustainable development goals. Notably, cooking is the primary energy-consuming activity in many third-world households, including those in Nigeria (Idris, 2020).

In Nigeria, the household sector accounts for the largest share of energy consumption, approximately 64%, primarily due to activities such as cooking, lighting, and use of electrical appliances (Okpara, 2020). Cooking alone contributes about 71% of the total energy consumed in the household. This high energy consumption for cooking is influenced by socio-economic and cultural factors, leading to a reliance on solid forms of energy sources, which contributes to deforestation, soil erosion, and desertification. Despite the contending problems associated with the consumption of energy from hydrocarbon sources, a significant portion of the population in Nigeria still lacks access to clean and modern cooking energy, such as electricity and liquefied petroleum gas (LPG). This reliance on traditional energy sources has significant environmental implications, including climate change. Therefore, there is a need for a substantial shift from the production and consumption of energy from hydrocarbon sources to more sustainable and modern sources, a concept

known as energy transition (Energy Commission of Nigeria, 2012; Obele, 2020).

Sustainable energy transition refers to the shift from conventional use of fossil fuels to modern energy sources, aimed at meeting growing energy demands in a sustainable manner. This transition is driven by the need to address climate change, improve energy security, and promote economic development. Climate change has affected human life in various negative ways, including rising sea levels, extreme weather, and droughts (Oruwari and Ogbuikwe, 2023). Nigeria, which is a significant producer of oil and gas, is facing two major challenges. The first is the need to shift towards sustainable energy sources, while the second is to reduce the effects of climate change. The country is struggling with energy poverty and limited access to electricity, particularly in rural areas. The use of traditional energy sources like firewood and charcoal is unsustainable and contributes to deforestation and indoor air pollution. Additionally, Nigeria is highly susceptible to the impacts of climate change, such as increased rainfall variability, rising temperatures, and flooding. These impacts have significant implications for the country's economy, food security, and public health (Oruwari and Ogbuikwe, 2023). In the light of these challenges, this study provides insights into the cooking energy transition situation in the study area in order to influence policy formulations that promote strategies for mitigating the contending problems of climate change and other environmental issues in Gombe Metropolis, Nigeria.

### MATERIALS AND METHODS

#### Study Area

Gombe Metropolis is located between Latitudes 11°08'0"E to 11°13'0"E and Longitudes 10°16'0"N to 10°18'0"N (See Fig.1). It is the administrative headquarter of Gombe LGA

with an area of 52 km<sup>2</sup> (Geohack, 2014). The study area is limited to Gombe Metropolis. Gombe is located within the sub-Sahara climatic zone. It is characterized by two distinctive seasons, that is, dry season (November-April) and wet season (May- October). The rainfall here averages 907 mm. The vegetation of Gombe is within Sudan/Guinea savannah. This is characterized by shrubs and scattered trees

with a different species of grasses. The predominant tree species include Locust bean tree, Baobab tree, Tamarin, Moringa, Date-palm, Neem trees and Azadirachta indica. The soils in the area are highly ferruginous, formed as a result of intensive weathering of the basement rocks (Mbaya et al., 2019).

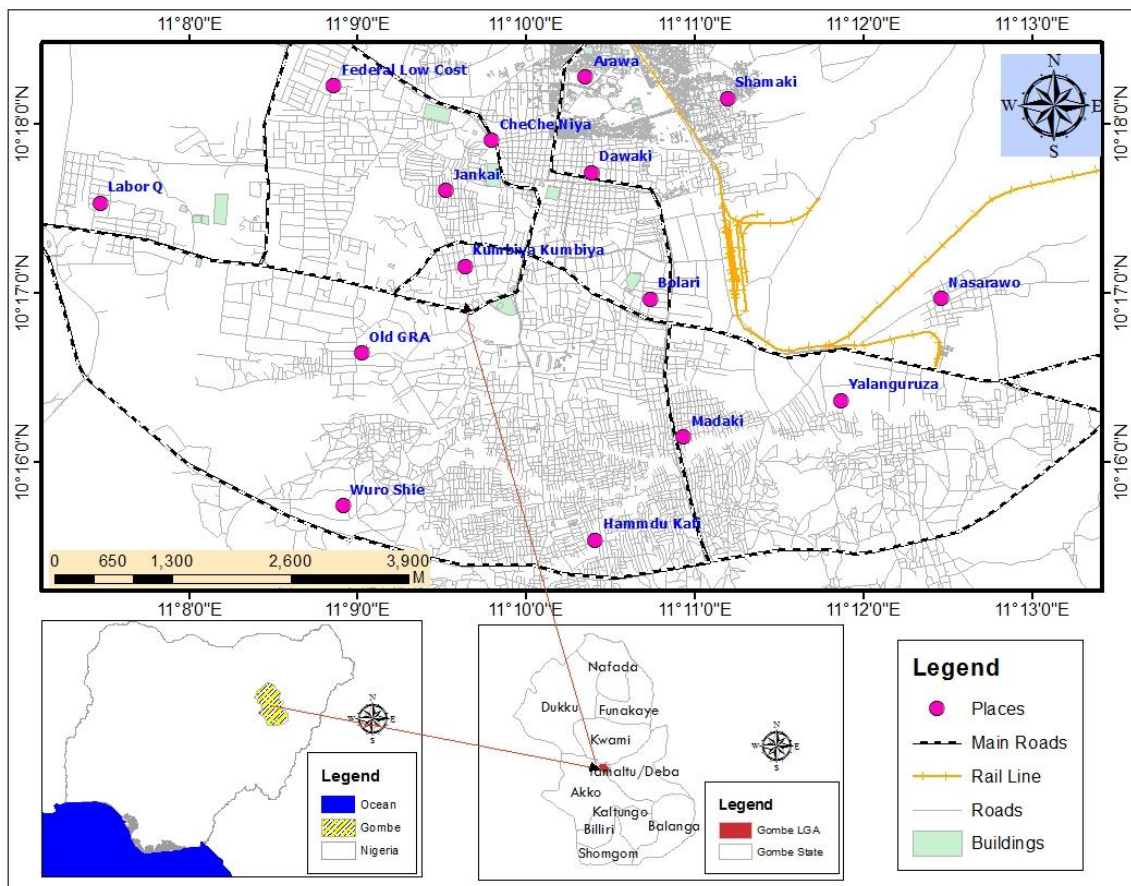


Figure 1: Map of Gombe Metropolis Showing Sampling Locations  
Source: Modified from administrative Map of Gombe State (2021)

**Procedure for sampling**

This study partly adopted the method used by Kiyawa and Yakubu (2017) in categorizing the study area into different residential zones based on the socio-economic status of the households. These divisions are still believed to persist, although with few changes taking place over time. For instance, in Gombe Metropolis, Federal low cost and G.R.A, formerly residential areas of expatriates, are now dominated

by businessmen and other elites, but still retain their features as zones of high-income earners. Other areas such as State low cost and Yalanguruza are classified as middle-income earners areas. Furthermore, areas such as Bolari, CheCheniya, and Shamaki are classified as areas of low-income earners. Residential areas for this study were selected systematically across the study area (see Table 1).

**Table 1: Selected Residential Clusters**

S/N	High income earners	Middle income earners	Low-income earners	Total Number of Residential Zones
1	Federal Low Cost	Dawaki	Arawa	3
2	Labor Quarters	Hammadu Kafi	Bolari	3
3	Old GRA	Yalanguruza	Checheniya	3
4			Jankai	1
5			Kumbiya-Kumbiya	1
6			Madaki	1
7			Nasarawo	1
8			Shamaki	1
9			Wuro Shie	1
<b>Total</b>	<b>3</b>	<b>3</b>	<b>9</b>	<b>15</b>

Source: Author's Computation, 2021

**Procedure for data collection**

The researcher used the following qualitative research methods; focus groups discussions and key informant interviews to collect extensive data from a small number of participants. Focus groups and key informant interviews were used in this study to collect primary data from selected respondents. Similarly, mp3 recorder was used to obtain information during focus group discussions and key informant interviews which formed the qualitative data used in this research.

**Focus Group/Key Informant Interview**

This data collection method was used because it provides a wide range of responses, reduces researcher bias, and helps to ease out responses that would otherwise be overlooked during personal interviews (Dawson, 2002). Two sessions of FGDs were conducted with six different households in the study area. FGD and KII participants were purposefully sampled within Gombe Metropolis. The communication languages were English and Hausa, and all participants were able to contribute significantly to the discussions.

The FGDs were held in the Department of Pharmaceutical Microbiology, Faculty of Pharmaceutical sciences, Gombe State University, Tudun-Wada, Gombe and Kagarawal Primary School, Gombe respectively. Indeed, because the households within each residential cluster share almost the same socio-economic characteristics, six participants were selected for each session of the FGD, with four households from three residential clusters representing the households around the study area. Five KII participants, on the other hand, were selected for interview who were picked from energy supply vendor's unions where their leaders were interviewed in their various offices within five days. Both the FGDs and the KIIs were conducted with the assistance of KII and FGD guides while the FGD participants were given a code P and KI for KII participants.

**Qualitative data analysis**

The researcher transferred the focus group discussions and key informant interviews audio files to a personal computer. These files were played at a suitable speed, and the information was transcribed into a Microsoft Word document. This is a collaborative process in which audio recordings were played, paused, and stopped until all responses were fully understood and written word to word. The transcripts of focus group and key informant interviews were analyzed using thematic method of qualitative data analysis involving manual coding and themes generations. Saldana, (2015) defines a code as a concise semantic description provided by a researcher to a segment of qualitative data sets during the analysis stages. Coding is a systematic process that organizes and categorizes data sets based on shared or related meanings in order to uncover hidden patterns. Based on these, the researcher manually coded the qualitative data in Microsoft Word with colored highlighters in two main coding cycles.

The first cycle involves descriptive coding, in which words were assigned to sentences in order to summarize and describe their content. In order to assign contextual information to the data, the researcher also performed attribute coding on the focus group and key informant interview transcripts. These codes are derived from field notes and personal observations made by the researcher while on the job. This process is very useful in qualitative analysis because it helps to assign unique attributes to various data sets, which can then be used to investigate inter-relationships and categorization (Lofland and Lofland, 2006). For example, the researcher assigned alphanumeric numbers to the

respondents' responses based on the order in which they were transcribed as a type of attribute code. Second cycle coding was used as an advanced analytic process to reorganize and categorize the data into themes. This was accomplished by grouping together similar or related codes, reducing the number of codes generated in the first cycle. These themes served as the framework for writing and interpreting the analysis. Throughout this analysis, direct quotations from respondents were used extensively to provide empirical evidence in support of the researcher's arguments and claims.

**RESULTS AND DISCUSSION****Reasons for Choosing Various Fuel Types for Cooking by Households in the Study Area**

Several individuals provided their reasons for using different cooking fuels in their households. Some households use LPG due to its ease of use and affordability while others use it because it is faster and clean. This finding is in agreement with that of Onyekuru et al. (2020) in Enugu, Nigeria whose findings revealed that the major reasons for choosing LPG for cooking was because of its fastness and cleanliness in Enugu, Nigeria. However, some individuals revealed that they cannot afford to adopt modern energy services, such as LPG, and instead use fuelwood, charcoal, and sawdust for cooking. In the same way some participants asserted that electricity is used for cooking whenever it is available. They further revealed that they use fuelwood and charcoal interchangeably due to their affordability and availability. This implies that majority of the households in the area are using energy mix consisting of solid form of fuels and modern energies. This is also similar to the findings of Anugwom et al. (2020) whose study in southeastern Nigeria revealed that households in the area used energy mix for domestic cooking including traditional and modern energy sources which on one hand contribute to the energy transition process and on the other hand consistent with assertion of the fuel stacking hypothesis which postulated that households utilized energy mix for cooking rather than single energy type as the major source of energy.

FGD response reports thus;

I use LPG for cooking in my household because it is easy to use compared to fuelwood and other solid fuels - (P1).

I am using LPG for cooking because of its affordability - (P6).

I use fuelwood and charcoal for cooking because my household is large and therefore, a large quantity of food needs to be cooked which require much amount of energy. I cannot afford to buy modern energy for cooking in my household because of the large family size - (P4).

LPG is faster and has less dirt when washing the cooking utensils - (P3).

In my household I use Electricity, LPG and Charcoal simply because it is easy to use, it's not dirty and it has an affordable price for me - (P7).

I use fuelwood, charcoal and sawdust for cooking in my household because of its affordability. When cooking a large quantity of food, I usually use fuelwood while when cooking a small quantity, I make use of charcoal. However, but I am giving more priority to sawdust because it gives strong heat during cooking than fuelwood and charcoal - (P8).

I use electricity, fuelwood and charcoal alternatively because sometimes there is a regular power outage in my area so anytime there is a

power outage I switch to fuelwood and sometimes charcoal because of affordability. I am not using LPG in my household because my household cannot take the safety measures due to the negligence of attitudes in handling it and it is also so expensive for me to adopt - (P9).

I use charcoal because of accessibility and availability - (P12).

I use LPG, fuelwood and charcoal interchangeably, I use LPG whenever it is affordable because the price changes periodically, anytime it is costly I change to fuelwood and switch to charcoal during the rainy season like this because using fuelwood is too stressful while charcoal is easier, affordable and accessible - (P10).

I use electricity for cooking anytime it is available but I mostly use fuelwood and charcoal in my household because of its availability and affordability - (P11).

The KII participants revealed that fuelwood is cheaper than modern energy like LPG for domestic cooking in the study area because of its availability and easy access. Also, poverty is among the major factors that hinders majority of the households from adopting modern energy for cooking.

In addition, family size also influences the type of energy used for cooking, and most households in Gombe metropolis have more than six members, making fuelwood more affordable and accessible while high cost of living make some households adopt charcoal for cooking while some households use LPG because it is user-friendly, easy to use, faster, and more sustainable and some use electricity because its clean, user-friendly, easy-to-use, and eco-friendly.

Equally the KII response assert thus;

Fuelwood is cheaper than modern forms of energy like the LPG for domestic cooking. Poverty is one of the major factors that hinders households from adopting modern energy for cooking and hence utilizes fuelwood. You know family size also influence the type of energy to be used for cooking, most of the households in Gombe metropolis have more than 6 members therefore, fuelwood is more affordable and available considering the low-income level of most of the people in Gombe Metropolis - (K11).

High cost of living and poverty challenges are important factors that make people adopt charcoal for cooking because some households were using kerosene for cooking but now, they cannot afford to buy it because of high cost and they have no option than switching to another form of energy for domestic cooking - (K12).

LPG is user friendly, easy to use, faster and more sustainable - (K13).

Electricity is clean, user friendly, and has no pollution and thus eco-friendly energy source - (K14).

#### **Environmental and Health Implications for Modern Fuel Consumption for Cooking**

According to several participants in the FGD sessions, the reasons for consuming modern energy for domestic cooking, are that modern energy sources like LPG are beneficial to the environment and human health. They reduce environmental pollution, save the environment from global warming, and are healthier than hydrocarbon energy sources. Modern energy for cooking also minimizes deforestation and reduces the risk of desertification. It is less toxic to human health and easy to

use. Additionally, modern energy systems like LPG for cooking are free of air pollution and reduce the volume of pollutants released into the atmosphere. They also minimize most cases of respiratory diseases and ozone layer depletion.

FGD participants perceived thus;

It reduces environmental pollution because it is not associated with any form of pollutant - (P5).

It saves the environment from global warming and it is healthier than the hydrocarbon energy sources even though it is connected to a lot of risk of fire outbreak. Furthermore, using modern energy for cooking minimizes the rate of deforestation and also reduces the risk for desertification, it is less toxic to human health, easy to use - (P2).

It reduces the volume of pollutants released into the atmosphere like carbon monoxide and methane, it also minimizes most cases of respiratory diseases and also, modern energy systems like the LPG for cooking is free of air pollution like fuelwood and it is healthier to human health - (P1).

Modern energy like LPG is free of air pollution - (P9).

It has fewer health problems, reduced the volume of pollutants in the atmosphere and minimizes ozone layer depletion - (P4)

I don't see any benefit of using modern energy like the LPG for cooking to the environment and human health - (P8).

#### **Environmental and Health Implications for Fuel Consumption from Hydrocarbon Sources**

FGD participants perceived that hydrocarbon-based energy sources for cooking have been associated with various health and environmental issues. They are generally associated with environmental pollution, are poisonous, usually lead to global warming, and increase the rate of deforestation, thereby triggering land degradation. They might affect the weather and climate of an area, cause cancer, trigger asthma and respiratory diseases. Consumption of these forms of energy has effects on photosynthesis and might affect the eyes and skin of women using such energy for cooking.

FGD participants perceived that consumption of energy from hydrocarbon-based sources for cooking have been associated with various environmental health and issues as thus;

It is generally associated with environmental pollution, it is poisonous, usually lead to global warming and increased the rate of deforestation thereby triggering land degradation - (P4).

It might affect the weather and climate of an area. It might also cause cancer and trigger asthma disease - (P3).

It might cause respiratory diseases to the women using such energy for cooking and cancer in the long run. It is usually ushered by the release of pollutants into the atmosphere such as carbon dioxide which is one of the major drivers of climate change - (P2).

Consumption of these forms of energy have effects on photosynthesis as the forest is depleting because of the continuous deforestation, it also causes air pollution and global warming because of the greenhouse gases released from using such energy systems. It might affect the eyes and skin of women using such energy for cooking - (P1).

It reduces the productivity of those using it for cooking. It is also time-consuming - (P2).

Fuelwood and charcoal are generally accompanied by the problems of deforestation and also lead to air pollution - (P7).

Any woman that is using fuelwood for cooking is inhaling smoke emanating from the burning of fuelwood regularly is the same as smoking 1 pack of cigarettes daily - (P10).

### **BARRIERS AFFECTING SUSTAINABLE ENERGY TRANSITION**

According to various findings, there are several hindrances to sustainable household energy transition in the study area. These include the level of household income, negligence of users when using LPG, accessibility and cost of modern energy, lack of knowledge on using modern energy, risk of fire outbreaks, cultural perceptions, level of educational attainment, affordability, family size, and distance to the sale points of modern energy. The present finding is partly in agreement with that of Assefa (2021) whose findings revealed that adoption of modern energy services in Northern Ethiopia have been associated with numerous barriers including accessibility, finance and lack of awareness. This could be attributed to the fact that majority of the households in the study areas has adequate access to traditional sources of energy at very little or no cost therefore, many households rely on it heavily.

FGD participants perceived thus;

Level of household income and negligence of the users especially when using the LPG which can result to hazards - (P3).

Perception of people towards the risks linked with using LPG and Electricity for cooking. Accessibility to modern energy and the cost of getting it is also a hindrance to adopting it for cooking - (P4).

Knowledge of using modern energy for cooking more especially the LPG is lacking in the Northern part of Nigeria. The risk of the fire outbreak is also an impediment to the adoption of modern energy systems for cooking and also cultural perception and educational attainment plays a significant role in adopting the modern forms of energy for cooking. Moreover, there is also a saying that food cooked with traditional fuels has a better taste compared to using modern energy systems for cooking - (P1).

Village people have a serious challenge in using modern energy like the LPG because of inadequate orientation and enlightenment on how to utilize the modern energy systems - (P1).

High cost of LPG and Electricity hinders households from adopting such energy systems for cooking. Because of the cost of this modern energy for cooking most of the households are currently backsliding back to the traditional forms of energy owing to its affordability and availability - (P6).

Affordability, risks of fire outbreaks and the size of families affects the adoption of modern energy systems more importantly the LPG and Electricity - (P5).

Level of income, availability, knowledge on how to use modern energy systems like the LPG - (P7).

Affordability, fear of fire outbreak - (P8).

Poverty issues, risks of fire outbreak, knowledge on how to use the modern forms of energy for cooking - (P10).

Distance to the sale of modern energy like the LPG - (12).

The FGD participants suggested ways to encourage households to adopt modern energy services for cooking and minimize the use of hydrocarbon-based energy sources. Some of the suggestions were that LPG should be subsidized thereby reducing the prices, accessibility and availability of modern energies should be strengthened, affordability and accessibility should be increased through government interventions like free distribution of gas cylinders as it happens under Katsina State government.

Public awareness should be carried out to enlighten households on the danger of using fuelwood for cooking. In addition, afforestation should be carried out regularly to replace the trees cut by the households. Awareness of the environmental and health issues associated with fuelwood consumption through social media and public gatherings should be taken into cognizance. Government should address poverty so that households can afford to adopt modern energy systems for cooking, and provision of adequate electricity.

Public enlightenment campaigns on the benefit of using clean energy for cooking, and awareness on how to use it should be carried out. The present suggestions contrast that of Timilsina et al. (2023) whose findings suggested that increasing income levels and education can lead to a shift toward cleaner household energy consumption, policies promoting economic growth and education can reduce greenhouse gas emissions from household energy consumption. Thus, policies like subsidies in LPG and electricity shall explicitly aim to assist impoverished households and lower-income families in enhancing their accessibility and affordability options for cleaner energy sources.

Thus; FGD responses:

The LPG should be subsidized so that people can afford to adopt it for cooking - (P3).

The price of modern forms of energy (LPG and Electricity) should be reduced - (P1).

Accessibility and availability of modern energies should be strengthened to minimize the adoption of dirty energies for cooking - (P4).

Affordability and accessibility should be increased through government interventions like subsidies, free distribution of gas cylinders to the households. Also, the myth of using modern energy systems for cooking like the LPG should be discouraged, energy policies should also be enacted to monitor the consumption of household energy for cooking - (P2).

Public awareness should be carried out to enlighten the households on the danger of using fuelwood for cooking and the benefits of utilizing modern energy systems (P6).

Sanitization exercises on how to use the LPG and to avoid the risks for fire outbreaks should be carried out regularly - (P5).

Sanitization and public awareness on the detriment of using fuelwood for cooking should be of great concern, afforestation should also be carried out regularly to replace the trees cut by the households - (P1).

Awareness of the environmental and health issues associated with fuelwood consumption through social media and public gatherings should be taken into cognizance so as households would be aware and switch faster to the use of modern energy systems for cooking - (P2).

Government should address poverty so that households can afford to adopt modern energy systems for cooking - (P4).

Government and people should engage in massive afforestation - (P7).

*Provision of adequate electricity, Provision of subsidies on the modern energy systems, public enlightenment campaign on the benefit of using modern energy system for domestic cooking and awareness on how to use it - (P8).*

The KII respondents suggested ways to encourage households to adopt modern energy systems for cooking and minimize the use of hydrocarbon-based energy sources. They suggested that the government should provide alternative employment and address poverty among households in order to discourage mass cutting of trees, rather massive afforestation should be carried out to replace the trees and augment the forest composition. The government should engage in public awareness campaigns on the dangers of cutting trees and encourage people involved in charcoal supply to plant more trees. Also, the government should provide subsidies and make LPG available so that households can easily access and afford to use it for cooking activities. Households should use appliances that do not consume much electricity and apply necessary protection measures in their houses like the mini circuit breaker (MCB) to avoid sudden fire outbreaks.

Key Informants Interview perceived as thus;

Despite the environmental implications of mass cutting of trees which we cannot stop simply because the government cannot provide us with alternative employment. We can only stop doing this business if the government provide us with alternative employment and also address the problem of poverty among the households which will equally encourage the adoption of modern energy systems for cooking. Massive afforestation can help to replace the trees and also augment the forest composition. Government should engage in public awareness campaigns on the danger of cutting trees thereby encouraging the adoption of modern forms of energy for cooking - (KI1).

Government should encourage people that are into charcoal supply to plant more trees in order to replace the trees that were cut because even if the government decide to stop the felling of trees to produced charcoal, we can go out of Gombe to make our supply because households cannot stop using charcoal for domestic cooking due to the high cost of LPG and Electricity - (KI2).

Government should provide subsidies and also make the LPG available so that households can easily access and afford to use it for cooking activities. Public awareness of the advantages of using LPG for cooking through media and public gatherings should be embarked upon- (KI3).

Households should use appliances that do not consume much energy so that they can use electricity for cooking because it is easier to use. The households should apply the necessary protection measures in their houses like the mini circuit breaker (MCB) so that any time there is a sudden fire outbreak the MCB would automatically disconnect the electricity from the house - (KI4).

## CONCLUSION

Access to sustainable, affordable and reliable modern energy services for domestic cooking is one of the major ways to achieving a sustainable environment. This article has

provided an insight on the energy transition status in Gombe Metropolis, Nigeria where some households have begun to shift significantly from the consumption of energy for domestic cooking from hydrocarbon-based sources such as fuelwoods and charcoal to modern energy services like the LPG, electricity and kerosene. This is because of their minimal environmental and health implications while other households still rely heavily on solid forms of energy for cooking owing to their easy access and availability. Evidently, there is an ongoing cooking energy transition throughout the study area, however, it was further found that cost of modern energy, family size, household income, level of educational attainment and cultural beliefs were the major hinderances to energy transition in Gombe Metropolis.

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