



# INCREASING HOUSE-HOLD DEMAND FOR WOOD FUEL: A GREAT THREAT TO SUSTAINABLE FORESTRY DEVELOPMENT IN NIGERIA

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## Abstract

*Over exploitation of forest-based products had been a serious issue and a great threat to forestry development in Nigeria. Among these forest products are the fuel woods. This comes as a result of deforestation without reforestation. Domestic cooking energy needs account for the high energy consumption in household and due to the increasing population of Nigeria, the available fossil fuels which serve as sources of cooking energy for most urban and rural dwellers have become inadequate, unaffordable and most times unavailable for the population. Fuel wood such as firewood and charcoal which is being used by 90% of rural households now becomes the highly demanded cooking fuel for households despite the health risks or environmental challenges that emanates from its use. This paper, therefore, evaluates the increasing rate of household demand both in rural and urban areas for wood fuel which is a great threat to forestry development in Nigeria. It specifically describes firewood and charcoal as the common types of wood fuels; kerosene and cooking gas as the most use fossil fuels in Nigeria. It also establishes that the increase in the price of fossil fuel leads to increase in the demand for wood fuels in Nigeria. The recent hike in wood fuel demand brought about by the high cost of fossil fuels such as kerosene and Liquefied Petroleum Gas (LPG) has led to the felling down of trees illegally by people especially those involved in firewood and charcoal productions. The paper therefore recommended that there should be increase the subsidy on fossil fuels, development of alternative cooking fuel (such as and use of agricultural and industrial wastes, forest plantations solely for the purpose of energy production should be established to prevent deforestation of forest reserves.*

**Keywords:** fuel wood, wood fuel, fossil fuel, sustainable forestry development

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## Introduction

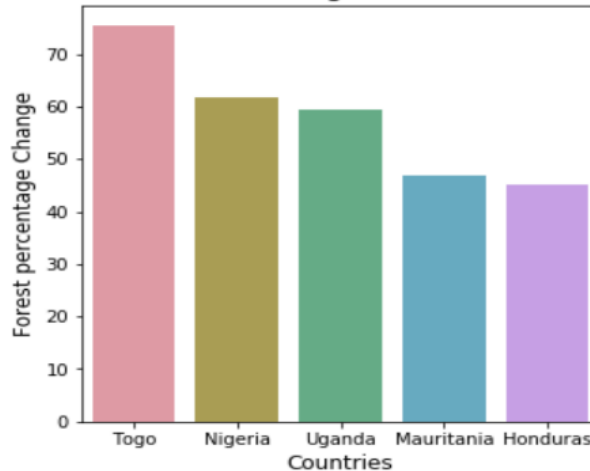
Forest is defined as a large area of land where trees and under bushes are densely dominated. It is also a large tract of land where trees and other plants are found closely growing together and forests in its natural state remain in a relatively fixed condition over a long period of time. (Lodla, 2007; Oludotun, 2011). Forest is termed as “primary” when there are no visible traces of human activities and “secondary”, when it is completely and powerfully altered by humans. Forests are called the “lungs of the earth” and it works against climate change. Nigeria’s forests provide significant economic, social and ecological benefits for the people. Ecological benefits of forests include climate amelioration, carbon dynamics, biodiversity conservation, reduction in global warming, maintenance of water shed, Soil stability, erosion and desertification control, wildlife conservation and aesthetic value (FRIN, 2015). The forests have traditionally yielded a great variety of useful products or resources which are useful asset to Nigeria as well as her citizens. This is because the welfare of many Nigerians is directly or indirectly linked with the forest and its resources. (Adedayo, 2018). Over 1.6 billion people all over the world depend on forests for their livelihoods (Vedeld *et al.* 2007), and the role of forest resources on the livelihood of rural dwellers has received an increased attention during the last decade (Angelsen *et al.* 2014). Forest resources can be classified as timber and non-timber forest products (NTFPs) which include food, fodder, medicine, housing materials and fuel among others. (Smith *et al.*, 2017). Besides providing access to basic materials, forests serve as subsistence income or an “economic buffer in hard times” thereby contributing to total household and cash incomes, (Kar and Jacobson 2012).

Nigeria population is among the highest in Africa countries. The population is estimated at 218 million people spread across 923,768km<sup>2</sup> areas (Wikipedia, 2018). The rise in population rate of the country shows that large amount of energy will be required for meeting the energy needs at both the urban and rural areas in the country. The country is blessed with energy resources that are sustainable. The nation is also rich in conventional energy resources, these energy includes oil, natural gas, lignite, and coal. Furthermore, renewable energy sources such as wood, solar, hydropower and wind could also be found in Nigeria (Okafor and Uzuegbu, 2010). Today, consumption of energy across the globe shows that Nigeria and many indeed African nations have the lowest rates of consumption. Nevertheless, inadequate supply of energy is one of the problems facing Nigeria as a nation. This is associated with increasing energy demand, a typical nature of developing economy. There are different sources of cooking energy used in Nigeria such as; liquefied petroleum gas (LPG), kerosene, compressed natural gas and electricity. These energy sources are expensive compared to traditional fuels such as biomass and wood fuel which are available at little or no cost. In Nigeria the average daily income of more than 60% of people is less than \$1 per day (Bello and Roslan, 2010) biomass and wood fuels stands as the preferred source of household cooking energy in Nigeria.

Nigeria is one of the fifteen (15) largest exporters of crude petroleum in the world, yet, a larger percentage of the country's population live in poverty. This poverty goes beyond low income, savings and growth rate but covers high inequality in terms of assets and income, basic infrastructural facilities and capabilities. Poverty is caused by low level of education, poor governance, high level of unemployment, widespread corruption amongst others.(UNDP, 2010; World Bank, 2012). A connection exists between poverty and energy which can be explained in terms of quantity and quality of energy used.

Forestry in developing countries with Nigeria as an example has faced and currently facing several challenges such as poor funding of the forestry sub sector, inadequate information on the impact of climate change on forest and the mitigation procedures, mismanagement of forest as revealed in the high rate of deforestation through uncontrolled tree felling for domestic and commercial purposes, overexploitation of the forest resources among others (Ayeni, 2013).The fact that most trees can be used as fuel wood and charcoal production increases deforestation activities which pose great threats to sustainable forest management. Deforestation rate in Nigeria was estimated at 10 million hectares per year between the period of 2015 and 2020 compared to the yearly estimate of 16 million hectares 1990s. There is tremendous decrease primary forest of over 80 million hectares worldwide since 1990. (FAO, 2020). Togo, Nigeria, Uganda and Mauritania are the four countries from Sub-Sahara Africa having the highest decrease in the forest cover. Among the four countries, Nigeria appears both on the list of decrease in forest area in sq. km and percent decrease. Therefore to tackle this global problem, strict actions should be taken by Nigeria.

**Biggest concern countries: largest deforestation in percentage**



Tyagi, (2020) Source: FAO, 2020

Sustainable Forest Management is the way through which forests are continually managed in order to achieve the stated goals and objectives of forest development without reduction of its inherent values and future productivity and without undesirable effects on the physical and social environment. It therefore follows that SFM will enhance the status of the forest to meet the forest resources needs of the people- especially the food needs of the people. (FAO, 2017). According to Lipper (2000), forests offer many benefits in terms of food production, income and protection of watershed. Therefore, deforestation and forest degradation impair the capacity of the forests to contribute to food security. This paper therefore examined energy uses among household and the hike in price of cooking energy such as kerosene and Liquefied Petroleum Gas (LPG) with implication on sustainable forest management due to the increasing demand for fossil fuel as alternative cooking energy sources.

### **Cooking energy**

Energy is the ability or capacity to do a work. Cooking activities account for the high energy consumption in household which is a potential source of indoor air pollutants and global warming (Borisade *et al.*, 2020). About 80% of the country's households depend on forest for the bulk of their domestic energy. Rural communities adjacent to forest plantations harvest wood for cooking (FRIN, 2015). Cooking energy sources can either be through wood or fossil fuels.

**Table 1: Fuels and their common household uses**

S/N	FUELS	HOUSEHOLD USES
➤	Firewood, animal dungs, Biomass	Cooking, water heating
➤	Charcoal	Cooking, water heating
➤	Candles	Lighting
➤	Kerosene	Lighting (wicks and hurricane lamps), cooking
➤	Biogas	Cooking
➤	Liquefied Petroleum Gas (LPG)	Cooking, lighting (less often)
➤	Diesel	Lighting lamps, electricity (diesel generators)
➤	Gasoline	Transport and electricity
➤	Distinct heating	Space heating
➤	Natural Gas	Cooking and space heating

Source: Borisade *et al.* (2020)

### ➤ WOOD FUEL

Wood energy is the energy generated from wood and wood- derived materials through combustion processes and used for energy purposes such as cooking, heating or electricity generation (WHO, 2014). Wood used as energy may come from the natural forests, trees found outside the forest, forest plantations, residues from wood harvesting and post processing wastes from wood processing industries. Wood fuels can come in three forms namely; solid wood fuels e.g. fuel wood (which is also known as firewood), charcoal, and wood pellets (e.g. chips, pellets, briquettes which are gotten from wood residues), unprocessed woody biomass (e.g. sawdust, wood shavings; gotten from the branches or other parts of a tree during wood processing. The liquid wood fuel comprises of the bio-oil, bio- ethanol/ methanol, black liquor and the wood gas is an example of the gaseous wood fuel. (FAO, 2008). Liquid and gaseous fuels derived from woody biomass are yet to be generated commercially for industrial purposes. Solid wood fuel in the form of wood pellets and wood chips, on the other hand, are used at a large scale for power generation and district heating in many industrialized countries, mainly in Europe. (FAO, 2017). The traditional household wood fuel consumption decreases as their income increases because there will be a shift to use of other fuels and electricity likewise the national consumption of wood fuel increases with increase in population growth rate. (FAO, 2008). This review will be focusing on Firewood and Charcoal as the two major wood fuels that are used in Nigeria.

### Fuel Wood (Firewood)

Household utilization of firewood has been estimated to about 1.55 billion cubic meters. This estimate is based on the use of fuel wood by about 3 billion people as their primary source of energy globally. In developing countries about 2 billion rural dwellers rely solely on firewood for heating and cooking. (Borisade *et al.* 2020) Fuel wood accounts to about 80% of household energy requirements in rural areas and thus accounts for close to 10% of net national energy consumption. However, at a national scale, an estimate of about 11 million tonnes of fuel wood is consumed in Nigeria per annum (FRIN, 2015). Carbon monoxide, sulphur and nitrogen oxides which are dangerous pollutants released to the atmosphere when fuel wood is being used are as a result of the incomplete combustion of firewood. In many households, poor ventilation worsens the effects of these pollutants, and women and children are often exposed to them at significant levels for 3 to 7 hours each day (Bruce *et al.*, 2000).

### Charcoal

Charcoal is another significant type of wood fuels. One of the reasons why wood is converted into charcoal is to reduce its weight with respect to its energy content and to increase its economic transportation distance. Charcoal has a heating value twice as much as fuel wood on an equal weight basis. FAO, 2019 noted that of all the woods used as fuels worldwide, about 17 percent is converted to charcoal. Charcoal production is expected to increase continually in the coming decades because it generates income for more than 40 million people even though the sector is informal.

Charcoal consumption is often linked to lack of modern alternatives but all over the world, electrified regions are still using charcoal as an energy source. In Brazil, the world’s largest producer and consumer of charcoal, for example, more than 90% of the population has access to electricity, yet residential consumption has persisted at 9.7% of the country’s total charcoal production. (Chidumayo and Gumbo, 2013). Despite Mainland China’s access to widespread electricity, it also features in the world’s top 10 charcoal producers (FAO, 2019). Germany, which has diverse financial assets of modern energy resources, is still the world’s biggest importer of charcoal (FAO, 2019). The global charcoal imports and exports are estimated at US\$1.16 B. From 1993–2017, the world’s top 10 charcoal-producing countries generated an average of 24.5 Mt of charcoal annually, of which more than 50% were produced by Brazil, Nigeria, and Ethiopia . With the exception of Nigeria and Mainland China, top charcoal producers are not necessarily the leading exporters of charcoal. (Macromarket; FAO, 2019).

### Advantages of wood fuel

- i. Fuel wood is the most locally available fuel.
- ii. Fuel wood is the most affordable fuel for cooking and heating especially among the low income households.

- iii. Sustainable Development Goals could be enhanced by wood fuel energy
- iv. The wood energy sector contributes to SDG8 (economic growth and employment); the modernization of the wood energy value chain would have considerable economic impacts and create many jobs, especially in rural areas. FAO has estimated that 195 million people in Africa are employed in the wood energy sector on a full-time or part-time basis – the equivalent of 45 million full-time jobs
- v. Wood energy can play an important role in combating climate change.

**Disadvantages of woodfuel**

- 11. Unsustainable and illegal production leads to deforestation, forest degradation and in some areas, wood fuel scarcity.
- 12. Another problem associated with the traditional wood fuel sector is indoor air pollution due to the use of inefficient woodstoves, wet firewood or charcoals.
- 13. Health problems arises from inhaling smokes from burning, charcoal particles etc
- 14. Fuel wood collection can impose a disproportionate work burden on women and children.

➤ **FOSSIL FUEL**

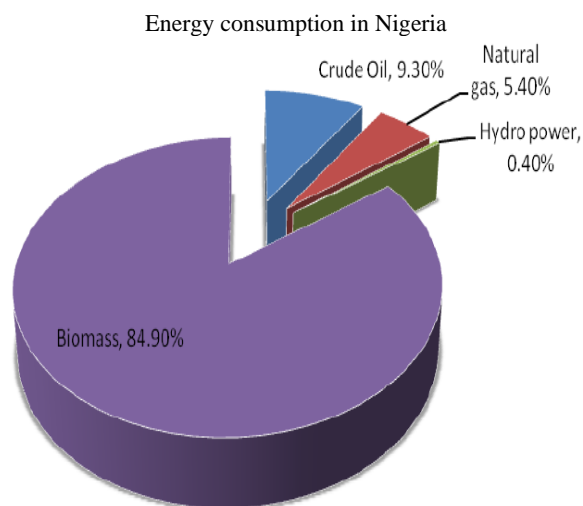
These are non renewable energy resources gotten from the altered remains of living organisms buried by sediments and exposed to elevated pressures and temperatures for millions of years. These resources are classified into three namely; petroleum (or crude oil), natural gas and coal. They are widely though not uniformly distributed in the earth (Gerali, 2020).

**Kerosene**

Kerosene, also known as paraffin is a transparent liquid fuel produced from coal (coal oil), with a mixture of hydrocarbon chains 6 to 16 carbons in length. (U.S. Environmental Protection Agency; EPA, 2016). Globally, an estimated 500 million households still rely on kerosene or other liquid fuels for lighting, corresponding to 7.6 billion liters that is consumed annually (Mills, 2005). Some notable international agencies have in the past treated kerosene as a “clean fuel” (ESMAP 2003) while some researchers treated it as a “polluting fuel” which was grouped with other known sources of air pollution e.g. coal and biomass. (Wichmann et al, 2006). The use of kerosene for cooking has greatly increased in many developing countries especially in urban areas where electricity and Compressed Natural Gas (CNG) are unreliable and expensive and Biomass is not readily available.

**Liquefied Petroleum Gas (LPG)**

Cooking fuels, most especially the liquefied petroleum Gas (LPG) and natural gas are the cooking fuels of choice in most countries (Parikh, 2010). LPG and natural gas provides higher energy efficiency than traditional fuels; and it is cleaner and more ozone-layer friendly. The causes of low consumption of LPG in Nigeria found in the literature include household income, infrastructural challenges, subsidy on kerosene, the perceived higher cost of LPG, and safety issues that have led to various government interventions through policies and plans (Ige, 2009).



Source: IEA, 2017.

**Shifts in household’s choice of cooking energy**

The fundamental energy needs of most household are for cooking and lighting. Energy consumption patterns in the world today shows that Nigeria and indeed African countries have the lowest rates of consumption. Nigeria is suffering from an inadequate

supply of usable energy due to the rapidly increasing demand, increase in population rate among others which is typical of a developing economy. The rural dwellers depend to a large extent on the traditional sources of energy for their domestic energy requirements while the majority of the urban dwellers depend on traditional energy sources and fossil fuels. (Iro and Danlami, 2022). The Nigerian energy sector is not well developed and one of the most inefficient sectors because people do not have access to reliable and affordable energy despite the enormous energy sources available. Therefore, the unavailability and unaffordability of these cooking energy sources pose a serious threat to forestry development in Nigeria.

The “energy ladder” is a simple model used to describe the hierarchy of household energy options characterized by attributes such as cost, cleanliness, energy efficiency and convenience. It also means that with increasing income, people move up the energy ladder from firewood to charcoal or kerosene and then to LPG/ natural gas, or electricity. Household tend to move from cheapest to least convenient fuel (biomass) to more convenient and normally more expensive ones (charcoal, kerosene) and eventually to the most convenient and usually most expensive type of energy (LPG, natural gas, electricity). (Masera *et al.*, 2000, Arnold *et al.*, 2006). The use of multiple fuels or use of combination of fuels is known as “fuel stacking”. Households partly switched from one type of fuel to the other or use of multiple fuels. Fuel stacking occurs due to three major factors namely; high cost of modern energy sources; cultural preferences(which includes familiarity with existing fuels) and to avoid total dependence on one fuel evident from price, demand and supply vulnerability. (Heltberg, 2005; Masera *et al.*, 2000).The literatures on fuel choice had shown that many factors other than income could influence the household fuel adoption decision. The main among these are the household size, gender composition, location, cooking habitat, gender of the household head, age, education, availability of fuel alternatives and accessibility including cooking utensils as well as the degree of the development of fuel markets and wage labour market (Moses, 2006). They may choose a combination of high-cost and low-cost fuels, depending on their budgets, preferences and needs (World Bank, 2003). Ease of access and consistent availability of fuels are important factors that determine the extent and or permanence of fuel switching in any household (Démurger and Fournier, 2010).

The energy ladder hypothesis is one of the most common conceptualizations of energy use dynamics among households. It has also been revealed through literatures that household energy demand and choice has shown that households in transition (that is, those between low income and high income) consume transition fuels such as charcoal and kerosene. While low income households use biomass fuels, higher income households consume energy that is cleaner and more expensive such as liquefied petroleum gas and electricity. (Heltberg, 2005).

The recent hike in prices of commodities in developing countries most especially Nigeria has led the low and transition income earners to be living below the standard. This low living standard induces greater dependence on firewood and other biomass fuels owing to a combination of income and substitution effects (Baland *et al.*, 2007). The use of wood fuels such as charcoal and fuel wood is now found in urban centers too as there has been a shift in the use of kerosene and Compressed Natural Gas. The shift is against Bhattarai, 1998, who asserted that even if the population in urban centers will be growing rapidly in the coming years, the demand for charcoal and other biomass fuels is not likely to increase accordingly due to peoples’ changing preferences. In Nigeria presently, the shift in the type of cooking energy used due to the increase in price of fossil fuels has also led to an increase in the demand and price of wood fuels and this has led to illegal deforestation of forests which is a serious threat to sustainable forestry in Nigeria.

#### **Implication of increasing household demand for fuel wood on sustainable forest management in Nigeria**

The cost of cooking gas and kerosene is fast rising. This has gone beyond the reach of common man despite the Federal Government declaration on making the products available for household usage and a decade of cooking gas with Central Bank of Nigeria (CBN) setting up a ₦250 billion fund to expand the usage of the product across the country. Due to high increase in the price of cooking gas, most household who had said goodbye to firewood and charcoal usage have embraced it again. This has a great implication on forest management. This means that the demand for firewood and charcoal which has been on the increase before will continue to be increased, more trees will be felled and resulted to high rate of deforestation (Odunwole *et al.*, 2017). More than 90 million of Nigerians live below one dollar per day this reflect high incidence of poverty. Therefore, the upward shift in the price of cooking gas and kerosene has made the products to become luxury in the midst of unemployment, high inflation rate and the un addressed effect of COVID-19 pandemic. This implied that if the trend in the price of cooking gas and kerosene is not checked and the demand for wood fuel continue to increase reduction in forest cover will continue and its adverse effect on environment is imminent (FRIN, 2015).

#### **Conclusion and recommendations**

It has been established that household demand for fuel wood is on the increase. The recent hike in wood fuel demand brought about by the high cost of fossil fuels such as kerosene and Compressed Natural Gas (CNG). This has a great implication on forest development as this would continue to result to the felling down of trees, hence, high rate of deforestation. This study therefore recommends that there should be development of alternative cooking fuel such as the use of agricultural and industrial wastes; forest plantations should be established solely for the purpose of energy production; supportive laws, regulations, policies (those governing wood fuel production, trade and consumption) and information should be disseminated to forest owners, entrepreneurs and actors involved in forest and forestry development.

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