



## **An investigation into the current household energy consumption mix in Nigeria.**

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### **Abstract**

Energy in any national economy is considered as a fundamental asset required for sustainable development and improvement of living standards. Within the context of developing countries, energy plays an even more significant role, as it is needed to meet up with the energy demands associated with rising economic growth, rising population and large-scale urbanisation. Being one of the leading African economies, Nigeria faces huge sustainability challenges associated with rising energy consumption. Much of the country's population relies on fossil fuel-based energy and solid fuels for energy generation and consumption. For which, the utilisation of these fuels is often considered as contributors to rising carbon footprints and diseases associated with household air pollution. This study, therefore, examines the current energy consumption mix in relation household energy use and its likely effects on the environment and health of Nigerians. Findings emerging from the study indicated that electricity, firewood, charcoal and liquified petroleum gas are the main household energy sources in Nigeria. The study also recommends that increased awareness on the health and environmental impacts of dependence on conventional energy sources would not only improve energy consumption trends amongst households but will enhance energy security and Nigeria's final energy consumption patterns.

**Keywords:** Renewable energy, Sustainability, Energy consumption, Energy mix, Household consumption, Nigeria.

### **1. Introduction**

Energy plays a crucial role in the development of any country and is considered as a major driver of economic and socio-economic development in any nation. Energy contributes not only to economic growth but acts as a propeller for sectoral development in any country especially the household sector [4]. Energy, being an essential necessity forms an important household ingredient required to perform various household activities including electrification, heating, cooking, transportation and communication [6]. Nevertheless, recent global attention on rising carbon dioxide (CO<sub>2</sub>) emissions leading to global climate change have resulted in sustainability concerns as regards the impacts of global energy consumption

on the environment and human health, especially sustainability concerns for household energy consumption [13].

In Nigeria, the household sector accounts for the highest share of primary energy consumption when compared to other economic sectors. Studies reveal that the Nigerian household sector accounts for about 78% of the country's total energy consumption [9]. However, much of Nigeria's household energy consumption mix is mainly dominated by fossil fuels and traditional solid biomass, which are often regarded as contributors to rising CO<sub>2</sub> emissions, environmental pollution and respiratory diseases in humans [7,14]. Therefore, creating severe sustainability concerns associated with the likely effects of increased consumption of fossil fuels and traditional solid biomass used to meet the energy demands of Nigeria's one hundred and ninety-two million (192,000,000) citizens [3]. Hence, this study seeks to examine current household energy consumption trend in Nigeria and its likely impact on the ecological balance and health of Nigerians.

## 2. Status of Household Energy Consumption in Nigeria

Nigeria being one of the leading developing economies in Africa boasts of a huge wealth of energy reserves comprising huge amounts of renewable and non-renewable energy reserves. The energy reserves shown in table 1, have being of immense benefits to the Nigerian economy in-terms of inflow of foreign investments and socio-economic development attributable to energy being the major export commodity for revenue generation in Nigeria [1].

**Table 1:** Nigerian Energy Reserves

Energy resources		Reserves
<b>Non-Renewables</b>	Crude oil	37.1 billion barrels
	Natural gas	187 trillion cubic feet
	Coal	2.7 billion tonnes
	Tar sand	31 billion barrels
<b>Renewables</b>	Solar	4-6 kWh/m <sup>2</sup> /day
	Wind	2-4m/s at 10m above land
	Hydropower	11,250 MW

*Source: Reproduced from Shaaban and Petinrin [12].*

Despite the abundant energy potentials in Nigeria, household access to energy supply is low, while some of the resources shown in table 1 remain largely untapped resulting in an overdependence on other resources particularly fossil fuels [10-12]. Thus, creating the need for energy diversification to ensure energy security and increase access to modern energy supply for households. Energy consumption in Nigeria is distributed across various economic sectors of the country but rising population growth, increasing living standards and gradual rural migration to urban cities has led to increased household energy consumption in Nigeria [10,12]. Studies show that about 80% (99.3 million tonnes of oil equivalent Mtoe) of the country's annual energy consumption is derived from combustible solid biomass fuels [7]. Since the household sector has the highest share of energy consumption, it implies that about 80% of the 99.3 Mtoe of total energy consumed annually is consumed by the household sector and derived from solid biomass fuels utilised for various domestic activities. Consequently, raising sustainability concerns linked with deforestation, acute respiratory

infections (ARI) and household air pollution (HAP) from the combustion of firewood and charcoal.

However, fuel types utilised in Nigerian households ranges from petrol, diesel, kerosene, electricity, LPG, firewood, charcoal and crop residue. Nevertheless, the consumption of firewood and charcoal surpasses the consumption other fuels. Studies reveal that about 70.7% of Nigerian households (152,000,000 people) use firewood and charcoal mainly for cooking and heating purposes [8]. Resulting in over 43.4 million metric tonnes of wood consumed annually leading to rapid rates of deforestation and about 64,000 deaths annually due to HAP from incomplete combustion of firewood and charcoal in poorly ventilated kitchens despite governmental efforts to increase household access to modern fuel such as LPG and electricity [12]. Despite these governmental efforts recurrent electricity shortages, inadequate gas supply coupled with other factors have resulted in an overreliance on personal generators for household electricity generation and firewood for cooking [5]. From the above review it can be observed that the need to diversify household energy sources to aid transition towards the introduction of cleaner renewable energy sources has become expedient and paramount.

### **3. Study Approach and Methodology**

This study adopted a quantitative survey-based approach to examine patterns of Nigerian household energy consumption and influencers of household choice of fuel. A total of 746 survey questionnaires are distributed for this study, of which 740 responses are considered valid (n=740). The survey as a research instrument was divided into themes to provide clear and insightful guidance to the target population on how to answer the questionnaire. In order to ensure non-overlapping of sample groups, a random sampling technique was adopted.

### **4. Findings and Discussion**

Drawing on data collated during the field-study, a descriptive analysis of the all actors in the field is presented below. All correctly filled surveys were analysed for incomplete and missing responses, resulting in 98% response rate.

#### **4.1. Main Source of Household Energy**

Results from the survey indicates that electricity as the major energy source for most respondent's households as 65.64% of respondents indicated electricity as their main source of energy. While electricity constitutes as the main energy source for most households, about 36.02% of respondents show that their main source of electricity is from the national grid, which indicates governmental efforts to increase household access to electricity in Nigeria. Whereas 29.62% of respondents indicated that their source of electricity is from personal generators that use fossil fuel for electricity generation as shown in Fig 1. This shows the level electricity access in Nigeria, as literature shows that only about 50% of Nigerians have access to electricity [2]. Hence, creating supply deficiencies for 92,000,000 Nigerians resulting in an overreliance on fossil fuels that contributes to greenhouse gas emissions (GHG). Despite the percentage of respondents indicating electricity as their main source of energy, 32.55% indicated using a combination of sources, implying that their main source of electricity contains a mix of grid-based electricity and personal generators. While 1.81%

indicate the use of renewable energy sources as their main source of electricity, which supports the renewable energy potentials of Nigeria. However, the use of renewable energy resources in many Nigerian household is slow and termed as expensive.

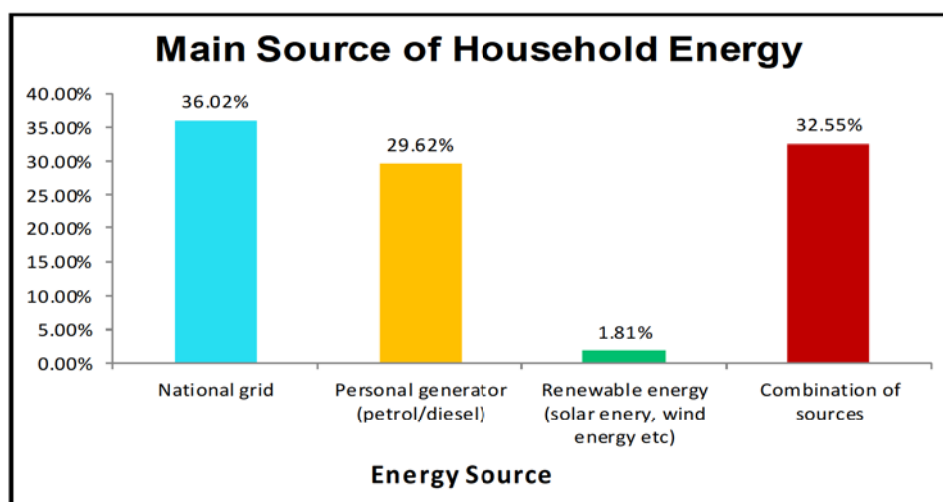


Figure 1: Household Main Source of Energy

#### 4.2. Composition of Household Energy Consumption for Basic Household Activities

Majority of respondents indicated the use of a mix of fuel types for cooking, heating, lighting and air-conditioning purposes. The survey revealed that firewood, charcoal, grid-based electricity, LPG, kerosene, petrol, diesel, biogas, and solar are used in most households for various household activities. Analysis of the survey shows a general trend involving the use of electricity for most household activities as 78.75% of respondents indicate the use of electricity for lighting, while 55.07% and 87.37% use electricity for cooking/heating and air conditioning respectively. However, due to supply shortages and inaccessibility of electricity in Nigeria, the use of diesel or petrol generators is prevalent in most households. The survey shows that majority of respondents use generators for electricity generation for cooking (20.96%), lighting (75.20%) and air-conditioning (43.76%).

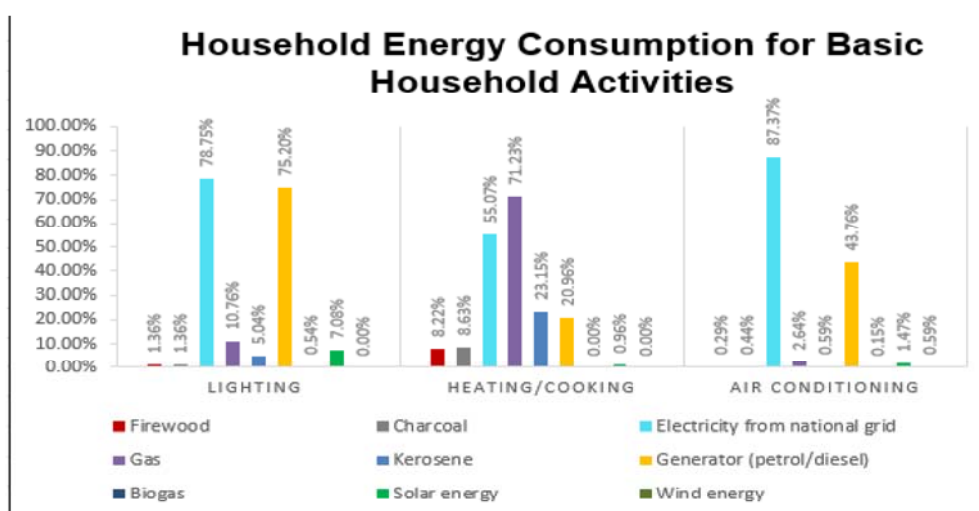


Figure 2: Energy Use for Basic Household Activities

Trends from the survey reveals that household fuel choice in most Nigerian households conforms to 'Fuel Stacking' energy model, since most households use a combination of fuel types. The fuel stacking model suggests that households may combine the use of different types of fuels (firewood – electricity – solar energy) depending on certain socio-economic factors such as their household income, household size, affordability or availability of fuels. From Fig 2, it can be observed that the use of firewood is minimal as compared to other fuels which is due to majority of the respondents being urban habitats. However, the use of renewable energy sources such as solar and wind energy for various household activities is low especially the use of wind energy. Based on the energy fuel stacking model, it can be observed that there exist certain factors that act as influencers as regards household choice of fuel.

### 4.3. Influencers of Household Choice of Fuel

Results from the survey indicates that there are certain factors which influence household choice of fuel source. The survey showed that factors such as; availability, accessibility, fuel cost, size of household, environmental concerns, convenience and culture constitute major factors that influence household choice of fuel. However, availability ranked as the highest influencer of household fuel choice as 60.50% of respondents indicated that the availability of a certain type of fuel determines the likelihood of using that fuel. Other factors the influences household fuel choice includes fuel cost (50.21%), accessibility (41.45%), convenience (41.03%), environmental concern (12.60%). While culture (5.84%) and household size (9.60%) are the least factors that influences household fuel choice.

## 5. Conclusion

Results from this study show that there has been an appreciable increase as regards household access to modern energy especially electricity attributable to governmental efforts to increase access to modern fuels. However, with electricity supply deficiencies, most households are still likely to use non-renewable forms of energy to meet the energy demands. For a population of 192,000,000 citizens, this poses a huge sustainability concern and strain on Nigeria's forestlands and increases the likelihood of ARI from exposure to smoke while cooking with firewood. From this study it is apparent that the introduction renewable energy resources such as solar and biogas would reduce household dependence on fossil fuel and aid towards reduction infections from the use of solid fuels. An awareness of the health and environmental impacts of dependence on fossil fuel and solid biomass should be done via policy formation and creating a level playing for renewable energy market entry into the Nigerian energy sector.

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