Addressing Household Cooking Fuel Options in Nigeria

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Abstract. Households constitute the most significant sector in energy consumption in Nigeria. A plethora of energy source endowments exists to fulfill this demand. However, addressing the cooking fuels need arises due to issues relating to the economy, health and the environment. This necessitates empirical evidence to effect national efficient choice making and policy to entrench modern energy services. Mixed methods of analysis were employed to assess the economics of household cooking fuel choice, and policy option that would enhance productivity and inform future policy for rapid economic growth and environmental sustainability in Nigeria. Given the study findings from survey, the best alternative household energy for cooking in Nigeria is liquefied petroleum gas (LPG). Unimproved solid fuel use contributing 69.1% and 68.6% clearly dominates the household energy cooking choice over the five year period 2013 and 2018 despite its deleterious effects on the health, productivity and environmental sustainability of the economy. Government support and policy should be used to address the existing energy trilemma of productivity growth, access and security, and environmental sustainability to the economy by effectively utilizing the natural gas (LPG) endowments of Nigeria that was little used of as household cooking fuel choice in the ratio of 2.3% and 14.0% over the same period.

Key words: households, cooking fuel, natural gas, climate change, and environmental sustainability.

1. Introduction

Today, the primary energy resource endowments of Nigeria have been widely acclaimed to be ubiquitous and surplus to domestic requirements. These endowments range from renewable, to non-renewable energy resources that had been the main stay of the economy due to its composition effect in the country’s export trade, foreign exchange earnings, and federal collectible revenues. The preeminent dominance of this fossil energy trade has dubbed Nigerian economy as a monoculture. Foreign trade and external views has, however, not adequately highlighted the Nigerian economy’s domestic energy consumption requirements in the various sectors, especially the household energy demand for cooking. This becomes imperative because of the potential productivity gain or loss (harm) from not so doing. The household sector is the most significant consumer of the country’s total
primary energy consumption, most of which were used for cooking. Household cooking fuel choice of unimproved energy sources contributes to indoor air pollution that restrains productivity, impairs the health of users and cause environmental degradation [1].

Barnes D. [2] views the energy problems of the developing world to be widespread and of contributing to serious immiseration of the people. Manifestation of these originates from the low access to modern energy services in the developing world and the consequential high poverty incidence. An implicit rule also, was that the poor generally pay more for useful units of the unimproved energy consumed due to the fact that they are handicapped by the monetary finance required to initiate service of an alternate more efficient fuel. Further, households in remote communities incidentally suffer more from inadequacy or lack of availability of efficient energy services because retail energy traders claim high operational costs to service these low density markets.

The households in remote communities would therefore be condemned to indoor burning of non-market or low-priced solid fuels on open fires or traditional tripod stove. Burning biomass/ solid fuels creates a dangerous cocktail of pollutants such as carbon monoxides, nitrous oxides, poly aromatic hydrocarbons, and other health damaging chemicals [3]. Sovacool [4] notes that the inefficient burning of solid fuels may as well result in a myriad of illnesses including; chronic obstructive pulmonary diseases, lung cancer, asthma and may ignite outdoor smog in dense urban slums thereby impacting the health and environmental sustainability of the entire economy. Remarkably, the labour time involved in non-market fuel wood collection depends on not only its availability, but also on the household size, travelling distance and season [5]. Crucially important also was that fuel wood collection aggravates other social and environmental sustainability problems including soil erosion, desertification, biodiversity loss, and climate change. Fuel wood collection increases the rate of deforestation and has been demonstrated to lead to biodiversity loss.

Porcaro. B. [6] research work in the Philippines averred that modern energy services could enable educational institutions to recruit and retain better qualified teachers and instructors and that the odds of being illiterate were far greater for households and people using traditional inefficient energy services. Consequences of unimproved energy consumption on a society can therefore be far-reaching as demonstrated in the study.

International Energy Agency [7] in an attempt to attenuate the constraints posed by poor access to modern energy for productivity by developing countries developed an ‘energy development index’ primed on four strands or indicators. This model reasserts specific energy poverty potential aspects viz: i) Per capita commercial energy consumption; this serves as an indicator of overall economic development. ii) Per capita electricity consumption in the residential sector; thus testing the reliability and affordability for electric energy services. iii) Share of modern fuels in total residential energy use. This indicator exposes the level of access to clean cooking facilities; and iv) share of the population with access to electricity.
Moderating Nigerian household energy consumption on the index would expose the economy’s proclivity to energy poverty, notwithstanding the huge energy resource endowment. Per capita commercial energy and or electricity consumption was quite low in Nigeria. Commercial energies are the modern energy carriers that grant modern energy services for high quality production and welfare enhancement. Households need energy, more particularly modern energy services to improve their wellbeing [8]. Modern energy carriers include electricity, liquid and gaseous fuels such as liquefied petroleum gas, biogas, and natural gas generally. Per capita electricity consumption in Nigeria in 2014 still rank at the low ebb of 145 kilowatt hour (kWh).
per annum; a level too low even in the sub Saharan Africa region where the average was 483 kWh [9]. Share of modern fuels in total household cooking fuel consumption in Nigeria was abysmally low at 14.7% in 2018 [10].

Nigeria’s hamstrung dearth of modern energy services for cooking by the household sector becomes more explicit with primary data. As of 2013, fuel wood for cooking was the preferred choice at 64% [11] while in conjunction with charcoal it was 67%. Use of solid fuels for cooking, a clear indicator of unimproved energy source, was 69.1% nationally with a one to two chances tilting against the rural households in the period. Along with this was the high rate of mortality due to the release of pollutants inimical to health of women and children. Combustion of unimproved energy (biomass, solid fuels) emits pollutants mainly water vapour, carbon dioxides and carbon monoxides, particulate matters and volatile organic compounds. Deaths in Nigeria attributable to unimproved cooking fuel consumption were 80,000 in the period of [11] causing 3.8% of the national disease burden. Survey highlights include the loss to the economy of 2.6 million life-adjusted years. The incidence is worrisome as studies show that Nigeria is endowed with numerous energy resources that could be tapped to provide modern energy services to the household sector for cooking. The negative impact of fuel wood dominance is getting worse with the estimated loss of forest cover at the rate of 11.1% annually. Forests were cleared for logging, fuel wood harvesting and charcoal production among others. The issue raises the importance to find the way forward for Nigeria to chart a new course that builds to enhance productivity with its abundant primary energy resources. The country has been in the forefront of exporting primary energy but, face serious challenge of adequate modern energy services in its domestic economy; especially for household cooking fuel needs. Improved energy access is noted to be the key driving characteristics of economic development and social progress.

In view of the above, this study questions the efficacy of the abundant primary energy source endowments of Nigeria’s potentials in prioritizing modern energy services for household cooking in the economy. Efficient utilization of the abundant primary energy resource to provide modern energy services for cooking could fast-track the productivity growth variables for the economy, reduce health morbidity and mortality, as well as enhance environmental quality.

2. Materials and method
Data was collated on the endowments of energy sources of Nigeria utilized for cooking by the household sector for the period 2000 to 2018. The method of analysis employed was mixed. First, the study reviewed recent literatures asserting the household cooking fuel choice in Nigeria. Secondly, descriptive statistic was used to explain the contribution of the various fuels’ in the household cooking fuel choice in Nigeria, and lastly a recap was made of using primary data of survey as derived from the internationally sponsored institutional data by the Government of Nigeria’s led National Population Commission (NPC) seminal case study series of ‘Nigeria Demographic and Health Survey (NDHS)’.

The household sector is synonymous with the residential sector. Empirical works use this interchangeably in review literatures consulted. The household is the microcosm of society. It may be defined as a group that consists of one or more people living together in the same dwelling and sharing amenities or meals. The household is grouped an institutional sector in
national accounts where together with firms and government expenditures, they constitute the domestic economy. Households consume some types of goods and services as a group or simply collectively. Such goods and services generally include mainly housing, foods, and energy. On the other hand, the residential sector may be defined and distinguished as a consuming unit/sector that consist of living quarters for private households. The residential sector is regularly mentioned in institutional and empirical studies as a significant energy consuming sector. Particular emphasis was accorded to the household sector in this study; however, the residential sector as mentioned in some peer-review journals was treated as synonyms to the former.

Studies had shown that households account for greater proportion of the total primary energy demand in most developing countries but in the advanced developed industrial countries, households account for less than 2% [12]. This analogous inelastic proportion of the demand for energy in the developing world was for cooking and heating to ensure basic survival [13]. Development planners basically devote much time and resources on electricity supply in deference to household cooking fuel needs. Incidentally, the inelastic demands for household cooking fuel in most developing countries are met through unimproved energy resources that produce a cocktail of pollutants deleterious to human health.

In Nigeria, the household sector consumes about 80% of the country’s total primary energy. 90% of this was used for cooking. Cooking fuel choice is dominated by unimproved energy source. Harvesting unimproved energy resources had been found to be detrimental to environmental quality. Unimproved energy sources include fuel wood, animal dung, agricultural residues/ crops and shrubs. Increases to cleaner energy access has been shown to contribute to transformation of economies from being rural agrarian based to industrial based where cleaner energy play dominant role in the production of goods and services. Fuel wood consumption endangers afforestation and increases the rate of desertification [14].

Nigeria shows the attribute of a backward developing economy by its energy consumption pattern. The household demand for energy accounts for 80% of the total energy consumption in Nigeria. Further, 90% of this household energy requirement comes from reliance on unimproved energy source of biomass and agricultural waste residues [15; 16]. Nigerian government policy to improved efficiency in fuel wood consumption through the introduction of improved cook stoves, has not been yielding the desired effort; thereby fast-tracking the environmental degradation through soil erosion in the South and desertification in the North due to intensive fuel wood harvesting. At the rate of its supply and consumption, fuel wood can no longer be classified as a renewable energy source in Nigeria [14]. Effort at fabrication of improved cookstove, supplemented with development partners’ efforts has been infinitesimal to assuage household need [17].
Table 1: Household cooking fuel choice in Nigeria

| Cooking fuel choice | 2003  | 2008  | 2013  | 2018  |
|---------------------|-------|-------|-------|-------|
|                     | national | urban | rural | national | urban | rural | national | urban | rural |
| Electricity/gas     | 0.5%  | 0.5%  | 0.1%  | 1.6%  | 3.7%  | 0.5%  | 2.7%  | 5.3%  | 0.7%  |
| Kerosene            | 26.9% | 53.4% | 12.1% | 25.6% | 51.6% | 11.3% | 23.5% | 47.6% | 8.7%  |
| Wood/charcoal       | 69.3% | 41.2% | 85.2% | 67.4% | 41.3% | 83.6% | 67.2% | 43.9% | 84.9% |
| Agric. waste/dung   | -     | -     | -     | 1.0%  | 0.7%  | 1.1%  | 1.9%  | 0.2%  | 3.2%  |
| % solid fuel use    | -     | -     | -     | 70.1% | 42.1% | 85.6% | 69.1% | 44.1% | 88.1% |
| Electricity coverage rate % | 52.2% | 84.9% | 33.8% | 50.3% | 84.8% | 31.4% | 55.6% | 83.6% | 34.4% |

Source: NPC (various years)

Table 1 indicates the household cooking fuel choices available to Nigerians both the modern energy service fuels and traditional energy fuels and the rate of their utilization. Biomass and agricultural residue used as cooking fuels by the household sector include fuel wood, charcoal, animal dung and agricultural residues were termed traditional fuels. These biomass renewable energy fuels contribute the most to household cooking fuel choice in Nigeria today. Low penetration of improved fuel wood stoves, biomass combustion in open fires and traditional tripod stove release a cocktail of household air pollutants that cause morbidity and mortality. The pollutants cause health problems that lead to about eighty thousand (80,000) deaths annually, representing 3.8% of disease burden in Nigeria [11; 16; 17]. Reliance on fuel wood for the domestic energy supply exacerbates deforestation, desertification and other environmental sustainability challenges that could further lead to climate change. Evidence abounds that biomass use is both time consuming and hazardous in all its harvesting, transportation, and use. It is associated with further negative environmental sustainability consequences like deforestation, desertification, soil nutrient depletion and other consequences.

The cooking fuel of choice adopted by a majority of urban household dwellers, aside solid fuels, was kerosene. Its use decreased marginally by about 5% between 2003 and 2013. Using kerosene poses some deleterious health challenges as identified by [18]. Highlighted negative consequences of kerosene use include release of pollutants, toxicity and household indoor air pollution. Added issue as a result of high level household consumption of kerosene in Nigeria was the impact on the fiscal treasury due to subsidy and reliance on the kerosene import. However, the government removed the subsidy on kerosene in 2016. This has impacted kerosene use statistic in the most recent survey. Noticeable decline appeared as the household energy choice of kerosene dropped from 26% in 2013 to a 15% thus recording a drop in use of over 40% in the interim. However, this decline in use could not lead to significant modern fuel use due to the negligible fall in solid fuel use from 69.1 to 68.6%. Worse still, urban household choice for solid fuel consumption increased from 44.1% to 47.7% [10].

Modern energy for Nigerian household cooking fuel choice tilts to electricity and natural gas (liquefied petroleum gas [LPG]). Electricity supply and coverage rate has been low. Per capita electricity consumption was 145 kilowatt-hours in 2014 [9] suggesting low access rate incapable of reliance for household cooking needs. The national electricity coverage rate was 52% in 2003 and 59.4% in 2018 [11, 10]. The muted access was much lower in the rural areas where majority of the households reside. Rural access to national electricity grid supply in 2018
was 39%. Reliance on electric energy services for household cooking was therefore miniscule at present.

Uptake of LPG as Nigerian household cooking fuel choice stood at less than one percent (2003) but rose to 2.3% (2013). NPC [10] records a jump to 15% as household cooking fuel choice. The increase in consumption of this modern fuel for cooking may not be unconnected to the removal of subsidy on the price of kerosene by the Federal Government of Nigeria in 2016. Comparing this to other sub-Saharan African countries would show that modern fuel consumption of LPG for household cooking in Nigeria is grossly underserved and inadequate. That Nigerian households were underserved could be seen from their counterparts’ consumption of LPG per capita; Ghana 9.5Kg, Senegal 9Kg, South Africa 7.5Kg. Across the continent, Egypt had 57Kg and Morocco was 66.27Kg [19]. Nigeria’s per capita consumption of LPG currently stands at 1.8Kg which is grossly inadequate for the country reputed to be the highest natural gas reserve holder in Africa. Nigeria natural gas reserves as of 2018 stood at 200.779 Tcf [20]. In deference to the above, Nigeria imported 35,734,932 metric tonnes of LPG in 2018 [20]. In 2016, LPG imports accounted for 40% of Nigeria’s total annual consumption of the fuel for the year [20]. Moreover, regional imbalance in LPG consumption was recorded in which the Southern states of Nigeria consumed 65% of this estimated modern fuel use for cooking.

This low consumption of LPG exacerbates socio-economic developments and worsens the environmental quality and sustainability in Nigeria principally due to high reliance on unimproved solid fuel consumption as household cooking fuel choice which stood at 66.8%, and for the general population at 77.4% [11]. Government policy on domestic gas supply obligation to the domestic economy before the multinational oil companies can export gas has attracted low compliance at about 35% in the period 2008 to 2018.

All these suggests that the Nigerian government policy, regulation and implementation could turn the tide in mainstreaming modern energy services (LPG) as the household cooking fuel choice by increasing its uptake. Import tariff on gas cylinders at 35% [20] works against LPG fuel choice. This administrative bottleneck should be removed.

3. Recommendations and Conclusion

It is therefore imperative that government policy targets should be used to increase consumption of LPG as the household cooking fuel choice. Other challenges; socio-economic, cultural and behavioral should then be addressed as the veil is lifted.

The Nigerian energy policy 2003 and its subsequent reviews had estimated that a mix of energy resources should be utilized to meet Nigeria energy need. However, the abundant biomass energy resource in the country were consumed in unimproved forms hence the deleterious consequences. No nation has been known to meet its developmental goals without improving access to cleaner, modern energy and the services they provide.

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