

Review

Wood fuel consumption in Nigeria and the energy ladder: A review of fuel wood use in Kaduna State

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Rural areas of developing countries are very dependent on biomass fuels such as wood fuel and dried dung for their energy consumption. Wood fuel as a source of energy plays a vital role in household energy requirements, due to increasing economic hardship in the country, many people are finding it increasingly difficult to afford conventional fuels in Nigeria. Wood fuel in Kaduna State is the most highly consumed fuel, together accounting to about 1,722,904 t/year consumed per person in the State. This review examines the wood fuel used and the energy ladder in Kaduna State. However, the major reason why people used wood fuel as the alternative source for heat energy generation is poor income, poverty and like of adequate national grid.

Key words: Wood fuel, energy ladder, consumption, conventional fuel.

INTRODUCTION

Fuel wood is a source of energy derived by burning wood materials like logs and twigs and is common among the rural dwellers. It is a traditional source of energy, which has remained the major source of fuel for over half of the world's population (FAO, 2001).

According to the UNDP (2002), the share of various energy sources in the total primary energy supply in Nigeria are made up of oil, 10.4%; gas, 6%; hydro, 0.6%; and commercial renewable energy, 83%. The greater portion of the commercial renewable energy is wood, while other agricultural wastes constitute the remaining smaller portion. The over-dependence on fuel wood for energy is chiefly because of its relatively low prices and easy accessibility (Adedayo, 2005). Other reasons are constraints in the supply of the conventional fuels and the growing population with a larger segment still falling below incomes that cannot afford the cost of conventional fuels (Adedayo, 2005).

In South Asia where there is a large poor population, poverty is the most significant parameter that drives extensive traditional use of fuel wood and residues

(UNDP, 2002). Fuel wood is consumed in diverse ways and at different levels and the life of the majority of rural dwellers depends either directly or indirectly on fuel wood. However, meeting rural household, wood fuel energy needs in the country has become a herculean task due to the enormous quantity of wood required. Daily consumption of firewood by the rural communities in Nigeria is estimated at 27.5 million kg/day (Ogunsanwo and Ajala, 2002).

This observation was buttressed by another recent data published by The Solar Cooking Archive (2011) which put the estimate of Nigeria's fuel wood consumption as percentage of energy at about 87%. Therefore, majority of the Nigerian rural people have been using and will continue to use the dried biomass fuels for energy for many years to come.

The objective of this review is to evaluate the consumption of wood fuel in Kaduna State and the energy ladder. However, this review study relied solely on secondary information available from different sources, such as, published reports and documents of R&D and

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Table 1. Removals according to purposes in Nigeria (FAO 2005).

Category	m ³ /year	Tones/year
Total removals	92'690'673	64'883'471
Of which for wood fuel	72'711'000	50'897'700
Of which for fuel wood proper	56'714'580	39'700'206

academic institutions, individual researchers, etc. There was no collection of primary data for the purpose of this study.

The study area

Kaduna State (96°15'E to 98°60'E longitude, 9°02'N to 11°32'N latitude) which is located in the northern part of Nigeria, occupies 48,473.2 km² and has a projected population of over 6.1 million, over 80% of them were involved in agriculture (Census, 2006). The State has two distinct seasons, a rainy season from April to October and a dry season from November to March and the vegetation extends from the Guinea Savanna in the southern part of the State to the Sudan Savanna in the northern part. The State, which is divided into 23 local government areas (LGAs) is further classified into three geo-political zones, a northern zone which consists of 8 LGAs, a central zone consisting of 7 LGAs, and southern zone which consists of 8 LGAs. The State has a pluralistic society with a total of 36 indigenous ethnic groups with Hausa being the general language common to all the groups.

NATIONAL CONSUMPTION

Nigeria is a country with large fuel wood deficit zones mainly in the north, while in some southern areas production exceeds consumption (Ogbonna, 1991). These areas supply the deficit zones. Therefore, a balance between annual re-growth and consumption has to be struck on a national level.

According to the Forest Resources Assessment (FRA) Country Report Nigeria 2005 (FAO, 2005), total wood removals from forests in 2005 amounted to 86,626,797 m³, and removals for wood fuel from forests in the year 2005 were 72,710,935 m³, the difference being made up by industrial roundwood, which accounted for 13,915,862 m³. However, wood may also come from areas outside forests like shrubland, savannah and grassland as no data are available on these sources in Nigeria, a reasonable estimate has to be made, based on figures from neighbouring countries. But neither from neighbouring Benin, Cameroon, or from Ghana data is available. The "FRA 2005 Country Report Senegal" however, presents data on the growing stock on "other wooded land" (FAO, 2005) which allows to conclude that

the growing stock on "other wooded land" is about 7% of the growing stock in forests. We assume the same percentage to be true for Nigeria. Adding 7% to 86,626,797 m³ gives us 92'690'673 m³ as the total harvest of wood from forest and other wooded land combined.

In Nigeria, the shares of fuel wood proper and wood for making charcoal is not known. We assume it to be about the same as in Chad that is 78 and 22%, respectively of all the wood used energetically (Kituyi, 2002) (Table 1).

National wood fuel consumption per head

Dividing the total fuel wood consumption of 39,700,206 t/year through the number of inhabitants, which is 140,003,542 (Census, 2006), we get about 0.284 t/person/year, that is, about 0.776 kg/day. Similar figures are reported in several publications. The difference between urban and rural households may be explained by the fact that urban households often have additional sources of energy at their disposal, like kerosene, gas, charcoal and electricity.

CONSUMPTION IN KADUNA STATE

As State specific consumption figures are not available, we multiply the national per-head wood fuel consumption (national average) of 0.284 t/person/year with the number of inhabitants of Kaduna State, which is 6,066,562 (Census, 2006) and we get a consumption of 1,722,904 t/year).

According to Yahaya (2002), there exists a direct relationship between human population and wood fuel demand, hence, the cutting down of wet wood can be said to be on the increase. The rate of consumption of fuel wood in Nigeria exceeds the rate of production. It is therefore right to say this renewable source of energy would sooner or later be scarce, should these form of exploitation continue.

THE SHIFT FROM FOSSIL MODERN FORMS OF ENERGY BACK TO FUEL WOOD

The unsustainable level of production of fuel wood in Nigeria is likely to continue for some time as long as the energy crisis facing the country remains unresolved. The

Table 2. Poverty rate and percent of wood as fuel source by geopolitical regions.

Region	Poverty rate	Percent of wood as fuel source
North-east	72.2	95.9
North-west	71.2	95.3
North-central	67.2	86.4
South-west	43.0	54.9
South-east	26.7	78.0
South-south	35.1	72.7

Source: NBS (2007).

country still witnesses erratic supply of petroleum products (Kerosene and Gas), and when available the prices are beyond the reach of ordinary people. The implication is not farfetched, as more people will resort to fuel wood, which is already in short supply (FAO, 2001; Experience of National Forestry Programmed in Nigeria). The situation in 2012 is still the same, if not worse. This means that people are reverting from modern to traditional forms of energy.

The role of poverty on wood fuel consumption

Information for this review was sourced from the publications of National Bureau of Statistics (NBS, 2007) and other sources. Table 2 is used to present findings and a correlation analysis was used to establish the relationship between poverty and the quantity of wood consumption by regions. The average percentage of wood used in 2007 in each of the six geopolitical regions of Nigeria was studied in relation to the poverty level of Nigerians in these respective regions (Table 2).

Table 2 shows clearly, that the poverty rate strongly suggests the use of wood fuel as cooking fuel, except for southeastern Nigeria, whose poverty rate is lower than that of southern Nigeria, but has a higher percentage of cooking fuel as wood fuel.

On a general note, a correlation coefficient of 0.771 (significant at 5%) shows that the poorer region tends to use more wood fuel to meet their domestic requirements. This finding suggests that poverty is a key factor in wood fuel consumption. These poorer regions (such as Northern Nigeria) have less woody vegetation compared to the richer regions (such as Southern Nigeria). In fact, forests are almost non-existent in the northern regions of the country, except for a few patches of trees here and there in the northwestern and northeastern parts of the country, and a better-off north central part, which forms the Savannah zone. These northern regions consume more wood fuel than the southern regions, where the forests are concentrated, on account of their higher poverty rate. A critical implication here is that more pressure is brought to bear on the patchy forests of the northern regions and, as time goes on, the movement of

wood fuel in the form of commercially processed charcoal from the southern regions northwards will intensify, bringing much pressure on the largely overexploited forests of the country.

THE ENERGY LADDER

Analysis of the wood fuel data over the decades has revealed certain trends in the wood fuel consumption. Firewood is the predominant fuel used in the rural areas of developing countries, whereas charcoal is the preferred fuel in urban centers replacing firewood as incomes rise (Arnold et al., 2006; Kituyi, 2002). This transition is often referred to as the “fuel ladder”. Figure 1 describes the situation where firewood and charcoal, which occupy the lower rungs of the ladder, are then substituted by kerosene, gas and commercial electricity as you rise up through the rungs (Brouwer and Falcao, 2004).

The implication of this is that as the economies of developing nations grow, one would expect to see a decline in the wood fuel mix of the country (Girard, 2002). This has indeed been observed in Asia where the consumption of wood fuels is declining in favour of alternative fuels, reflecting the rapid economic growth of the region since the 1980s. However, in Africa, one of the most marginalized regions in the world, economic growth has been slow and wood fuel consumption is increasing (Kituyi, 2002). This growth is associated with the rural to urban migration found in many African countries, combined with low incomes and savings, which inhibit the transition to others fuel types. As a result, Africa’s wood fuel dependence is likely to persist for decades to come, which could have significant consequences for forest resources and the rural livelihoods dependent upon them (Kituyi, 2002; WEC, 2004).

CONCLUSION

Studies have shown that inhabitants of developing countries, especially in the rural areas, are dependent upon plant resources for livelihood and sustenance. The

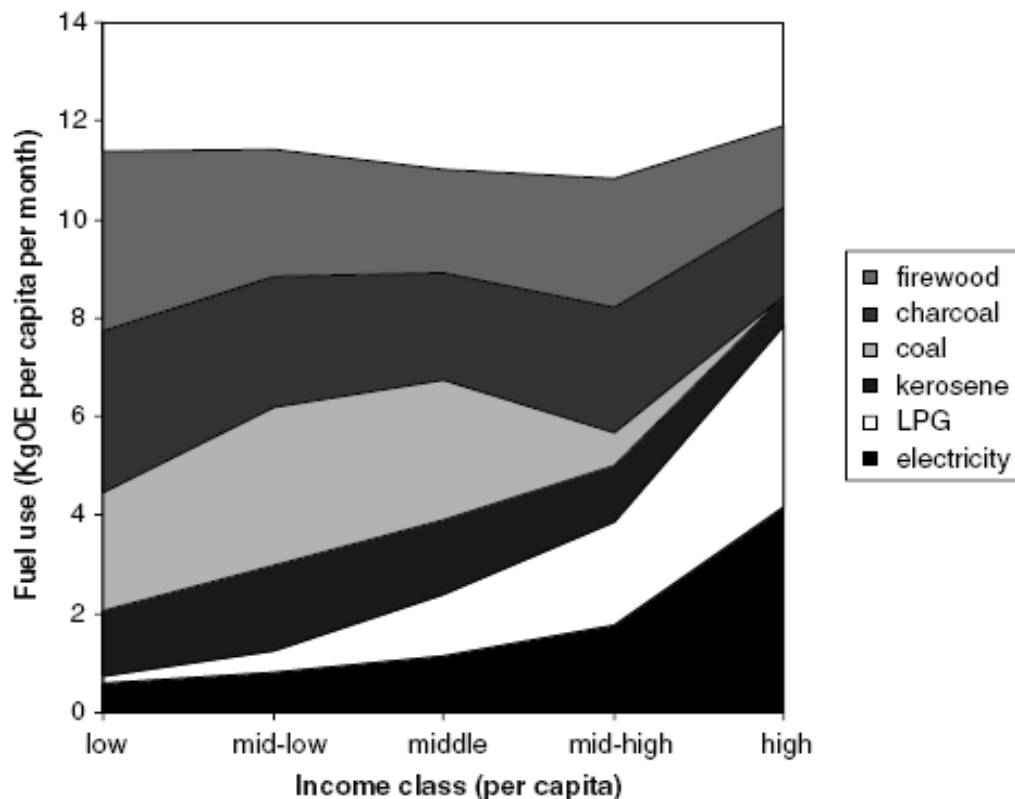


Figure 1. The “energy ladder” relationship between income and fuel type use showing a decline in wood fuel as income increases. Source: Arnold et al. (2006).

use of biomass, especially wood, for energy generation in this country is an issue that may not be easily wished away in the nearest future, probably owing to the vagaries associated with demographic and socio-economic conditions, coupled with the level of technological advancement. Since a cheaper alternative is yet to be found for the use of wood as fuel wood, it is important that strategies which can enhance sustainable means of producing wood for energy generation be look into.

From the foregoing, governments and other development agents are encouraged to make use of this information to support availability of alternative energy sources to supplement fuel wood. In this regard, converting wood wastages (wood shavings and sawdust) to briquettes and motivating the public to plant trees would improve energy supply.

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