



FIREWOOD, FOOD VENDING AND THE FATE OF FORESTS IN IBADAN

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Abstract

Firewood, an ancient energy source has persisted in use in contemporary times for cooking in developing countries, despite associated negative health and environmental impacts. Literature posits that as cities evolve, urban livelihoods such as food vending will transit from firewood to more use of modern fuels. In Nigeria, commercial food vendors have maintained strong associations with firewood energy, however studies on their fuel use pattern and preference for firewood is limited. Empirical links between firewood use and food vending are required in order to understand better the present role of firewood in shaping local energy use patterns. A sample survey of 200 food vendors in five local governments in Ibadan city using questionnaires and interviews was done. A quantitative weighing procedure of firewood consumed was also adopted. Results indicate the mean age of respondents was 45.0, 99% were female and more than 60% had below primary education. Main preferred energy type is Liquefied natural gas while kerosene was least preferred. Preference for firewood is induced by cultural factors. Over 56.5% of the respondents use firewood alone as main order fuel, charcoal 34%, gas 7% and kerosene 2.5%. Mean weekly volume of firewood use was 84.1kg. Key factors inducing use are speed and affordability. Food vendors' energy use pattern supports the energy ladder hypothesis. The paper recommends modern fuel subsidies along with intensification of advocacy on modern fuel adoption to reduce firewood demand.

Keywords: Food vendors; Energy preference; Urban livelihood; Firewood use; Commercial energy; Ibadan

Introduction

Firewood, a primordial cooking energy source for many poor households in developing countries as Africa, remains relevant in current energy-societal discourses due to its environmental significance globally. An energy resource for cooking and lighting, firewood is critical in the achievement of the millennium development goals of environmental sustainability and resource loss reduction (UNDP, 2005), as it provides almost 80% of total energy for more than 2.6 billion people (IEA 2019). Past studies indicate an association between fluctuating fossil fuel prices and increased firewood activities by the poor, reinforced by limited access to other income

generating resources such as arable land (Mndolwa et al 2015).

Although firewood supply is often rural, urban demand usually by the poor is driven by broad socio-economic processes (Spetch, Felipe and Melo, 2015), including factors such as income, cost and lack of affordable alternatives and convenience (Gioda 2019; Leach and Gowen 1987). As demand increases, there are sustained environmental concerns about its intensified use, given inferences to its apparent complicity in environmental degradation (Arnold et al., 2003; Spetch et al 2015; Ekveldt 2011; Kyaw et al 2020; Yigezu et al 2020; Ketlhoilwe, M.J. and Kanene 2018) and negative user

health implications (Naughton-Treves *et al* 2007; Sola *et al* 2017). Notwithstanding a few counter narratives emphasize the use of trees outside forests (TOFS) as well as dry dead wood as firewood that are environmentally friendly buttressing the older argument that it can rarely be a trigger for deforestation (Geist and Lambin 2002).

Firewood is distinct from other biomass fuels because as woody biomass, it requires little processing for it to be ready for use other than drying (Khin Thu 2020) unlike Charcoal. Both fuel types are often referred to as wood fuels. Being a product from Nigerian forests, firewood extraction activities have intensified due to local use which seem not to have other acceptable substitutes (Eckholm, 1975; FAO, 2009). Other dimensions of fuelwood use impacts are still unclear and not well understood due to a lack of reliable empirical data (Arnold *et al* 2003). Although, firewood is currently said to be one of the most common cooking fuel type used in rural households (Nzabona *et al* 2021), many reports indicate its simultaneous use alongside other fossil fuels (Horst and Hovorka, 2009; Malla and Timilsina 2014; Ozor *et al* 2018; Gould *et al* 2020) since it is not likely to serve all household cooking needs as a single energy fuel type (Shankar *et al* 2020). This is particularly true in Nigeria where the recent increase in the cost of fossil fuels (Gas and kerosene) and its attendant scarcity has forced many low-income urban dwellers to resort to the use of fuelwood/charcoal as their major cooking energy source (Maconachie, 2009; Naibbi, 2013).

Other studies suggest sustained firewood use to be driven by factors beyond income (Gould *et al* 2020) especially for Nigerian households due to the costs of utilizing cleaner fuels and its unstable supply (Ikurekong *et al* 2009; Ifegbesan *et al* 2016; Baiyegunhi *et al*; 2014, Desalu *et al* 2012; Umar *et al* 2018). Many of the past researches in firewood use in Nigeria have focused more on household consumption and drivers of use (Morgan, 1983, Cline-Cole, 1987, Ayoub, 1988, Adebulugbe and Akinbami, 1995, Adelekan and Jerome, 2006, Horst and Hovorka, 2009, Naibbi, 2013) to the exclusion of other commercial users like food vendors.

Food vendors have been unrecognized in firewood research because commercial user contributions to annual consumption figures often look small compared to the sheer overall volume recorded for households. The local food vending business, a

recognized economic activity in Ibadan akin to street trading, is associated with income generating activities outside the regulated waged labour sector (Timilsina, 2011; Okojie *et al* 2014). These users trade in cooked meals for the public, utilizing more of permanent structures rather than the Street food vendors (SFVs) who sell food in semi-static or temporary structures or moveable vending sites (Mazi *et al* 2023). These commercial food handlers typically cook foods like boiled yam and vegetable stew, rice and beans, amala, eba, iyan (Pearce *et al* 1988), while others cook bean cake, roasted plantain, bean pudding and local delicacies in open fires of lit firewood (Iwu *et al* 2017; Nwankwo *et al* 2018).

Food vending in particular as a livelihood strategy has had close associations with firewood due to the cheapness of the fuel (Gbadegesin and Olorunfemi, 2011). There are however, limited studies focused on vendors' firewood use pattern and energy preferences. Extant studies have shown more interest in health impacts of firewood consumption (Adewole *et al* 2013; Langbein *et al* 2017; Nwankwo *et al* 2018), gendered concerns around usage and on how income affects usage (Siong 2011). There are few studies with a socio-cultural approach into why firewood has remained relevant from past decades until now (Mazzone *et al* 2021). This paper presents a fresh attempt to provide empirical links between firewood use and food vending, in order to highlight the importance of food vendors in shaping urban energy patterns in Ibadan. It gives a historical snapshot of the field while raising awareness about energy access among food vendors. The paper is divided into five sections. Following this introductory section is the second section which explores the nexus between food vending as an urban livelihood and firewood use. The third section discusses the methodology of the study, while in the fourth section the results are presented and discussed. The paper concludes by highlighting the implications of firewood use for local surrounding forests and recommendations on sustainable firewood use.

Conceptual Framework and Literature Review

The study utilizes the Energy- Livelihood Nexus conceptual framework proposed by the World Economic Forum WEF which first drew attention to the interconnectedness between energy access, water availability and food security (Purwanto *et al*, 2021).

This concept emphasizes the need for a holistic approach to handling resource management of water, energy and food matters to ultimately improve livelihoods (Hoff et al 2011, Yupanqui et al 2025). This framework identifies energy access as a critical component of livelihoods and how it may impact on human wellbeing. This in effect identifies a range of factors germane to such studies to include energy access, social and economic factors (Aboelnga et al 2018). For food vendors, firewood use and therefore reliance on such resources may mean vulnerability to dislocations in energy firewood resources making such users to be in among the food insecure. Since the popularity of fuel wood amidst the poor in these countries is due to their inability to afford other fuels for cooking the implications for the energy-forest–development scenario remains precarious.

Urban Livelihood and Firewood Use

The livelihoods approach was originally conceptualized to give better understanding of how people earn a living in rural areas but has increasingly been applied to urban settings. It is often seen as the capabilities, assets and activities required for a means of living within a city. In the context of energy use, many people who are involved are people who often lack access to common property resources found free in rural areas. Such people usually have moved rural areas into the city to engage in urban livelihoods often retaining rural cooking habits of firewood use (Adelekan and Jerome, 2006). Shifts in wood supply may be threatening for such livelihoods (Timalsina et al 2011). For these livelihoods, access to fuel supply is paramount as shifts can be threatening to the viability of such businesses as past reports indicate pottery declines, salt drying losses, fish smoking declines (Vermeluen, 2001).

In extant literature (Van de Kroon et al 2013; Adam et al 2020; Waweru et al 2022; Fentie et al 2023), household cooking has been associated with the energy ladder concept where firewood use is basic but gradually gets replaced by charcoal, kerosene, gas and electricity as incomes rise. Very few attempts have been made to assess vendor energy use and of which Siong et al. (2011) found food vendors in Ibadan used more of solid fuels (firewood and charcoal) alongside kerosene as their main sources of energy. Findings however did not indicate a focus on firewood as a first order fuel nor were the vendors sampled from within the Oyo State Canteen Workers

Association (OSCWA) registered pool of vendors. In light of current events of increasing fuel prices, the research questions surrounding vendor consumption patterns, cooking energy sources and average cost and quantity firewood a food vendor uses remain relevant today. This study contributes valuable insights to this significant issue integrating additional data as a benchmark for future research.

Ibadan was spotlighted for the consumption study due to its unique status as Nigeria's most populous indigenous city. Although, it had been previously seen as the largest indigenous city in Sub Saharan Africa, it currently retains the distinction of being cosmopolitan. Ibadan with a total land area of about 130 sq.km, is located on longitude 3°54' East of the Greenwich meridian and latitude 7°23' North of the Equator (Adelekan and Jerome, 2006). Ibadan is divided into 11 local government areas of which five are urban (Ibadan South-East, Ibadan North, Ibadan North-West, Ibadan North-East, Ibadan South-West) and six semi-urban (Akinyele, Lagelu, Ido, Egbeda, Ona Ara, Oluyole).

The physical landscape has prominent hills that generally lie across the city in a northwest and southeast manner. Drained by rivers Kudeti and Ogbere in the center, the city has other major rivers and lakes such as the Ona river and Lake Eleyiele in the Northwest, Asejire Lake at the city boundary and river Ogunpa running through the city as well. The city shows a very dense network of roads. Previously, Ibadan was largely populated by Yorubas but now accommodates a large mixture of migrants who largely retain more of their rural cooking habits involving woodfuels. More than 65% of the Oyo state lands are devoted to agricultural related activities (Ezebilo 2004). Ibadan was known economically in the past for food production (vegetables, cereals and yam) and trading (shea butter, salt, pots and ironworks) and wood processing industries (Fourchard, 2002).

Materials and Method

The key objective of the research was to highlight the importance and contribution of food vending to urban energy use patterns, exploring particularly the links to firewood use. The study utilized primary data collected through a food vendor energy survey. Questionnaires were administered to 200 food vendors randomly drawn from the list of Food

Canteen Workers Association in Ibadan headquarters elicited from the Secretariat at Oranyan, Ibadan South East Local Government Area. The Vendors were drawn from the five local government areas in the metropolis including Ibadan North, Ibadan South East, Ibadan South West, Ibadan North West and Ibadan North East. Forty questionnaires were administered to each local government area and the total of 200 questionnaires was used. The vendor questionnaire comprised of two main sections: Section A had questions on the socio-economic characteristic of the vendors, preference, energy use, years in business, non-family employment. Qualitative data from the focus group discussion and interviews were also obtained. Permission for the survey was sought and received from the chairperson of the Food Canteen Workers Association at Oranyan. Vendor support was also sought from the Oyo state Zonal food vendor heads and Local Government food vendors' leaders throughout Oyo state. Informed consent was also obtained from all respondents interviewed.

Section B involved the quantitative weighing and recording of actual firewood used by respondents before cooking started. Different methods of determining domestic fuelwood consumption have been studied (Fox, 1984) and the weight survey method was found to be the most accurate but laborious. Other methods as the annual recall method generally overestimated quantities by factor of 1.95 attributable to socio-physical factors but was recommended as the most practicable with occasional weighed measurements done to improve accuracy (Fox 1984). To generate firewood consumption data for this study, the recall method was combined with weighing to give more robustness to the data. A 50kg handspring balance was used to weigh the bundles of firewood on each vendor site to generate an average bundle /weight constant. Respondents were asked to recall how many bundles had been used or was usually used for that day and this figure was multiplied by the weight constant to estimate the daily consumption for that particular user (Njiti and Kemcha 2003).

The remaining unburnt logs of the last used bundle (if any) were weighed and subtracted from the daily consumption to reduce overestimation (Kersten *et al* 1998, method III). The method of setting apart fuel enough for a day's use and the remnant weighed the next day (Remedio., 1993; Kituyi *et al.*, 2001) was not

fully applicable in this study as many of the respondents would not keep to using fuel only from the restricted pile. Many were suspicious of the effect of using such fuel on their sales for the day. As such, the daily recall method was also used in combination with the weighing method. Most vendors had a clear idea of how much was used per day due to its importance in profit maximization. Descriptive statistics module o the Statistical Package for the Social Sciences (SPSS) software was used to determine the basic distributional characteristics of each variable identified such as demographics, primary energy sources for cooking, pattern of fuelwood use and expenditure on fuelwood across the five LGAs. The location of each respondent was also taken with a GPS handheld device to generate data which was processed using the Geographic Information System (GIS) software Arc GIS to produce the map of sampled food vendors in the city

Table 1: Showing Oyo state Canteen workers subdivisions and samples for the study.

LGA	Total Listed Members	Selected samples (n=200)
Ib North	718	35
Ib Northwest	531	27
Ib Northeast	957	47
Ib Southeast	1159	57
Ib Southwest	700	34

Source: Field interview of OSCWA officials.

Results

1. Demographics and Primary Energy Source of Surveyed Food Vendors

Two hundred (200) food vendors comprised only of those registered with the Oyo State canteen Workers body were surveyed (Figure1). They all had stationed canteens, kiosks or food stalls at designated locations.

The study results indicate that the mean age of respondent was 45 years with less than 40% of the vendors educated beyond the primary school level (Table 2). This low literacy level may also be a part of a reason why young people are not prominent in this activity. When asked, some vendors said their children preferred the modern catering and confectionary art to food vending. It is also significant that is a women-dominated activity (99% females). This means their source of livelihood is also vulnerable to disruptions with little or no backup if any crises were to occur.

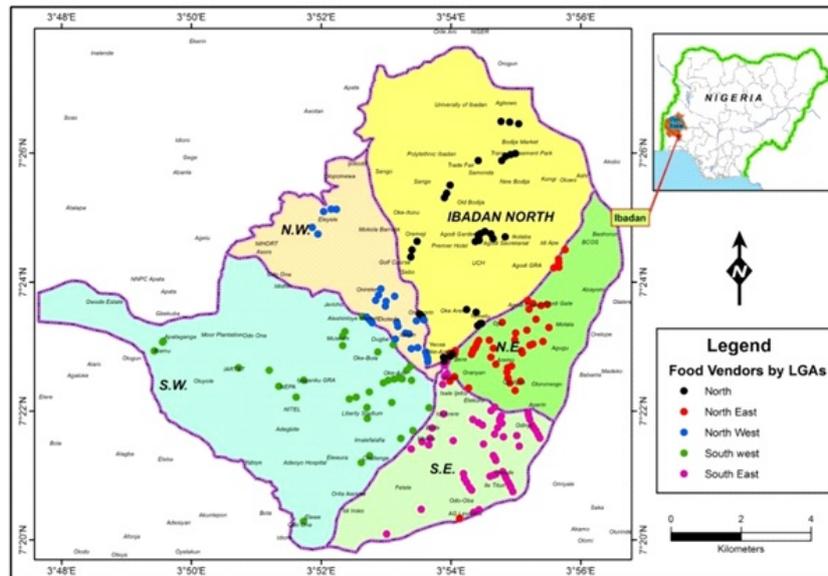


Figure 1: Map of Surveyed Food Vendors in Ibadan Metropolis

Table 2: Summary Mean values of socioeconomic characteristics of food vendors

Socio-economic Characteristic	Mean values
Age	45±10.5
Gender (Male)	2(1%)
Gender (Female)	198(99%)
Average Level Educ	Primary (80)
Marital status (AVE)	Married (190)
Firewood users	113 (56.5%)
Monthly Firewood use range	28kg – 1792kg

Source: Field data, 2015.

95% of the respondents claimed to be married which was slightly different from the information generated from the interviews with most key informants. The informants said that most of these vendors were separated, single moms or widowed with no husband in their lives. Some of these key informants also opined that food vending was a strenuous job that often generated underlying tensions in domestic affairs, sometimes leading to the demise of many marriages as vendors pursued their business goals or simply operated their business below optimum capacity to keep both ends functional. Therefore, avoiding the social stigma associated with divorce, or single parenting may have influenced the responses on marital status. Many of the vendors indicated employing non-family members, which speaks to the fact that it is not a family run business but one done for profit maximization. Most vendors got involved in the business due to a lack of other gainful employment. A few however mentioned that they inherited the skills from their parents.

Table 3: Number of Food Vendors Using Firewood as a first order fuel for cooking.

Energy type	% of users(N=200)
Firewood	56.5%
Charcoal	34%
Kerosene	5%
Gas (LPG)	7%
Total	(100%)

Source: Field data, 2015.

Findings indicate over 56% of vendors are heavily reliant on firewood as a primary cooking fuel and are significant consumers of firewood (Table 3). A further 34% of food vendors had a preference for charcoal over firewood instead. Although past findings on energy use by urban commercial groups (Ayoub, 1988; Kersten *et al*, 1998) indicate a significant use of wood (90%), data for food vendors was not disaggregated. More than half of the vendors surveyed admitted to using firewood as a first order fuel for cooking but found other fuels as more handy for quick heating of left overs or small quantities of food.

2. Pattern of Vendor Firewood Consumption (Daily/Monthly)

From the firewood weighing done in the field, there was considerable variation in pattern of use, in frequency, volume and expenditure for food vendors across the five local governments (Figure 2, Figure 3). Findings indicate that the mean monthly range of

firewood consumed ranged from 28kg to over 1700kg. This was found to be higher than estimated by Gbadegesin and Olorunfemi (2011). The mean daily consumption was found to be 81kg. Most vendors cooked at least once a day from Monday to Saturday leaving out Sunday. Many vendors chose firewood due to speed in cooking large meals and its affordability. Food vendors' energy use pattern supports the energy ladder hypothesis. Majority of food vendors (56.5%) used firewood ranging in volumes from 7kg to 448kg weekly. In terms of spread, the SE area had the largest number of sampled users, while the North consumed the highest volume of fuelwood of all the areas. More than 80% of respondents used below 100kg in a week while heavy users consuming about 400kg weekly were found in the N, NW and SE.

From figure 4, findings reveal the average daily

expenditure varies across location. The Ibadan North has the few (3%) larger spenders (above 60,000naira every month) and these heavy users represented by larger circles, are clustered in hubs around educational centers and business districts. Another dimension explored was the food vendors' energy fuel preference which can be seen as a predictor of future fuel consumption trajectories and is identified by the user's indicated choice if all impediments to access were removed. For this study, results found that the most preferred fuel by food vendors is overwhelmingly gas (74%) while charcoal is surprisingly preferred over firewood due to the laborious nature of starting a fire (Figure 5). Kerosene was however not particularly preferred in spite of its availability and affordability as some complained of taste of food cooked with it was not as flavored as firewood cooked food.

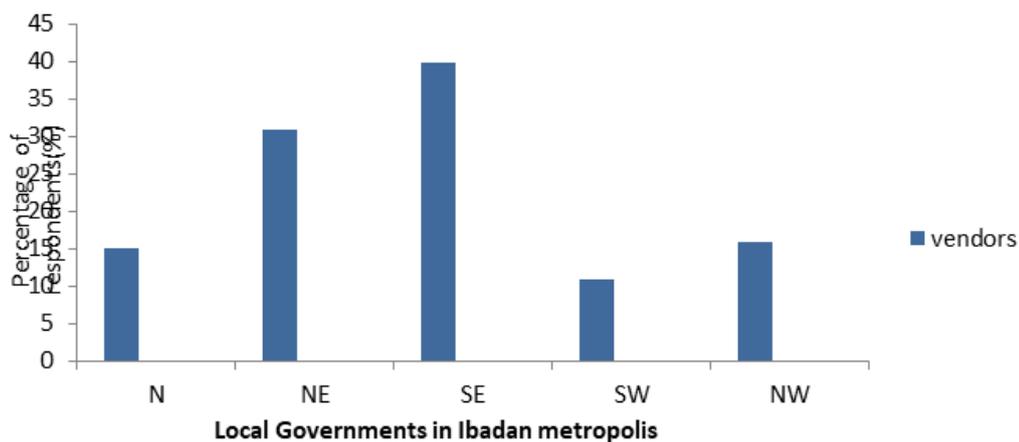


Figure 2: Number of sampled first order firewood users comparatively across LGAs

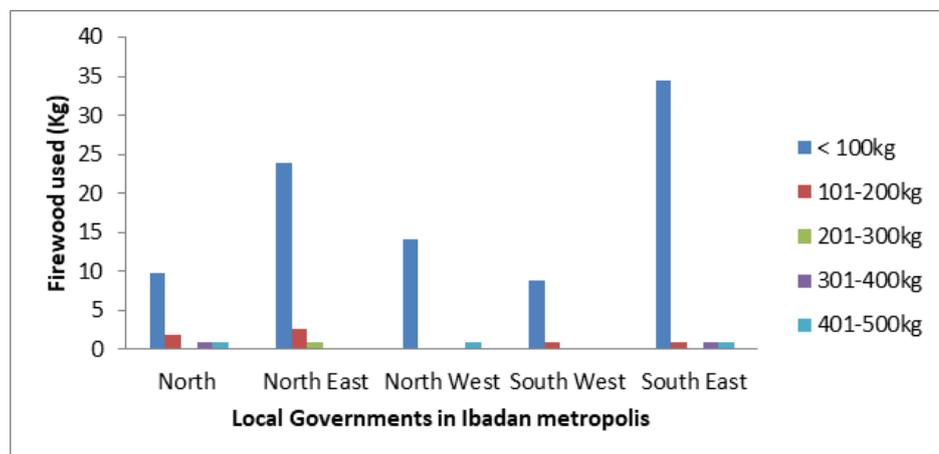


Figure 3: Volume of Ave. daily firewood used comparatively across LGAs.
 **Consumption range: Highest = 44k8g, Lowest = 7kg. Mean (84.14±103.0)

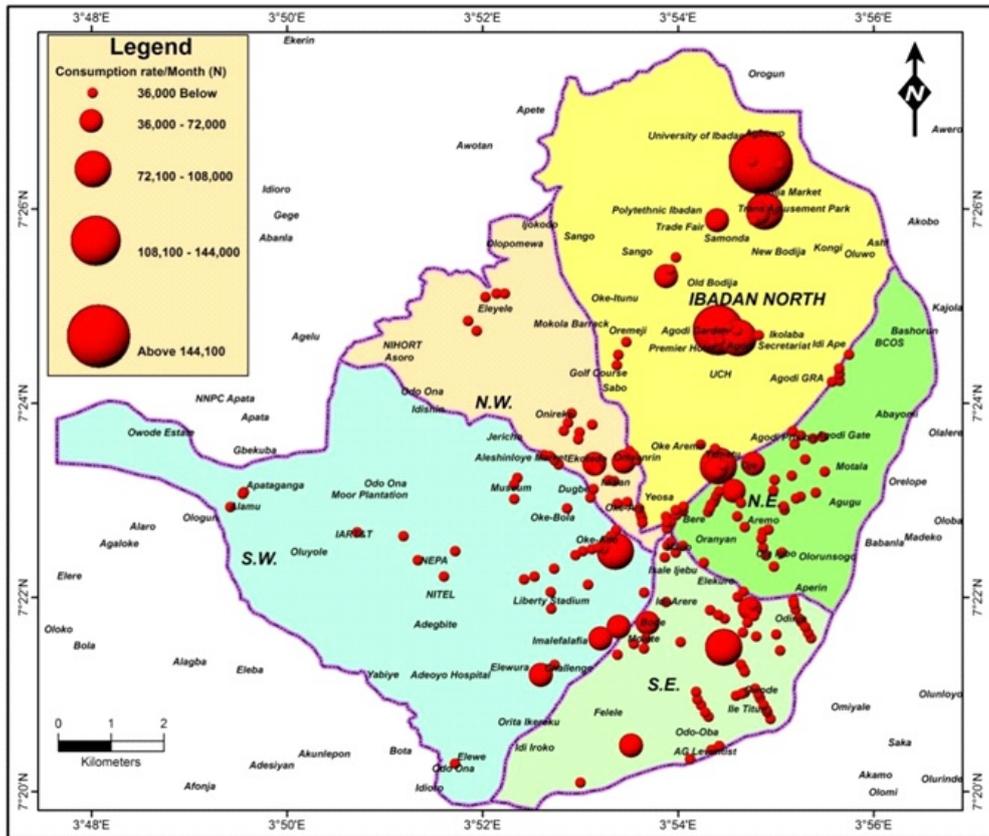


Figure 4: Ave. daily expenditure on firewood used comparatively across LGAs (Exchange rate of \$1 to N237 as at July 2015)

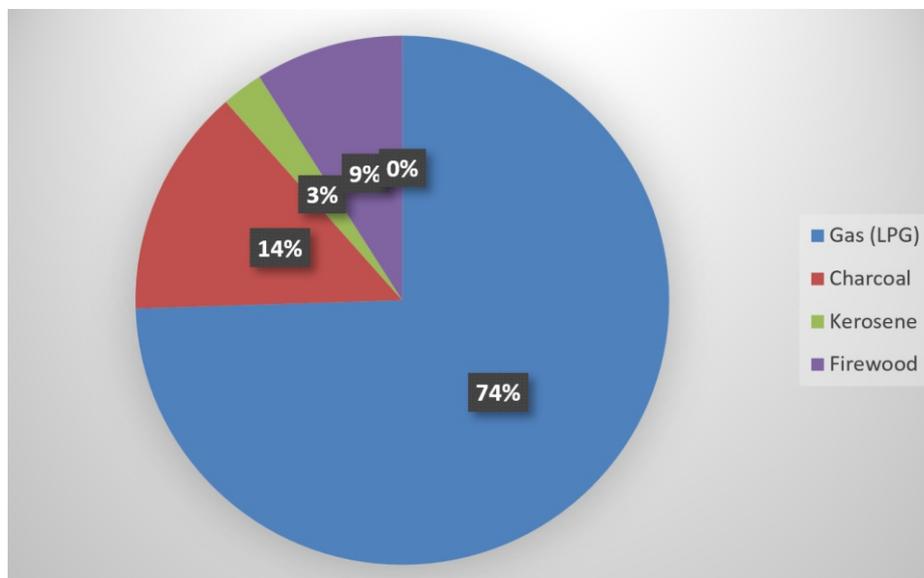


Figure 5: Surveyed Food Vendors' Cooking Energy Preference

A multiple regression was conducted to show if consumption levels of fuelwood could be predicted by socio-economic characteristics (vendor sex, age, marital status, level of education, number of years in business, number of workers Table 4). The multiple R was 0.64 which indicated a positive relationship between the independent variables and

consumption. All the socio-economic variables were first of all used for the analysis to assess their contribution and most of the variables selected gave p-values bigger than 0.05. Some variables were removed (marital status, level of education) and the analysis run again (Table 5). Results showed the multiple R as 0.67 indicating a positive relationship

Table 4: Multiple Regression Analysis between Number of years, Number of workers and Consumption

<i>Regression Statistics</i>		F	Significance F	df
Multiple R	0.649849	40.57117	6.34E-14	2
R Square	0.422303			111
Adjusted R Square	0.40809			113
Standard Error	101.7637			
Observations	113			

Table 5: Regression model coefficient of socioeconomic variables of food vendors predicting consumption levels

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Vendor Sex	-2.03562	24.57939	-0.08282	0.934148	-50.7512	46.67993	-50.7512	46.67993
No of Workers	12.54174	11.49843	1.090735	0.277795	-10.2478	35.33126	-10.2478	35.33126
No of years in business	26.02616	8.321546	3.127563	0.002261	9.533126	42.51919	9.533126	42.51919
Age	-0.25042	0.824394	-0.30376	0.761891	-1.88434	1.383504	-1.88434	1.383504

between the independent variables and consumption ($R^2=.42$, $F(2,113) = 6.34E-14$, $p\text{-value} > 0.05$). The main variable from the analysis that had significance for how much firewood a vendor consumed was the number of years a vendor had spent in the business ($p > 0.01$). The result was statistically significant at 0.05 significance level.

Discussion

Implications of Firewood Consumption

The issue of vendors being almost exclusively dependent on firewood is further exacerbated by the increasing number of food vendors participating in the informal economy (Tedd *et al* 2001) as a result of a high number of working-class people feeding away from home which is a reflection of the urbanized setting of the area (Tinker 1997). The findings of this study highlight certain environmental and social implications of continued harvest and consumption of firewood within Oyo state. One is that stronger advocacy efforts would be needed to encourage vendors to patronize modern fuels, as there will likely be a continued cultural inducement towards firewood regardless of income as some vendors insisted on the overriding choice of firewood as the only logical fuel choice in the preparation of large sized meals especially to acquire the favored taste that comes from cooking over firewood. This is similar to other studies that suggest the place of cultural affinity in fuel choices (Axelson 1986; Stoppok 2018; Nuno-Martinez 2020; Mazzone *et al* 2021). The increased wood removal overtime

naturally reduces tree cover and therefore may likely intensify heat islands within and outside the city as temperature increases. As more trees are being cut for firewood production, the land cover is being depleted leading to more soil exposures and therefore a higher tendency for erosion and soil infertility to develop. Although more studies point out that firewood extraction and intensification is not closely associated with heavy deforestation (Geist and Lambin 2002), it does portend serious implications for the continued availability of forest products as Non-Timber Forest Products (NTFPs) which act as safety nets for local livelihoods within the area. More wood removals and firewood production are likely to exacerbate Climate Change due to the increased release of greenhouse gases (GHGs) as more trees are processed into wood. On the long run, sustained removals are practically unsustainable as forest resources dwindle.

Other notable implications for the local firewood users (vendors) themselves revolve around their health as studies are replete with evidence on the negative import on human health of which many are oblivious of (Piabuo and Puatwoe 2020; Adjei-Mantey *et al* 2022). This study underscores the need for suitable and sustainable alternatives to firewood to be sought and promoted to food vendors as acceptable substitutes. More policies need to be made promoting such alternatives alongside new technologies while increasing enlightenment on energy use for the public.

Conclusion

The study's findings clearly point to an overwhelming firewood use within the city while energy use preference remains gas. Policymakers need therefore to engage more advocacy and enlightenment of food vendors on the need for them to shift from firewood to other acceptable and still affordable modern fuels. This will entail more interventions to draw fuel demand towards modern fuels inspite of its higher costs as alternatives to firewood. More research can be done on how to get better substitutes or reduce

volume of waste in firewood production to ultimately cut back on firewood quantities consumed.

Limitations of the work was based on available funds and time leading to a sample size of 200. For more elaborate research, more explorations can be done on investigating a wider group of commercial users to generate more insights into firewood consumption in Oyo state.

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APPENDIX A



Plate 1: Food vendors' use and temporary storage of fuelwood in piles at Ode- Aje, SE Ibadan.

Source: Author's Analysis, September 2015