

Assessment of the Rate and Pattern of Household Cooking Energy Consumption in Yobe State, Nigeria

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Abstract

This study assesses the rate and pattern of household cooking energy consumption in Yobe State, Nigeria, focusing on fuel types, usage intensity, and associated socioeconomic characteristics. A descriptive survey design was employed, with primary data collected from 346 household heads using structured questionnaires across selected settlements in three agro-ecological zones. Data were analysed using frequency distributions and percentages. The results reveal a strong reliance on biomass fuels, with 79.5% of households using fuelwood and 11.9% using charcoal, whilst adoption of cleaner energy sources such as liquefied petroleum gas (LPG) and kerosene remains low. Fuel stacking is common, with households combining multiple energy sources based on cost and availability. Approximately 71% of households use fuelwood three times daily, with an estimated annual consumption of 648 kg per annum per head, amounting to over 2.26 million tons statewide. The study concludes that household energy use in Yobe State is largely unsustainable, driven by poverty, infrastructure deficits, and limited access to modern energy alternatives, with significant environmental implications. It recommends policies promoting affordable clean energy, improved rural energy infrastructure, and awareness of alternative cooking fuels.

Keywords: Household Cooking Energy; Biomass Fuel Consumption; Fuelwood Dependence; Semi-Arid Nigeria; Yobe State; Fuel Stacking.

Introduction

Energy is a fundamental requirement for household survival, particularly for cooking. In Nigeria, the household sector accounts for a significant proportion of total energy consumption, with biomass dominating energy use (Gujba et al., 2015). Over 80% of household energy consumption in Nigeria is derived from biomass sources broadly defined, while estimates specific to cooking energy indicate that approximately 90% of cooking fuel is derived from firewood, charcoal, and agricultural residues (Nnaji et al., 2015; National Bureau of Statistics, 2024). These two figures reflect different denominators total household energy versus cooking energy specifically and are not contradictory. Household energy consumption is a critical component of socio-economic development, especially in developing countries like Nigeria, where cooking is the dominant energy-consuming activity. This heavy reliance on traditional fuels has significant implications for environmental sustainability, public health, and climate change. Yobe State, located in the

semi-arid region of northeastern Nigeria, faces increasing energy challenges due to climate change, poverty, and limited access to modern energy infrastructure. As a result, households rely heavily on traditional cooking fuels, contributing to deforestation and environmental degradation.

The consequences of anthropogenic climate change are not confined to any single region but extend across Nigeria, Africa, and the world at large, affecting economic systems, ecological biodiversity, human society, and political structures (Intergovernmental Panel on Climate Change, 2022). Manifestations include increased frequency and intensity of droughts, heatwaves, precipitation anomalies, and extreme events such as floods, hurricanes, desertification, storms, and wildfires, all attributable in significant part to human activity. In Yobe State, the widespread harvesting of trees for household fuelwood represents a direct anthropogenic driver of vegetation loss and climate change vulnerability. The state is characterised by rural settlements and low-income households, making traditional fuels the primary source of cooking energy. These conditions significantly influence energy consumption patterns, as households depend largely on locally available biomass resources (Naibbi & Healey, 2014). The increasing demand for fuelwood contributes to deforestation, desertification, and environmental degradation in the region. The reliance on biomass has significant implications for environmental sustainability, health, and climate change. Studies of household energy consumption in Nigeria show that traditional fuels dominate cooking energy use. About 74.24% of households depend on biomass energy, while only 25.76% use modern energy sources such as Liquefied Petroleum Gas (LPG) and electricity. Firewood remains the most widely used fuel due to affordability and availability (Bisu et al., 2016; Abubakar et al., 2024).

In terms of cooking energy use, household energy consumption often involves multiple fuels. In northern Nigeria, households combine firewood, charcoal, kerosene, and LPG depending on availability and cost. Evidence from comparable semi-arid contexts in northern Nigeria suggests that a substantial proportion of households use multiple energy sources simultaneously, while a majority rely primarily on fuelwood as their principal cooking fuel (Bisu, et al., 2016). Several contextual characteristics shape cooking energy choices in Yobe State, including income level, household size, education, urban-rural location, and fuel availability. Low-income households tend to rely on biomass, while households with higher incomes are more likely to adopt cleaner fuels such as LPG (Heltberg, 2005). Household energy consumption patterns in Nigeria are characterised by fuel stacking, where multiple energy sources are used simultaneously, and households often combine fuelwood, charcoal, kerosene, and LPG depending on availability and cost (Masera et al., 2000). This pattern indicates a gradual but slow transition toward cleaner energy.

Several contextual characteristics influence household energy choices, including income level, household size, education, and fuel availability (Heltberg, 2005). Low-income households tend to rely on biomass fuels due to cost constraints, while higher-income

households are more likely to adopt cleaner energy sources such as LPG (Danlami et al., 2018). Education also plays a role, as households with higher literacy levels tend to demonstrate greater awareness of the health and environmental risks associated with biomass fuels (Martins et al., 2018). Despite this growing body of literature on household energy consumption in Nigeria, zone-specific empirical data on fuel type, usage rate, and volumetric consumption in Yobe State remain absent from the published literature. No peer-reviewed study has systematically documented cooking energy patterns disaggregated across the three agro-ecological zones of the state. This study addresses that gap by providing primary data on household cooking energy consumption rates and patterns in Yobe State, generating a locally grounded evidence base for energy policy and planning in this semi-arid, climatically vulnerable region.

Statement of the Problem

Despite the well-documented dominance of biomass fuels in Nigerian households, detailed empirical data on the rate and spatial pattern of household cooking energy consumption specific to Yobe State remain scarce. Existing national-level studies and surveys do not adequately capture the zone-specific variations in fuel type, frequency of use, and volumetric consumption that are essential for designing targeted energy interventions in semi-arid northeastern Nigeria. The absence of such localized evidence means that energy policymakers, environmental planners, and development agencies operating in Yobe State lack a reliable empirical foundation upon which to base clean energy transition strategies. Furthermore, the environmental consequences of unchecked biomass dependence including accelerated deforestation, desertification, and greenhouse gas emissions continue to intensify without adequate data to quantify their scale at the state level. This study addresses this gap by providing primary, agro-ecological zone-disaggregated data on household cooking energy consumption patterns and rates across Yobe State, thereby generating the evidence base necessary for evidence-informed energy policy and planning in this climatically vulnerable region.

Research Questions

This study is guided by the following three research questions:

RQ1: What are the dominant patterns of household cooking energy consumption in Yobe State, in terms of fuel types used and frequency of use across the three agro-ecological zones?

RQ2: What is the rate of household fuelwood consumption in Yobe State, and what is the estimated annual volumetric consumption at the individual and statewide levels?

RQ3: What socioeconomic characteristics are associated with household cooking energy choices in Yobe State, and how do these vary across the agro-ecological zones?

Theoretical and Conceptual Framework

This study is informed by two complementary theoretical frameworks: the Energy Ladder Model and the Multiple Fuel Use (Fuel Stacking) Framework. The Energy Ladder Model, developed by Hosier and Dowd (1987) and subsequently refined by Leach (1992), posits that as household income rises, households progressively transition from traditional, low-efficiency fuels such as firewood and charcoal to cleaner, higher-efficiency fuels such as kerosene, LPG, and electricity. This linear transition is conceptualized as an ascending ladder of fuel modernity, with fuel choice serving as a proxy for socioeconomic status and energy access. The model provides a useful heuristic for understanding why low-income households in semi-arid regions such as Yobe State remain concentrated at the lower rungs of the energy ladder, relying on locally available and low-cost biomass. However, empirical evidence from sub-Saharan Africa has consistently demonstrated that the energy ladder model oversimplifies household energy behaviour. In practice, households do not neatly abandon lower-rung fuels as income rises; rather, they engage in fuel stacking the simultaneous use of multiple fuel types depending on availability, cost, and cooking purpose. The Multiple Fuel Use Framework, advanced by Heltberg (2005) and supported by Bisu et al. (2016), better captures this reality by recognizing that household energy choice is not a single transition but an ongoing, contextually determined combination of fuels. This framework underpins the study's focus on the coexistence of fuelwood, charcoal, kerosene, and LPG within Yobe State households, and its attention to the socioeconomic and geographic factors that shape this coexistence across the three agro-ecological zones.

Materials and Methods

Study Area

Yobe State is located in northeastern Nigeria between latitudes 10°05'N and 13°23'N and longitudes 10°35'E and 12°30'E. It covers an area of approximately 45,750 km² and has a projected population of about 4.35 million (National Population Commission (NPC), 2023; National Space Research and Development (NASRDA), 2010; & Office of the Surveyor General of the Federation (OSGOF), 2007). The State has a population density of 79.77/km² and lies mainly in the dry savannah belt, or rather in the Sahel. It has a semi-arid climate type (Bsh), (Koppen, 1958), in which the Sudan-Sahel ecological zone experiences a semi-arid climate characterized by low rainfall and high temperatures (Ayoade, 2004). These environmental conditions influence the availability of biomass resources used for cooking. It consists mainly of rural communities engaged in agriculture. The semi-arid climate and vegetation influence the availability of biomass resources used as cooking fuel. It shares a border to the north with the Niger Republic, to the East with Borno State, to the west with Jigawa and Bauchi States, and to the South with Gombe and Borno States (Orounye, 2009). It's Hot and dry for most of the year, except in the southern part where the climate is milder. Being situated in a tropical environment, it experiences high temperatures. This makes climatic interest centered on rainfall rather than on temperature, and consists mainly of

rural communities engaged in agriculture. The semi-arid climate and vegetation influence the availability of biomass resources used as cooking fuel (Figure 1). The study area is stratified into Agro-ecological zones (AEZ).

Data Sources

The required data were obtained quantitatively, about the rate and pattern of household cooking energy consumption, from the heads of households.

Data Collection

Field observations were conducted during the dry and rainy seasons to record the rate and pattern of household cooking energy consumption carried out in each season. These include income level, household size, education, urban-rural location, fuel availability, and the participants' prevailing social behavior and economic trends. The study adopts a descriptive survey design. Data were collected using structured questionnaires, administered to heads of households. Secondary data from the Nigeria Demographic and Health Survey (NDHS) (2020) and the National Bureau of Statistics (NBS), as well as published journal articles and government reports, were also utilized.

Sampling Size and Technique

The population of this study comprises the household heads of the selected settlements from the Local Government Areas (LGAs) in Yobe State. The State has a projected total population of approximately 4,350,401 (National Population Commission, 2023), distributed across 17 LGAs. Table 1 shows the agro-ecological zones, settlement types, sampled settlements, household heads, and percentages per settlement. Krejcie and Morgan's (1970) sampling table was used to derive a sample of 346 households from the enumerated population of the sampled settlements. The samples were subsequently distributed proportionately across the sampled household heads.

The multi-stage sampling technique was employed for this study, based on income, neighborhood, and heterogeneity of the sampled fuelwood across the agro-ecological zones of the study area. In this regard, 17 LGAs (Bade, Bursari, Damaturu, Geidam, Gujba, Gulani, Fika, Fune, Jakusko, Karasuwa, Machina, Nangere, Nguru, Potiskum, Tarmuwa, Yunusari, and Yusufari) are involved in fuelwood consumption.

Location of the Study Area and Sample Communities within AEZs.

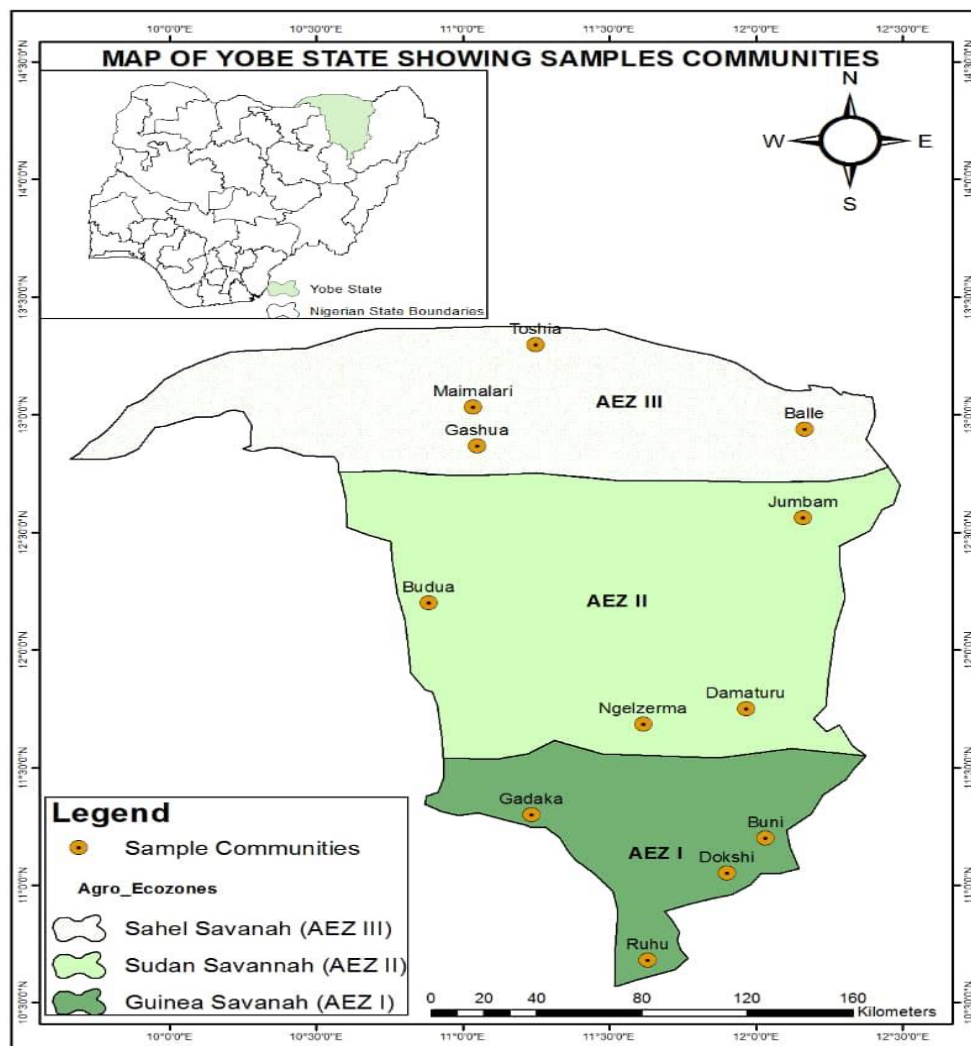


Figure 1.

Source: Author's, 2026

Table 1:

AEZS, Settlement types, Sample settlements, Sample HH Head, and percentages per settlement.

Agroecological Zones (AEZ)	Settlement types	Sampled settlement	Sampled Household Heads	Percentage per settlement
AEZ I	Urban	Buni-yadi	38	11.0
	Semi-urban	Gadaka	32	9.2
	Rural (Agrarian)	Dokshi	34	9.8
	Pasto-agrarian	Ruhu	16	4.6
AEZ II	Urban	Damaturu	70	20.2
	Semi-urban	Ngelzarma	22	6.4

Agroecological Zones (AEZ)	Settlement types	Sampled settlement	Sampled Household Heads	Percentage per settlement
AEZ III	Rural (Agrarian)	Njumbam	16	4.6
	Pasto-agrarian	Buduwa	07	2.0
	Urban	Gashua	66	19.1
	Semi-urban	Toshia	16	4.6
	Rural (Agrarian)	Balle	19	5.5
	Pasto-agrarians)	Maimalari	10	2.9
Total		12	346	100

Source: Author's Analysis, 2026.

From the 17 LGAs, 12 settlements (AEZ I - Buni-yadi, Gadaka, Dokshi and Ruhu; AEZ II - Damaturu, Ngelzarma, Njumbam, Buduwa; and AEZ III - Gashua, Toshia, Balle, and Maimalari) were purposively selected on the basis of their documented reliance on fuelwood as the primary household cooking fuel, as identified through preliminary consultations with local government energy officers and agricultural extension workers in the study area.

Data Analysis

Frequency tabulations and percentages were used to analyze data about the rate of fuelwood consumption, types of fuel used, and Socio-economic influences in selected LGAs.

Ethical Consideration

Institutional clearance and approval were obtained from the Yobe State Ministry of Agriculture and Natural Resources research ethics committee. Also, local permission from the selected Local Government authorities/community leaders was secured. Hence, participants were informed of the study's purpose, their rights, and the confidentiality of their responses before the questionnaire administration. For confidentiality, all responses (data) were anonymous, protecting participants' identities.

Results

The Pattern of Household Cooking Energy Consumption

The pattern of household cooking energy consumption and the results are presented in Table 2. It was observed against the 'pattern of domestic household energy usage' where about 80% of households rely on fuelwood, while 12% use charcoal. A similar trend was observed in the aspects of 'Energy Used for Domestic Household Cooking Only' and 'socioeconomic characteristics associated with energy choice'.

Table 2:

Pattern of Household Cooking Energy Consumption by Item and Energy Type in Yobe State

Item	Energy Type	Frequency	Percentage (%)
Pattern of Domestic Household Energy Usage	Kerosine	9	2.6
	LPG	13	3.76
	Fuelwood	275	79.5
	Charcoal	41	11.9
	Electric Stove	1	0.3
	Gas Cooker	1	0.3
	Electricity	1	0.3
	Electric	1	0.3
	Hot Plate	1	0.3
	Stock (Kara)	1	0.3
	Cow Dump	1	0.3
	Electrical energy	1	0.3
	Total	346	100
Energy Used for Domestic Household Cooking Only	Fuelwood	182	52.2
	Charcoal	62	18.0
	Fuelwood & Charcoal	55	16.1
	LPG	25	7.3
	Kerosene	7	2.0
	Others	6	1.7
	Missing	11	3
	Total	346	100
Energy Source Used (as Proxy for Socioeconomic Context of Energy Choice)	Fuelwood	128	36.2
	Fossil Fuels	83	24.0
	Pearl Millet Briquette	89	25.8
	Electric Hot Plate	18	4.9
	Gas	16	5.1
	LPG	15	4.0
	Total	346	100

Source: Author's Analysis, 2026.

This outcome confirms the dominance of biomass energy consumption patterns in all households, encompassing cooking, space warming, and ironing. This aligns with findings by Masera et al., 2000 and Kumar et al. (2015), who reported similar patterns in developing countries. The household pattern of cooking energy is heavily skewed toward fuelwood (79.5%), indicating a high level of biomass dependence that, if sustained, may contribute to fuel scarcity and accelerated vegetation loss across the study area. Overall, the data show that nearly 92% of households depend on biomass (fuelwood and charcoal combined), while only approximately 11% use cleaner energy sources such as LPG and kerosene.

The third panel of Table 2 records the energy sources used by households in a context of socioeconomic variation; it should be noted that "Pearl Millet Briquette" in this panel refers to an energy source used by some respondents, not a socioeconomic factor per se. The dominance of fuelwood and fossil fuels in this panel reflects the constrained energy choices available to low-income households in Yobe State. These socioeconomic patterns are consistent with the broader literature: Heltberg (2005) established that low-income households are more likely to rely on traditional fuels due to economic constraints, while Heltberg (2005) found that income level is associated with energy source choice, with higher-income households more likely to use cleaner fuels such as LPG. Therefore, findings revealed that low adoption of modern energy sources is attributed to poverty. Likewise, Kumar et al. (2015) observed that wood-based fuels dominate household energy consumption due to their affordability and accessibility. The continued reliance on traditional fuels is also evident in other regions, particularly in sub-Saharan Africa, where fuelwood and charcoal are widely used despite their environmental and health implications (International Energy Agency, 2022; Food and Agriculture Organization, 2021). This suggests that Yobe State reflects a broader regional trend. The implication of this high dependence is significant, as it contributes to increased carbon emissions and environmental degradation. According to Flammini et al. (2023), biomass energy use is a major contributor to greenhouse gas emissions in developing countries. Income level is associated with energy source choice, with higher-income households more likely to adopt cleaner fuels such as LPG (Heltberg, 2005). This corroborates the findings of this study: low adoption of modern energy sources is attributed to poverty and limited access.

The Rate of Household Cooking Energy Consumption

The rate of household cooking energy consumption reveals the fuelwood commonly used by households (Table 3), where specific tree species dominate fuelwood consumption. The dominance of *Balanites aegyptiaca* (32.7%) is attributed to its wide availability across the agroecological zones. This finding is consistent with Audu et al. (2023), who reported that this species is widely used in northern Nigeria due to its high fuel value. Similarly, Dadile and Sotannde (2020) noted that fuelwood selection is influenced by fuel efficiency, availability, and cultural preferences. These findings suggest that environmental and ecological factors play a key role in shaping household energy choices. The most commonly used species include *Balanites aegyptiaca* and *Ziziphus mauritiana*, due to their availability and efficiency, which aligns with the findings of Audu et al. (2023) and Dadile & Sotannde (2020).

Concerning the frequency of fuelwood usage, the data showed that about 71% of households use fuelwood three times daily, indicating a high level of dependence. This is consistent with findings by Matavel et al. (2023), who observed similar usage patterns in East Africa. Frequent use increases overall fuelwood demand, thereby accelerating

deforestation and environmental degradation. According to Naibbi and Healey (2014), such practices significantly contribute to desertification in semi-arid regions like Yobe State. The frequency and volume of consumption, by a population of 4,350,401 in the study area. As shown in Table 3, the “per year per head” row records a metric value of 648 kg, which represents 92% of the total annual fuelwood metric tonnage (704.4 kg) derived by summing consumption across per-meal, per-day, per-month, and per-year units. This 92% figure therefore reflects the proportional share of annual (yearly aggregate) consumption within the total measurement framework used, and not a separate survey statistic. Applying this annual per capita figure of 648 kg to the state’s estimated population of 4,350,401 yields a statewide annual fuelwood consumption estimate of approximately 2,260,886 metric tons. This finding is consistent with Khan et al, (2024), who reported high fuelwood consumption in mountainous regions, though the semi-arid context of Yobe State drives consumption through scarcity of alternative fuels rather than altitude-related isolation. The high consumption rate underscores the unsustainable nature of current energy practices and the urgency of transitioning households toward cleaner alternatives.

Table 3:

Rate of Household Cooking Energy Consumption by Item and Energy Type in Yobe State

Item	Fuelwood Type/Usage	Frequency	Percentage (%)
Types of Fuelwoods Consumed	Balanites aegyptiaca (Aduwa)	113	32.7
	Ziziphus Mauritiana (Magarya)	65	18.8
	Piliostigma reticulata (Kargo)	53	15.3
	Prosopis africana (Marke)	49	14.2
	Albizia chevalieri (Kirya)	35	10.1
	Others	20	5.8
	Missing	11	3.2
	Total	346	100
Frequency of Fuelwood Use	Once daily	17	4.9
	Twice daily	65	18.9
	Three times daily	244	70.5
	Occasionally	9	2.6
	Not used	11	3.2
	Total	346	100
Frequency and Volume of Consumption	Metric Value	Kg	%
	Per meal per head	0.6	0.1
	Per day per head	1.8	0.26
	Per month per head	54	7.7

Item	Fuelwood Type/Usage	Frequency	Percentage (%)
	Per year per head	648	92.0
	Total	704.4	100

Source: Author's Analysis, 2026.

Discussion

The findings of this study confirm that household cooking energy in Yobe State is overwhelmingly dominated by biomass, with 79.5% of households relying on fuelwood as their primary fuel. This figure is broadly consistent with national-level estimates for northern Nigeria (Nnaji, et al., 2015; Bisu, et al., 2016) and with comparable semi-arid contexts across the Sahel, suggesting that Yobe State is not an outlier but rather a representative case of entrenched biomass dependence in low-income, resource-constrained settings. The Multiple Fuel Use Framework is evidently operative: the coexistence of fuelwood, charcoal, kerosene, and LPG across households confirms that energy transitions in the state are not linear but characterized by fuel stacking, wherein households maintain access to multiple fuel sources and select among them based on availability, cost, and cooking purpose (Heltberg, 2005). This pattern has important policy implications, as it suggests that promotion of cleaner fuels need not require complete substitution but can focus on incentivising the upward shift in the fuel mix.

Comparative analysis across the three agro-ecological zones reveals meaningful variation in energy consumption patterns. In AEZ I (southern zone: Buni-yadi, Gadaka, Dokshi, Ruhu), the mix of urban, semi-urban, and pasto-agrarian settlements corresponds to relatively greater diversity in fuel sources, with a higher proportion of semi-urban households reporting access to charcoal and occasional LPG use. In AEZ II (central zone: Damaturu, Ngelzarma, Njumbam, Buduwa), the dominance of Damaturu as the state capital introduces an urban energy dynamic with greater market access to LPG and kerosene, though fuelwood remains dominant even in this zone. AEZ III (northern zone: Gashua, Toshia, Balle, Maimalari), the most arid and remote of the three zones, exhibits the highest rates of exclusive fuelwood dependence, consistent with the reduced availability of alternative fuels in more isolated settlements. These zonal differences underscore the need for spatially differentiated energy policy responses rather than uniform state-level interventions, and they represent the primary knowledge contribution of this study over existing national-level surveys that do not capture intra-state spatial variation in Yobe.

The estimated annual per capita fuelwood consumption of 648 kg, aggregating to approximately 2.26 million tons statewide, points to an alarming rate of biomass extraction that the semi-arid vegetation of Yobe State is unlikely to sustain. This is consistent with Naibbi and Healey (2014), who documented accelerating desertification in Yobe State partly attributable to fuelwood harvesting pressure. The dominance of *Balanites aegyptiaca* and *Ziziphus mauritiana* as preferred fuelwood species further suggests that consumption is increasingly focused on drought-resistant species that are otherwise

ecologically important for dryland agroforestry and food security, raising additional environmental concerns beyond deforestation alone. Together, the findings reaffirm the urgency of transitioning Yobe State households toward accessible and affordable clean energy alternatives, particularly biomass briquettes from agricultural residues, which present a locally producible and lower-emission substitute for raw fuelwood.

Conclusion

Household cooking energy consumption in Yobe State is overwhelmingly dependent on biomass fuels, with widespread fuel stacking and limited transition to cleaner energy sources. Despite the availability of modern energy alternatives, adoption remains low due to poverty, infrastructure deficits, and the limited affordability of LPG and kerosene in rural and peri-urban settlements. The environmental implications of this sustained dependence are substantial: heavy reliance on fuelwood contributes to accelerated deforestation, desertification, and elevated greenhouse gas emissions in an already climatically vulnerable semi-arid region. These findings are consistent with broader patterns documented across northern Nigeria and the Sahel, and they provide a zone-specific empirical foundation for evidence-based energy policy in Yobe State.

This study is subject to several limitations that should be acknowledged when interpreting the findings. First, the cross-sectional survey design captures a snapshot of household energy consumption at the time of data collection and may not reflect seasonal variation in fuel use, even though dry and rainy season observations were conducted. Second, consumption data are based on self-reported estimates provided by household heads, which are subject to recall bias and social desirability effects; laboratory-based measurement of actual fuel consumption would yield more precise volumetric estimates. Third, the analysis is limited to descriptive statistics (frequency distributions and percentages), which describe patterns and rates but do not permit causal inference or the statistical testing of associations between socioeconomic characteristics and energy choice. Fourth, the sample was restricted to household heads, who may not fully represent the energy decision-making dynamics of all household members, particularly women who typically manage cooking. These limitations point to the need for longitudinal, mixed-methods follow-up research incorporating inferential analysis in future work on household energy consumption in Yobe State.

Recommendations

Based on the findings of this work, it was recommended that:

1. Federal and state governments should integrate Yobe State's household energy profile into national clean energy policy, specifically by extending LPG subsidy programmes to rural and peri-urban areas, establishing affordable LPG distribution networks in the three agro-ecological zones, and formally recognizing biomass

- briquettes from agricultural residues as a supported clean cooking technology under Nigeria's National Renewable Energy and Energy Efficiency Policy (NREEEP).
2. Private sector actors and development organizations should invest in community-level briquette production units using locally available pearl millet and crop residues, provide microfinance and technical training to small-scale producers, and support public awareness campaigns on the health and environmental risks of prolonged biomass combustion, targeting women and youth as primary agents of household energy decision-making.
 3. Civil society organizations and research institutions should commission longitudinal, zone-specific energy consumption studies incorporating inferential analysis to identify the key socioeconomic predictors of fuel choice in Yobe State, and should work with agricultural extension services to disseminate clean cooking technologies and energy efficiency practices at the community level across all three agro-ecological zones.

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