WORLD BIOENERGY ASSOCIATION

June 2026

WBA White Paper

UGANDA: BIOENERGY PATHWAYS FOR SUSTAINABLE DEVELOPMENT

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WBA White Paper

White papers from the World Bioenergy Association (WBA) offer a comprehensive overview of the bioenergy sector in a specific country or region. It encompasses the latest data on bioenergy development, policy frameworks, financing trends, and insightful case studies.

These papers go beyond conventional reports by adopting a commentary format, presenting a nuanced qualitative analysis coupled with the first-hand experiences of WBA within the respective countries of study. This approach aims to provide a deeper understanding of the unique challenges, successes, and opportunities in each context. It offers a rich perspective that goes beyond mere data points to capture the essence of bioenergy development in different global landscapes.

Disclaimer

Acknowledgements

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Executive Summary

Reaching energy access and clean energy sources for cooking and power are still major challenges for Uganda and have been recognized by the government as a priority to achieve socio-economic development.

Even though Uganda has made progress in power generation and energy capacity in the last decade, the country continues to have one of the lowest electrification and clean cooking rates in sub-Saharan Africa. To date, only 3.8% of Uganda's has access to clean cooking fuels, while only a quarter of the population is connected to the grid for electricity.

More than 92% of the population relies on wood fuel and charcoal for cooking. With a growing population and the highest rate of refugee population in Africa, Uganda is faced with an energy and development crisis that affects health, reinforces gender inequality, and drives environmental degradation.

With major dependence on highly inefficient fuels like woodfire or charcoal, biomass is essential in the country's energy mix. The availability of agricultural residues and organic waste in the country creates a great potential for modern bioenergy technologies to become a timely solution for Uganda's energy challenges.

The recognition of energy as a foundational enabler of socioeconomic development has been translated into actions in policy frameworks like Vision 2040 and its National Development Plans. As part of these pledges, access to clean cooking fuels has also been imperative, prioritized in national plans like the National Energy Policy 20203, and the recently announced National Integrated Clean Cooking Strategy.

This white paper assesses how bioenergy can support clean cooking and energy access in households, public institutions, and humanitarian settings in Uganda, drawing on data, policy review, and selected case examples.

The analysis shows that the continued dependence on traditional biomass for cooking is primarily driven by gaps in efficiency, affordability, and delivery of modern alternatives. Modern bioenergy solutions, such as improved biomass cookstoves, ethanol, or biogas, are already emerging across the country, but at a slow rate. Recent policy developments are starting to signal a stronger commitment to clean cooking with growing private sector engagement. However, implementation remains uneven and constrained by limited financing mechanisms, weak coordination, and affordability barriers for end-users.


Source: Canva

1. Introduction

In its Vision 2040, Uganda aims to transform into a modern and prosperous country. The country has made progress in setting up ambitious plans to develop its extensive energy and mineral resources, to promote socio-economic development, energy access, and lead to a just energy transition. Expanding and modernizing the energy system is central to achieving Uganda's development goals, as energy access underpins economic productivity, public services, and social well-being.

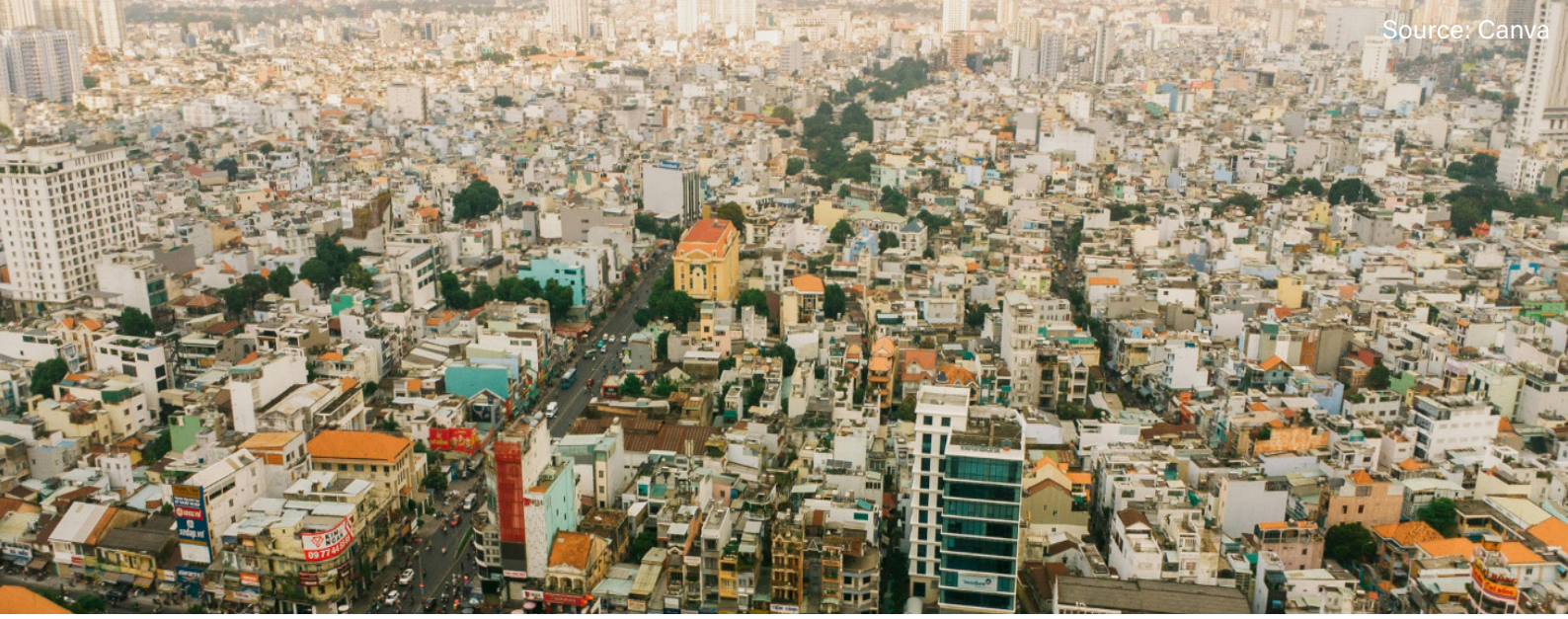
Despite some progress in electricity generation and infrastructure, access to clean, reliable, and affordable energy remains a constant challenge for a large share of the population. Uganda's energy system continues to be dominated by traditional biomass, primarily firewood and charcoal, which together account for approximately 87% of total final energy consumption. More than 90% of households rely on these fuels for cooking, often using inefficient technologies. This reliance has major consequences, including household air pollution, pressure on forests and biodiversity, and reinforcing gender inequalities.

Modern bioenergy is highly relevant in this context. Uganda's existing dependence on biomass, combined with the availability of agricultural residues, organic waste, and established fuel supply practices, creates a strong foundation for a transition towards cleaner and more efficient bioenergy pathways. When sustainably produced and used, bioenergy can improve energy access, reduce health and environmental impacts, support local value chains, and increase energy security. It also offers solutions that can be deployed in settings where grid-based electricity or modern fuels remain difficult to reach, including low-income households, public institutions, and humanitarian contexts.

From a policy perspective, expanding access to clean cooking and modern energy services is closely linked to Uganda's national development priorities and international commitments. Progress in this area directly contributes to Sustainable

Development Goal 7 on access to affordable, reliable, sustainable, and modern energy for all, while also supporting related goals on health, gender equality, climate action, and sustainable land use.

The purpose of this white paper is to examine the role of bioenergy in advancing clean cooking and energy access in Uganda. It focuses on household, institutional, and humanitarian settings, where energy needs are most acute, and where modern bioenergy technologies can be potential solutions. The paper brings together available data, selected case examples, and policy insights to assess current practices, highlight opportunities, and identify key considerations for scaling sustainable bioenergy solutions in support of Uganda's development and climate goals.

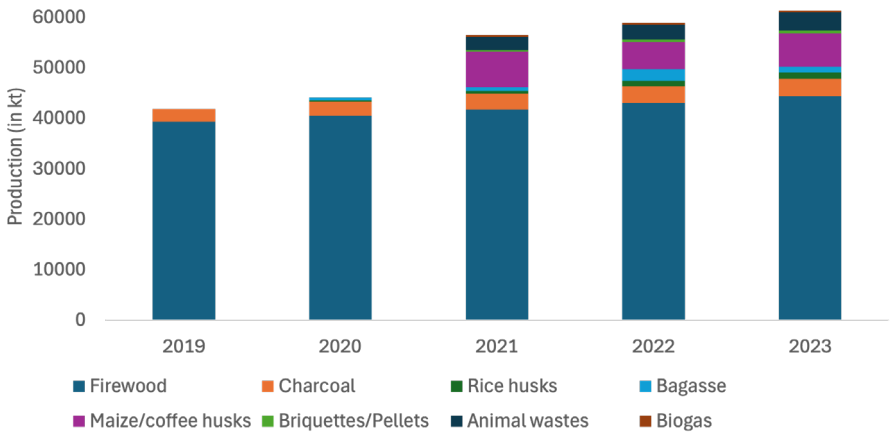

Source: Canva

2. Uganda's Energy Mix

Access to clean and reliable energy remains a major challenge in Uganda. Dependence on inefficient energy sources is high, and a rapid population growth, reaching almost 46 million people in 2024 (UBOS 2024), has continued to put pressure on energy systems and slowed progress towards universal access to modern energy services.

Uganda's energy profile is marked by a significant reliance on biomass, accounting for almost 90% of the country's total primary energy supply (MEMD 2023b). In 2024, households accounted for half of final energy consumption, followed by commercial and public services (28%), industry (12%), and transport (9%) (MEMD 2024). In terms of sources, biomass accounts for 84% of the total energy consumption, mainly targeted at cooking purposes. Oil products such as petrol and diesel account for approximately 13%, while electricity represents only about 3% (ibid.).

Figure 1 **Biofuels production in kT, 2019-2023**
Source: MEMD, 2023



Most of Uganda's electricity comes from renewable sources. In 2024, 6,789 GWh of electricity was generated (up 12% YoY), with hydropower remaining the backbone of the power sector, covering around 84% of electricity generation (MEMD 2024). Overall, renewables represent approximately 92% of installed generation capacity, with hydropower as the main source, followed by cogeneration from bagasse at about 7% and thermal and solar photovoltaic at around 5 and 4%, respectively (ibid).

In terms of biomass usage, the most widely used bioenergy sources include firewood and charcoal, along with agricultural residues such as bagasse, rice husks, maize cobs, and coffee husks, as well as animal waste and municipal organic waste. Total bioenergy production in 2023 was approximately 61,315.13 kT (MEMD 2023b). Firewood accounted for the largest share (72%), followed by charcoal and animal wastes, and a growing contribution from agricultural residues and processed fuels such as briquettes and pellets.

The current use of biomass remains highly inefficient. According to data from the Ministry of Energy and Mineral Development, traditional charcoal kilns operate at an average efficiency of around 30%, meaning that roughly 70% of the original firewood energy is lost during conversion. Similarly, biogas systems currently achieve an average efficiency of about 9.8%, with significant losses during transformation (MEMD 2023b). These figures point to substantial room for improvement through better technologies, improved feedstock management, and more efficient conversion processes.

Overall, Uganda's energy mix reflects both a challenge and an opportunity. On one hand, the reliance on traditional biomass shows the urgency of addressing access to renewable, efficient, and modern fuels. At the same time, the scale and diversity of biomass resources provide a strong basis for transitioning towards more efficient and cleaner bioenergy solutions. However, besides the lack of awareness of the availability of more suitable technologies, the high upfront costs associated with these technologies are a big barrier to investment and adoption of these technologies (MEMD, UNDP 2013).

3. Energy Access

3.1 Power

Uganda has one of the largest populations without access to electricity in Sub-Saharan Africa and one of the lowest electrification rates in the region (IEA 2023). Despite the strong renewable profile in electricity production, electricity access at the household level remains limited. In 2023, around 53% of Ugandan households, or approximately 5.7 million households, had access to electricity, either through the grid (25%) or solar power (28%) (MEMD 2023b). The distribution between urban and rural areas with access to the grid is significant, with around 50% of the urban households having access to the grid, while only 9% of the rural ones do. While nearly 70% of Uganda's population lives in rural areas, the gap in energy access becomes greater as the pace of urbanization increases, making development and energy planning challenging.

Expanding electricity access at the household level in Uganda continues to face major affordability challenges. The IEA's 2023 Policy Review Report indicates that most potential customers find on-grid connection costs too high. Although the government has introduced subsidies to make connections more affordable, the high costs of electrical appliances and electricity use still limit access and discourage private sector investment (IEA 2023).

At the industrial level, 20% of the energy used comes from oil products, and around 64% of the energy comes from biofuels, specifically, solid biofuels in the form of wood fuel (68%) and charcoal (32%) (MEMD 2024). Energy demand is concentrated in a few key industries, including iron and steel, machinery, and food, beverages, and tobacco sectors, where process heat is essential for production.

Field observations from a WBA visit to Uganda in 2023 highlighted both opportunities and challenges within this energy mix. In several sugar mill plants,

large quantities of sugarcane straw were found stockpiled and unused, pointing to a significant underutilized biomass resource that could support industrial energy needs by being converted into pellets, for example. At the same time, the national ban on charcoal production introduced in May 2023 led to sharp price increases and exposed the vulnerability of industries that depend heavily on a single fuel. This was especially evident in food processing industries such as breweries and tea producers, where reliable and affordable process heat is critical.

During the same visit, the WBA documented concrete cases that show both the availability of biomass residues and the structural barriers to using them effectively. The **Busoga Sawmill**, which mainly processes pine and eucalyptus, produces about 7,000 tonnes per year (dry basis) of sawmill residues, but these by-products are only partly used for in-house energy or sold in bags to the beverage industry, with low efficiency because of outdated equipment and manual boilers. The **Bugiri sugar mill**, with a processing capacity of 3,000 tonnes of sugarcane per day and a bagasse share of 30–35%, operates at only 65% of its capacity due to insufficient raw material. The plant has a 5 MW CHP unit and leaves around 25% of its bagasse unused. WBA estimates indicate that this surplus bagasse alone could sustain pellet production of about 40,000 tonnes per year.

3.2 Transport

In 2024, Uganda's transport sector relied entirely on imported oil products for its energy needs, mainly gasoline, diesel oil, and a small share of jet kerosene. Of these imports, the sector consumed 80% of the gasoline and 60% of the diesel. Road transport was the highest consumer, accounting for over 90% of the sector's energy use and about 8% of total national energy consumption.

Under this context, biofuel alternatives like ethanol offer a strategic opportunity to reduce import dependence, mitigating risks from international geopolitical disruptions that could affect fuel availability and prices. Consequently, by July 2025, the Government of Uganda launched the National Biofuels Blending Program, rooted in the Biofuels Act of 2020 that regulates production, storage, and transportation of biofuels and their blending with petroleum products. The biofuels blending program started with a mandatory petrol blending with 5% of locally sourced ethanol (NREP 2025).

Annual production capacity in Uganda is around 78.5 million liters of ethanol and is currently available from local producers like Kakira Sugar Works, Bukona Agro, GM Sugar, and Hoima Sugar (NREP 2025). With the new blending program, production capacity is estimated to increase gradually. Additionally, the Ugandan National Bureau of Standards (UNBS) has developed an ethanol standard for gasoline blending, and as of July 2024, a 1% blend by volume ratio of ethanol into gasoline is mandated (FAO 2025).

3.3 Clean Cooking

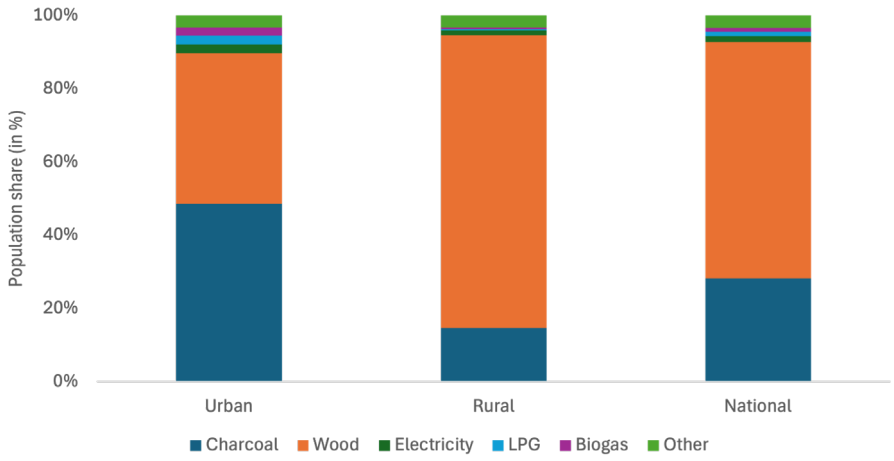
One of the most pressing challenges for Uganda's energy sector is access to modern cooking fuels. Currently, more than 92% of the population relies on traditional biomass, such as wood fuel or charcoal, for cooking purposes. As a result, Uganda ranks among the countries with the lowest clean cooking rates in the sub-Saharan Africa region (IEA 2023).

The widespread dependence on inefficient cooking fuels has far-reaching consequences. This includes, high levels of indoor air pollution, which pose serious respiratory infections and premature deaths affecting more than 20 million Ugandans annually; increased pressure on forests and natural ecosystems, contributing to a deforestation rate of 1.44%, one of the highest in the region; and the reinforcement of gender inequalities, as women and girls are disproportionately affected, with 70% of household members involved in firewood collection are female (both adults and minors) and cooking is generally attributed to woman (IEA 2023).

Despite these impacts, traditional fuels remain the most available and affordable energy source for many households, reflecting persisting socio-economic constraints and infrastructure limitations, particularly in rural areas. Nationally, only 3.8% of Ugandan households have access to clean fuels and modern technology for cooking. In urban and rural areas, the distribution is 6.5% and 1.9%, respectively (UBOS 2024).

Traditional biomass fuels dominate cooking energy use across the country. At the national level, firewood accounts for approximately 65% of household cooking fuel, while charcoal represents 28%. In urban areas, wood and charcoal together account for nearly 80% of cooking energy use, while in rural areas, reliance on firewood alone reaches around 80% (UBOS 2024).

Figure 2 **Distribution of households by cooking fuels in Uganda**
Source: UBOS 2023



Household cooking practices in Uganda remain overwhelmingly dependent on traditional, inefficient, and unsafe technologies. Nationally, nearly 60% of households continue to rely on three-stone stoves and open fires for cooking (UBOS 2024). Most remaining households use solid fuel cookstoves, both traditional and manufactured low-emission variants, with usage concentrated largely in urban areas. By contrast, access to modern cooking solutions, including solar cookers, improved biomass stoves, and electric cooking appliances, remains extremely limited, reaching only a small fraction of the population.

An often-overlooked component of national cooking energy demand is institutional cooking. This includes schools, hospitals, prisons, and other public institutions. While households rely mainly on collected biomass, institutions mainly rely on purchased fuel (IEA 2023). Approximately 80% of institutions rely on firewood and charcoal as their primary cooking energy sources, with nearly 95% reporting that they purchase these fuels (ibid.). Firewood use is nearly universal in schools as well as in police and prison barracks. In the health sector, reliance on biomass remains high, with about 75% of hospitals and other health facilities using firewood, while 13% use charcoal and a further 13% use electricity for cooking (Akumu 2025). As part of its latest submitted Nationally Determined Contributions (NDC), Uganda aims to have at least 50% of schools and other institutions using improved charcoal cookstoves by 2030 (IEA 2023).

3.4 Humanitarian Settings

Uganda hosts the largest refugee population in Africa, with approximately 1.9 million refugees and asylum seekers as of 2025 (UNHCR 2025). Most are settled in refugee settlements spread across 12 districts. Energy access in these areas remains limited for both refugees and host communities, mainly due to weak infrastructure and low household incomes.

For lighting, solar solutions such as pico-PV systems and basic torches are the most common sources of energy. Access to electricity is extremely low, with only 2% of host community households and 1% of refugee households connected to the national grid (IFC 2025). Cooking energy needs are met almost entirely with solid biomass in the form of firewood or charcoal. Firewood accounts for approximately 85% of cooking fuel use, while charcoal accounts for around 14%. Cooking technologies are largely inefficient, with 76% of host households and 46% of refugee households relying on open three-stone fires or simple mud stoves (ibid.). Most households build their own stoves rather than purchasing improved options. As a result, cooking fuels place a heavy burden on household finances, accounting on average for 22% of monthly income, according to a 2022 survey by the International Finance Corporation (IFC) (IFC 2025).

Energy challenges also affect public and community institutions. Schools, for example, depend almost exclusively on firewood for cooking, which is either purchased by the school or brought by students upon request. The same survey

found that maintaining a steady supply of firewood is both costly and increasingly difficult, highlighting the unsustainable nature of current practices.

There is clear potential to reduce both costs and environmental pressure through improved bioenergy solutions. Promoting energy-efficient cooking technologies could significantly cut expenditure on firewood and charcoal, estimated at around 39 million US dollars (IFC 2025). If cleaner fuels, like pellets, ethanol, and biogas, are made accessible through targeted financing mechanisms and reliable supply chains in refugee-hosting areas, they could ease pressure on surrounding forests while also reducing indoor air pollution, associated respiratory health risks, and gender-based violence.

4. Modern Bioenergy Solutions

Among the existing modern bioenergy alternatives in Uganda are biogas, ethanol fuel for transport and for ethanol cookstoves, as well as processes solid biomass like briquettes or pellets, that could feed an improved biomass cookstove.

Biogas

For the dissemination of biogas technologies, Uganda has been receiving support from the Dutch Government, through the Netherlands Development Organization (SNV), since 2009. SNV has been conducting demonstration projects, advisory and training services that have led to the construction of over 15,000 biogas plants (Akumu 2025). Additionally, the certification of over 200 masons aims at the construction of low-tech brick biogas digesters, which could allow users to produce methane from cow dung and other agricultural waste, to be used for cooking, power, and other purposes. This collaboration has also led to the formation of over 20 biogas construction enterprises and trained over 500 promoters at individual and organizational levels (ibid.).

In 2022, the Ministry of Energy and Mineral Development (MEMD) and SNV, as project lead, launched the African Biodigester Component (ABC) project in Uganda. The four-year project (2022-2025) has been implemented under the "Strengthening the Entrepreneurial Ecosystem for Clean Cooking – SEE-CC programme", targeting the commercialization of biodigesters in five Sub-Saharan countries.

The ABC project targets the installation of at least 8,000 small-scale biodigesters across Uganda, providing energy access to at least 40,000 people (SNV 2023). The approach is a combination of interventions in the demand and supply sides, as well as support for an enabling policy and regulatory environment for the biodigester sector in Uganda.

The Government of Uganda has also set a target to install approximately 50,000 biodigesters across institutions, such as schools, markets, and households (Akumu 2025). Progress to date indicates growing, though still limited, uptake of biogas for cooking. By 2023, more than 100,000 households nationwide (1.1% of the total) reported using biogas as their primary cooking fuel, with adoption remaining uneven (UBOS 2024). Biogas use stands at approximately 2% in urban areas compared to just 0.4% in rural areas. Whereas for power, biogas is the main energy source for lighting for almost 25 000 households in the country (ibid.).

In 2025, the African Development Bank Group (AfDB) approved financing for the Uganda Biogas and Electric Cooking Project (UBEP). The financing entails USD 8.79 million and targets the construction of 47 small-scale biogas plants for schools, markets, and farming communities (AfDB 2025). The project will support market development and capacity building for implementation and scaling.

Biofuels

Liquid biofuels are usually linked to their use in the transport and cooking sector, as the potential advantage for biofuel blending can help reduce the need for imported petroleum products and reduce GHG emissions; also, their use in ethanol cookstoves can help reduce the reliance on traditional sources for cooking.

Ethanol can be produced locally, from sugar cane, maize, and cassava, as staple crops with surplus land and low market prices (FAO 2025). In the transport sector, the mandatory blending of 5% locally sourced ethanol into petrol will significantly boost ethanol demand in the sector. In the clean cooking space, the use of bioethanol is gaining traction thanks to supportive strategies or policies for clean cooking, such as the National Development Plan III (NDPIII), the recently launched National Integrated Clean Cooking Strategy, and the Updated Energy Policy (see Section 6).

Bioethanol for cooking fuel is exempt from duty tax (60%) and VAT (18%) (FAO 2025). Additionally, the Ugandan National Bureau of Standards (UNBS) has adopted two standards for denatured bioethanol intended for use as cooking and appliance fuel (ibid.).

The progress in deployment for ethanol cooking in Uganda will depend on tackling bottlenecks in the market, which, according to an analysis by the Global Bioenergy Partnership (GBEP), includes four key areas: access to finance and affordability, with high initial costs and low consumer demand driven by low investment and limited end-user financing; infrastructure and supply chain, especially in rural areas, where distribution networks are not developed and hinders the supply chain for distribution; sociocultural awareness, which can lead to misperception for the technology and ultimately rejection of new technologies; and policy and regulatory environment that can send the necessary signals to financing institutions and private sector for a sustainable established market (FAO 2025).

Advanced biomass cookstoves

Advanced biomass cookstoves are industrially manufactured systems designed to deliver higher efficiency and lower emissions than traditional biomass stoves. They often incorporate features such as forced air fans, gasification principles, and basic electronic controls. As a result, these stoves achieve significantly better thermal performance and reduced smoke, but they require more consistent fuels, typically pellets or briquettes.

Uganda has strong potential for the deployment of advanced biomass cookstoves due to the wide availability of agricultural and organic residues. Feedstocks such as sugarcane bagasse, maize cobs, coffee husks, groundnut shells, and municipal organic waste can be processed into pellets or briquettes, supporting a more reliable and cleaner fuel supply. This makes advanced biomass technologies particularly relevant in areas where access to LPG, electricity, or liquid fuels remains limited. As of 2025, over 50 companies are producing briquettes in the country (Akumu 2025). In 2023, 248 Ktoe of energy was consumed in the form of pellets and briquettes, 80% for households, and 20% for commercial and public services (MEMD 2023b).

Policy and programme support help to accelerate market uptake. Under the Strengthening the Entrepreneurial Ecosystem for Clean Cooking – SEE-CC programme, the Higher Tier Cooking Component provides financial subsidies to small and medium-sized enterprises to support the procurement and sale of high-quality, low-emission, and energy-efficient cookstoves, including Tier 3-5 pellet and briquette stoves (Clasp, n.d.). The programme targets around 12,000 households, corresponding to approximately 60,000 beneficiaries, to expand access to higher-performance cooking solutions (ibid.).

Additional fiscal measures further improve the market outlook. The waiver of value-added tax (VAT) on pellets, effective from 1 July 2025, is expected to reduce fuel costs and strengthen the economic case for advanced biomass cookstoves in both household and institutional settings (Akumu 2025).

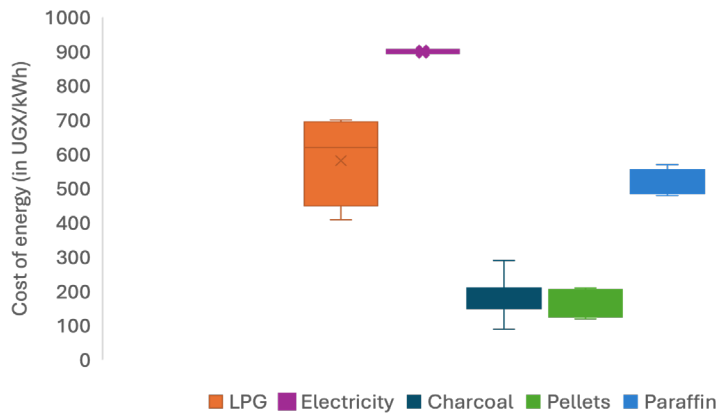
Source: Canva

5. Energy Prices

As mentioned before, affordability is one of the main challenges for renewable energy access in Uganda; therefore, comparing energy prices is vital to analyze the viability of fuels for a household. In 2024, the electricity consumption per capita was 105.58 kWh (MEMD 2024). Additionally, minimum wage ranks amongst the lowest in the world, with 130,000 UGX monthly by 2025 (MGLSD, n.d.).

In 2023, the WBA conducted a survey in Kampala, Uganda, comparing energy prices per unit of energy content for key fuels: LPG, charcoal, purified fuel oil (paraffin), pellets, and electricity. Figure 3 shows large price differences across these fuels. Electricity and LPG are by far the most expensive options. Electricity prices average 900 UGX per unit, with typical monthly household consumption around 130 kWh; for LPG, the costs range from approx. 400UGX and 700UGX per unit.

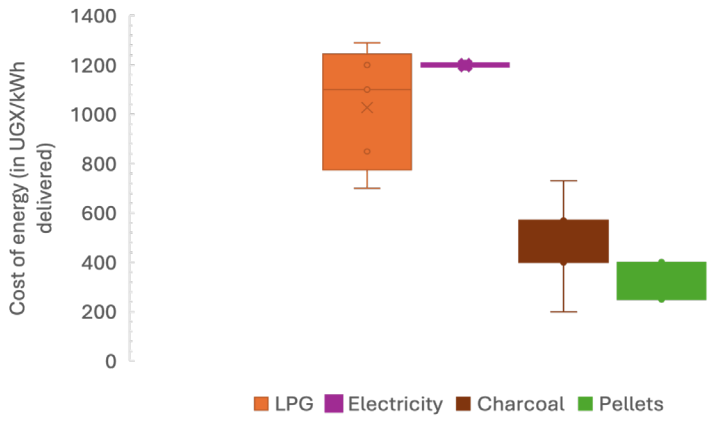
Figure 3 **Cost of energy per energy content in Kampala, Uganda.**
Note: fossil fuel costs of March 2023, charcoal cost of August 2023.
Source: WBA

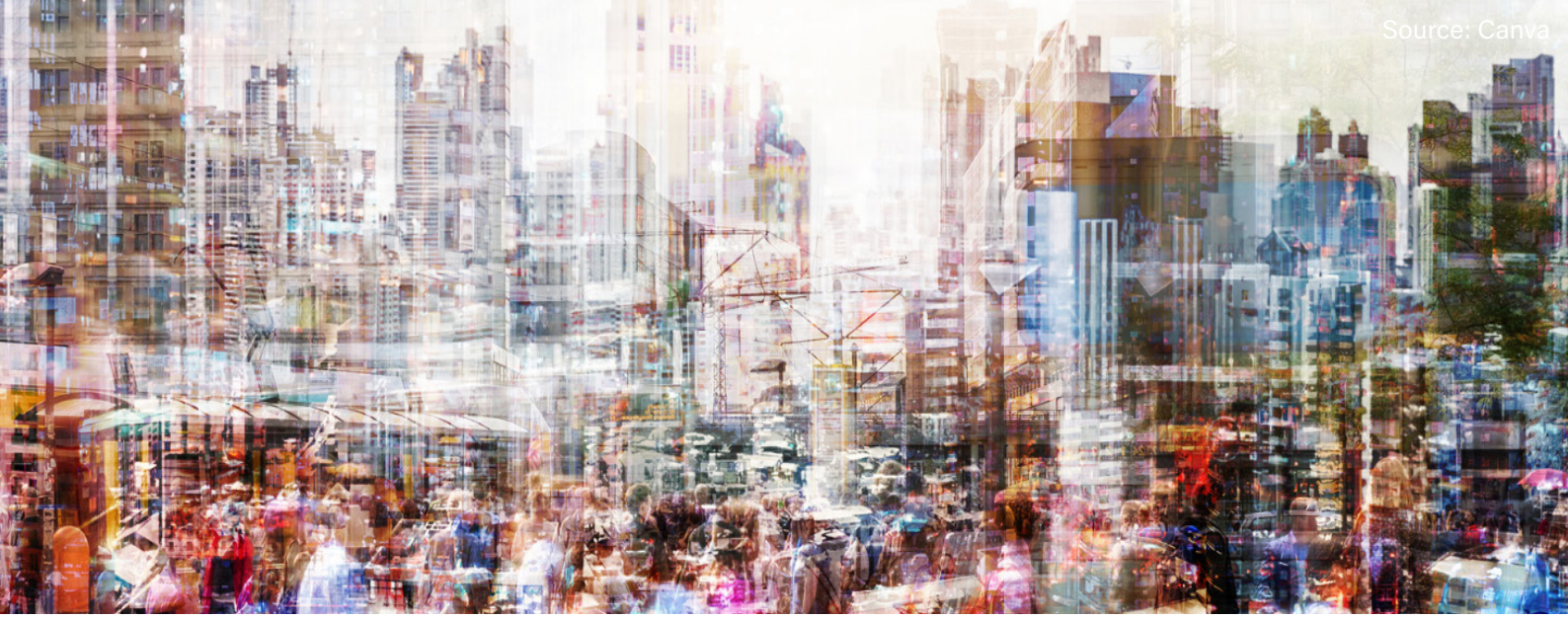


Additionally, a household cooking energy cost survey carried out in Kampala found that pellets were the cheapest option per unit of energy, at around 200–400 UGX/ kWh delivered (See Figure 4). LPG and electricity were the most expensive fuels, costing roughly four to six times more than pellets. These price differences create favorable conditions for the economically viable production and use of pellets for both household and institutional cooking. However, high upfront investment for industrial pellet plants, the need for technical expertise, and the absence of an established pellet market and value chain remain key barriers.

Other biofuels, such as ethanol, were not covered in this survey; however, after the VAT exemption on bioethanol as cooking fuel, retail prices for ethanol used in bioethanol cookstoves have fallen below 3,500 UGX/ liter (1USD), equivalent to around 52,500 UGX/month (15USD) for an average household (FAO 2025).

Figure 4 **Cost of energy sources for useful household cooking.**
Note: prices consider cookstove efficiency and assume excellent cookstove performance. Source: WBA




Source: Canva

6. Policy and Regulatory Frameworks

At a governmental level, the Ministry of Energy and Mineral Development (MEMD) is the main institution to oversee Uganda's energy sector. Within the energy sector, the role of the MEMD includes providing policy guidance, creating and maintaining an enabling context for investment attraction, gathering and analyzing energy data, and monitoring the private sector's activities. The MEMD is guided by national policies such as Vision 2040, the Third National Development Plan (NDP III), and the National Energy Policy for Uganda 2023, among others.

Vision 2040

After six years of consultations and planning processes, the government of Uganda published its Vision 2040 in 2013, a document that sets out the country's long-term development pathway. The vision aspires to transform Uganda from a predominantly low-income country to an upper-middle-income country within 30 years (GOU 2013).

Energy is identified as a foundational enabler of this transformation. Vision 2040 recognizes that reliable and affordable energy access is essential for economic growth, social development, and improved service delivery. A central target under the vision is to increase electricity access to 80% of the population by 2040, up from around 11% in 2011 and approximately 53% in 2023 (GOU 2013; UBOS 2024).

National Development Plans (NDP III-IV)

Uganda Vision 2040 is implemented through five-year National Development Plans that translate long-term ambitions into sector priorities and actions. Following the Third National Development Plan (NDP III), which covered the period 2020/21 to

2024/2025, the government has formulated its fourth National Development Plan (NDP IV) for the period 2025/26–2029/30.

NDP III focused on inclusive growth, industrialization, and human capital development, while recognizing energy access as a key constraint to productivity and service delivery. The plan prioritized expansion of electricity generation and grid connections, alongside efforts to increase energy efficiency and reduce reliance on traditional fuels (GOU 2020). However, clean cooking received limited attention, and bioenergy solutions were largely referenced in general terms.

NDP IV marks a more explicit shift towards clean cooking and modern energy use. The NDP IV aims at increasing the share of clean energy used for cooking from 25% in FY2023/24 to 50% by 2029-2030. Promoting modern cooking services and technologies is identified as a priority intervention, reflecting growing recognition of cooking energy as a national development issue rather than a local-level concern (GOU 2024).

Planned interventions under the NDP IV include the development of small-scale ethanol distilleries for cooking fuel production, support for pellet and briquette manufacturing facilities, promotion of electric cooking, and wider use of alternative clean cooking fuels and technologies (GOU 2024).

Both Vision 2040 and the National Development Plans recognize energy, particularly electricity access and clean cooking, as drivers of socio-economic transformation. NDP IV is notable for being the first national plan to explicitly reference modern bioenergy technologies such as ethanol, biogas, pellets, and briquettes as part of the strategy to modernize and diversify Uganda's energy supply. It also introduces bioenergy development as a specific intervention under efforts to accelerate sustainable energy development and diversification (GOU 2024).

Under the NDP IV, and aligned with their NDCs, Uganda has set targets to increase electricity access to around 65 % by 2030 and to expand the use of clean energy for cooking to about 10% nationally, with differentiated targets for rural areas at 4%, and urban areas at 12% (UN 2025). This represents a significant increase from the 2024 baseline when electricity access stood at approximately 58% and clean cooking access at around 3.8% (MEMD 2023b). NDP IV, therefore, provides an important policy bridge between long term development goals and near-term action on clean cooking and sustainable bioenergy.

The 2023 National Energy Policy

Uganda's National Energy Policy 2023 was developed to update and replace the previous policy framework and to respond to changes in the country's energy sector since the adoption of the earlier policy. The policy provides an updated strategic direction across key subsectors, including electricity, clean cooking, renewable energy, energy efficiency, and rural electrification, with the overarching objective of achieving universal access to modern, affordable, and sustainable

energy services.

The new National Energy Policy acknowledges several contextual shifts since the previous version, including a power generation surplus, increased use of public-private partnerships, and increased use of public financing instruments to improve affordability and expand access. It also highlights the connections with key policies developed since 2022, such as Vision 2040, NDP III, and the Sustainable Development Goals (MEMD 2023a).

Electricity access remains a central pillar of the policy. The National Energy Policy sets a long-term objective of achieving 100% national energy access by 2040, with grid-based electricity access reaching around 65% of the population by that time, up from approximately 25% in 2023 (MEMD 2023a).

Clean cooking is addressed more directly and prominently than in previous policy frameworks. The policy recognizes that reliance on traditional biomass for cooking remains a major development challenge with implications for health, environment, and gender equality. It sets a target for at least 50% of the population to use clean cooking fuels and technologies by 2040 (IEA 2023). A combination of financing mechanisms, consumer awareness, and standards is part of the policy approach to achieve its set targets.

Biomass Energy Strategy (BEST) (2013)

The Biomass Energy Strategy (2013) was developed by the Ugandan government in collaboration with the UNDP. It addresses fundamental challenges in how biomass is produced, traded, transformed, and used in the country. Some of the challenges outlined by the strategy included limited awareness of biomass contribution to socio-economic development, widespread use of highly inefficient technologies across entire supply chains, and weak coordination among responsible government agencies (MEMD, UNDP 2013).

As a clear goal, the strategy aimed at securing a more stable biomass energy supply for socioeconomic development, energy supply, and poverty reduction (IEA 2023). To respond to the challenge, interventions were grouped into four categories of action, including policy initiatives, supply management interventions, demand management measures, and cross-cutting actions (MEMD, UNDP 2013).

Even though the strategy was foundational in recognizing biomass as a vital energy source and as a sustainability challenge, the implementation of the strategy uncovered persistent gaps in institutional coordination and technology uptake (UNDP and FAO 2025). These insights have informed later energy policy development, including the National Energy Policy 2023 and the emerging National Integrated Clean Cooking Strategy, which builds on BEST's core concerns while placing stronger emphasis on cleaner fuels, modern bioenergy pathways, and measurable access targets

National Integrated Clean Cooking Strategy (NICCS)

In late 2025, Uganda introduced its first National Integrated Clean Cooking Strategy (NICCS). The strategy was developed in collaboration with the MEMD, the Stockholm Environment Institute (SEI), the Berkeley Air Monitoring Group, the Centre for Integrated Research and Community Development of Uganda (CIRCODU), the Clean Cooking Alliance, and Community Development Uganda (Nerious Dieto 2025).

The strategy provides a long-term framework through 2040, focusing on integrating existing policies and convening stakeholders to develop a National Clean Cooking Roadmap to increase the use of clean and transitional cooking fuels and appliances in Uganda (UNDP and FAO 2025).

The NICCS outlines clear institutional roles and coordination mechanisms across government agencies and stakeholders. It also proposes the establishment of a national monitoring and tracking system to support evidence-based decision-making and to effectively track progress over time. Flexibility and adaptive planning are built into the strategy, allowing it to respond to changing market conditions, technology developments, and user needs (Nerious Dieto 2025). On that note, the document suggests the extension of the timeframe for each fuel-specific strategy so that annual investment is more achievable; it also defines targets for clean and transitional solid fuels, which were not directly addressed in existing policies; also, it addresses supply and demand barriers to create an enabling environment that promotes a realistic transition.

As of January 2026, the strategy is pending formal approval by the Ministry of Energy and Mineral Development, after which implementation is expected to begin. Once adopted, the strategy is set to become a key policy instrument for aligning clean cooking interventions, mobilizing investment, and scaling sustainable bioenergy solutions in support of national energy and development goals.

7. WBA Experience in Uganda - Case Studies

The World Bioenergy Association, as an observer party of the Global Bioenergy Partnership (GBEP), has participated in the 12th GBEP Bioenergy Week in Kampala, Uganda.

The GBEP Bioenergy Week included a study trip on the last day of the event. On 11th July, the delegates had an opportunity to visit the National Livestock Resource Research Centre (NaLIRRI) – about 25 km north of Kampala city. The research center is in a 270-acre farmland with 190 cattle currently being managed. A key characteristic of the research center is minimal waste from the cattle, with a wide variety of products being produced from liquid and solid waste. The research center is also leading efforts in developing breeding as well as vaccines for a variety of diseases, including ticks, foot and mouth, African swine fever, etc. The facility is funded by the Ugandan government.

The delegates had an opportunity to walk through the cattle feeding area as well as visit the biogas facility. The research center follows mechanized feeding, and all the cattle are of the Danish Jersey variety. Manure is collected via a mechanized slanting gradient system. The collected manure is fed into a biodigester, which produces biogas with 50% methane content. A 75 kva generator produces electricity that can be fed into the electricity grid. One of the challenges being faced by the company is the lack of a bigger compressor that can support the storage of biogas in larger containers.

Post biogas production, the slurry is collected, and the wet manure is sun-dried. The dried manure is packed and sold as animal feed, as it has significant protein content. A wide variety of products are produced, including briquets, shower gel, pesticide, feed pellets, deionized water, liquid soap, hand wash, and shampoo. 70% of all the

products are produced from the manure, while the rest include preservatives to increase the life span of the products.

The visit shows the benefits of maximizing the utilization of wastes and residues. For truly scaling up and replicating the model, it is critical to ensure adoption of the latest technologies and supportive policies.

The 2nd visit was to BioBurn Energy Solutions Ltd, a pellet-producing company located 15 km to the east of Kampala city. The company currently utilizes a wide variety of feedstock, predominantly agro-waste such as coffee and rice husks, along with wood chips. Current feedstock that can be used includes pinecones, wood chips, cocoa pods, sawdust, rice husk, and coffee husk. The plant sources material from a range of 120 km.

The capacity of the pellet plant is 40 tons per day, and the plant started production in November 2023. The company also demonstrated institutional stoves (from SSM and Mimi Moto) targeted at schools with capacities of 25/50 and 100 liters, and pellet converter technology targeted at converting users of Diesel & HFO burners/boilers.

Currently, the pellets are sold primarily to major industrial users with biomass boilers. The company is focused on two growth areas: (1) SME users who want to transition from heavy furnace oil to pellets, and (2) the developing market in domestic use for cooking.

Some of the challenges faced by the company include the lack of knowledge/awareness about new technologies. There is a need for support for marketing and packaging. The entry point to the domestic market is challenged by the need to invest in developing a large distribution network, investment in smaller packaging capability, taxation on cookstoves at 55%, and the lack of government support in developing local alternative cookstoves. However, the recent tax waiver (previously at 18%) for the pellet commodity is an important support tool.

Irrespective of the challenges, the company expressed optimism with the latest developments in policies, regulations, taxation, as well as the general support of the various ministries in promoting bioenergy solutions. Developing partnerships with international organizations for the transfer of technology and knowledge remains a critical component for the development of the sector in the region.


Source: Canva

8. Conclusions

Uganda stands at an important crossroads in its energy transition journey. This white paper has shown that the country's near-total dependence on traditional biomass for cooking and power needs goes beyond the energy sphere, and reaches health, environmental, gender, and economic development issues too.

In this context, modern bioenergy technologies, including advanced biomass cookstoves fueled by pellets and briquettes, biogas digesters, and bioethanol for clean cooking and transport, are viable modern technologies that are slowly demonstrating their potential in the country. The information presented in this report suggests that these solutions are available, cost-competitive, and in some cases, already being deployed at a small scale.

The developing policy context now names specific modern bioenergy technologies that could untap opportunities in terms of targeted investments, technology standards, and measurable progress tracking.

That said, several challenges must be addressed for this potential to translate into impact at scale. Affordability and upfront costs remain the most persistent barrier, particularly for low-income households, institutions operating on thin budgets, and humanitarian settings where energy expenditure already consumes a disproportionate share of household income. Infrastructure and supply chain gaps, especially in rural and refugee-hosting areas, limit the reach of even well-designed programmes. Lastly, sociocultural factors, including limited awareness of cleaner technologies and deeply ingrained cooking habits, mean that technology availability alone is insufficient.

Uganda's path to modern energy access and energy security will require a transition within the biomass sector, from inefficient and harmful traditional practices to efficient, reliable, and sustainably managed modern bioenergy systems. With the

building blocks in place, Uganda needs sustained implementation, coordinated investment, and the political commitment to move from strategy to action.

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