UGANDA'S ENERGY SYSTEM AT A CROSSROADS: THE UNSUSTAINABLE RELIANCE ON BIOMASS AND THE NEED FOR ENERGY TRANSITION

POLICY BRIEF BY

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KEY MESSAGES

- Biomass (firewood and charcoal) accounts for 87% of Uganda's final energy consumption. This share has remained persistently high between 2016 and 2024.
- Electricity consumption grew by 84% over the same period, yet its share remains only 2.5%. Transmission constraints limit further expansion.
- Oil product consumption for transport increased by 38% (2016–2024), reaching 2,179 ktoe. This dependence on imports creates vulnerability to global price shocks.
  Overall energy intensity improved by 42%, but the energy system has not fundamentally shifted away from biomass.
- Uganda's Ten Fold Growth Strategy (US$500 billion economy by 2040) and population growth (2.9% per year) will sharply increase energy demand. A modern energy system is a prerequisite for achieving these goals.

1. Introduction and Motivation

A persistent dual structure characterizes Uganda's energy system. Traditional biomass (firewood, charcoal, agricultural residues) supplies the majority of energy, while modern sources (electricity, petroleum products) serve industry, transport, and commercial activities. According to energy balances from the Ministry of Energy and Mineral Development (MEMD) and physical energy flow accounts from the Uganda Bureau of Statistics (UBOS), total primary energy supply grew by 25% between 2016 and 2024. However, the share of renewable sources, almost entirely biomass has remained between 87% and 91%.

This reliance on biomass is not sustainable. The companion forest policy brief shows that Uganda's wood stock is declining faster than it can regenerate. At the same time, the government's Ten Fold Growth Strategy aims to expand GDP from US$50 billion to US$500 billion by 2040, while the population grows by 3% annually, adding roughly 1.3 million people each year. Meeting this demand requires a fundamental energy transition.

Uganda has made international commitments to guide this transition. The updated Nationally Determined Contribution (NDC) commits to reducing emissions and increasing forest cover to 21% by 2030. The Energy Transition Plan (launched at COP28) targets universal clean cooking by 2030 and 52 GW of renewable electricity capacity by 2040. The National Climate Change Policy reinforces these objectives. Yet, as this brief demonstrates, progress remains slow.

The Brief answers the following questions:

1. Why does biomass continue to dominate Uganda's energy mix despite decades of policy attention?
2. What is required to accelerate the shift from biomass to electricity and other modern fuels?
3. How can the presidential ban on commercial charcoal in northern Uganda be turned into a successful transition strategy?
4. What policy measures are needed to align energy planning with macroeconomic and demographic realities?

This brief aims to:

(i) Present the key trends in Uganda's energy supply and final consumption (2016–2024) based on official data.

(ii) Link these trends to Uganda's growth strategy, population dynamics, and climate commitments.

(iii) Identify structural barriers to energy transition, including transmission constraints.

(iv) Propose actionable recommendations for policy makers.

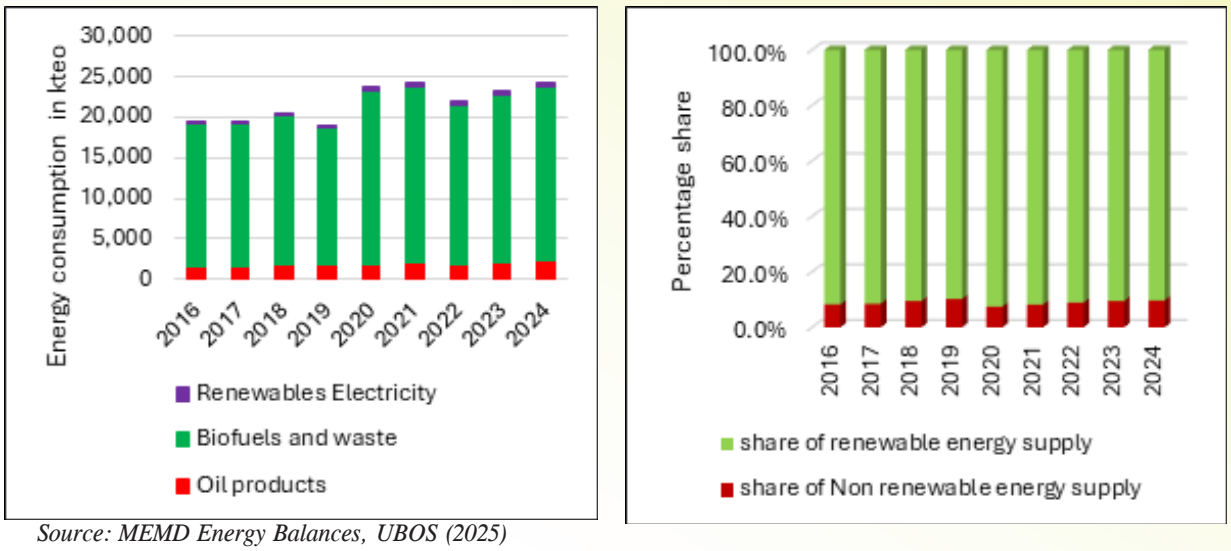
2. Methods

The analysis uses official energy balances from MEMD (2016–2024) and physical energy flow accounts from UBOS, supplemented by GDP (current UGX million) and population statistics from UBOS. Energy is presented in thousands of kilo-tonnes of oil equivalent (kteo). Wood stock projections are derived from UBOS Wood Asset and Forest Resources Accounts (2020). Sectoral consumption is disaggregated into households, manufacturing, agriculture, transport, and other industries. Energy intensity is calculated as energy consumption per unit of GDP.

3. Key Findings

(i) Energy supply remains overwhelmingly dependent on biomass

Total primary energy supply increased from 19,392 ktoe (2016) to 24,189 ktoe (2024), a 25% rise. Renewables (almost entirely biomass) accounted for 87–91% of supply throughout the period (Figure 1). The share of non renewable sources (imported oil products) increased only modestly, from 8.2% to 9.7%.



Source: MEMD Energy Balances, UBOS (2025)

Figure 1: Total Primary Energy Supply by Source vs Non Renewable Energy Supply (2016–2024)

(ii) Biomass dominates final consumption, driven by households

Total final energy consumption grew by 20% between 2016 and 2024, from 13,839 ktoe to 16,574 ktoe (Table 1). Biomass's share remained between 87% and 91%. Households consumed 8,082 ktoe of biomass in 2024 (58% of total biomass), followed by "other industries" (trade, education, health, public administration, entertainment and recreation services) at 4,632 ktoe (33%) and manufacturing at 1,264 ktoe (9%).

Table 1: Total Final Energy Consumption by activity (ktoe)

Energy product	Activity	2016	2017	2018	2019	2020	2021	2022	2023	2024
Biofuels and waste	Agriculture, Forestry and Fishing activities	-	-	-	-	-	-	-	-	-
	Manufacturing activities	2,293	2,293	2,659	2,642	4,704	336	1,210	1,230	1,264
	Transport activities	-	-	-	-	-	-	-	-	-
	other industries	1,004	1,004	1,172	1,168	1,308	5,346	4,277	4,790	4,632
	Households	8,741	8,742	9,235	9,239	10,415	9,101	7,492	7,914	8,082
Oil products	Agriculture, Forestry and Fishing activities	64	68	163	168	164	182	177	196	208
	Manufacturing activities	339	352	384	386	377	414	390	426	453
	Transport activities	1,087	1,143	1,248	1,292	1,191	1,266	1,251	1,386	1,476
	other industries	39	41	25	25	5	13	14	15	3
	Households	49	50	51	50	15	26	31	33	38
Electricity	Agriculture, Forestry and Fishing activities	-	-	-	-	-	-	-	-	-
	Manufacturing activities	141	155	174	186	187	206	225	245	270
	Transport activities	-	-	-	-	-	-	-	-	-
	other industries	29	31	33	31	31	36	39	44	50
	Households	53	55	57	60	63	67	75	84	97
Total		13,839	13,934	15,201	15,247	18,459	16,993	15,181	16,363	16,574

Source: MEMD Energy Balances, UBOS (2025)

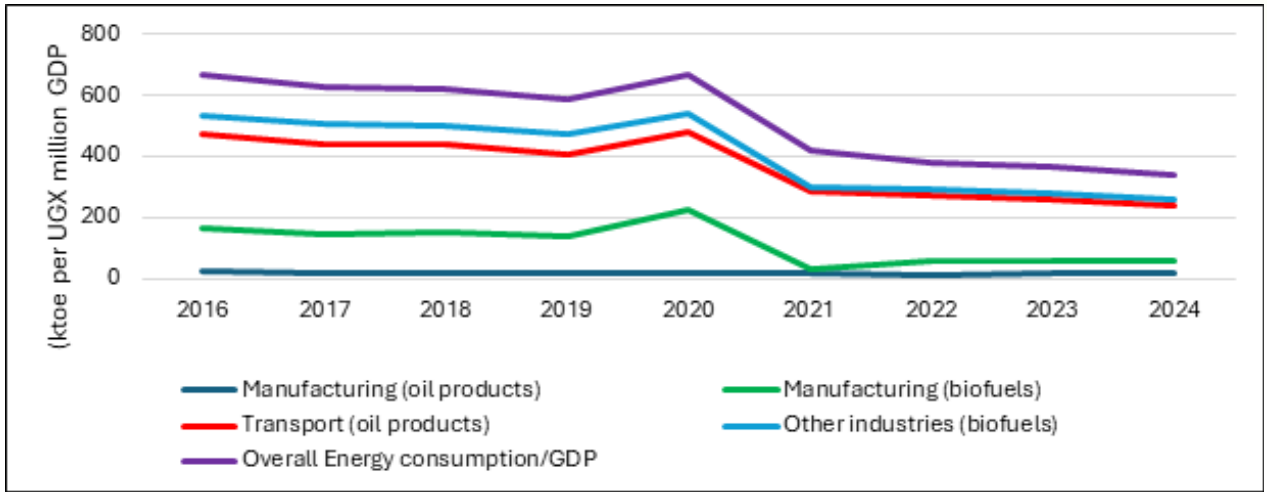
(iii) Electricity is growing fast but from a very low base

Electricity consumption increased by 84% between 2016 and 2024, reaching 417 ktoe (Table 4). Yet its share of final energy remains only 2.5%. Manufacturing accounts for 65% of electricity use, households for 23%. Transport and agriculture consume negligible amounts. Transmission constraints are a critical barrier: new generation (e.g., Karuma 600 MW, Isimba 183 MW) operates at only 30% of its capacity and cannot always reach users, especially in remote areas.

(iv) Energy intensity has improved, but data show volatility

Overall energy intensity declined by 42% between 2016 and 2024 (Figure 2), indicating improved efficiency. However, large fluctuations, for example, manufacturing biofuels intensity jumping to 207.8 in 2020 and falling to 40.1 in 2024, suggest data quality issues that need attention.

Figure 2: Energy Intensity by Sector (ktoe per UGX million GDP)



Source: UBOS 2025

(v) Transport remains locked into imported oil Oil product consumption for transport increased by 38% between 2016 and 2024, reaching 2,179 ktoe. The sector is 100% dependent on imports, exposing Uganda to global price volatility and balance of payments pressures.

(vi) The presidential charcoal ban is a test case for transition

Executive Order No. 3 (May 2023) bans commercial charcoal production and trade in northern and north eastern Uganda. Enforcement has intercepted over 120 illegal trucks, but illegal trade continues. Without affordable alternatives (LPG, electric cooking, improved stoves), the ban alone cannot achieve a sustainable transition.

Policy Implications

- Current Biomass dependence is not sustainable. Continued reliance on traditional biomass will lead to resource exhaustion, energy shortages, and higher costs for poor households.
- The charcoal ban will fail without alternatives. Enforcement must be paired with large scale deployment of clean cooking solutions.
- Transmission constraints must be addressed urgently. Electricity cannot replace biomass if the grid cannot deliver power to users.
- Energy and forestry policies must be integrated. Wood stock depletion is an energy problem as much as a forestry problem.
- The Ten Fold Growth Strategy depends on modern energy. A US$500 billion economy cannot be powered by firewood and charcoal.
- Population growth adds relentless pressure. Each year, 1.3 million new Ugandans require cooking fuel and productive energy.

Policy Recommendations

1. Accelerate the shift to clean cooking. Reduce LPG costs further through tax exemptions and duty reductions. Scale up improved cookstoves (30–60% less biomass). Target: 50% clean cooking access by 2030 (as in Uganda's NDC).

2. Fix the transmission bottleneck. Prioritise grid reinforcement in industrial corridors (Kampala Jinja, Mbarara, Gulu). Expand mini grids and off grid solutions for remote areas. Reduce transmission losses from current levels(19.1% to 16.8%) to below 10%.

3. Turn the charcoal ban into a transition. Use fuel tax revenues to subsidise alternative cooking fuels (Electricity and LPG). Formalise sustainable charcoal production from plantations. Strengthen enforcement while creating legal supply chains.

4. Integrate energy and forestry policies. Link energy planning with forest restoration targets (21% forest cover by 2030 under the National Climate Change Policy). Monitor wood stock and biomass consumption together annually.

5. Align energy planning with macroeconomic goals. Plan energy demand for a US$500 billion economy, not today's GDP. Connect industrial parks to reliable electricity. Use the Energy Transition Plan as the roadmap.

6. Strengthen energy data systems. Improve UBOS' capacity to collect and validate sectoral data through training and fostering stakeholder participation. Publish annual energy accounts linked to GDP, population and forest stocks.

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