National Integrated Clean Cooking Strategy for Uganda

September 2025

Prepared by
Stockholm Environment Institute
Berkeley Air Monitoring Group
Clean Cooking Alliance
CIRCODU

For Uganda's Ministry of Energy and Mineral Development

Funded by the Climate and Clean Air Coalition; co-funded by the Clean Cooking Alliance

Summary for Decision Makers

Introduction

Currently, 93% of Ugandan households use wood or charcoal as their main source of energy for cooking. The same is true for the majority of commercial food service enterprises and public institutions. A thirty-year trend shows a gradual decline in the use of fuelwood, and increase in charcoal and LPG, with other options, including electricity, showing no clear trend (See Section 2). Uganda's Third National Development Plan (NDP III) defined an objective of achieving a 50% share of clean energy for cooking by 2025, but this target will not be met. The NDP III target was adapted for the country's Fourth National Development Plan (NDP IV), which repeats calls to reduce the share of traditional biomass to 50%, increase the share of clean energy used for cooking to 50%, and increase access to residential electricity to 70% of households by the 2029/2030 fiscal year.

There are many barriers to increasing access to cleaner, more efficient cooking options, some of which are discussed in this summary with full details provided in Section 3. This document presents a strategy to reduce or eliminate those barriers.

In recent years, Uganda has developed several strategies to promote specific cooking fuels and appliances, including an LPG promotion project, national strategies for e-cooking and biogas, and a feasibility study for ethanol. The strategies have targets for adoption of their respective fuels and appliances that are meant to transform cooking options for 60% of Ugandan households, plus thousands of enterprises and public institutions, by the early 2030s. However, these strategies were developed in parallel, without considering other strategies under development at the time.

The targets that the existing strategies aim to achieve are ambitious but are unlikely to succeed for several reasons. First, they require an annual investment of USD 115-130 million consistently between now and 2030. These investments have not yet been made and are unlikely to be made at this scale or on this timeframe. Recent programmes, including major investments in e-cooking from the British government, the EASP program funded by the World Bank, and the African Biogas Component, funded by the Dutch government, are extremely welcome and necessary, but add just a fraction of what is needed to achieve these objectives.

Second, achieving these targets requires 30-40% annual growth in LPG and electricity adoption between now and 2030. These rates far exceed growth rates of clean cooking in other low- and middle-income countries in recent decades. For example, household transitions to clean fuels in India and Indonesia, which were both supported by billions of USD in subsidies, achieved annual growth rates in LPG adoption of just 4-5%. Kenya, Uganda's neighbour to the east is in the midst of its own clean cooking transition, and annual growth rates in the number of Kenyan clean fuel users were roughly 14% between 2014 and 2022, which is the most recently available data. It is not realistic to think that Uganda can achieve and sustain 30-40% annual growth in households using LPG or electricity in the next five years.

Third, the strategies that have been put forth, covering 60% of the population, focus only on clean fuels and appliances, with little attention to transitional options relying on wood, charcoal, or processed biomass. The International Energy Agency proposed an "Energy Transition Plan" that envisions over 40% of the population adopting improved wood and charcoal stoves by 2030, but this is not an official strategy of the Ugandan government. The IEA's plan is correct in noting that

solid fuel options will likely be needed by a large fraction of the population; those who currently use traditional stoves and fuels but would face many obstacles in making a leap directly to the cleanest options in the near term. See Section 4 for a deep dive into existing policies, strategies, and feasibility studies.

Key elements of the strategy

This document presents a roadmap to integrate the existing policies, strategies, and feasibility studies that aim to increase the use of clean and transitional cooking fuels and appliances in Uganda. This National Integrated Clean Cooking Strategy (NICCS) was developed after extensive review of existing policies and strategies (reviewed in Section 4) and informed by key informant interviews and focus group discussions (synthesised in Section 5). It builds on existing targets and, where necessary, fills gaps in order to create an ambitious but realistic path to clean cooking with the following core objective:

Define a path to provide clean or transitional cooking fuels and appliances for all Ugandans by 2040

To achieve this overarching objective, NICCS identifies the following three specific goals:

Integrate existing clean cooking policies and strategies into a single overarching strategy;
Ensure adequate supply of clean cooking fuels and appliances
Stimulate demand and address barriers to access for clean fuels and appliances among the residential and commercial sectors and public institutions

While NICCS uses the existing policies, strategies, and feasibility studies as the basis for an integrated pathway toward clean cooking, it makes fundamental changes and additions to those fuel-specific approaches, including:

- Extending the timeframe of each fuel-specific strategy so that the annual investment they require, though still substantial, is more achievable, and
- Incorporating the remaining 40% of the population not included in the existing strategies
- Defining targets for clean and transitional solid fuels, which were not addressed

These changes are outlined in Table SDM 1, with fuel-specific policy measures outlined in the Sector-specific recommendations below.

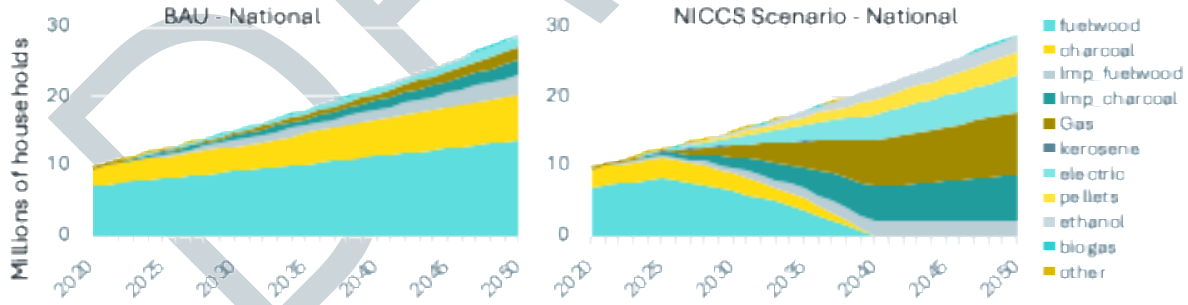
Achieving the NICCS targets will radically transform Uganda's cooking energy landscape. By 2040 and continuing into the future, all Ugandans will use cleaner, more efficient fuels and appliances, which meet Class 1-3 standards for safety, durability, and emissions. Figure SDM 1 compares the current BAU scenario to NICCS pathways for each major stove/fuel category.

Many of the targets included in Table SDM 1 were designed to achieve the goal of 50% share of clean energy used for cooking first described in NDP III and later adapted for NDP IV. Under NICCS, these targets will not be met on the NDP IV timeframe of FY2029/2030. However, as Table SDM 2 shows, final energy consumption used for cooking will be 19% lower in 2030 and 58% lower in 2040 than under a business-as-usual (BAU scenario).

Table SDM 1: Comparison of targets from current strategies and feasibility studies and NICCS targets

Fuel/stove pathway	Existing strategy/plan	Target(s)	NICCS target(s)
LPG	LPG Promotion, Supply, and Infrastructure Intervention	LPG adopted by at least 30% of Households by 2030	Achieve 30% adoption of LPG as a primary household cooking fuel by 2040
E-cooking	National E-Cooking Strategy	Increase the proportion of population cooking with electricity from 0.8% to 18% by 2030	Achieve 18% adoption of e-cooking appliances as a primary household cooking fuel by 2040
Biogas	National Biogas Strategy and Action Plan (NBSAP)	37,500 new domestic biogas digesters and 1,600 institutional and industrial biodigesters installed by 2033	100,000 domestic biodigesters are installed by 2040 (about 0.6% of the population). The NBSAP target for 1,600 industrial biodigesters by 2033 is unchanged.
Ethanol	Sustainable Biofuels Infrastructure Development Project: Feasibility Study Report	1.6 million households adopt ethanol by 2032 (equivalent to ~10% of the population in 2032)	1.6 million households adopt ethanol-based cooking as their primary cooking fuel by 2040 (about 8% of the population).
Solid biomass	IEA's Uganda Energy Transition Plan	Over 40% of the population use improved biomass cookstoves by 2030	46% of the population use Class 1-3 biomass stoves as their primary stove including 10% using Class 1 biomass stoves such as forced draft pellet stoves.

Figure SDM 1: Population using different fuel-stove combinations as a primary source of cooking energy under BAU (left) and NICCS scenarios (right) between 2020 and 2050



Similarly, the share of the population using clean or transitional cooking options as a primary household fuel would increase from under 10% in 2025 to nearly 40% in 2030, which is close to NDP IV targets. Section 8 reviews these and other impacts of the NICCS trajectories on the population using clean and traditional fuels, energy consumption used for cooking, and emissions of well-mixed greenhouse gases (GHGs) and short-lived climate pollutants (SLCPs).

Table SDM 2:

Key indicators	BAU	NICCS	% change from BAU to NICCS
Percentage of households nationwide using clean or transitional cooking options (Class 1-3 and equivalent)	2030: 16% 2040: 23%	2030: 39% 2040: 100%	2030: +139% 2040: +337%
Cooking energy consumption (PJ)	2030: 371 2040: 456	2030: 300 2040: 191	2030: -19% 2040: -58%
Woodfuel demand (Mton/yr)	2030: 31.6 2040: 40.3	2030: 25.2 2040: 14.4	2030: -20% 2040: -64%

While collecting public inputs of draft versions of NICCS, several stakeholder groups took issue with the pace of transitions recommended by this strategy relative to previous strategies as outlined in Table SDM 1. Pointing to the ambitious targets for economic growth, electrification, and other key development indicators outlined in Uganda's Vision 2040, these stakeholders stressed that Uganda may be much wealthier in the next decade than it is today. In a wealthier Uganda, the barriers to affordability and access described in Section 3, may be easier to overcome than they are today. While the NICCS team in this optimism and would like to see a rapid transition away from polluting cooking fuels, the team feels that the trajectory shown in the right side of Figure SDM 1 is highly ambitious. Based on cooking transitions that have occurred or are underway in other LMICs, a more rapid transition Uganda is unlikely. Nevertheless, the team includes a recommendation to that GoU regularly review progress toward NICCS goals and adjust targets accordingly. For example, if Uganda is on track to meet its Vision 2040 targets, then an accelerated pace of transition may be justified.

Budget implications

Based on the existing fuel-specific strategies and feasibility studies, providing 60% of Uganda's population with a mix of LPG, e-cooking, biogas, and ethanol by the early 2030s, while also promoting Class 1-3 solid fuel stoves for the remaining 40% of households, including 1.4 million advanced Class 1 pellet stoves, requires an investment of about one billion USD (UGX 3.7 trillion). This includes a mix of public investment to create an enabling environment that promotes a transition to clean and transitional fuels and appliances (including upstream infrastructure, standards and regulations, awareness raising, financing mechanisms, etc.), and private sector investment in manufacturing, distribution, and supply chains, as well as retail infrastructure. Achieving this between now and 2030 requires investment of about 170 million (UGX 620 billion) per year, which far exceeds the current funding allocated toward clean cooking efforts from government sources as well as international donors.

In addition, except in cases where the fuel-specific strategies include free stove handouts like the *LPG Promotion, Supply, and Infrastructure Intervention*, these cost projections do not include the upfront cost of stoves or recurring cost of fuel for families, commercial enterprises, and government institutions. Moreover, the costs of stoves and fuel are several times larger than the capital investment costs. This analysis estimates that in the NICCS scenario, after accounting for taxes and subsidies, consumers will pay *UGX 40,100 billion* out of pocket for stoves and fuel than they would pay under the BAU scenario. Both capital costs and the cost to consumers present a daunting challenge and is the primary reason for extending the NICCS timeframe through 2040. For a detailed review of the budget implications of implementing NICCS between now and 2040, including cost implications for end users and impacts on GoU tax revenues, please see Section 4.

Main recommendations

The fuel specific strategies and feasibility studies that NICCS builds on each contain specific recommendations and implementation measures. This document does not replicate them but refers to them extensively. In addition, the document presents a series of sector specific recommendations and cross cutting recommendations that complement the implementation measures that are already articulated in the previous strategies. These are summarized briefly here. See Section 6 for additional details.

Sector-specific recommendations

Stove standards

- GoU should follow US 761:2019. Appliances falling in Class-1 are "clean"; stoves falling in Class-2 and 3 are "transitional" and stoves that do not achieve Class-3 are "polluting" and their use should be phased out by 2040.
- As it is currently written, US 761:2019 only applies to biomass appliances. To ensure all appliances meet standards for safety, reliability and pollution control, UNBS should develop performance standards for other fuels and appliances including EPCs, induction stoves, and ethanol stoves.
- When it is next up for revision, UNBS should update US 761:2019 to align with WHO guidelines and ISO 19867-3.
- Currently, US 761:2019 is voluntary. To ensure all appliances that are deployed to meet NICCS objectives meet quality and performance criteria, US 761:2019 and the analogous standards developed for other appliances should be mandatory.
- GoU should provide UNBS with sufficient funding and personnel to monitor and enforce all standards related to cooking fuels and appliances that are currently in place and that are implemented in future.

Wood and charcoal stoves

- To achieve the massive scale-up of high-efficiency, low-emissions woodfuel stoves called for by NICCS, 1.5 million stoves will be needed by 2030 and nearly 4 million new appliances will be needed by 2040. GoU should ensure that a sufficient supply of quality, high-performing Class 1-3 wood and charcoal stoves are available for consumers.
- If domestic production is insufficient to meet this demand, then GoU should create incentives including a temporary reduction in import duties to encourage imports until sufficient domestic production comes online.
- GoU should develop new financing mechanisms and support existing mechanisms targeting lower-income households with low-interest loans for Class 1-3 wood and charcoal stoves.
- GoU should ensure that all financing options are open, including carbon finance. Consider "white listing" Class 1-3 wood and charcoal stoves to facilitate their inclusion in Uganda's carbon market.

Processed solid biomass

- Invest in research to develop cooking appliances that can burn biomass briquettes and consistently achieve Class 3 performance or better. These efforts should focus particularly on stoves for commercial and institutional users, which represent an untapped market for processed biomass fuels.

- Invest in research to accurately quantify, assess costs, and geo-locate sources of agricultural residues and wood waste to fully understand the potential supply of raw materials that can be used to produce briquettes and pellets at prices that are competitive with fuelwood and charcoal currently used for commercial and institutional cooking.

E-cooking

- Ensure that there is sufficient supply of e-cooking appliances for residential, commercial and institutional sectors across a range of price points
- Leverage GoU's ambitious electrification plans to promote E-cooking among the newly electrified population.
- If domestic production of e-cooking appliances is insufficient to meet demand, reduce trade barriers to encourage imports until domestic production comes online.
- Consider revising the electricity tariff structure so that the low-cost units of electricity are more accessible for low-income households.
- Revise the timeline of the National e-Cooking Strategy from 2030 to 2040 to reduce the magnitude of annual investment required and allow for more time to achieve the target f 18% of households using modern electric cooking appliances.

LPG

- Revisit the objectives of the "LPG Promotion, Supply, and Infrastructure Intervention Project" in light of new circumstances including progress on the Hoima refinery and investments in LPG distribution infrastructure.
- Explore the market potential of PAYGO LPG and small (3kg and 6kg) cylinders to better understand the customer appeal and potential trade-offs between each option.
- The "LPG Promotion, Supply, and Infrastructure Intervention Project" included free giveaways of LPG kits with 13 kg cylinders. At the time of writing, fewer than 100,000 cylinders have been distributed. However, free giveaways of LPG kits do not typically result in sustained use among recipients, particularly for large cylinders that are costly to refill. Hence, going forward, GoU should avoid free giveaways of kits with large cylinders.
- The timeline of the "LPG Promotion, Supply, and Infrastructure Intervention Project" to achieve 30% uptake of LPG was unrealistic and should be revised reach that objective by 2040.

Biogas

- Increase the number of residential biodigesters in the National Biogas Strategy and Action Plan (NBSAP) from 37,500 units by 2033 to 100,000 units by 2040.
- Develop a detailed approach to target subsidies for biodigester systems (this approach could support other subsidies for other Class 1-3 cooking options).

Ethanol

- MEMD should reconsider the recommendation made by the *Sustainable Biofuels Infrastructure Development Project* (SuBID) that Uganda's underutilised ethanol production capacity be devoted to meeting transportation blending targets and instead devote some or all of that capacity to meeting cooking demand in the early stages of NICCS implementation.
- Invest in awareness raising to support the market for ethanol cooking.

- Develop standards for ethanol stoves.

Cooking in Commercial and public institutions

- The use of fuelwood and charcoal in appliances that do not meet Class 1-3 performance criteria should be phased out in public institutions by 2030 and replaced by a mix of improved solid fuel appliances that meet standards for transitional or clean appliances.
- US 761: 2019 applies to small scale residential devices. There are no standards for large commercial and institutional appliances, therefore UNBS should develop standards for institutional and commercial solid fuel stoves that are analogous to US 761: 2019 or adopt ISO 5714:2023, which includes Test protocols for institutional cookstoves (keeping in mind the previous recommendation US 761:2019 be updated to align with WHO guidelines and ISO 19867-3).
- Data on fuel consumption by commercial Enterprises and public sector institutions is inconsistent and incomplete. MEMD should work with UBOS to develop consistent, standardised, and nationally representative data collection methodologies so that cooking energy consumption among commercial enterprises and public institutions can be quantified and tracked over time.

Cross-cutting recommendations

1. Integrate existing policies and strategies into a single overarching strategy

1a. Invest in cross-sectoral coordination

Integrating the existing clean cooking policies and strategies will be challenging. There are many moving parts and potentially competing interests. First and foremost, it will require strong coordination. The recently created *Clean Cooking Unit* will lead coordination of NICCS. However, with the unit housed within MEMD and staffed entirely by MEMD personnel, there may still be a gap in cross-ministerial coordination that will need to be filled

1b. Increase the GoU workforce

Implementing NICCS will require additional GoU personnel. The UK government's recent announcement that it is supporting the creation of a "Clean Cooking Unit" within MEMD [1] including a commitment to hire additional staff is a start. However, still more personnel will be needed to generate the necessary momentum and ensure the proper capacity exists to work across sectors and scales of operation.

In addition, to be successful, NICCS requires the enforcement of existing standards and the development of new standards. To successfully accomplish these critical tasks, UNBS will need additional resources and personnel.

1c. Revise, update, and fill gaps

Several of the strategy documents that are being integrated in this effort are outdated. For example, the LPG Programme that informed this assessment was written in 2020. The timing and context of Uganda's petroleum development have changed in ways that could affect LPG supply. In addition, with 30,000 LPG kits distributed, there is an opportunity to assess the impact of those kits. Are recipients cooking with LPG? Updating the plan to reflect lessons learnt from the initial

distribution would increase the likelihood that the next phase of the LPG program is successful and boost the overall impact of NICCS.

Similarly Uganda's Biomass Energy Strategy dates to 2015 [2] and is completely outdated. This study collected current views from many stakeholders involved in biomass-based cooking; but NICCS would benefit from a more detailed and up-to-date biomass-specific assessment that includes attention to conventional wood and charcoal as well as processed biomass.

Moreover, the ethanol component of this assessment is based on a feasibility study rather than a true strategy document. The study devoted significant attention to ethanol-based cooking but focused mainly on fuel production. A more detailed assessment of ethanol focused on downstream processes would be helpful in refining the role of ethanol cooking in NICCS.

Lastly, the existing policies all had targets converging around 2030, making it difficult to implement them all simultaneously. This led to the NICCS recommendation to extend timeframe through 2040. However, Uganda has ambitious plans to grow the economy and achieve other development goals, as outlined in Vision 2040. If those goals are achieved, then it may be possible to accelerate the NICCS targets. This points to the need to:

- Implement a rigorous MRV system that regularly tracks progress toward NICCS targets and also tracks other development indicators that affect access to and adoption of clean fuels and appliances like household income, poverty rate, income inequality, employment, and literacy or education.
- Adjust NICCS targets upward (or downward) based on regularly collected data on stove and fuel adoption rates and progress toward broader development objectives.

2. Ensure adequate supply of clean cooking fuels and appliances

Uganda currently lacks sufficient supply of several types of clean fuels and appliances which NICCS has targeted for scale up. The following steps are recommended to address this lack of supply for NICCS to be successful:

- Understand supply needs and adapt to changing circumstances
    - Plan for future demand. For example, the NICCS scenario envisions that 12% of the population use LPG as a primary fuel by 2030, climbing to 30% by 2040. Meeting LPG demand for 30% of the population in 2040 requires about one million tons of LPG, which is three times larger than Uganda will produce domestically after all envisioned domestic production comes online. Therefore, large volumes of LPG will still need to be imported.
    - Similarly, if 18% of the population adopt e-cooking as a primary source of cooking by 2040, they will consume roughly 6 TWh/year. GoU must ensure that power sector expansion plans can accommodate this demand while also accommodating plans for increased use by industries, electrification of transport, and other sources of future demand.
- Reduce the costs of raw materials, import duties, and taxes
    - Remove import duties on all materials necessary for domestic production of clean and transitional fuels and appliances
    - Temporarily remove import duty on stoves and fuels for companies that commit to invest in domestic fuel production and stove manufacturing or

assembly of any Class 1-3 technologies. This will make it easier for those enterprises to establish market presence and gain brand recognition, which will reduce the risk inherent in their investment.
    - Explore options for bulk purchasing of raw materials or components to reduce prices for small manufacturers or assemblers
- Increase access to finance
    - Work with institutional lenders to ensure they reach a diverse range of enterprises supplying clean and transitional fuel and appliances
    - Create a fund to derisk or guarantee loans made to stove and fuel enterprises
    - Develop "boot camps" to assist Class 1-3 stove and fuel enterprises to develop viable business plans that lenders are willing to fund

3. Stimulate demand and address barriers to access for clean fuels and appliances among residential and commercial sectors and public institutions

If supply barriers are lowered so that Class 1-3 cooking options are more accessible, will demand follow suit? The list below suggests measures that can be taken to ensure that it does:

- Reduce the cost of acquiring appliances and purchasing fuels by introducing targeted subsidies, and easily accessible credit for both enterprises and end-users
- Regulate and tax charcoal and commercial fuelwood so that there is closer price parity with clean and transitional alternatives
- Raise awareness about the negative implications of using polluting fuelwood and charcoal, and the multiple benefits of adopting cleaner, more efficient cooking options, including time savings, and rapid "return on investment".

Implementation steps

Implementing NICCS entails several critical activities. Specifically, mobilising sufficient financial resources, monitoring, reporting and verifying progress toward NICCS objectives, ensuring a conducive regulatory environment, and clear delineation of roles. This section reviews each of these activities. For a more detailed review, see Section 7 of the main text.

Financing the transition

Several financing options are available to support the transition to clean cooking technologies, which play a crucial role in promoting the adoption of efficient and sustainable cooking solutions, especially in regions with limited access to modern cooking methods. Key options include carbon finance, results-based finance, public-private partnerships, and Pay-as-you-go (PAYGO) business models.

Carbon finance

Due in part to its supportive policy framework, Uganda has a strong history of carbon financed clean cooking projects. This includes the country's *Green Growth Development Strategy*, the *National Climate Change Policy*, and the *National Climate Change (Climate Change Mechanisms) Regulations*, which outline the processes through with Uganda will prioritise and finance mitigation activities, as well as the *National Financial Inclusion Strategy*, which aims to expand access to financial services across the population and includes provisions to develop carbon finance as income opportunities for marginalised groups.

Results-based finance (RBF)

RBF links financial support to the achievement of measurable outcomes. Rather than providing funding upfront, RBF facilities disburse payments after specific verifiable results are achieved. The easiest outcome to verify is stove sales, but stoves sales do not necessarily lead to desired benefits, particularly if the stoves are not used regularly. Therefore, RBF facilities can focus on other outcomes, like sustained stove use, displacement of previously used fuels or appliances, or reductions in emissions. However, these other outcomes require more technically advanced methods to monitor and verify, which adds cost and complexity to the RBF facility. RBF facilities can also be designed with incentive structures that aim to achieve specific policy objectives like encouraging stove enterprises to expand into underserved rural areas and Refugee/Host Community Districts.

Public–private partnerships (PPPs)

PPPs are contractual agreements that involve both private enterprises and the public sector or government agencies. These agreements are designed to deliver services more cost-effectively than either entity could on its own. PPPs in the energy sector take many forms, and PPPs been effectively deployed to specifically target service provision for poor populations, which are often deemed too risky by the private sector. PPPs have been used for investments in Uganda's power sector and ethanol production.

Pay-as-you-go (PAYGO)

The upfront cost of cleaner cooking appliances and fuels like LPG, which are typically sold in bulk quantities, present a major barrier to widespread adoption, particularly for less well-off households facing severe liquidity constraints. A 6 kg LPG cylinder, the smallest size commonly sold by retail vendors, costs UGX 55,000, which is over 25% of the median monthly household income in Uganda, making it very difficult for most households to afford refills. In contrast, charcoal is often purchased in small tins for a few thousand UGX, which is sufficient to cook for 1-2 days. To make clean fuels more affordable, several companies have adopted a PAYGO model. This approach was originally developed to boost access to household solar electrification and has been adapted by some enterprises promoting clean cooking options to overcome consumers' limited ability to pay for fuel.

However, establishing PAYGO is more capital intensive than conventional business models. In contrast to conventional delivery models in which consumers can purchase fuel from a range of retail outlets, PAYGO enterprises working with LPG, pellets, or ethanol must procure large volumes of fuel in advance. They must also invest in storage infrastructure or arrange with other fuel suppliers to do so. The PAYGO model is also riskier than other approaches. To overcome these risks, GoU can support PAYGO efforts by introducing risk mitigation measures, including loan guarantees or revolving funds that enterprises can use if they face large numbers of defaulters.

Monitoring, Reporting and Verification (MRV)

MRV will be an essential component of NICCS implementation to ensure that the efforts and investments result in the desired outcomes, The second part of Section 7 reviews data needs, defines a set of key performance indicators (KPIs) that the data will feed into, and discusses the complementary approaches for tracking progress toward meeting NICCS objectives.

Data needs include regular collection of information about the number of existing households using clean fuels, access to electricity for cooking, new adoption of improved biomass stoves,

production and use of pellets/briquettes, biogas adoption and use, and ethanol stove adoption and use. Data can be collected from a variety of sources, including nationally representative household surveys like Demographic and Health Surveys and surveys periodically implemented by UBOS, sales data from fuel suppliers like LPG and ethanol distributors, pellet companies, and electric utilities, and PAYGO platforms. Data cleaning, analysis, storage, and sharing are also essential components of the MRV system. MEMD should create a platform for collecting the data, analysing it, and sharing it a transparent manner.

To support MRV of NICCS, two complementary approaches are proposed for tracking progress across key performance indicators KPIs. The first is the development of a dedicated, purpose-built Energy Sector Survey conducted every two years to generate detailed, high-quality data specifically aligned with NICCS targets. The second involves leveraging Uganda's existing national survey platforms, such as the DHS, UBOS Census, and MEMD data collection efforts, by integrating targeted clean cooking modules and supplementing them with focused follow-up studies where needed. Each approach addresses current data limitations in different ways and offers distinct strengths for building a credible and actionable MRV system.

Roles and responsibilities

Lastly, Section 7 discusses roles and responsibilities of ministries and other GoU agencies in implementing each aspect of NICCS. While MEMD will lead implementation, inputs from other ministries and agencies will be essential to achieving NICCS objectives (Table SDM 3).

Table SDM 3: Roles and responsibilities of GoU ministries and agencies

Entity	Activities related to the cooking sector
Office of the President	▪ Hosts inter-ministerial committee on clean cooking ▪ Advocates for policy, planning, and resource allocation within the relevant ministries. ▪ Coordinates government agency activities related to clean cooking. ▪ Convenes the committee with increased frequency.
Office of the Prime Minister	▪ Develops and implements programs to support clean cooking in refugee settlements and host communities.
MEMD	▪ Develops and enact strategies to achieve universal access to Class 1-3 cooking. ▪ Implements the LPG promotion project. ▪ Supports renewable energy for cooking ▪ Tracks progress towards clean and transitional cooking targets. ▪ Publishes data on renewable energy. ▪ Builds repair and maintenance capacity for Class 1-3 stoves. ▪ Designs and implements national awareness-raising campaigns promoting Class 1-3 cooking options and develops appropriate messages for specific population groups.
MWE	▪ Develops and implements climate policy. ▪ Serves as designated national authority for Paris Agreement. ▪ Provides operational framework for carbon finance to support Class 1-3 cooking.
MFPED	▪ Coordinates the five-year national government's planning cycle. ▪ Includes realistic clean cooking targets and pathways in *National Development Plan IV*.
MoGLSD	▪ Empowers women entrepreneurs to develop and disseminate innovative Class 1-3 cooking appliances and fuels.
MoH	▪ Participates in awareness raising campaigns on the health impact of cooking with polluting fuels. ▪ Trains community health practitioners to track illnesses associated with exposure to smoke from household cooking.
UBOS	▪ Conducts the census and other nationally representative surveys, such as the *National Service Delivery Survey* ▪ Implements, or support the implementation of future, sector-specific surveys for MRV of NICCS objectives

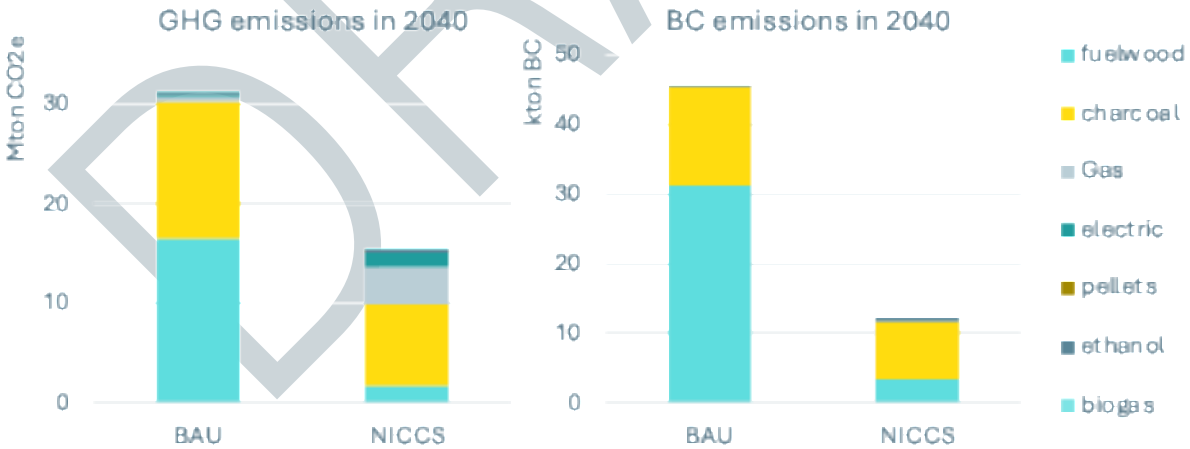
UNBS	▪ Develops and enforces national product standards. ▪ Creates standards for induction stoves, EPCs, ethanol stoves, and LPG infrastructure ▪ Improves consistent enforcement of existing standards.
URA	▪ Develops and implements tax and tax relief policies for cooking fuels and appliances, including VAT, excise taxes, and import duties. ▪ Audits all cooking-related taxes to ensure they are consistent and supports the scale-up of Class 1-3 cooking fuels and appliances.
UMEME	▪ Operates an electricity distribution concession from the GoU through 2025. ▪ Promotes e-cooking by providing customers access to appliances and building awareness of the cooking tariff.
UECCC	▪ Develops and administers innovative financing initiatives for financial institutions and stove/fuel enterprises ▪ Ensures that all stakeholders have access to sufficient technical assistance to develop business plans and access financial resources

NICCS impact on climate-forcing emissions

Burning less wood in three-stone fires and traditional charcoal stoves will result in substantial emission reductions relative to the BAU pathway. In the NICCS scenario, emissions decline rapidly between 2025 and 2040 as people transition from polluting woodfuels to Class 1-3 options.

Figure SDM 2 shows fuel-specific GHG (left) and BC (right) emissions in 2040. Following the NICCS pathway results in a 50% reduction in emissions of well-mixed Greenhouse Gasses (GHGs) and 73% reduction in black carbon (BC) emissions. In the BAU scenario, emissions are dominated by fuelwood and charcoal. In the NICCS scenario, woodfuels still produce the majority of emissions, but clean fuels also result in some CO_2 emissions.

Figure SDM2: 2040 Fuel-specific emissions of well-mixed GHGs (left) and BC (right) for BAU and NICCS scenarios



Acknowledgements

NICCS was developed with the support of many individuals and organisations. The core NICCS team comprises clean cooking experts from the Stockholm Environment Institute, Berkeley Air Monitoring Group, and the Clean Cooking Alliance (CCA). The core team was supported by experts from the Centre for Integrated Research and Community Development Uganda (CIRCODU). The entire effort was funded by the Climate and Clean Air Coalition (CCAC) with co-funding provided by CCA.

The core NICCS team worked closely with members of the Ministry of Energy and Mineral Development (MEMD) and specifically with MEMD's newly formed Clean Cooking Unit. In addition, the team gratefully acknowledges valuable inputs from staff of other government ministries and departments including the Ministry of Finance Planning & Economic Development (MFPED), Uganda National Bureau of Standards (UNBS), and Uganda Energy Credit Capitalisation Company (UECCC).

In addition, the team is thankful for the many useful insights obtained during key informant interviews conducted between mid-2024 and early 2025 with 35 individuals representing 24 entities including private enterprises, financial institutions, development partners, and government agencies. The team is also grateful for the inputs from participants in two focus-group discussions (FGDs) held in 2024. Appendix E includes a list of interviewees and FGD participants.

Abbreviations

ABC	African Biodigester Component
ABPP	Africa Biogas Partnership Program
ALRI	Acute Lower Respiratory Infection
BEST	Biomass Energy Strategy
BPD	Barrels (of oil) per day
BSUL	Biogas Solutions Uganda Limited
CCA	Clean Cooking Alliance
CCAK	Clean Cooking Association of Kenya
CCT	Controlled Cooking Test
CDM	Clean Development Mechanism
CET	Common External Tariff
CH_4	Methane
CIRCODU	Centre for Integrated Research and Community Development Uganda
CO	Carbon monoxide
CO_2	Carbon dioxide
COPD	Chronic Obstructive Pulmonary Diseases
CREEC	Centre for Research in Energy and Energy Conservation
DHS	Demographic and Health Surveys
EASP	Electricity Access and Scale-up Project
EnDev	Energising Development
EPC	Electric Pressure Cooker
ERA	Electricity Regulatory Authority
ESMAP	Energy Sector Management Assistance Program
FY	Fiscal Year
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GGGI	Global Green Growth Institute
GoU	Government of Uganda
HAP	Household Air Pollution
ICLEI	originally “International Council for Local Environmental Initiatives”
ICS	Improved Cookstove
IEA	International Energy Agency
ISO	International Organization for Standardization
KPI	Key Performance Indicator
LMIC	Low- and Middle-Income Country
LPG	Liquefied Petroleum Gas
KCJ	Kenyan Ceramic Jiko
MAAIF	Ministry of Agriculture Animal Industry & Fisheries
MECS	Modern Energy Cooking Solutions
MEMD	Ministry of Energy and Mineral Development
MFI	Micro Finance Institutions
MFPED	Ministry of Finance Planning & Economic Development
MIS	Malaria Indicator Survey
MoES	Ministry of Education and Sports
MoGLSD	Ministry of Gender, Labour, & Social Development

MoH	Ministry of Health
MJ_{del}	Megajoules delivered to cook food after accounting for heat transfer losses
MRV	Monitoring Reporting and Verification
MSTI	Ministry of Science, Technology and Innovation
MWE	Ministry of Water and Environment
NBSAP	National Biogas Strategy and Action Plan
NDC	Nationally Determined Contribution
NDP III	Third National Development Plan
NEFCO	Nordic Environmental Finance Corporation
NGO	Non-governmental Organization
NPV	Net Present Value
PAYGO	Pay-as-you-go
$PM_{2.5}$	Particulate matter with an aerodynamic diameter < 2.5 microns
PMUY	Pradhan Mantri Ujjwala Yojana (India's LPG subsidy programme)
RBF	Results-based Finance
RTC	Regional Testing Centre
SACCO	Savings and Credit Cooperative Organization
SLCPs	Short-lived Climate Pollutants
SuBID	Sustainable Biofuels Infrastructure Development Project
SDG	Sustainable Development Goals
SEDP	Sustainable Energy Development Programme
SEforALL	Sustainable Energy for All
SMEs	Small and Medium-sized Enterprises
SNV	Netherlands Development Organization
toe	Tons of oil equivalent – often used with prefixes (e.g. ktoe = 1000 toe, etc)
TOR	Terms of Reference
TSOF	Three Stone Open Fire
UBOS	Uganda Bureau of Standards
UECCC	Uganda Energy Credit Capitalisation Company
UEDCL	Uganda Electricity Distribution Company Limited
UNACC	Uganda National Alliance on Clean Cooking
UNBS	Uganda National Bureau of Standards
UNDP	United Nations Development Programme
UN FAO	United Nations Food and Agriculture Organisation
UNFCCC	United Nations Framework Convention on Climate Change
UNOC	Uganda National Oil Company
URA	Uganda Revenue Authority
VAT	Value Added Tax
VSLA	Village Saving and Lending Association
WBT	Water Boiling Test
WHO	World Health Organization

Table of contents

Graphs and figures

Tables

1. Introduction

Objectives of NICCS

Uganda has made laudable steps toward raising the profile of clean cooking through overarching national policies including the country's Third and Fourth National Development Plans (NDP III and IV) [3,4] and 2023 Energy Policy [5]. Those policies articulate overarching goals including dramatically cutting dependence on biomass energy for cooking and increasing the share of clean energy used for cooking.

However, those broad policy documents did not include specific steps to achieve these objectives. To achieve these goals, the Ugandan government, with the support of development partners, has approved, or is in the process of approving, several strategies that support specific clean fuels and appliances. These include an ambitious LPG promotion project [6], a national E-cooking strategy [7], a national biogas strategy [8], and a feasibility study for bioethanol infrastructure development with a strong focus on ethanol-based cooking [9].

These fuel-specific policies and strategies were developed independently, without integration of the other policies and strategies under consideration. As a result, potential synergies, redundancies, and conflicts that may arise with each strategy's implementation have not been fully examined. Furthermore, the overall budget requirements, technical capacity, and personnel needed to implement these strategies simultaneously have not been critically analysed. Each strategy proposes to achieve very ambitious scale-up of the fuels and technologies in question (see Section 4 for details). Individually, each strategy would be challenging to implement. Implementing them at the same time introduces additional challenges but also creates opportunities. For example, the LPG promotion plan, biogas strategy, and e-cooking strategy all call for substantial investment from the Government of Uganda (GoU) in awareness-raising to support specific clean cooking options. However, taking this approach can result in competing and potentially confusing messages. Instead, the GoU can pool the resources allocated for each strategy and invest in awareness-raising for all clean cooking options. This approach will help communicate the benefits of clean fuels and appliances and educate the public about the differences between various clean fuels and appliances so that each household can select the most appropriate for their circumstances.

Uganda's National Integrated Clean Cooking Strategy (NICCS) brings together these existing policies, and, where necessary, fills gaps in order to create an ambitious but realistic path to clean cooking with the following core objective:

Define a path to provide clean or transitional cooking fuels and appliances for all Ugandans by 2040

This core objective will be achieved through a set of specific objectives, which include the following

1. Integrate existing clean cooking policies and strategies into a single overarching strategy;
Ensure adequate supply of clean cooking fuels and appliances
Stimulate demand and address barriers to access for clean fuels and appliances among the residential and commercial sectors and public institutions

Achieving NICCS core and supporting objectives requires a balance of ambition and pragmatism. Historically, proponents of clean cooking have advocated one of two paths: either make the available clean or make the clean available [10]. "Making the available clean" starts with fuels that are already in widespread use, like wood, charcoal, and other solid biomass, which are highly polluting when burned in common household stoves and introduces new stoves that burn more cleanly and efficiently. This approach could also involve processing solid biomass to make it easier to burn, such as converting raw biomass into briquettes or pellets, which are less polluting when burned in well-designed appliances.

In contrast, "making the clean available" involves increasing access to cooking options that are inherently *clean at the point of use* like LPG and biogas, as well as electricity and ethanol [11],[1] but are inaccessible for most people due to minimal supply, high upfront costs, and/or more expensive operating costs. For rural populations, this often means replacing free biomass fuel with a fuel that requires a cash outlay.

Many discussions of clean cooking transitions present the approaches as "either-or" options. NICCS takes both approaches. A full transition to inherently clean cooking fuels takes time. In many locations where clean options have been introduced, adopters commonly continue to use the solid biomass fuels they used previously for some of their cooking tasks. This "stacking" behaviour has been well documented and can persist indefinitely [14]. Moreover, it will take many years to make the cleanest fuels and appliances accessible to the poorest most marginalized communities. Making cleaner or "transitional" solid fuel appliances available will reduce emissions and fuel consumption for everyone: it will allow families that have adopted clean fuels to use more efficient options when they decide to use solid biomass, and it will also allow poorer families, who are unlikely to gain access to the cleanest fuels in the near term, to access more efficient "transitional" appliances.

Organisation of this report

This report is organized in the following way. Section 1 reviews the objectives of NICCS, and review how clean and transitional cooking fuels and appliances are defined. This central concept of the strategy relies on a mix of internationally developed metrics and Uganda's own standards. We also describe the approach that was utilized to synthesize existing policies and strategies relevant for the cooking energy sector in Uganda and to gather inputs from a wide range of stakeholders in order to develop this integrated strategy.

Section 2 reviews Uganda's current cooking landscape, highlighting recent trends in residential, commercial, and institutional cooking fuels and technologies. It explores the how different segments of the Ugandan population currently cook and how NICCS might introduce cleaner alternatives based on income, accessibility, and other factors. This section also reviews the range of clean and transitional fuels and technologies that are currently available or could be introduced as NICCS is implemented.

Section 3 explores the barriers that impede scale-up of clean and transitional fuels and technologies in Uganda. The section reviews both supply-side and demand-side barriers as well

[1] Here, the phrase "clean at the point of use",means that when they are used in a properly functioning appliance, they result in very little health risks for end-users. However, it is also important to acknowledge that LPG, and about 60% of the electricity produced globally, are derived from fossil fuels, which cause many well-documented health and environmental problems [12,13].

as cross-cutting issues. It also reviews the existing fiscal policies that add to costs for both suppliers and consumers.

Section 4 provides a detailed review of the existing policies and strategies that this NICCS will integrate. This includes strategies for e-cooking, and biogas, as well as a feasibility study for ethanol-based cooking, and a large-scale LPG promotion project. Section 4 also provides a detailed discussion of the role of solid biomass in NICCS, although there are no existing policies targeting that sector. Similarly, the section includes a discussion of commercial and institutional cooking, although there is no current policy or strategy for those groups either. The section reviews the budget implications of implementing all of these policies, and presents an alternative "NICCS scenario", which mirrors, the existing policies, but with a more gradual rollout in order to reduce annual costs and allow for a more adaptive approach.

Part of the approach taken to carry out the assessment included key, informant interviews and focus group discussions. In total 22 separate interviews were carried out with 34 participants overall. In addition, two focus group discussions were conducted, each with 10-15 participants. Section 5 synthesizes findings from these interviews and discussions.

Select sections throughout the document close with recommendations specific to the topics covered in those sections. Section 6 first summarizes these sector-specific recommendations and then provides additional cross-sectoral recommendations necessary to achieve a broadly integrated clean cooking strategy. Note, however, that because NICCS is building on several existing policies and strategies all of which contain well thought out recommendations that have already been vetted by a wide range of stakeholders, those recommendations are not replicated in this document.

Section 7 reviews the measures that are required to implement NICCS including mobilizing the necessary finance, and introducing a framework for monitoring, reporting and verification (MRV) of NICCS objectives and assigning roles and responsibilities to GoU ministries and other key stakeholders. Finally, Section 0 includes a list of references cited throughout this text and Section 10 concludes with several technical appendices.

Defining clean and transitional cooking options

An effective clean cooking strategy requires consensus around how to define "clean". Stove standards are common policy tools that are used to define emissions, efficiency, safety, and/or durability thresholds. The Uganda National Bureau of Standards (UNBS) has developed standards for biomass stoves [15]. There are also global standards and standards in neighbouring countries. This section explored how these standards can be used to define clean cooking and compare the thresholds that they have set in relation to the potential health impacts using different cooking fuels and appliances.

To support clean cooking globally, the World Health Organisation (WHO) developed guidelines that differentiate between *clean, transitional* and *polluting* cooking options based on "Voluntary performance targets for cookstoves" developed by the International Standards Organisation (ISO) [16]. ISO 19867-3 defines performance tiers that are recognized internationally and are used to

determine appliance eligibility in several major clean cooking finance schemes.[2] ISO 19867-3 includes tiers for emissions of fine particulate matter ($PM_{2.5}$) and carbon monoxide (CO) as well as energy efficiency, safety, and durability (Table 1). ISO tiers are defined separately for each indicator, so that stoves can be "Tier 5" for one category and "Tier 3" or "Tier 4" for other categories. All categories represent important aspects of performance and are included in NICCS through current and recommended future standards developed by UNBS, which is explained later in the section.

ISO tiers and WHO definitions

The ISO Tiers for $PM_{2.5}$ and CO are based on health risks associated with exposure to each pollutant. For example, emission rates for $PM_{2.5}$ Tiers 1 to 4 are set at levels that indoor air pollution dispersion models indicate would cause $PM_{2.5}$ concentrations resulting in relative risk ratios of 3.15 (Tier 1), 3.0 (Tier 2), 2.5 (Tier 3), and 1.5 (Tier 4), based on the integrated exposure response for acute lower respiratory infections (ALRI) in children under 5.[3] The Tier-5 limit of 5 milligrams per megajoule delivered (mg/MJ_{del}) was set at a level at which the majority of homes would meet the WHO mean annual guideline value of 10 micrograms per cubic meter ($\mu g/m^3$), which is associated with relative risk of 1.0 [19].[4]

Table 1: Tier values for ISO stove performance [19]

	Tier	CO (g/MJ_{del})[a]	$PM_{2.5}$ (mg/MJ_{del})[a]	Efficiency (%)	Safety (score)	Durability (score)
Better performance [b] ↑	5	≤ 3.0	≤ 5	≥ 50	≥ 95	≤ 10
	4	≤ 4.4	≤ 62	≥ 40	≥ 86	≤ 15
	3	≤ 7.2	≤ 218	≥ 30	≥ 77	≤ 20
	2	≤ 11.5	≤ 481	≥ 20	≥ 68	≤ 25
	1	≤ 18.3	≤ 1030	≥ 10	≥ 60	≤ 35
	0	> 18.3	> 1030	< 10	< 60	> 35

[a] CO and $PM_{2.5}$ emissions are expressed as grams (g) and milligrams (mg) per megajoule delivered (g or mg/MJ_{del}), which accounts for the calorific value of the fuel and the efficiency of the device.

[b] WHO's clean options are shaded in green, transitional options in yellow, and polluting options in red.

Similarly, the ISO 19867-3 thresholds for CO emissions are designed to range from Tier 1, which was set so that the majority of homes would have kitchen CO concentrations at or below 230 mg/m^3 during cooking, which is associated with acute mild adverse symptoms [19]. Tier 5 is set so that the majority of homes would meet the WHO air quality guideline value of 7 mg/m^3. The intermediate CO tiers represent equal divisions between Tiers 1 and 5. Based on these health risks, WHO makes the following definitions (Table 1):

- Tiers 4 and 5 are "clean" for $PM_{2.5}$ and Tier 5 is "clean" for CO (light green shading)
- Tier 3 is "transitional for $PM_{2.5}$ and Tiers 3 - 4 are "transitional" for CO (yellow shading)

[2] For example, the World Bank's ASCENT programme and NEFCO's "Modern Cooking Facility for Africa" both require appliances to achieve at least Tier 3 performance for emissions of CO and $PM_{2.5}$ to be eligible for inclusion in their financing schemes [17,18].

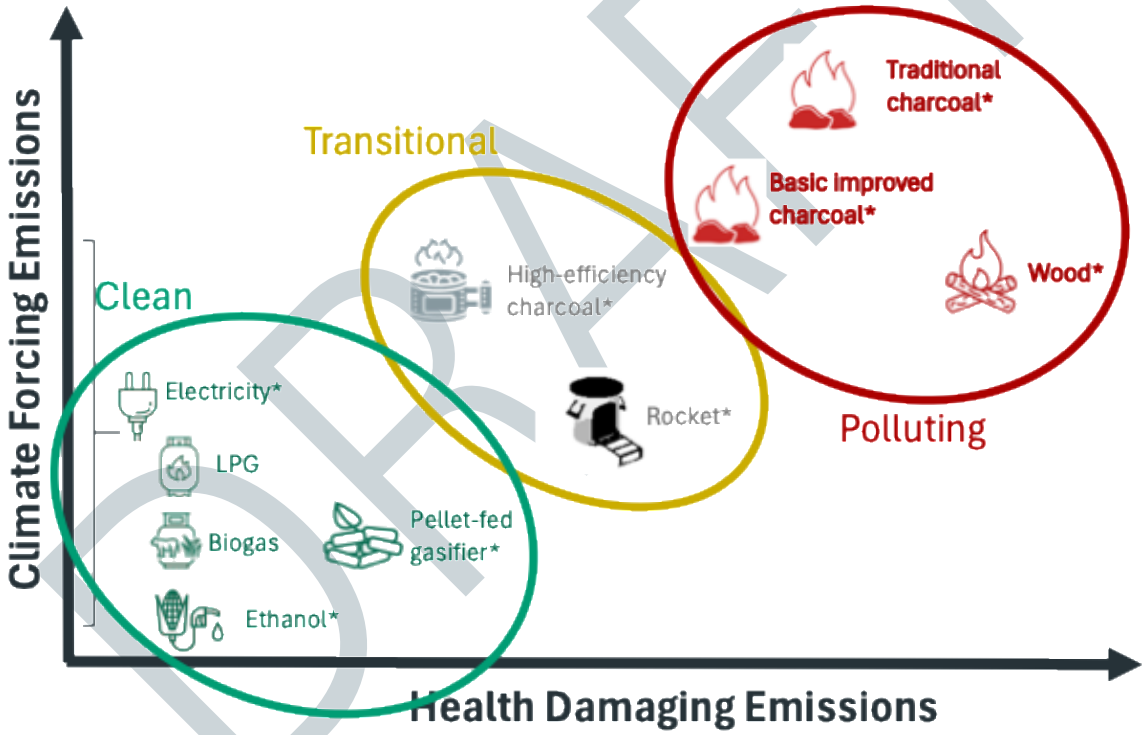
[3] Relative risk (RR) is the ratio of the probability that an exposed person will contract an illness compared to the probability that an unexposed person will contract the same illness. For example, an RR = 3 means that children in households using Tier 2 stoves are three times more likely to contract ALRI than children in households using a Tier 5 stove.

[4] When ISO 19867-3 was developed, WHO's annual guideline for average $PM_{2.5}$ exposure was 10 $\mu g/m^3$. New guidelines have been released that reduce the annual mean to 5 $\mu g/m^3$ and redefined 10 $\mu g/m^3$ as "Interim Target 4" [20]. WHO's "interim targets" support progress in resource-poor regions.

- Tiers 0, 1, and 2 are polluting for both $PM_{2.5}$ and CO (red shading)

WHO's delineation of clean, transitional, and polluting stoves is based entirely on health outcomes. However, there is a close correlation between emission of health-damaging pollutants and other aspects of stove performance. For example, shifting from traditional wood or charcoal stoves to transitional or clean options results in large efficiency gains and lower fuel consumption, which relieves pressure on forest resources. There is also a close correlation between health-damaging pollution and climate-forcing emissions, which means that cleaner stoves generally have lower climate impacts.[5] This is critical because it creates an opportunity for carbon finance to support transitions to cleaner, healthier cooking options, which is discussed further in Section 7. Figure 1 illustrates the correlation between health-damaging and climate-forcing emissions.

Figure 1: Schematic diagram illustrating the correlation between health-damaging and climate-forcing emissions from Polluting, Transitional, and Clean cooking options.



* Climate impact of electricity depends on the feedstock and network losses; impacts of wood, charcoal, and other biomass depend on specific management practices.

National stove performance standards

Standards and labels play a fundamental role not only in product quality control but also in guaranteeing reliability and consistency, supporting marketing, and protecting against sub-standard or unsafe products. When they are implemented and enforced consistently and transparently, standards can build consumer confidence and support adoption, which is

[5] Cookstoves with chimneys, which are designed to prioritize removing cooking smoke from the house, have sometimes been the exception to this trend.

particularly important for novel fuels and appliances [21]. Additionally, standards help manufacturers to meet regulatory requirement while encouraging innovation [22]. Adherence to the standards can also facilitate to access carbon finance and other forms of international financial aid [23,24].

As mentioned previously, Uganda and several of its East African neighbours have introduced national stove performance standards [15,25–27]. These regional standards have similarities to ISO 19867-3 but also differ in several ways. For example, Uganda's standard defines three classes for biomass stove performance rather than ISO's five tiers. Uganda's classes have different emissions and efficiency thresholds for carbonised biomass like charcoal and non-carbonised biomass like firewood. Rwanda's standard follows a similar approach (Table 2).

Uganda's and other regional standards do not use the same thresholds used by ISO to define stove performance tiers. For example, if a wood stove meets Uganda's "Class 1" standard, the lowest emitting category, it emits less than 100 mg of $PM_{2.5}$ per MJ_{del} and 3 g of CO per MJ_{del}. Under ISO standards, this stove might be a Tier 3 stove for $PM_{2.5}$, which WHO considers *transitional for $PM_{2.5}$*, and a Tier 5 stove for CO, which WHO considers *clean for CO*.

Table 2: Stove performance standards from Uganda and other East African countries

Country	Performance Categories	Eff (%)	$PM_{2.5}$ mg/MJ_{del}	CO g/MJ_{del}	Correspondence to ISO tier(s)	Correspondence to WHO
Uganda: carbonised biomass	Class 1	> 50%	< 60	< 9	Efficiency Tier 5; $PM_{2.5}$ Tier 4; CO Tier 3	$PM_{2.5}$ – clean CO – polluting
	Class 2	41–50%	60–99	9–11	Efficiency Tier 4; $PM_{2.5}$ Tier 3; CO Tier 2–3	$PM_{2.5}$ – transitional CO – polluting
	Class 3	30–40%	100–250	12–16	Efficiency Tier 3; $PM_{2.5}$ Tier 2–3; CO Tier 1–2	$PM_{2.5}$ – transitional/polluting CO - polluting
Uganda: non-carbonised biomass	Class 1	> 44%	< 100	< 3	Efficiency Tier 5; $PM_{2.5}$ Tier 4; CO Tier 3	$PM_{2.5}$ –clean/transitional CO – clean
	Class 2	35–44%	100–199	5–8	Efficiency Tier 4; $PM_{2.5}$ Tier 3; CO Tier 2–3	$PM_{2.5}$ – transitional CO – transitional/polluting
	Class 3	25–34%	200–380	8–12	Efficiency Tier 3; $PM_{2.5}$ Tier 2–3; CO Tier 1–2	$PM_{2.5}$ – transitional/polluting CO - transitional/polluting

Recognizing the importance of nationally developed standards, NICCS recommends using the US 761: 2019 to define biomass stoves that are included in the transitions that NICCS aims to achieve. Stoves falling in Class-1 are considered "Clean" and stoves falling in Classes-2 or -3 are defined as "transitional". Appliances performing below Class-3 would be "polluting" and should be phased out. Hereafter, the term "Class 1-3" stoves will mean stoves that are "clean" or "transitional" cooking options that are analogous to the WHO's usage of those labels.

In making these definitions, it is important to acknowledge that US 761: 2019 only applies to biomass stoves. While most other fuel/appliance combinations like LPG, biogas, and ethanol very likely meet WHO guidelines for "clean", this may not be true in all cases. Poorly made or malfunctioning stoves may be more polluting than well-designed models. To ensure that substandard stoves do not enter the market, UNBS should develop performance standards for other fuels and appliances.

In addition, it is important to acknowledge UNBS thresholds do not fully align with WHO guidelines. Defining Class-1 stoves using carbonised biomass as "clean" could result in some

charcoal stoves entering the market that fall in WHO's definition of polluting for CO emissions. Similarly, defining Class-1 stoves using uncarbonised biomass as "clean" could result in some wood stoves entering the market that fall in WHO's definition of "transitional" for $PM_{2.5}$ emissions. To lessen risks associated with harmful stove emissions and bring Uganda's stove standards into closer agreement with WHO guidelines, when US 761: 2019 is next reviewed, it should be adjusted to align with ISO 19867-3.

Lastly, several of the strategy documents note that UNBS faces challenges monitoring and enforcing existing standards. Similar concerns were also expressed in many stakeholder interviews (see Section 5). For example, briquette producers reported that there are overlapping standards applied to these products that are inconsistently interpreted and enforced. These challenges could increase as more standards are developed and will need to be addressed to ensure that standards play their intended role in Uganda's clean cooking ecosystem.

Recommendations for stove standards:

1. NICCS should follow US 761: 2019 to define clean, transitional, and polluting biomass stoves: stoves falling in Class-1 are "clean"; stoves falling in Class-2 and 3 are "transitional" and stoves that do not achieve Class-3 are "polluting" and their use should be phased out.
2. UNBS should develop performance standards for other fuels and appliances
3. When it is next up for revision, UNBS should update US 761:2019 to align with WHO guidelines and ISO 19867-3.
4. Ensure that UNBS has sufficient funding and personnel to monitor and enforce all standards related to cooking fuels and appliances are currently in place and that are implemented in future.

Description of the study approach and methods

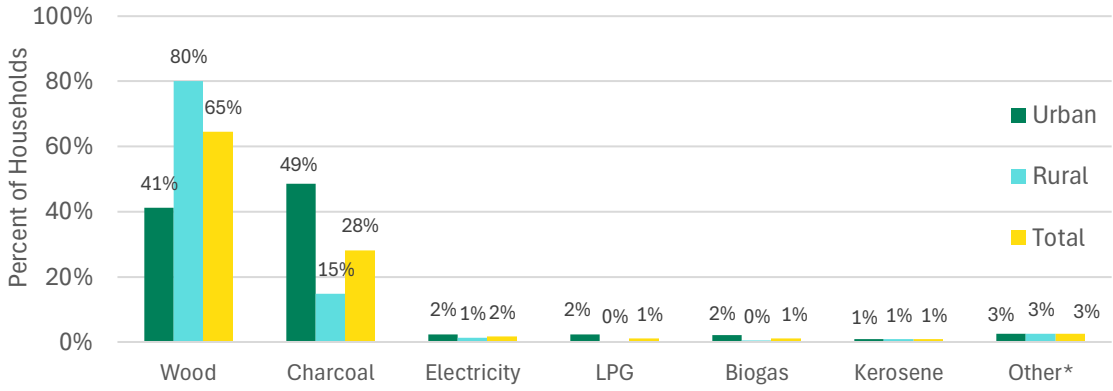
Development of an ICCS was carried out in several stages. First, the team undertook an extensive literature review of recent policies, strategies, feasibility studies, and assessments relevant to Uganda's cooking energy sector. The team wrote a review of these policies which was shared with GoU partners. The team also conducted a series of key informant interviews with stakeholders representing the government, private sector, development partners, and financial institutions. In total, 22 interviews were carried out, with over 30 individual respondents involved. In addition, the group organised two focus group discussions, one with solid biomass stove and fuel enterprises and a second with women from a community on the outskirts of Kampala to get their impressions of clean cooking options that are commercially available (see Appendix E for a list of interviewees and focus group participants). Findings from the interviews and focus group discussions are summarized in Section 5 and cited throughout the text as appropriate. This document reflects the combined learning from the extensive policy review, key informant, interviews, focus group discussions, stakeholder consultations, and discussions with personnel from MEMD.

2. Uganda's current cooking landscape

The most recently available nationally representative data collected in the 2024 National census indicates that wood and charcoal were the most commonly used cooking fuels throughout Uganda [28]. Nationally, nearly two-thirds of households relied on fuelwood, and 28% used charcoal (Figure 2). Fuelwood was more common in rural areas, where 80% considered it their primary cooking fuel.

Charcoal was more common in urban areas, where 49% used it for most cooking tasks. E-cooking and LPG follow with 1-2% of households using each as a primary fuel.[6]

Figure 2: Type of fuel or energy source used by households "most of the time" in 2024 [28]



* Other includes alcohol, petrol or diesel, coal, crop residues, grass, dung, processed biomass, garbage/plastic, or sawdust

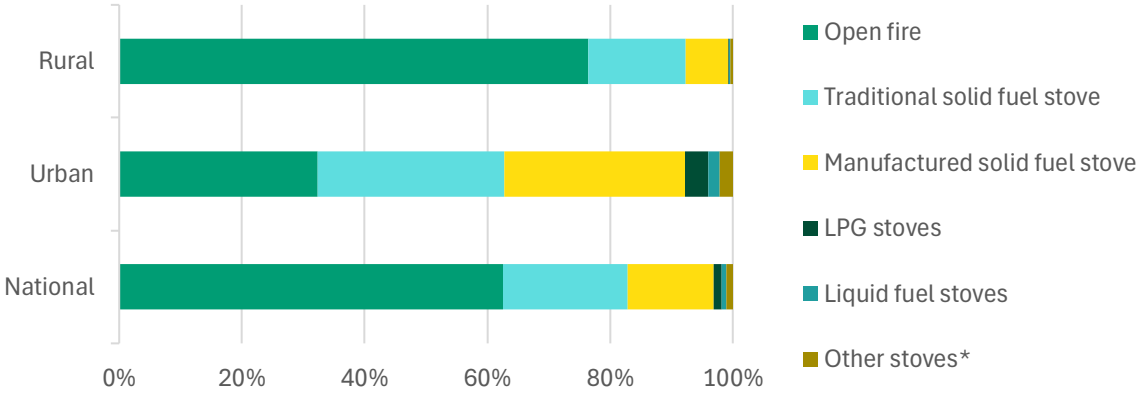
Figure 2 underscores Uganda's heavy reliance on woodfuels, particularly in rural areas, highlighting the challenge facing Uganda's transition to clean cooking options. The same survey collected data on cooking appliances, which provides some deeper insight into Uganda's baseline use of clean cooking options. Nationwide, over 80% of households use either a 3-stone fire or traditional (artisanal) solid fuel stove for most cooking tasks. As explained in the previous section, these stoves are polluting, and present serious health risks. They are also generally much less efficient than manufactured options. Roughly one in seven households (14%) burn woodfuels in some type of manufactured stove (Figure 3). Notably, the uptake of manufactured stoves in urban areas far outpaces uptake in rural areas and is negligible in many parts of the country (Figure 4 - right).

The manufactured stoves used by Ugandan households are likely to be cleaner and more efficient than 3-stone fires and artisanal stoves. However, the extent of emission reductions or fuel savings cannot be accurately assessed because there is no data indicating the specific types of manufactured stoves that households are using. Still, it is unlikely that the manufactured appliances meet WHO clean or transitional requirements for CO or $PM_{2.5}$ emissions because very few such stoves were available in Uganda at the time of the 2021 survey.[7] The prevalence of other appliances aligns closely with data on fuels shown in Figure 2.

[6] The census data show surprisingly high use of biogas, at ~1% nationwide, with the majority of users in urban areas. This is very unlikely and may indicate confusion between biogas and LPG among census enumerators and respondents.

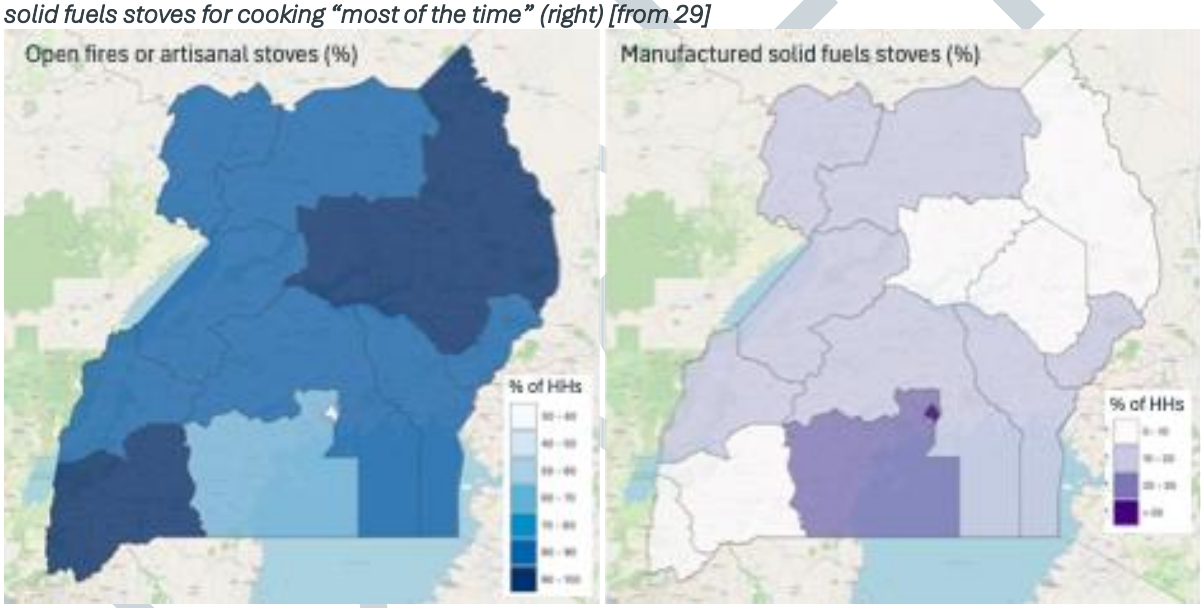
[7] To our knowledge, Burn Manufacturing and SSM are the only enterprises currently mass producing natural-draft wood or charcoal stoves that achieve Class 1-3 ratings for both CO or $PM_{2.5}$.

Figure 3: Types of appliances used by households for cooking "most of the time" [from 29]



*Other stoves include electric stoves, biogas stoves, and movable fire pans

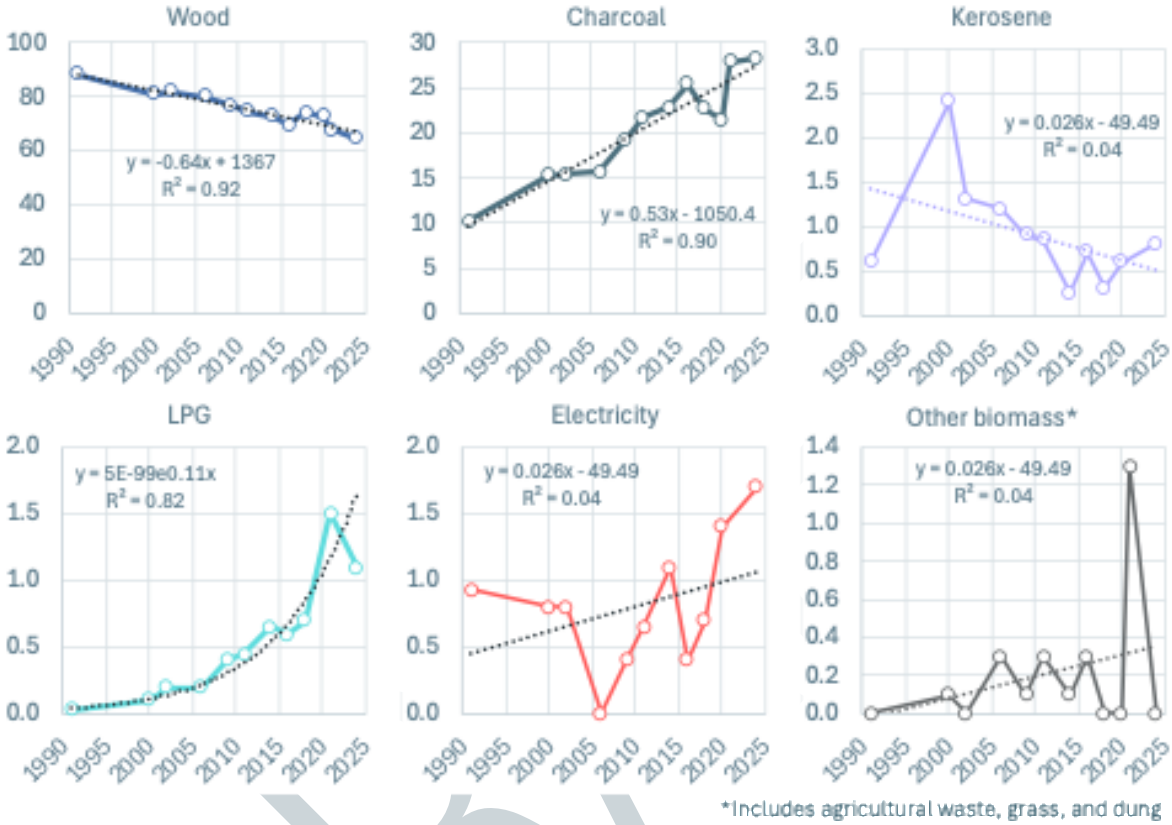
Figure 4: Percentage of households that report using open fires or artisanal stoves (left and manufactured solid fuels stoves for cooking "most of the time" (right) [from 29]



Trends in household fuel choice over time

While the prevalence of woodfuels is still extremely high, the primary household fuel choice has gradually shifted over time (Figure 5). The percentage of households reporting that wood is their primary cooking fuel has declined from 88% in the early 1990s to 67% in 2021. Conversely, the percentage of households reporting charcoal as a primary fuel steadily increased from just 10% in the early 1990s to nearly 30% in the latest survey. This shift correlates very closely with Uganda's rate of urbanization, which also increased from 10% to nearly 30% of the population during the same timeframe [30]. LPG has also shown a dramatic uptick in use, albeit from a very low baseline. Other fuels, including electricity, show a more erratic pattern with no clear trend over the past three decades.

Figure 5: 30-year patterns in primary household fuel choice from nationally representative surveys with trendlines added [8]



Accessibility, Market Size, and Potential

Many factors affect whether families adopt clean and transitional fuels and appliances [34,35]. At the most basic level, there is a question of physical access and affordability. Are the fuels and appliances reasonably easy to obtain, and does the family have the money and/or time to acquire sufficient quantities to meet their needs? While other factors are also important, this simple assessment, relies on accessibility and affordability to examine the size and potential of the residential clean cooking market.

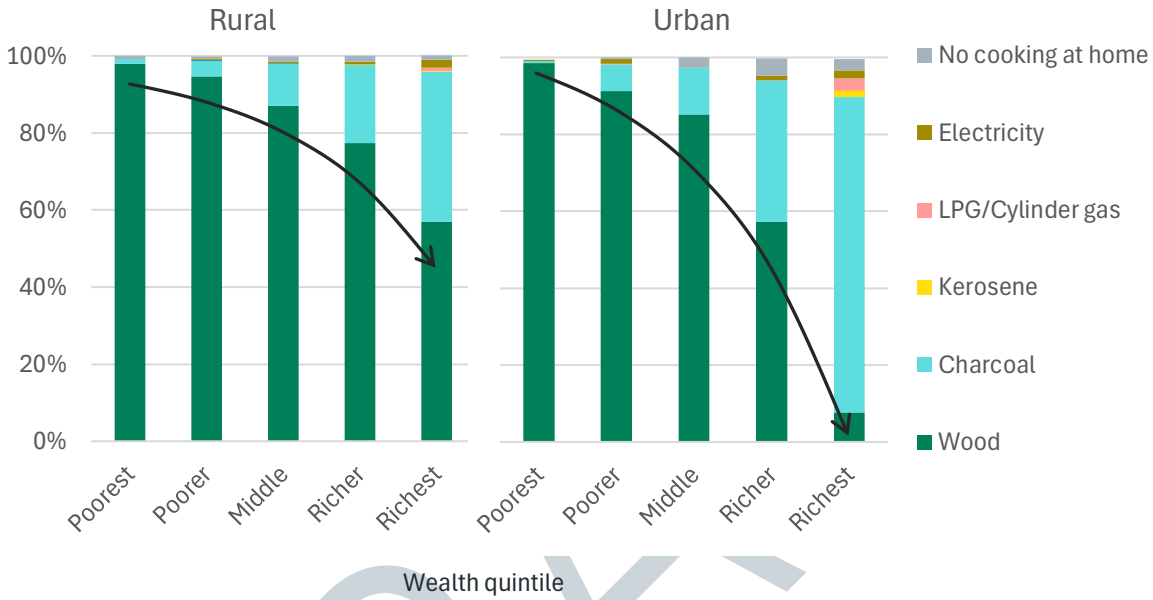
Household wealth and location are well correlated with uptake of clean cooking options. This pattern is clear from the country's most recent DHS data,[9] which shows the several disparities in primary cooking fuel choice. Though this data is from 2018 and therefore somewhat outdated, it reveals some important patterns that are likely still in place today. Figure 6 shows primary household fuel choice disaggregated by location and wealth quintiles, highlighting differences along both indicators. For example, in both rural and urban households, wealthier groups are less likely to cook with fuelwood and more likely to cook with charcoal (illustrated by arrows in Figure 6). The disparity between wood and charcoal users is more pronounced in urban areas, where over

[8] Data are from the following sources:1991, 2002, 2014, and 2024 are from UBOS national censuses [31], 1995, 2000/01, 2004/05, 2006, 2009, 2011, 2014/15, 2016, 2018/19 are from DHS and associated surveys [32], 2019/20 and 2021 are from UBOS household and national service delivery surveys [29,33].

[9] DHS is a nationally representative survey carried out every four or five years that collects demographic, housing, wealth, and public health information [36].

80% of the top quintile use charcoal. However, it is also worth noting that nearly 40% of the top wealth quintile in rural areas use charcoal as a primary fuel. Similarly, while just 4% of the richest quintile of rural households use clean fuels, clean fuels are much more prevalent in the top wealth quintile than in less well-off groups.

Figure 6: Primary fuel choice in rural and urban areas by wealth quintile [from 37]



Factors that define cooking archetypes

The information about household wealth and fuel choice used to create Figure 6 can also be used to develop categories of archetypal households for residential cooking in Uganda. We present these archetypes based on accessibility and affordability, with an additional dimension added to account for those households that already have a connection to the national grid, which dramatically lowers the barrier to adopting an e-cooking option. Figure 8 shows a graphical representation of how Uganda's population are divided into these archetypal categories.

Accessibility

Access is a major determinant of adoption. If clean and transitional cooking options are difficult to obtain, it is unlikely that people will bring the appliances into their home and regularly purchase fuel. There are multiple ways to define access. For this assessment, urban and rural locations are used to define a simple proxy of higher and lower access.[10] Combining the latest population data from the 2024 census [38], with older data on household fuel choice, approximately 10.5 million households currently use polluting fuels and appliances. Of these, 7.7 million reside in rural areas, 2.6 million reside in urban areas, and 0.2 million are classified as refugee households.

Grid connections

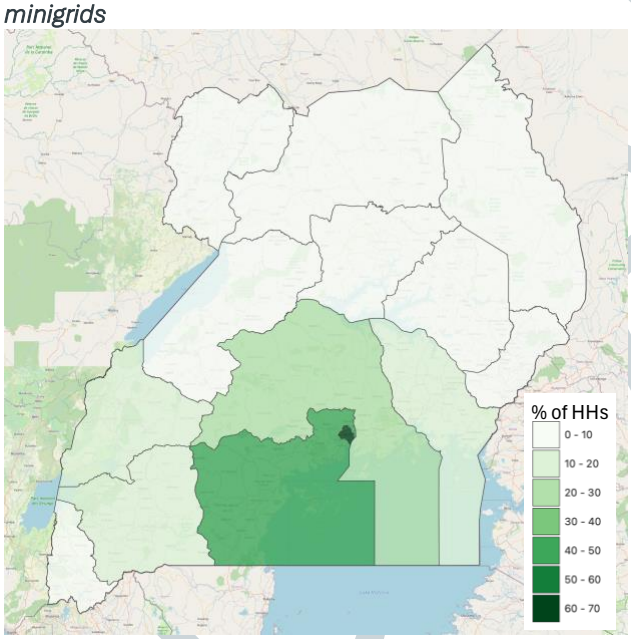
Grid connections are an important factor in defining the market potential for clean and transitional fuels and appliances because access to grid electricity is the most straightforward way to

[10] We acknowledge that this is an imperfect approach, but it serves purpose for this simple example. For a more sophisticated assessment, access could be defined in other ways such as travel time to nearest paved roads, market centres, petrol stations, or electrical distribution infrastructure.

introduce e-cooking to new households. Off-grid options exist, but they entail higher upfront costs and would likely need different financial models to reach scale.[11] Like other clean cooking pathways, household grid access in Uganda is currently concentrated in and around Kampala, with access decreasing with increasing distance from the capital region – shown in Figure 7 [from 29].

While current access to grid and mini-grid electricity is limited, Uganda has ambitious plans to extend grid access into currently unserved areas. For example, NDP IV includes plans to significantly expand the country's transmission and distribution network and achieve universal access to electricity by FY 2029/30 while increasing per capita electricity consumption by 165%. As these plans are implemented, e-cooking options become will become more accessible. We return to this in Sections 4 and 6 below.

Figure 7: Percentage of households by sub-region reporting access to electricity from the national grid or minigrids



Affordability

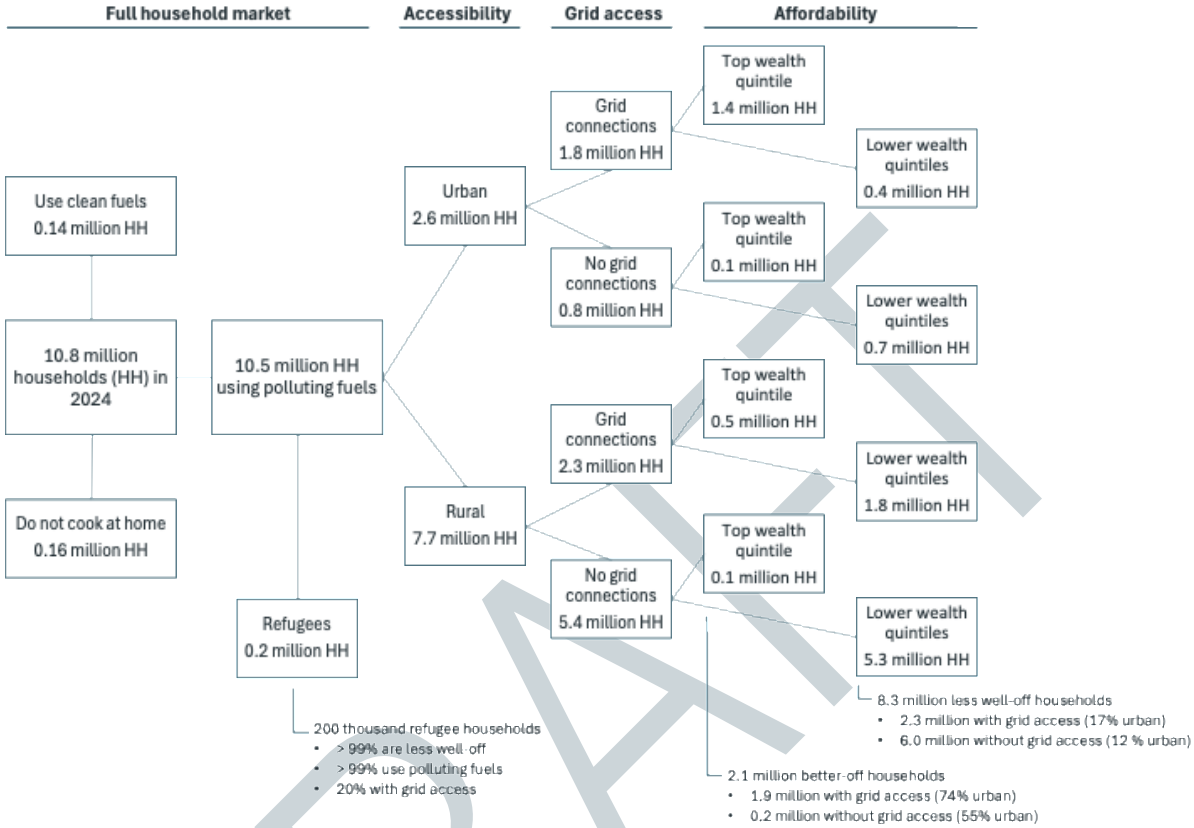
The ability to pay for clean and transitional fuels and appliances is another important determinant of adoption and use. Families must be able to pay both upfront and ongoing costs of cooking. This is challenging in Uganda, where over 20% of the population lives below the nationally defined poverty line [33]. Indeed, the cost of cooking daily with clean fuels is out of reach for many Ugandans, ranging from 6-18% of median monthly income.[12] For comparison, in the US, the

[11] Grid connection data are from Uganda's most recent DHS/MIS survey [39]. However, the survey simply asked whether the household has electricity and does not ask the source. In that survey, 40% of households report having access. However, in the 2021 UBOS National Service Delivery Survey, only 20% of households report having access to electricity from the national grid or a mini-grid [29]. Thus, the 2018 DHS/MIS data likely includes other forms of electricity like solar home systems. Therefore, the data in Figure 8 likely overstates the percentage and number of households with grid access.

[12] UBOS's 2020 household survey indicates that median monthly household income was UGX 190,000, which would be UGX 2.28 million per year [33].

government considers families to have a "high energy burden", if their total energy costs exceed 6% of their income [40].

Figure 8: Estimated no. of households falling into each cooking access archetype



For simplicity, in this assessment, households in the top wealth quintile are considered “better off.” These families very likely can afford clean or transitional cooking options. This assertion is upheld by data from Uganda’s most recent DHS/MIS survey, which indicates that 75% of the families in this group use either charcoal or a clean fuel [32]. Charcoal, though not clean, is nearly always purchased rather than collected, which is an indication that the family has sufficient income to buy fuel. Many assessments estimate that cooking with charcoal in a traditional stove actually costs more than most cleaner options [41–43] (see Appendix 0 for more details). Thus, many families in the top wealth quintile could potentially save money by switching from charcoal to a clean or transitional option without the need for subsidies, though they may require some kind of incentive, training, or financing to spread the upfront cost the appliance over time.

The remaining 80% of households are considered “less well-off.” This group includes the 20% of Ugandan households who live below the nationally defined poverty line as well as the middle 60% who are not necessarily poor but still have severe constraints on their household expenditures. 87% of the less well-off households use fuelwood as their primary cooking fuel, which the majority collect for free [33]. The majority also use open fires that cost nothing to build, or simple artisanal stoves that cost very little to acquire [29]. The majority of this less well-off group -- 5.3 million households, slightly over half the total population -- lives in rural areas and lacks access to electricity.

Refugee households

We consider refugees separately from the general population. Based on the 2024 census, there are roughly 200,000 refugee households in Uganda today.[13] They are concentrated in certain sub-regions. Nearly all are less well-off and cook with polluting fuels. About 20% have access to electricity [39]. The international community provides resources to support Uganda's efforts to host refugees. Support includes provision of "clean energy for cooking and lighting" [44]. Support extends to adjacent communities that can be impacted by refugee settlements; however, current funding is less than half of what is required, which makes it difficult to provide for the needs of both refugees and adjacent host communities.

Size of each archetype

This section summarizes the archetypal groups. Section 6 discusses measures that could be utilized to support their transitions to clean or transitional cooking options. Note, the numbers are based on data from several different sources and are therefore approximate. However, the key messages apply regardless of uncertainty in the size of each group.

People currently using clean fuels (140,000 households)

This group comprises roughly 1.3% of the population. 59% live in urban areas and 74% fall in the top wealth quintile. However, about 30,000 households using either LPG or electric appliances as their primary fuel are less well-off and live in rural areas. These families would be worth studying further to better understand how they access and pay for clean fuels and appliances despite their lack of wealth and rural locations.

Better-off urban families currently using polluting fuels (1.5 million households)

This group represents about 14% of the total population. The majority have electricity and cook with charcoal. This group could be considered the "low-hanging fruit" for the clean cooking transition. They live in urban areas and are close to a variety of retail outlets that supply fuels and appliances. If enterprises choose to deliver fuels, these households are relatively easy to reach. Similarly, if appliances malfunction, families are easily reached for after-sales service. Moreover, these families already purchase fuel, and most are connected to the national grid. Household heads in this cohort are more likely to have attended secondary school or obtained post-secondary education [39].

Less well-off urban families currently using polluting fuels (1.1 million households)

This group represents about 10% of the total population. About one third of these families have access to electricity but the majority do not. About 20% use charcoal, but the majority cooks with fuelwood, some of which may be purchased and some freely collected.[14] Achieving a transition to Class 1-3 cooking options will be more challenging for this group. Families in this category do have some of the same advantages as the better-off urban families: many purchase their fuel, have access to retail markets, and can be reached by stove and fuel

[13] The preliminary data from Uganda's 2024 census notes that the refugee population is 780,000, which is considerably lower than UNHCR's estimate of 1.7 million individuals [44]. In addition, the preliminary data released at the time of writing does not include household size or the number of households in refugee communities. This assessment simply divides the total number of individuals by the national average household size of 4.4 and rounded up. However, if UNHCR is more accurate than the recent census, then the number of households may be considerably more than 200 thousand.

[14] Two recent national surveys include information about fuelwood sourcing [33,45]. However, these sources are different than the source used to define primary cooking fuel and household wealth, and different survey data cannot be combined.

retailers. However, they tend to be less educated and face greater income constraints. Those purchasing wood or charcoal may save money by switching to a cleaner option, but they will likely need some type of subsidy to reduce the upfront cost of a Class 1-3 stove.

Better-off rural families currently using polluting fuels (600,000 households)
This group comprises about 6% of the population. The majority, over 80%, have access to electricity, making them good candidates for e-cooking solutions. In addition, despite the stereotype of charcoal as an "urban fuel", nearly 40% of these households consider charcoal as their primary cooking option, which indicates that they are already paying for fuel and could be amenable to adopting high quality Class 1-3 charcoal stoves, particularly if some favourable financing mechanism allowed them to spread the upfront cost over time. In addition, better-off rural families are more likely than other households to own livestock, and particularly the type and quantity of livestock that are most appropriate for biogas production.

Less well-off rural families currently using polluting fuels (7.1 million households)
This group is the largest of the archetypal groups defined for this assessment and comprises 66% of the total population. The group includes 1-2 million rural families living below the national poverty line and hundreds of thousands of extremely poor families struggling to meet their basic caloric needs [33]. Over 90% of this group cook with firewood. The majority own some type of livestock but have smaller holdings than their better-off rural neighbours, which makes biogas a less attractive option. Supporting a transition to cleaner cooking options for this group will be the most challenging aspect of NICCS, and will require intensive investment in awareness raising, technical support, and financial resources.

People who do not cook at home (160,000 households)
This group comprises less than 2% of the population and is rarely discussed in the context of clean cooking strategies but should not be ignored. About two thirds of these households are better off and may opt out of home cooking because they purchase prepared foods. However, the remainder consist largely of less well-off rural families, who may be food insecure. In any case, any of these families may decide to prepare food at home in the future.

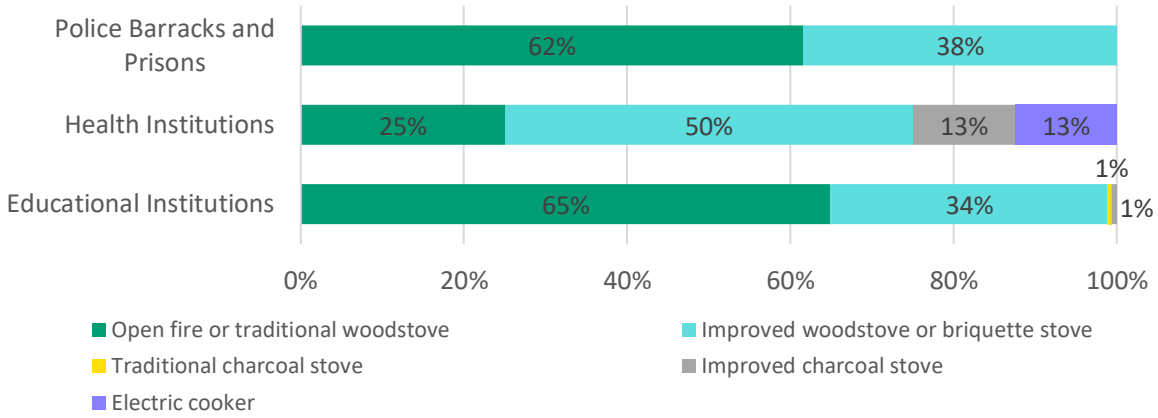
Commercial and institutional cooking

Like the residential sector, Uganda's commercial and institutional sectors also depend heavily on woodfuels and would benefit from increased access to cleaner fuels and appliances. Commercial cooking consists of formal and informal restaurants, bakeries, and roadside food vendors as well as hotels and resorts. Institutions include thousands of pre-primary, primary, and secondary schools, and dozens of colleges and universities, as well as prisons, health facilities, police stations, and military barracks [46].

Including commercial and public institutions in NICCS requires an understanding of the fuels and appliances these entities currently use. There are several sources of information, including MEMD's annual statistical abstracts, which combine energy consumption in commercial enterprises and public institutions [47], MEMD's *National Firewood And Agro Residue Survey* from 2020 [45], UBOS *National Service Delivery Survey* from 2021 [29], and a *Clean Cooking Energy Needs Assessment in Public and Private Institutions* commissioned by MEMD in 2023 [48]. MEMD's 2015 Biomass Energy Strategy also includes estimates of commercial and institutional energy consumption [2], though that data is somewhat out of date.

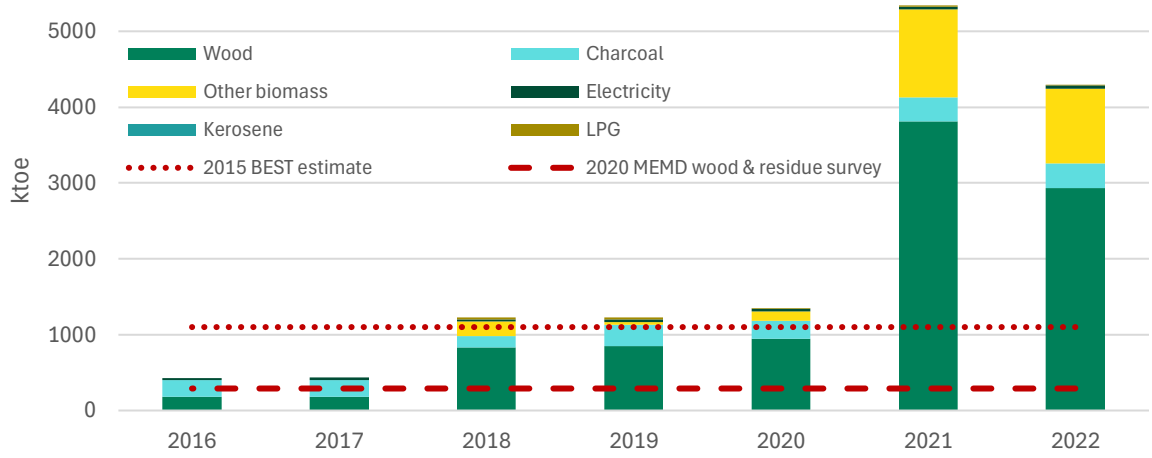
All data sources indicate that commercial and public sectors rely heavily on woodfuels. For example, data from MEMD's 2023 Needs Assessment indicates that every school and nearly every surveyed relies on biomass for most of their cooking needs [48] (Figure 9). In fact, of 1,269 institutions surveyed in that study, only one reported using an electric cooker and none reported using LPG as their main fuel, although some institutions were "benchmarked" for investing in or piloting clean cooking options, including electricity, biogas, and LPG. Notably, the data also reveals 35% of institutions use improved biomass stoves. However, the report also notes some of the improved stoves were not being used because of restrictive designs that required specific sizes of pots and pans, as well as technical defects, and poor ergonomics.

Figure 9: Primary fuels and appliances used for cooking in public and private institutions [48]



While the data is clear that commercial and institutional cooking relies heavily on biomass, there is lack of consistency within and between different sources about the quantities of woodfuels that are consumed. For example, according to MEMD's annual statistical abstracts, between 2017 and 2018, the combined consumption of fuelwood, charcoal, and other solid biomass in commercial enterprises and public institutions increased by 190%, then held steady for three years before increasing by over 300% between 2020 and 2021 (Figure 10). It is unlikely that these large jumps in energy demand reflect actual changes in consumption. Instead, they may reflect changes in the way that MEMD collects or reports data. In any case, it raises questions about the consistency and accuracy of data that MEMD collects from these sectors.

Figure 10: Energy consumption in PJ by commercial entities and public sector institutions from MEMD statistical abstracts [47] with data from the BEST and MEMD Firewood/Residue Surveys



Other sources of cooking energy data in the commercial and public sectors come from one-time surveys conducted by UBOS and MEMD. Uganda's 2015 Biomass Energy Strategy estimates that commercial enterprises and public institutions consumed about 1,100 ktoe of wood, charcoal and other biomass [2][15], which aligns well with MEMD statistics from 2018-2020, but does not agree with data from before 2018 and after 2020.

The 2020 *National Firewood And Agro Residue Survey* also provides estimates of wood and charcoal consumption in commercial enterprises and public sector derived from surveys of over 700 businesses and institutions [45]. This study reports that nationwide businesses and GoU institutions use 780 tons of wood and 690 tons of charcoal each day. In energy terms, this is roughly 290 ktoe per year[16], which is less than one fourth of MEMD's estimate of commercial and public sector wood and charcoal consumption for 2020.

Based on these widely varying estimates of wood and charcoal consumption, it is clear that commercial food service enterprises and public institutions rely heavily on fuelwood, charcoal, and other forms of solid biomass, but the quantities used and potential for introducing clean fuels and appliances remains uncertain. This indicates a need for better, more harmonised data collection. However, the data that is available shows that a high percentage of public institutions have adopted some type of improved solid fuel stove as their primary cooking appliance.[17] This represents a leverage point for NICCS targets. Public institutions generally purchase their fuel and would see direct savings by adopting more efficient stoves. Moreover, GoU has direct oversight of investment decisions and can easily mandate that public institutions install improved solid fuel stoves or fuels and appliances that would meet WHO "clean standards" like LPG or e-cooking

[15] This estimate is based on BEST Table 2, which reports biomass demand in PJ, using a conversion factor of 1000 ktoe = 41.87 PJ

[16] 780 tons of wood per day x 16 GJ/ton x 365 days per year = 4.6 million GJ or 4.6 PJ per year

690 tons of charcoal per day x 30 GJ/ton x 365 days per year = 7.5 million GJ or PJ per year

Combined 4.6 PJ and 7.5 PJ is equivalent to 12.1 PJ or 290 ktoe

[17] Compare the percentage of institutions that adopted improved solid fuel stoves in Figure 9 to the percentage of households using manufactured solid fuel stoves in Figure 3.

options.[18] Note, NICCS does not require that these stoves meet US 761: 2019 because that standard only applies to household appliances. Implementing a policy focusing on public institutions will allow GoU to use their own facilities as a "proving ground" for larger stoves and cooking technologies that can then be promoted for adoption by private commercial food service enterprises. Based on these observations and proposals, NICCS makes several recommendations for commercial and institutional cooking.

Recommendations for commercial and public institutional cooking:

1. UNBS should develop standards for institutional and commercial solid fuel stoves that are analogous to US 761: 2019 (keeping in mind the previous recommendation US 761:2019 be updated to align with WHO guidelines and ISO 19867-3).
2. The use of fuelwood and charcoal in unimproved should be phased out in public institutions and replaced by a mix of improved solid fuel appliances that meet standards for transitional or clean appliances.
3. MEMD should work with UBOS to develop consistent, standardised, and nationally representative data collection methodologies so that cooking energy consumption among commercial enterprises and public institutions can be quantified and tracked over time.

Clean and transitional fuels and technologies

This section reviews the range of clean and transitional cooking options that meet WHO criteria. Section 4 examines the existing policies and strategies that GoU has introduced to promote access to each option.

Solid biomass

The previous section noted that solid biomass, predominantly fuelwood and charcoal, supplemented by agricultural waste, comprise the majority of Uganda's energy supply, particularly in the residential sector [51]. The impacts that result from this scale of biomass consumption are the main motivations for the policies and strategies reviewed in this document. However, it is important to acknowledge that biomass remains dominant because it is plentiful and accessible to the majority of Ugandans. While NICCS brings together policies and strategies that aim to reduce the share of biomass in Uganda's energy mix, it is important to acknowledge that biomass will continue to meet some of Ugandan's energy needs for the foreseeable future. This points to a need for two types of policies: first, policies that promote cleaner, more efficient biomass-burning appliances; and second, policies that encourage biomass pre-processing, such as briquetting or pelletising, which utilises waste materials and creates a more uniform, cleaner burning fuel.

Improved solid biomass stoves have been promoted to reduce the impacts of cooking with fuelwood and charcoal for decades in Uganda and throughout sub-Saharan Africa [52]. Many attempts to promote improved biomass stoves were based on donor aid and failed to gain much traction beyond the immediate target population [2]. However, in an exception to the trend, the Kenyan Ceramic Jiko (KCJ) was introduced in the early 1980s and became fully commercialized throughout the region. Now, 40 years after its introduction in Kenya, KCJ-style charcoal stoves are the "baseline" option throughout of East Africa.

[18] This strategy was adopted with some success in Tanzania, where the government banned cooking with fuelwood and charcoal in institutions that feed more than 100 people in January 2024 [49,50].

Early efforts to disseminate improved stoves mainly targeted artisanal stoves, which generally cannot consistently achieve WHO's clean or transitional status for both $PM_{2.5}$ and CO emissions.[19] However, in the past decade, the international community has increasingly supported manufactured solid fuel stoves, which can be mass produced using materials and designs that ensure better, more consistent performance. As a result of this shift toward mass-production in automated factories, there are now several commercially available wood and charcoal stoves that have achieved WHO's "transitional" rating, meaning ISO Tier 3 for $PM_{2.5}$ and Tier 3-4 for CO emissions [53]. Some of these appliances are manufactured in East Africa.

Wood and charcoal stoves that achieve "transitional" ratings share similar design characteristics: they are lightweight, with small, well-insulated combustion chambers, and rely on natural draft with user-controlled airflow.[20] ISO-tested efficiencies exceed 40%, and costs range from USD 20-50 [53]. Stoves like these will play an essential role if NICCS is to achieve the objective of ensuring all Ugandans use clean or transitional stoves by 2030.

By labelling these stoves "transitional", WHO explicitly sends a message that policymakers should not consider these appliances as end points, but rather as a stage along the pathway to clean cooking. There are no natural-draft wood or charcoal-burning stoves with emissions below the WHO's clean threshold. To date, only forced-draft stoves burning pellet fuels have achieved WHO "clean" status for both $PM_{2.5}$ and CO [53], and those options will be essential for any strategy that seeks to utilize solid biomass, while moving from "transitional" to "clean" appliances. We elaborate on this in Section 6.

E-cooking

E-cooking -- using efficient electrical appliances, such as electric pressure cookers (EPCs), rice cookers, and induction stoves -- has received a lot of attention in recent years largely thanks to the UK-funded Modern Energy Services (MECS) programme, which kicked off in 2019 intending to "spark a new approach to clean cooking" largely by promoting energy efficient electric appliances [54]. Historically thought to be too expensive for poor families, e-cooking is now a more realistic solution for this segment due to expanded electrification and the proliferation of efficient low-cost appliances [55]. Integrating the appliances with renewable sources, particularly solar PV and microgrids, can provide cost-competitive and sustainable cooking options, especially in off-grid areas. However, high upfront costs, particularly for off-grid options, remains a major barrier, necessitating innovative financing models, such as pay-as-you-go (PAYGO) and subsidised appliances [56]. Other barriers including grid instability and high electricity tariffs, as well as cultural preferences for "smoky" flavours, low awareness, and livelihood impacts must also be addressed. Some countries address high costs of grid-based electricity by offering either a "lifeline" tariff or a cooking tariff. Uganda's current residential tariff includes both.

Therefore, a holistic approach involving multi-stakeholder engagements, policy frameworks, awareness campaigns, understanding of local contexts and behaviour change strategies, and

[19] The Clean Cooking Alliance's stove catalog includes data from nearly 200 solid biomass stoves including a mix of artisanal and manufactured models. Only 8 stoves achieve or exceed ISO Tier 3 for $PM_{2.5}$ and CO and all are manufactured models [53].

[20] "Natural draft stoves rely on convective airflow driven by the heat of the burning fuel. In contrast, forced-draft stoves use an internal fan to augment airflow. Forced-draft devices tend to be cleaner and more efficient, but require a power supply and electronic controls, making them more expensive and complicated to operate than natural draft stoves.

technical solutions, such as optimised hybrid mini-grids and electricity demand-side management, is necessary. We return to this in Section 6.

LPG

LPG is a mix of butane and propane that is recovered during fossil fuel extraction or processing [57]. The mixture is a gas at room temperature and pressure but liquefies under moderate pressure, which makes it easy to store and transport in metal cylinders. Roughly 60% of global LPG production is derived from natural gas, where butane and propane can constitute as much as 10% of the volume of extracted gas. The remaining 40% of global production comes from oil refining; LPG typically constitutes between 1 and 4% of crude oil feedstock [57].

LPG's ease of storage, portability, and relative abundance make it a common household fuel in many low- and middle-income countries (LMICs). Analysis by the WHO suggest that 70% of the 1.2 billion people who gained access to clean cooking fuels between 2010 and 2020 did so by adopting LPG [58]. LPG is popular throughout Latin America and Asia and formed the basis of India's massive "Pradhan Mantri Ujjwala Yojana" (PMUY) programme, which provided subsidised LPG access to 103 million poor families between 2016 and 2024 [59]. LPG also forms the core of Kenya's recent upswing in access to clean cooking. In 2022, over 60% of urban Kenyan households considered LPG their primary fuel, a three-fold increase from the early 2010s [37].

As mentioned above, about 1.5% of households in Uganda used LPG as a primary cooking fuel in 2021 [29], compared to 5% of households in Tanzania and 30% in Kenya [32,50]. Data from the most recent census, which was released while NICCS was being developed, show only 1.1% of households considered LPG their primary cooking fuel in 2024; however, some experts dispute this finding. Regardless of the accuracy of the recent census data, there is little dispute that LPG uptake as a primary cooking fuel remains low. This is due to several factors. For example, the retail price of LPG is significantly higher in Uganda than in neighbouring countries [6]. Upfront costs of LPG kits are also high relative to other common household fuels, especially as smaller cylinders are not yet widely available. In addition, there are safety concerns and limited availability. Retail outlets are largely concentrated in urban centres, which leaves smaller towns and rural areas unserved. GoU together with development partners have come up with some initiatives to support the adoption of LPG, such as tax exemptions on LPG, development of LPG standards, and provision of subsidized fully fitted gas cylinder kits.

Biogas

Biogas is a clean burning mix of gases produced by anaerobic digestion of organic matter like animal dung, food waste, and agricultural residues, as well as human waste. The organic matter is collected in a closed airtight biodigester, where it is decomposed by anaerobic bacteria, producing a mix of CH_4 and CO_2 with other trace gases, along with bio-slurry, a nutrient-rich liquid that can be utilized as organic fertilizer [60].

Biogas is a proven clean cooking technology suitable in rural areas where livestock are plentiful and access to commercial fuels and appliances is limited. Biodigesters have been promoted in East Africa for nearly 20 years [61]. However, uptake has been slow for several reasons, including high upfront cost, livestock requirements, and potential resistance to cooking with fuel derived from animal or human waste [60].

Ethanol

Ethanol is a clean burning type of alcohol typically produced through the fermentation of starch or sugar-based feedstocks.[21] It has been proposed as an alternative cooking fuel in sub-Saharan Africa for over two decades [63]. However, until recently, ethanol has not gained much traction in the region's cooking fuel markets. Past efforts to promote ethanol faced barriers related to cost, lack of supply and distribution infrastructure, and lack of awareness among potential end-users. In addition, because ethanol is the intoxicating component of alcoholic beverages, it is often regulated more heavily and taxed at higher rates than other fuels [64]. Ethanol proponents argue that ethanol would be a viable alternative to polluting fuels like charcoal and compete favourably with clean options like LPG and e-cooking if the taxes levied were aligned with taxes levied on other cooking fuels [65].

In addition to burning cleanly, ethanol has other favourable characteristics. Because it is derived from starch- and sugar-based crops, feedstocks can be sourced from domestically produced crops and distilled in local refineries, which provides markets for local agricultural products and employment for non-farm workers. Using domestically produced ethanol as a clean cooking fuel increases energy security and reduces the need to import LPG [65].

3. Barriers impeding access to clean and transitional cooking

Many factors impede the adoption and sustained use of clean and transitional cooking fuels and appliances [34,35]. From the end-user's perspective, barriers to adoption are often related to cost, lack of accessibility, and supply uncertainty [66]. Suitability, convenience, and ease of use are also critical [67,68]. Each of these barriers can be addressed with distinct approaches, some of which are applicable to all clean and transitional cooking options and some of which only apply to specific technologies. For example, lack of affordability could be addressed by introducing a clean cooking subsidy that applies to any qualifying appliance. This is the approach adopted by the World Bank's Electricity Access and Scale-up Project (EASP – see below for more details). In contrast, accessibility is often limited by supply constraints, which require technology-specific interventions to address. For example, enhancing LPG access requires bulk storage near the point of use to facilitate bulk purchasing and reduce costs, sufficient cylinders to meet consumer demand, and sufficient bottling plants to expand distribution networks [6]. In contrast, boosting e-cooking access could be achieved by expanding electricity transmission and distribution networks. In both cases, investment in distribution infrastructure is needed, but the specific actions differ substantially.

We present a general overview of barriers in Table 3, and provide specific details about ways to overcome those barriers in Section 6 below.

Table 3: Overview of barriers to achieving clean cooking targets [adapted from 69]

Cross-cutting issues	
Insufficient capital allocation	Insufficient funding is allocated by the government and development partners to achieve existing targets.

[21] Ethanol can also be derived from cellulosic materials including plant stalks and wood waste, but these so-called "second generation" pathways are more costly and not yet fully commercialized [62].

Gaps in government coordination	Despite creating an inter-ministerial committee on clean cooking in 2016, which was intended to "to advocate for policy, planning and resource allocation for clean cooking solutions" [70], there is still a "lack of connection between government, non-government, and academia" [71 p. 6], which impedes coordinated progress.
Inadequate enforcement of existing standards and regulations	Many regulations covering clean and transitional options are not adequately enforced (e.g. LPG cylinder refilling, charcoal quality, biomass stoves, etc).
Lack of standards for “new” clean fuels and appliances	Standards and regulations for induction stoves, electric pressure cookers (EPCs), and ethanol stoves do not exist.
Lack of coordinated monitoring reporting and verification (MRV) frameworks	There is inadequate data to establish an accurate baseline of current access to clean and transitional fuels and appliances, and no framework in place to monitor progress toward targets articulated in existing policies and strategies.
Unpredictable policy and regulatory environment	Policies have been implemented to discourage the use of polluting fuels and encourage uptake of clean and transitional cooking options including the executive order banning commercial production of charcoal in Northern regions and the LPG promotion programme; however, these and other programmes have been implemented unpredictably and without broad coordination.
Slow pace of policy development and resource mobilisation	The time required to develop and implement policies to increase access to clean and transitional fuels and appliances leads to missed opportunities.

Supply-side Barriers	
High cost of raw materials, import duties, and taxes on some fuels, and appliances	Importing raw materials and parts to manufacture or assemble appliances, as well as finished appliances, can be costly. Some products are also subject to VAT. While VAT generates revenue for GoU, it also increases the cost of doing business and makes it harder for private enterprises to reach consumers.
Limited access to, and high cost of finance	There are limited options for enterprises to fund capital investments in manufacturing, increase inventory, or expand their business. Most lenders require collateral and other assurances, which raises barriers, particularly for SMEs. In addition, while carbon finance is an essential piece of the clean cooking financial landscape, there is uncertainty surrounding Uganda’s implementation of Article 6.2 and 6.4 of the Paris Agreement. The high cost of borrowing is also problematic in Uganda, where commercial lending rates are much higher than in neighbouring countries [72]. LPG marketers noted that the high cost of borrowing contributes directly to the high retail prices they charge consumers [73]. In October 20924, Uganda’s central bank cut its benchmark policy rate [74], but it is unclear if this will impact commercial lending rates and reduce borrowing costs for clean cooking enterprises.
High energy prices and reliance on imported fuels	Uganda currently imports all of its LPG, which raises costs for suppliers and leaves them vulnerable to price shocks. Uganda also has relatively high electricity prices, which adds to the costs of doing business [75].

Foreign exchange and inflation risks	In comparison to the U.S. dollar, the UGX has lost thirty percent of its value over the past decade [76]. This depreciation increases the cost of loan servicing for enterprises that borrow in hard currency but generate revenue in local currency. In addition, inflation of energy-based commodities has outpaced Uganda's core inflation rate by roughly 10% in recent years [77].
Lack of distribution infrastructure	With the exception of biogas, and household-scale solar arrays, which produce energy on-site, clean fuels require extensive distribution infrastructure. Achieving massive scale-up requires large investment to ensure that fuels are widely accessible with no supply disruptions. The specific investments vary with each fuel pathway and include: • LPG – construction of storage and refilling facilities, acquisition of millions of cylinders • E-cooking – construction of new and upgrading of existing last-mile electrical grid distribution infrastructure • Ethanol – construction of storage tanks and acquisition of tanker trucks for high-volume distribution and/or bottling facilities if fuel will be retailed in individual bottles • Pellets – construction of storage facilities to ensure adequate reserves and buffer against supply disruptions due to seasonal fluctuations in feedstock availability or other factors
High distribution costs	Populations lacking access are widely dispersed and difficult to reach due in part to the poor road infrastructure in many rural areas.
Insufficient supply of clean cooking fuels	Currently, domestic supply of clean fuels is insufficient to meet GoU's stated targets. For example, current LPG supply is less than four percent of the quantity needed for 30% of the population to use LPG as a primary fuel and domestic production of LPG has not yet begun. Current domestic ethanol production is less than 7% of the quantity required for 10% of the population to use ethanol as their primary fuel.[22]

Demand-side Barriers	
High cost of appliances	The upfront cost of clean appliances is too high for most households. In 2020, the national median monthly HH income in Uganda was UGX 190k (151k in rural area and 436k in urban areas) [33], which is well below the retail cost of an LPG start-up kit, e-cooking appliances, ethanol cookers, and high-performing solid fuel stoves.

[22] Current domestic supply of LPG is taken from MEMD's 2022 statistical abstract (the most recently available edition) [51]. Ethanol production is taken from .

High cost of fuels	High fuel costs are both a perception and a reality. The reality is that the cost of cooking daily with clean fuels is out of reach for many Ugandan HHs. We estimate that the cost of cooking monthly meals with unsubsidised LPG, pellets, or ethanol ranges from 6-18% of Ugandan's median monthly income. Electric cooking at the subsidised cooking tariff rate costs 9% of the median monthly income (and to obtain the subsidised rate, families need to first consume 80 kWh at a cost of over 30% of Uganda's median household income). For comparison, in the U.S., households are considered to have a "high energy burden" if all energy costs exceed 6% of their income [40]. In addition to the reality affecting less well-off Ugandan families, there is also a perception among better-off households that cooking with LPG and other clean fuels is more expensive than charcoal, the most common fuel choice for Uganda's upper wealth quintile. This view is not accurate in most circumstances but may be reinforced by the way that some fuels are purchased (see the discussion in Appendix 0 for more details). For example, LPG is typically retailed in 6 to 15 kg cylinders, which cost between UGX 55,000 to UGX 140,000 to fill. In contrast, families can buy small quantities of charcoal for a few thousand UGX. This demonstrates the need for well-designed awareness raising regarding the cost of cooking, as well as the potential role for differentiated products. For example, 6 kg LPG cylinders may be more attractive for many consumers facing liquidity constraints (these are the most popular option in Kenya, where over 30% of the population uses LPG as a primary fuel [78]). PAYGO approaches that allow users to purchase LPG and other clean fuels in smaller bundles like they do for charcoal are also promising.
Lack of access to credit	End users have very limited access to credit, and few stove retailers offer loans or other ways to reduce the upfront cost of the clean appliances.
Availability of low-cost or no-cost alternatives	Fuelwood and other unprocessed biomass are widely available at no monetary cost. Charcoal, though costly, is widely available in small, flexible quantities, making it convenient and easy to access, and placing some clean fuels at a disadvantage.
Limited access to fuels and appliances	Many regions lack distribution channels for clean fuels and appliances. Remote, rural populations are completely unserved. For example, nationwide, fewer than 1in 10 rural Ugandans have access to grid electricity; in some areas, it is fewer than 1 in 20 [29].
Lack of awareness	Many people are unaware of the full range of clean options and or have the perception that clean or transitional appliances cannot cook certain dishes. In addition, people may have concerns about the safety of fuels like LPG. This can be address through public awareness campaigns including live cooking demonstrations, informational videos spread on social media, etc.

Taxes and other fiscal policies

With over 20% of Ugandans living below the nationally defined poverty line and over 60% accustomed to cooking with freely collected fuelwood burned in no-cost open fires or very low-cost artisanal stoves, price is a major impediment to increased adoption of clean or transitional fuels and appliances. While taxes imposed by GoU represent a fraction of the total price consumers pay, they are the only component over which the government has direct control without introducing subsidies. GoU has already reduced or removed taxes on some clean and transitional fuels and appliances. However, other fuels and appliances are still taxed. Taxes are

levied in the form of import duties, VAT, excise tax (applied to imported ethanol and kerosene), and other smaller taxes like an infrastructure levy and withholding tax.

Import duties are implemented to generate revenue from external trade, "protect' domestic industry from lower cost imports, and to favour (or penalise) specific trade partners. Duties are currently waived for LPG, wood pellets, and electricity, but remain in place for denatured ethanol and all clean and transitional appliances. Similarly, VAT, which is applied to generate revenue on the sale of goods and services, has been waived for a few fuels and appliances, such as domestically produced denatured ethanol, as well as kerosene and LPG, but is still applied to electricity, wood pellets, and all appliances except domestically produced ethanol stoves.[23] Table 4 lists the taxes currently applied to fuels and appliances.

Table 4: Import duties, VAT, and additional taxes levied on cooking fuels and appliances [79][24]

	Fuel or appliance	Imported or made in Uganda	Import duty	VAT[25]	Excise duty	Infrastructure levy	Withholding tax
Fuels	Denatured ethanol	Made in Uganda	NA	0%	NA	NA	NA
		Imported	36%	18%	60%	1.5%	6%
	Electricity	All sources	0%	18%	NA	NA	NA
	Wood pellets	Made in Uganda[26]	NA	18%	NA	NA	NA
		Imported	0%	18%	NA	1.5%	6%
	Kerosene	Imported	0%	0%	UGX 500/l	1.5%	6%
	LPG	Imported	0%	0%	NA	1.5%	6%
	Fuelwood	All sources	0%	18%	NA	1.5%	6%
	Charcoal	All sources	0%	18%	NA	1.5%	6%
Appliances	Gas stoves	Made in Uganda	NA	18%	NA	1.5%	6%
		Imported	10%	18%	NA	1.5%	6%
	LPG cylinders	Made in Uganda	NA	18%	NA	1.5%	6%
		Imported	35%	18%	NA	1.5%	6%
	Liquid fuel stoves	Made in Uganda	NA	Ethanol stoves [23] 0% Others 18%	NA	1.5%	6%
		Imported	10%	18%	NA	1.5%	6%
	Solid fuel stoves	Made in Uganda	NA	18%	NA	1.5%	6%
		Imported	10%	18%	NA	1.5%	6%
	Electric stoves	Made in Uganda	NA	18%	NA	1.5%	6%
		Imported	10%	18%	NA	1.5%	6%
	Stove parts	Made in Uganda	NA	18%	NA	1.5%	6%
		Imported	10%	18%	NA	1.5%	6%

NICCS proposes an array of fuels and appliances to allow consumers to choose the most appropriate clean or transitional cooking option(s) for their household and institutional budgets and cooking needs. It is difficult to predict *a priori* the pathways that will be most favoured by families, food service businesses, and public institutions. The best approach may be to "let the market decide." For this approach to work, GoU should ensure a level playing field, particularly for novel clean cooking pathways that have not yet gained much market share, like ethanol and pellet

[23] VAT on domestically assembled ethanol stoves has been zero-rated through 2028.

[24] According to PWC, the Environmental levy is only applied to imports of used household appliances

[25] Businesses are required to register with URA and charge VAT if their sales exceed or are likely to exceed UGX 37.5 million for three uninterrupted calendar months or with annual sales exceeding UGX 150 million.

[26] Uganda's 2025/26 Tax Bill removed VAT for domestically produced pellets [80].

fuels. Thus, NICCS recommends that GoU apply a uniform tax regime to avoid distorting the market in favour of some options over others. For example, if VAT is zero-rated for LPG and domestically produced ethanol, then it should also be zero-rated for pellets and electricity (at least for the cooking tariff band).[27] The same notion applies to VAT levied on appliances and associated equipment like LPG cylinders.

Import duties are more complicated than VAT because they differentiate between domestically produced and imported products. In addition to generating government revenue, they protect domestic industries by making it easier for them to compete in local markets. This protective approach makes sense for industries that are already well established in Uganda like ethanol production, because domestic suppliers currently produce enough ethanol to meet demand and could lose market share if cheaper ethanol was imported duty free. However, import duties present a barrier to scale-up for clean and transitional cooking options that are not produced domestically, like most Class 1-3 cooking appliances. While GoU should encourage local industries to produce these goods, manufacturing facilities take time to construct and ramp up production. Meeting the near-term goals spelt out in Uganda's existing policies and strategies and providing access to multiple clean and transitional cooking options to millions of families (Table 5), will be easier if import duties are lowered or removed for those cooking options that lack sufficient domestic capacity to meet the target level of demand.

These tax breaks can be temporary, to enable the private enterprises to gain a foothold and create sufficient demand to justify deeper investment. For example, during a key-informant interview with the leadership team of an enterprise promoting pellet fuels and advanced gasifier stoves, a stakeholder suggested that NICCS include provisions for:

> *temporary import duty waivers for companies that commit to invest in domestic fuel production and stove manufacturing or assembly. These investments would not only make it easier to rapidly deploy the fuels and technologies needed to achieve existing targets. They would also create high-paying jobs and ensure a long-term domestic supply of clean fuels and high-quality appliances [81].*

The interviewees also expressed a desire to create a formal agreement with GoU to make a sizeable investment in pellet manufacturing if GoU agreed to zero-rate VAT on pellet sales as it has for LPG and domestically produced ethanol [81].

Reducing or removing VAT and import duties decreases the tax revenues that GoU would collect as NICCS is implemented, which could make it more difficult to implement the strategic measures proposed in this document. This is a difficult trade-off that must be considered carefully. However, it is also important to note that currently, GoU receives very little revenue from domestic sales of cooking fuels and appliances. Over 95% of households use wood or charcoal "most of the time," and over 80% burn their wood and charcoal in open fires or artisanal stoves [29]. These fuels and appliances generate no tax revenue, while imposing huge costs on Ugandan society in the form of environmental degradation, avoidable public health impacts, and climate-forcing emissions. Thus, temporarily reducing import duties and removing VAT will not result in material reductions in tax revenues that GoU collects; rather it will result a temporary loss of

[27] Uganda's 2025/26 Tax Bill removed VAT for domestically produced pellets [80].

potential revenue, while creating conditions for large societal benefits. We return to this discussion in Section 6.

Recommendations for VAT and Import Duties (see Section 6 for more detail)

1. Reduce or remove import duties for appliances that lack sufficient domestic capacity to meet the targeted level of demand including Class 1-3 biomass stoves, pellet stoves, e-cooking appliances, ethanol stoves, and biodigester equipment.
2. Temporarily remove VAT for clean fuels and appliances; consider gradually reinstating VAT after a pre-determined period, which is clearly communicated to key stakeholders in the sector.

4. Existing policies and alternative scenarios

GoU has initiated a range of policies, strategies, and programmes to transition families, businesses, and institutions from reliance on polluting biomass fuels to cleaner, more efficient cooking solutions. Initiatives range from broad national development plans and overarching sectoral policies to fuel- and technology-specific strategies and detailed technical standards. This section briefly reviewd GoU policies and strategies to highlight the specific objectives and the incentive structures that were proposed or enacted to meet those objectives and discuss lessons that can be drawn from their implementation, with the understanding that some of the policies are quite recent, and it is too soon to draw conclusions from them.[28]

The introduction of the National Biomass Strategy in 2015 [2] was a key step towards managing the country's energy resources more sustainably. It was the first in a series of policies designed to bring systemic change to Uganda's energy consumption. Since that time, additional policies have been established, each with specific objectives linked to improving the country's energy landscape. Uganda's National Energy Policy, revised in 2023 [5], reflects the government's approach to adapting to new energy challenges. It includes measures to promote sustainable biomass utilisation and energy efficiency. Other broad sectoral policies include NDP III and IV [3,4] and the Renewable Energy Policy (2007-2017) [82]. The former emphasised increased access to electricity and clean energy, and the latter focused on public awareness, sustainable production, and utilisation of biofuels. Uganda's 2023 Energy Transition Plan (ETP), developed by the International Energy Agency (IEA) [83], is not an official government policy, but it is similarly overarching in scope.

Other policies and plans, such as the LPG promotion project [6], the National E-Cooking Strategy [7], the National Biogas Strategy and Action Plan [8], and a recently submitted feasibility study for bioethanol infrastructure development [9] each lays out a fuel-specific pathway towards increased access to cleaner cooking options.

Current targets for fuels and appliances

Table 5: Targets for clean and transitional fuels and appliances in recent policy documents

Policy or strategy	Fuel or Appliance	Target	Baseline data and other comments

[28] For a detailed review of GoU policies and strategies, see "A review of current incentives supporting access to clean cooking in Uganda" that was completed in preparation for this deliverable.

Third National Development Plan (NDP III)	All	Achieving a 50% share of clean energy for cooking by 2025	NDP III noted that the share of clean energy used for cooking in 2018 was 15% [3]. However, this contradicts other data. For example, one nationally representative survey from 2018 shows that only 1.4% of households used clean fuels [37] and the 2023 Energy Policy notes that "Uganda has less than 5% uptake of clean cooking technologies and fuels" [5 p. 34]. In addition, NDP III does not specify which fuels and appliances will be used to achieve the 50% target.
Fourth National Development Plan (NDP IV)	All	Achieving a 50% share of clean energy for cooking by 2025	NDP IV noted that the share of clean energy used for cooking was 25% in FY2023/24 [4]. However, this also contradicts other data. For example, the 2024 National Census found that 94% of households nationwide used either fuelwood, charcoal, or kerosene as their primary cooking fuel. In addition, like NDP III, NDP IV does not specify which fuels and appliances will be used to achieve the 50% target.
LPG Promotion, Supply, and Infrastructure Intervention	LPG	LPG adopted by at least 30% of Households by 2030	In 2024, 1.1% of the population used LPG as their main cooking fuel [28]. To reach 30% of households by 2030, the number of households with access needs to increase by ~40% annually.
National E-Cooking Strategy	E-cooking	Increase the proportion population cooking with electricity from 0.8% to 18% by 2030	In 2024, 1.7% of the population used electricity as their main cooking fuel [28]. To reach 18% of households by 2030, the number of households with access needs to increase by ~30% annually.
National Biogas Strategy and Action Plan	Biogas	37,500 new domestic biogas digesters and 1,600 institutional and industrial biodigesters installed by 2033	The National Biogas Strategy estimates that there are currently 10,000 domestic biodigesters in use [8].[29] To install an additional 37,500 by 2033 requires ~16% annual growth.

[29] The 2024 census has a much higher estimate, but this may be incorrect [28].

Sustainable Biofuels Infrastructure Development Project: Feasibility Study Report	Ethanol	1.575 million households (about 10% of the population) adopt cooking ethanol by 2032	Currently, there are just a few thousand households cooking with ethanol.[30] The number of users would need to increase over 80% annually to achieve 1.5 million users by 2032. The Report also suggests that the GoU should provide 300,000 households with subsidised ethanol stoves to kickstart access; however, this cost is not included in the budget.
IEA Energy Transition Plan	ICS	40% of rural households adopt solid fuel ICS by 2030	In 2021, a nationally representative UBOS survey found 29% of urban and 7% of rural households reported using a "Manufactured solid fuel stove" [29]. However, there is no information about the specific types or performance tiers of the stoves that fell in this category at the time of the survey.

In addition to these policies and strategies, GoU has also developed a series of technical standards supporting clean cooking technologies (see Sections 1). Standards play an important regulatory function in that they ensure that fuels and appliances meet pre-defined quality and safety criteria. They also create incentives for manufacturers and vendors to invest in product quality, while serving as barriers to market entry for enterprises that are unwilling or unable to offer safe, high-quality products. Knowing that the safety and performance of new cooking products is assured can increase consumer confidence and support more rapid scale-up. UNBS has already developed standards for many clean and transitional fuels and appliances (see Appendix A for a list). Gaps remain, but most of the strategies listed in Table 5 include provisions to fill those gaps.

Fuel and technology-specific strategies

Solid biomass

Section 1 examines the ways in which solid biomass is likely to play a role in Uganda's energy mix for the foreseeable future even with the strategies that GoU is planning to implement. Roughly 60% of the population is included in the sum total of targets from fuel-specific strategies for LPG, e-cooking, ethanol, and biogas (Table 8), although some population groups may be the target of multiple strategies. To provide clean or transitional cooking options for all Ugandans, the remaining 40% of the population must be able to access biomass stoves that achieve Class 1-3 performance for $PM_{2.5}$ and CO. The NDPs and the 2023 National Energy Policy include statements that are supportive of solid biomass stoves and fuels, but they do not include specific targets or concrete policy suggestions regarding how to achieve widespread uptake. This section explores more specific strategies supporting widespread uptake of clean or transitional solid biomass options.

[30] Interview with Bukona Agro 03 May, 2024.

Increasing access to high-performing solid biomass cooking options can be split into several approaches. The first involves promoting "transitional" appliances that burn firewood and charcoal. Improved wood and charcoal stoves are already widely available in Uganda, but most would not qualify as Class 1-3 appliances. The second approach involves alternate forms of processed biomass like pellets and briquettes ideally in combination with Class 1-3 appliances that employ forced air, which are not yet available in large quantities. The third approach focuses on institutional stoves. We examine each approach below.

Wood and charcoal stoves

While accurate data about current uptake of Class 1-3 stoves is not available, interviews indicate that very few of the enterprises currently selling solid fuel stoves have products that meet this standard. Moreover, a 2021 UBOS survey indicates that while 97% of Ugandan households cook with solid biomass, just 14% use a manufactured stove, primarily in Kampala and other urban centres [29].[31] In most regions, fewer than 20% of households use manufactured stoves (Figure 4).

To increase access to Class 1-3 wood and charcoal stoves, the supply of those appliances must increase dramatically. Reaching a minimum of 40% of the population between 2025 and 2030 requires an average of 950 thousand new stoves per year, not accounting for periodic breakage or the need to replace worn-out stoves. This will be challenging because there are few enterprises globally that manufacture stoves meeting these performance criteria. Their capacity to supply the quantity of stoves that not only meet emissions performance criteria, but are also of sufficient quality and durability, is unclear.

Ensuring adequate supply is not sufficient. The upfront cost must also be addressed. Class 3 wood and charcoal stoves are made from higher quality materials than artisanal stoves, and cost considerably more. This is a challenge for the less-well off majority of households described in Section 2. For example, the Ecoa Char stove (formerly the "Jiko Koa") retails for USD 30-40. The stove achieves Class1, 2, and 3 performance for energy efficiency, CO, and $PM_{2.5}$ respectively [53]. The manufacturer claims that the Ecoa Char stove reduces fuel consumption by 45%. One recent peer-reviewed study of 1,000 low-income Ecoa Char users found that actual fuel savings were very close to the manufacturer's claim: 39% (with a 95% confidence interval of 29-47%) [84]. The same study found that households saved over USD 100 per year on fuel purchases. However, despite the high "return on investment" and quick payback period, most households were unwilling to pay the full retail price of the stove. Moreover, few had access to sufficient credit. The average willingness-to-pay for the stove was only USD 12, but that willingness to pay doubled to USD 25 if buyers could access a short-term loan at a reasonable interest rate [84].

Rural households face even higher barriers to accessing high-quality stoves. Rural incomes are lower and rural households generally have higher liquidity constraints than urban households. Moreover, many households collect wood for free so that reductions in fuel consumption do not translate directly into cash savings. This indicates a need for financing mechanisms to make high-quality stoves more affordable for lower-income households, with particular attention to less-well off rural households. Note, even with vastly improved access to credit, poor households may not

[31] Most manufactured stoves do not achieve Class 1-3 performance. However, since only manufactured stoves can achieve Class 1-3 for $PM_{2.5}$ and CO, this represents an upper-bound of the uptake of solid fuel stoves that could be considered transitional.

be willing to invest in the stove and some subsidy might be needed to reach the least well-off households.

And, by the same token, when subsidies are available, a credit mechanism will still be needed to help the least well-off consumers afford the fraction of the retail price that is not covered by the subsidy. For example, EASP programme offers a 50% subsidy for charcoal stoves, but caps this subsidy at UGX 30,000 (about USD 8) (see Appendix C). This is less than 25% of the retail price of the Ecoa Char stove. Other commercially available stoves that achieve Class 1-3 performance like are similarly priced. If only modest subsidies are available, then some type of finance will be needed. Carbon finance could help by either increasing the magnitude of subsidy made available to consumers or providing financial backing to establish a credit facility.

Recommendations for wood and charcoal stoves:

1. Ensure that a sufficient supply of quality, high-performing Class 1-3 wood and charcoal stoves are available for consumers.
2. If domestic production is insufficient, reduce trade barriers to encourage imports until domestic production comes online.
3. Develop new financing mechanisms and support existing mechanisms targeting lower-income households with low-interest loans for Class 1-3 wood and charcoal stoves.

Processed biomass: pellets and briquettes

Biomass briquettes and pellets made from agricultural residues or wood waste have been proposed as alternatives to fuelwood and charcoal for many years [85]. They have the advantage of being derived from locally available materials that are produced in abundance and can often be obtained at little or no cost. The 2015 Biomass Strategy noted that biomass waste and other "low quality" raw materials like bushes and shrubs could be utilised to supply as much as 40% of the country's biomass energy demand at the time that the strategy was published [2].

Processed solid biomass is typically utilised either as briquettes or pellets. Briquettes are made from chopped or milled biomass mixed with a binding material like starch, clay, or molasses, and pressed into a convenient shape by simple machinery under low pressure. Some briquette producers use carbonised biomass to create a fuel that is similar to charcoal. In contrast, pellets are made with finely milled biomass that is processed with more advanced machinery using high pressure to compress the material to the desired shape. Typically, pellets do not require a binder because the high pressure creates heat, which is sufficient to create a durable product.

Briquette machinery is less costly and easier to operate, which typically results in a cheaper product than pellets. Pellet production requires greater technical skill to operate and maintain the machinery, but pellets are more durable than briquettes, which makes them easier to transport and store. In addition, pellets are typically smaller, with a more uniform size, moisture content, and consistency, which makes them easier to burn cleanly and efficiently. This is an important consideration for the NICCS objective of providing universal access to Class 1-3 cooking options. Currently, there are no briquette-burning stoves that achieve Class 1-3 performance for emissions commercially available in Uganda. In the absence of such a device, it will be challenging to find a role for briquettes in NICCS. In contrast, there are several pellet stoves that achieve Tier 3+ ISO standards for both CO and $PM_{2.5}$ emissions, which is equivalent Class 1 or 2 in US 761: 2019 (Table 6) .

Table 6: Pellet stoves achieving ISO Class 1-3 performance

Stove name	ISO Tiers			Current status	Source of ISO data
	Eff	CO	$PM_{2.5}$		
GASIO Household	4	5	4	Designed and produced in Vietnam; commercial status unknown.	[53]
Mimi Moto	4	5	4	Designed in the Netherlands, made in China, and widely marketed around East Africa.	[53]
Chap Chap	4	3	3	Designed and produced in East Africa; commercial status unknown.	[53]
EcoSafi Better Stove	5	5	4	Designed in the US, produced in China, and recently introduced in Kenya.	[86]

The stoves in Table 6 are all forced-draft, batch-loaded gasifier stoves. They are equipped with an internal fan that directs air into and above the combustion zone, which results in lower emissions than conventional stoves. The fans are adjustable, which allows users to control the heat output. Several private enterprises are marketing these types of stoves throughout Eastern and Southern Africa including SupaMoto in Zambia, Biomassters in Rwanda, and EcoSafi which is based in Kenya but recently entered the Ugandan market.

The addition of a fan dramatically cuts emissions but requires electrical power to properly run the stove. The power requirements are minimal, but present challenges for off-grid households. Most companies include a small solar panel when selling stoves to off-grid customers, and stoves include a power port so that excess electricity can be used for phone charging or other small energy applications. While useful, these components add to the stoves' cost and complexity. The stoves cost as much as USD 100, which is unaffordable for most families. However, the enterprises promoting these stoves generally provide their stoves for a minimal payment and recoup the losses through pellet sales. Some enterprises also rely on carbon finance to partially subsidise the stove, which reduces the amount of pellets they need to sell to recover the cost of the stove.

This approach allows enterprises to provide a technically sophisticated, clean burning appliance at little or no cost to consumers. However, the model only works if families consistently purchase pellets from the enterprise until the enterprise recovers the initial cost of the stove, which presents a significant business risk. To ensure that they recover the cost, some companies require their customers to sign a binding contract committing to purchase a specified volume of pellets. If customers do not abide by the terms of the contract, then the enterprise can repossess the stove. While this approach makes "business sense" and is common for appliances, automobiles, and other durable goods, it is unfamiliar to consumers in the context of clean and transitional cookstoves. During a focus group discussion with women in Kampala, several discussants shared an unfavourable view of the model. They considered the stove "their" property, which the company should not take back under any circumstance. For this approach to achieve broad success, the terms of the contract must be clearly communicated and include provisions that allow customers some flexibility in payments, while ensuring that enterprises are not exposed to unreasonable risk.

Summarizing, briquettes and pellets are low-cost fuels derived from locally available waste materials that can be a viable alternative to current polluting fuels like wood and charcoal, as well

as to clean fuels like LPG and electricity. While briquettes do not achieve Class 1-3 performance for emissions in currently available stoves, there are several commercial pellet stoves that achieve these standards. Thus, while they are not included in any of the current strategies or policy documents informing NICCS, pellets used in combination with advanced gasifier stoves can play a critical role in Uganda's clean cooking future. briquettes

Recommendations for processed biomass:

1. Invest in research to develop cooking appliances that can burn biomass briquettes and consistently achieve Class 3 performance or better, with particular attention to commercial and institutional stoves.
2. Invest in research to accurately quantify and geo-locate sources of agricultural residues and wood waste to fully understand the potential supply of raw materials that can be used to produce briquettes and pellets at prices that are competitive with commercial fuelwood and charcoal.

E-cooking

The National e-Cooking Strategy was designed to increase the national proportion of the population cooking with electricity from under 0.8% to 18% by 2030 [7]. To achieve this objective, measures must be implemented to address the barriers to mainstreaming e-cooking with efficient appliances suitable for households, institutions, and commercial establishments.

There are already a number of stakeholders distributing electric appliances including PowerUp, EnerGrow, UpEnergy Uganda, AM Household Supplies, Biogas Solutions Uganda (BSUL), BURN, ECOCA, UMEME and Resilient Energy Africa. These entities have established distribution channels and partnerships to make e-Cooking technologies accessible to end users. Some of these suppliers also offer after-sales services, such as repair and maintenance, usage monitoring and analysis, ongoing user engagement and support, user training and education, as well as end-of-life management and disposal guidance. However, the current supply of e-cooking appliances is insufficient to meet the target set by the National e-Cooking Strategy, which will require the adoption of 400,000-500,000 e-Cooking appliances every year through 2030 to achieve its intended target of 18% of households.

In addition to limited supply, e-Cooking in Uganda faces a number of other challenges including lack of regulations and standards, limited technical capacity for testing, maintenance and repair of appliances, limited access the national electricity grid or mini-grids, low quality and reliability or power, high upfront cost for appliances and high cost of power, limited access to appropriate credit facilities, lack of distribution networks for appliances, consumer perceptions about the cost of cooking with electricity, and concerns that staple dishes cannot be prepared on electric appliances.

Overcoming the high upfront cost of acquiring the e-Cooking appliances will require readily accessible and flexible payment plans. Currently, microfinancing customers purchasing EPCs from EnerGrow pay 20% of the cost of the e-Cooking appliance upfront, and the balance is paid over a mutually agreed time period. EnerGrow also plans to introduce carbon financing for e-cooking appliances. Achieving the ambitious goals of the National e-Cooking Strategy will require rapid scale-up of credit mechanisms like these.

Operating costs present another barrier to e-cooking. As noted in Section 2, affordability is a key barrier to adoption and sustained use of clean cooking options, including e-cooking. In

comparison to other fuels and appliances, estimates of e-cooking costs vary widely, depending on the source of the analysis and assumptions made (see Appendix 0). Despite this variation, the assessments find cooking with an EPC is less costly than cooking with wood (if purchased) or charcoal on a per-meal basis. The assessments also conclude that EPCs are cheaper than LPG.

There is a cooking tariff in place to make e-cooking more affordable. However, the tariff is somewhat complicated and poorly understood by consumers (see Section 5). Moreover, the cooking tariff only applies after consumers use 80 kWh of electricity at a higher unit price. To reach the low-cost cooking tariff, the family must spend over UGX 62,000 (about USD 17), which is over one third of median household income and over 15% of median income among urban households (see Appendix G).[32]

The estimated budget to implement the e-cooking strategy between 2023 and 2030 is roughly USD 267 million (not including the electricity that would be purchased by people using it to cook). Of this, USD 125 million is allocated to increasing accessibility and affordability of e-Cooking appliances. To cover this budget, financial resources must be mobilised from the private sector, development partners, and GoU among others. In addition, the e-cooking budget includes USD 17.2 million to "promote awareness about e-Cooking technologies to increase adoption" (p. 72). This budget should be integrated in the GoU-funded awareness-raising efforts to educate consumers about all clean and transitional cooking options.

In September 2024, the British government committed GBP 5 million (UGX 24.3 billion) to support e-Cooking in Uganda [1]. The investment will fund a two-year programme with three components:

- The creation of a "Clean Cooking Unit" within MEMD in partnership with the Global Green Growth Institute (GGGI)
- Support municipal governments in the Greater Kampala Metropolitan Area to provide e-cooking options to at least 6,000 households in informal settlements in partnership with ICLEI-Africa.
- Work in partnership with MECS to expand provide at least 10,000 e-cooking appliances, train at least 600 technicians to maintain and repair appliances, develop standards for Electric Pressure Cooker (EPCs) and induction stoves, and pilot institutional electric cooking in 100 schools across the country.

This initiative is a critical step to building the momentum that is needed to achieve the objectives of the National e-Cooking Strategy. However, it is only a fraction of the UGX 140 billion annual investment necessary to scale-up e-cooking to the magnitude envisioned by 2030. This points to the need to reconsider the National e-Cooking Strategy's timeline. This is examined in more detail in the conclusion of this section.

Recommendations for E-cooking[33]

1. Ensure that there is sufficient supply of e-cooking appliances for residential, commercial and institutional sectors across a range of price points
2. Leverage GoU's ambitious electrification plans to promote E-cooking among the newly

[32] Electricity tariffs are periodically adjusted. This estimate is based on ERA's tariff schedule from April to June 2025 [87].

[33] Summarized from the July 2023 E-Cooking Baseline Study Report [88] and the 2023 National E-cooking Strategy [7].

electrified population: e.g. MEMD works with UEDCL and any future concessionaires to provide high-quality e-cooking appliances to newly connected or upgraded customers, which can be paid off over time through a surcharge on their bill or pre-paid meter.
3. Incentivise investment in local EPC manufacturing through tax incentives
4. As with Class 1-3 biomass stoves, if domestic production of e-cooking appliances is insufficient to meet demand, reduce trade barriers to encourage imports until domestic production comes online. Organize bulk importation of e-cooking components and materials to facilitate local assembly and reduce costs.
5. Consider revising the electricity tariff structure so that the low-cost units of electricity are more accessible for low-income households or otherwise subsidise low-income households and carry out information campaigns to explain how the tariff works
6. Support the expansion of e-cooking in refugee settlements
7. Enforce standards and quality control and co-market/co-brand or endorse high quality electric cooking products
8. Pilot IOT applications that would allow the cooking appliance to communicate with the grid and ensure a lower electricity cost for cooking
9. Build on MECS efforts to raise awareness about using induction stoves and EPCs to cook local foods
10. Revise the timeline of the National e-Cooking Strategy from 2030 to 2040 so that there is more time to meet the stated objectives.

LPG

Current targets for LPG are based on the "LPG Promotion, Supply, and Infrastructure Intervention" that was developed in 2021 [6]. While this programme was not fully implemented and is now outdated, it forms the basis for discussion because no alternative programme or strategy has been introduced.

To implement the LPG programme and increase uptake of LPG more generally, GoU has collaborated with development partners in several ways, including investing in baseline studies on LPG adoption to aid evidence-based decisions, introducing fiscal policies such as removing import duty and zero-rating VAT (although stoves and cylinders are still subject to both charges -- see Table 4), and fast-tracking the development of LPG standards.

The long-term objective of the "LPG Promotion, Supply and Infrastructure Intervention Project" was to achieve LPG adoption by 30% of Ugandan households by 2030. However, the Project itself was only designed to run from 2021-2025, and included specific measures designed "kick-start" the transition without fully articulating how to achieve the long-term goal of 30% uptake. The Project's specific objectives included:

a. Free distribution of one million LPG start-up kits

b. Construction of 8,000 tons of LPG storage to serve Kampala

c. Construction of six 700-ton regional LPG storage and distribution facilities to serve markets around Mbale, Arua, Gulu, Mbarara, Fort Portal, and Hoima

d. Procurement of 72 train wagons to support greater import volumes.

e. LPG awareness campaigns to support the adoption of LPG

By mid-2024, only 30,000 LPG kits had been disseminated, which is just 3% of the million-household target. COVID disrupted the initial roll-out, but activity did not pick up after the pandemic disruptions ceased. One interviewee from MEMD noted that no budget had been allocated for the project during FY 2024 [89]; however, the 2024/25 budget included funds to procure and disseminate 57,000 new cylinders [90]. While this is nearly double the number already disseminated, it is still far short of the one million envisaged by the LPG Project. In addition, there has been no follow up to determine if the 30,000 kits that were given for free, led to adoption and sustained use of LPG among beneficiary households. There is little evidence that free giveaways of technology like LPG, the use of which requires costly refills, are an effective way to drive adoption, particularly among poor households. Indeed, evidence from India indicates that subsidising LPG kits for poor households *does not* lead to widespread LPG adoption as a primary cooking fuel [91,92].

Interviewees also indicated that several aspects of the Project would change in response to changing circumstances in the domestic market. For example, with oil production expected to start in 2025 and a refinery planned to start operations in 2027 [93], Uganda will rely on its domestic supply to meet some of the anticipated demand. This removes the need for some or all of the train wagons. However, several key components need to fall into place for Uganda to successfully supply a substantial fraction of domestic demand including completion and commissioning of the refinery, construction of storage and distribution facilities, and supply of millions of LPG cylinders.

Other activities promoting LPG include an LPG subsidy scheme launched by UN FAO in collaboration with MWE and MEMD targeting teachers in government-aided secondary schools in Luweero, Gulu, and Arua. The scheme distributed over 700 subsidized 6 kg gas cylinders fitted with a burner and a grill. Most beneficiaries are women.[34]

As with e-cooking, both upfront and operating costs are significant obstacles to widespread LPG adoption. Upfront costs include price of the stove and ancillary equipment as well as the gas in the first cylinder and a deposit on the cylinder itself, which is owned by the gas distributor. Ongoing costs consist of cylinder refills. Both upfront and ongoing costs depend on cylinder size. For example, common 13 kg cylinders require a separate stove, which is attached to the cylinder via a gas regulator and hose connection, while smaller 6kg cylinders can accommodate an inexpensive single burner that screws directly into the gas outlet, removing the need for a regulator and hose. Small cylinders are also less costly to refill, which makes it more affordable for cash-constrained families. The 6kg “meko” stove is popular in neighbouring countries, although they are not widely available in Uganda.[35]

Moreover, LPG is Uganda is more expensive than in neighbouring countries leading to high costs per meal (see Appendix 0). This can be explained in part by the cost of transporting LPG from ports in Mombasa or Dar es Salaam. One study estimates that transport from those coastal points of entry adds approximately UGX 650 per kg of gas [95]. Eventually, the eventual opening of the refinery in Huma should reduce transport costs and result in lower retail prices for consumers. We return to this discussion in Section 6 below.

[34] Based on an interview with FAO personnel.

[35] A 2019 nationally representative survey in Kenya revealed that nearly 30% of the population used LPG, and 75% of those families used 6kg cylinders [94].

The bulk nature of cylinder-based LPG sales exacerbates the problem of high cost for consumers. Unlike charcoal and kerosene, which can be purchased in small quantities, LPG is conventionally bought in full 6 or 13kg cylinders, which forces consumers to purchase several days or weeks' worth of fuel at one time. Some enterprises have introduced "pay-as-you-go" (PAYGO) models for LPG, which allow consumers to purchase fuel on an "as-needed" basis. The additional cost of hardware to enable PAYGO purchases results in higher unit costs than conventionally purchased LPG, but the cleanliness, convenience, and ability to purchase fuel in small quantities are considered to be sufficiently beneficial that consumers are willing to pay a premium.

However, there are several challenges to PAYGO LPG. For example, users are very price sensitive so that the premium that they will pay is determined largely by the cost of fuels like charcoal. This results in low profit margins for PAYGO enterprises, which means that they need to achieve large-scale distribution to be viable. By the same token, capital requirements are high: one interviewee noted that the smart-meters that monitor and control PAYGO LPG consumption cost over USD 150 per unit. Moreover, companies must buy all of the LPG that they distribute in advance and rely on consumer purchases to cover these costs. The high upfront investment creates risk, which deters investors [96]. As a consequence, PAYGO LPG has not gained much momentum in Uganda. For example, Wana Energy Solutions, an LPG currently has a little over 3,000 PAYGO customers, which they were able to achieve with support from UNCDF, but they could not find investors to support expansion beyond those initial PAYGO users [97].

The pace of progress toward LPG adoption, while generally accelerating over the past two decades, raises serious questions about Uganda's ability to achieve 30% adoption by 2030 as outlined in the "LPG Promotion, Supply, and Infrastructure Intervention Project". Indeed, data from the 2024 census indicates that there may have been a drop off in the fraction of population who consider LPG their primary cooking fuel (see Figure 5, lower left), though some concerns have been raised about the accuracy of this data.[36] As with e-cooking, to promote a more realistic but still ambitious target, NICCS extends the timetable to achieve 30% adoption. This is explored in more detail in the conclusion to this section.

Recommendations for LPG

1. Explore the market potential PAYGO LPG and smaller (3kg and 6kg) cylinders to better understand the customer appeal and potential tradeoffs between each option
2. Revisit the objectives of the "LPG Promotion, Supply, and Infrastructure Intervention Project" in light of new circumstances including progress on the Hoima refinery and investments in LPG distribution infrastructure
3. Avoid free giveaways of LPG kits with 13 kg cylinders
4. Revise the timeline of the "LPG Promotion, Supply, and Infrastructure Intervention Project" from 2030 to 2040 so that there is more time to meet the stated objectives.

Biogas

Uganda's 2023 *National Biogas Strategy and Action Plan* (NBSAP) includes provisions to install 37,500 new small-scale domestic biogas systems by 2033, a 375% increase over the 10,000 units that are currently installed [8]. NBSAP also includes plans to supply 1,600 large-scale institutional, industrial, and agricultural systems.

[36] Based on conversations with MEMD personnel.

MEMD and development partners have supported biogas development in Uganda since the mid-2000s with the introduction of the Africa Biogas Partnership Program (ABPP), funded by the Dutch government [61]. ABPP underwent two phases in Uganda, ultimately resulting in the installation of nearly 8,000 biodigesters by 2018. ABPP also led to a successor program, the African Biodigester Component (ABC), which is currently underway. ABC will be active through 2025, with an objective of installing an additional 8,000 household-level biodigesters. ABC works in partnership with Biogas Solutions Uganda Limited (BSUL), which serves as a local implementing partner. BSUL's website notes that nearly 10,000 biodigesters have been installed [98].

Despite these efforts, uptake of domestic biogas in Uganda remains well below its potential. To enhance the contribution of biogas to Uganda's clean cooking landscape, in 2023 MEMD approved a *National Biogas Strategy and Action Plan* (NBSAP) meant to run through 2033 [8]. The strategy is intended to "to promote the development, adoption, and safe utilisation of biogas and co-products" (p. 3).

However, biogas faces many barriers to scale-up. The technology has among the highest upfront costs of any clean cooking option. Credit facilities are essential to make the technology affordable for most rural families. Other barriers to wider uptake of domestic biogas include lack of access to sufficient water to mix with the organic matter, and lack of technical expertise to ensure systems are properly installed and maintained. Finally, lack of access to sufficient feedstock can be problematic. For example, although a majority of rural Ugandan households keep some type of livestock, only a fraction keep their livestock in enclosures, which greatly facilitates manure collection [99].

Lastly, the NBSAP document notes that UNBS has several national standards for biogas stoves and biodigester systems in place [100–103]; however, it also acknowledges that a "lack of enforcement has led to a high failure rate of domestic biogas systems and insufficient policy for promotion" (p. 2). NBSAP includes provisions to overcome these barriers. Specifically, it has four main objectives:[37]

1. Promote the biogas market development, innovation, and R&D in biogas technology and applications for increased adoption supporting research and market development, encouraging investment, introducing new financial instruments, raising awareness, and increasing technical capacity.
2. Promote sustainable capacity building of biogas stakeholders to effectively promote and respond to technical, financial and managerial aspects of biogas technology.
3. Increase awareness creation, communication and knowledge building and management to ensure maximised use of biogas technologies and applications.
4. To promote multi-sectoral coordination to develop, enforce and promote legislation and regulation environments (such as standards and quality, finance, skills and technical) for investments in biogas.

High upfront cost, lack of technical capacity, the need for awareness raising, and a stronger regulatory environment all overlap with domestic biogas and other high-tier clean cooking options. However, it is important to note that biogas is unique for several for several reasons. First, upfront costs are significantly higher than most other options. The least expensive domestic biogas

[37] Each NBSAP objective is supported by detailed actions; see the original strategy document for details [8].

option, which can function with organic matter from a single cow, costs UXG 2 million [8]. This is roughly 90% of the country's median annual household income. Larger systems can be two to three times more expensive.

Overcoming this cost requires substantially larger and potentially more complicated credit facilities than LPG, e-cooking, and ethanol or pellet stoves. In addition, the population of potential adopters is narrower and concentrated among livestock-owning rural households with access to sufficient water. This population, who would likely fall within the "Can afford, but cannot access" archetype (see Section 2), is dispersed and may require a different approach to marketing. Subsidies will likely be required to make biodigesters accessible to other archetypal groups. NBSAP mentions the need for "targeted subsidies" and EASP includes subsidies for up to 30% of the installation costs of biogas systems, capped at UGX 870k (about USD 240). However, NBSAP includes no information explaining how these subsidies will be targeted.[38] Further elaboration is needed to ensure that subsidies reach those households that need them and are not captured by better-off families, which can afford unsubsidised biogas with a well-designed financing mechanism.

Finally, because domestic biogas requires on-site installation of biodigesters, valves and pipes to bring gas from the digester into the home, and other physical infrastructure, any maintenance issues must be addressed at the user's home, in contrast to smaller self-contained appliances that can carried to centralised repair centres if repairs are needed. Creating a robust system of after-sales service and maintenance is essential to the long-term viability of biogas but will require more investment per unit installed than other clean cooking options.

The estimated budget for NBSAP is roughly USD 17.2 million. Of this, nearly USD 9 million, over half of the total, is allocated to "Mobilise incentives and finance support". With ABC closing in 2025, this injection of strong financial support will be essential to maintain the momentum created by ABC. In addition, the NBSAP budget includes USD 2.2 million to "increase awareness creation, communication and knowledge building and management to ensure maximised use of biogas technologies and applications" (p. 55). As was mentioned earlier, GoU-funded awareness-raising efforts should be combined to educate consumers about all clean and transitional cooking options. In addition, discussions with MEMD indicated that a greater aspiration for biogas than NBSAP's objective of 37,500 residential units, although on an extended timetable similar to that proposed for LPG and e-cooking.

The NBSAP calls for a combination of targeted subsidies and credit facilities to support end-user access, and Results-Based Finance (RBF) to incentivize private enterprises to provide products and services. Subsidies have been deployed in some biogas projects, including aid-driven efforts led by CARITAS. The EASP includes provisions for direct subsidies to consumers up to 30% of the installation cost of a small- to medium-sized domestic biodigester system (Appendix C). EASP also has an RBF component (described above). ABC, in contrast, offers no subsidies but includes

[38] EASP offers the same level of subsidy to all consumers nationwide, so does not target subsidies for individual consumers. However, it does provide additional incentives for service providers to "effectively target remote and underserved communities and/or specific product types. This can include additional supports required to target specific communities such as on island, in refugee settlements etc., where the ESCOs can demonstrate that they require additional supports to expand operations into these communities and that these communities would not be served by the RBF program otherwise" [104].

provisions for low-cost loans for end-users and RBF facilities aimed at incentivising biodigester enterprises to enter the market.

Recommendations for Biogas (in addition the recommendations in NBSAP)

1. Increase the targeted number of residential biodigesters to 100,000 units and extend the timeline from 2033 to 2040.
2. Develop a detailed approach to target subsidies for biodigester systems (will potentially support other subsidies for other Class 1-3 cooking options).

Ethanol

Ethanol is the final clean cooking option that has been addressed in existing policies or feasibility studies. GoU commissioned a feasibility study on the *Sustainable Biofuels Infrastructure Development* (SuBID) Project , which explores the investments, policies, and regulations necessary to achieve a 10% blending target in the transportation sector and cooking in ~1.6 million households [9].[39] Current statistics are not clear, because published reports combine ethanol with other cooking fuels (e.g. see Figure 5). However, the limited information available indicates there are just a few thousand households that currently cook with ethanol.[40]

Despite this very low baseline, ethanol-based cooking has a lot of potential in Uganda and throughout the region. Uganda hosts 18 ethanol refineries that range in capacity from micro-distilleries producing just 500 litres per day, to large facilities capable of producing 40,000-60,000 litres per day [105]. The total installed capacity is approximately 130 million litres per year. However, the industry operates well below capacity, producing 40 million litres of ethanol per year, leaving 90 million litres of production capacity unutilised [9].

The SuBID study projects that annual demand for ethanol will exceed 300 million litres to meet volume required to achieve a 10% blending target (200 million l/yr) and provide cooking fuel for 1.6 million households (113 million l/yr). The study contends that the 90 million litres of unutilised production capacity could be brought online relatively easily. However, it proposes that this capacity be devoted entirely to supplying ethanol for the transport sector and that new capacity be added to supply ethanol for the cooking fuel market. MEMD should reconsider this suggestion so that the availability of ethanol for clean cooking is not contingent on the construction of new production facilities. Instead, cooking fuel supply can rely on existing capacity to meet demand in the early stages of NICCS implementation, while additional production facilities are constructed.

Feedstocks for domestic production

Whether relying on existing capacity or new facilities, supplying sufficient ethanol to meet both petrol blending targets and demand for clean cooking fuel requires sufficient feedstock. Assuming production facilities use starch and sugar crops, including sugarcane, cassava, and maize, (in

[39] NICCS is focused on cooking, but the blending target is relevant because SuBID is designed to achieve both objectives.

[40] For example, Bukona Agro is promoting ethanol stoves and fuel, coupled with conventional pressure cookers. They currently have several thousand customers in the greater Kampala metropolitan area.

order of market potential defined by the SuBID study).[41] Uganda produces all of these crops in abundance, but many challenges would need to be overcome to achieve the production volumes envisioned by the study.

Reaching consumers

In addition to overcoming supply and production constraints, reaching 1-2 million consumers with ethanol stoves and fuel will require major investments in distribution infrastructure and retail development. Different models have been tried in the past including selling stoves alongside ethanol fuel in retail shops and home delivery of fuel bottles. When sold in retail shops, bottles may be sized differently to cater to different consumers' needs and ability to pay, and shops may be dedicated kiosks managed by the ethanol stove/fuel developer or in existing retail shops. The former option allows greater brand visibility and facilitates direct contact with consumers, which could aid in adoption and long-term use, but also increases costs. Fuel sales in individual bottled also raises logistical challenges. If fuel bottles are disposable like bottled water or soda, then they will contribute to plastic waste, which is already a growing problem in Kampala [106]. Reusable bottles are preferable from a waste management perspective but require additional investment to effectively collect and refill. In any case, delivering either reusable or disposable individual bottles to thousands of retail shops will require a massive last-mile distribution network.

In Kenya, and more recently Rwanda, KOKO Networks has taken a different approach. Rather than sell ethanol in pre-filled bottles, they developed customised "smart" vending machines that dispense flexible quantities of fuel, which customers buy with mobile money -- no cash required. They use sealed bottles that fit into the vending machines and also attach directly to KOKO's ethanol stoves, so the ethanol itself cannot easily be extracted from the bottle for uses other than cooking in a KOKO stove. The "KOKO points" are placed strategically in existing shops around low- and middle-income neighbourhoods in towns and cities where KOKO is active. KOKO's objective is to emulate charcoal or kerosene salespoints, which are distributed throughout residential areas and sell fuel in flexible quantities, allowing customers to buy as much or as little fuel as they can afford at the time of the transaction.

KOKO's has been quite successful. By 2023, they had sold over million stoves in Kenya and began sales in Rwanda, where they currently have 30,000 customers. KOKO's business model required a very large upfront investment in vending points, stoves, and fuel bottles as well as an extensive transportation, distribution, and storage network along with sophisticated software to track sales and distribution. In Kenya, KOKO partnered with Vivo Energy, a company that distributes and markets Shell-branded fuels in the region, which gave KOKO access to dedicated fuel tanks at 5Vivo Energy depots and service stations as well as a fleet of tanker trucks to transport ethanol in bulk from storage tanks to vending points [107].

KOKO's success could be attributed in part to their innovative marketing and distribution model. However, another important factor contributing to KOKO's rapid growth is their use of carbon finance to heavily subsidise both stoves and fuel [108]. KOKO has used over USD 100 million in carbon revenues to set the price of ethanol in Kenya below market prices, making their cooking

[41] Other starch and sugar crops like bananas and sweet sorghum could be used, but the SuBID study considered these to have lower potential due to the highly dispersed nature of banana production and its role as a staple crop, and limited volume of sweet sorghum production. In addition, more advanced, second-generation pathways, could be considered, but this would be more costly and technically challenging, and is not recommended in the near term

system the most cost-effective option for most consumers. Without this subsidy, ethanol would not be competitive with other options (see Appendix 0). However, this dependence on carbon finance carries some risk. For example, research was published in early 2024 questioning the integrity of carbon offsets from clean cooking projects [108]. As a result, many buyers sought to renegotiate or even cancel their offset purchase agreements. This reduced carbon revenues for many companies not directly implicated in the research, including KOKO. They've since had to reduce their subsidy, which has negatively affected sales and reduced growth. We return to the potential role of carbon finance and associated risks in Section 7 below.

Lastly, in addition to innovative, distribution models, promoting ethanol-based cooking will require substantial investment in awareness raising and familiarisation. Unlike LPG and electric appliances, which have been used by tens of thousands of households since at least 2000 (see Figure 5), cooking with ethanol is relatively new. The SuBID budget does not include a budget for awareness raising, but this will likely be needed to create a market for ethanol stoves and fuel. In addition, there are currently no standards for ethanol-based appliances. This will be necessary, not only to ensure safety, but also to help build consumer confidence in an unfamiliar technology.

Recommendations for Ethanol (in addition the recommendations in SuBID)

1. Reconsider the recommendation in SuBID that currently underutilised capacity be devoted to meeting the transportation blending target and instead devote that capacity to meeting demand in the early stages of NICCS implementation.
2. Introduce dedicated awareness raising campaigns focused on ethanol-based cooking.
3. Work with UNBS to develop ethanol stove standards.

Policies for commercial and institutional cooking

As discussed in Section 2, despite uncertain data, it is clear that commercial and institutional cooking constitute a substantial fraction of Uganda's overall cooking energy demand. Woodfuels are the main source of cooking energy in Uganda's thousands of schools, colleges and universities, prisons, health facilities, police stations, and military barracks [2,29]. However, despite consuming a substantial amount of fuelwood and charcoal, Uganda's existing clean cooking policies and strategies pay minimal attention to these sectors. Table 7 lists the targets and objectives for public and commercial institutions that are included in existing policy and strategy documents.

Table 7: Targets and objectives for public and commercial institutions in current clean cooking policy and strategy documents

Policy or strategy	Attention to cooking by commercial and public institutions
National Development Plan (NDP III)	No specific mention of expanding access in public and commercial institutions, but one objective calls for promoting "uptake of alternative and efficient cooking technologies including…institutional biogas and LPG" (p. 149)
LPG Promotion, Supply, and Infrastructure Intervention	No specific provisions for expanding access, but the document notes that: • LPG consumption among public and commercial institutions represents about 10% of national consumption • public and commercial institutions are potential "big users of LPG"

National E-Cooking Strategy	No specific provisions for expanding access, but the strategy mentions: • a Centenary Bank loan program that can be used for "improved cooking institutional stoves and power connection" • "Manufacturing and Assembly of Institutional / Commercial e-Cooking Appliances" as a possible project under the strategy • calls for schools and other public institutions to be used in awareness raising campaigns
National Biogas Strategy and Action Plan	Includes provisions promoting access to biogas among commercial and public institutions including: • promotion and dissemination programmes for institutional, commercial, and industrial biogas • installation of 1,600 institutional, commercial, and industrial biodigesters by 2033[42] • suggests allocating over USD 450,000 (3% of the total budget) to reach institutional, commercial, and industrial users • call for UNBS to develop an institutional cookstove standard (not specific to biogas)
Sustainable Biofuels Infrastructure Development Project: Feasibility Study Report (SuBID)	No mention of public and commercial institutions.
IEA Energy Transition Plan	No specific provisions for expanding access, but the plan notes that: • "solid biomass accounts for nearly 95% of (energy) demand…in public buildings such as schools and restaurants" • all public institutions gain access to electricity by 2030 • the services sector replaces "biomass in cooking, water heating and other applications with modern fuels, such as LPG" by 2050

With the exception of NBSAP, none of the current clean cooking policies and strategies include specific targets for commercial and institutional cooking. This is a missed opportunity. As Section 2 notes, public institutions in particular represent the only consumer group over which GoU has direct control. As such, they could represent a "proving ground" for new technologies and serve as showcases that commercial and residential users could learn from and emulate. See Section 2 for sector-specific commercial and institutional recommendations.

Budget implications of existing policies

To integrate the existing policies into a single coherent strategy, it is helpful to consider the budget implications of each. The fuel and stove-specific targets listed in Table 5 include the following:

- LPG adopted by 30% of households by 2030
- Electric cooking adopted by 18% of households by 2030
- 37,500 new domestic biogas digesters installed by 2033
- Ethanol for cooking adopted by 1.575 million households by 2032

[42] Note, the strategy document does not specify how biodigesters will be used, and these targets could include industrial systems that are not used for cooking.

If it is assumed that there is no overlap among households targeted by each fuel-specific strategy, these strategies seek to provide clean cooking options to about 60% of the population in 2030.[43] To achieve clean or transitional cooking for all, the remaining 40% will need access to Class 1-3 biomass stoves. Table 8 shows the cost implications of implementing these programmes simultaneously.

Providing 60% Uganda's population with a mix of LPG, e-cooking, biogas, and ethanol while also promoting Class 1-3 solid fuel stoves for the remaining 40% of households, including 1.4 million advanced Tier 4-5 pellet stoves, requires an investment of USD 1,015-1,098 million (UGX 3,720-4,020 billion), or USD 169-183 million (UGX 620-670 billion) per year between 2025 and 2030.[44] This includes a mix of public investment to create an enabling environment that promotes a transition to clean and transitional fuels and appliances (including upstream infrastructure, standards and regulations, awareness raising, financing mechanisms, etc.), and private sector investment in manufacturing, distribution, and supply chain, and retail infrastructure. Note, except in cases where the strategies include free stove handouts like the *LPG Promotion, Supply, and Infrastructure Intervention*, the budgets outlined in Table 8 do not include the upfront cost of stoves or recurring cost of fuel for families, commercial enterprises, and government institutions, which are several times larger than the costs described here.

For comparison, the annual investment requirement derived from Table 8 is 40-45% of the UGX 1,325 billion budget proposed for MEMD's Sustainable Energy Development Programme (SEDP) in FY2024/25 [109]. Clean cooking falls within the mandate of the SEDP. However, the SEDP budget in FY2024/25 is almost entirely intended for investment in the power sector, with 37% going to generation and 62% going to transmission and distribution. Those applications overlap with the e-cooking strategy, but just 1% of the budget, UGX 13 billion, remains for the other strategies listed in Table 8.

[43] This assessment uses rough percentages rather than give a false sense of precision.

[44] This assumes spending occurs between 2025 and 2030. However, the timing of each strategy does not align perfectly. For example, the LPG plan was supposed to have been implemented between 2021 and 2025, but at the time of writing, only a small fraction of the budget had been allocated, thus this discussion assumes that the full amount will be allocated between now and 2030. The ethanol plan and biogas strategy extend to 2032 and 2033 respectively, but this analysis compresses the timeline to illustrate the investment required to achieve universal access to Class 1-3 cooking options by 2030.

Table 8: Costs and household coverage envisioned in the existing fuel- and technology-specific policies and strategies

Fuel/Stove		unit	Million USD	Pct. of HHs	Millions of HHs	Comments
Current or draft policies and strategies	Ethanol	Five mini-distilleries	$244	10%	1.6	The budget only reflects the cost of constructing ethanol distilleries. The target is for 2032 from the "Biofuels Infrastructure Development" feasibility study.
		One full-sized distillery	$161			
	LPG	full program implementation	$237	30%	4.3	The cost includes investment in storage facilities, transportation and distribution infrastructure, plus the LPG initiative's goal of distributing 1 million free LPG kits between by 2025. To achieve uptake in 30% of households by 2030, the necessary investment would be substantially higher.
	Electricity	full program implementation	$267	18%	2.6	E-cooking strategy 2030 goal, including investment in regulatory framework, grid and mini-grid development, measures to increase accessibility and affordability, and awareness raising.
	Biogas	full program implementation	$17	< 1%	0.04	New installations by 2033 (based on policy statement of 37,500 new domestic installations). The Budget also includes ~1,600 institutional and industrial biodigesters.
Total of existing strategies and policies			$682-765	~60%	8.5	The lower value assumes a single large distillery and the higher value assumes 5 mini-distilleries
Policy gaps	Class 1-3 biomass stoves	Cost per stove (no additional investment)	$93	31%	4.5	No target currently exists. This estimate reflects the balance of households in remaining 2030 after the strategies listed above are successfully implemented. The division between Tier 3 and Tier 4-5 options is arbitrary.
	Tier 4-5 gasifiers w/pellets	Estimated capital expenditure needed for 1.4 million stoves[45]	$240	10%	1.4	
Total for all investment			$1,015-1,098	100%	14.4	The lower value assumes a single large distillery and the higher value assumes 5 mini-distilleries

Considered from another perspective, the entire global investment in clean cooking in 2022 (the most recent available data) was just over USD 200 million [110]. Implementing the strategies listed in Table 8 will require annual investment that is equivalent to two-thirds of recent global investment in clean cooking, which will be extremely challenging. Notably, the African Development Bank (AfDB) has committed to allocating USD 2 billion to clean cooking over the next 10 years. This adds an additional USD 200 million annually; however, mobilizing USD 150-160 million specifically for Uganda will still be difficult. This is highlighted not to discourage

[45] This assumes capital expenditure for pellet and stove production of USD 170 per stove.

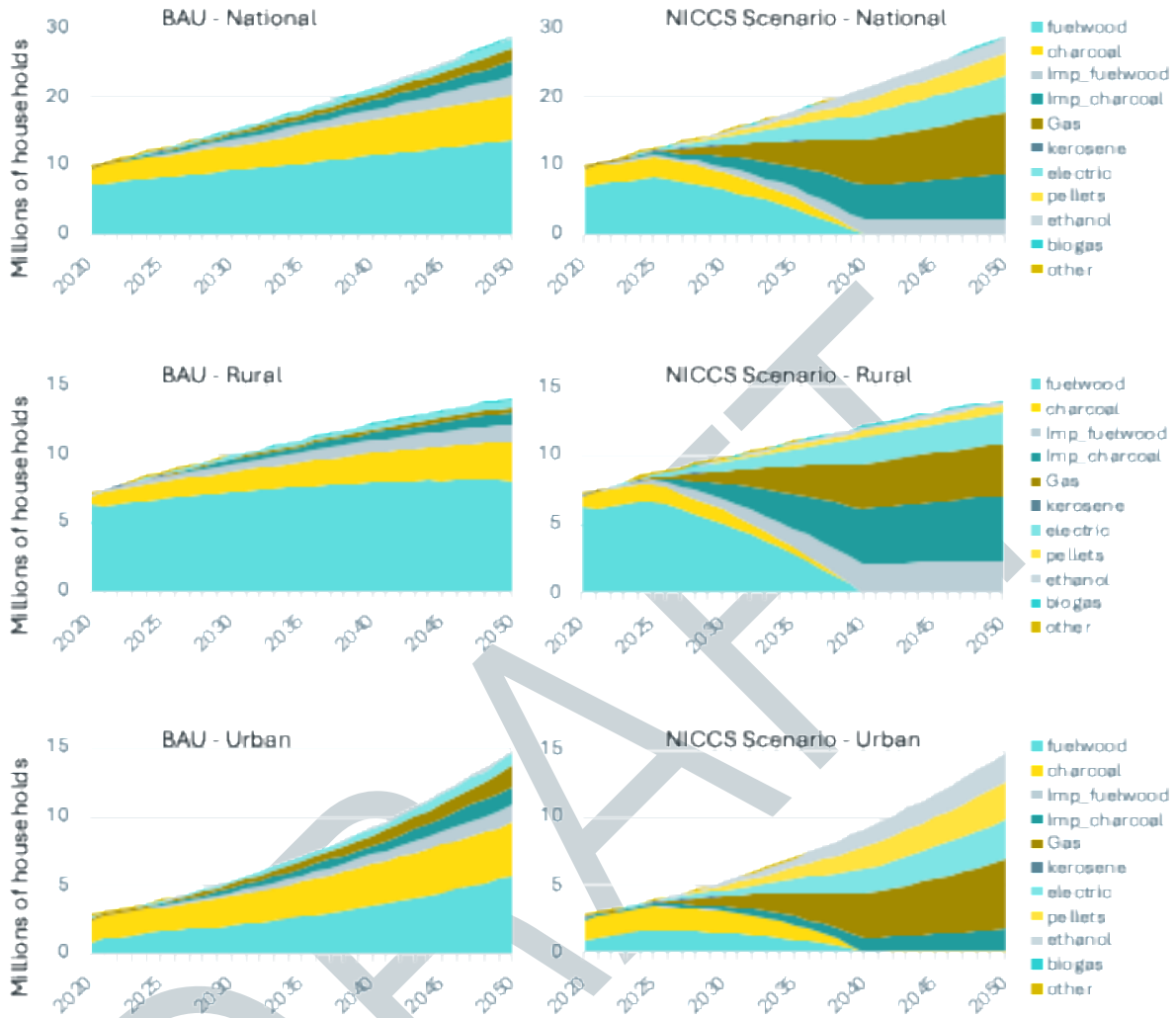
Uganda's ambition, but to emphasize the magnitude of the financial commitment required to achieve universal access to clean and transitional cooking options.

The NICCS scenario

Understanding that the investment may not occur at the necessary pace to achieve the objectives of each fuel-specific strategy described in this section, NICCS proposes an alternate scenario that still results in universal access to clean and transitional fuels and appliances but at a slower. Table 5 shows growth rates that would be necessary to achieve the objectives of the existing strategies. For example, achieving 30% adoption of LPG by 2030, from a baseline of 1.1% in 2024 [28], while accounting for population growth, requires that the number of households using LPG would need to grow from about 125 thousand households (1.1% of the population in 2024) to 4.3 million households (30% of the estimated population in 2030 based on UBOS projections of population growth). This is an annual growth rate of 59%, which is much higher than observed growth in access to clean household fuels in other countries. The IEA's 2023 "Energy Transition Plan" [83] notes that household transitions to clean fuels in India and Indonesia, which were both massively subsidised, reflected annual growth rates of just 4-5%. In Kenya, primary use of clean fuels (mainly LPG) grew from 1.3 million people in 2003 to 16.5 million people in 2022 [32], which reflects annual growth of nearly 13%.

We present the NICCS scenario, which takes the same ambitious targets outlined in current policy and strategy documents but extends the timetable from 2030 (2032 and 2033 in the case of ethanol and biogas) to 2040. Figure 11 compares the evolution of primary stove and fuel choices between BAU, which assumes no major policy changes and no major increase in investment to the NICCS scenario. In the NICCS scenario, the sustained annual rate of growth in adoption of clean and transitional cooking options between 2024 and 2040 ranges would be ~22%, which is still considerably higher than recent cooking transitions observed in other LMICs, but could be achieved with sufficient investment and political support. Under the NICCS scenario, by 2030 28% of the population use clean cooking options (equivalent to Class 1 stoves) and 14% use transitional biomass stoves (equivalent to Class 2-3 stoves). By 2040, 70% of the population use clean options and 30% use transitional biomass stoves.

Figure 11: Projected primary household fuel and stove choice under BAU and the NICCS scenario nationwide (top), and in rural (middle) and urban (bottom) populations



The NICCS scenario still requires the same overall investment described in Table 5, but the investment occurs at a slower pace, which spreads the cost over more time and reduces the magnitude of annual investment required. In addition, moving at a slower pace has other advantages by allowing all stakeholders to periodically evaluate progress, learn from experience, and adapt to changing circumstances and new opportunities.

In addition to the capital costs and other investments described in Table 8, which are expected to be borne by a mix of private sector and public investment, achieving NICCS objectives will have cost implications for the entire Ugandan population. When people switch from traditional biomass to clean or transitional cooking options, they must purchase new stoves and, in most cases, regularly purchase fuel. If stoves and/or fuel are subsidized, then the population pays less, but GoU or another entity is responsible for payment. Regardless, it is helpful to quantify the funding required and consider who will pay it. While a precise financial assessment is difficult because future stove and fuel prices are uncertain, this section presents a rough calculation, using current fuel prices projected into the future. This provides some insight into the broader financial implications of the NICCS scenario in comparison to BAU, with details presented in Table 9. The assumptions used for this analysis are listed in Appendix D.

Table 9: Main characteristics and financial implications of the NICCS transition scenario

Key indicators	BAU	NICCS	% change from BAU to NICCS
Percentage of households nationwide using clean or transitional cooking options (Class 1-3 and equivalent)	2030: 16% 2040: 23%	2030: 39% 2040: 100%	2030: +139% 2040: +337%
Cooking energy consumption (PJ)	2030: 371 2040: 456	2030: 300 2040: 191	2030: -19% 2040: -58%
Woodfuel demand (Mton/yr)[46]	2030: 31.6 2040: 40.3	2030: 25.2 2040: 14.4	2030: -20% 2040: -64%
Net present value (NPV) of financial flows required for NICCS scenario (2025-2040)			**Billion UGX**
Overall change in fuel costs for consumers (including taxes)			38,600
Tax revenues paid to GoU from fuel purchases[47]			3,300
Foregone tax revenue due to zero-rating of VAT and waiving of import duty on fuels[47]			6,400
Overall cost of subsidised stoves for consumers (including taxes) [47]			1,500
Overall cost of stove subsidies (including taxes) [47, 48]			1,200
Tax revenues from stove purchases[47]			680
Foregone tax revenue due to zero-rating of VAT and waiving of import duty on stoves[47]			40

Table 9 shows that achieving NICCS targets will result in a 139% increase in the percentage of households with access to Class 1-3 cooking options by 2030 and 337% increase by 2040 (relative to the BAU trajectory). In addition, as people transition to cleaner, more efficient cooking options, they require less energy to perform the same cooking tasks. Thus, overall energy demand declines 19% by 2030 and 58% by 2040.

However, this transition requires substantial expenditure by Ugandan consumers between now and 2040. The largest expense is for fuel, which totals UGX 38.6 trillion, including 3.3 trillion in taxes on the fuels that are not zero-rated. Consumers will also pay UGX 1.5 trillion for *subsidised* stoves, assuming subsidies are similar to those implemented with EASP (Appendix C).[48] The subsidies in turn cost GoU UGX 1,200 trillion. Thus, in the NICCS scenario, after accounting for both taxes and subsidies, consumers will pay *UGX 40,100 billion* out of pocket for stoves and fuel than they would pay under the BAU scenario. This includes UGX 4,200 billion in taxes paid to GoU. The government in turn spends UGX 1,200 billion in stove subsidies and "misses out" on nearly UGX 7,000 billion in additional revenue by waiving import duties and VAT on certain stove and fuels.[47]

Thus, under this transition, GoU receives UGX 1,600 billion tax revenues. Tax revenues are primarily from sales of LPG and electricity and the associated appliances (though VAT is waived on LPG, it is still subject to an infrastructure levy and withholding tax). In addition, by waiving import duties and VAT on some fuels and appliances, GoU would forego an additional UGX 2,200 billion in tax revenue. However, this revenue could be considered as an investment in the benefits associated with a clean cooking transition including reduced health risk, improved air quality,

[46] Wood mass is expressed in "oven dry" tonnes.

[47] Table 4 lists the stoves and fuels that are subject to taxation. This assessment assumes that this tax schedule remains fixed through 2040.

[48] The estimate of subsidies is based on the subsidies offered through EASP, assuming that they are extended through 2040. See Appendix C for details.

climate change mitigation, and time savings. Moreover, if VAT and other taxes were in place, those costs would be borne by consumers. It would be more difficult for them to afford Class 1-3 fuels and appliances and make it less likely that NICCS targets are achieved.

While collecting public inputs of draft versions of NICCS, several stakeholder groups took issue with the pace of transitions recommended by this strategy relative to previous strategies (Table 5). Pointing to the ambitious targets for economic growth, electrification, and other key development indicators outlined in Uganda's Vision 2040 [111], these stakeholders stressed that Uganda may be much wealthier in the next decade than it is in 2025. In a wealthier Uganda, the barriers to affordability and access described in Section 3, may be easier to overcome than they are today. While the NICCS team shares this optimism and would like to see a rapid transition away from polluting cooking fuels, the team feels that the trajectory shown in the right side of Figure 11 is highly ambitious and that a more rapid transition is highly unlikely. Nevertheless, the team includes a recommendation to periodically review progress and adjust targets accordingly. If the Vision 2040 targets come to pass, then a more ambitious set of clean cooking targets would indeed be warranted.

Recommendations to periodically review progress and adjust NICCS targets

1. Implement a rigorous MRV system that regularly tracks progress toward NICCS targets (as outlined in Section 7) and also track other development indicators that are likely to affect access to and adoption of clean fuels and appliances. These include *inter alia* household incomes, poverty rates, income inequality, employment, and literacy / education.
2. Adjust NICCS targets appropriately based on progress tracking and trends in development indicators

5. Results of stakeholder consultations

Interviews were conducted with 33 individuals from 22 public, private, and government entities representing the following fuel and/or cooking appliance transition pathways: biogas; ethanol; electricity; LPG; cleaner and more efficient biomass combustion, including using pellets and briquettes (see Appendix E for a list of interviewees and their affiliations). The stakeholder consultations also covered the planning and financing of cooking energy transitions across the country, including the particular circumstances surrounding cooking energy transitions in refugee settlements and their host communities, as well as in peri-urban neighbourhoods. This section presents both the cross-sectoral themes that were raised by the majority of stakeholders as well as the issues particular to each transition pathway.

Cross-sectoral themes

Many stakeholders spoke of the need for national government-sponsored awareness-raising or sensitization campaigns. Capital is available for many kinds of clean cooking businesses, but very few businesses meet the criteria for investment ready. Similarly, there are loans available for consumers, but they often don't effectively create affordability or access. Quality control is a problem. Many bogus products on the market. Standards are unclear and unevenly enforced.

Sector-specific themes

Biogas

Biogas has tremendous potential in Uganda. Currently 10-12 thousand households have biogas digesters, mostly of the fixed dome variety, as the tubular models are much newer. Although the national target is only 37,500 new biodigesters by 2033, there is the near-term potential to deploy up to 200,000 households, and the potential to install digesters in 1.8 million households if further barriers were overcome. Stakeholders cited both barriers to access and adoption as factors limiting the scaling of biogas as a clean cooking solution.

Barriers to adoption include both natural limitations in terms of feedstock and water access, as well as financial challenges covering the upfront costs and/or accessing sufficient credit to make biogas installation affordable. The behaviour change needed to optimize gas production from tubular digesters was also cited as an impediment to rapid and full adoption.

Barriers to access focus on the market-based approach currently favoured by development partners and the GoU. Stakeholders reported that countries that have scaled up biogas more rapidly have had more intensive government engagement. The market-based approach is limiting capacity in Uganda, because most entrepreneurs in the sector don't qualify for debt or equity financing.

E-cooking

E-cooking includes solar-electric cooking systems with integrated solar panels and batteries as well as induction stoves and EPCs powered by the national grid or a mini-grid. E-cooking used to be considered aspirational, but it has become much more accessible recently, especially in the greater Kampala region. A growing number of people view e-cooking as the preferred pathway to clean cooking. In part, increasing price and decreasing availability and quality of charcoal has pushed people to consider electric cooking. However, many barriers to scale-up remain.

Barriers to adoption include the public perception is that electricity for cooking is too expensive (see Appendix 0). While a cooking tariff has been introduced, several interviewees noted that it is not effective for several reasons. As discussed in Section 4, there is a lack of awareness and understanding of the tariff. In addition, while the cost per kWh within the cooking band is low, reaching the cooking band requires using electricity for other purposes at a higher tariff. The use of illegal connections to grid to power some cooking appliances introduces safety concerns and also raises issues with the tariff structure, which is designed for a single household.

Additional barriers arise because not all rural communities are connected to the grid. Furthermore, more marketing is needed to reach remote populations. More working capital is needed to increase supply and more subsidies to help consumers overcome affordability barriers. Low-income consumers need subsidies.

Good quality EPC's (like the ones distributed by UMEME) have few repair issues, but consumers do need behaviour change support provided through a sustainable customer service infrastructure. (The potential end of UMEME's contract is not expected to have a significant impact on their -cooking activities, which will likely be continued if the government takes over the electricity distribution.) However, many EPCs currently on the market are inefficient.

LPG

GoU has been actively promoting LPG for cooking. Several interviewees mentioned that about 3% of population uses some gas for cooking. Currently, here are 36 commercial LPG retailers in Uganda, of which two are Uganda-owned. Others have Kenyan, Indian or multi-national owners. No companies are distributing beyond a ~200 km radius of Kampala city centre. Most customers are located in cities, as LPG is not yet available in the countryside.

In 2016, MEMD conducted a baseline study, followed by a pre-feasibility study, and finally a feasibility study in 2020 [6]. The study noted three types of barriers: infrastructure, economic, and social. Key infrastructure barriers cantered on lack of access outside of central urban areas and irregular supplies in urban areas with access, causing delays for customers seeking to refill their canisters. Affordability is the primary economic barrier, especially for rural families. They can't afford the upfront cost of the burner and the canister, and they don't have the cashflow to refill a large cylinder. Finally, social barriers include fears that LPG can cause explosions and house fires as well as resistance to cooking local foods with gas, especially those with long cooking times such as matoke and beans.

The National program aimed to address all three of these barriers with a combination of give-aways, education, and investment in supply chains. The program planned to invest in increased storage and additional tanker train cars. While Uganda expects to have some domestic LPG supply by 2025,[49] storage and distribution infrastructure will still need to expand. To overcome the economic barriers, the national program planned to give out 1 million starter kits over 5 years, each including a 13 kg canister, regulator, hose and two-burner stove. Finally, the program planned extensive awareness-raising campaigns, focused on alleviating safety concerns and promoting LPG as the best choice for preparing certain foods or meals. It is also important for customers to understand that, on a per-meal basis, LPG is cheaper than charcoal.

The program has been delayed due to COVID restrictions and (potentially related) scarcity of resources. They have distributed 30,000 kits and have done some stakeholder engagements and media to raise awareness, although the program has not yet reached all parts of the country. They also secured a property in Kampala for a centralized LPG storage facility, but they have not had the budget to develop it yet.

The general program approach is still current, but MEMD is prioritizing particular aspects based on the expected available funding over the course of NDP IV. There will be some funding for awareness-raising. Awareness is crucial, so that LPG that is produced in the country are used there and not exported. In the next one to three years, CNOOC and Total will start producing LPG in Uganda at oil fields and build storage there. CNOOC plans 20k tons of LPG, and Total, 40k tons per year. MEMD also expects to conduct an environmental impact assessment on the Kampala parcel so they can attract an investor to build the storage facility there.

MEMD plans to distribute an additional 60,000 kits in FY 2024/25, low-income families, i.e. people earning less than $5 million UGX (~USD 1364). They are interested in potentially distributing smaller canisters in the kits in order to make refilling more affordable, but more research is needed into the public perception of smaller canisters, particularly whether there is any stigma attached to them. Wana Energy has been successfully included 6 kg cylinders in their product

[49] More recent estimates have pushed back the start-up of domestic petroleum refining to 2027 [93].

line, both with integrated burners and two-burner stoves. Monitoring and evaluation activities are planned to start in 2025-26 to see how successful the program has been.

Wana Solutions has been able to overcome the economic barrier by engaging employers as guarantors for in-house financing of cooking equipment. 70-80% of their customer base are low-income earners, employed by hospitals and schools. Retailers are also experimenting with schemes that help consumers bank a fraction of their savings from avoided charcoal purchases so that they can cover the cost of their LPG refill when it is needed.

Commercial companies struggle with the high cost of cylinders, which are all currently imported. Having to import cylinders is a drag on growth, as each retailer has limited stock on-hand. Import tariff and VAT adds to cylinder costs. GoU is mobilizing support for private sector to manufacture cylinders locally, but until that occurs, .

Illegal refillers pose a threat to regulated LPG retailers, who have lawfully obtained licenses for their operations. They also create safety risks because they are unregulated. Lethal accidents have occurred at illegal LPG depots in neighbouring countries [112]. MEMD is pursuing revised legislation to close a loophole in the law that has prevented full enforcement of the regulations to date. The aim is to be able to apply this new regulation by the end of the year to eliminate illegal refilling operations. Commercial companies have been frustrated by the lack of enforcement action again illegal refilling operations, which are pervasive. For example, there is a hotel in Kampala where everyone knows you can get an informal refill outside the kitchen.

Solid Biomass

Uganda has had its own biomass cookstove industry for several decades that includes manufacturers and distributors of improved wood and charcoal stoves, as well as producers of charcoal briquettes. More recently, there have been new market entrants offering imported stoves burning biomass pellets. The older enterprises in this industry are focused on providing more efficient charcoal stoves to urban and peri-urban consumers, along with briquettes made from various waste streams. The new enterprises have introduced imported stoves that are both very efficient and low-emitting. These newer enterprises are largely supported through carbon financing, which traditional enterprises have struggled to access due to its complex rules and significant upfront costs.

Traditional biomass enterprises view their mandate as providing an improved cooking experience to populations who experience strong barriers to accessing clean cooking solutions. There is a strong perception that they are meeting the needs of everyday people, especially women and more isolated rural households, also termed “last-mile customers.” Therefore, they want the GoU to promote and incentivize a mix of fuels and technologies that includes biomass fuels and stoves in order to provide equal access to improved cooking for all Ugandans.

This stakeholder group also emphasized that most of their customers are primarily motivated to reduce their fuel costs and improve their productivity. A national approach to sensitization and awareness-raising should include these messages. Information on clean cooking needs to be disseminated through local trusted sources at the grassroots level, such as through local environmental officers, primary schools or community health workers.

Producing and differentiating a quality product in the marketplace is also a struggle for these stakeholders. Stove producers want training and incubation programs for young manufacturers and labour entering the industry, as well as government support for production mechanization.

They want to better access to high-quality affordable raw materials, which would lower the upfront costs of quality. Briquette producers want more effective regulation of wood charcoal to help them differentiate their products as more sustainable and affordable. Many feel standards should be mandatory, with sensible and consistent testing requirements and enforcement. For example, each briquette shape/size (offered to accommodate different stove types) should not require a separate test certification. Testing must also be accessible and offered at a standardized, affordable cost.

The erratic and uneven enforcement of taxes was also a barrier raised by many biomass industry stakeholders. They felt a two-pronged response was needed. First, the finance unit needs to devise a suitable tax regimen that is fair to all technologies and fuels. Second, all tax officers need to be effectively trained and supervised to implement the tax code as written. Some stakeholders also recommended that improved biomass cookstoves should be exempt from VAT.

Finally, biomass stove and fuel producers were unanimously frustrated with the GoU's approach to business capital. They felt it is GoU's responsibility to provide fund the expansion of both producers and distributors, especially last-mile sources, of improved cooking products, as the existing public-private partnerships and donor-provided results-based financing (RBF) were not meeting the need. Stakeholders reported that the UECC's fund, delivered through commercial banks, such as Centenary Bank and Stanbic Bank, had such high barriers to entry that it was not workable for them. Barriers included testing requirements, collateral, and short-pay back periods. Margins in the industry are often very small, making loans with shorter pay-back periods inaccessible. Participants expressed that RBF was positioned to help established businesses enter new markets, rather than support start-ups, and that these programs also fail to build sustainability.

Solution Bundling

Many stakeholders support a multi-fuel approach, positing that preventing households from "back-sliding" to their baseline fuels and practices when they encounter challenges with their clean solution is an important strategy, in order to lock in health and climate benefits and accelerating the pace of change. For example, the grant-funded ICLER pilot project offers participants three choices: EPC plus LPG; EPC plus briquettes or LPG plus briquettes. Some commercial stove companies likewise take a "big-tent" approach, offering improved wood and charcoal stoves as well as LPG and electric products.

Planning and funding themes

The GoU should conduct an audit of all the tax schemes (taxes, tariffs, duties, credits, etc.) that impact clean cooking markets in order to streamline them and ensure that they are incentivizing the most promising clean cooking transition scenarios. Further stakeholders across multiple fuel and technology types complained about uneven enforcement of existing tax codes. It seems not all tax collectors are knowledgeable or consistent about applying the various tax measures designed to incentivise cleaner and more efficient cooking practices.

Uganda has strong policies that support the transition to cleaner and more efficient cooking but there is a lack of enforcement. In central region has a charcoal ban on the books, but it is not enforced. In contrast, Kenya and Rwanda have enforced their charcoal bans, and they are seeing results.

Many actors in the cooking energy sector regretted the lack of reliable, current, and fit-for-purpose, government data on the current state of cooking energy in the country. The census provides limited data on fuels used for cooking. Data on imports should be provided by the Uganda Revenue Authority, but it is not regularly shared. Data on commercial sales is also missing, as many businesses are afraid that sharing data on their operations will bring increased scrutiny from the tax authorities. GoU should consider providing a sweetener to encourage businesses to share data.

EnDev operates several cooking programs in Uganda, which include robust monitoring and evaluation components. They track sales, quality, and sustainable adoption (i.e. usage) for all their Ugandan private-sector partners. There two information streams: sales data and field studies for independent ground-truthing. EnDev samples up to 5% of the reported sales but does not randomly sample non-customer households. They share feedback with their private-sector partners and report to MEMD on a quarterly basis. MEMD uses that data to inform energy policy and ministry activities, as well as to report to SE4All.

There are several ways the government could support the cooking sector with improved data.

1. Conduct shared baselines to lower the barriers for companies to access carbon finance;
2. Provide more data on the level of quality and capacity of partners through an annual UBOS market status survey;
3. Publicize the level of standards compliance, in order to incentivise more companies to become compliant; and
4. Publish more detailed and regular import and export data, including information on product quality, and provide transparency around importers receiving tax exemptions.

Companies struggle to access capital at reasonable interest rates. While grant funding has been critical for many companies in the sector, it also increases the complexity of their operations. Many of the SMEs in the cooking sector are not ready to receive investment capital. EnDev is one of the programs providing pre-investment support to these companies in the form of results-based financing, grants, technical advising and capacity building.

The GoU could support market development and business growth in several ways. They could consider using challenge funds to spur R&D and market development. They could also provide capacity building and support for companies seeking to access carbon finance. Many resources are available to help the GoU build systems to facilitate stakeholder access to the carbon markets under Article 6. Close collaboration between MEMD and MWE would also help to further carbon financing support for cooking sector businesses.

Population group themes

Peri-urban households

A focus group discussion on cooking energy options was conducted with more than a dozen female residents of a peri-urban Kampala neighbourhood. Firewood and charcoal were the primary fuels for these women, but almost all of them stacked with kerosene, LPG, and electricity. Electricity was used for pressure cookers, percolators, and rice cookers. Their choice of fuel depended on the nature of the cooking task (long slow tasks vs. quick warming), as well as the

cost of alternatives. Several participants raised that the price of charcoal was increasing as the quality decreased. In many cases, the electricity used was from informal connections.

Most participants were aware of clean cooking options, and many were using or had used them for some of their cooking needs. Barriers to greater adoption included cost, as well as safety concerns over live wires and LPG canisters. Some also noted restrictions from their landlords, an inability to keep their young children away from the cooking area, and the physical limitations of their grid connections. Many also mentioned that food cooked on firewood tastes better.

Even though the participants had some awareness of clean cooking options, there were multiple clean cooking technologies available in Uganda that they had not seen before or did not know where to purchase. They suggested that clean cooking technologies and fuels be distributed through markets in their neighbourhood or door-to-door salesmen. They would also like the GoU to de-risk their purchases by providing quality standards and labelling, information on making the transition to new technologies, and payment plans to make the cost affordable.

Refugee settlements

Uganda hosts more than 1.8 million refugees, and the country continues to receive people from the Democratic Republic of Congo, South Sudan, and Sudan. Refugee settlements in different parts of the country are supported by a patchwork of charities and government agencies. When refugees arrive, they receive a kit that includes a lantern, jerrycans, and cooking pans, but does not currently include stoves or fuel. UNHCR supports the distribution of rocket and lorena type biomass stoves, which are made from local materials by trained artisans. Since 2020, these stoves have been disseminated to 124,000 refugee households. Refugees also have the opportunity to learn to make these stoves.

UNHCR aims to minimize conflict between host communities and refugee settlements over fuel availability. In addition to encouraging the distribution of improved efficiency stoves, they also advocate for situating sustainable woodlots with fast-growing species on government lands. In some locations, briquettes are also produced. Some households with specific vulnerabilities and needs may also receive a fuel supply from UNHCR for a specific period of time.

In general, UNHCR is moving away from a relief model towards a development approach, which focuses on providing income-generating opportunities for refugees so that they have purchasing power, especially as humanitarian donor funding is becoming less available. Some partners help address the upfront cost of improved cooking technologies for refugees, although cookstoves are lower on the list of items that refugees seek to acquire. GIZ has piloted demand-side subsidies to incentivize cookstove purchases and adoption and found that the subsidy needs to be substantial in order to make the improved cooking technologies affordable to refugee households. UNHCR headquarters is also exploring tapping into carbon finance to support refugee operations. They have partnered with KfW to design and fund projects, with a cookstove pilot is likely to start in Uganda soon that will potentially bring clean cooking to tens of thousands of refugee households.

UNHCR would like to engage the private sector as much as possible to meet the cooking energy needs of refugee settlements, but these enterprises are far away, and government support is needed to attract them to the refugee communities. At the 2023 Global Refugee Forum, the GoU committed to include refugees and their specific situations in its nationally determined contributions and adaptation plans to effectively reduce the carbon emissions from deforestation and to enhance access to safe, clean, and affordable energy in refugee hosting districts by 2027.

Ideally subsidizing the upfront cost of cooking appliances and lowering the cost of electricity for e-cooking appliances could be part of this commitment. E-cooking would be particularly valuable in places where wood is scarce, such as in the southwestern settlements. However, the current grid infrastructure needs to be extended in many settlements in order to make e-cooking a viable option. Similarly, LPG access is limited in refugee settlements, due to the lack of distribution infrastructure that could support LPG retailers, which the GoU could also address.

Some charitable partners have also initiated other cooking energy programs in refugee settlements. For example, Ecoca is producing an off-grid solar electric stove that is assembled and repaired at facilities within or adjacent to some refugee settlements. These facilities also offer employment opportunities to refugees and host communities. Ecoca's charitable partners vet potential customers and provide subsidies and/or financing for the stove purchase. Some stakeholders expressed concern that refugees are not able to fully adopt these new technologies and often revert to using traditional biomass. GoU support could support private sector enterprises operating in refugee settlements with awareness-raising, marketing, and financing.

6. Recommendations

Specific thematic recommendations have been presented throughout this document. This section summarises and elaborates on those recommendations in more details. It then provides a set of higher level, crosscutting recommendation that are necessary to fully integrate the fuel-specific strategies that comprise NICCS.

Sector-specific recommendations

Stove standards

UNBS has developed and adopted a series of standards for clean and transitional cooking fuels and technologies. These include standards directly addressing characteristics of fuels and appliances, as well as standards that target transport and distribution of fuels, and standards that specify procedures to measure, inspect, and test appliances, fuels, and modes of transport (see Appendix A for a comprehensive list).

However, some gaps remain for certain fuels and appliances. For instance, the country lacks standards addressing novel electric appliances like induction cookers and EPCs as well as ethanol stoves. Further, the 2023 energy policy notes that standards for LPG cylinder certification, distribution and accessories are inadequate [5,7]. In addition, although recently updated standards address the safety and performance of transitional biomass stoves, that sector relies heavily on small-scale artisanal production, resulting in inconsistent quality and possible mismatches between the performance that is measured during testing and actual performance of products sold to the public. This makes compliance logistically challenging and expensive to implement [22].

Developing standards and designing labels for clean and transitional fuels and technologies in Uganda is a critical point in the journey towards universal access to clean and transitional cooking options. However, standards and labels alone are insufficient; they must be backed by strong awareness and enforcement mechanisms to ensure compliance and credibility. UNBS currently lacks sufficient staffing and capacity, which hampers enforcement and allows low-quality products to persist in the market [113]. This affects all sectors, including cooking fuels and

appliances [2]. UNBS must be equipped to undertake timely testing and labelling as novel fuels and appliances are introduced, and to monitor and enforce standards. This calls for a significant expansion of the bureau's workforce to ensure there are enough skilled personnel to conduct inspections and market surveillance. Additionally, modern testing facilities and equipment will be critical to maintain the integrity of the standards and protect consumers. A stable and consistent financial commitment from the government, combined with revenue generated from testing and labelling activities, will ensure the sustained operation and success of the program [22]. By investing in these areas, Uganda can build consumer trust, promote the adoption of clean cooking solutions, and ensure the market is safeguarded against substandard or unsafe products. Specifically, NICCS will undertake the following steps regarding standards:

- To define inclusion criteria for appliances that meet NICCS targets of universal adoption of clean or transitional cooking appliances for all Ugandans by 2040, GoU should follow US 761:2019. Appliances falling in Class-1 are "clean"; stoves falling in Class-2 and 3 are "transitional" and stoves that do not achieve Class-3 are "polluting" and their use should be phased out by 2040.
- As it is currently written, US 761:2019 only applies to biomass appliances. To ensure all appliances meet standards for safety, reliability and pollution control, UNBS should develop performance standards for other fuels and appliances including EPCs, induction stoves, and ethanol stoves.
- When it is next up for revision, UNBS should update US 761:2019 to align with WHO guidelines and ISO 19867-3.
- Currently, US 761:2019 is voluntary. To ensure all appliances that are deployed to meet NICCS objectives meet quality and performance criteria, US 761:2019 and the analogous standards developed for other appliances should be mandatory.
- Provide UNBS with sufficient funding and personnel to monitor and enforce all standards related to cooking fuels and appliances are currently in place and that are implemented in future.

Wood and charcoal stoves

Wood and charcoal have formed the foundation of cooking in Uganda for generations and will still have a major role under NICCS. With NICCS successfully implemented, wood and charcoal will still contribute between 40 and 50% of Uganda's cooking energy by 2040. Thus, several measures are required to ensure that the negative impacts of using these fuels are minimised through the introduction of high-quality, clean, and efficient stoves. To achieve this, NICCS includes the following measures:

- To achieve the massive scale-up of high-efficiency, low-emissions woodfuel stoves called for by NICCS, 1.5 million stoves will be needed by 2030 and nearly 4 million new appliances will be needed by 2040. Ensure that a sufficient supply of quality, high-performing Class 1-3 wood and charcoal stoves are available for consumers.
- If domestic production is insufficient to meet this demand, then GoU should create incentives including a temporary reduction in import duties to encourage imports until sufficient domestic production comes online.
- Develop new financing mechanisms and support existing mechanisms targeting lower-income households with low-interest loans for Class 1-3 wood and charcoal stoves.
- Ensure that all financing options are open, including carbon finance. Consider "white listing" Class 1-3 wood and charcoal stoves to facilitate their inclusion in Uganda's carbon

market.

Processed solid biomass

Processed solid biomass like briquettes and pellets are an attractive alternative to unprocessed fuelwood and charcoal because they are typically made from forest and agricultural waste, thereby taking pressure off of forested landscapes. Moreover, their uniform size and physical characteristics makes it easier to optimise stove designs to maximise energy efficiency and minimise emissions.

- There are currently pellet-burning appliances that achieve ISO Tier 4-5 performance (equivalent to US 761: 2019 Class 1). However, briquette-burning devices have not achieved the same level of performance, which indicates a need to invest in research to develop cooking appliances that can burn biomass briquettes and consistently achieve Class 3 performance or better. These efforts should focus particularly on stoves for commercial and institutional users, which represent an untapped market for processed biomass fuels.
- While there is some consensus that forest and agricultural waste are plentiful resources that can be utilised as feedstocks for pellets and briquette production, there is no detailed "supply curve data" which would indicate what could be supplied at various price points. To fill this gap, GoU should invest in research to accurately quantify, assess costs, and geo-locate sources of agricultural residues and wood waste to fully understand the potential supply of raw materials that can be used to produce briquettes and pellets at prices that are competitive with fuelwood and charcoal currently used for commercial and institutional cooking.

E-cooking

NICCS calls for very rapid scale-up of e-cooking, with the number of primary users set to increase by over 800,000 households between now and 2030 and an additional 2.6 million households by 2040. The 2023 *The National eCooking Strategy* included many recommendations, which are not repeated here. Instead, NICCS focuses on these additional recommendations:

- Ensure that there is sufficient supply of e-cooking appliances for residential, commercial and institutional sectors across a range of price points
- Leverage GoU's ambitious electrification plans to promote e-cooking among newly electrified and upgraded households: e.g. work with UEDCL and any future concessionaires to offer high-quality e-cooking appliances to newly connected or upgraded customers, which can be paid off over time through a surcharge on their bill or pre-paid meter.
- If domestic production of e-cooking appliances is insufficient to meet demand, reduce trade barriers to encourage imports until domestic production comes online.
- Consider revising the electricity tariff structure so that the low-cost units of electricity are more accessible for low-income households.
- Revise the timeline of the National e-Cooking Strategy from 2030 to 2040 to reduce the magnitude of annual investment required and allow for more time to achieve the target of 18% of households using modern electric cooking appliances.

LPG

NICCS also calls for massive scale-up of LPG use among residential users from an estimated 60,000 tons in 2025 to 300,000 tons in 2030. Many of the measures called for in the 2021 "LPG Promotion, Supply, and Infrastructure Intervention Project", which were meant to lay the groundwork this scale-up, have not yet been implemented. NICCS defines a similar target as the LPG Intervention project, but extends the timetable by a decade, given more time to ramp up ambition. However, urgent action is still needed, including:

- Revisit the objectives of the "LPG Promotion, Supply, and Infrastructure Intervention Project" in light of new circumstances including progress on the Hoima refinery and investments in LPG distribution infrastructure.
- Currently, most LPG is marketed in 13kg cylinders. However, refilling 13kg cylinders requires a lump-sum payment that few can afford. Smaller cylinders and PAYGO business models both represent alternatives to the larger cylinders. To achieve NICCS objectives for LPG adoption, GoU should explore the market potential of both PAYGO LPG and smaller (3kg and 6kg) cylinders to better understand the customer appeal and potential trade-offs between each option.
- The "LPG Promotion, Supply, and Infrastructure Intervention Project" included free giveaways of LPG kits with 13 kg cylinders. At the time of writing, fewer than 100,000 cylinders have been distributed [114]. However, there is evidence from other countries that free giveaways of LPG kits do not typically lead to sustained use among recipients, particularly for large cylinders that are costly to refill. Hence, going forward, GoU should avoid free giveaways of kits with large cylinders.
- The timeline of the "LPG Promotion, Supply, and Infrastructure Intervention Project" to achieve 30% uptake of LPG was unrealistic and should be revised reach that objective by 2040 rather than 2030 so that there is more time to meet the stated objectives.

Biogas

Biogas has tremendous potential to provide clean, sustainable cooking energy for rural livestock-owning households with access to sufficient land and water. Efforts like the Africa Biogas Partnership Programme and the African Biodigester Component have created a strong foundation for biogas in Uganda. However, to succeed, biogas requires investment in supporting infrastructure, capable technicians, and training for users, as well as accessible finance to help users overcome the high upfront cost of biodigesters and ancillary equipment. The NBSAP includes many sensible recommendations, which are not repeated here. NICCS adds these recommendations to fill gaps that that NBSAP did not cover.

- Increase the targeted number of residential biodigesters to 100,000 units and extend the timeline from 2033 to 2040.
- Develop a detailed approach to target subsidies for biodigester systems (will potentially support other subsidies for other Class 1-3 cooking options).

Ethanol

GoU commissioned a feasibility study on the *Sustainable Biofuels Infrastructure Development* (SuBID) Project , which explores the investments, policies, and regulations necessary to achieve a 10% blending target in the transportation sector and cooking in ~1.6 million households [9]. Current statistics are not clear, because published reports combine ethanol with other cooking

fuels (e.g. see Figure 5). However, the limited information available indicates there are just a few thousand households that currently cook with ethanol.

- The SuBID study projects that annual demand for ethanol will exceed 300 million litres as a result of both a 10% blending target and as cooking fuel for 1.6 million households. The study contends that the 90 million litres/year of unutilised production capacity could be brought online easily but suggests that capacity be directed toward the automotive blending target. We recommend that MEMD reconsider the recommendation that underutilised capacity be devoted to meeting the transportation blending target and instead devote some or all of that capacity to meeting cooking demand in the early stages of NICCS implementation.
- Unlike LPG and electric appliances, which have been used by better-off households for decades, cooking with ethanol is relatively new. Substantial investment in awareness raising will be necessary to support the market for ethanol cooking. Budget allocation for this was not included in the SuBID feasibility study cost projections.
- Similarly, the SuBID study did not include any mention, or budgetary allocation for the development of ethanol stove standards. We recommend that MEMD work with UNBS to develop standards.

Cooking in Commercial and public institutions

Commercial and public sector institutions rely heavily on woodfuels, but there is limited data on quantities of woodfuel consumed and the types of appliances used. There is some indication that a high percentage of public institutions use improved solid fuel stoves, but the quality and performance of those stoves is unknown. Moreover, commercial food service enterprises and public institutions regularly cook large volumes of food and purchase the majority of their fuel, they are very strong candidates for upgrading to clean cooking options. In addition, because GoU has direct influence over public institutions, they should serve as early adopters of improved cooking devices. NICCS makes the following recommendations to integrate commercial food service enterprises and public sector institutions:

- The use of fuelwood and charcoal in appliances that do not meet Class 1-3 performance criteria should be phased out in public institutions by 2030 and replaced by a mix of improved solid fuel appliances that meet standards for transitional or clean appliances.
- US 761: 2019 applies to small scale residential devices. There are no standards for large commercial and institutional appliances, therefore UNBS should develop standards for institutional and commercial solid fuel stoves that are analogous to US 761: 2019 (keeping in mind the previous recommendation US 761:2019 be updated to align with WHO guidelines and ISO 19867-3).
    - The UNBS protocol for institutional and commercial stoves should build on ISO 5714:2023, which covers testing protocols for institutional cookstoves, but does not set performance guidelines or limits on emissions [115].
- Data on fuel consumption by commercial Enterprises and public sector institutions is inconsistent and incomplete. MEMD should work with UBOS to develop consistent, standardised, and nationally representative data collection methodologies so that cooking energy consumption among commercial enterprises and public institutions can be quantified and tracked over time.

Cross-cutting recommendations

In addition to fuel- and stove-specific recommendations outlined above, there are many obstacles to achieving the objectives of NICCS which are structural in nature (see Section 3). There are additional measures that can be implemented to reduce or eliminate these barriers, which are described in this section, grouped by the main NICCS objectives of 1) Integrating existing policies and strategies into a single overarching strategy; 2) Ensuring adequate supply of clean cooking fuels and appliances; and 3) Stimulate=ing demand and address barriers to access for clean fuels and appliances among residential and commercial sectors and public institutions

1. Integrate existing policies and strategies into a single overarching strategy

1a. Invest in cross-sectoral coordination

Integrating the existing clean cooking policies and strategies will be challenging. There are many moving parts and potentially competing interests. First and foremost, it will require strong coordination. The creation of the Clean Cooking Unit with support from GGGI and the UK government will take the lead in coordination of NICCS objectives (see Section 4). However, with the unit housed within MEMD and staffed entirely by MEMD personnel, there may still be a gap in cross-ministerial coordination that will need to be filled.

1b. Increase the GoU workforce

Implementing NICCS will require additional GoU personnel. The UK government's recent announcement that it is supporting the creation of a "Clean Cooking Unit" within MEMD [1] including a commitment to hire additional staff is a start. However, still more personnel will be needed to generate the necessary momentum and ensure the proper capacity exists to work across sectors and scales of operation.

In addition, to be successful, NICCS requires the enforcement of existing standards and the development of new standards. To successfully accomplish these critical tasks, UNBS will need additional resources and personnel.

1c. Revise, update, and fill gaps

Several of the strategy documents that are being integrated in this effort are outdated. For example, the LPG Programme that informed this assessment was written in 2020. The timing and context of Uganda's petroleum development have changed in ways that could affect LPG supply. In addition, with 30,000 LPG kits distributed, there is an opportunity to assess the impact of those kits. Are recipients cooking with LPG? If not, what additional support do they need? Updating the plan to reflect lessons learnt from the initial distribution would increase the likelihood that the next phase of the LPG program is successful and boost the overall impact of this NICCS.

Similarly Uganda's Biomass Energy Strategy dates to 2015 [2] and is completely outdated. This study collected current views from many stakeholders involved in biomass-based cooking; but NICCS would benefit from a more detailed and up-to-date biomass-specific assessment.

Lastly, the ethanol component of this assessment is based on a feasibility rather than a true strategy document. The study devoted significant attention to ethanol-based cooking but focused mainly on fuel production. A more detailed assessment of ethanol focused on downstream processes would be helpful in refining the role of ethanol cooking in NICCS.

2. Ensure adequate supply of clean cooking fuels and appliances

Table 3 noted some of the barriers that must be overcome to supply sufficient fuels and appliances to meet NICCS objectives. The needs vary with the specific fuel and technology in question. The existing strategy documents outline some key measures needed to overcome fuel-specific constraints. This section explores higher level measures that could reduce or remove supply barriers and boost market activity for all players.

2a. Understand supply needs and adapt to changing circumstances

Meeting the targets outlined in the strategy will require dramatically increasing the supply of clean and transitional fuels and appliances. For example, the NICCS scenario envisions that 12% of the population use LPG as a primary fuel by 2030, climbing to 30% by 2040. Assuming a household uses about one 13 kg cylinder per month [6], then meeting projected demand in 2030 will require 300 thousand tons of LPG.

In 2022, Uganda's total supply of LPG was ~37 thousand tons, all of which was imported [46]. As Uganda develops its domestic oil industry, some LPG will be produced domestically. Oil production is expected to commence in 2026, after which the Kingfisher project, in Kikuube district, is expected to produce 20,000 tons of LPG annually. Similarly, the Tilenga project in Buliisa and Nwoya districts, will produce 80,000 tons/year when it comes online [116]. Finally, the refinery at Hoima, which has faced numerous delays and is now expected to come online sometime in 2029, will produce 220,000 tons of LPG/year [116,117]. Taken together, these three sources will result in LPG domestic production of roughly 320,000 tons per year.

This will just be sufficient to meet 2030 demand, but if LPG adoption continues to grow to 30% of households by 2040, demand will increase to roughly 1 million tons/year, over three times domestic supply. Table 10 shows similar assessments for other clean fuels included in the scenarios described in Section 4 to demonstrate the volume of fuel needed to meet these targets and highlight potential shortfalls in supply.

As Table 10 indicates, meeting the demand of some clean fuels will require significant growth in supply, either through domestic production, imports, or both. GoU must plan accordingly to avoid supply constraints.

Table 10: Supply and demand of clean fuels in 2030 and 2040 under the NICCS Scenario

Fuel	Units	Current supply	Projected supply in 2030	Demand in 2030 under the NICCS scenario	2030 supply shortfall	Comment
Gas	kton	37[a]	320[b]	300	None	Output from the Kingfisher, Tilenga, and the Hoima refinery will just be sufficient to meet demand in 2030, but if LPG adoption continues to increase, demand in 2040 will exceed domestic supply by a factor of three.
Electricity	GWh	5,211[c]	14,000[d]	2,020	None	Future supply is based on ERA's *Least Cost Electricity Expansion Plan*, which anticipates that Uganda's installed capacity reaches 2300 MW of by 2030 and assumes an annual load factor of 70% [118]. This will be sufficient to meet the additional demand from e-cooking. However, this does not account for increased demand from other sectors.
Pellets	kton	0.01[e]	?	240	?	Pellet supply data is for 2021 and may include other types of wood waste products in addition to pellets. There are no supply projections for 2030.
Ethanol	kton	31[f]	178[f]	180	0-328	Currently, ethanol output is only 30% of production capacity [9]. For domestic supply in 2030, it is assumed that existing refineries produce at capacity and new refineries are constructed that produce an additional 100 million litres per year. This is sufficient to meet demand under Scenario 3 but leaves a shortfall under Scenarios 1 and 2. In addition, the Sustainable Biofuels Infrastructure Development Project calls for blending ethanol with petrol, which would lead to additional supply shortfalls for cooking.

Sources: [a] [9]; [b] [116]; [c] [46]; [d] [118]; [e] [119]; [f] [9]

2b. Reduce the costs of raw materials, import duties, and taxes

- Remove import duties on all materials necessary for domestic production of clean and transitional fuels and appliances
- Temporarily remove import duty on stoves and fuels for companies that commit to invest in domestic fuel production and stove manufacturing or assembly of any Class 1-3 technologies. This will make it easier for those enterprises to establish market presence and gain brand recognition, which will reduce the risk inherent in their investment.
- Explore options for bulk purchasing or raw materials or components to reduce prices for small manufacturers or assemblers

2c. Increase access to finance

- Work with institutional lenders to ensure they reach a diverse range of enterprises supplying clean and transitional fuel and appliances
- Create a fund to derisk or guarantee loans made to stove and fuel enterprises
- Develop "boot-camps" to assist Class 1-3 stove and fuel enterprises to develop viable business plans that lenders are willing to fund.

2d. Expand distribution infrastructure and reduce distribution costs

Clean and transitional cooking options currently reach a very limited fraction of the population. With the exception of biogas, access to clean and transitional fuels and appliances is highly

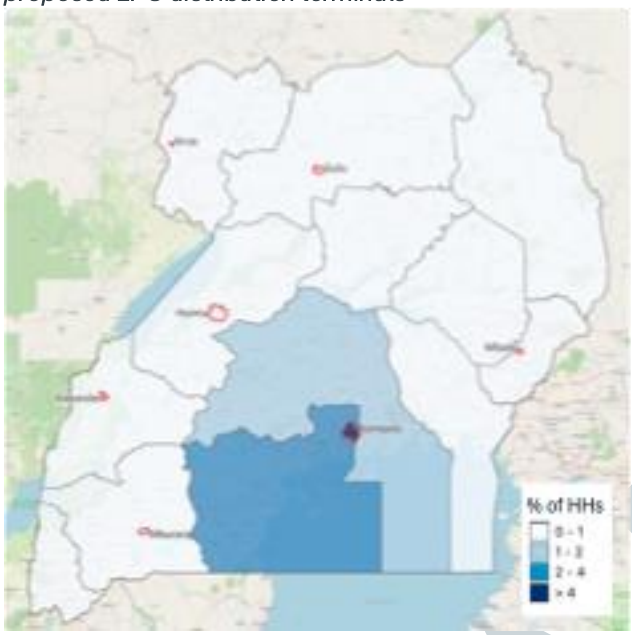
concentrated in urban areas and falls off outside of the capital region. To achieve NICCS targets, GoU must rapidly expand the distribution infrastructure for every fuel and technology pathway. The existing e-cooking strategy, Biogas Strategy, and LPG Programme include specific measures to expand access, which are not repeated here. However, other fuel and technology pathways lack coherent measures. Specifically, there are no existing strategies that address the need to expand access to Class 1-3 biomass stoves beyond the markets that they currently serve. Similarly, while the ethanol feasibility study includes plans to construct additional refining capacity, it lacks specific measures to expand access to ethanol fuels and stoves for residential users. To address these gaps, GoU should incentives for manufacturers and distributors of Class 1-3 biomass stoves, processed solid biomass fuels like pellets, and ethanol stoves and fuel to extend supply chains and marketing efforts to up-country districts similar to incentives included in e-cooking and LPG strategies. For example:

- The LPG programme includes plans to invest USD 62 million (UGX 225 billion) to construct regional distribution terminals for LPG, which will be located in areas with very low access. Figure 12 shows the sites of proposed terminals and the most recently available data showing use of LPG as a primary cooking fuel. The sub-regions selected for LPG terminals all had fewer than one percent of households using LPG as their main cooking fuel.
- E-cooking strategy includes provisions to:
    - invest in grid expansion “particularly in underserved and rural areas”
    - support access to appliances such as establishing “regional hubs” where manufacturers can showcase products and offer after sales service
- Establish an inclusive distribution and supply network that links manufacturers and assemblers of e-cooking appliances
    - invest in warehouses in strategic locations to facilitate appliance storage
    - developing efficient logistics networks to ensure timely delivery of new appliances and repair of malfunctioning ones

Similar measures should be implemented to support access to pellets fuels, ethanol, and Class 1-3 appliances including:

- Invest in regional storage and distribution facilities for all clean fuels with particular attention to underserved regions. To reduce land acquisition, permitting, and transportation costs, consider co-locating storage and distribution facilities at the same sites as the LPG terminals but also include regions in which LPG distribution terminals are not currently planned (Figure 12) including remote districts in the far northeast and southwest regions of the country.
- Incorporate pellets fuels, ethanol, and all Class 1-3 appliances in the “regional hubs” suggested for e-cooking so manufacturers can showcase all Class 1-3 products.
- Support enterprises to extend after-sales service for all Class 1-3 appliances in underserved regions.

Figure 12: Percentage of households that report using LPG for cooking "most of the time" with sites of proposed LPG distribution terminals[50]



3. Stimulate demand and address barriers to access for clean fuels and appliances among residential and commercial sectors and public institutions

There is a bit of a chicken-and-egg dilemma with clean and transitional fuels and appliances. If supply barriers are lowered so that Class 1-3 cooking options are more accessible, will demand follow suit? There are measures that can be taken to ensure that it does. This section considers ways to address each of the demand-side barriers listed in Table 3: high cost; lack of credit; availability of low/no-cost alternatives; limited access; and lack of awareness.

Reduce the cost of acquiring appliances and purchasing fuels

Numerous studies have found that the lack of ability to pay for appliances and fuels is the one of the main barriers to adoption and sustained use of clean and transitional fuels and appliances [120–122]. The previous section examined the ways in which GoU could support fuel and appliance providers to lower import, production, and distribution costs. However, even after effective measures are in place, costs will be too high for most less well-off households, who constitute the majority of the country's population (Section 2). This can be addressed through a combination of enhanced credit facilities targeting households in mid-income strata and subsidies focused on the poorest households. This is the approach that NBSAP suggests for biogas, which has upfront costs that are considerably higher than most other clean cooking options [8]. The next section discusses consumer credit. Here the focus is on subsidies, which have been deployed in some biogas projects, including aid-driven efforts led by CARITAS.

EASP includes provisions for direct subsidies to consumers for "eligible" clean appliances ranging from 30% to 50% of the retail cost with caps in place to ensure that retail costs are not inflated (see Appendix C). Appliances eligibility is determined by technology-specific performance criteria

[50] [LPG uptake is from 29, and terminal siting is from 6]

to ensure that appliances qualify as clean or transitional [104]. However, EASP leaves up to Energy Service Companies (ESCOs) to identify eligible households and offers the same level of subsidy to all consumers nationwide, regardless of their income or wealth status.

It would be more economically efficient if subsidies could be targeted to less well-off households. This requires some investment in a subsidy targeting mechanism. India's PMUY, described in Section 2, represents an example of effective targeting to poor households, which could be emulated to ensure any subsidies mobilised for NICCS implementation are targeted efficiently. However, subsidies cannot and should not be expected to completely overcome the high costs of appliances and fuels. There is a role for credit, which is addressed below.

Increase access to credit

Achieving universal access to clean and transitional cooking options will require widely available credit facilities. One recent study of poor peri-urban households found that access to credit effectively doubled people's willingness-to-pay for a high-quality charcoal stove, making it much more likely that people would adopt the stove [84]. However, lack of access to financial services is an issue both for households and for small enterprises. 2024 census data indicates that less than half of Ugandan adults, just 43%, invested in any savings, through either formal or informal measures in the past year [28]. Of those that were able to save money, fewer than two thirds did so through formal financial institutions. The rest kept cash at home or used informal savings mechanisms. Similarly, the 2021 National service delivery survey reported that lack of financial services was the main obstacle that enterprises faced in their business activities [29]. This is corroborated by many of the private sector stakeholders interviewed for this assessment (see Section 5). The National Financial Inclusion Strategy has as its overarching objective, to achieve "universal access and usage of a broad range of quality and affordable formal financial products and services, delivered in a responsible and sustainable manner" [123].[51]

The retail cost of Class 1-3 appliances is a substantial fraction of household monthly income for the majority of Ugandan families. Very few households can afford to pay the entire price upfront. Even if the partial subsidies available through EASP are universally available, which they are not, many households will find the balance too expensive to pay in one lumpsum payment. In addition to the subsidies mentioned in the previous sub-section, EASP also includes provisions for loans to which are to be disbursed by UECCC to financial institutions, who pass the funds along to "sub-borrowers", which can include both energy service companies and end-users (Figure 13).

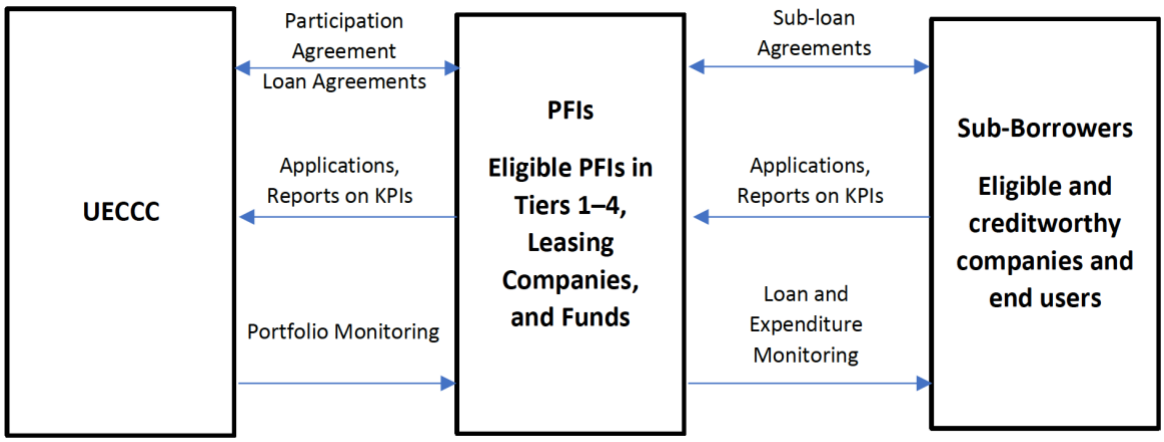
Thus, EASP has created mechanisms through which stove Enterprises and consumers can access credit. However, it does not provide specific details through which financial institutions, and energy service companies receiving loans from those institutions can or should provide loans to and users. There are many ways to approach this, providing stoves on layaway, as KOKO does in Kenya or designing simple instalment plans that spread the cost of the stove over a fixed time period. Payments can be made through mobile money, which reduces transaction costs

In addition, if loans can be provided at below-market interest rates for the poorest consumers, to ease the burden of regular payments. Of course, loans create risks for the loan provider, whether it is a financial institution or an energy service company. One way to reduce this risk is to target customers employed in the formal sector who receive monthly pay checks from their employer.

[51] The Strategy includes the number of loans disbursed for energy efficient appliances as a KPI, which is an encouraging development that should be tracked.

Lenders can arrange with employers to deduct the loan payments directly from the customers' pay checks, which takes the burden off of the customer to make payments themselves, and ensures that the lender receive regular payment. Similarly, financial institutions and energy service companies could make agreements with commercial banks or SACCOs to make regular withdrawals from customers' accounts.

Figure 13: Financial flows and supporting activities for EASP credit facilities [Fig. 1 from 124]



*Participating Financial Institutions

Address the availability of low-cost or no-cost alternatives

One challenge that has proven particularly difficult to overcome in other clean cooking interventions is the fact that fuelwood is very commonly available at no monetary cost to the user. Similarly, charcoal is perceived as a low-cost fuel, despite some analysis showing that clean options are more economical (see Appendix 0). The same applies to the stoves that people use. Over 60% of the Ugandan population uses open fires, which cost nothing to produce and maintain. An additional 20% use traditional biomass stoves, which cost very little (see Figure 3).

There's a little that can be done through policies and regulations to address freely available wood and no-cost open fires. For that, NICCS should rely on raising awareness of the numerous benefits of clean and transitional fuels and appliances among the large portion of the population that cooks with wood in open fires. We address this in the section immediately below. However, for those households, commercial enterprises, and public institutions using purchased wood or charcoal in low-cost traditional devices, then some regulatory measures could help incentivise them to transition. For example, charcoal is perceived as a low-cost fuel, because the price does not reflect the true cost. Charcoal causes many environmental externalities like forest degradation, air pollution, and climate change, none of which are included in the price. In addition, with formal forest products like sawn timber or pulp and paper, the cost of growing the next generation of trees is internalized in price. This is not the case with charcoal; producers typically make no investments in regeneration. Finally, while GoU officially levies VAT on charcoal, official taxes are collected. All of these combine to results in an artificially low price for charcoal. This could be addressed by regulating and formalizing some aspects of the charcoal supply chain. This would raise the cost for consumers and make alternatives more attractive. Combining this approach with some of the cost reduction options for clean fuels discussed above like PAYGO business models, smaller LPG cylinder sizes, or "smart" ethanol dispensers, would weaken the perception of charcoal as a low-cost fuel.

Raise awareness

Achieving NICCS target will be facilitated by an aggressive awareness raising campaign. Nearly all of the policy and strategy documents for specific clean cooking options that are being integrated into this strategy include specific steps to increase awareness of those specific options. For NICCS, the budgetary allocation and awareness raising efforts will be pooled into a single campaign, stressing the following points:

- Negative aspects of using polluting fuels including personal risks to the health of family members from harmful smoke emissions, drudgery and heavy burden of collecting wood, gender inequities linked to the disproportionate role that women play in obtaining fuelwood and cooking daily meals, environmental risks linked to forest degradation from unsustainable harvesting, and contributions to climate change from stove emissions and degradation.
- Positive aspects of clean and transitional fuels and appliances, which reduce or eliminate of the risks described immediately above. Here, GOU should present a fact-based and technology-agnostic message that doesn't favour one clean or transitional option over another. Individual stove enterprises can highlight the characteristics of specific clean cooking options in their marketing messages.
- The importance of buying only stoves that have been labelled as meeting NATIONAL standards and the role of the standards play in ensuring quality, safety, and durability.
- The positive trade-off between higher upfront cost (which should be reduced by subsidies and/or easily accessed credit mechanisms) and lower fuel expenditure. Using appropriate messaging, GoU can convey the idea of "payback times", which are quite short, or "return on investment", which is highly positive, when comparing a Class 1-3 woodfuel stove, ethanol, pellets, e-Cooking options and LPG to a much cheaper, but less efficient, polluting stove.
- The availability of both subsidies and credit mechanisms. After these mechanisms have been fully designed and are being rolled out, they should be widely publicized so that everyone is aware of them and has equal access to them. They must be explained appropriately so that people fully understand how the mechanisms work, who is eligible, and how they can be accessed.

These information campaigns should be rolled out in a multipronged manner, with messages tailored to specific audiences.

7. Implementation

Implementing NICCS entails several critical activities. Specifically, mobilising sufficient financial resources, monitoring, reporting and verifying progress toward NICCS objectives, ensuring a conducive regulatory environment, and clear delineation of roles. This section reviews each of these activities.

Financing the transition

Achieving the NICCS objectives requires very large investments in infrastructure, supply chains, and manufacturing facilities. A share of the funds should come from GoU to provide the necessary infrastructure and create an enabling environment. However, the majority of the funding will need

to come from the private sector. Indeed, the IEA projects that 80% of the investment in clean cooking globally needs to originate from private investors [125].

Several financing options are available to support the transition to clean cooking technologies, which play a crucial role in promoting the adoption of efficient and sustainable cooking solutions, especially in regions with limited access to modern cooking methods. Key options include:

Carbon Financing

Carbon finance has the potential to advance clean cooking solutions, as it provides a mechanism for supporting initiatives that reduce greenhouse gas emissions. This financing option aligns with climate goals, delivering incentives for emission reduction programs. In Uganda, carbon finance initiatives have supported projects like improved cookstoves and biogas systems. Carbon finance has enabled these projects to gain competitive advantages in the market and secure funding from international organizations and investors, supporting both emission reduction and sustainable development goals.

Uganda has fostered a favourable policy framework to encourage carbon financing, including Uganda Green Growth Development Strategy [126], which guides the country's shift toward a green economy, the National Climate Change Policy and National Climate Change (Climate Change Mechanisms) Regulations [127,128], which outline the processes through with Uganda will prioritise and finance mitigation activities, and the National Financial Inclusion Strategy [123], which aims to expand access to financial services across the population and includes provisions to develop carbon finance as income opportunities for marginalised groups.

Uganda's most recent Nationally Determined Contribution (NDC), released in 2022, includes several actions related to clean cooking, both as adaptation and mitigation measures [129]. This NDC estimates that reductions of 8 Mton of CO_2e per year, which is over 20% of its total ambition, can achieved by transitions from polluting to clean or transitional cooking options. While the NDC does not break down specific costs for these options, it notes that the full implementation cost would be ~USD 28 billion USD, 85% which is based on "conditional" funding, meaning that 85% of activities require international support to implement.

Uganda can leverage international carbon finance mechanisms like the Green Climate Fund (GCF) and Climate Investment Funds (CIFs), both established under the UNFCCC. These funds are designed to support climate mitigation and adaptation projects, including clean cooking technologies, by providing financial support to developing countries combating climate change.

In addition, market-based approaches are a major channel through which carbon finance supports clean cooking interventions. These operate either through the generation of voluntary offsets, or in compliance-based markets. Article 6 of the Paris Agreement enables international cooperation for mitigation activities by creating a framework for countries to voluntarily collaborate in generating and trading emissions reductions (or removals). Uganda's recent Climate Change (Climate Change Mechanisms) Regulations outlines detailed rules for both activities under Article 6 as well as voluntary markets and specifically includes "Sustainable Cooking" as an acceptable project type.

It is worth mentioning that major concerns have been raised around the integrity of carbon emission reductions from clean and transitional cooking interventions [130,131]. Therefore, while carbon finance is a critical means to unlock external funds needed to achieve NICCS objectives, GoU should ensure that rigorous, internationally accepted methodologies are used to quantify the

emission reductions achieved by any activity implemented under NICCS. This will instil confidence in buyers and assure higher prices for the offsets that are generated.

RBF

RBF links financial support to the achievement of measurable outcomes. Rather than providing funding upfront, RBF facilities disburse payments after specific verifiable results are achieved. For example, a stove manufacturer or fuel distributor may receive partial subsidies for each unit sold and used correctly, which the enterprise passes on to end-users. RBF relies on independent verification to ensure that quality standards are met and that the technologies are being used in a way that meets the broader objectives of the intervention. The easiest outcome to verify is stove sales, but stoves sales do not necessarily lead to desired benefits, particularly if the stoves are not used regularly. Therefore, RBF facilities can focus on other outcomes, like sustained stove use, displacement of previously used fuels or appliances, or reductions in emissions. However, these other outcomes require more technically advanced methods to monitor and verify, which adds cost and complexity to the RBF facility (see the next section for details about NICCS approaches to MRV).

RBF facilities can also be designed with incentive structures that aim to achieve specific policy objectives. This is the case in Uganda, where EASP has designed its RBF mechanism to encourage stove enterprises to expand into underserved rural areas and Refugee/Host Community Districts.

The ABC programme also relies on RBF. Experiences gained through EASP and ABC will be helpful in designing future RBF mechanisms to support the broader NICCS objectives. We recommend that in MEMD commission studies of both programs to synthesize lessons learned and apply them to other RBF facilities as these programmes wind down.

Public–private partnerships (PPPs)

PPPs are contractual agreements that involve both private enterprises public sector or government agencies that are designed to deliver services more cost-effectively than either entity could deliver acting on its own. PPPs in the energy sector take many forms, and PPPs been effectively deployed to specifically target service provision for poor populations, which are often deemed too risky by the private sector [132]. PPPs have been used for investments in Uganda's power sector [133] and, more recently, to support the construction of Bukona Agro's ethanol refinery, in which GoU owns a 40% share [134].

Combining the government's financial resources and ability to navigate potentially complicated regulatory frameworks with the private sector's ability to innovate and market, PPPs reduce investment risk, mobilize capital, and increase efficiency. The government can also tap into development assistance to access technical assistance or other international expertise. Ideally, this type of collaborative framework can be replicated beyond the power sector and ethanol refining to other fuel and stove providers to encourage domestic production.

PAYGO

The upfront cost of Class 1-3 appliances and fuels like LPG, which are typically sold in bulk quantities, present a major barrier to widespread adoption, particularly for less well-off households facing severe liquidity constraints. A 6 kg LPG cylinder, the smallest size commonly sold by retail vendors, costs UGX 55,000, which is over 25% of the median household income in Uganda, making it very difficult for most households to afford to refill. In contrast, charcoal is often purchased in small tins for a few thousand UGX, which is sufficient to cook for 1-2 days. To make clean fuels more affordable, several companies have adopted a Pay-as-you-go (PAYGO) model. This approach

was originally developed to boost access to household solar electrification [135,136], and has been adapted by some enterprises promoting clean cooking options to overcome consumers' limited ability to pay for fuel.

PAYGO allows customers with limited resources to purchase fuel in smaller quantities than typical retail outlets permit. The business model varies with different enterprises, but each follows a similar approach. Customers typically pay small upfront cost to acquire the necessary equipment. For LPG, this includes a regulator, hose, stove, and LPG cylinder with a wireless smart meter attached. The customer purchases credit using mobile money, which makes a pre-determined amount of LPG available for them to cook. When that amount is used, the smart meter shuts off, and customers must pay to access more. Most PAYGO enterprises offer home delivery and use the smart meter to monitor the LPG remaining in the cylinder, which they refill as needed, thereby ensuring customers have uninterrupted access.

Smart meters, monitoring infrastructure, and home delivery make PAYGO LPG more expensive than conventional LPG cylinders, but enterprises recover these costs by adding a margin to the price of fuel. Hence, the cost per meal using PAYGO LPG is higher than conventional LPG, but it is more accessible for cash-constrained consumers who cannot afford to purchase full cylinders [137].

Several companies have started PAYGO LPG services in East Africa including Sun King, a household solar company based in Nairobi that acquired PayGo Energy in 2023 [138], KopaGas, which operates in Tanzania [139], and Envirofit's "SmartGas" system [140].

Variations of the PAYGO approach have been introduced by enterprises selling other types of clean fuels including pellets and ethanol. For example, EcoSafi provides their pellet-burning "Better Stove" to customers for free, provided they commit to buying pellets for a fixed period, allowing the enterprise to recover the cost of the stove, and earn a profit from pellet sales [141]. This reduces the upfront cost for customers and ensures they have access to the necessary equipment. Similarly, KOKO networks, described in Section 4, doesn't offer home delivery but allows consumers to purchase flexible quantities of ethanol with mobile money from conveniently located smart dispensers.

PAYGO for e-Cooking is also gaining traction in Uganda. For example, Powerup is marketing EPCs with PAYGO capabilities including a user-interface that indicates cooking costs, integrates with popular mobile-money apps, and tracks data in compliance with Gold Standard's metered carbon offset methodology [142]. Similarly, Burn Manufacturing is marketing induction stoves with PAYGO capabilities aligned with Gold Standard's metered carbon offset methodology. The stove includes sensors that monitor electricity consumption in real-time and affordable payment plans for low-income households [143].

The PAYGO business model has several advantages to conventional fuel provision. Specifically for LPG, PAYGO eliminates the risk of illegal cylinder refilling, which is common in East African markets [144,145]. This increases safety and builds consumer confidence. The PAYGO approach also generates a wealth of data about consumption and use patterns, which helps enterprises understand their customer base as assists government regulators and researchers who need reliable data to understand trends and analyse impacts of household energy consumption. The data generated by PAYGO activities also facilitates access to carbon finance. Offsets that are supported by "robust quantification" [146], which is enabled by PAYGO approaches, are favoured by ratings agencies and commend higher prices from buyers.

However, establishing a PAYGO enterprise is more capital intensive than conventional business models. In contrast to conventional delivery models in which consumers can purchase fuel from a range of retail outlets, PAYGO enterprises working with LPG, pellets, or ethanol must procure large volumes of fuel in advance. They must also invest in storage infrastructure or make arrangements with other fuel suppliers to do so. The PAYGO model is also riskier than other approaches. In addition to having to raise more capital than conventional fuel delivery models, PAYGO services rely on low-income households consistently purchasing fuel to recoup their investment. Poor households often experience income shocks or unexpected expenses that force them to alter their consumption patterns. To cope with these shocks, consumers may revert to using traditional fuels, leaving the enterprises unable to recover their costs. Enterprises may respond by repossessing stoves and reconditioning them for sale to other customers or stripping them down for spare parts, both of which incur additional costs. To overcome these risks, GoU can support PAYGO efforts by introducing risk mitigation measures, including loan guarantees or revolving funds that enterprises can tap into if they face large numbers of defaulters.

Monitoring, Reporting and Verification

MRV is an essential element of any transformative development strategy. Implementing NICCS will require an enormous investment of public funds, private capital, and investments by end-users into new fuels and appliances. In order to ensure that these investments result in the desired outcomes, NICCS must include a robust system to collect, analyse, and catalogue information and track progress. This data will be used to understand the cost-effectiveness of interventions and inform decision makers about the need for course corrections as time passes, and interim goals are met (or missed). This section reviews the types of data that are needed, define a set of key performance indicators (KPIs) that the data will feed into, and discuss the complementary approaches for tracking progress toward meeting NICCS objectives.

Data needs

The need for up-to-date, accurate data cannot be overstated. High quality data helps us understand past trends and current usage patterns. Data will also be essential to monitoring progress toward any targets that are adopted as a result of the NICCS process. Data must be nationally representative to ensure all regions, sectors, and populations are included. In developing this strategy, the NICCS team relied heavily on nationally representative household surveys from UBOS, MEMD, and the DHS programme. Strengths and weaknesses of each dataset are described in Table 11 below.

Table 11: Datasets with information about cooking fuels and appliances in Uganda

Source	Title of dataset	Year	Comment
UBOS	The National Service Delivery Survey	2021, 2015, 2008, 2004	**Strengths:** Nationally representative and collected very 6-7 years. Most recent survey included data about stove and fuel choice. Cover institutions as well as households. Questionnaires include questions about multiple stove and fuel use, so could be used to assess “stacking” behaviour. **Weaknesses**: Data not publicly available.

UBOS	Uganda National Household Survey	2019/2020, 2016, 2012/2013, 2009/2010, 2005/2006, 2002/2003	**Strengths:** Nationally representative and relatively frequent (every 2-3 years). Most recent survey included data about stove and fuel choice. Questionnaires include questions about multiple stove and fuel use, so could be used to assess "stacking" behaviour. Also collect information about household income so can link fuel choice to wealth and other socioeconomic factors. **Weaknesses**: Data not publicly available. Does not cover institutions.
UBOS	National Population and Housing Census	2024, 2014, 2002…	**Strengths:** Nationally representative and relatively frequent (every 2-3 years). Most recent survey included data about stove and fuel choice. Questionnaires include questions about multiple stove and fuel use, so could be used to assess "stacking" behaviour. Also collect information about household income so can link fuel choice to wealth and other socioeconomic factors. **Weaknesses**: Data not publicly available. Does not cover institutions.
UBOS and ICF	DHS and DHS/MIS Surveys	2024, 2018, 2016, 2014, 2011, 2009, 2006, 2001	**Strengths:** Nationally representative and relatively frequent (every 3-5 years); cleaned datasets are freely available (with registration). Include questions about primary fuel choice and primary device (since 2020). Surveys include questions about household wealth and other sociodemographic data that are helpful for understanding underlying drivers of stove and fuel adoption. **Weaknesses**: Only include household data. No information about commercial or institutional use. Surveys only cover primary fuel and stove choice; they include no information about secondary fuels or appliances and no information about expenditure on fuel or quantities consumed.

Key Performance Indicators

Developing a full MRV system for quantifying CO_2e reductions from the various initiatives will require substantive effort and technical capacity. While these capacities and systems are developed, tracking KPIs for interim progress is required under the Paris Agreement. These KPIs provide immediate insights into adoption, accessibility, and usage trends for various clean cooking technologies, allowing stakeholders to evaluate the effectiveness of interventions, identify implementation gaps, and refine strategies as needed.

Monitoring KPIs supports informed decision-making and resource allocation. For instance, if adoption rates for a particular technology fall short, adjustments can be made to outreach, financing, or distribution strategies, maximizing impact even before CO_2e reductions are fully quantified. Additionally, KPI tracking builds foundational datasets necessary for the MRV framework, establishing baselines on fuel use, stove adoption, and energy access that will support accurate CO2e calculations. Table 12 outlines KPIs that may be associated with the different initiatives and potential data sources. Priority recommendations are shaded.

Table 12: KPIs to support MRV of emissions, and emission reductions from implementing NICCS

Key Performance Indicator	Primary Data Sources	Recommended Additional Data Collection Activities	Monitoring Frequency
Households Using Clean Fuels	- National Household Surveys (e.g., DHS, Uganda National Household Survey)	- Periodic energy sector surveys to capture both primary and secondary household-level clean fuel use	Annual or Biennial
	- Sales data from fuel suppliers (e.g., LPG, ethanol distributors)	- User surveys focusing on fuel stacking behaviours	
	- PAYGO platforms	- Quantities and patterns of usage	
Access to Electricity for Cooking	- Grid connection data from UETCL and distribution companies	- Surveys targeting households with newly established connections	Annual
	- Off-grid solar providers' reports	- Smart meter data to track actual usage for cooking	
Adoption of Improved Biomass Stoves	- Household surveys	- Periodic energy sector surveys targeting rural and peri-urban regions	Annual or Biennial
	- Sales records from stove manufacturers and retailers	- Sensor-based field testing	
Production and Use of Pellets/Briquettes	- Sales and distribution data from fuel suppliers	- Periodic energy sector surveys targeting adoption rates	Annual
	- Household surveys from program implementers	- Surveys on production capacity and inventory of pellet/briquette suppliers	
Biogas Adoption	- Reports from program implementers	- Periodic energy sector surveys to estimate coverage and access	Annual
	- Household surveys from program implementers	- Surveys on biodigester functionality and gas production	
Ethanol Stove Adoption	- Distribution and sales data	- Periodic energy sector surveys to estimate coverage and access	Annual
	- Household surveys from program implementers	- Surveys on fuel production and distribution capacity	

To support MRV of NICCS, two complementary approaches are proposed for tracking progress across key performance indicators KPIs. The first is the development of a dedicated, purpose-built Energy Sector Survey conducted every two years to generate detailed, high-quality data specifically aligned with NICCS targets. The second involves leveraging Uganda's existing national survey platforms, such as the DHS, UBOS Census, and MEMD data collection efforts, by integrating targeted clean cooking modules and supplementing them with focused follow-up studies where needed. Each approach addresses current data limitations in different ways and offers distinct strengths for building a credible and actionable MRV system.

Approach 1: Dedicated Energy Sector Survey

One proposed approach for supporting MRV under NICCS is the development and implementation of a stand-alone, purpose-built national Energy Sector Survey administered every 2-4 years. This independent survey would be explicitly designed to capture the full range of clean cooking indicators, including the use of clean fuels and appliances, as well as the frequency and type of stove use. Its core purpose would be to ensure that all key KPIs linked to NICCS, such as electricity use for cooking, pellet and briquette uptake, biogas adoption, and ethanol stove use, are tracked consistently and in detail across Uganda's cooking landscapes.

The rationale for this approach stems from limitations in existing national surveys. While platforms such as the DHS, the UNHS, and MEMD statistical reports provide foundational data on energy access and fuel use, they are not designed to explicitly monitor clean cooking transitions. These surveys generally track primary cooking, with limited data on stove/fuel stacking, cooking technology characteristics, stove use frequency, or the sustained adoption of clean technologies over time. Moreover, they rarely include information on emerging fuels such as pellets and ethanol.

A dedicated energy sector survey would address these limitations directly. It could be administered by an independent team under the oversight of MEMD or UBOS, ideally in collaboration with technical partners with experience in energy monitoring and household survey design. The sample would be nationally representative and stratified by region, urban versus rural status, wealth quintile, and key sub-populations such as refugee households and commercial cooking enterprises. Data would be collected using digital tools, and surveyors would be trained to capture detailed fuel and appliance information, including both primary and secondary cooking methods, the age and brand of stoves, and the quantity and cost of fuel consumed.

The survey would be designed to track changes over time and allow for the measurement of sustained adoption and behaviour change, rather than one-time uptake. Additionally, institutional and commercial cooking could be assessed through tailored modules focused on schools, hospitals, businesses, and other non-household entities.

The advantages of this approach are significant. It provides a consistent, comprehensive, and technically robust dataset that directly aligns with NICCS implementation targets. It enables detailed disaggregation of results across population groups and fuels, and it allows Uganda to measure not just access to clean cooking, but usage patterns and impacts—metrics essential for carbon finance, development effectiveness, and policy refinement.

However, this approach also has challenges. Developing and implementing a dedicated survey requires sustained financial resources, strong coordination among stakeholders, and institutional capacity to design, manage, and analyse the results. Further, it would need to be institutionalized

as a regular data collection effort with long-term support from government and development partners.

Approach 2: Enhanced Integration into Existing National Surveys
Rather than creating a new stand-alone survey, Uganda could strengthen NICCS MRV by enhancing its existing national surveys, particularly the DHS, UNHS, UBOS census efforts, and MEMD statistical reports, through the addition of targeted clean cooking modules. These surveys already offer a foundation for tracking household energy use but currently lack the level of detail needed to monitor progress across NICCS indicators.

Major gaps include limited data on fuel stacking (secondary fuel use), stove types and performance levels, usage frequency, and sustained adoption. Similarly, MEMD's institutional data is often inconsistent and lacks standardisation across fuel types and appliance categories.

To address these gaps, clean cooking modules should be added to existing household and institutional surveys. These modules would capture stove type, fuel costs, stacking behavior, and usage frequency. Institutional surveys would collect standard metrics on appliance type, fuel purchases, and cooking volume.

In addition, if there is a gap of two or more years between major national surveys, targeted fuel-specific modules can be deployed as streamlined, rapid-assessment tools. These modules would act as mini-surveys (adapted from the more comprehensive Energy Sector Survey proposed in Option 1) and could focus on the KPI's most critical to the NICCS. They could also be deployed strategically to monitor uptake and use for high-priority fuels or in rapidly changing markets.

Table 13: Proposed enhancements to existing national surveys and reporting systems to support NICCS MRV, including targeted modules to fill data gaps when regular surveys are delayed or insufficient

Survey Platform	Current Limitations	Proposed Enhancements
UBOS Census / UNHS	Tracks only primary fuel; lacks stove details, usage frequency, fuel costs, or stacking behaviour	Add modules on secondary fuels, stove type/brand, use frequency, and fuel expenses.
DHS / MIS	Limited data on stove stacking and no data on commercial cooking.	Add modules on secondary fuels, stove type/brand, use frequency, and fuel expenses.
MEMD Statistical Reports	Inconsistent data across years; no appliance-level detail; poor visibility on institutional stove use	Standardize institutional reporting: stove type, year acquired, cooking frequency, fuel consumption, and fuel expenditures
Ad-hoc, targeted surveys	Currently absent	Targeted surveys for key NICCS KPIs to be deployed when >4-year gaps in national surveys

Long-Term MRV Framework

While the KPIs are tracked, a more robust MRV system for estimating CO_2e reductions is planned. This system will need to include detailed fuel consumption inventories that, combined with emission factors and the fraction of non-renewable biomass (fNRB) values, can accurately track progress towards climate goals. A detailed MRV system plan, expected to be completed after the launch of NICCS, will establish specific timelines, workplans and capacity investments to support

the implementation of the MRV system. The key components of this system are presented below as a preliminary MRV framework.

1. Fuel Consumption

Tracking fuel consumption over time will form the foundation of the MRV system. GoU will need to establish fuel consumption inventories at national, regional, and household levels through regular surveys, direct measurements, and real-time monitoring tools (e.g., kitchen performance testing, SUMs, PAYGO data). Data collection should focus on both baseline fuel consumption before intervention and changes over time after clean cooking options are introduced. Data should be disaggregated by fuel type (e.g., wood, charcoal, LPG, biogas, electricity, ethanol) and stove type to understand shifts in usage patterns.

2. Emission Factors

Fuel consumption estimates will then be combined with emission factors to generate emission estimates. The MRV system should integrate standard emission factors for each fuel type, sourced from the IPCC Guidelines for National Greenhouse Gas Inventories, adjusted for Uganda-specific conditions where applicable. Values generated from high-quality field studies or existing peer-reviewed literature can be used for fuels or technologies that are not currently covered in the IPCC guidelines.

3. Fraction of Non-Renewable Biomass (fNRB)

The fraction of non-renewable biomass (fNRB) reflects the proportion of biomass use that contributes to net CO_2 emissions. This parameter is unique to cookstove carbon methodologies and is a strong influence on the estimation of CO_2e. The MRV system will include baseline fNRB values for different regions, based on studies of biomass availability, regeneration rates, and harvesting patterns. The peer-reviewed spatial-temporal MoFUSS model can be customized to generate these values. The model can be used to monitor changes in fNRB over time to capture impacts of improved biomass stove adoption and fuel-switching programs.

4. CO_2e Estimation Methodology

The MRV system should include rigorous and comprehensive approaches to estimating emission reductions generated by the implementation of NICCS. Existing pragmatic, high-integrity methodologies for assessing emission reductions from both transitional and clean cooking interventions can be adapted to the Ugandan context. The MRV system should include upstream emissions for fuels that require processing, storage, and transport, as well as emissions from the electrical grid for transitions to electric cooking technologies.

5. Digital Tools

Current best practice for cookstove MRV systems calls for the integration of digital tools, such as mobile apps, sensors, and smart meters, which streamline data collection. The application of digital tools reduces manual reporting errors, improves real-time data access for stakeholders, and protects against risks of over-crediting and fraud. Incorporating high-frequency automated data reporting from PAYGO platforms and stove use monitors can provide accurate tracking of fuel consumption and stove use patterns.

6. MRV Capacity Building

A functional MRV system requires integrated expertise from multiple domains. Training programs for government agencies, NGOs, and private sector partners will ensure effective implementation of the enhanced MRV system. A consistent focus on building local expertise in emissions

accounting, data collection, and analysis will help sustain the MRV system beyond initial project funding.

7. MRV system integration and coordination

To the extent possible, the data collection and calculations should be harmonized in a central platform that automates the calculations and provides quality assurance and quality control checks. The accuracy and effectiveness of the MRV system will also depend on regular data sharing among GoU ministries and agencies.

Roles and responsibilities

Table 14: Roles and responsibilities of GoU ministries and agencies

Entity	Activities related to the cooking sector
Office of the President	▪ Hosts inter-ministerial committee on clean cooking ▪ Advocates for policy, planning, and resource allocation for clean cooking within the relevant ministries. ▪ Coordinates government agency activities related to clean cooking. ▪ Convene the committee with increased frequency.
Office of the Prime Minister	▪ Develops and implements programs to support clean cooking in refugee settlements and host communities.
Ministry of Energy and Mineral Development	▪ Develops and enacts strategies to achieve universal access to Class 1-3 cooking. ▪ Implements the LPG promotion project. ▪ Supports renewable energy for cooking, including promoting biomass, biogas and biofuels and appliances. ▪ Tracks progress towards clean and transitional cooking targets. ▪ Publishes data on renewable energy. ▪ Build repair and maintenance capacity for Class 1-3 stoves. ▪ Design and implement a coordinated national awareness-raising campaign that promotes a basket of Class 1-3 cooking options and targets relevant messaging to specific population groups.
Ministry of Water and Environment	▪ Develops and implements climate policy. ▪ Serves as designated national authority for Paris Agreement. ▪ Provide operational framework for carbon finance to support the scale-up of Class 1-3 cooking.
Ministry of Finance, Planning, and Economic Development	▪ Coordinates the five-year national government's planning cycle. ▪ Include realistic clean cooking targets and pathways in *National Development Plan IV*.
Ministry of Gender, Labour, and Social Development	▪ Empower women entrepreneurs to develop and disseminate innovative Class 1-3 cooking appliances and fuels.
Ministry of Health	▪ Participate in awareness, raising campaigns over the health impact of cooking with polluting fuels.

	▪ Train community health practitioners to track illnesses associated with exposure to smoke from household cooking.
Uganda Bureau of Statistics	▪ Conducts the census and other nationally representative surveys, such as the *National Service Delivery Survey* ▪ Implement, or support the implantation of future, sector-specific surveys for MRV of NICCS objectives
Uganda National Bureau of Standards	▪ Develops and enforces national product standards. ▪ Create standards for induction appliances, EPCs, ethanol stoves and LPG infrastructure. ▪ Improve consistent enforcement of existing standards.
Uganda Revenue Authority	▪ Develop and implement tax and tax relief policies for cooking fuels and appliances, including VAT, excise taxes, and import duties. ▪ Audit all cooking-related taxes to ensure they are consistent and support the scale-up of Tier3+ cooking fuels and appliances.
UMEME	▪ Operates an electricity distribution concession from the Government of Uganda through 2025. ▪ Promotes e-cooking by providing customers access to appliances and building awareness of the cooking tariff.
Uganda Energy Credit Capitalisation Company (UECCC)	▪ Develop and administer innovative financing initiatives for financial institutions and stove/fuel enterprises ▪ Ensure that all stakeholders have access to sufficient technical assistance to develop business plans and access financial resources

8. NICCS trajectory and climate-forcing emissions

Climate-forcing emissions from cooking fuels consist of well-mixed GHGs like CO_2, CH_4, and N_2O that persist in the atmosphere for many years, as well as short-lived climate pollutants (SLCPs) like black and organic carbon (BC and OC) aerosols that only stay in the atmosphere for a couple of weeks but have a large impact on climate.

Climate-forcing emissions from cooking occur as a result of two distinct processes: 1) land cover change caused by unsustainable wood harvesting, and 2) combustion emissions of non-CO_2 gases, as well as CO_2 from LPG, thermal electricity production, and other non-renewable energy sources. Some renewable fuels result in emissions from upstream processes: for example, sugarcane production for ethanol often involves mineral fertilizers and field burning; biogas could result in methane leaks; and pellet manufacturing requires electricity that creates emissions. These emissions are much lower than emissions from woodfuels burned in polluting devices; nevertheless, they are accounted for in this assessment. See Appendix D for the emission factors used in this assessment.

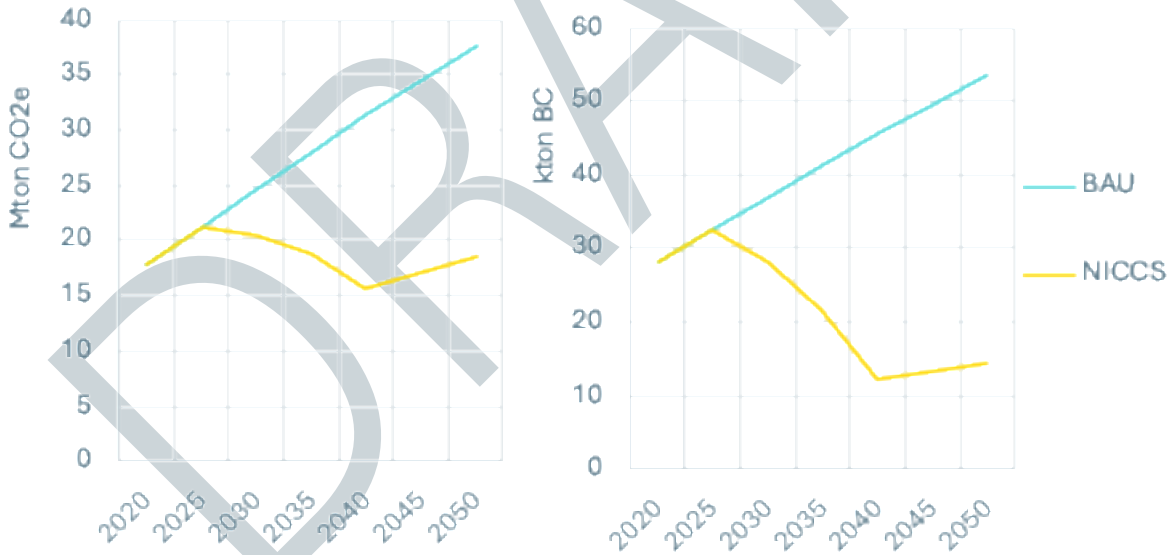
The land cover component is based on a recent global assessment of woodfuel renewability commissioned by the UNFCCC [147]. That assessment estimates that 39% ± 3% of Uganda's woodfuel harvesting between 2020 and 2030 is unsustainable. This means that out of the total

projected, woodfuel harvest, 39% will not regenerate. Thus, when the harvested wood is burned, 61% of the CO_2 released will be absorbed by future tree growth, and the rest will remain in the atmosphere, contributing to climate forcing [148].

If Uganda can shift to the NICCS pathway outlined in previous sections, then by 2030 nearly 40% of the population, 5.9 million households, will be using Class 1-3 fuels and appliances for their primary cooking needs. This represents an increase of 3.4 million households over the projected number using Class 1-3 options under a BAU pathway. By 2040, the NICCS pathway will result in universal primary use of Class 1-3 options. As Section 4 discussed, this will result in a 20% reduction in woodfuel consumption by 2030, saving an estimated 6.4 Mton of wood. By 2040, savings increase to 64% reduction relative to BAU, or roughly 26 Mton.

Burning less wood in three-stone fires and traditional charcoal stoves will result in substantial emission reductions relative to the BAU pathway. To quantify the emission reductions, this assessment uses a life-cycle approach that accounts for the emissions from fuel production, transportation and end-use for every fuel (details are provided in Appendix D). Figure 14 shows the trajectory of well-mixed GHGs and BC emissions for BAU and NICCS pathways. In the NICCS scenario, emissions decline rapidly between 2025 and 2040 as people transition from polluting woodfuels to Class 1-3 options. Emissions increase after 2040, because in this scenario the distribution of the population using Class 1-3 stoves remains constant, but the population continues to grow (as shown on the right side of Figure 11).

Figure 14: Emissions of well-mixed GHGs (left) and BC (right) for BAU and NICCS



Following the NICCS pathway results in a 50% reduction in emissions of well-mixed GHGs and 73% reduction in BC emissions in 2040. The relative change in BC emissions is larger than well-mixed GHGs because Class 1 options like LPG and electricity, which have the largest role in the NICCS transition, emit little or no BC , but do emit CO_2 (emission factors are listed in Appendix D).

Figure 15: Fuel-specific emissions of well-mixed GHGs (left) and BC (right) for BAU and NICCS in 2040

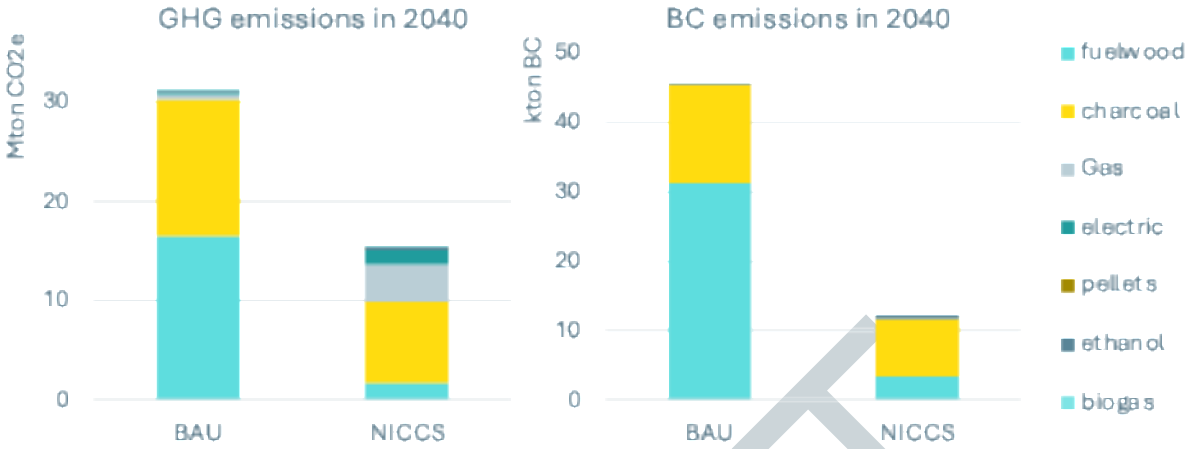


Figure 15 shows fuel-specific emissions of well-mixed GHGs (left) and BC (right) in 2040. In the BAU scenario, emissions are dominated by fuelwood and charcoal. In the NICCS scenario, woodfuels still produce the majority of emissions, but clean fuels also result in some CO_2 emissions.

9. References cited

[1] British High Commission Kampala 2024 Electric Cooking to transform the cooking landscape in Uganda *Energy and climate change: evidence and analysis*

[2] Ministry of Energy and Mineral Development 2015 *The Biomass Energy Strategy (BEST) Uganda* (Kampala, Uganda: MEMD and UNDP)

[3] National Planning Authority 2020 *THIRD NATIONAL DEVELOPMENT PLAN (NDPIII) 2020/21 – 2024/25* (Kampala, Uganda)

[4] National Planning Authority 2024 *FOURTH NATIONAL DEVELOPMENT PLAN (NDP IV) 2025/26 - 2029/30* (Kampala, Uganda)

[5] Ministry of Energy and Mineral Development 2023 *Energy Policy for Uganda 2023*

[6] Ministry of Energy and Mineral Development 2021 *LPG Promotion, Supply and Infrastructure Intervention Project Proposal* (Kampala, Uganda: Sustainable Energy Development - Petroleum Supply Department)

[7] Ministry of Energy and Mineral Development 2023 *The National eCooking Strategy* (Kampala, Uganda: MEMD and CIRCODU)

[8] Ministry of Energy and Mineral Development 2023 *NATIONAL BIOGAS STRATEGY AND ACTION PLAN 2023-2033*

[9] Ministry of Energy and Mineral Development 2024 *SUSTAINABLE BIOFUELS INFRASTRUCTURE DEVELOPMENT PROJECT* (Kampala, Uganda: Ministry of Energy and Mineral Development and National Planning Authority)

[10] Smith K R and Sagar A 2014 Making the clean available: Escaping India's Chulha Trap *Energy Policy* **75** 410–4

[11] World Health Organization 2022 Defining clean fuels and technologies

[12] Perera F 2018 Pollution from Fossil-Fuel Combustion is the Leading Environmental Threat to Global Pediatric Health and Equity: Solutions Exist *International Journal of Environmental Research and Public Health* **15** 16

[13] Lelieveld J, Klingmüller K, Pozzer A, Burnett R T, Haines A and Ramanathan V 2019 Effects of fossil fuel and total anthropogenic emission removal on public health and climate *Proceedings of the National Academy of Sciences* **116** 7192–7

[14] Shankar A V, Quinn A K, Dickinson K L, Williams K N, Masera O, Charron D, Jack D, Hyman J, Pillarisetti A, Bailis R, Kumar P, Ruiz-Mercado I and Rosenthal J P 2020 Everybody stacks: Lessons from household energy case studies to inform design principles for clean energy transitions *Energy Policy* **141** 111468

[15] Uganda National Bureau of Standards 2019 *Household biomass stoves — Requirements* vol US 761: 2019

[16] International Standards Organization 2018 *ISO/TR 19867-3:2018 Clean cookstoves and clean cooking solutions — Harmonized laboratory test protocols — Part 3: Voluntary performance targets for cookstoves based on laboratory testing* (International Standards Organization)

[17] World Bank 2023 *PROJECT APPRAISAL DOCUMENT ON A PROPOSED GRANT IN THE AMOUNT OF SDR 38.1 MILLION (US$50 MILLION EQUIVALENT) TO THE COMMON MARKET FOR EASTERN AND SOUTHERN AFRICA* (Washington DC: World Bank)

[18] NEFCO 2024 Modern and clean cooking in Africa *NEFCO/Financing*

[19] World Health Organization 2021 *Setting national voluntary performance targets for cookstoves* (Geneva: World Health Organization)

[20] World Health Organization 2021 *WHO global air quality guidelines: particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide* (Geneva: World Health Organization)

[21] Clean Cooking Alliance 2018 *ISO Cookstove Standards: FAQ and Stakeholder Guidance* (Washington DC: Clean Cooking Alliance)

[22] Kearney N 2017 Standards and Labelling Best Practice: Application in cookstoves certification programmes

[23] Hewlett O 2024 The Future of Clean Cooking in the Carbon Market *Gold Standard*

[24] Little M, Richter A, Eales A and Müller-Karpe Z 2023 *A review of the standards, methodologies, technical needs and available resources related to digital monitoring, reporting and verification for modern cooking devices in the context of carbon finance* (Loughborough, UK: MECS)

[25] Kenya Bureau of Standards 2019 *Biomass stoves — Performance requirements* vol KS 1814:2019

[26] Ethiopian Standards Agency 2019 *Clean Cook Stove and Clean Cooking Solution Performance Requirements and Test Methods* vol ES 6085: 2019

[27] Rwanda Standards Board *Solid biomass cookstoves — Specifications* vol DRS 290: 2016

[28] Uganda Bureau of Statistics (UBOS) 2024 *National Population and Housing Census 2024 – Final Report – Volume I (Main)* (Kampala, Uganda: Uganda Bureau of Statistics)

[29] Uganda Bureau of Statistics (UBOS) 2022 *The National Service Delivery Survey 2021* (Kampala, Uganda: Uganda Bureau of Statistics (UBOS), Ministry of Public Service (MoPS))

[30] World Bank 2024 Urban population (% of total population) *The World Bank - Data*

[31] Uganda Bureau of Statistics (UBOS) 2024 Explorer Publications by Sector *Explorer Publications by Sector*

[32] ICF 2024 The DHS Program STATcompiler

[33] Uganda Bureau of Statistics (UBOS) 2021 *Uganda National Household Survey (2019/20 UNHS)* (Kampala, Uganda: Uganda Bureau of Statistics (UBOS))

[34] Lewis J J and Pattanayak S K 2012 Who Adopts Improved Fuels and Cookstoves? A Systematic Review *Environmental Health Perspectives* **120** 637–45

[35] Kar A and Zerriffi H 2018 From cookstove acquisition to cooking transition: Framing the behavioural aspects of cookstove interventions *Energy Research & Social Science* **42** 23–33

[36] ICF 2024 The DHS Program *The DHS Program*

[37] ICF 2023 The DHS Program STATcompiler

[38] Uganda Bureau of Statistics (UBOS) 2024 Projected Households up to 2040

[39] Uganda National Malaria Control Division (NMCD), Uganda Bureau of Statistics (UBOS), and ICF 2020 *Malaria Indicator Survey 2018-19* (Kampala, Uganda: UBOS and ICF)

[40] US Department of Energy 2024 Low-Income Energy Affordability Data (LEAD) Tool and Community Energy Solutions *Office of State and Community Energy Programs*

[41] Open Capital 2024 Market assessment: Clean cooking in Uganda

[42] CREEC 2020 *Cooking with Electricity in Uganda: Barriers and Opportunities* (Kampala, Uganda: ESMAP and Loughborough University)

[43] MECS 2022 *Uganda eCooking Market Assessment* (Kampala, Uganda: MECs and EnDev)

[44] UNHCR 2024 Uganda *UNHCR Global Focus*

[45] Ministry of Energy and Mineral Development 2021 *NATIONAL FIREWOOD AND AGRO RESIDUE SURVEY FOR UGANDA 2020* (Kampala, Uganda: Ministry of Energy and Mineral Development)

[46] Uganda Bureau of Statistics (UBOS) 2024 *2023 Statistical Abstract* (Kampala, Uganda: Uganda Bureau of Statistics)

[47] Ministry of Energy and Mineral Development 2024 Resource Centre – Ministry of Energy and Mineral Development *Ministry of Energy and Mineral Development*

[48] CIRCODU 2023 *CLEAN COOKING ENERGY NEEDS ASSESSMENT IN PUBLIC AND PRIVATE INSTITUTIONS IN UGANDA: FINAL REPORT* (Kampala, Uganda: Ministry of Energy and Mineral Development)

[49] Chidawali H 2023 Tanzania sets January 2025 as deadline for using charcoal, firewood *The Citizen*

[50] MINISTRY OF ENERGY 2024 *National Clean Cooking Strategy 2024 - 2034* (Dodoma: The United Republic of Tanzania Ministry of Energy)

[51] Ministry of Energy and Mineral Development 2022 *2022 STATISTICAL ABSTRACT* (Kampala, Uganda: Ministry of Energy and Mineral Development)

[52] Wallmo K and Jacobson S K 1998 A social and environmental evaluation of fuel-efficient cook-stoves and conservation in Uganda *Environmental Conservation* **25** 99–108

[53] Clean Cooking Alliance 2021 Clean Cooking Catalog *Clean Cooking Catalog*

[54] MECS 2019 Our mission: Accelerating access to clean, electric cooking *Modern Energy Cooking Services*

[55] Kashyap S R, Pramanik S and Ravikrishna R V 2023 A review of solar, electric and hybrid cookstoves *Renewable and Sustainable Energy Reviews* **188** 113787

[56] Odoi-Yorke F 2024 A systematic review and bibliometric analysis of electric cooking: evolution, emerging trends, and future research directions for sustainable development *Sustainable Energy Research* **11** 24

[57] WLGA 2024 What is Liquid Gas? *About Liquid Gas*

[58] World Health Organization 2024 Household air pollution data *Air pollution data portal*

[59] Ministry of Petroleum and Natural Gas 2024 PMUY : Home *About PMUY*

[60] IRENA 2017 *Biogas for domestic cooking* (Abu Dhabi: IRENA)

[61] Clemens H, Bailis R, Nyambane A and Ndung'u V 2018 Africa Biogas Partnership Program: A review of clean cooking implementation through market development in East Africa *Energy for Sustainable Development*

[62] Kramer D 2022 Whatever happened to cellulosic ethanol? *Physics Today* **75** 22–4

[63] Utria B E 2004 Ethanol and gelfuel: clean renewable cooking fuels for poverty alleviation in Africa *Energy for Sustainable Development* **8** 107–14

[64] Puzzolo E, Zerriffi H, Carter E, Clemens H, Stokes H, Jagger P, Rosenthal J and Petach H 2019 Supply Considerations for Scaling Up Clean Cooking Fuels for Household Energy in Low- and Middle-Income Countries *GeoHealth* **3** 370–90

[65] Dalberg 2018 *Scaling up clean cooking in urban Kenya with LPG & Bio-ethanol: A market and policy analysis* (Nairobi, Kenya: Dalberg)

[66] Gill-Wiehl A, Ray I and Kammen D 2021 Is clean cooking affordable? A review *Renewable and Sustainable Energy Reviews* **151** 111537

[67] Gill-Wiehl A, Price T and Kammen D M 2021 What's in a stove? A review of the user preferences in improved stove designs *Energy Research & Social Science* **81** 102281

[68] Jürisoo M, Lambe F and Osborne M 2018 Beyond buying: The application of service design methodology to understand adoption of clean cookstoves in Kenya and Zambia *Energy Research & Social Science* **39** 164–76

[69] Ministry of Energy and Petroleum 2024 *Kenya National Cooking Transition Strategy (KNCTS)* (Nairobi: Ministry of Energy and Petroleum)

[70] The New Vision 2016 gov-pushes-clean-cooking-technologies *New Vision*

[71] Ogwok J, Naluwagga A, Abbo M S and Tesfamichael M 2022 *Uganda's cooking energy sector: a review* (Kampala, Uganda: CREEC and Loughborough University)

[72] International Growth Centre 2021 *Why are lending rates high in Uganda?* (London: London School of Economics and Political Science)

[73] Stantec, GiZ, and TYPSA 2021 *The European Union Global Technical Assistance Facility on Sustainable Energy* (Brussels: European Union)

[74] Busuulwa B 2024 Bank of Uganda cuts key lending rate again *The EastAfrican*

[75] Okafor C 2023 Top 10 African countries with the highest cost of electricity in 2023 *Business Insider Africa*

[76] Xe.com 2024 Ugandan Shilling to US Dollar Exchange Rate Chart *Xe Historical Currency Exchange Rates Chart*

[77] Uganda Bureau of Statistics (UBOS) 2024 Consumer Price Index (CPI) Excel tables

[78] MINISTRY OF ENERGY 2019 *Kenya Cooking Sector Study: Assessment of the Supply and Demand of Cooking Solutions at the Household Level* (Nairobi, Kenya: Kenya Ministry of Energy and Clean Cooking Association of Kenya)

[79] European Commission 2024 My Trade Assistant *Access2Markets*

[80] Uganda Printing and Publishing Corporation (UPPC)min 2025 Planned Tax Bills to Boost Economic Performance in 2025/2026 *The Gov Info Hub*

[81] Team from EcoSafi 2024 Key Informant Interview

[82] Ministry of Energy and Mineral Development 2007 *THE RENEWABLE ENERGY POLICY FOR UGANDA*

[83] International Energy Agency (IEA) 2023 *Uganda Energy Transition Plan* (Paris: International Energy Agency (IEA) and Ministry of Energy and Mineral Development (MEMD))

[84] Berkouwer S B and Dean J T 2022 Credit, Attention, and Externalities in the Adoption of Energy Efficient Technologies by Low-Income Households *American Economic Review* **112** 3291–330

[85] Eriksson S and Prior M 1985 *The briquetting of agricultural wastes for fuel* (FAO)

[86] Aprovecho Research Center 2023 *Laboratory Testing of the Ecosafi BetterStove without Pot Skirt* (Cottage Grove, OR: Aprovecho Research Center)

[87] Electricity Regulatory Authority 2024 *Tariff Schedules - ERA - Electricity Regulatory Authority* (Kampala, Uganda: Electricity Regulatory Authority)

[88] CIRCODU 2023 *AN E-COOKING BASELINE STUDY REPORT - DRAFT* (Kampala, Uganda: Ministry of Energy and Mineral Development)

[89] Edward Nuwamanya 2024 Key Informant Interview

[90] KPMG 2024 *Uganda Budget Brief 2024/2025* (Kampala, Uganda: KPMG Uganda)

[91] Kar A, Pachauri S, Bailis R and Zerriffi H 2019 Using sales data to assess cooking gas adoption and the impact of India's Ujjwala programme in rural Karnataka *Nature Energy* 1

[92] Kar A, Pachauri S, Bailis R and Zerriffi H 2020 Capital cost subsidies through India's Ujjwala cooking gas programme promote rapid adoption of liquefied petroleum gas but not regular use *Nat Energy* **5** 125–6

[93] Murungi P 2022 Oil refinery to start operations in 2027 - govt *Monitor*

[94] Ministry of Energy and Petroleum 2019 *Kenya Cooking Sector Study: Assessment of the Supply and Demand of Cooking Solutions at the Household Level* (Nairobi, Kenya: Kenya Ministry of Energy and Clean Cooking Association of Kenya)

[95] M-Kopa Labs 2022 *Uganda's LPG Fuel Market Assessment: Assessing M KOPA's fit in Uganda's LPG value chain to increase access to modern cooking* (Kampala, Uganda: MECS)

[96] Perros T, Tomei J and Parikh P 2024 Stakeholder perspectives on the future of clean cooking in sub-Saharan Africa and the role of pay-as-you-go LPG in expanding access *Energy Research & Social Science* **112** 103494

[97] Wasirwa E 2024 Key Informant Interview

[98] Biogas Solutions Uganda Limited (BSUL) 2025 Biogas Solutions Uganda Limited - Home *Biogas Solutions Uganda Limited (BSUL) is an implementing Partner of the African Biodigester Component (ABC), a 5 year program in Uganda*.

[99] Uganda Bureau of Statistics (UBOS) 2024 *National Livestock Census 2021* (Kampala, Uganda: Uganda Bureau of Statistics)

[100] Uganda National Bureau of Standards 2016 *Domestic biogas plants - Design and construction - Code of practice - Part 1: General* vol US 1644-1:2016

[101] Uganda National Bureau of Standards 2016 *Domestic biogas plants design and construction - Code of practice - Part 2: Fixed dome* vol US 1644-2:2016

[102] Uganda National Bureau of Standards 2016 *Domestic biogas plants design and construction - Code of practice - Part 3: Floating dome* vol US 1644-3:2016

[103] Uganda National Bureau of Standards 2016 *Domestic biogas stoves - Specification* vol US 1642: 2016

[104] UECCC 2023 *RESULTS BASED FINANCE MANUAL (PART C OF EASP PROJECT OPERATIONS MANUAL)* (Kampala, Uganda: Uganda Energy Credit Capitalisation Company and World Bank)

[105] Ministry of Energy and Mineral Development 2024 Biofuel production quantities

[106] WWF 2023 "Engage Gear Shits to Stop Further Plastic Pollution in Uganda", WWF urges *africa.panda.org*

[107] KOKO Networks 2018 KOKO & Vivo Energy announce Kenya operating partnership *NEWS*

[108] Wilson T 2023 Start-up taps carbon markets to boost clean cooking in Africa

[109] Ministry of Finance, Planning and Economic Development 2023 *National Budget Framework Paper (NBFP) FY 2024-25* (Kampala, Uganda: Ministry of Finance, Planning and Economic Development)

[110] Clean Cooking Alliance 2024 *Unit Economics Framework and Analysis for the Clean Cooking Sector* (Washington DC: Clean Cooking Alliance)

[111] National Planning Authority 2013 *UGANDA VISION 2040* (Kampala, Uganda: National Planning Authority (NPA))

[112] Associated Press 2024 A fire set off by a gas explosion in Kenya kills at least 3 people and injures 280 *NPR*

[113] Nattabi A K 2022 Vulnerability of product standards enforcement in Uganda *EPRC Highlights*

[114] Barigaba J 2025 Uganda eyes LPG windfall from Lake Albert oil projects *The East African*

[115] International Standards Organization 2023 *ISO 5714:2023 Clean cookstoves and clean cooking solutions — Test protocols for institutional cookstoves*

[116] Ssempogo H Y 2025 Gas from Oil Projects to Protect Environment, Boost Health *UNOC*

[117] Anon 2025 *Uganda's oil refinery to begin operations in 4 years* (Kampala, Uganda)

[118] Electricity Regulatory Authority (ERA) 2021 *Least Cost Electricity Expansion Plan 2020-2030* (Kampala, Uganda: Electricity Regulatory Authority (ERA))

[119] World Bank 2023 World Integrated Trade Solution (WITS)

[120] Vigolo V, Sallaku R and Testa F 2018 Drivers and Barriers to Clean Cooking: A Systematic Literature Review from a Consumer Behavior Perspective *Sustainability* **10** 4322

[121] Kar A and Zerriffi H 2018 From cookstove acquisition to cooking transition: Framing the behavioural aspects of cookstove interventions - ScienceDirect *Energy Research & Social Science* **42** 23–33

[122] Furszyfer Del Rio D D, Lambe F, Roe J, Matin N, Makuch K E and Osborne M 2020 Do we need better behaved cooks? Reviewing behavioural change strategies for improving the sustainability and effectiveness of cookstove programs *Energy Research & Social Science* **70** 101788

[123] Bank of Uganda and Ministry of Finance, Planning and Economic Development 2023 *National Financial Inclusion Strategy 2023-2028* (Kampala, Uganda: Ministry of Finance, Planning and Economic Development)

[124] UECCC 2023 *CREDIT SUPPORT FACILITY MANUAL (PART B OF PROJECT OPERATIONS MANUAL)* (Kampala, Uganda: Uganda Energy Credit Capitalisation Company and World Bank)

[125] International Energy Agency (IEA) 2025 *Universal Access to Clean Cooking in Africa: Progress update and roadmap for implementation* (Paris: International Energy Agency (IEA))

[126] National Planning Authority 2022 *THE UGANDA GREEN GROWTH DEVELOPMENT STRATEGY 2017/18 – 2030/31* (Kampala, Uganda: National Planning Authority (NPA))

[127] Ministry of Water and Environment 2021 *National Climate Change Act 2021*

[128] Ministry of Water and Environment 2025 *THE NATIONAL CLIMATE CHANGE (CLIMATE CHANGE MECHANISMS) REGULATIONS, 2025* vol 2025 No. 9

[129] Ministry of Water and Environment 2022 *Uganda - Updated Nationally Determined Contribution (NDC)* (Kampala, Uganda: Ministry of Water and Environment (Uganda))

[130] Szabo M 2024 Former C-Quest Capital CEO accused of wrongdoing, reported to US authorities over alleged carbon credit over-issuance « Carbon Pulse

[131] Gill-Wiehl A, Kammen D M and Haya B K 2024 Pervasive over-crediting from cookstove offset methodologies *Nat Sustain* 1–12

[132] Sovacool B K 2013 Expanding renewable energy access with pro-poor public private partnerships in the developing world *Energy Strategy Reviews* **1** 181–92

[133] Nsasira R, Basheka B C and Oluka P N 2013 Public Private Partnerships (PPPs) and Enhanced Service Delivery in Uganda: Implications from the Energy Sector *International Journal of Business Administration* **4** 48

[134] Matovu M MPs praise local investor in Nwoya district for processing cassava into fuel *Nilepost News*

[135] Adwek G, Boxiong S, Ndolo P O, Siagi Z O, Chepsaigutt C, Kemunto C M, Arowo M, Shimmon J, Simiyu P and Yabo A C 2020 The solar energy access in Kenya: a review focusing on Pay-As-You-Go solar home system *Environ Dev Sustain* **22** 3897–938

[136] Kizilcec V, Parikh P and Bisaga I 2021 Examining the Journey of a Pay-as-You-Go Solar Home System Customer: A Case Study of Rwanda *Energies* **14** 330

[137] Patel S 2017 Pay-As-You-Go Technology to Boost Access to Cooking Fuel *UN Foundation Data and Technology Blog*

[138] Sun King 2025 Unlocking Clean Cooking *About PayGo*

[139] KopaGas 2024 KOPAGAS *Clean Cooking Change Lives*

[140] Envirofit 2025 SmartGas *Envirofit: Smarter Living*

[141] EcoSafi 2025 EcoSafi – A Better Way to Cook

[142] PowerUP 2025 Our Products *PowerUP - Clean tech for everyone!*

[143] Burn 2025 Ecoa Induction Cooker *BURN*

[144] Mwangi W 2024 We are coming for you; Energy PS warns unregistered LPG refillers – Kenya News Agency *Kenya News Agency*

[145] Rugadya N 2021 UNBS to Strictly Enforce LPG Standards, Bans Cylinder Swapping : *Uganda Radionetwork*

[146] ICVCM 2025 The Assessment Framework *Core Carbon Principles Assessment Framework and Procedure*

[147] Ghilardi A and Bailis R 2024 *Updated fNRB Values for Woodfuel Interventions* (Bonn, Germany: UNFCCC)

[148] Bailis R, Drigo R, Ghilardi A and Masera O 2015 The Carbon Footprint of Traditional Woodfuels *Nature Climate Change* **5** 266–72

[149] Uganda National Bureau of Standards 2019 *Handling, storage, and distribution of Liquefied Petroleum Gas (LPG) in domestic, commercial, and industrial installations - Code of practice - Part 1: Storage and filling sites for refillable LPG containers of capacity not exceeding 150 L* vol US EAS 924-1:2018

[150] Uganda National Bureau of Standards 2019 *Handling, storage, and distribution of Liquefied Petroleum Gas (LPG) in domestic, commercial, and industrial installations - Code of practice - Part 2: LPG installations involving gas storage vessels of individual water capacity exceeding 150 L and combined water capacity not exceeding 9 000 L per installation* vol US EAS 924-2:2018

[151] Uganda National Bureau of Standards 2019 *Inspection and testing of Liquefied Petroleum Gas (LPG) road tankers* vol US EAS 925:2018

[152] Uganda National Bureau of Standards 2021 *Grill for domestic Liquefied Petroleum Gas (LPG) cylinders- Specification* vol US EAS 939:2020

[153] Uganda National Bureau of Standards 2021 *Mountable burner for use with Liquefied Petroleum Gas (LPG)- Specification* vol US EAS 940:2020

[154] Uganda National Bureau of Standards 2021 *Transportable refillable steel and aluminium Liquefied Petroleum Gas (LPG) cylinders- Procedures for gas freeing and disposal* vol US EAS 938:2020

[155] Uganda National Bureau of Standards 2021 *Handling, storage, and distribution of Liquefied Petroleum Gas (LPG) in domestic, commercial, and industrial installations- Code of practice- Part 3: Liquefied petroleum gas installations involving storage vessels of individual water capacity exceeding 9000 L* vol US EAS 924-3:2020

[156] Uganda National Bureau of Standards 2021 *Handling, storage, and distribution of Liquefied Petroleum Gas (LPG) in domestic, commercial, and industrial installations- Code of practice- Part 4: Road, rail and maritime transportation of LPG in bulk* vol US EAS 924-4:2020

[157] Uganda National Bureau of Standards 2013 *Household and similar electrical appliances - Safety - Part 2-6: Particular requirements for stationary cooking ranges, hobs, ovens and similar appliances* vol US IEC 60335-2-6: 2008

[158] Uganda National Bureau of Standards 2020 *Household electric cooking appliances -Part 2: Hobs -Methods for measuring performance* vol US IEC 60350-2:2017

[159] Uganda National Bureau of Standards 2017 *Standard Specification for Denatured Ethanol for use as Cooking and Appliance Fuel* vol US 1685:2017

[160] Uganda National Bureau of Standards 2019 *Solid biofuels Determination of calorific value* vol US ISO 18125:2017

[161] Uganda National Bureau of Standards 2019 *Solid biofuels - Specification - Part 1: Lump charcoal* vol US 765-1:2019

[162] Uganda National Bureau of Standards 2019 *Solid biofuels - Specification - Part 2: Carbonized briquettes* vol US 765-2:2019

[163] UNDESA 2018 World Urbanization Prospects: 2018 *United Nations, Department of Economic and Social Affairs - Population Dynamics*

[164] Ghilardi A and Bailis R 2024 *Updated fNRB Values for Woodfuel Interventions* (Bonn, Germany: UNFCCC)

[165] Floess E, Grieshop A, Puzzolo E, Pope D, Leach N, Smith C J, Gill-Wiehl A, Landesman K and Bailis R 2023 Scaling up gas and electric cooking in low- and middle-income countries: climate threat or mitigation strategy with co-benefits? *Environ. Res. Lett.* **18** 034010

[166] IPCC 2006 *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories* (Hayama, Kanagawa, Japan: Institute for Global Environmental Strategies (IGES))

[167] Argonne National Laboratory 2021 The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model

[168] Brocard D, Lacaux C, Lacaux J P, Kouadio G and Yoboué V 1996 Emissions from the combustion of biofuels in western Africa *Biomass Burning and Global Change* (Cambridge, Mass.: MIT Press) pp 350–60

[169] Bertschi I T, Yokelson R J, Ward D E, Christian T J and Hao W M 2003 Trace gas emissions from the production and use of domestic biofuels in Zambia measured by open-path Fourier transform infrared spectroscopy *Journal of Geophysical Research: Atmospheres* **108**

[170] Akagi S K, Yokelson R J, Wiedinmyer C, Alvarado M J, Reid J S, Karl T, Crounse J D and Wennberg P O 2011 Emission factors for open and domestic biomass burning for use in atmospheric models *Atmospheric Chemistry and Physics* **11** 4039–72

[171] Smith K R, Uma R, Kishore V V N, Lata K, Joshi V, Zhang J, Rasmussen R A and Khalil M A K 2000 Greenhouse Gases from Small-Scale Combustion Devices in Developing Countries, Phase IIA: Household Stoves in India *US EPA, Washington D.C.*

[172] Smith K, Pennise D M, Khummongkol P, Chaiwong V, Ritgeen K, Zhang J, Panyathanya W, Rasmussen R A and Khalil M A K 1999 *Greenhouse gases from small-scale combustion devices in developing countries: Charcoal-making kilns in Thailand* (Research Triangle Park, NC: U.S. Environmental Protection Agency)

[173] Pennise D M, Smith K R, Kithinji J P, Rezende M E, Raad T J, Zhang J and Fan C 2001 Emissions of greenhouse gases and other airborne pollutants from charcoal making in Kenya and Brazil *Journal of Geophysical Research: Atmospheres* **106** 24143–55

[174] Lacaux J-P, Brocard D, Lacaux C, Delmas R, Brou A, Yoboué V and Koffi M 1994 Traditional charcoal making: an important source of atmospheric pollution in the African Tropics *Atmospheric Research* **35** 71–6

[175] Christian T J, Yokelson R J, Cárdenas B, Molina L T, Engling G and Hsu S-C 2010 Trace gas and particle emissions from domestic and industrial biofuel use and garbage burning in central Mexico *Atmospheric Chemistry and Physics* **10** 565–84

[176] Technical Working Group (TWG) of IFIs 2022 Harmonized IFI Default Grid Factors 2021 v3.2 *IFI TWG - List of methodologies*

[177] UEDCL 2025 Electricity End User Tariffs and Charges *Uganda Electricity Distribution Company Limited*

10. Appendices

A. Existing UNBS standards for clean and transitional cooking options

- LPG
  - US EAS 924-1:2018 Handling, storage, and distribution of Liquefied Petroleum Gas (LPG) in domestic, commercial, and industrial installations - Code of practice - Part 1: Storage and filling sites for refillable LPG containers of capacity not exceeding 150 L [149]
  - US EAS 924-2:2018 Handling, storage, and distribution of Liquefied Petroleum Gas (LPG) in domestic, commercial, and industrial installations - Code of practice - Part 2: LPG installations involving gas storage vessels of individual water capacity exceeding 150 L and combined water capacity not exceeding 9 000 L per installation [150]
  - US EAS 925:2018 Inspection and testing of Liquefied Petroleum Gas (LPG) road tankers [151]
  - US EAS 939:2020 Grill for domestic Liquefied Petroleum Gas (LPG) cylinders- Specification [152]
  - US EAS 940:2020 Mountable burner for use with Liquefied Petroleum Gas (LPG)- Specification [153]
  - US EAS 938:2020 Transportable refillable steel and aluminium Liquefied Petroleum Gas (LPG) cylinders- Procedures for gas freeing and disposal [154]
  - US EAS 924-3:2020 Handling, storage, and distribution of Liquefied Petroleum Gas (LPG) in domestic, commercial, and industrial installations- Code of practice- Part 3: Liquefied petroleum gas installations involving storage vessels of individual water capacity exceeding 9000 L [155]
  - US EAS 924-4:2020 Handling, storage, and distribution of Liquefied Petroleum Gas (LPG) in domestic, commercial, and industrial installations- Code of practice- Part 4: Road, rail and maritime transportation of LPG in bulk [156]
- E-cooking
  - US IEC 60335-2-6: 2008 Household and similar electrical appliances - Safety - Part 2-6: Particular requirements for stationary cooking ranges, hobs, ovens, and similar appliances [157]
  - US IEC 60350-2: 2017 Household electric cooking appliances
    - Part 2: Hobs -Methods for measuring performance [158]
- Biogas
  - US 1642: 2016 Domestic biogas stoves - Specification [103]
  - US 1644-1: 2016 Domestic biogas plants - Design and construction - Code of practice
    - Part 1: General [100]
    - Part 2: Fixed dome [101]
    - Part 3: Floating dome [102]
- Ethanol
  - US 1685: 2017 Standard Specification for Denatured Ethanol for use as Cooking and Appliance Fuel [159]
- Biomass
  - US ISO 18125: 2017 Solid biofuels - determination of calorific value [160]
  - US 761: 2019 Household biomass stoves - Requirements [15]

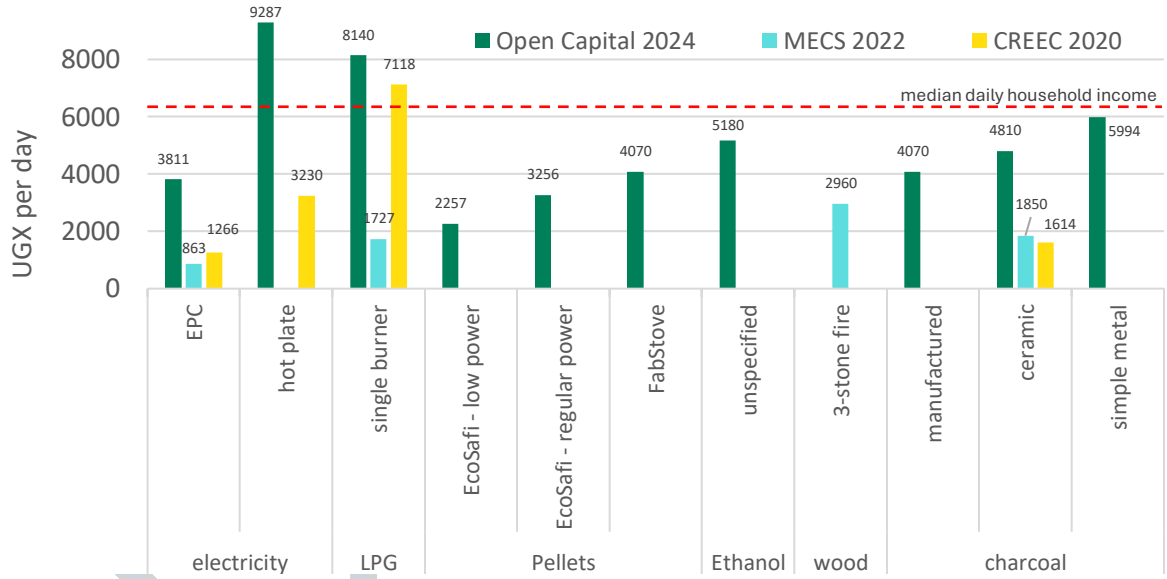
- US 765: 2019 Solid biofuels - Specification
  - Part 1: Lump charcoal [161]
  - Part 2: Carbonised briquettes [162]

B. Estimates of cooking costs from recent studies

Cooking cost is an important factor in determining whether a given stove/fuel combination will be adopted. People may be very happy with a clean-burning, well-functioning stove, but not use it regularly because the operating cost is too high. Estimates of cooking costs are helpful metrics that can inform the public how much they can expect to spend, and save, on clean and transitional cooking options. However, a review of recent studies in Uganda shows a wide range of cooking costs that use different assumptions and report their results in different units, which can lead to potentially mixed messages being communicated to the public.

Figure 16 shows estimates of daily cooking costs from three recent studies. Two studies conclude that cooking with an EPC is the most economical option [42,43]. A third study finds cooking with pellets using a forced-draft gasifier stove is the least costly option, which was not considered in the other two studies. Notably, that study was commissioned by a company that is promoting pellet stoves and fuel , but the study also found that EPCs are more economical than all other options [41]. One study concluded that cooking with LPG is cheaper than cooking with charcoal, but the other two conclude that charcoal is considerably cheaper than LPG.

Figure 16: Recent estimates of daily cooking cost using different stove-fuel combinations in Uganda [41–43] with median daily income shown for comparison.



These disparate results are mainly caused by different assumptions about fuel costs. For example, the price of charcoal used by the studies varies from 1200 to 3000 UGX per kg. Similarly, the studies use LPG costs ranging from 7000 to 9500 UGX per kg. However, several other factors also affect these estimates including the types of foods cooked, the efficiency of specific appliances, and whether the analysis includes the price of the stove itself (and how the analysts convert that price into daily cost of cooking).

In addition, the studies use different metrics to estimate cooking costs. The CREEC study from 2020 [42] reported the cost of cooking four common Ugandan dishes. We simply took the sum of the dishes to estimate the cost of cooking for the day. Other studies estimated the cost per day [41], or per month [43]. We divided monthly results by thirty to arrive at a daily cooking cost and compare to the other studies.

It is recommended that MEMD commission a specific study with pre-agreed assumptions about fuel costs and appliances to derive results that are more easily compared. The reassessment should include a clear explanation of how key factors affect results and sensitivity analyses that transparently explain how changes in inputs contribute to variability in cooking costs.

C. EASP targets and subsidy schedule

Table 15: EASP targets related to Clean Cooking:

Category	Baseline (2022)	Target (June 2027)
People with access to clean cooking solutions under the project	0	1,660,000
in refugee-hosting districts	0	53,000
in refugee-hosting districts, of which refugees	0	26,000
Public institutions provided with clean cooking solutions	0	600
in refugee-hosting districts	0	50

Table 16: Consumer Subsidies (as % of Retail Price) offered by EASP [104]

Stove/fuel category	Subsidy Rates	Subsidy Cap (UGX)
Category A. Household Biomass Cookstove		
i. Biomass stove using carbonized fuel	50%	30,000
ii. Biomass stove using uncarbonized fuel	50%	40,000
iii. Modern stove using processed fuels like pellets and woodchips	50%	72,500
Category B. Household Biogas	30%	870,000
Category C. LPG package	40%	130,000
Category D. Ethanol cookstoves	40%	120,000
Category E. Electric Cooking devices		
i. Induction/Infrared Cookers	50%	140,000
ii. Electric Pressure Cookers	50%	150,000
Category F. Solar cooker with PV and battery	30%	600,000

D. Assumptions used for scenario development and emission estimates

To develop and model the BAU and NICCS scenario the NICCS team collected numerous data sets including household fuel choice, stove and fuel costs, population and urbanisation, VAT and import duty schedules (already described in Table 4). To estimate emissions, the team combined the data used to create the scenarios with estimates of household fuel consumption and emission factors. All data and sources are described below.

Household fuel choice

This assessment used three recent nationally representative data sets to build a current trajectory of household fuel choice and projected that into the future to define the BAU scenario (). The data sets were not entirely consistent. For example, each includes a category of "other", but that category included different stove and fuel choices. In addition, there is no nationally representative data on the percentage of households that use Class 3 wood or charcoal stoves. For this, the team made a conservative guess of 2% in 2020 increasing to 3 to 4% in 2024. Remaining data is taken directly from the sources described below the table.

Table 17: Data on primary household fuel choice from nationally representative sources

	Rural			Urban		
	2020	2021	2024	2020	2021	2024
Traditional fuelwood	85.6	80.8	77.0	29.4	35.2	41.2
Traditional charcoal	9.2	15.0	14.7	55.0	54.2	44.6
Improved fuelwood	2.0	2.0	3.0			
Improved charcoal				2.0	2.0	4.0
Gas	0.1	0.2	0.3	4	4.5	2.4
kerosene	0.2		0.8	1.6		0.9
electric	0.5		1.3	4.0		2.4
other	2.4	0.4	2.6	3.9	2.9	2.5

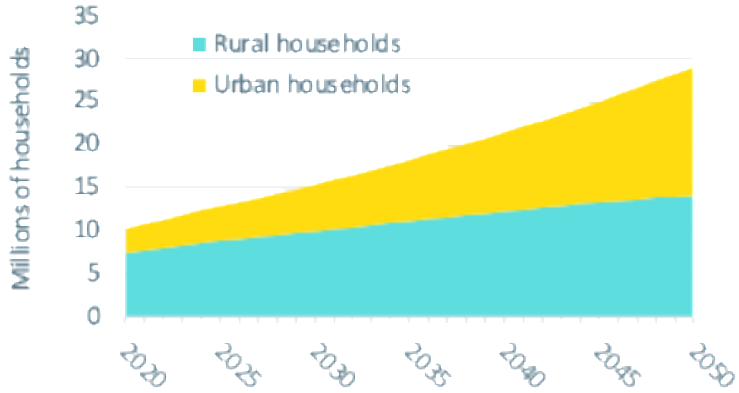
Sources:

2020: Uganda National Household Survey (2019/20 UNHS) [33]
2021: The National Service Delivery Survey 2021 [29]
2024: National Population and Housing Census – Final Report – Volume I (Main) [28]

Population and urban growth

To model population growth, this assessment relied on United Nations projections for both overall population and urbanization [163]. In addition, to convert from individual population to households, the assessment used several data points on average urban and rural household size from UBOS [28,33,38] and filled in the missing gaps using simple linear extrapolation. The projected rural and urban household populations used in BAU and NICCS is shown in Figure 17.

Figure 17: Projections of rural and urban households through 2050



Household fuel consumption

To estimate fuel consumption, the team used the same approach that was used to estimate woodfuel renewability for the UNFCCC, which underwent extensive expert review and public comments [164]. These data are used because there are no robust current estimates of household fuel consumption available. The values used for this assessment are shown in Table 18

Table 18: Annual per capita fuel consumption used to estimate emissions for each scenario

Fuel	Quantity	Units
biogas	0.144	ton/cap-yr
electricity	0.428	MWh/cap-yr
ethanol	0.076	ton/cap-yr
Improved charcoal	0.100	ton/cap-yr
Improved fuelwood	0.240	ton/cap-yr
Kerosene	0.053	ton/cap-yr
LPG	0.040	ton/cap-yr
pellets	0.117	ton/cap-yr
Traditional charcoal	0.160	ton/cap-yr
Traditional fuelwood	0.400	ton/cap-yr

Emission factors

The approach follows the approach taken by Floess et al [165] and accounts for emissions from production, transportation, and use of each fuel. These are shown in Table 19.

Table 19: Emission factors used to estimate emissions from each fuel (superscripts link to notes below the table with sources)

		Firewood[1]	Charcoal[2]	Improved fuelwood[1]	Improved charcoal[2]	Kerosene[1]	LPG[3]	Ethanol[4]	Pellets[5]	biogas[1]	Electricity[6]
Production	CH_4	--	89	--	89	4.2	4.7	16.5	0.1	61	--
	N_2O	--	0.2	--	0.2	--	--	1.3	0.0	--	--
	CO_2	--	3840	--	3840	375	506	-313	65	--	246
	BC	--	2.8	--	2.8	--	--	1.3	--	--	--
Transportation	CH_4	--	--	--	--	--	0.2	--	--	--	--
	N_2O	--	--	--	--	--	--	--	--	--	--
	CO_2	--	13	--	13	12	144	13	13	--	--
	BC	--	--	--	--	--	--	--	--	--	--
End-use	CH_4	4.7	5.6	4.7	6	--	0.3	--	1.4	0.3	--
	N_2O	0.1	0.2	0.1	0.2	0.4	--	--	--	--	--
	CO_2	1747	2356	1747	2356	3149	3075	1896	1164	2753	--
	BC	1.6	1.3	1.6	1.3	--	--	--	--	--	--
Total	CH_4	4.7	95.1	4.7	95.1	4.6	5.3	16.5	1.5	61.3	--
	N_2O	0.1	0.4	0.1	0.4	--	--	1.3	0.0	0.0	--
	CO_2	1747	6208	1747	6208	3437	3725	1595	1241	2753	246
	BC	1.6	4.1	1.6	4.1	--	--	1.3	--	--	--

Notes:

1. End-use emissions for firewood, improved firewood, coal, kerosene, and biogas are from IPCC default values [166]. Production and transportation emissions for coal, kerosene, and biogas are based on Floess et al. [165], and were originally derived using the GREET model [167].
2. Charcoal and improved charcoal end-use emission factors are taken from four peer-reviewed studies of emissions from traditional charcoal stoves [168–171]. Charcoal production emission factors are taken from six peer-reviewed studies of emissions from traditional kilns [169,170,172–175]. The average conversion rate from those studies is 3.7 tons of oven-dry wood per ton of charcoal. Those studies were conducted under controlled conditions, which yields higher conversion efficiencies than those observed in field conditions. This assessment assumes a 6:1 charcoal conversion factor, which is typical in LMICs. The upstream emissions factors here were therefore adjusted to align with a 6:1 conversion factor.
3. LPG end-use and upstream emissions are taken from Floess et al. [165].
4. Ethanol emissions are taken from Floess et al. [165], which assumes the ethanol is derived from sugarcane. CO_2 emissions from production are negative because carbon is fixed during plant growth; CH_4 emissions from production are due to field burning, which is common for sugarcane produced in LMICs; and Life Cycle Assessment impacts are allocated by mass assuming 20% of farm-gate output goes toward ethanol.
5. Pellet emissions are taken from Floess et al. [165].
6. Uganda-specific estimates of marginal grid emissions from International Financial Institution's Technical Working Group on GHG Accounting [176].

E. List of interviewees and focus group participants consulted for this assessment

No.	Date	Sector	Agency/Organisation	Name	Title(s)
1	2024-03-04	Development partners	UNCDF	Julius Magala	Energy Access Coordinator
2	2024-03-05	Development partners	GIZ	Victoria Butegwa Solomon Atepo Ella Tirwanwe	Head of Cooking Energy Component Energy advisor Energy advisor - gender focal point
3	2024-03-05	Development partners	UNDP	Michael Kiza	National Coordinator - Climate Aggregation Platform
4	2024-04-05	LPG	Wana Energy Solutions	Emmy Wasirwa	Director/Co-Founder
5	2024-04-09	LPG	MEMD	Edward Nuwamanya	Principal Petroleum Officer
6	2024-04-30	E-cooking	ECOCA / Pesitho	Ronald Kaweesa Ruth Komuntale	Business Manager Managing Director
7	2024-05-02	E-cooking	UMEME	Peter Mwesiga	Project Manager
8	2024-05-03	Ethanol	Bukona Agro Processor's Ltd	Praviin Kekal	Managing Director
9	2024-05-06	Biogas	BSUL	Michel Muvule	PROGRAMME COORDINATOR
10	2024-05-07	E-cooking	PowerUP	Kato Kibuka	CEO
11	2024-05-10	Biogas	SNV, Africa Biodigester Component	Esther Namuyondo Nyanzi	Project Manager
12	2024-05-14	E-cooking	Makerere University	Samuel Kucel	Professor
13	2024-06-04	E-cooking+	BURN Manufacturing	Molly Brown Edward Kwesiga Kigweru Mombi Abdihakim Ali	Head of Carbon Strategy Country Management Consultant Policy Officer Senior Analyst
14	2024-06-06	E-cooking	MECS	Ed Brown	Director
15	2024-06-10	Ethanol	Koko Networks	Ed Agnew Farai Mwamuka Doreen Rwigamba	Carbon New markets team New markets team
16	2024-06-12	Government	MFPED	Joseph Ahaisibwe Darious Mugabe	Senior Economist Economist and Policy Researcher
17	2024-06-17	Government	Office of the Prime Minister	John Paul Magezi	Energy and Environment Officer, Refugees
18	2024-06-20	Green charcoal	Kijani Forestry Group	Quinn Neely	CEO
19	2024-06-21	Green charcoal	FAO	Zainabu Kakungulu	Program Officer
20	2024-07-18	Financial Institutions	UECCC	Mwaka Agoba Annette Ssempala	Programme Manager-Results Based Financing
21	2024-07-19	Financial Institutions	Equity Bank	Virginia Ssemakula	Manager for Energy, Environment and Climate
22	2024-07-22	Pellets/briquettes	EcoSafi	Matt King Jordy Corcoran Tom Price	Chief Climate Officer COO & Co-Founder CoFounder/CEO

23	2024-07-22	Development Partners	UNHCR	Miriam Natoba	Associate Energy and Environment Officer

No.	Date	Sector	Organisation	Participants	Role
FGD 1	2024-03-06	Biomass	Josa Green Technologies	Samuel Asiimwe	Managing Director
			Masupa Enterprises	Margaret Kyamulah	Executive Director
			New Energy Nexus	Julius Mujuni	Regional Coordinator
			Raising Gabdho	Sarah Basemera	Founder
			Ugastove	Rehema Nakyazze	CEO
			Ugastove	Crispus Tashobya	General Manager
			UpEnergy	Andrew Wanyaka	Head of Data, Monitoring and Evaluation
FGD 2	2024-03-09	Periurban consumers	Kaleerwe, Kampala	Abdul Lukwago Goerreti	Community member
				Nakawuki Tatu Namubiru	Community member
				Doreen Kyosimire	Community member
				Margret Nagawa	Community member
				Hadija Muduwa	Community member
				Violet Babirye	Community member
				Kasim Maburuka	Community member
				Cissy Namatovu	Community member
				Shamim Namutebi	Community member
				Ibrahim Olong	Community member
				Madina Nazimuli	Community member
				Ruth Nassozi	Community member
				Harriet Nakagwa	Community member
				Haytah Hanifah	Community member
				Patrick Waweyo	Community member
				Rashid Ssegujja	Community member
				Caroline Gabeya	Community member
					Community member

F. List of attendees of the inception meeting held in September 2023

No.	Date	Sector	Organisation	Participants	Role
Inception Meeting	2024/09/12		CCAC/UNEP	Fred Onyai	National Consultant
			CIRCODU	Juliet Kyayesimira	Director
			CIRCODU	Joseph Arineitwe	Founder
			CREEC	Mary Suzan Abbo	Managing Director
			FAO	Zainab Kakungulu	Capacity Development Officer
			GIZ/EnDev	Victoria Butegwa	Cooking Energy Programme Manager
			Makerere University	Paul Nduhuura	Lecturer, Business School
			MECS	James Baanabe	Energy Consultant
			MEMD	Justine Akumu	Energy Officer
			MEMD	Michael Ahimbisibwe	Senior Energy Officer
			MEMD	Edward Nuwamanya	Principal Petroleum Officer
			MEMD	Ian Kisawuzi	Ag. Senior Statistician
			MEMD	Herbert Abigaba	Principal Energy Officer
			MEMD	David Birimumaso	Principal Energy Officer
			MEMD	Susan Nalwoga	Communications Officer
			MEMD	Brian Isabirye	Commissioner, Renewable Energy
			MEMD	Davin Oyesigye	PSD
			MWE	Irene Chekwoti	Principal Climate Change Officer
			MWE	Derick Senyonga	Senior Climate Change Officer
			MWE	Lisa Amena	Climate Change Department
			MWE	Hope Asiimwe	Regional Forest Officer
			Ntl Renewable Energy Platform	Nicholas Mukisa	Deputy National Coordinator
			APMPU	Anthony Ogalo	General Manager
			UNACC	Sarah Babirye	Project Coordinator
			UNBS	Richard Ebong	Manager Legal Metrology
			UNDP	Michael Kiza	National Coordinator - Climate Aggregation Platform
			WWF	Annet Turnwine	Extractives Manager

G. Electricity tariff structure

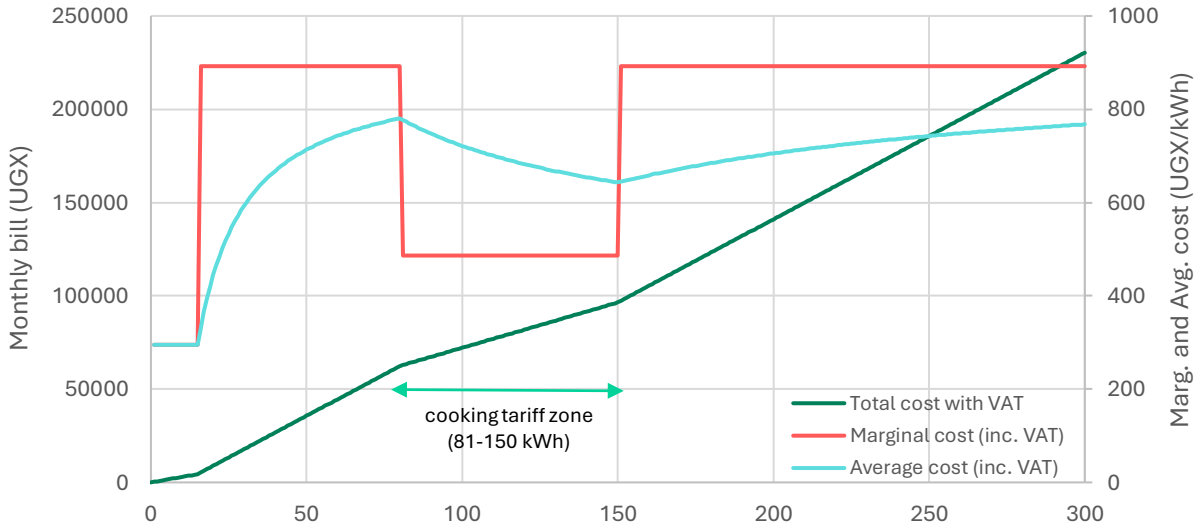
Uganda has both lifeline and cooking tariffs, which supply limited quantities of subsidised electricity to residential customers. The lifeline tariff applies to the first 15 kWh consumed each month and the cooking tariff goes into effect after families use 80 kWh and applies up to 150 kWh. 70 kWh or 2 kWh per day is considered sufficient for cooking with an efficient device. The standard tariff applies between 15 and 80 kWh and again above 150 (Table 20).

Table 20: ERA tariff structure in effect during Q2 2025

Tariff band	Cost
Lifeline - First 15 Units (UGX/kWh) [52]	250
Energy Units between 16-80 (UGX /kWh)	756
Energy Units between 81-150 (UGX /kWh)	412
Energy Units above 150 (UGX /kWh)	756

This structure, while providing some subsidised power for poor households, can be confusing. In addition, even with these subsidies, families earning at or below the median urban household income (UGX 436k per month) need to spend at least 14% of their monthly income before the subsidised cooking tariff goes into effect. Figure 18 shows how this tariff structure translates into an electric bill for consumers. The red line shows the tariffs listed in Table 20, with 18% VAT added. This is the marginal cost of consuming each additional unit (read on the right-hand axis). The green line shows the total cost that consumers pay as they use more electricity (read on the left-hand axis). The blue line shows the average cost, which is calculated by dividing total cost (green line) by consumption (right-hand axis). Note, the cooking tariff zone only applies after families consume UGX 63k worth of power at higher rates.

Figure 18: Marginal, average, and total costs of electricity consumption using Q2 2025 tariffs [177]



[52] The lifeline tariff only applies for consumers whose rolling average monthly consumption is less than 100 kWh during the previous six-months.