

Uganda's cooking energy sector: A Review

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Abstract

The backdrops of solid biomass-based cooking are no longer an abstract issue, and the reality of its impacts has been expressed in a wide array of numbingly repeated literature related to its limitations on health, environment, economic livelihoods, and gender issues. Failed technical, social, and economic attempts to improve these shortfalls have opened new opportunities for electric cooking. However, the immediate foreseeable challenge is the struggle to repeal the satisfactory feedback from the use of biomass built over the years. As such, a new perspective of the cooking energy sector has been reframed from dialogues and interviews with key stakeholders in the energy sector, complemented with a meta-synthesis and analysis of reports, documents, and peer-reviewed publications within the cooking energy domain. Broadly, the negation of biomass-based cooking is not sufficient to drive the transition to modern energy cooking services (MECS). Nevertheless, the reality of confronting the foreseeable possibilities of biomass scarcity currently being advanced by pressure from demographics and urbanization, holds great promise for behavioural change and acceptance of electric cooking as a viable and scalable alternative for biomass-based cooking.

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1. Introduction

Traditionally, domestic energy use in Uganda is dichotomized into traditional biomass for cooking, and electricity for lighting, yet examining them together reveals a potentially transformative development opportunity for skipping the conventional stages of slow transition from traditional polluting fuels directly to clean and modern fuel, electricity (Leary et al., 2021a). Lombardi et al. (2019) note that access to clean cooking and electricity are often treated as separate, and programmes aimed at improving the provision of electricity fail to take cooking into account. Yet, where renewable energy is the predominant source of electricity, as it is the case in Uganda, efficient electric cooking devices present a sustainable and reliable option to achieve the universal access to clean cooking facilities by 2030 (Lombardi et al., 2019). Batchelor et al. (2019) acknowledges that this approach could have significant potential in mitigating over-reliance on biomass, especially in developing countries that have made progress towards increasing access and supply of electricity. But the main challenges affecting universal transition to electric cooking is lack of viable infrastructural options for the dissemination of modern energy cooking services i.e. transmission of electricity and transportation of appliances and bottled fuels such as liquefied petroleum gas (LPG) to the last mile consumer (Wright et al., 2020).

In Uganda, in the past ten years, on one side has witnessed a serious decrease in biomass attributed to population increase (approx. 3% annually) (UBOS, 2016) and urbanization (5.7% annually), on the flip side, there has been a remarkable increase in electrification. Uganda's cooking energy sector has for long relied on biomass (94%) as the primary source of energy (UBOS, 2021; Price, 2017). Over the past two decades, the government has concerted efforts and allocated budgets towards the promotion of improved cookstoves (GOU, 2013). However, Batchelor et al. (2019) observes that in the global south, although policy and technology interventions have improved the combustion efficiency of biomass fuels, thus far efforts have failed to keep up with population growth and urbanization. In recent years, some also have been questioning the effectiveness of improved cookstoves in delivering the benefits associated with them. For example, studies show that the most advanced models have been proven to be insufficient to meet health targets set by the World Health Organisation (WHO) for household air pollution (Lombardi et al., 2019). The environmental sustainability of ICSS is also questionable when considering the foreseen population growth and resource scarcity (Lombardi et al., 2019).

More recently, the government in Uganda has turned to LPG. However, this also has its limitations. First, LPG is not renewable and conflicts with the national long-term climate mitigation targets. Second, LPG is an imported fuel. Hence, not only does it cost the government its limited foreign currency but also it cannot guarantee a continuous supply. Alcohol fuels like ethanol could also potentially offer an alternative solution. However, despite the efforts to increase the supply, there is limited preparedness in terms of appliances and programs to promote this drive. Biogas is another alternative fuel. However, despite its long tenure in Uganda's cooking energy sector, adoption has remained low because of high upfront costs and poor after-sale service.

Electric cooking is not new in Uganda, however, supply constraints are a major hurdle to the household use of electricity (Rahut et al., 2017). Leary et al., (2021b) highlights that electric cooking is also hindered by perception

around taste, cost, safety, steep learning curve for new appliances, lack of awareness, availability of technology, and reluctant male decision makers to authorize purchase. Batchelor et al., (2019) points out that the main barriers to electric cooking are low access to electricity; high cost of bills from tariffs and weak grids. But this is not the case for Uganda. Currently, significant investment in generation capacity has doubled the total installed capacity from 600MW to 1,346.6 MW between 2010 and 2022. Uganda today produces an electricity surplus of almost double the current demand of 680 MW and is proactively seeking to boost demand, i.e., through use of electricity for cooking. This offers opportunity to leapfrog Uganda's energy development path hitched on biomass based cooking directly to electric cooking. Watson and Sauter (2008) posit that the leapfrogging approach would prevent developing countries from going through the same pollution intensive stages of development experienced by industrialised countries, as they might be able to embrace more sustainable low carbon approaches. The catch phrase "[e]lectricity was developed from continuous improvement of a candle", holds great promise for universal acceptance of electricity as a potential replacement for biomass. But access to electricity still does not equate to utilization and as Tesfamichael et al., (2020) note electricity is desired to the extent that it enables families to carry out socially desirable activities.

This paper contributes to the understanding of the status quo of the cooking energy sector in Uganda, challenges faced and also examines whether cooking with electricity stands a chance to capture the cooking energy market whilst identifying barriers and drivers for cooking with electricity.

2. A general outlook of Uganda's cooking energy sector

Of the 94% Ugandan households that primarily depend on biomass, 73% use firewood while 21% use charcoal for cooking, electricity (1.4%), kerosene (0.6%), and other sources including LPG, bio-fuels account for 3.9% (UBOS, 2021). There is a variety of cooking technologies used given the diversity of cultures whose cooking behaviour differs considerably as do the staple foods consumed in different parts of the country. For instance, for preparation of a millet or sorghum bread meal which is enjoyed by people in parts of Eastern, Northern and Southwestern Uganda, the three stone fire or a sturdy wood stove with a high fire power is commonly used for roasting simsim, sorghum and millet before milling; while cooking steamed and mashed banana (matooke) largely consumed in Central and Western Uganda is commonly done on a stove that preserves heat for long hours e.g. a ceramic lined charcoal stove. Stacking of cooking fuels and technologies is also a common practice in Ugandan households especially in urban areas.

With energy poverty defined as the absence sufficient choice in adequate, affordable, reliable, and safe energy services (Reddy, 2000), Uganda's over-reliance on traditional on biomass is an indicator of a country trapped in a tragedy of environmental degradation and its concomitant impacts related to health, gender and household expenditure (GIZ, 2014). Uganda suffers a degradation loss of USD 2.3 billion, of which 25% is wood fuels (National Planning Authority, 2020, p. 145). According to the National Environment Management Authority (NEMA), 2.6% of Uganda's forests are cut down annually for firewood, charcoal, agriculture, and to make way for population growth. If this trend persists, Uganda will lose all its forest cover in less than 25 years (NEMA, 2020).

Uganda's population is predominantly rural (73%); however, the proportion of population living in urban areas is increasing. The latest data from the Bureau of Statistics (UBOS, 2021) shows a two percent increase from 25% in 2016/17 to 27% in 2019/20 (UBOS 2021). Due to the increase in urbanization, the urban energy demand is increasingly growing with most of the urban households (86%) using biomass for cooking of which majority use charcoal (57%) compared to only 9% of households in rural areas. The per capita fuelwood and charcoal consumption is 240kg and 680kg per annum respectively and demand for charcoal is 1.5 million tons (MEMD, 2015). According to a report on Uganda Wood Asset and Forest Resources Accounts (UBOS, 2020), demand for wood is led by the high requirements for charcoal production. A combination of inefficient methods of charcoal production relying on the traditional earth mound kiln and inefficient traditional cooking appliances – three stone hearth and metallic charcoal - with low thermal efficiencies and saving ability, worsen the case for biomass use. The current charcoal market structure and value chain offer minimal incentive for the adoption of improved kilns, as frequently promoted, because charcoal operates under sub-optimal subsistence conditions that are less profitable than firewood production.

2.1 Sector Governance

Uganda's energy landscape that is abundant with renewable and non-renewable energy resources has created a multipolar cluster of fuel-based institutions formed on account of anticipated conventional fuel (charcoal and wood) scarcity and Uganda's rich portfolio of locally available alternative fuels. The local governance anatomy is tripolar; namely state, private sector and civil society organisations, and each of these categories comprises a cohort of institutions with either direct or indirect interest in the cooking energy sector. The Ministry of Energy and mineral Development (MEMD) is the government lead agency responsible for the management and development of the energy sector through coordinated national policy formulation, implementation, and monitoring. The mission of the Ministry is to create conditions for the provision of safe, reliable, efficient, cost effective and environmentally appropriate energy services to all sectors on a sustainable basis and thereby contribute to the economic growth of the country (REA, 2020).

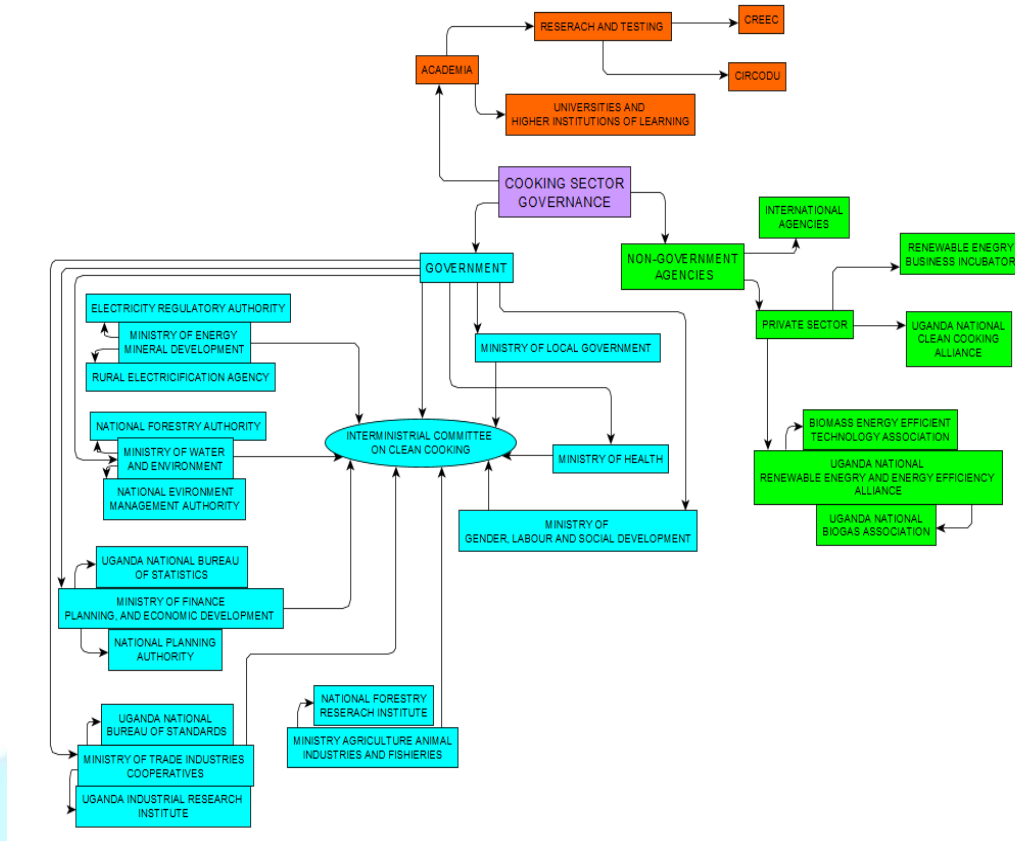
Although the MEMD plays a significant role in national energy governance, there are a multitude of issues beyond a single government ministry to manage in terms of policy, and implementation. Considering, energy is the mainstay of the economy, its anatomy forms a spider web with strands clang to non-state actors and other line ministries such as Ministry of Water and Environment - water and biomass resources management; Ministry of Agriculture Animal Industry and Fisheries – crops residues and animals waste; Ministry of Science, Technology and Innovation – technology innovation and knowledge transfer; Ministry of Finance Planning and Economic Development – setting national development priorities; Ministry of Education and Sport – knowledge transfer in energy related practices; Ministry of Gender, Labour and Social development – protection gender of undermined population in relation to energy access; Ministry of Local Government – decentralisation of energy programs; Ministry of Health – setting optimum occupational standards for an energy active setting. As a result of this wholeness, the inter-ministerial committee on energy was formed to ratify connections that energy has with other line ministries and develop a workable coordination mechanism to steer operations. Under the

above-mentioned ministries also lie a line of autonomous and semi-autonomous agencies with direct impact on Uganda's energy governance system. These include National Forestry Authority (NFA), National Environment Management Authority (NEMA), and National Forest Resources Research Institute (NAFORRI).

Uganda's cooking energy sector also rides on multilateral and bilateral market systems, as such, international organisations such as GIZ, Food and Agriculture Organization (FAO), United Nations Development Programme (UNDP), World Wide Fund for Nature (WWF), SNV Netherlands Development Organisation, World Bank group have a significant impact on dynamisms within Uganda's cooking energy sector.

Locally, the Uganda National Alliance for Clean Cooking (UNACC), an affiliate of CCA, was established to spear-head cooking interventions at national level. Formed in 2013 as a membership-based association to support efforts towards reduction of demand on biomass energy resources, UNACC provides a joint coordination framework for private and public actors in the Uganda cooking sector. However, UNACC establishment was abreast with indirect mandate of Uganda National Renewable Energy and Energy Efficiency Alliance (UNREEEA), an umbrella organization that consists of six member associations, honorary and associate members including Biomass Energy Efficient Technology Association (BEETA), Uganda National Biogas Alliance (UNBA). The primary role of UNREEEA is to avail a platform for consolidating the renewable energy and energy efficiency private sector as well as improving the business environment. Other UNREEEA members include the Hydro Power Association of Uganda (HPAU), Wind Power Association of Uganda (WPAU), Energy Efficiency Association of Uganda (EEAU) and Uganda Solar Energy Association (USEA); some of whom have overarching links to clean cooking mainly electricity production, an auxiliary and undermined cooking fuel.

Another key set of stakeholders in the cooking energy sector is the academia which includes higher institutions of learning and research and testing centres. These include the Centre for Research in Energy and Energy Conservation (CREEC) whose mandate is to enhance access to modern energy services; the Centre for Integrated Research and Community Development Uganda (CIRCUDO) whose vision is to attain a healthy environment and strong research capacity for sustainable community development. And lastly, Nyabyeya Forestry College which offers different courses related to forestry. All these provide testing services for the cooking energy sector albeit with varying capabilities. Below is an illustration of the governance structure of the cooking energy sector:



Source: CREEC 2022

As illustrated above, there is active participation from the different categories of stakeholders in Uganda’s cooking energy sector. However, the most significant gap has for long been the lack of connection between government, non-government, and academia as there was no shared platform to coordinate the efforts of these stakeholders. As a result, programs and policies in the sector have lacked coordination, harmony and consistency in the design of targets and strategies, resulting in lack of clarity, inconsistent decision making and reactive planning without prioritization (Twesigye, 2019). The third National Development Plan (NDP III) recognizes this lack of coherence as evidenced in the slow implementation of core projects under the former NDPs which undermined Uganda’s vision 2040 and SE4All Uganda target of increasing access to modern cooking solutions to more than 99% of the population by 2030.

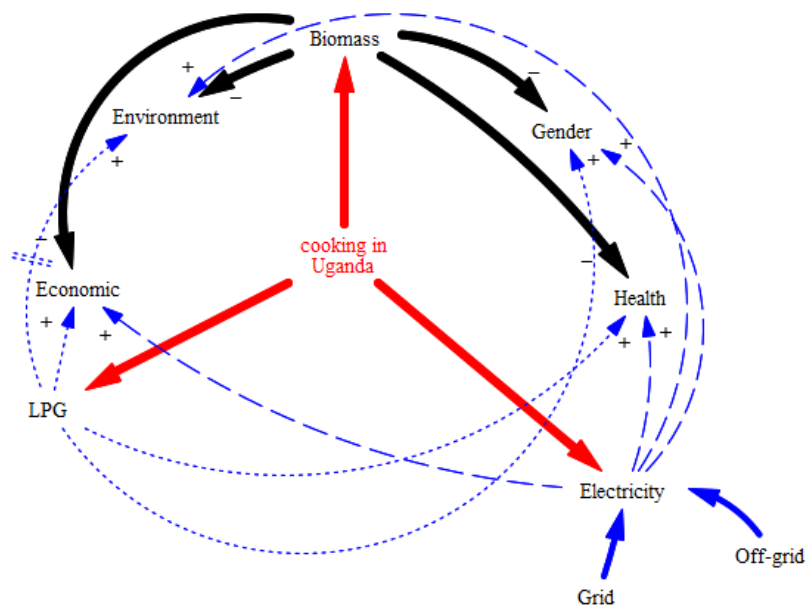
Cognisant of this critical need to strengthen sector coordination, the Ministry of Energy and Mineral Development (MEMD) very recently launched the “National Renewable Energy Platform” (NREP) which seeks to increase connectivity, linkages and a common goal approach among government, private sector, and development actors. NREP will bring together stakeholders and strategic partners oriented in renewable energy to generate, share and promote knowledge dissemination, enhance innovations in renewable energy so as to

solve common challenges and harness opportunities in the energy landscape. Comprised of the following key stakeholder groups; Government through Ministries, Department and Agencies (MDAs), Development Partners, Private Sector and Civil Societies, Academia, Research for development and communities of practice, Finance Institutions and Consumer Organisations; activities will be implemented under five technical working groups: Technology development and deployment; Training, research and communities of practice; Policy, standards, planning and quality assurance; Information and knowledge hub and lastly access to finance and refinance.

2.2 A systemic outlook on cooking fuels

Biomass persistence in Uganda’s cooking landscape is a systemic problem that requires a system outlook to decipher interconnections that exist between the conglomerates of matters in the cooking sector. It is well known that management of supply side issues alone cannot substantially postpone the continued consumption of biomass fuels. It is also noted that dynamic variables such as technology, cooking practices, food, taste, and fuels are sensitive to demand conditions. For instance, one would think that Government’s waiver of value added tax on cooking gas in 2020 would have resulted in increased demand for LPG, however, there has been no apparent change in demand. The current increasing fuel prices have aggravated the situation with increased LPG prices despite the tax waiver. We present a casual loop diagram to illustrate factors determining long supply and demand of biomass fuels in light of increased desire to switch to modern and clean cooking fuels.

Systemic Analysis of cooking in Uganda



Source: CREEC 2022

The causal loop diagram illustrates the dynamic behaviour of Uganda's cooking energy sector which illuminates a three-way race between biomass, liquid petroleum gas (LPG) and electricity. Nevertheless, biomass has remained in the spotlight, majorly because of its long tenure as the principle cooking energy fuel and preference concerns related to cost, taste, and availability. However, the future of biomass use is uncertain given its increasing scarcity and government regulations that are prioritizing modern clean energy. The author acknowledges health, gender, economic and environmental benefits that await consistent users of LPG and electricity using the positive sign and negative impacts of using biomass with the negative sign. The figure also denotes all three fuels are used interchangeably depending on the occasion or season. Additionally, it highlights that the three energy sources co-exist but LPG and electricity show great promise in terms of sustainability of supply. In the subsequent section, we further assess the potentials of cooking with electricity in Uganda.

3. Cooking with Electricity in Uganda; is it Possible?

Compared to other clean cooking and electrification technologies, eCooking is still at a relatively nascent stage. The third national development plan (NDP III), is cognizant of electric cooking as a path to reduction of biomass use and a strategy to increase demand for the surplus electricity (National Planning Authority, 2020). The draft national energy policy (2019) also mentions eCooking as a diversification mechanism to liberation of biomass-based cooking in Uganda. This section presents the barriers and drivers for cooking with electricity.

3.1 Potential drivers for cooking with electricity

Commitment by the government to climate change treaties under the green growth development strategy such as the Sustainable Development Goals and sustainable energy for all, makes energy one of Uganda's priorities in improving lives of its citizens (Fashina et al., 2018). Uganda's commitment to achieving SDG goals especially SDG 7 on affordable and clean energy and SDG 13 on climate change as well as SE4All target of universal access to modern cooking solutions by 2030 place pressure on Uganda to incorporate climate change mitigation and adaptation measures in the energy sector.

At national level, government has committed to change the status quo in the energy sector as envisioned in the different policies, plans and government workplans. With the ambitious Vision 2040 target of increasing electricity access to 80% by 2040, the government envisions expanding electricity generation by introduction of new electricity generation options such as peat and nuclear power. Currently, Uganda is producing surplus electricity with a total installed capacity of 1,346.6 MW in 2021 (ERA, 2022). This has triggered government initiatives geared towards increasing the demand for electricity especially at household level. For example, in December 2021, the Government through the Electricity Regulatory Authority (ERA) introduced a '[cooking tariff](#)' – a declining block tariff for domestic consumers to incentivize cooking with electricity. With the cooking tariff, consumers pay UGX 412 for each unit of electricity in the threshold of the 81st to 150th unit instead of the UGX 747.5 paid for each of the first 80 units of electricity. The lifeline tariff of UGX 250 for each of the first 15 units consumed in a month only applies to customers who consume less than 100 units in a month.

Uganda's third National Development Plan (NDPIII) for the period 2020/21 to 2024/25 incorporates an Energy Development Programme which seeks to reduce the share of biomass for cooking to 50%, increase electricity access, increase per capita electricity consumption and enhance grid reliability. The integration of electrification and clean cooking objectives into a single energy programme is a major step forward for modern cooking in Uganda. A key objective of the programme is promoting the uptake of alternative and efficient cooking technologies such as electric cooking, domestic and institutional biogas and LPG.

The Electricity Regulatory Authority, an independent regulator under the Ministry of Energy and Mineral Development has piloted a program entitled "charcoal to power project" aimed at switching from biomass to electricity for cooking with an overall goal of reducing carbon emissions through increased per capita consumption of electricity in Uganda. The project aims to transition 500 institutions (and eventually 50,000 households) to electric cooking. ERA in partnership with the United Nations Development Programme (UNDP), has already transitioned part of Mulago Hospital, the main national referral hospital, from biomass to electric cooking.

UMEME, Uganda's primary electric utility, in collaboration with ERA is piloting an electric cooking programme that seeks to change the perception around cooking with electricity and thus promote cooking with electricity. The Rural Electrification Agency (REA) has a plan to install over 600 mini grids and microgrids in 14 mapped out territories across the country in 10 years; this means more connectivity for households and businesses and as such an opportunity for integration of e-Cooking right at the design stage of these initiatives. The other advantage associated with mini grids is that it creates an atmosphere for enhanced reliability of supply at a lower cost in remote locations presenting an opportunity for households to have access to improved cooking services. The government through the Global Energy Transfer Feed in Tariff (GETFIT) program is leveraging investment in small scale renewable energy generation projects by private developers and with a total installed capacity of up to 170MW.

The government also has provision to offer financial credit for development of energy efficient technologies. Uganda Energy Credit Capitalization Company (UECCC), works with financial institutions such as Centenary Bank to avail financial opportunities for development of viable technologies. The government under Ministry of Energy and Mineral Development has designed annual energy campaign programs for awareness creation. This provides a vantage point for penetration of electric cooking appliances. For example, the energy week which attracts all categories of energy products and entrepreneurs. Besides MEMD, other stakeholders such as GIZ and UNDP have picked interest in ecooking and are seeking ways to build awareness and support the sector.

Manufacturing and supply capacities of Improved Cookstoves lag behind the magnitude of the potential market, policy targets and health challenges, and thus inviting need for alternative reliable and modern cooking solutions. This has opened windows for interventions such as introduction of e-cooking appliances. The LPG market is also set to grow with the government removing VAT on LPG and the discovery of oil. Though LPG is not a renewable option, it could serve as a transition fuel to encourage households move to cleaner and modern options hence opening up to innovative approaches such as bottled biogas for cooking.

While the quality of appliances on the market is still wanting, the government under the Uganda National Bureau of Standards (UNBS) is well positioned to develop certification and labelling guidelines for electric cooking appliances to ensure quality products on the market. UNBS is already aware of the increased interest in e-Cooking and is planning to initiate expert engagements for standard development on e-Cooking appliances.

3.2 Barriers to cooking with electricity

Leary et al.(2021b) observes that adoption of eCooking is limited by perceptions such as cost of the appliance and electricity. Whilst eCooking is not new in Uganda, most of the appliances available in the market (hotplate, electric oven) are inefficient and thus consume a lot of electricity. This is worsened by the relatively high cost of electricity that makes it hard for consumers to purchase appliances and also create a budget periodically for paying electricity bills.

Bad user experiences probably from use of imported counterfeit products and high energy intensive electric appliances has greatly impacted on adoption of electric appliances, eCooking inclusive. Uganda's free market space that is open to a wide range of technologies often suffers unfair competition from counterfeit products staged against legitimate products, given that consumers will most often purchase the cheaper counterfeit product as they are less informed or aware of what different price ranges mean from the efficiency and quality perspectives. This is aggravated by the lack of an elaborate certification and labelling standard for e-Cooking appliances.

Engendered decision making in households also has a great stake on the success of electric cooking programs in Uganda. Financial decisions are always made by the men, yet women are the renowned custodians of the kitchen. Therefore, delayed decision making by the men has great hindrance on early technology adoption.

Lack of market intelligence in Uganda's cooking energy sector. Often decisions are made from anecdotal information and as such technologies fail. For instance, despite the long tenure of improved cook stoves in Uganda's market, less than 15% of the population have enjoyed the associate benefits. The few that have access to modern cooking technologies are filled with great uncertainty, facilitating the common theory of fuel and stove stacking.

Availability bias for accessible appliances and fuel options. The most direct challenge facing clean cooking in Uganda is lack of an all-inclusive supply chain model, where clean cooking products are available or easily accessible to all users in urban, peri-urban and rural areas. Relatively clean and costly fuels are limited to urban centres, where there is guarantee of access. Distribution and supply chain issues hamper the development of a market for clean cookstoves and fuels in developing countries, and the difficulty of reaching rural residents who do not have access to retail stores in which to purchase or repair a clean cookstove can further complicate adoption rates. Weak supply chains have limited the exposure of consumers to more advance and state of the art technologies, thus choking demand growth resulting in market spoilage.

Insufficient political support which also limits financial, technical support and enabling conditions required to attract private investment needed to create a thriving market for clean cook stoves and fuels. There is weak collaboration between government and private sector in the drive to meet policy targets for efficient clean cooking technologies.

A lack of robust evidence on the impacts of interventions has also contributed to a shortage of commitments by governments and donors to secure the necessary investment, technology development and support for implementation.

Limited awareness among households regarding the benefits of clean cook stoves and fuels is another key barrier. This affects the purchase rates of cleaner cooking technologies but often more costly products, and raises the bar for new entrants wishing to sell clean cook stoves in sufficient quantities to be profitable. In addition, the available appliances in the market do not favor large family sizes that were largely dependent on traditional three stone fire and large pots.

Lack of favorable credit and financing options for clean cooking, makes it difficult for consumers to purchase upfront high-cost appliances. Stove marketing and distribution are limited to a few poorly capitalized distributors and therefore manufacturers bear the burden of inventory financing and securing working capital. Household poverty, lack of disposal income for purchase of efficient cooking appliances at the expense of more dire household development challenges

Lastly, though the installed capacity of electricity has greatly increased, the main challenge is evacuation. Transmission is challenged by losses, vandalism and dilapidated infrastructure, particularly eucalyptus poles used in transmission, low and unstable voltages which is a challenge to cooking with electricity due to unreliability.

4. Conclusion

Uganda's cooking energy sector demonstrates a liberal and receptive stand towards emerging technological advancements and subjective policy demands. For instance, the clean cook stove market is dominated by both local and imported products. Local stoves comprise of biomass burning stoves and imported stoves, and a mix of stoves that use biomass, ethanol, LPG, and electricity. Biomass dominance has been protracted by two assumptions; 1) guarantee of biomass fuel availability and 2) assurance of continuous technical improvement to achieve high thermal performance and low emissions. However, despite numerous attempts to improve the two key performance parameters of biomass stoves, it is evident that a peak has been reached, particularly in attempts to reduce emissions. Secondly, there is minimal empirical evidence to justify health benefits associated with biomass cook stoves. On the flip side, electric cooking from renewable sources offers transformative potential to reconcile where biomass-based cooking has lacked.

Past attempts to reduce biomass utilization were focused on its deleterious effects on health, gender and environment which was not successful given the continued usage. However, the new reality focuses on concerns over sustainability of supply stemming from competing needs and foreseeable scarcity of biomass resources

stimulated by population growth and urbanization. Currently, government development plans are more cognizant of electricity development, and the generation capacity has been boosted, however, the main limitation is that the demand is below the generation capacity. To reduce losses and leverage financial benefits the government will be forced to drive energy consumption.

A shift to low carbon energy can be of course costly in the face of other development requirements for emerging economies like Uganda, but the co-benefits that can be captured in this process could compensate the costs in the medium and long term (Bianco, 2017). Whereas the government is trying to increase access to and demand for electricity, the government is also motivated to drive events that drive its interests, and interventions such as modern energy cooking services in the form of e-cooking are likely to meet this need and gain government support.

5. Recommendations

5.1 Short term strategies

Coordination across sectors and institutions to take advantage of complementariness and provision of appropriate inputs to promote cooking with electricity to achieve maximum benefits and avoid duplication of efforts.

Increased awareness and dissemination of the benefits and the evidence of the potential of cooking with electricity to key decision makers in government, regulatory bodies, users, private sector, academia, funding bodies is vital for the sustained uptake of cooking with electricity. This will facilitate informed decision making of priority work areas for different stakeholders as well as influence user choices for cooking energy.

5.2 Medium term strategies

To curb the issue on quality of electric cooking appliances on the market, UNBS should fast track the standards and labelling development process for e-Cooking to control that quality of products sold on the market. The developed label should be widely communicated to users to enable them identify quality products when buying. Alongside standards development, the capacity of existing local testing centres should be enhanced to be able to assess the performance of e-Cooking appliances. Provision of innovative financing or targeted support to suppliers, users and institutions to increase interest in cooking with electricity, spurring behavioural change thus resulting in sustained adoption of modern energy service for a lifetime. Innovative business models could include; the pay-as-you-go (PAYG) model for users that allows for payments in instalments and has largely been successful with solar PV and home systems in Uganda and across Africa. EnerGrow, an innovative asset financing company based in Uganda aims to revolutionise communities by financing customers to unlock local productivity and increase energy demand. It provides asset finance for electrical appliances for small businesses to grow their businesses thus increase their income and their ability to pay for energy consumed.

Addressing issues around reliability for the electricity provided is key to ensure continued uptake. This requires a mindfulness of the rapid population growth in the urban areas which cause constraints on the existing grid infrastructure thus proper planning should be done and timely interventions done.

Addressing demand constraints at all stages of the electrification process is essential to raising uptake. Most households cannot afford connection charges and consumption tariffs because of lack of regular and adequate income. Households also face challenges related to inability to afford quality appliances. One possible solution for this would be to target and promote productive use of electricity to improve household income and as such improved livelihood and ability to pay for the energy used. The Utilities 2.0 Twaake pilot is a new integrated innovative pilot that seeks to deliver universal electrification in Uganda for half the cost, fraction of the time as grid-only. Funded by the Rockefeller Foundation and coordinated by Power for All with several partners including UMEME, the pilot intends to tackle energy access by using mini grids and increasing power consumption to ensure that connections translate to revenue. The project provides asset finance for electrical appliances for small businesses, and households thus electric cooking appliances fit well in the scope.

5.3 Long term strategy

Considering local manufacture is key for knowledge transfer, technical sustainability, and continued adoption of modern technologies. This is to also provide opportunity to different stakeholders along the supply chain of eCooking appliances.

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