Advancing Electric Cooking Transitions in Informal Settlements: Lessons from Kampala

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SPOTLIGHT KAMPALA

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Executive Summary

Overview

This report presents insights into conditions of electricity access in informal settlements in Kampala, Uganda, as they relate to efforts to increase uptake of electric cooking (e-cooking). Accelerating the uptake of e-cooking appliances like electric pressure cookers (EPCs) and induction stoves is a key strategic objective for government policymakers and development partners. Displacing charcoal with electricity for cooking uses can slow deforestation and reduce air pollution, while supporting the financial stability of the electricity sector. Aligned with these objectives, partners like the Modern Energy Cooking Services (MECS), ICLEI Africa, Umeme Limited, and the Ministry of Energy and Mineral Development (MEMD) have launched initiatives to introduce EPCs in Kampala. This report provides research-based evidence to understand how e-cooking initiatives can be most impactful for the majority of Kampala's population that live in low-income communities.

Following the findings in Spotlight Kampala's previous publication *Illuminating Energy Inequities in Informal Urban Communities: Main Findings Report*, it was evident that communities desire to use electricity for cooking but face multifaceted barriers to their regular use. With the support of MECS, Spotlight Kampala carried out additional research to understand barriers to e-cooking. Empirical evidence was collected using surveys, interviews, focus group discussions, electricity consumption monitoring, and wiring inspections. This report presents five key results related to current e-cooking habits, power supply quality, affordability, gender dynamics, and safety. In partnership with ACTogether Uganda and the National Slum Dwellers Federation of Uganda, its objective is to translate these findings into policy-actionable recommendations that can improve the wellbeing and livelihood of informal communities in Kampala.

Key findings

1. **Community members understand the benefits of e-cooking and want to cook with electricity, but need access to affordable, high-quality appliances**

   Many households in Kampala's informal settlements are eager to adopt e-cooking and have already integrated electric appliances to varying degrees. Electric kettles (58%) are the most commonly owned appliance, followed by hot plates, blenders, and cooking coils, while high-efficiency appliances like EPCs, and microwaves remain rare (≤5%). Awareness of EPCs is limited (41%). Among those that knew what an EPC was, perceived benefits included efficiency, cleanliness, and convenience. Despite strong demand, adoption is hindered by poor appliance quality and high upfront costs, as 95% of households purchase appliances outright with no access to financing options.

2. **The reliability and stability of electricity supply undermines e-cooking uptake**

   Frequent outages, voltage fluctuations, and sustained low voltages significantly hinder the uptake of e-cooking in informal communities. These barriers operate on two levels: firsthand experiences with unreliable supply undermine confidence in electricity as a cooking fuel source, and reinforce broader perceptions of unreliability which deter adoption even where power supply could support e-cooking. Monitoring data shows that voltage drops by around 10 V when e-cooking appliances are in use, further deteriorating already-low voltage supply levels. In addition to damaging certain appliances, sustained low voltages can extend cooking times with electric appliances and, in some cases, prevent them from turning on or functioning properly.

3. **Rising charcoal prices improve the economic case for fuel switching, but high electricity costs deter e-cooking adoption**

   Rising charcoal prices are strengthening the economic case for e-cooking. Households in informal communities already spend 9% of their monthly income on cooking fuels, which is primarily charcoal. Lower-income households often purchase charcoal daily in small quantities, paying a premium of up to 20%. While e-cooking, especially with efficient appliances like EPCs, can be cheaper than charcoal at current electricity tariffs, uptake remains limited. Electricity is relatively expensive in Uganda compared to neighboring countries, and affordability concerns are compounded by inflexible payment structures and poor efficiency of many electric appliances. Regardless of actual costs, there is a widespread perception that e-cooking is unaffordable, which remains a major barrier.

4. **Women are leading cooking energy transitions, but face gendered resistance to e-cooking adoption**

   Women play a central role in household energy use and are key drivers of e-cooking adoption, yet they often lack decision-making power over fuel choices. While women are responsible for preparing 86% of meals, social norms, household power dynamics, and financial constraints limit their ability to transition to e-cooking. Nearly a quarter (23%) of women reported needing household approval to purchase an e-cooking appliance, with 75% citing a male head of household as the decision-maker. Concerns over safety, cultural preferences for traditional cooking methods, and myths about electricity use further discourage adoption. Women entrepreneurs in the food sector also face barriers, balancing business needs with household responsibilities while navigating customer preferences for charcoal-cooked food.

5. **Electrical hazards undermine safe e-cooking adoption**

   Unsafe household wiring and lack of overcurrent protection pose serious risks for e-cooking in informal communities. Survey data revealed high levels of electrical injuries, with 5% of respondents knowing someone in their home or business who had been injured by electricity in the past month. Wiring inspections found that 35% of households lacked circuit breakers, 52% of tested sockets were not properly grounded, and 89% of wiring was damaged or bare. Undersized wiring is a particular concern where electrical circuits are shared among multiple households.

Priority actions to accelerate e-cooking adoption in informal communities

1. **Enable safe and fair meter sharing**

   Many households in informal settlements access electricity through shared meters, but existing payment schemes based on estimated consumption discourage e-cooking by incentivizing meter holders to restrict appliance use. Without mechanisms to measure and bill individual consumption, these limitations will persist. Regulatory guidelines for domestic meter sharing should be developed to define clear responsibilities for meter holders. Outreach efforts should encourage participation in the utility's current connection subsidy program. Affordable access to meters (or sub-meters) can help fairly allocate electricity costs and hence address a key barrier to e-cooking adoption. Additionally, off-grid solutions could provide an alternative for households that remain unable to secure metered or sub-metered connections.

2. **Domestic wiring improvements are key to safe e-cooking uptake**

   Without improvements to domestic wiring, the increased electrical load from appliances like EPCs could exacerbate fire hazards, shocks, and voltage instability. To ensure a safe transition, low-cost wiring inspections and upgrades should be integrated into e-cooking initiatives. Bundling EPC distribution with wiring improvements would enhance safety and build consumer confidence. Leveraging local electricians—through training, certification, and contracting for wiring assessments—can both address critical safety gaps and create economic opportunities.

3. **Sensitize communities on cooking health and safety risks**

   Damaged wiring and improper grounding pose significant safety hazards for e-cooking, yet many residents lack awareness of these risks. Community education initiatives should provide practical guidance on diagnosing wiring issues and improving household electrical safety, with a focus on targeting women, who are primary decision-makers in cooking but often lack control over energy choices. Additionally, public awareness campaigns—through workshops, EPC demonstrations, and blind taste tests—can help address widespread misconceptions about e-cooking, including concerns over food safety and taste.

4. **Address misconceptions about electric cooking costs and efficiency**

   Many households perceive e-cooking as too expensive, often due to limited understanding of appliance efficiency and the difficulty of comparing the relative cost of charcoal. Community sensitization efforts should demonstrate the cost-saving potential of high-efficiency appliances like EPCs, showing how they consume less energy while reducing cooking time and expenses. Hands-on demonstrations in local markets, schools, and community centers can provide tangible proof of these benefits, helping to shift perceptions. Additionally, teaching energy-efficient cooking practices—such as using the right cookware, optimizing cooking times, and leveraging retained heat—can further improve affordability and build confidence in e-cooking adoption.

5. **Expand flexible financing options**

   The lack of affordable financing options—including subsidies, installment payment plans, and credit schemes—is a major barrier to e-cooking adoption. Pay-as-you-go models, successfully used for solar energy, could help households purchase appliances incrementally. Community kitchens, where multiple households share appliance and electricity costs, offer another viable solution. Savings groups and microfinance institutions should be leveraged to provide targeted credit, while better targeting of the e-cooking tariff could ease financial burdens for low-income households.

6. **Support private sector innovation to develop solutions tailored to informal settlement contexts**

   E-cooking solutions must be adapted to the unique constraints of informal settlements, including affordability, security, and limited space. Off-grid solutions are of particular interest given the challenges with electricity supply. Private sector actors should develop modular, portable systems with pay-as-you-go payment options and include the functionality to support auxiliary uses like lighting, phone charging, and water heating. Partnerships with manufacturers can align product designs with community needs, while carbon financing and results-based finance schemes could help scale these solutions and attract private investment.

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Data Availability

Supporting data and resources are available on Harvard Dataverse at the following permanent link: https://doi.org/10.7910/DVN/SRNFEW. All resources are redacted to remove any personally identifiable information like GPS coordinates, names, or phone numbers. The names of the participating communities are also removed for their privacy and protection.

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1. Introduction

Within global efforts to achieve Sustainable Development Goal 7 "to ensure access to affordable, reliable, sustainable and modern energy for all," electricity access in urban areas has not been a sustained focus in recent years. Particularly in sub-Saharan Africa (SSA), experts tend to conflate the physical footprint of the grid with access to — and ability to benefit from — electricity [1]. However, inequitable access to infrastructure services like electricity is a fundamental feature of urbanization [2]. For a growing proportion of socioeconomically marginalized urban communities, like informal settlements and "slums", the available evidence shows that energy transitions are uneven and incomplete. In these communities, electricity use remains limited to basic services like lighting and charging, and carbon-intense biomass and fossil fuels meet the majority of household energy needs.

In informal communities, cooking is the most intensive daily use of energy. Yet, recent studies have shown that only 56% of all urban households in SSA cook with a "clean" fuel which includes electricity, biogas, natural gas, liquified petroleum gas (LPG), or solar [3], [4], [5]. In low-income communities, this proportion is likely much lower. Smoky, polluting fuel sources like charcoal and firewood are the main sources of cooking fuels for the majority of residents [6], [7], [8], [9], and are typically used with low-efficiency cookstoves that produce unsafe levels of household air pollution (HAP). Across SSA, HAP is estimated to cause around 700,000 premature deaths each year, making up 10% of all mortality [10]. In Kampala, Uganda, recent research has found an annual mortality rate of nearly 100 deaths per 100,000 people attributable to HAP and other forms of air pollution [11], [12]. Charcoal use is increasing deforestation in Uganda at alarming rates [13], [14]. The health and economic burdens of solid fuel use disproportionately fall to women, those with lower incomes, and less education, who also benefit little from production value chains [15], [16], [17].

Electric cooking (e-cooking) is emerging as a promising alternative to biomass and fossil fuel sources to address multiple developmental, social, and environmental challenges. E-cooking offers a pathway to reducing cooking-related carbon emissions, particularly in countries like Uganda where the majority of electricity is produced renewably through hydropower [18]. Also, unlike biomass, or to a lesser extent gas, electricity does not produce any localized air pollution at its point of consumption and does not contribute to HAP. For these reasons and others, there has been a push to commercialize e-cooking appliances like electric pressure cookers (EPCs) and induction stoves. These appliances are capable of cooking a wide variety of staple foods commonly consumed in SSA, such as beans, rice, and stews. They are designed to be highly energy-efficient, reducing both the time and energy required for cooking compared to biomass energy sources and resistive electric heating appliances like hot plates.

However, there are barriers preventing a transition to e-cooking from incumbent fuel sources in low-income urban settings. The cost of purchasing appliances like EPCs is a constraint for many would-be users, as is the ongoing cost of electricity. The cost tradeoff of switching to e-cooking may not be perceived as viable, especially to users who are accustomed to using low-efficiency appliances that consume large amounts of electricity. E-cooking also may not be seen as viable where power grids deliver unreliable electricity supply, or where regular voltage fluctuations may damage or make e-cooking appliances unusable for extended periods. Finally, social and cultural practices and beliefs are often a barrier to e-cooking uptake. Cooks may believe that certain dishes cannot or should not be cooked with electricity. These dynamics are also deeply gendered, and women — despite disproportionately bearing the health and time burdens of cooking — do not always have the decision-making power or financial autonomy to purchase appliances or transition cooking fuels.

Earlier research from Spotlight Kampala explored the role of cooking within the energy access landscape of 25 informal communities in Kampala, Uganda. This report extends and deepens this earlier analysis by focusing specifically on the use of energy for cooking. It provides a grounded understanding of cooking preferences, fuel choice tradeoffs, expenses and financial constraints, gender dynamics, and other factors that influence day-to-day decision making around cooking behaviors. Some questions that motivate the report's content are:

- Do people know about, use, and want to use electricity for cooking?
- What are the cost constraints and tradeoffs that e-cooking solutions must address?
- How much awareness is there of high-efficiency e-cooking?
- Are EPCs commercially available to these communities, and do the sales models meet community needs?
- How might womens' roles as cooks transform with e-cooking?

The purpose of this special report is to identify how e-cooking initiatives can most benefit people living in urban informal communities. This includes understanding how existing initiatives to promote e-cooking must be adapted to meet the needs of the marginalized communities that constitute a majority of urban citizens in Kampala and in SSA more broadly.

2. Background

2.1 International experiences with e-cooking in informal settlements

Informal settlements are currently home to the majority (over 60%) of SSA's urban population and constitute the fastest-growing urban population [19], [20]. Yet, despite the physical availability of grid infrastructure in most large metropolitan areas and an 81% urban electrification rate in SSA, an estimated 100 million urban dwellers live "under the grid" but lack an electricity connection [21], [22]. Even more troublingly, 64% of urban residents rely on dirty, polluting fuels which contribute to household and ambient air pollution and deforestation [3]. Reliable, continent-wide estimates of clean cooking rates in informal settlements do not currently exist. However, evidence from case studies in various cities has demonstrated that clean cooking solutions, particularly e-cooking, are slower to be taken up by low-income urban communities [7], [23].

Multiple initiatives have begun to elucidate and address barriers to e-cooking in informal settlements. Work in Nairobi, Kenya pointed to the widespread use of informal electricity connections and poor wiring conditions as risk factors for e-cooking uptake. They found that 86% of informally settled households had informal electricity connections, with around 40% of households improperly wired (e.g. missing ground) and posing safety risks for e-cooking [24], [25]. The accessibility, reliability, and stability of power supply were another challenge cited in several studies, especially given that many informal settlements are not (fully) electrified. Further, despite EPCs requiring 15 times less energy than charcoal, affordability remained a major barrier [26]. The upfront cost of high-efficiency electric appliances is prohibitive for many low-income households, who often prioritize lower-efficiency, low-cost options like hot plates [27]. Accessibility of appliance markets is also a concern as high-efficiency e-cooking appliances are generally not sold by local retailers. A lack of financing mechanisms further restricts access to e-cooking solutions [28].

Early efforts to promote e-cooking in informal settlements have shown promise but also underscore persistent challenges. Cooking diaries recorded the cooking activities of households in informal settlements in Nairobi as they transitioned their fuel use as part of an EPC pilot program. After EPCs were introduced, 70% of recorded cooking events used electricity. This study also highlighted the importance of *orodhas* (second-hand appliance markets) to supplying high-efficiency appliances to low-income communities at an affordable price. Finance is also a key nexus to accelerate e-cooking uptake. Work by ICLEI Africa and Energy 4 Impact has highlighted the need for catalytic capital, which can include philanthropic finance, climate adaptation funds, or carbon credits to complement public finance in supporting clean cooking initiatives [29]. Specifically, they point to the need for end-user financing options like pay-as-you-go or payment plans to overcome affordability barriers related to the upfront cost of appliance purchase [30].

2.2 E-cooking experience in the Uganda

In recent years, Uganda has made significant efforts to prepare the country for a transition to clean cooking, with e-cooking as a key focus. The National e-Cooking Strategy, developed by the Ministry of Energy and Mineral Development (MEMD) in conjunction with MECS, targets an increase from the current 1% to 18% e-cooking share by 2030 [31]. Progress has resulted from collaborative efforts from government entities such as MEMD and the Electricity Regulatory Authority (ERA), development partners such as MECS, GiZ-EnDev, and the Food and Agriculture Organization (FAO), the electricity distribution utility company Umeme Limited, research institutions such as Centre for Research in Energy and Energy Conservation (CREEC) and the Centre for Integrated Research & Community Development Uganda (CIRCODU), and many private sector players under the coordination of the Uganda National Alliance on Clean Cooking (UNACC), among others [32].

Initial efforts focused on feasibility studies, resulting in the publication of a Uganda eCookbook [33] and a market assessment report [34]. In addition, a EPC pilot project led by Umeme since 2023 has distributed 1,500 EPCs to users, with priority to its own staff, throughout Kampala [35]. This project aims to create awareness and then demand for e-cooking appliances, enabling further suppliers to enter the sector and grow their businesses, while also collecting crucial usage data and opinions on electricity costs to evaluate the e-cooking tariff [35]. The pilot has concluded as of publishing, and endline survey findings are expected soon. An e-cooking tariff was introduced in 2021 and was designed to signal to the population that electricity is a viable and cost-effective option for cooking [36]. The e-cooking tariff provides a discounted electricity rate for monthly consumption between 81 and 150 kilowatt-hours (kWh). However, the monthly consumption in informal settlements averaged between 20–30 kWh, precluding a large proportion of informal settlement dwellers from benefiting from this tariff [37].

At the 28th Conference of the Parties (COP) in December 2023, the Prime Minister of Uganda Hon Robinah Nabbanja described how Uganda is working to rapidly scale e-cooking [38]. Several results-based financing schemes are under implementation to further open up the Uganda market to e-cooking [39]. Further impetus was provided in May 2024, with a commitment of up to £5 million in financing to Uganda's clean cooking programme by the UK government, to support the acceleration of national supply chains and the establishment of a National Clean Cooking Unit at MEMD [31]. This financing is expected to avail over 10,000 efficient, affordable electric cooking appliances to homesteads, while also training technicians in e-cooking appliance repair, developing standards, piloting institutional e-cooking in 170 schools across the country, and supporting a National Behavioral Change e-cooking Campaign led by the National Renewable Energy Platform (NREP). However, without taking special consideration of the circumstances in which people in informal settlements find themselves, these communities will be left behind.

2.3 The need for a special report on e-cooking

Low-income urban communities are underrepresented among the diverse initiatives which have emerged to promote e-cooking transitions in SSA. The e-cooking tariff, as previously noted, *de facto* excludes informal households whose average consumption is well below the tariff threshold. The Umeme EPC pilot, as another example, provided EPCs mainly to Umeme staff who are likely to live in higher-income communities. While these programs are producing important learnings for Uganda's e-cooking sector, there is a need for initiatives that explicitly target the needs of the majority of Kampala's residents who live in informal communities. ICLEI and Energy 4 Impact have provided crucial leadership in this respect through their Enabling African Cities for Transformative Energy Access (ENACT) program. However, their clean cooking pilots have so far focused on a single informal community and must scale significantly to drive broader adoption across Kampala.

In 2021, Spotlight Kampala was formed as a participatory action initiative to explore barriers to energy access in partnership with 25 informal settlements in Kampala. Though clean cooking was not an explicit focus of early research activities, the need for a large-scale transition to cleaner and more convenient cooking fuels emerged as an urgent priority. In conversations, focus groups, interviews, and other interactions, community members expressed a desire to use more e-cooking appliances. Findings from the early phases of Spotlight Kampala's research highlighted several critical barriers to electricity access and, consequently, to the uptake of e-cooking. These included high tariffs and connection fees, unreliable and unstable power supply, and persistent misperceptions around affordability and appliance efficiency. The research also pointed to a heavy reliance on charcoal and firewood, driven by both affordability constraints and limited consumer awareness of available e-cooking solutions.

With financial and technical support from MECS, this special report aims to provide a comprehensive assessment of e-cooking opportunities and challenges in Kampala's informal settlements. Grounded in a mixed-methods approach, the report's findings are based on household surveys, interviews, focus groups, wiring inspections, and electricity consumption monitoring. It builds on Spotlight Kampala's research to explore the intersection of technical feasibility, user needs, and policy gaps, offering practical recommendations for expanding access to e-cooking. The report examines affordability and financial constraints, assessing household income patterns, willingness to pay, and potential financing mechanisms for appliance acquisition. It also addresses infrastructure challenges, particularly grid reliability, connection policies, and the feasibility of alternative solutions such as mini-grids or standalone solar-powered systems. Furthermore, the report investigates user perceptions and behavior, evaluating cooking habits, concerns over energy costs, and cultural preferences that influence fuel choices.

This special report is a necessary step to ensure that low-income urban communities are not left behind in Uganda's clean cooking transition. While e-cooking presents a promising pathway to reducing household air pollution, improving health outcomes, and mitigating deforestation, existing programs and policies have not adequately addressed the realities of informal settlements. Addressing cooking challenges in urban low-income areas will require further work in relation to subsidy targeting, improved grid reliability, and accessible financing models for appliances. Ultimately, a successful e-cooking transition in Kampala will require collaboration between communities, utilities, policymakers, researchers, and the private sector to develop inclusive solutions that work for all households. Without such efforts, the benefits of e-cooking will remain out of reach for the majority of urban residents and undermine the promise of a just and sustainable energy transition.

3. Methods

The following sections provide an overview of the research methods, which include the following five activities:

1. **Focus group discussions** in five communities
2. **Surveys** of 100 households and businesses across five communities
3. **Interviews** of 17 community members and expert stakeholders
4. **Consumption monitoring** of electricity usage for cooking purposes for 53 households across 10 communities
5. **Wiring inspections** of 100 households across five communities

We direct readers interested in the process of selecting, engaging, and facilitating the work in partnership with community leadership and advocates to Spotlight Kampala's *Main Findings Report*. Research tools, including survey templates, interview questionnaires, etc. are available for download in an online repository. De-identified data will be uploaded following the conclusion of academic publishing processes, and can be requested from the authors.

3.1 Focus group discussions

The research began with five focus group discussions (FGD) held between late January through the first week of February 2023. FGDs consisted of 8-12 participants each, with women making up approximately 80% of the group. This composition was deliberate to prioritize women, as they are primarily responsible for cooking in these contexts. FGDs were semi-structured using a questionnaire. Topics of discussion included cooking habits (e.g. describe a typical day of cooking), cooking practices related to non-electric and electric appliances, fuel source preferences, perceptions and aspirations around e-cooking, safety and capacity of domestic wiring, and electric appliance costs and financing options. FGD participants were also asked whether they are familiar with EPCs and had the opportunity to ask questions and express opinions about EPC uses, functionality, and costs.

Each FGD lasted between 45 and 90 minutes and were held in a location chosen by community leaders. Conversations were recorded and later transcribed. Participants provided written consent and were compensated 20,000 UGX for sharing their time and experience.

Photo 1. A women's focus group discussion hosted a community-based AID/HIV support NGO where participants discussed their preferences, constraints, and decision-making around everyday fuel use for cooking. Photo by Jess Kersey. Photo taken with consent of those featured.

3.2 Surveys

From March 13–8, 2023, 20 surveys were conducted across five participating communities for 100 total responses. The pilot survey of 20 respondents performed well, and these responses are included in the sample for a total of 120. A team of five experienced enumerators from the National Slum Dwellers Federation of Uganda (NSDFU) performed the enumeration following one day of training, hosted at Makerere University, and two days of practice enumeration. Participants were required to be over 18 years old, to represent a household or co-located household and business, and to have electricity at the time of the survey. Surveys were conducted on tablets using KoboToolbox software. The survey had nine separate sections whose contents are described in **Table 1**.

To ensure that the survey respondents were geographically dispersed, the geospatial boundary of each community was divided into five equal areas. Each enumerator was randomly assigned to one area. The assigned areas were downloaded onto each enumerator's tablet through the Google Earth mobile application. During surveying, each enumerator could see their own GPS location relative to their enumeration boundary, and as such could space their surveys randomly across their enumeration area. Each survey took on average 35 minutes to complete. Each respondent provided written consent and were compensated 10,000 UGX for their participation.

Table 1. e-Cooking survey sections and description of questions.

No.	Section name	Description
1	Demographics and decision-making	Captures a full household roster (including age, gender, and relationship to head of household), time of residence in community, whether they rent or own. The roster captures how much income each family member contributes to the household budget, and which members are responsible for decision-making, managing expenses, and cooking.
2	Income and expenditure prioritization	Determines the monthly household income, with disaggregated expenditure data on categories like airtime and data, school fees, energy, transportation, food, rent, etc.
3	Connection type	Records how the respondent is connected to the electricity grid, whether they have a prepaid meter, whether the meter is shared, and who electricity bills are paid to.
4	Cooking behaviors	For each meal that the household prepares at least once a week, documents who from the household prepares and eats the meal, and the foods that are most often prepared.
5	Cookstove and appliance use	Captures which cooking appliances (e.g. *sigiri*, hot plate) are used to prepare foods, disaggregated by meal.
6	Cooking fuel preferences	Captures habits and preferences around daily cooking fuel selection, including questions on why certain fuels are or are not preferred.
7	Perceptions of EPCs	Asks about the respondent's knowledge of EPCs, and their perceptions around the benefits, challenges, and risks of their use. Includes questions on perceived affordable price for EPCs.
8	Appliance decision-making	Inquires about inter and intra-household dynamics related decision-making around appliance use. Asks whether people within the household, or the electricity supplier, would be against buying or using a new appliance, and if so, why.
9	Appliance purchases	Captures information on where households normally buy appliances, what they look for when they purchase, and how they normally finance purchases.

3.3 Interviews

Interviews specific to e-cooking challenges were conducted with 16 community members and one expert stakeholder between April 10 and 19, 2024. Interviewees are shown in **Table 2**. These are in addition to 66 interviews completed as part of Spotlight Kampala's original data collection [7]. A purposive sampling approach was employed to select interview participants for this study. The research team spoke with community members engaged in a wide range of activities along the cooking supply chain, including appliance repair people, restaurant owners, and financial service providers. The interview questionnaire sought to understand their lived experiences as they relate to cooking habits, cooking fuel choices, e-cooking perceptions, and appliance costs and financing.

Table 2. Interview participants by type and affiliation.

Type	Number of interviews	Stakeholders represented
Electricity intermediaries	5	Landlords *Kamyufus*
Household users	6	Renters Homeowners
Business users	2	Restaurant owners
Financiers	1	Microfinance institution
Appliance suppliers	2	Appliance sales people Appliance repair people
International aid	1	GIZ ENDEV

Each interview took from 15 to 90 minutes to complete and were conducted in a location chosen by the participant. Non-expert interviewees provided written consent and were compensated 20,000 UGX for their participation.

3.4 Consumption monitoring

Remote electricity consumption monitors were deployed across 53 participants in 10 informal communities between March 30 and June 26, 2023 to measure e-cooking appliance energy consumption. Of these, 25 smart sensors were provided by the Access to Energy Institute (A2EI). These sensors provided voltage, current, and power measurements at one-minute intervals with data transferred to a server in real time [40]. An additional 28 consumption monitors manufactured by Kosko were provided by the Electricity Growth and Use in Developing Economies (e-GUIDE) initiative. The Kosko sensors provide voltage, current, and power readings 15-minute intervals, and additional measurements each time the measured device is turned on or off. For Kosko sensors, data is stored locally on the device and downloaded at the end of the monitoring period.

Photo 2. An A2EI sensor is placed between an outlet and a resistive cooking coil in a participant's home. Photo by Paul Kyoma.

Candidate participants were identified by a community guide appointed by local council leaders. The only requirement for selection was owning an e-cooking appliance that was used regularly. **Appendix A** shows a detailed breakdown of consumption monitoring participants by installation and deinstallation date and appliance(s) monitoring. Each participant provided written consent. Households hosting the monitors were compensated 10,000 UGX and received an extension cable for their participation.

3.5 Wiring inspections

From March 11–21, wiring inspections were conducted in five communities. In each, 20 participants were selected via a random walk sampling method, with the only criterion being an existing electricity connection. The inspections involved visual assessments of various electrical components (see **Table 3**) and wiring standards, testing socket functionality (**Photo 3**), and short questions about electricity-related incidents, including appliance damage, electric shocks, and electrocutions, reported in the past month. Photo evidence of the inspected components was collected for documentation. To ensure data authenticity, qualified electricians carried out the inspections and data collection.

Table 3. Wiring inspection sections and description of questions.

No.	Section name	Description
1	Safety and appliance damage	Records the number of rooms in the structure, the frequency and types of appliances damaged by electricity, and the occurrence of safety incidents (e.g. electrocution).
2	Meter boxes	Records whether an electrical meter box[1] is present and, if accessible, its condition. Also records the capacity of circuit breakers within the meter box.
3	Breaker panels	Documents the presence of an electrical breaker panel within the respondent's premises. If present and accessible, the inspection also records the location (indoors or outdoors) and the number and ratings of circuit breakers.
4	Conductors	Records the gauges and condition of any visible wiring within the structure being inspected.
5	Sockets	Captures the number of sockets in the structure. For sockets that are accessible, records their location and condition (e.g. tight-fitting cover, exposed wiring, burn damage). If safe to do so, an electrical outlet tester is used to verify whether the socket is properly grounded and if hot and neutral wires are connected to the correct terminals.
6	Extension cords	Documents whether extension cords are being used as permanent wiring. Captures their number and condition.

Participants were randomly selected during a community walkthrough with a local guide. All participants provided written consent and were compensated 10,000 UGX. Results were informally shared with participants during the wiring inspection.

Photo 3. An electrical socket tester in use during wiring inspections. Photo by Paul Kyoma.

[1] The meter box refers to the enclosure for the utility's service line protection equipment. In Kampala the meter box is most often a metal enclosure which previously contained a post-paid meter. In a regular connection, the meter box houses a 63 A circuit breaker installed by the utility as a protection for the service drop.

3.6 Consent and ethical review

This research is approved by the Institutional Review Board of the University of California, Berkeley under protocol 2022-07-15500 and the AIDS Support Organization under reference number TASO-2022-141. It is also registered with the Uganda National Council for Science and Technology under registration number SS1437ES. Prior to participating in the research, all human subjects received information on the risks, benefits and voluntary nature of their participation. They then provided written consent in the language of their choice (Luganda or English).

4. Findings

Cooking is typically the most energy-intensive and costly activity in informal households and businesses. Initial study findings revealed that 95% of residents in informal settlements were connected to the grid [7]. Despite this widespread electricity access, charcoal remains the primary cooking fuel among residents of informal communities. However, households own a diverse array of appliances and fuel sources, including a relatively high degree of electric cooking as shown in **Figure 1**. Overall, 62% of 120 survey respondents reported cooking with electricity at least once a week. Respondents also report that an electric appliance is available to be used for a third (28%) of meals cooked. However, in practice, decision-making often leads households to rely on charcoal, meaning that the actual rates of e-cooking, as measured by energy consumption, are likely much lower. The contrast underscores the continued reliance on charcoal while also highlighting the prevalence of fuel stacking, including e-cooking, to meet diverse cooking needs.

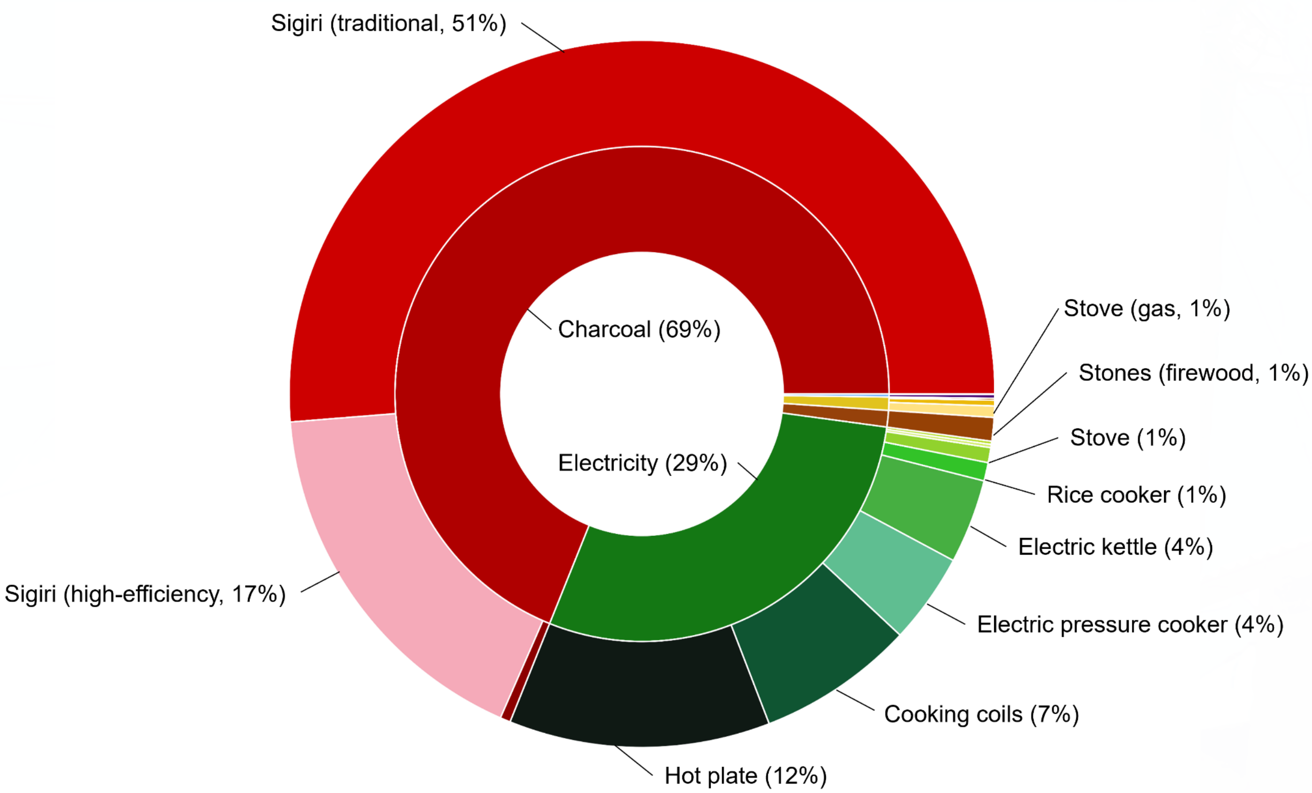

Figure 1. Distribution of appliance availability by fuel source, based on 45 survey responses listing all appliances used at least once per week for cooking specific meals and foods. This differs from preferred fuel data as it captures secondary appliance choices, which are not always the preferred or primary options. Real-life usage patterns favor charcoal-based appliances in day-to-day decision-making. Based on survey data (n=120).

As **Figure 2** demonstrates, rates of e-cooking are dependent on how a household or business is connected to the electricity grid. Households and businesses with a formal electricity connection, who do not share an electricity meter (*individual metered*), report the highest availability of e-cooking appliances at 45%.[2] Users with a formal electricity connection that is shared among multiple users (*collective metered*) have remarkably lower levels of e-cooking, despite making up the largest share (42%) of households and businesses in informal communities. Finally, users that share a direct, unmetered connection to the grid (*collective unmetered*) reported that an electric appliance is available only around 20% of the time they cook. This is despite not being billed on a per kWh basis.

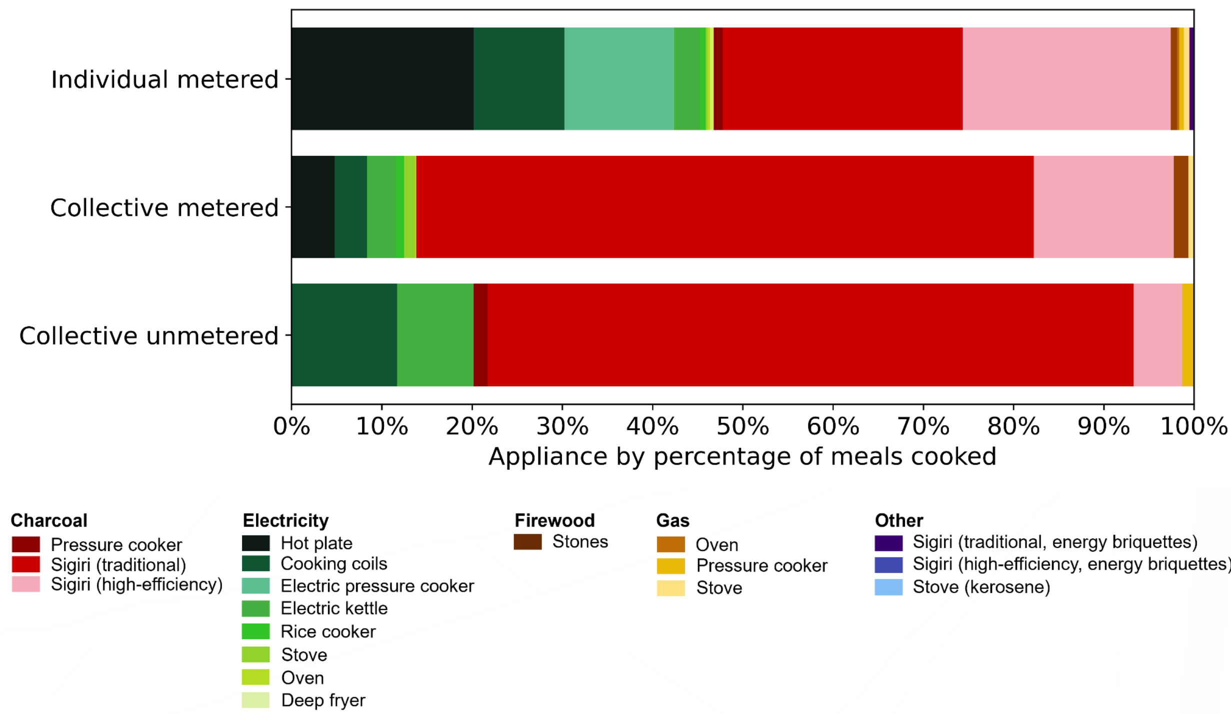

Figure 2. Frequency of appliance use by connection type. Based on survey data (n=120).

These findings show a clear correlation between e-cooking uptake and income. Earlier research from Spotlight Kampala linked connection types to socioeconomic status, showing that individual metered users earned the highest incomes, had higher rates of home ownership, and had on average lived in the community longer [41]. This user group has more financial resources to purchase e-cooking appliances and can afford to regularly use them, which is reflected in their relatively high levels of e-cooking. Collective unmetered users, who are the lowest-income user group, are more likely to rely on charcoal and traditional cookstoves.

These statistics also reflect the struggles that many people who share meters or who negotiate access through intermediaries face in using e-cooking appliances. Users whose usage and payments are managed by a landlord, for example, may not have the autonomy to use electricity in the way they wish. Collective metered users, for example, are often restricted from using certain appliances per the terms of their rental agreement. Collective unmetered users,

[2] We note again that this figure represents the appliances available (not necessarily used) to cook a specific meal. Real-life rates of e-cooking rates measured on an energetic basis are likely much lower because households are more likely to opt for a biomass source.

though they pay for electricity as a monthly flat rate instead of per-kWh basis, face similar restrictions. As the findings in the following sections will highlight, e-cooking appliances are commonly restricted because of their high power demand.

Charcoal was much more likely to be used for heavier, more energy dense foods. **Figure 3** shows the breakdown of cooking appliances and fuel sources used for each meal reported by survey respondents. For foods like posho (maize flour dough) and matooke (steamed green banana) there was virtually no e-cooking. In contrast, e-cooking levels were remarkably high for meals where convenience is a priority. Over half of all water boiling for tea and coffee is already electric. Snacks are commonly prepared with electricity, as well as some lunch and dinner foods that are lower in energy intensity like beef and chicken. In terms of the mix of e-cooking appliances used, hot plates, cooking coils, and electric kettles are the most used. **Photos 4–5** shows typical hot plates and cooking coils from survey respondents' kitchens.

Cooking is more than just a daily routine — it is shaped by economic constraints, infrastructure challenges, and deeply ingrained cultural norms, beliefs, and practices. While traditional cooking fuels such as charcoal remain dominant in many developing regions, there is a growing discourse on transitioning to electric cooking as a cleaner, safer, and more efficient option, particularly in urban areas. In our focus on electric cooking in Kampala's urban informal communities, we explored communities' cooking habits, particularly on the interplay between electric and non-electric cooking and the challenges households encounter in adopting modern cooking technologies.

The following chapters provide an in-depth analysis of fuel choices, affordability, and household perceptions to highlight the complexities of transitioning to e-cooking solutions in low-income urban areas of Kampala. **Section 4.1** discusses community members' desire to adopt e-cooking, but highlights barriers related to appliance affordability and quality. **Section 4.2** examines how unreliable electricity supply, including outages and voltage fluctuations, limits the feasibility of e-cooking. **Section 4.3** highlights how rising charcoal prices improve the economic case for e-cooking, but high electricity costs and perceptions of affordability remain major barriers. **Section 4.4** explores how women drive cooking energy transitions yet face gendered constraints and burdens that restrict their decision-making ability. **Section 4.5** concludes by detailing how poor wiring and electrical hazards undermine the safe adoption of e-cooking, increasing risks of shocks, fires, and appliance failures.

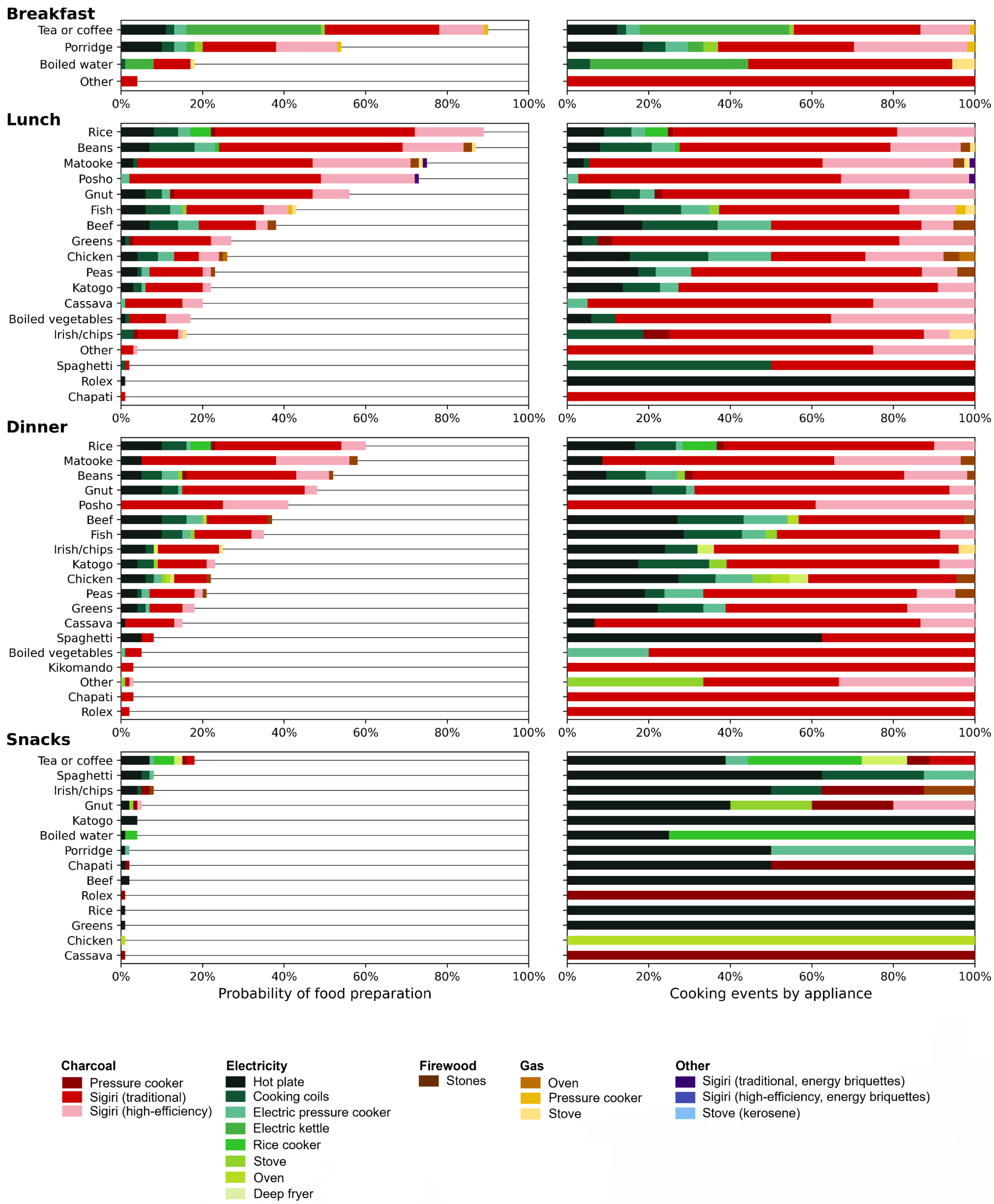

Figure 3. Results showing how frequently foods are cooked for each meal (breakfast, lunch, dinner, or snacks) weighted by the number of times each meal is prepared per week. The plots on the right show the availability of various cooking appliances for each food and meal. Based on survey data (n=120).

 

Photo 4–5. Examples of a hot plate (left) and cooking coils (right) in use in the homes of research participants. Photos by Paul Kyoma (left) and Judith Mbabazi (right).

4.1 Community members understand the benefits of e-cooking and want to cook with electricity, but need access to affordable, high-quality appliances

Unlike rural areas where the grid is absent and there is limited exposure to electric appliances, residents of urban informal settlements in Kampala are increasingly knowledgeable of and eager to adopt e-cooking. Many households have incrementally incorporated e-cooking in diverse ways in small ways and aspire to own more electric appliances.

During our surveys and interviews, we asked community members whether they used electricity for cooking, which appliances they owned, and which ones they wished to have. **Figure 4** shows that electric kettles (known locally as percolators) are the most widely used appliance, particularly for boiling water and making tea, with 58% of households owning one. There is also a relatively high use of hot plates, blenders, and cooking coils, especially among young demographics like university students and roadside food vendors. However**,** appliances like EPCs, microwaves, and ovens were much less common, with less than 5% of respondents reporting owning these appliances.

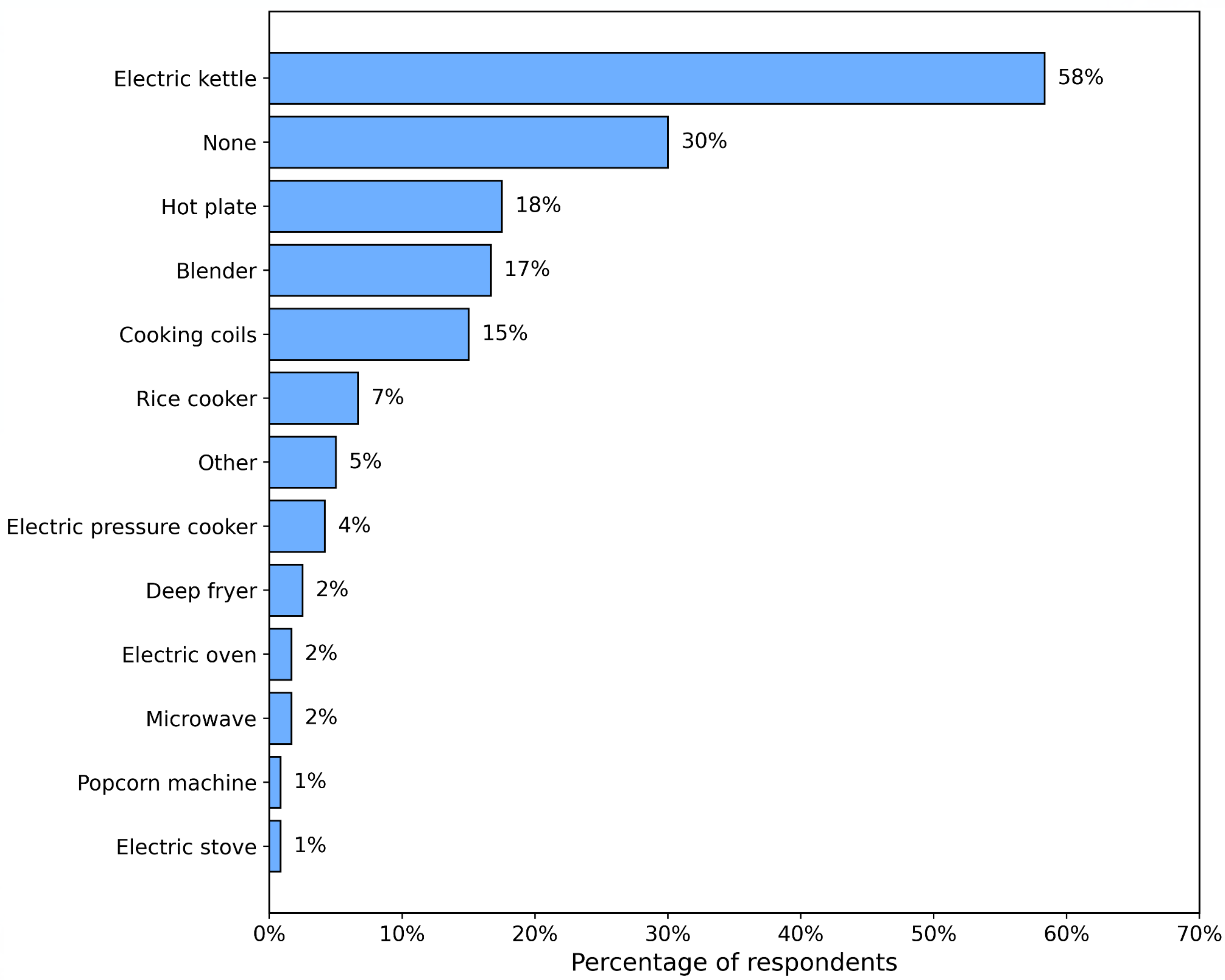

Figure 4. Electric appliance ownership rates from survey (n=120).

When assessing awareness of high-efficiency e-cooking appliances — EPCs specifically — only 41% of respondents recognized an EPC by name or by photo (**Figure 5**). Among those familiar with it, 48% cited time efficiency as its main advantage (**Figure 6**). Respondents also cited cleanliness and convenience as important benefits of e-cooking. In focus group discussions, community members conveyed a strong awareness of the health hazards stemming from exposure to charcoal smoke and indoor pollution: "*Some types of charcoal produce so much smoke that you end up getting flu just from cooking," "Charcoal dust gets into our noses, and over time, it can cause health problems. When lighting stoves, we burn plastic, which is dangerous to inhale.*" In terms of challenges, nearly half (45%) of respondents cited affordability of the appliance's upfront cost and perceived high electricity consumption as a barrier to EPC use. Wiring quality and safety are additional challenges that are explored later in the report.

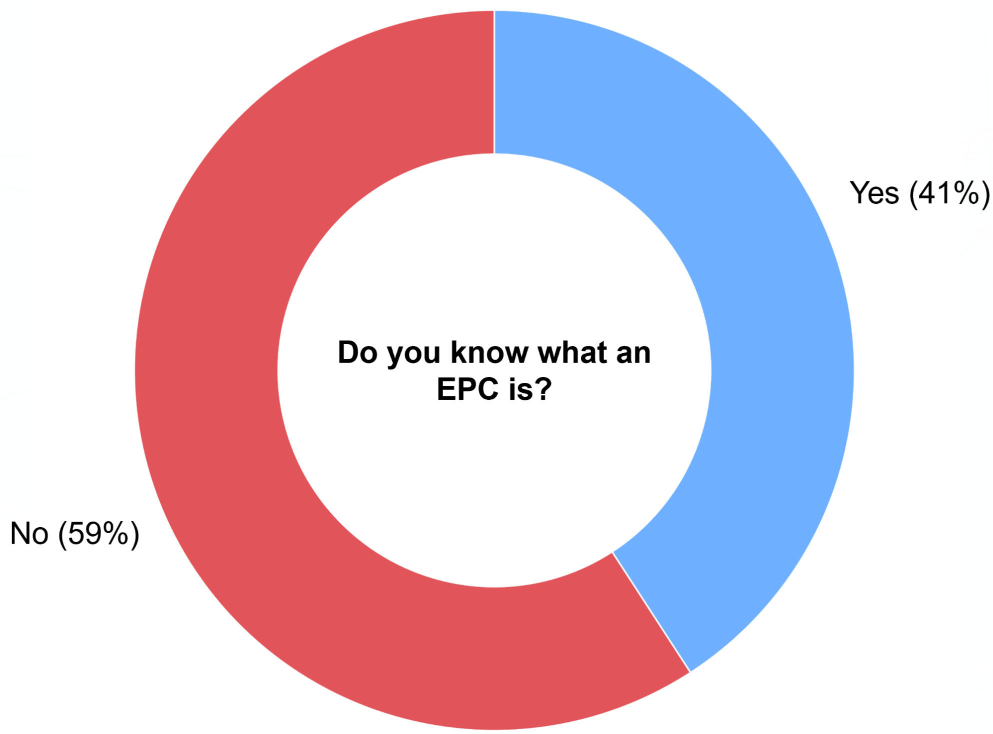

Figure 5. Responses to survey question gauging awareness of EPCs. Based on survey data (n=120).

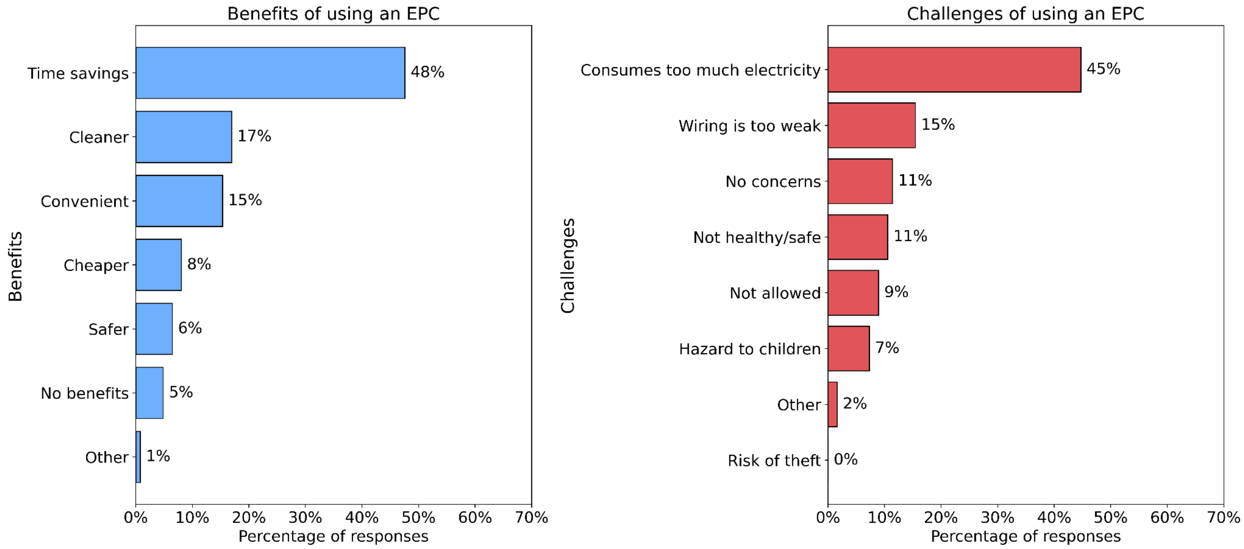

Figure 6. Response to survey questions "What do you see as the benefits of using an electric pressure cooker?" (left) and "What concerns do you have about owning or using an electric pressure cooker?" (right). Based on survey data (n=86).

We also examined how residents acquire electric cooking appliances and the factors they prioritize in their purchasing decisions. The majority (78%) reported buying their appliances new rather than secondhand, with supermarkets and large, reputable department stores being the most common purchase locations (**Figure 7**). Local markets, appliance hawkers, and local repairmen were secondary sources. The preference for supermarkets is likely due to the belief that appliances bought there are of higher quality. Indeed, 81% of survey respondents cited quality as their top priority when purchasing new appliances. While appliances are readily available, many are of poor quality and prone to breakdowns, especially when subjected to the fluctuating voltages common in informal settlements. As one focus group discussion participant put it, "*the appliances are available even within our neighborhood, but they are often of poor quality. With frequent voltage fluctuations causing damage, it becomes frustrating."*

Another constraint is the high upfront cost of appliances like EPCs and the lack of options for appliance financing. Many residents would like to embrace e-cooking but struggle with affordability because appliances must be purchased upfront and in full. Nearly all (95%) of survey respondents reported purchasing appliances outright with personal savings (or funds borrowed from family and friends). When asked about appliance financing options, respondents indicated that they did not consider any of the existing credit schemes a viable option. Some cited lack of collateral as a key reason, while others pointed to the high interest rates associated with potential financing options. As one shop manager explained, "*It's hard to trust customers from informal communities because they can easily relocate. Without a permanent address or collateral, we can't offer loans on appliances. Instead, we allow them to make partial payments, but they can only take the appliance once they've fully paid for it.*"

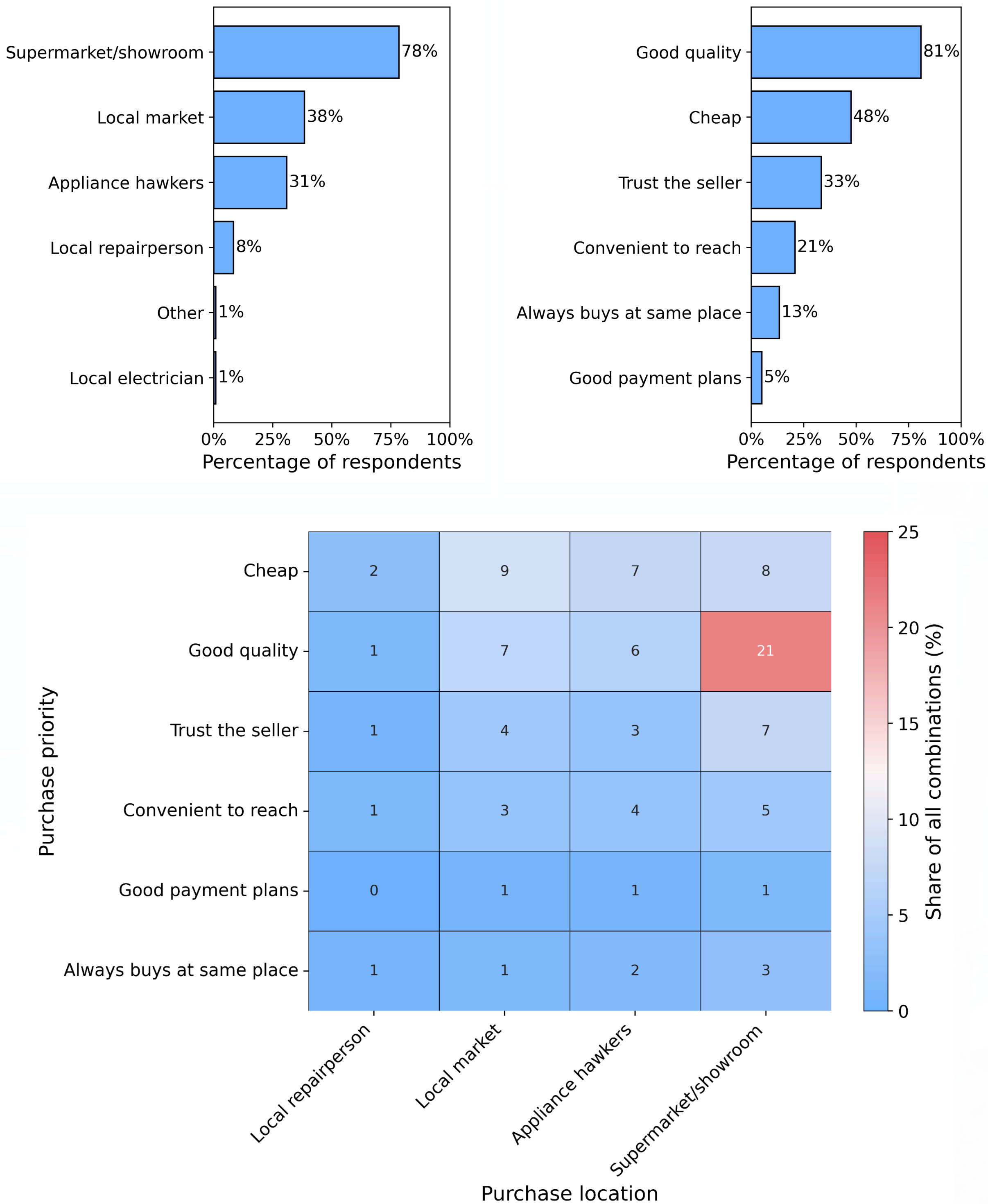

Figure 7. Distribution of responses to a survey question asking where households most commonly purchase electric appliances (top left). Distribution of responses to a survey question asking "What do you prioritize when you decide where to buy an appliance?" (top right). Distribution of appliance purchase priorities by location, shown as a heatmap of the share of all reported combinations across respondents (bottom). Based on survey data (n=120).

4.2 The reliability and stability of electricity supply undermines e-cooking uptake

Across multiple of our methods, respondents made it clear that unstable or unreliable electricity supply is a limiting factor for e-cooking uptake. **Figure 8** shows the results of a survey question posed to respondents who participated in our remote monitoring study, asking them to cite the factor(s) that impact their ability to cook with electricity. Affordability was the top-cited barrier with 49% of responses. Affordability is discussed in detail in **Section 4.3**. Following affordability, 31% of people cited outages as a determinant of their ability to cook frequently with electricity. This is supported by responses from the larger survey, where when asked what they disliked about cooking with electricity people wrote in answers like "*power is always off and on*" and "*[electricity] can go off while cooking.*"

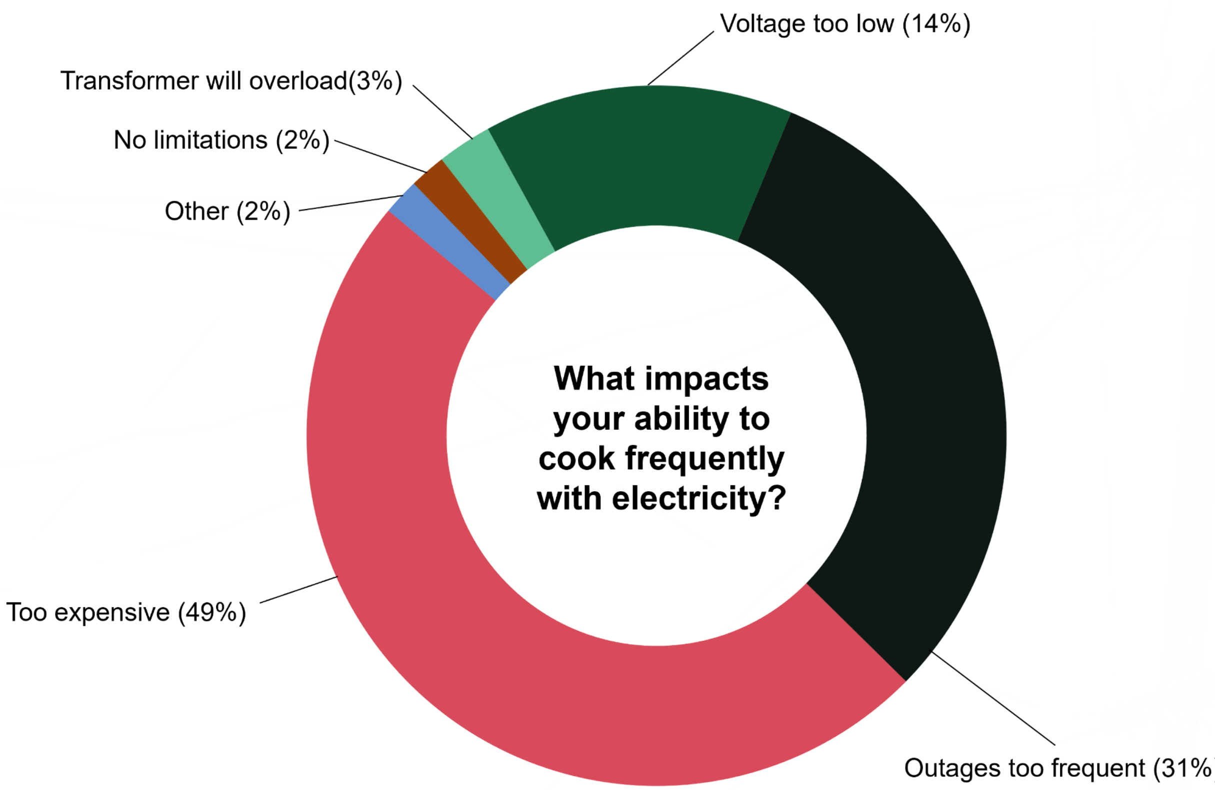

Figure 8. Responses to an intake survey administered to consumption monitoring participants (n=88). This figure excludes responses citing affordability, which were 48% of the original response count.

Figure 9 visualizes the distribution of outage times versus the nearly 9,000 unique cooking events observed by our consumption monitors. The cooking event distribution shows the start hours in cooking events began, and includes electrical appliances like kettles (percolators), hot plates, and cooking coils. There is a peak in the early morning between 5 and 7 am, likely driven by electric kettles used to heat water for tea, porridge, and bathing. There is sustained cooking throughout the middle of the day as larger meals are being prepared and in the evening to prepare or reheat food for dinner. Outages, which were measured in previous Spotlight Kampala activities using remote power quality sensors, are distributed throughout the day with peaks around midday and evening. There is some coincidence of outages with peak cooking hours, especially in the evening. This seems to validate the observations of interviewees and focus group participants, who expressed frustration around the power going out and having to switch to alternative fuel sources mid-meal. Interestingly, outages tend to peak at midday when meals are not as frequently prepared. However, it is also likely that this data is also capturing some dynamics of avoidance, where households decide not to cook with electricity at times they know outages are likely.

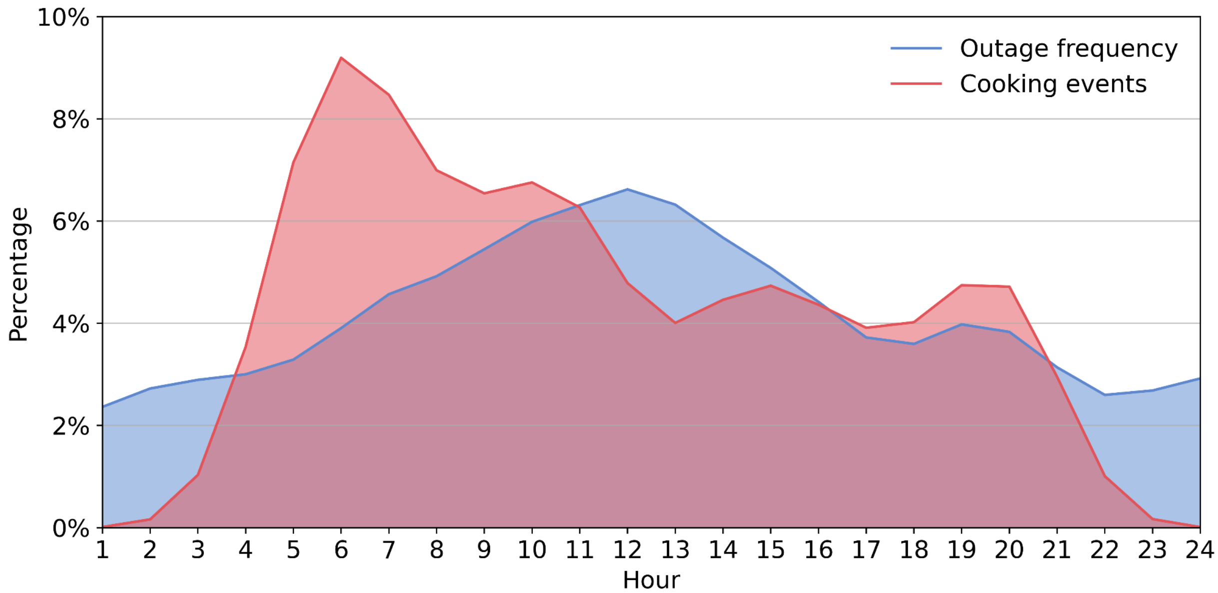

Figure 9. Distribution of outages vs. cooking event start time by hour of day. Outage start times are based on remote power quality monitoring with sensors from nline.io (n = 146 participants for 60 days), collected during previous phases of Spotlight Kampala research. Distribution of e-cooking events start hours is from consumption monitoring participants (n=8,869 cooking events across 53 participants for 60 days).

"*Sometimes there are shocks, and if power goes off you have to suffer, there's no cooking.*" — Renter

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Voltage fluctuations and extended periods of low voltage (brownouts) are also a barrier to using electric appliances. Based on our measurements, 35% of cooking events occurred with starting voltages outside the ±6% of 240 V threshold established by the Electricity Regulatory Authority [42]. **Figure 10** shows the average voltage measured across consumption monitors each hour, based on whether the e-cooking appliance is on or off. It shows a large drop in voltage when e-cooking appliances are in use. On average, households experience a voltage drop of 7.3 V when the cooking appliance is turned on compared to when it is off. Readers should note that voltage drops are not intrinsic to cooking appliances, but would occur for any appliance that draws a large load.

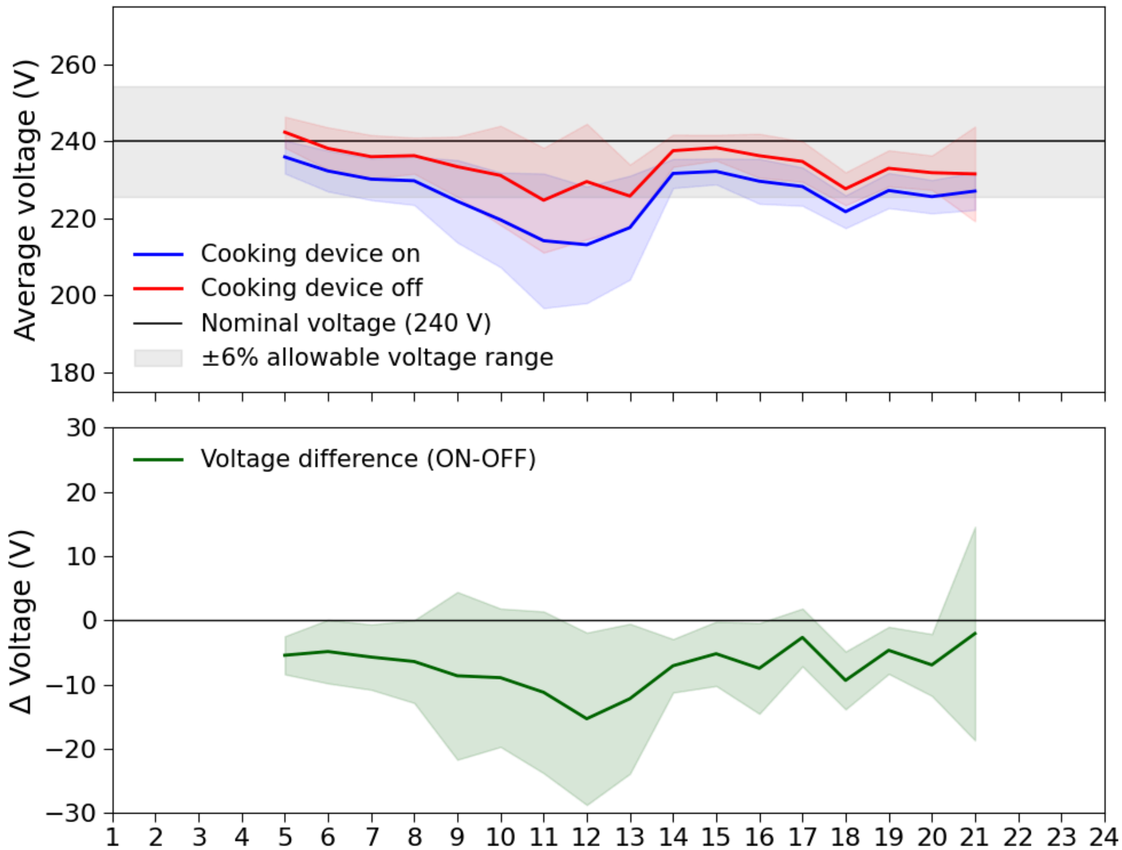

Figure 10. Average voltage by hour of day (top), depending on whether an electric cooking appliance is on (blue) or off (red). The horizontal line and gray band show the nominal voltage of 240 V and the electricity regulator's accepted tolerance of ±6% [42]. The bottom figure shows the average difference in voltage during cooking appliance on and off state, by hour of day.

Our results show that households already experiencing poorer voltage quality are more likely to face compounded challenges from the additional load of e-cooking appliances. As shown in **Figure 11**, the lower the voltage is when an e-cooking event starts, the greater their voltage drop will be. Earlier findings from Spotlight Kampala power quality monitoring sensors revealed that voltages are on average lower in informal communities, particularly for users that share electricity connections and tend to have lower average incomes. This highlights a potential challenge for inequity in access to quality electricity, where vulnerable populations may face more severe disruptions as a result of e-cooking, further entrenching disparities in service quality.

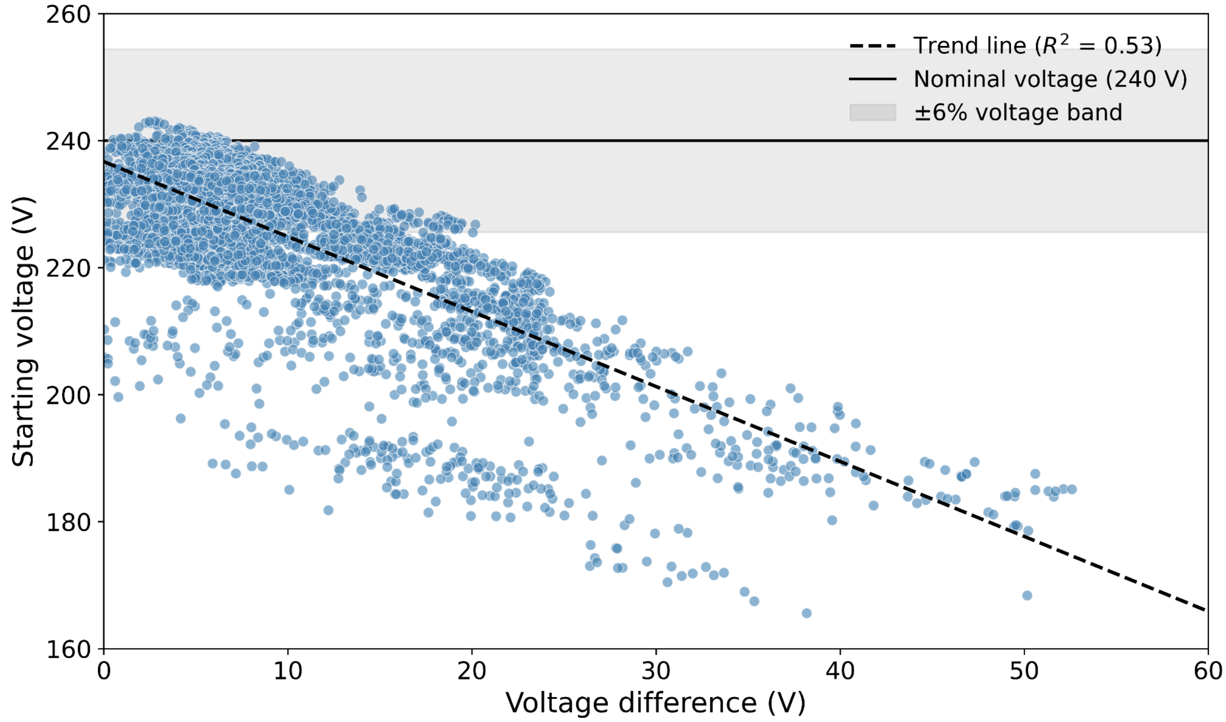

Figure 11. Scatter plot of the voltage at the start of a cooking event, versus the voltage difference across the cooking event (n = 7,868 cooking events). The dashed black line represents an ordinary least squares regression.

The impact of e-cooking appliance use on voltage stability is context-dependent. **Figure 10** shows that voltage deterioration is worse mid-day, when outages are also most likely. This points towards voltage deterioration caused by the local distribution network, particularly overloaded transformers as documented in earlier Spotlight Kampala research [7]. Our evidence also suggests that the condition and configuration of sub-metering—meaning all domestic wiring beyond the utility meters, often used to extend a connection to additional households—also contributes to voltage quality. However, further research is needed to disentangle the specific factors contributing to voltage deterioration, including overloaded transformers, sub-metering conditions, appliance quality, and other variables, and to determine the mechanisms through which each factor influences voltage stability.

"*Of course electricity simplifies everything, but since this issue [unstable electricity] is still persistent, we still use charcoal.*" — Homeowner

Another key risk related to unstable voltage and e-cooking is potential damage to appliances. While high-voltage surges are the most immediate concern, chronic low voltage over time can also cause significant damage to some appliances. In our survey, 11% of respondents reported owning an electric kettle that had failed within the past month. To put this failure rate into context, this suggests that nearly 94% of electric kettles would be damaged over the course of a year under similar conditions. Appliances with motors—such as blenders or food processors—attempt to compensate for low voltage by drawing more current in an effort to maintain constant power. This excess current can overload internal components, leading to overheating, wear, and eventual failure. On the other hand, resistive appliances like EPCs or electric kettles are less likely to draw more current during voltage drops. While these appliances do not suffer from overheating in the same way, they still face the risk of inefficiency and underperformance, and prolonged use under low voltage conditions can gradually degrade internal wiring and components. As a result, households with poor voltage quality may be reluctant to purchase efficient appliances like EPCs, fearing that they will be damaged due to persistent voltage issues.

4.3 Rising charcoal prices improve the economic case for fuel switching, but high electricity costs deter e-cooking adoption

Cooking is the seventh highest expense for households and businesses in informal communities, after food, business expenses, rent, loan repayment, school fees, and transportation. Our survey findings indicate that residents in informal communities spend on average 9% of their monthly income on cooking energy (charcoal, gas, or firewood) and 4% on electricity, for a total energy burden of 13% (**Figure 12**).

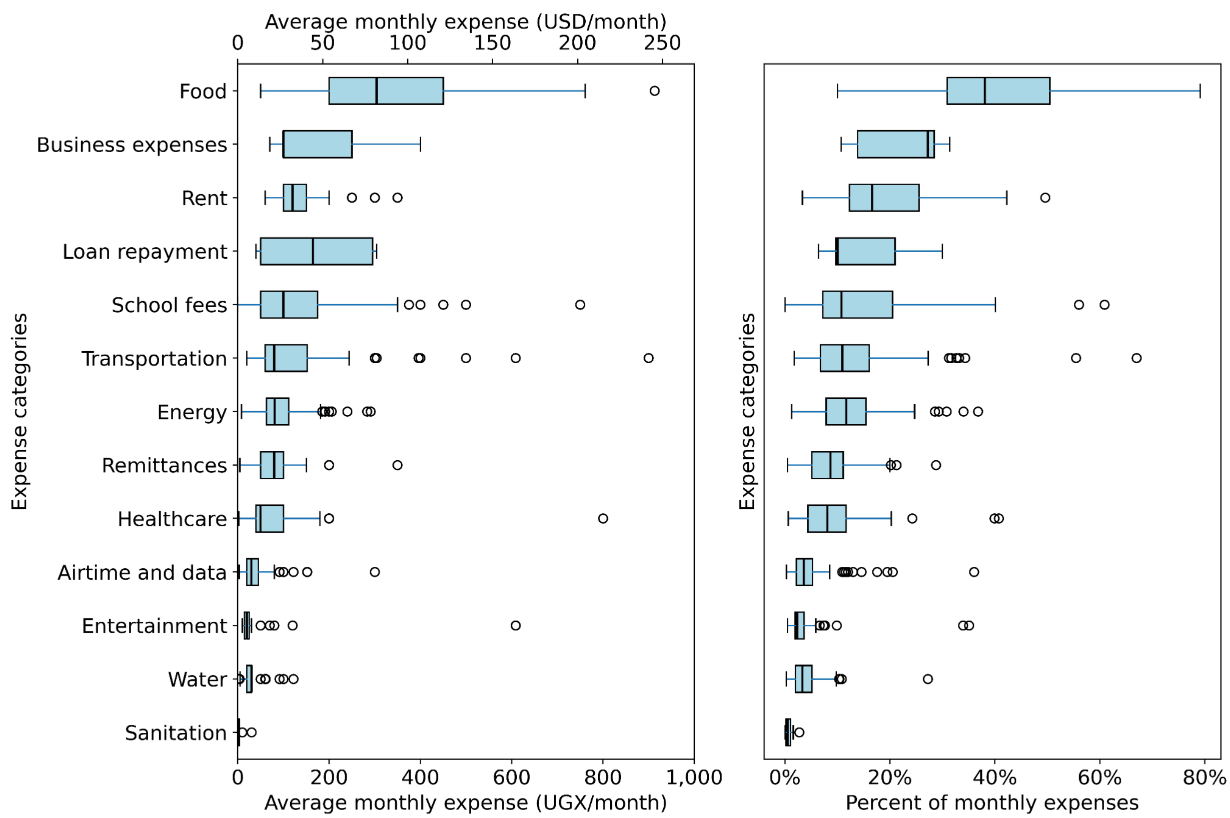

Figure 12. Average monthly household expenditure by expense category. Based on survey data (n=120).

In interviews, respondents described living day-to-day, making spending decisions based on their most pressing needs and the income they earned that day. Food was one of the most flexible household expenses. When income was insufficient, meal-skipping was a common strategy to cope with financial constraints. In the words of one FGD participant, "*It truly depends on your daily income. If I fail to raise the money, I just buy kikomando for my kids and I sleep hungry.*" Another added, "*It depends on how a day goes, when you have the money, you make two meals a day. When you don't have the money, you cook one meal a day.*" As **Figure 13** demonstrates, just over half of all surveyed households reported skipping at least one meal a week because of limited funds.

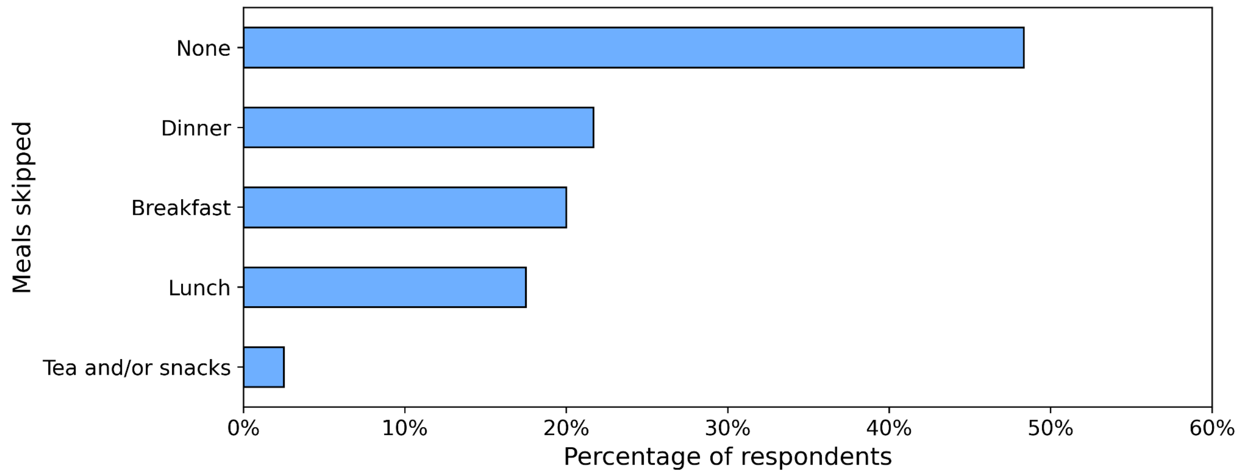

Figure 13. Responses to the survey question "Which of the following meals (if any) does the family skip at least once a week because there is not enough money to prepare?" Based on survey data (n=120).

These findings highlight the reality that most households operate on a hand-to-mouth basis, making financial decisions within extremely tight daily constraints. This challenges prevailing narratives encountered by the research team, in which some expert stakeholders framed household spending choices through a moralistic lens — for instance, attributing electricity theft to unwillingness to pay rather than to genuine financial hardship. By contextualizing energy expenses within the broader landscape of daily spending, this analysis underscores the extreme cost sensitivity of these communities. Any proposed energy transition solutions must be designed to function within these narrow financial margins, ensuring that they do not exacerbate economic precarity for already vulnerable households.

Charcoal is the dominant cooking fuel expense, representing 96% of all non-electric energy expenditures. Households spend on average 60,000 UGX (16 USD) on charcoal each month. Electricity expenses (including non-cooking uses) are roughly half, at 30,000 UGX (8 USD) per month. Firewood, gas, and energy briquettes are present in the fuel stack, but as **Figure 14** demonstrates these make up only a minor portion of the total cooking fuel expense outlay. In a recent ICLEI study which polled informal community members in Kisenyi, gas was ranked as the second most acceptable cooking technology behind electricity. There were also high levels of community awareness of the technology and its benefits. However, community members attributed its low levels of adoption to the high expense, inability to purchase in small quantities, and perceived safety risks [28].

We also find that energy expenditure is correlated with household income. Recalling that households with an individual metered connection are the highest-earning group (250 USD/month) and collective unmetered are the lowest-earning (120 USD/month), **Figure 15** illustrates that average monthly expenses for charcoal and electricity decrease with decreasing income. We also observe that electricity expenditures are relatively elastic relative to charcoal. A household's energy burden from charcoal increases with decreasing incomes, while electricity scales proportionally. This pattern reflects the availability of informal or flat-rate electricity arrangements among lower-income users, which help buffer against variable consumption costs and allow households to manage expenses more predictable. In contrast, charcoal expenditures appear more rigid, reflecting a baseline necessity for cooking that is less responsive to shifts in income.

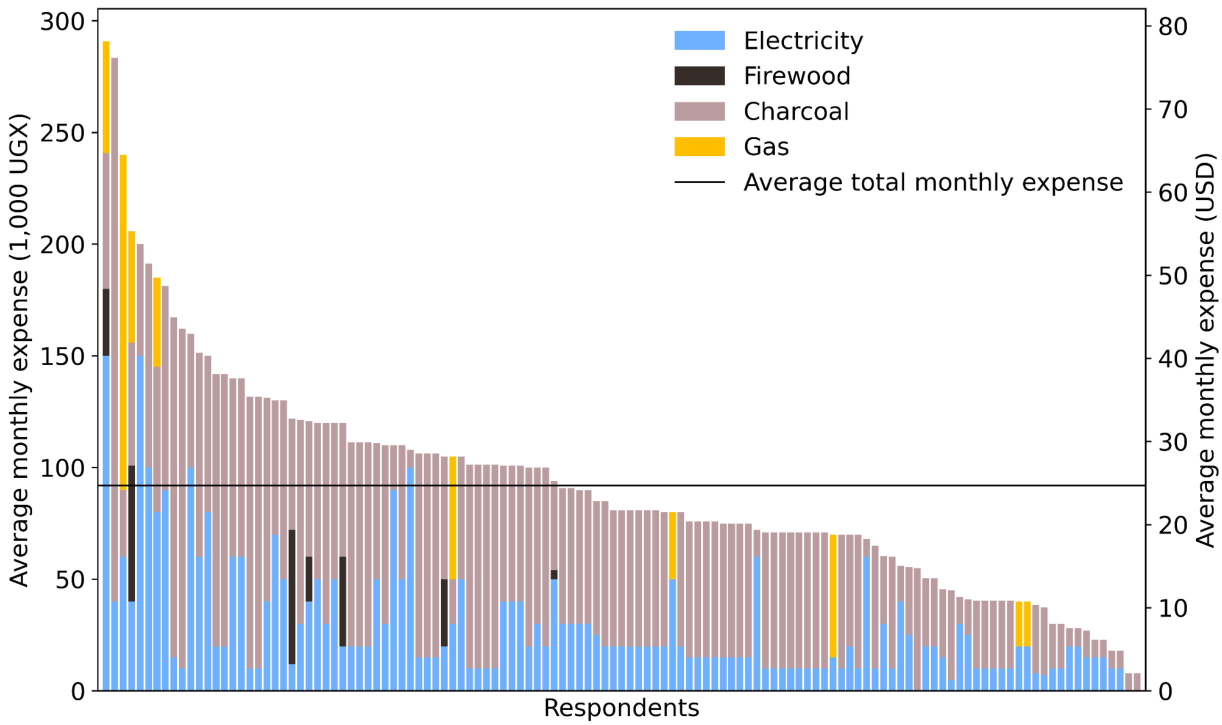

Figure 14. All responses (n = 120) on average monthly cost of cooking fuels, based on fuel source.

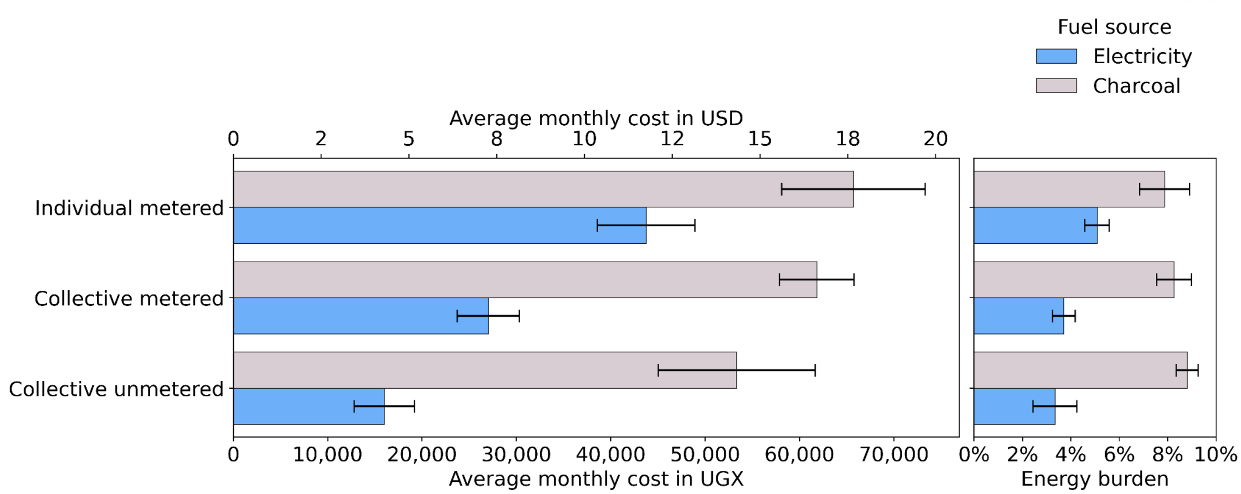

Figure 15. Average monthly cost of cooking fuels (left). Includes the cost of electricity for non-cooking purposes. Average fuel burden for electricity and charcoal, defined as a percentage of total monthly expenses (right). Based on survey data (n=103).

We also observe the presence of a “poverty penalty” related to charcoal purchases. As **Figure 16** shows, lower-income households (e.g. users with a collective unmetered connection) often buy small quantities of charcoal daily, indeed often purchasing only enough to prepare a single meal. **Figure 17** shows that households that buy charcoal at a daily frequency spend on average 2,400 UGX per purchase. In contrast, wealthier households buy large sacks of charcoal in bulk often at monthly intervals, spending on average 61,000 UGX per month. Holding household size and consumption constant, our data suggests that households purchasing charcoal on a daily basis pay 20% more on a per kg basis than those purchasing at monthly frequencies.

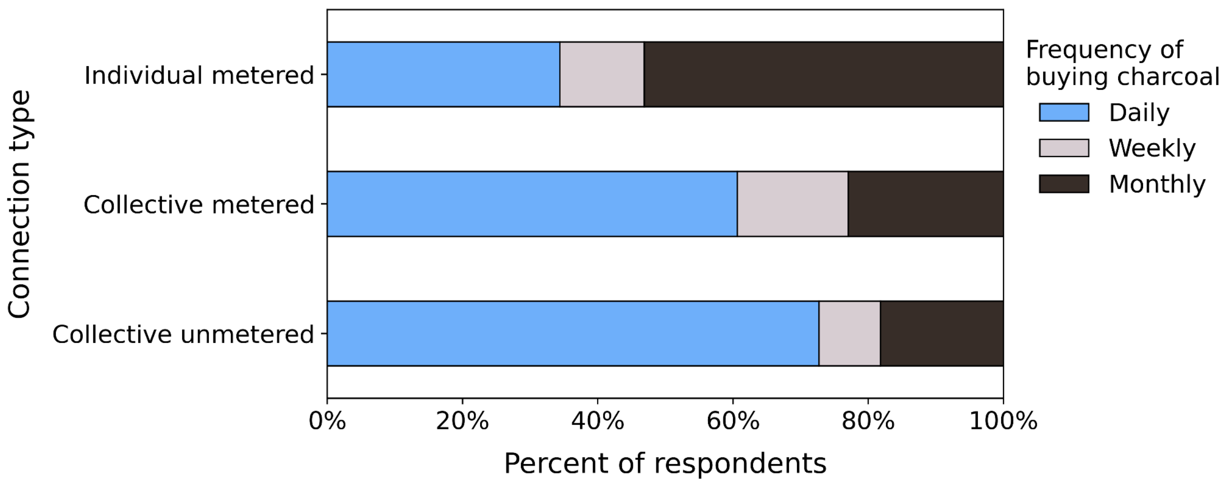

Figure 16. Purchase frequency of charcoal by connection type. Based on survey data (n=104).

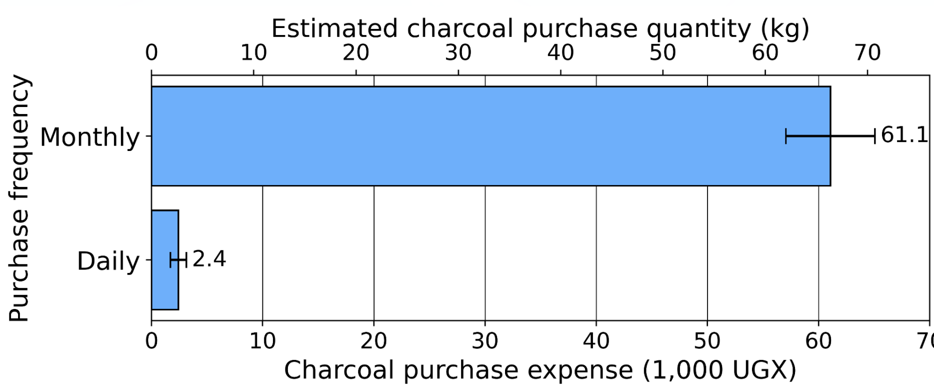

Figure 17. Average expense and quantity of charcoal purchases, by purchase frequency. Quantity is estimated from expenditure data assuming an average cost of 0.286 USD/kg, per [26]. Based on survey date (n=89).

Our findings support recent claims by MECS and other partners that high-efficiency electric cooking is less expensive than charcoal used in a traditional clay cookstove (sigiri) at the current electricity tariff of 760 UGX/kWh[3]. **Figure 18** compares the cost of using 1 kWh for cooking with an EPC or hot plate against the cost of cooking the equivalent amount of energy with charcoal, across electricity prices ranging from 0.05 to 0.40 USD/kWh (approximately 200–1,400 UGX/kWh). This calculation is based on energy ratios between charcoal and electric appliances from empirical measurements of gross fuel energy use in real-world kitchens published by MECS [26]. These values enable a direct comparison of fuel costs without needing to account for thermal conversion efficiencies. Assuming a current electricity price of 0.21 USD/kWh and charcoal price of 0.29 USD/kg, cooking with charcoal is 2.8 and 2.0 times more expensive than cooking with an EPC or a hot plate, respectively.

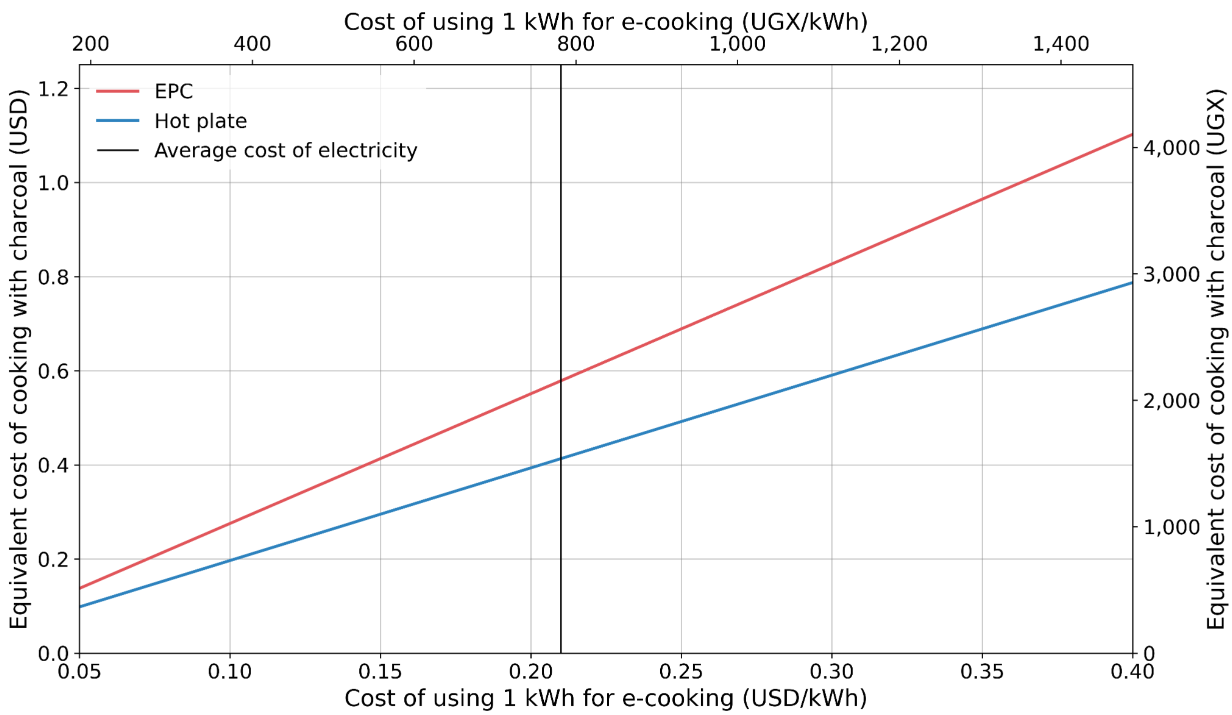

Figure 18. This graph illustrates the equivalent cost of cooking with charcoal compared to cooking with electricity, using either an Electric Pressure Cooker (EPC) or a hot plate. The x-axis shows the electricity price per kilowatt-hour (kWh), which represents the cost of using electricity to cook one kWh of energy. The y-axis shows the equivalent cost of using charcoal to cook the same amount of energy. The red line represents the cost for EPCs, and the blue line shows the cost for hot plates. Refer to **Appendix B** for the assumptions underlying this calculation.

The cost of charcoal has been on the rise for the last five years since the government banned its production in certain regions as a means to promote e-cooking and mitigate deforestation [44]. Further increases in charcoal prices will improve the cost competitiveness of high-efficiency e-cooking. However, the high cost of electricity remains a key barrier to e-cooking transitions.

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[3] This is the levelized cost of electricity assuming a monthly consumption of 34 kWh (the average in our sample), a lifeline tariff of 250 UGX/kWh for the first 15 kWh of monthly consumption, a tariff of 775.7 UGX/kWh until the 34th unit of consumption, a service fee of 3,360 UGX/month, and an 18% value-added tax [43].

Informal communities largely do not benefit from the e-cooking tariff introduced by the Electricity Regulatory Authority in 2021 which subsidizes consumption beyond the 81th kWh — a threshold 2.4 times the average consumption for a household in an informal community. Solutions to better target the existing lifeline tariff to low-income communities, or to create an e-cooking tariff that is adapted to low-consumption users, can improve the economic case for electric cooking transitions.

Finally, we call attention to the important role of perception in guiding household decision-making around cooking fuel usage. Discussions on e-cooking were largely shaped by perceptions of affordability with the majority of the residents believing that cooking with electricity is more expensive than they can afford. As one woman explained, "*Why we can't cook with electricity is because as soon as you switch on the electric cooker, units will deplete so fast.*" These perceptions, whether accurate or not, have real consequences for energy choices and must be directly addressed in any effort to promote e-cooking. Sensitization and awareness-raising initiatives should not only provide clear information on actual costs but also engage with households' lived experiences, demonstrating how and under what conditions e-cooking can be a viable, cost-effective alternative. Without tackling these deeply held beliefs, technical and financial solutions alone may struggle to gain traction.

4.4 Women are leading cooking energy transitions, but face gendered resistance to e-cooking adoption

Women are central to household energy use in informal settlements in their multiple roles as cooks, entrepreneurs, and as decision-makers in day-to-day activities of purchasing fuel, preparing meals, and managing household expenditures. Findings from our study (**Figure 19**) show that women prepare 86% of all meals, yet they make up only 59% of those who consume them, underscoring their disproportionate role in food preparation and energy use. Further, while women earn income and make household decisions at relatively similar rates to men, they are more likely to manage household finances. Beyond the home, women are also key players in the informal economy, running small food businesses and shops. These roles position women as critical drivers of energy transitions—but only if they are supported in navigating the complex gender dynamics that surround cooking practices.

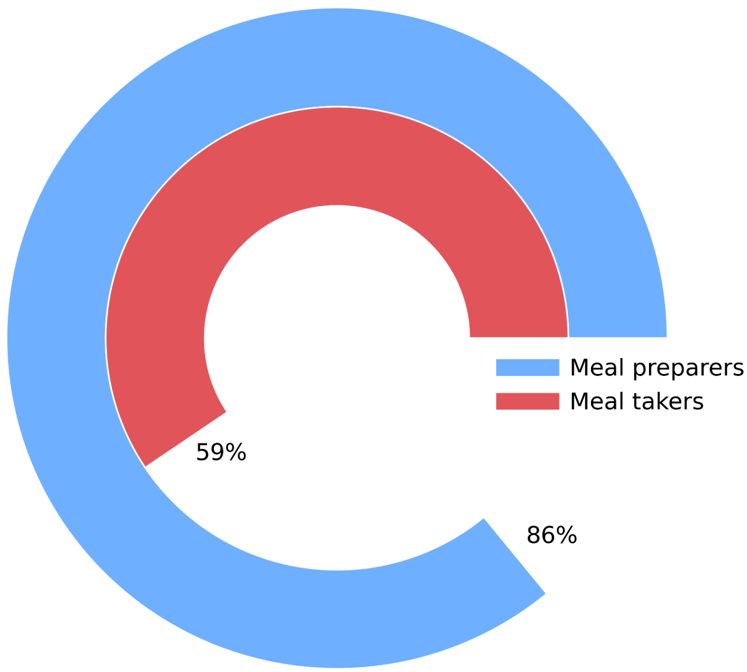

Figure 19. Frequency of womens' participation in meal preparation and consumption. Based on survey data (n=120).

Women are often constrained in their ability to decide which cooking fuel to use by parties internal and external to the household. Externally, as discussed in depth in Spotlight Kampala's original findings report, women tend to be at a disadvantage when negotiating access to the electricity grid. They are more vulnerable to exploitation by electricity service intermediaries like local electricians and landlords and often face unfair pricing practices and/or have limited bargaining power.

Inside the household, women may lack the autonomy to decide how meals are prepared. Even when financially capable of transitioning to e-cooking, some women are prevented from doing so by the preferences of spouses and family members. As one male FGD participant stated, "*I would never allow my wife to cook food on electricity. She has time to make proper meals the traditional way—the way I want my meals.*" A quarter (23%) of survey respondents reported that they would need the agreement of someone in their household to be able to purchase an e-cooking appliance. Asked to identify who in their household would need to agree, 74% of respondents cited a male head of household and 26% cited a female head of household. This finding supports a substantial amount of research which has documented how gender norms condition the uptake and use of electric appliances [45]. These studies have similarly found that women often "do not have sufficient authority and economic power within the household to impose their decision [to change cooking fuels] on men" [46].

Resistance to e-cooking was often based on socio-cultural beliefs, perceptions, and fears. For example, some participants believe that food cooked with electricity is less tasty than food cooked over charcoal. Others fear electric cooking is unsafe, citing past electrocution incidents or myths about electricity compromising food quality or causing illness. Additionally, women bear a disproportionate burden when it comes to ensuring household safety. Poor wiring quality is a particular concern related to e-cooking, which we discuss in detail in the following section. Some women, fearing shocks and electrocution, only use electricity for cooking while their children are at school, switching to what they perceive as safer alternatives, such as charcoal, when the children are home. Others cook with electricity in the early morning or late evening but turn it off when away to prevent potential hazards.

Table 4. Quotes representing key beliefs, perceptions, and fears around e-cooking from focus group discussions.

"*I would get a cooking coil but my kids are curious and might try to emulate me. They see me when I'm ironing, I once found when they'd plugged in the iron and burnt the sofa. That scares me. At least I know they'd not be able to light a charcoal stove.*"
"*I don't like that electricity cooks too fast… it might not allow food to fully cook, which is why children are always sick. Our traditional foods require slow-burning to cook properly, which only natural fuels like charcoal can provide. That's why I will never allow my wife to cook with electricity.*"
"*There's a belief that cooking with electrical appliances causes cancer so people fear it, especially making tea with electricity. Someone can tell you "You've made me tea with a percolator! I won't take it! Diseases are spreading from this!*"
"*Even when you make juice with a blender they'll say it causes diseases. They claim electricity passes through the food you've cooked with it and enters your body. [Laughter]. We all have our own way of reasoning.*"
"*[The electric kettle] just switches off [prematurely] and you just come and make the tea and drink. That's why typhoid is rampant among us because of that water we drink.*"
"*I use charcoal because I fear for the young ones. If by mistake they touch these appliances when I'm not seeing and get electrocuted…I fear because I was once electrocuted back when I was a child.*"

Women also play crucial roles in the small and medium enterprise sector within informal communities, particularly in the local restaurant industry and its broader value chain. Financial constraints prevent many households and individuals from affording regular meals or cooking fuel, and women help bridge this gap by running small, local restaurants. These local fast food restaurants operate throughout the day, offering affordable foods and snacks to a significant population in informal communities. When we spoke with women entrepreneurs in the local restaurant business about e-cooking, they expressed a strong willingness to switch entirely from charcoal to electric cooking due to perceived benefits.

However, despite their willingness to adopt e-cooking, women entrepreneurs face gendered constraints that limit their ability to make the switch. Their businesses often operate within tight financial margins, and many must balance commercial decisions with household responsibilities, reinforcing the expectation that women should manage both domestic and economic tasks. Additionally, socio-cultural perceptions around cooking methods extend into the business sphere, where customer preferences and community norms can shape fuel choices. Without the autonomy to fully control their energy use, women in the informal food sector remain caught between economic opportunity and entrenched gender roles that dictate how they should cook.

4.5 Electrical hazards undermine safe e-cooking adoption

Earlier work by Spotlight Kampala documented that informal communities live with and have normalized very high levels of daily electrical risk. Like earlier findings, **Figure 20** shows that five percent of survey respondents reported knowing of at least one person in their home or business who had been injured by electricity in the past month. To put this in context, this means that within a month period, one in every 20 people will experience some type of shock or other electrical accident. Community members drew a clear link between cooking appliances, which usually require higher currents than appliances like lights and TV, and electrical risk in the form of overheating wires, insulation breakdown, fires, and shocks. As one woman noted in an interview, "*Electricity is bad. It's dangerous. We use it but it's dangerous. It shocks. Sometimes you may put on a saucepan and it shocks you.*" Often, these shocks are minor. However, cases where electrocution leads to serious injury requiring treatment or hospitalization are often not reported, particularly if they stem from an illegal connection.

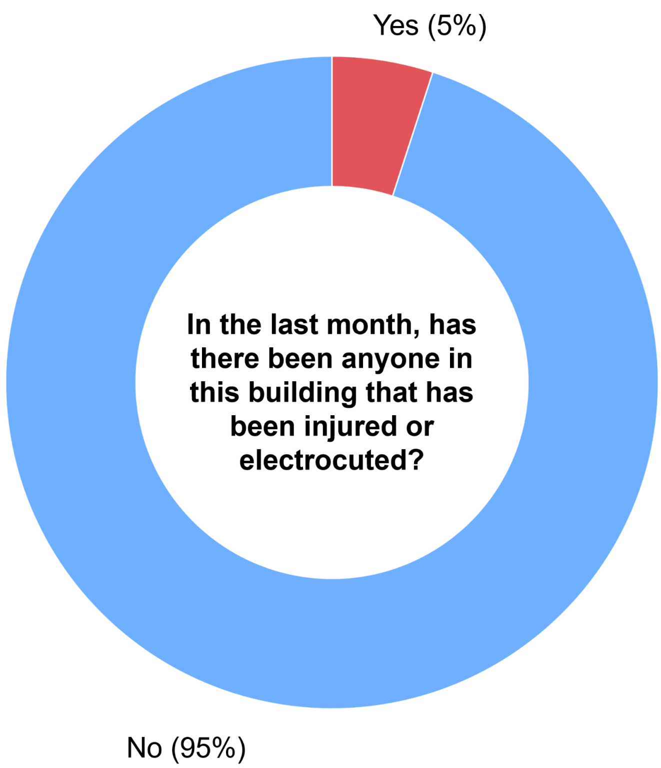

Figure 20. Responses to survey question capturing the frequency of electrocution and other injuries stemming from electricity within the past one month preceding the survey. Based on wiring inspections (n=100).

Wiring inspections provided insight on the likely causes of safety incidents. Across 100 households in five communities, inspections captured the condition of household domestic wiring, the presence of appropriate load-limiting protection (e.g. circuit breakers), and whether wiring was correctly installed. In a typical, safely-wired household connection there are two types of automatic overcurrent protection to guard against overloads and short circuits. The first is a service protection breaker, installed by the utility company, which is typically rated between 60 and 90 amps (A). These breakers represent the point where the main supply connects to the customer's premises. In Kampala, these are usually located in the metal enclosures formerly housed post-paid meters. Though they are meant to be the responsibility of the utility, they are usually accessible to households and often modified by residents or electricians. The second overcurrent protection is a household circuit breaker, which receives supply from the service protection breaker and distributes it to individual circuits within the house. This breaker is installed by the homeowner. We note that in small households it is common for there to be only one circuit, and thus only one household circuit breaker. **Photos 6-7** show typical examples of a service protection breaker and a household circuit breaker.

Photos 6-7. A service protection breaker installed by the utility (bottom left), a service protection breaker enclosure (top right), and a household circuit breaker (right). Photos by Paul Kyoma.

Wiring inspections found that 35% of surveyed households lacked both forms of overcurrent protection. We note that in cases where multiple households shared the same circuit, a circuit breaker may have been present but located off-premises or unknown to the respondent. This is a common occurrence in shared electrical setups. Service protection breakers were only present in 62% of surveyed households, as shown in **Figure 21**, and only 49% reported a household circuit breaker present on the premises. Only 46% reported both forms of protection. The absence of protective equipment also raises the likelihood of electric shocks and electrocutions due to current leakage or ground faults. Electrical overloads can overheat circuits, degrading the insulation of wiring and increasing the risk of fire. One FGD participant relayed a personal example of fire risk associated with electricity use: "*The house caught on fire [from electricity]. I was looking for the electrician to disconnect me, but I had to first get the kids to safety. I couldn't leave my grandmother outside because it was raining, so I gathered my courage, got a stick and switched it off, then threw sand over it.*"

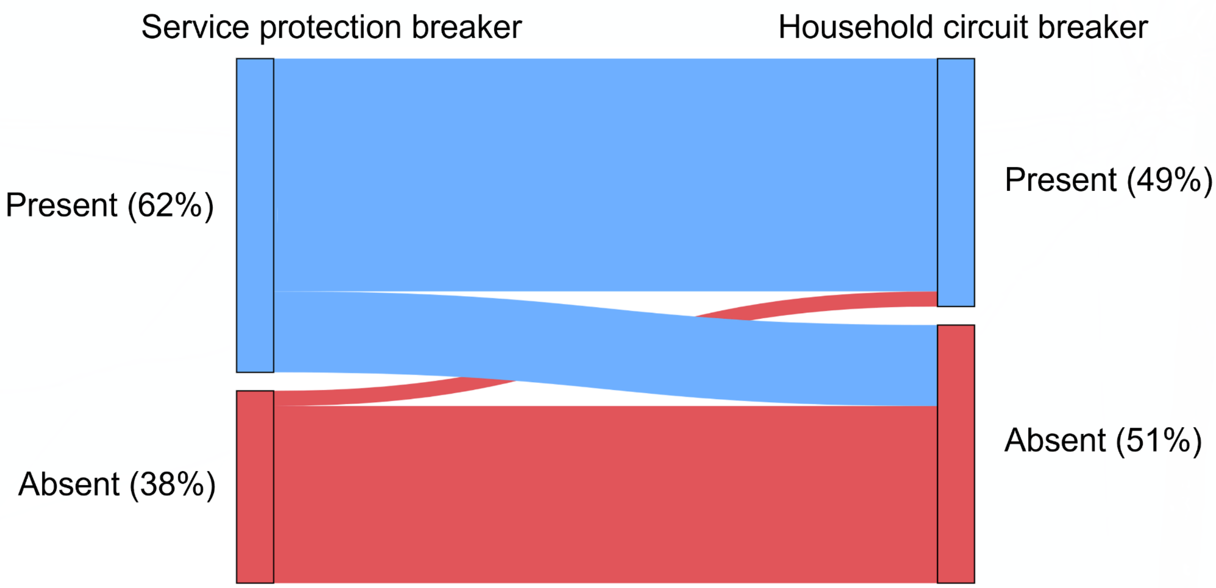

Figure 21. Presence or absence of service protection and household circuit breakers in household wiring inspections.

A socket tester was used to evaluate the wiring configuration of each accessible socket. The testing aimed to identify the proportion of sockets with a correct wiring configuration compared to those with faults, such as open grounds. Across 78 total households, we find that 52% of tested sockets are not properly grounded (**Figure 22**). This is a significant safety risk, as grounding provides a safe path for excess current in the event of a fault (e.g. a short circuit from a damaged appliance). Without grounding, this current can easily travel into a person who comes in contact with electrical equipment, or can cause overheating and sparking that can lead to a fire. Grounding also helps protect sensitive electronic devices from power surges and voltage fluctuations, and if not present can put these appliances at higher risk of damage. In interviews, respondents reported their own lived experiences of these unsafe circumstances: as one woman said, "*Sometimes when me and my neighbor cook, the consumption is high and* *electricity sparks.*" In addition, we find that 9% of tested sockets were damaged, and had for example evidence of burns, a broken casing, or exposed wiring.

Another important element of household electrical safety is the condition of the wiring. In roughly a quarter of surveyed households (24%), wiring was concealed within building elements and was not directly observable. Where wiring was visible, only 11% had wiring that was in good condition. A concerning 89% had household wiring where metal conductors were exposed, or where wiring was improperly spliced (**Figure 23**). **Photos 8-11** show examples of exposed conductors, damaged sockets, and other electrical safety hazards observed during the inspections. There are various reasons for poor quality wiring. Low-income households will often buy secondhand wiring materials. In many rental units, tenants are responsible for providing their own wiring. As a result, it is common for renters to strip and take their wiring with them when they move. This reuse, combined with daily wear—often under loads that exceed the wire's capacity—leads to rapid degradation. Lastly, wiring is commonly installed by the homeowner or an informal electrician and the quality of informal installations greatly varies.

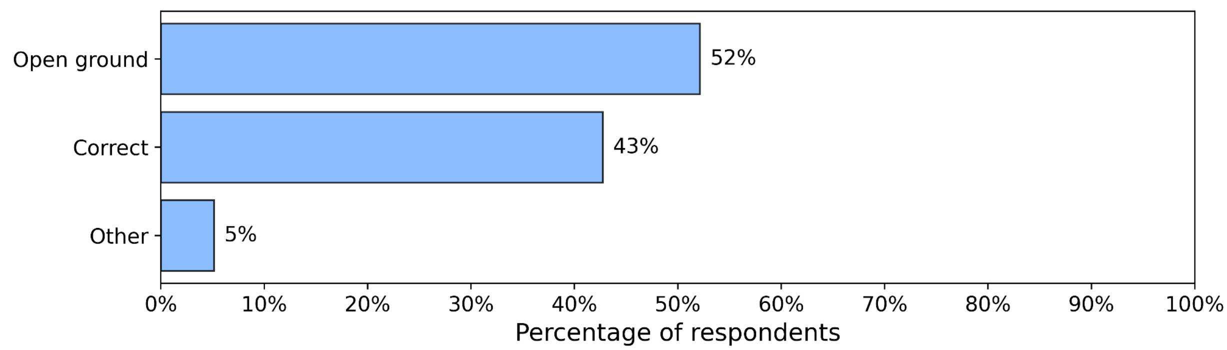

Figure 22. Results from a socket tester of 96 sockets across 78 households. Each household's contribution is evenly weighted, meaning that households with multiple tested sockets do not disproportionately influence the results. For example, if a household had two sockets with differing conditions, each socket result is weighted equally (e.g., 0.5 each).

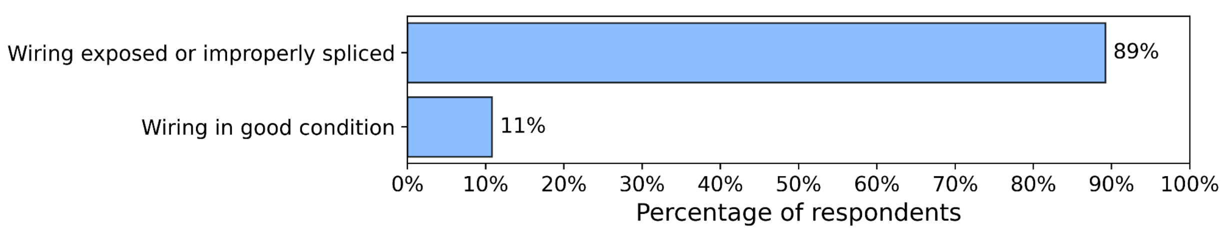

Figure 23. Condition of visible wiring in buildings where conductors were accessible for inspection. Results exclude cases with no visible wiring.

Photos 8–11. Examples of unsafe wiring where conductors are exposed (top left), splices are bare or improperly done (top right), and sockets and extension cables are damaged or show signs of burns and melting (bottom left and right). Photos by Paul Kyoma.

Finally, wiring inspections provided insight into the gauge of household wiring, which has implications for how much current it can safely carry without overloading. Overloading of wiring due to e-cooking was a concern that surfaced frequently in focus group and interview conversations. When asked why he didn't like his clients to cook with electricity, one *kamyufu* (informal electrician) answered: "*When they [cook with electricity] it weakens the wires, that's* *why we now install* solidos[4] *in houses because it is stronger and can stand a heavy load but even then, we install only one* solido *to be the neutral and the current.*" The statement suggests that electricians may be using a single conductor as the phase conductor, and relying on the ground as a return path instead of a proper neutral wire — a practice that leads to poor power quality due to variable ground impedance and poses significant safety hazards from ground currents.

Figure 24 shows the distribution of wiring sizes recorded in 73 households. Inspectors documented the gauge of all visible conductors within each household; where multiple sizes were present, all were recorded. These results should be interpreted with caution—they are indicative and descriptive rather than representative. For example, some small-gauge wiring may have been used appropriately for low-load applications such as lighting, but the inspection did not capture the specific purpose of each conductor.

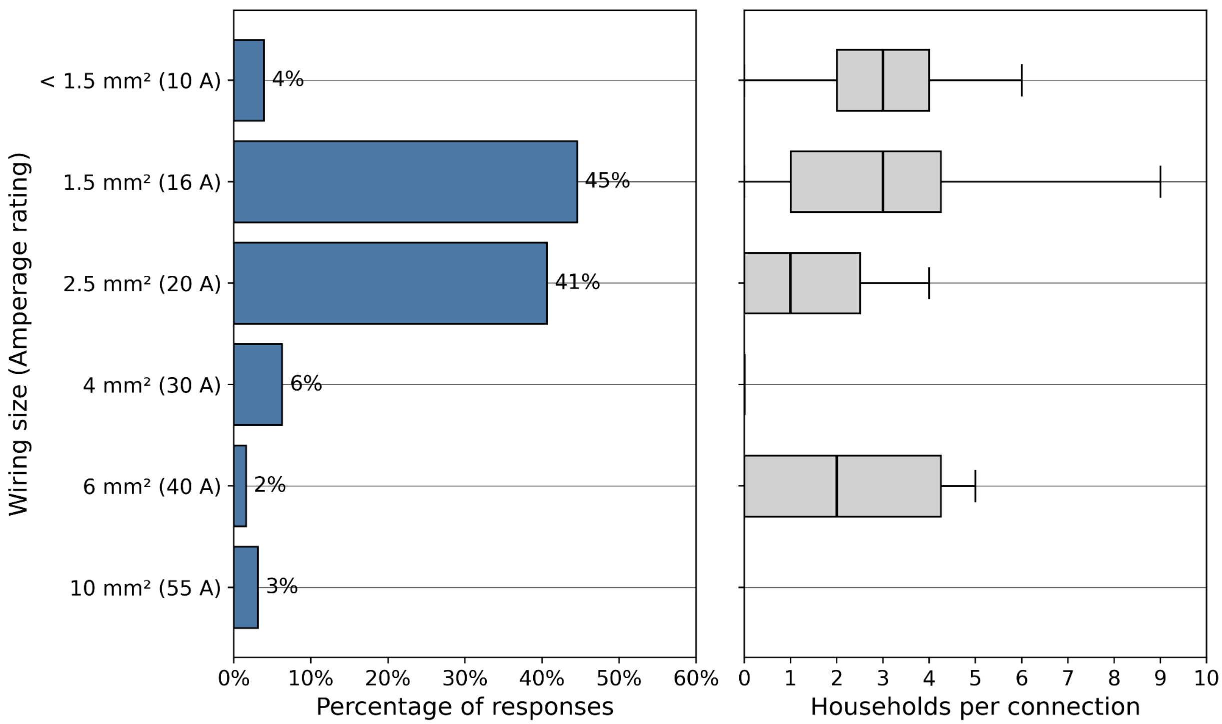

Figure 24. Wiring size distribution and households per connection. The left panel shows the percentage of households with each wiring size (including rated amperage). The right panel displays the number of households sharing a connection for each wiring size. Results for households per connection were omitted for wiring sizes with less than three respondents. Based on wiring inspections (n=73).

In 45% of households, we estimate that wiring is rated for 16 A, which in theory should be enough to accommodate an appliance like an EPC, which should draw at most 6-7 A during

[4] "Solidos" refer to solid core wires, which are thicker, more robust, and better equipped to handle higher electrical loads compared to thinner, stranded wires commonly used in lower-capacity installations.

use. However, safety issues may arise when multiple households share a circuit. While a 1.5 mm^2 wire should safely accommodate the consumption of a single household, in a scenario where multiple households are using e-cooking appliances at the same time (e.g. to cook dinner) the wiring could easily be overloaded. Overloaded wiring can overheat, causing thermal damage or melting wiring insulation which then creates shock or fire risks. Undersized wiring also introduces more resistance, which translates into large voltage drops along the line which may deliver a voltage too low to be useful for e-cooking and other types of appliances.

5. Priority actions to accelerate e-cooking adoption in informal communities

The overarching finding of this study is that electricity is already an important cooking fuel source in informal communities in Kampala. Most community members readily recognize the benefits of e-cooking, particularly in regards to health and convenience, and would like to add more electric appliances to their kitchens. Our findings also point to the likelihood that savings from fuel switching could produce better nutritional or educational outcomes by allowing more money to be diverted to school fees, food, or small businesses. However, communities face an intersectional set of barriers related to gender, safety, autonomy, cost, and other themes discussed in this report. Building on these findings, the following recommendations provide starting points for policymakers, utilities, community advocates, development partners, and other stakeholders interested in advancing the uptake of high-efficiency e-cooking by addressing barriers specific to informal communities.

5.1 Enable safe and fair meter sharing

Echoing recommendations from the *Spotlight Kampala Main Findings Report*, we emphasize the importance of building on existing service delivery models instead of focusing singularly on "regularizing" connections. Sharing meters is a common and effective way to provide grid access to households and businesses that otherwise could not secure a connection. However, existing payment schemes rely on intermediaries to estimate consumption based on appliance use, rather than measure actual consumption. Commonly, restrictions are placed on the use of e-cooking appliances to keep costs low and uniform. Without mechanisms to meter and bill individual usage, these limitations will persist, constraining the adoption of e-cooking. Solutions must address the incentive structure that leads meter holders to restrict appliance use. One approach is to encourage community members, especially renters, to take advantage of the utility's ongoing connection subsidization program. Another approach could be to develop regulatory guidelines for domestic meter sharing that outline clear responsibilities for the primary meter holder while ensuring access to low-cost sub-meters to disaggregate individual consumption. This would promote fair cost allocation and reduce barriers to e-cooking. Alternatively, off-grid solutions—such as solar and battery-based systems with pay-as-you-go financing—could provide a viable pathway for households facing persistent metering and billing constraints. These systems can also help address wiring limitations by allowing batteries to charge slowly at low current, reducing the risk of overload on undersized or degraded wiring.

5.2 Domestic wiring improvements are key to safe e-cooking uptake

The uptake of e-cooking could exacerbate already high levels of risks if household wiring conditions are not addressed in tandem. Our findings show that damaged or undersized wiring is the norm, not the exception, in informal communities. For many households and businesses the safe adoption of an EPC will require wiring upgrades. Yet, wiring upgrades

To ensure a safe transition to e-cooking, initiatives should integrate low-cost wiring inspections and upgrades as part of appliance distribution programs. Bundling EPCs with wiring assessments and necessary improvements would help mitigate safety concerns while increasing consumer confidence in e-cooking. These programs could leverage existing networks of local electricians.One potential model is to build on past utility-led efforts to train and certify local electricians, then contract them to conduct wiring assessments and upgrades as part of e-cooking deployment efforts. Such an approach could create economic opportunities for local electricians while addressing critical safety gaps.

5.3 Sensitize communities on cooking health and safety risks

Community education initiatives should be implemented to improve awareness of both actual and perceived risks associated with e-cooking and household wiring. While many residents had an intuitive sense of electrical risks in their environments, there is often limited understanding of root causes like undersized or damaged wiring, the absence of proper grounding, or low-quality or improvised appliances. Sensitization efforts should focus on practical guidance, such as how to diagnose household wiring issues, the dangers of reusing old or low-capacity wiring, and providing resources to address risks. Additionally, targeted public campaigns should address misconceptions surrounding e-cooking, including fears that it compromises taste and food safety. Continuous, community-driven engagement—through workshops, radio programs, and local outreach—can help dispel myths, build trust, and ensure that households feel confident in transitioning to electric cooking.

5.4 Address misconceptions about electric cooking costs and efficiency

Community sensitization on energy efficiency is essential to addressing cost concerns, which often stem from a lack of understanding of appliance efficiency. Many households perceive e-cooking as expensive without recognizing the potential energy savings offered by high-efficiency appliances like EPCs. Targeted outreach efforts should include simple, hands-on demonstrations to showcase how EPCs and other efficient electric appliances consume less energy while reducing cooking time and costs. Public demonstration programs in local markets, schools, and community centers can provide tangible evidence of these benefits, allowing residents to see cost savings in real time. Such initiatives should also emphasize best practices for energy-efficient cooking, such as using the right cookware, optimizing cooking times, and leveraging retained heat. Technological approaches can complement these approaches. In Nepal, mobile apps paired with smart plugs have helped those with e-cooking appliances to understand and manage their electricity consumption. Equipping communities with practical knowledge and tools can help shift perceptions and build confidence in the affordability and feasibility of e-cooking.

5.5 Expand flexible financing options

The lack of financing options—such as subsidies, installment payment plans, and credit schemes—remains a major barrier to e-cooking adoption in informal communities. This is particularly true for higher-quality appliances like EPCs, which offer significantly higher efficiencies but are more expensive than other electric cooking appliances. To address this, a range of flexible financing models should be explored. Pay-as-you-go schemes, which have been successfully implemented for solar energy, could be adapted for e-cooking appliances, allowing households to make incremental payments over time. Another promising approach, demonstrated in Nigeria and Haiti, is the community kitchen model, where multiple households share the cost of appliances and electricity, reducing financial strain on individual users. Where possible, financing solutions should leverage existing community financial structures, such as savings groups, which are widely used for collective resource pooling. Additionally, partnerships with local microfinance institutions could be strengthened through loan guarantees or risk-sharing mechanisms, enabling them to offer credit products tailored to e-cooking adoption. Finally, the e-cooking tariff does not currently benefit households with low electricity consumption, limiting its impact on those most in need. Improving the targeting of this subsidy could be a critical mechanism to ease the financial burden of e-cooking adoption, making it more accessible to lower-income households.

5.6 Support private sector innovation to develop solutions tailored to informal settlement contexts

Off-grid cooking systems like the ECOCA have been successfully deployed in remote and displacement settings in Uganda but have yet to be adapted to the specific socioeconomic and spatial constraints of informal settlements. Private sector actors should develop tailored solutions that address affordability, security, and space limitations while ensuring that systems are practical for dense urban environments. Key design considerations include rightsizing generation and storage capacities, enhancing modularity and portability to prevent theft, and integrating IoT-enabled pay-as-you-go and time-of-use billing. Expanding system functionality to support additional household energy needs, such as lighting, phone charging, and water heating, could further improve viability and uptake. To support scalability and long-term adoption, partnerships with private sector manufacturers—such as Pesitho, d.Light, and Village Infrastructure—should be strengthened to ensure that product designs align with the realities of informal communities. Addressing financial gaps will also be crucial. Carbon financing presents a significant opportunity, as remote monitoring can quantify emission reductions and generate revenue from carbon markets. Additionally, incorporating off-grid e-cooking solutions into existing results-based finance schemes from the Government of Uganda and the World Bank could provide further incentives for private sector investment and market expansion.

6. Conclusion

The findings of this report have shown that e-cooking is already a part of daily life in many informal settlements in Kampala. Yet, its broader adoption remains limited by a combination of infrastructural, financial, and social barriers. Despite growing awareness of the benefits of e-cooking, communities face systemic constraints—including unreliable power supply, lack of financing for appliances and wiring upgrades, safety risks, and restrictive tenant-renter and gendered dynamics—that prevent widespread uptake of efficient appliances like EPCs. Addressing these barriers will require multi-stakeholder efforts that center the lived realities of informal communities and prioritize inclusive, context-specific solutions.

The competitiveness of electricity vis-à-vis other fuel sources remains a critical factor shaping household cooking decisions. While charcoal is currently the dominant cooking fuel, its price has been rising steadily due to government restrictions on production and the growing scarcity of forest resources—trends that are expected to continue. In parallel, Uganda is undergoing structural changes in the management of its electricity sector. The reversion to a public utility, the Uganda Electricity Distribution Company Limited (UEDCL), has been driven in part by public dissatisfaction with the high cost of electricity during Umeme's 20-year concession. It remains to be seen whether this restructuring will be accompanied by reforms to the tariff structure, and if so, whether those reforms will prioritize low-income communities. If addressing affordability is taken up as a policy priority, whether through targeted mechanisms like a revised e-cooking tariff or broader lifeline subsidies, it could tip the balance in favor of electricity as an economically preferable option for many low-income households.

Safety is another challenge that merits more attention than it currently receives from policymakers. Communities have valid concerns about electrical hazards, including shocks and fires, which could be exacerbated by introducing high-power e-cooking appliances into poorly wired homes. However, these risks must be weighed against the daily, but normalized, dangers of charcoal use. Traditional charcoal stoves put households at risk of fires. Burns are also common, particularly in homes with young children, due to the exposed and unshielded design of these stoves. In addition, charcoal use produces high levels of indoor air pollution, contributing to respiratory illnesses that disproportionately affect women and children. Electrical safety concerns have to be taken seriously and mitigated—ideally by treating domestic wiring improvements as an integral component of e-cooking programs. If these challenges can be addressed, e-cooking offers a safer long-term alternative for daily cooking. Further, it can lay the groundwork for broader energy transitions by equipping households with the wiring and infrastructure needed to safely use a wider range of electric appliances.

The implications for the technical and commercial viability of the utility must also be considered in the scenario of a large-scale transition to e-cooking. Widespread e-cooking adoption could increase household electricity demand and significantly improve utility revenue. This is particularly true if adoption is paired with efforts to move users onto individual meters through connection subsidy programs—something that our research indicates community members are eager to pursue if affordability barriers can be addressed. Increasing demand is important in the

Ugandan context, where low per-customer consumption has historically challenged the financial sustainability of the distribution system. On the other hand, our data shows that existing distribution infrastructure is often undersized in densely populated informal settlements with high connection densities. Introducing EPCs in areas with weak distribution networks could worsen voltage instability and overload local transformers. While these risks are unlikely to be triggered by isolated uptake, more research is needed to understand the threshold at which broader adoption could compromise grid performance. Strategic planning and targeted upgrades will be essential to ensure that increased demand from e-cooking strengthens, rather than strains, utility operations.

Finally, e-cooking must be considered as one alternative among other clean cooking options. Energy briquettes, made locally from household biomass waste, are commonly distributed through community-based organizations and have gained some market traction among low-income households and institutions. However, despite their potential, briquette adoption remains limited. Although their energy content is comparable to charcoal, briquettes are currently more expensive per unit of energy [47]. Users also report issues with fuel quality, which producers attribute to issues with production efficiency and standardization [48]. LPG is widely available and known in Kampala, but barriers to uptake mirror those of electricity: high upfront costs for cylinders and refills, safety concerns around gas leaks, and limited access to flexible payment models. Poor road infrastructure in informal areas further constrains LPG distribution [28]. Increasingly, there is also skepticism about promoting imported, hydrocarbon-based fuels like LPG in a country where electricity is generated almost entirely from domestic renewable hydropower.

While a mix of solutions will likely be needed, especially in the short term, the long-term direction of clean cooking in Uganda will depend on how policymakers balance priorities around affordability, sustainability, and energy access. The Government of Uganda has articulated an ambitious vision to expand e-cooking as part of a larger social and environmental agenda to reduce reliance on biomass fuels, improve public health, and conserve natural resources by slowing deforestation. As Ms. Rhoda Gwayinga of the Kampala Capital City Authority reminds us, "*Access to clean cooking is not a privilege, but a basic entitlement for all individuals, including those residing in the informal settlements of Kampala city*" [49]. Realizing this entitlement will require deliberate, inclusive policy choices that reinforce Uganda's commitment to scaling e-cooking as a cornerstone of a clean and just energy transition.

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Appendix A — Details of consumption monitoring deployment

Table A1. Breakdown of consumption monitoring participants by sensor type, start and end dates, total monitoring time in days, community, and appliances monitored. All dates are in 2023. Community names are anonymized for privacy.

Participant no.	Sensor type	Start date	End date	Time (days)	Community	Appliance(s)
1	A2EI	March 30	June 10	72	1	Cooking coils
2	Kosko	March 30	June 10	72	1	Cooking coils, electric kettle
3	Kosko	March 30	June 15	77	1	Blender
4	A2EI	March 30	June 10	72	1	Electric kettle
5	A2EI	March 30	June 10	72	1	Blender, electric kettle, hot plate
6	Kosko	March 31	June 15	76	2	Electric kettle
7	A2EI	March 31	June 10	71	2	Electric kettle, hot plate
8	Kosko	March 31	June 10	71	2	Electric kettle
9	A2EI	March 31	June 10	71	2	Cooking coils
10	A2EI	March 31	June 15	76	2	Electric kettle, cooking coils
11	A2EI	March 31	June 10	71	2	Cooking coils
12	A2EI	April 3	June 12	70	3	Cooking coils
13	A2EI	April 3	June 15	73	3	Electric kettle, hot plate
14	A2EI	April 3	June 12	70	3	Electric kettle, hot plate
15	Kosko	April 3	June 16	74	3	Electric kettle
16	Kosko	April 3	June 12	70	3	Electric kettle
17	A2EI	April 4	June 12	69	4	Cooking coils, electric kettle
18	Kosko	April 4	June 12	69	4	Deep fryer
19	A2EI	April 4	June 12	69	4	Cooking coils, electric kettle
20	Kosko	April 4	June 12	69	4	Deep fryer
21	Kosko	April 5	June 15	71	5	Electric kettle
22	Kosko	April 5	June 15	71	5	Electric kettle
23	Kosko	April 18	June 26	69	6	Cooking coils, electric kettle

24	Kosko	April 18	June 26	69	6	Cooking coils, electric kettle
25	A2Ei	April 18	June 26	69	6	Electric kettle
26	A2EI	April 18	June 26	69	6	Electric kettle
27	Kosko	April 18	June 26	69	6	Electric kettle
28	A2EI	April 18	June 26	69	7	Cooking coils, electric kettle
29	A2EI	April 18	June 26	69	7	Electric kettle, popcorn machine
30	Kosko	April 18	June 26	69	7	Electric kettle, juicer
31	A2EI	April 18	June 26	69	7	Hot plate
32	Kosko	April 18	June 26	69	7	Electric kettle, juicer, hot plate
33	Kosko	April 18	June 26	69	7	Blender, electric kettle, hot plate
34	A2EI	April 19	June 263	68	8	Electric kettle, hot plate
35	Kosko	April 19	June 26	68	8	Electric kettle
36	A2EI	April 19	June 26	68	8	Electric kettle, hot plate
37	A2EI	April 19	June 26	68	8	Electric kettle, hot plate
38	Kosko	April 19	June 26	68	8	Electric kettle
39	A2EI	April 19	June 26	68	8	Electric kettle, hot plate
40	Kosko	April 19	June 26	68	9	Electric kettle, EPC
41	A2EI	April 19	June 26	68	9	Electric kettle
42	A2EI	April 19			9	Cooking coils, popcorn machine
43	A2EI	April 19	June 26	68	9	Electric kettle, hot plate
44	Kosko	April 19	June 2	44	9	Blender, cooking coils, electric kettle
45	Kosko	April 19	June 26	68	9	Hot plate
46	Kosko	April 20			9	Cooking coils
47	Kosko	April 20	June 26	67	9	Electric kettle, hot plate
48	Kosko	April 20	June 26	67	10	Cooking coils, electric kettle
49	Kosko	April 20	June 26	67	10	Cooking coils, electric kettle
50	A2EI	April 20	June 26	67	10	Blender, electric kettle
51	Kosko	April 20	June 26	67	10	Electric kettle

52	Kosko	April 20	June 26	67	10	Electric kettle
53	Kosko	April 20	June 26	67	10	Blender, cooking coils, electric kettle, EPC

Appendix B — Assumptions of fuel cost comparison

Assumption	Value	Unit	Source
Empirical energy ratio (charcoal:EPC)	14	unitless	[26]
Empirical energy ratio (charcoal:hot plate)	10	unitless	[26]
Conversion of kWh to MJ	3.6	MJ/kWh	[50]
Cost of charcoal	0.286	USD/kg	[26]
Cost of electricity	0.21	USD/kWh	[51]
Charcoal energy content	24.9	MJ/kg	[47]