Piloting Electric Pressure Cookers in Kalobeyei Integrated Settlement

Project Experiences & Key Lessons Learned

endev SNV clasp

Content

List of Abbreviations and Acronyms

EnDev	Energising Development
EPC	Electric Pressure Cooker
FI	Financial Institution
KIS	Kalobeyei Integrated Settlement
KPLC	Kenya Power and Lighting Company
KYC	Know Your Customer
LPG	Liquified Petroleum Gas
MBEA	Market-Based Energy Access
MECS	Modern Energy Cooking Services Programme
PEPCI-K	Piloting Electric Pressure Cookers in Kalobeyei
SHS	Solar Home Systems
SMEs	Small Medium Enterprises
SNV	Netherlands Development Organisation
UNHCR	United Nations High Commissioner for Refugees
VSLA	Village Savings and Loan Association

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EnDev at a glance

Around 2.6 billion people are without access to modern cooking energy and 759 million people have no access to electricity. This has a dramatic impact on quality of life, environment, health, education and income opportunities. EnDev's involvement focuses on providing access to modern, renewable energy. This is a pivotal factor in strengthening socio-economic development and combatting climate change.

EnDev's drive is to improve the lives of the most vulnerable people, ensuring no one is left behind. Economic opportunities and green jobs are created by building markets for modern, renewable energy. EnDev contributes to reducing greenhouse gas emissions to protect our planet's climate. Its approach is to empower structural, selfsustaining change; kickstarting market and sector development that evolves further without support by EnDev.

EnDev's work is about people. Results are monitored and reported rigorously. EnDev's achievements on helping people, schools, health centres, and companies gain access to electricity or improved cooking technologies can be found in this report. This report also presents EnDev's impacts on gender, job creation, and reduced carbon emissions.

EnDev is a strategic partnership. Dedicated donors, partners and individuals work together to support social development and economic growth by providing access to modern, renewable energy in more than 20 countries around the globe. The driving force behind EnDev is the partnership of Germany, the Netherlands, Norway, and Switzerland; donors who are committed to accelerating energy access and socio-economic development.

Executive summary

This report presents the activities, results, and key insights from implementing the **Piloting Electric Pressure Cookers in Kalobeyei** (PEPCI-K) **project**. The project was implemented by SNV and CLASP under the Energising Development (EnDev) Innovation Window from November 2021 to December 2022 in Kalobeyei integrated settlement (KIS), and Kalobeyei town and the surrounding area, including Kakuma town and Kakuma refugee camp in Northern Kenya.

Project objectives and activities

The project focused on: (i) gaining insights in the potential for cooking with electric pressure cookers (EPCs) for mini-grid users in a refugee setting, and (ii) the requirements and potential barriers to developing a market for EPCs in low-income mini-grid settings, in particular within a displacement context. To do so, the project activities included product sensitization, testing, and selection, commercial distribution (including marketing and end-user trainings), and the testing of various payment models for EPC purchase. The commercial distribution of the EPCs and the testing of payment models was led by a private sector company with support from the project. Furthermore, the project conducted research on the impact of EPC uptake on end-users' cooking experiences and their electricity consumption from the mini-grid systems through baseline, bi-weekly, and endline surveys, and through electricity consumption monitoring.

Key pilot results

Commercial distribution and testing of payment models

- **Households showed good demand and *willingness* to pay for EPCs:** The project distributed EPCs for testing to 20 end-users based in Kalobeyei town and KIS. Subsequently, the distributor commercially sold EPCs using various payments plans, ranging from cash to 4- to 20-week repayment periods, of which the 20-week and 12-week payment plans were most preferred. A total of 80 units were sold to refugees and host community members in the area[1] . Sales are counted as customers having paid a deposit and started their payment plans by the end of the project distribution period (October 2022). All units were sold for household use, as the 6-litre EPC was shown to be too small for commercial usage.
- **The EPC payment plans recorded high default rates:** All payment plans saw high default rates, which can be explained by several factors, including low purchasing power due to/and competing financial commitments, a common indebtedness culture, insufficient customer vetting and ineffective processes and systems for payment recollection.

EPC usage patterns and impact

- **EPC impact on cooking events and time**: The number of cooking events remained similar, namely twice a day on average. The research indicates that EPC usage saves overall cooking time and frees up time during cooking. A consistent and sufficient supply of electricity is critical for ensuring continuous EPC usage.
- **EPC impact on cooking water usage:** EPC users reported average water savings of 22 litres a day when cooking with an EPC; however, this requires more research to further

[1] Sales were made both in Kalobeyei and Kakuma, as the geographical scope was expanded during the distribution phase.

validate and quantify. Still, the water savings potential of EPCs is an important benefit in drought-stricken areas and is worth including in marketing messages and EPC usage training to optimize water savings rates.

- **EPC impact on use and costs of cooking fuel and meal preference:** Most EPC users reduced the use of charcoal and firewood for cooking. The average fuel savings are 691KES/6.40 EUR per month (factoring in average electricity expenditure). Interestingly, the multi-national and ethnic composition of the communities does not seem to significantly impact the uptake and use of the EPC, as the type of meals cooked did not change when transitioning to cooking with EPCs, indicating compatibility of food types with the EPC.
- **EPC awareness and ownership:** Overall awareness of EPCs significantly increased due to marketing activities. Time savings from fast cooking, cooking convenience, cost savings, and reduced smoke were mentioned as primary drivers of uptake, while lack of access to finance and the high price of EPCs are the main barriers preventing people from purchasing EPCs.
- **EPC usage experience, adaptation, and continuity:** Most EPC users are satisfied with the EPC, which is primarily attributed to the faster cooking time and it being a clean source of fuel. The least-liked attributes include small pot size and lack of a spare pot.

Electricity consumption and mini-grid system impact

- **Impact of EPC use on electricity consumption:** Monitored EPCs contributed on average 4kWh per month per household to total household power consumption for 18 bi-weekly surveyed users. There is high usage variety, showing potential to optimize usage where consistent and reliable electricity supply is available, among low users through (post-uptake) user trainings.

Scaling e-cooking in Kakuma and Kalobeyei

- For 50,000 households in Kakuma and Kalobeyei to cook with electricity, an estimated 10-15MWp grid capacity is required as derived from low, medium and high EPC usage scenarios. This could save 24 to 354 CO2 emissions annually. Individual households could pay off an EPC in 4 to 35 months with the savings resulting from charcoal or firewood replacement, depending on the usage frequency and the type of fuel replaced. From the modelled scenario's, the magnitude of the gains to be achieved, both at household level and for the environment, is evident.

A roadmap for e-cooking market development interventions

The project activities and results have generated substantial insights into the challenges that come with developing a market for e-cooking in a low-income (mini-grid) setting such as Kalobeyei, especially within a displacement context. The roadmap presents steps to consider in:

- **Pre-project design.** This requires in-depth feasibility assessments on the site selection, local demand, supply and identifying and selecting appropriate e-cooking technologies using an end-user centric approach.
- **Project design: private sector support modalities.** The technical (and financial) assistance to the private sector needs to cover quality product sourcing, design, and operationalization of appropriate business models, end-user financial literacy education; design of smart subsidies, development of marketing messages and strategy, facilitation of end-user trainings, electricity source compatibility assessments, and after sales service provision.

- **Developing and maintaining a conducive environment.** This includes (but is not limited to) stakeholder sensitization and engagement, monitoring market development in terms of sales and customer feedback, continuous provision of market intelligence to the private sector in terms of demand for e-cooking and e-cooking market development trends, and knowledge development and dissemination.

Introduction

This report presents the activities, results, and lessons learned from implementing the **PEPCI-K** project, which took place from November 2021 to October 2022. The project was implemented by SNV and CLASP, with funding from the EnDev Innovation Window, and piloted a market-based approach to electric cooking (e-cooking) among both refugee and host communities in Kalobeyei town, KIS, and the surrounding area in Turkana County, Kenya, with specific (research) focus on solar mini-grid customers in Kalobeyei town and KIS.

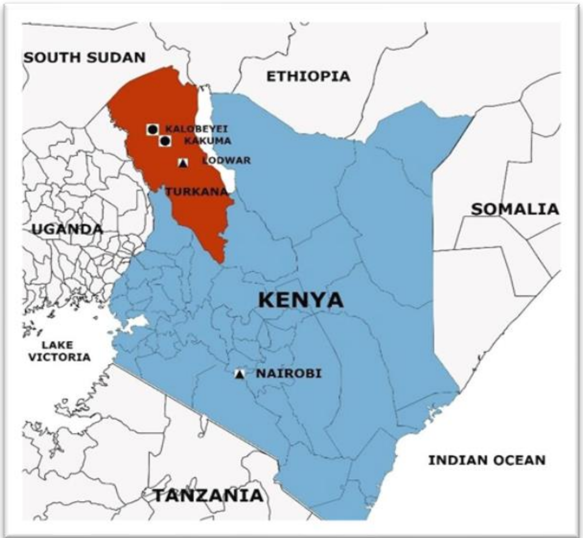
This report describes: (1) the background in which the project took place in terms of the Kalobeyei context: the cooking and electricity situation, and the opportunity for e-cooking; (2) the project activities; (3) the project results on distribution, and the research results on end-user experience and electricity consumption; and (4) the key lessons learned and recommendations for EPC market development in low-income (mini-grid) settings.

1. Background

1.1 Kalobeyei integrated settlement

Kalobeyei integrated settlement (KIS) and Kalobeyei town are part of Kakuma refugee camp in Turkana County, northern Kenya. Kakuma refugee camp was established in 1992, following an influx of Sudanese refugees, and hosts more than 244,000 registered refugees and asylum-seekers across 22 nationalities.[2] KIS was established in 2015 after Kakuma refugee sub-camps surpassed capacity, and was designed to promote the self-reliance of refugees and the host population and deliver integrated services to both through market-based opportunities.

Kalobeyei integrated settlement ©SNV/EnDev



Kakuma and Kalobeyei in Kenya
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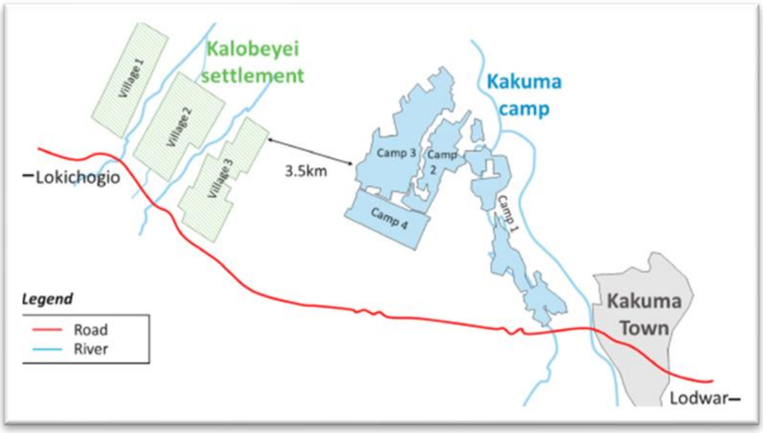


Map of Kakuma town, Kakuma camp, and Kalobeyei settlement ©Journal of Development Economics

[2] UNHCR, October 2022. Operational data portal. Online.

KIS currently hosts 47,702 displaced persons (approx. 9,540 households) from South Sudan (76%), Ethiopia (12%), Burundi (6%), Democratic Republic of Congo (4%), Sudan, and Uganda.[3] KIS is located 3.5km northwest of the Kakuma refugee sub-camps and is divided into three villages, which are divided into neighbourhoods and compounds.

Although the host community has been encouraged to move to KIS, most people residing in the Kalobeyei settlement are still refugees. Kalobeyei town is about 14km from KIS and has an estimated population of 3,500, composed primarily of Turkana community members. The gender divide in KIS is almost equal (49.1% female and 50.9% male); however, the population is largely youthful, with 63% being below age 18. The most common languages spoken are Kiswahili, English, Arabic, and French (outside the native tongues of the respective nationalities/ethnic groups).

Most people in KIS live in a permanent dwelling made of stone and iron sheets, developed under the Cash for Shelter Programme managed by United Nations High Commissioner for Refugees (UNHCR). The area has a variety of small businesses, both operated and owned by Kenyans and refugees, concentrated in market areas, or operated from homes within the residential areas to provide livelihoods for their families. The most common types of businesses are *dukas* (small shops), vegetable stalls, eateries, barber shops, clothing shops, saloons, tailors, and hardware shops. Lastly, various institutions and agencies provide social services to the communities, including schools and training centres, health centres, and churches.

1.2 Cooking and electricity in Kalobeyei

The majority (94-96%) of the 258,000 people living in and around Kakuma and Kalobeyei (including host communities) use firewood and/or charcoal for cooking, which, if using inefficient stoves and methods, can have adverse effects on health and the environment.[4] Respiratory diseases that could be caused by household air pollution are common, as reported by local healthcare providers, and deforestation has been a major issue in Turkana County for decades.

Alternative fuel choices are limited, and most refugees spend 1,050 KSH (8.50 EUR) on fuel per month on average, or (illegally) collect firewood around the camps.[5] Firewood collection is a time-consuming task, poses safety risks to women, and creates tensions with the host communities (who can collect firewood freely, making the sale of firewood an important source of income).

Significant progress has been made by introducing improved and higher-tier cookstoves to the local markets by projects such as the EnDev Market-Based Energy (MBEA) project, but all are biomass based due to a lack of alternative fuel supply, and people easily resort to open fires and basic charcoal stoves if their stove breaks or if they are unable to afford an improved or high-tier stove.

The households, businesses, and institutions in Kakuma and Kalobeyei have various levels and sources of energy access. This ranges from KPLC diesel-grid connection (in Kakuma town) to solar lanterns, solar home systems (SHS), component-based solar systems, diesel/petrol generators, and solar mini-grids (in Kalobeyei town and KIS). Other common sources specifically for lighting are torches, mobile phones, firewood, and candles. See Table 1 for an overview of primary sources of lighting for households in the area, as drawn from the

[3] ibid
[4] IFC, 2022. Energy Sector Baseline Study in the Kakuma-Kalobeyei Refugee-Hosting Area in Kenya. Online.
[5] ibid

IFC Energy Sector Baseline Study in the Kakuma-Kalobeyei Refugee-Hosting Area in Kenya published in March 2022.

Table 1: Household primary source of lighting (IFC, 2022).

	Total	Kakuma town	Kakuma camp	Kalobeyei town	Kalobeyei settlement
Sample size	1,001	260	468	63	210
Solar lantern	29%	46%	22%	24%	23%
SHS	16%	27%	17%	7%	3%
Dry-cell torch	13%	6%	16%	12%	17%
Private electricity service provider	11%	0%	17%	10%	12%
Mobile phone	11%	8%	13%	10%	11%
KPLC	3%	8%	0%	13%	0%
Firewood/twigs/wood waste	2%	0%	0%	7%	4%
Candles	1%	2%	0%	1%	2%
Other	6%	2%	8%	6%	8%
None	8%	2%	7%	6%	21%

The solar lanterns, SHS, and larger component-based systems are widely available in the local markets due to focused efforts from development and humanitarian agencies on supporting the private sector to enter the market, grow their businesses, and raise product awareness among residents. The private electricity providers in Kakuma sub-camps operate diesel mini-grids, while in Kalobeyei they refer to the Renewvia Energy operated hybrid solar mini-grid systems.

The hybrid solar mini-grid systems were installed in 2019 by Renewvia Energy and include a 20kWp hybrid solar mini-grid system in Kalobeyei town, which supplies electricity to 103 households, 29 businesses, and four institutions, and a hybrid solar mini-grid in KIS Village 1. The system in KIS had a capacity of 60kWP at the time of pilot inception in November 2021, connecting 347 households, 131 Small Medium Enterprises (SMEs), and 17 institutions. In June 2022 this system was expanded to 541kWp. Renewvia Energy has since been connecting new customers with an estimated maximum capacity of 2,500 new connections. Renewvia Energy charges a 500 KES[6]/4 EUR connection fee and a commercial and residential tariff per kWh used of 27.33 KES/0.22 EUR and 33.54 KES/0.27 EUR, respectively.

The increased electrification rates due to access to the mini-grid systems provided an opportunity to introduce e-cooking devices to mini-grid customers, given their potential advantages for end-users and positive impact on mini-grid viability, as further explained in the next section.

1.3 Electric cooking

The opportunity for e-cooking as a clean cooking solution has been gaining interest due to the increased grid coverage and decreased costs of batteries and PV modules, making electricity from mini-grids more accessible even in very remote areas. The evidence base underpinning

[6] Exchange rate of 125 KES = 1 EUR used throughout report.

this potential is growing rapidly, pushed strongly by the UK-aid funded Modern Energy Cooking Services Programme (MECS)[7] and other public and private initiatives.

The value proposition for e-cooking includes the opportunity for end-users to replace biomass as primary cooking fuel, leading to faster cooking times, increased cooking convenience due to unsupervised cooking, cost savings due to higher efficiencies, reduced exposure to Household Air Pollutants and cleaner cooking environments.[8] From a mini-grid system operator perspective, e-cooking can contribute to the financial sustainability of mini-grids due to increased power consumption. Solar mini-grid developers face the challenge of securing a load that demonstrates clear return of investment. Average household energy demand for the Kalobeyei mini-grid systems is low (5.7 kWh per month), specifically during daytime. Appliances that are used during the day can help to better balance supply and demand during sun hours, and improve the economic viability of the mini-grid system.

Several electric devices have been explored as clean cooking solutions, including induction cookers, hotplates, rice cookers, air fryers, electric frying pans, and EPCs. EPCs are considered well suited in a mini-grid context due to their high efficiency and their suitability for (unsupervised) preparation of staple meals during daytime, promoting additional power consumption during typical low-demand (daytime) hours.[9] Various studies have tested EPCs with mini-grid users (e.g., by PowerGen/CLASP in Tanzania, and Earth Spark/MECS in Haiti).[10] Initial findings indicate that EPCs can positively impact end-users' cooking experience, especially regarding time savings, cooking convenience, and absence of smoke, and their uptake can increase (daytime) mini-grid power consumption.

1.4 The Piloting Electric Pressure Cookers in Kalobeyei (PEPCI-K) project

Photo: Renewvia Energy solar mini-grid system in KIS ©KKCF

Given the findings from previous pilot studies, the existence of the mini-grid systems in Kalobeyei and the nascency of e-cooking in this displacement context, SNV and CLASP designed and implemented the PEPCI-K project with funding from the EnDev Innovation Window.

EPCs were selected as e-cooking technology to promote in the pilot based on findings from earlier studies, including expected compatibility with staple foods, the convenience of cooking, fast and efficient cooking time, and availability in the Kenyan market. This pilot was designed because the technology had not been tested before (with mini-grid customers) in refugee

[7] See also www.mecs.org.uk
[8] ESMAP & MECS, 2020. "Cooking With Electricity A Cost Perspective."
[9] Hivos, WFC, 2020, "Beyond Fire How to Achieve Electric Cooking."
[10] EarthSpark International, 2021. "Solar Power for Electricity Access and Electric Cooking in Haiti." Powergen & CLASP, 2020. "Electric Pressure Cooking: Accelerating Microgrid E-Cooking Through Business and Delivery Model Innovations."

settings. Therefore, there were many unknowns in terms of consumer demand and impact on cooking practices, willingness and ability to pay, the type of support the private sector requires to distribute the technology in the area, and impact on mini-grid electricity consumption and power capacity.

Project objectives

The pilot had a strong research focus to generate knowledge centred on: (i) gaining insights in the potential for cooking with EPCs for mini-grid users in a refugee setting, and (ii) the requirements for and potential barriers to developing a market for EPCs in low-income mini-grid settings, in particular within a displacement context.

More specifically, the project intended to:

- understand end-user experience cooking with EPCs in terms of impact on fuel, time, costs, fuel stacking practices, and overall cooking experience, including exposure to smoke and cooking convenience;
- understand EPC use within a multi-national and ethnical displacement context and the suitability with different types of food cooked by these groups;
- understand the technical and commercial impact of EPC use on electricity consumption from mini-grids in low-income settings; and
- identify requirements to develop the EPC market within a mini-grid (refugee/low-income) context, including ability and willingness to pay, suitable design for end-user financing, and capacitating a distributor to continue sales after the pilot.

The pilot set out to test the use of EPCs with 100 refugee and host community households and microbusinesses connected to the solar mini-grid systems in KIS, Kenya,[11] and was implemented from November 2021 to December 2022. The project leveraged from SNV's existing local presence and partnerships, with humanitarian agencies, local government entities, and private sector players in Kakuma, as developed through the EnDev MBEA project, which is being implemented by SNV since 2017.[12]

The MBEA project implemented by SNV under the EnDev programme aims to promote market-based access to clean cooking and solar-powered solutions in Kakuma refugee camp, KIS, and the host communities. The project, which started in 2017 with a pilot and is currently in its second phase, has facilitated and supported the entry of various improved stove and solar companies, including two stove production units through the provision of technical assistance and activity-based financial facilitation. The support to the private sector in combination with targeted community sensitization activities have resulted to wide availability and awareness of cooking and solar solutions for household, commercial, and institutional use among refugee and host community members in Kakuma and the Kalobeyei area.

The PEPCI-K project presented in this report has been implemented in the context of the MBEA II project, leveraging the presence of the project team in the area, the private sector partner network, large (local) stakeholder network, and further extensive knowledge of the local context relevant to implementing an energy market development project.

The EnDev MBEA Project

[11] The geographical scope was later expanded to people residing in Kakuma town due to high demand from residents connected to the national grid.
[12] For more information see https://snv.org/project/market-based-energy-access-mbea-ii and SNV, 2020. "Promoting Market Based Energy Access for Cooking and Lighting in Kakuma Refugee Camp Experiences and lessons learned." https://snv.org/assets/explore/download/mbea_external_report_final_for_uploading.pdf

2. Pilot activities

The PEPCI-K project implementation activities were divided into four main workstreams: (1) 'Product sensitisation, testing, and selection', (2) 'Commercial distribution and testing of EPC payment models', (3) 'Data collection and analysis', focused on research on end-user experience and electricity consumption, and (4) 'Learning and knowledge dissemination'. This chapter will describe the activities of workstream 1-3, as summarized in Table 2.

Table 2: PEPCI-K activities per workstream.

Workstream	Activities
1. Product sensitization, testing, and selection	Demonstration events with stakeholders
	Pre-pilot testing with 20 selected end-users
	Product selection for commercial distribution
2. Product distribution and EPC payment model testing	Commercial EPC distribution (80 units)
	Developing and testing EPC payment models
3. Data collection and analysis	Baseline survey
	Bi-weekly surveys EPC users Energy consumption monitoring
	Endline survey
4. Learning and knowledge dissemination	Presentations, contribution e-cooking community of practice, publication key learnings report

2.1 Product sensitization, testing, and selection

Product sensitization and selection

- **Demonstration events:** The SNV team organised several demonstration events with local stakeholders, including humanitarian agencies and (host and refugee) community-based organisations based in Kalobeyei and Kakuma to showcase the new cooking technology and familiarize people with it, and receive feedback and buy-in for the introduction of the technology in the area.
- **Product selection and testing:** To understand initial end-user experience and grid implication, 15 households and five business owners were selected, trained on EPC use, and provided with an EPC for testing. Five units of each EPC model available in Kenya (Sayona, Burn Ecoa, Von, and Powerhive) were distributed among the 20 participants. These EPCs were selected based on their availability in Kenya and the fact that all models have been quality tested against the Global LEAP EPC Test Method.[13] (See Annex 1. Overview of tested EPC models a comparative overview of the different models). From the feedback of the test participants, the Burn Ecoa EPC model was preferred because of the size (7.5 litres) and pre-set options tailored to Kenyan cuisine. Von and Powerhive EPCs with 6 litres were well-received, despite the smaller size, and had similar feedback regarding usage. The Sayona model functioned well; however, the manual time setting was considered to be less preferable to the digital pre-set options of the other models. Unfortunately, there was no more stock available of the Burn ECOA model at the time;

[13] The EPC product performance results are presented in the 2020 Global LEAP EPC Buyers Guide document. https://storage.googleapis.com/e4a-website-assets/2020-Global-LEAP-EPC-Buyers-Guide.pdf

therefore, the Powerhive EPC model was selected for commercial distribution based on stock availability and commitment of Powerhive staff to train the distributor on EPC marketing and repair services, which the Von EPC retailers could not provide to that extent.

2.2 Commercial distribution and testing of EPC payment models

Commercial distribution

- Solar Integrated Appliances Limited (Solaria), a solar and stove distributor for D-light and Burn, was selected after a competitive selection process among partner companies of the EnDev MBEA II project with existent presence in the Kakuma and Kalobeyei area, including existing partnerships with local stockists and sales agents. It was decided to work with one distributor to simplify the value chain and testing of the payment models. To clarify, the mini-grid developer Renewvia Energy did not express interest to sell EPCs at the time, as this was outside its scope of business as a mini-grid developer and operator. In collaboration with the selected distributor, product flyers, sales agents T-shirts, and a use and safety manual were designed for marketing and end-user training purposes. The distributor's field manager and technician were also trained at Powerhive's premises in Kisii on EPC marketing, product safety, and repair training. The distributor mobilized a sales agent team and two stockist points in Kalobeyei. The sales agents and stockists were trained on the product and sales process in a sales agent training co-facilitated by the distributor and project team.
- The distributor commenced the commercial distribution in May 2022 looking to sell the 80 units of stock. The proceeds of the distribution were to be used for marketing, distribution, after sales, and scale up beyond the project. The distribution kicked off with radio talk shows at the local radio station, a roadshow, and cooking demos. After the kick off, weekly marketing activities continued until the stock was depleted in October 2022. Marketing activities included radio shows, flyering, door to door sales, and weekly market cooking demonstrations. The 20 pre-pilot test participants also supported awareness activities within their activities and contributed to the research activities as further explained in 2.3.

Increasing affordability: testing EPC payment models

Freshon Energy was contracted to conduct research and design payment models for EPCs. Research activities included a survey among mini-grid users on income levels, sources, and access to finance (integrated in the baseline study questionnaire), and key informant interviews with financial intermediaries, Village Savings and Loan Associations (VSLAs), Renevwia Energy, and humanitarian/development agencies implementing livelihood interventions in Kakuma refugee camp. The findings informed the development of four payment models, one cash and three credit options, which were tested during commercial distribution. The payment models were designed as seen in Table 3.

Payment model	Deposit %	Deposit amount	Duration weeks	Weekly payment	Total payable[14]
1. Cash and carry	100%	9,439 KES 75.51 EUR	NA	NA	**9,439 KES** 75.51 EUR
2. Credit (large instalments)	50%	946 KES 39.57 EUR	4	1,236 KES 9.89 EUR	**9,890 KES** 79.12 EUR
3. Credit (small instalments)	30%	2,968 KES 23.74 EUR	12	577 KES 4.62 EUR	**9,892 KES** 79.14 EUR
4. Credit (small instalments)	15%	1,495 KES 11.96 EUR	20	424 KES 3.39 EUR	**9,975 KES** 79.80 EUR

Table 3: Overview of tested payment models.

The pricing incorporated markups for profit margins for distributor, agent commissions, transport, marketing, and credit management costs to reflect a real market price rather than subsidized product to understand real end-user willingness and ability to pay, and to show a commercially viable scenario to other (future) interested distributors, highlighting that they can get a return on their investment. This resulted in an approximate markup of 40-50%.

To operationalize the different models, Freshon developed implementation tools for Solaria, including a Know Your Customer (KYC) form, customer contract, and terms and conditions. The different models were tailored to different target groups, in specific savings groups such as VSLAs, which are widely present in Kalobeyei and are primary sources of access to finance for most refugee and host communities. The credit contracts were set up so that a group member would co-sign and act as a guarantor.

2.3 Research on end-user cooking experience and electricity consumption

The research activities were coordinated by CLASP and implemented by SNV's Kakuma team. The activities included a baseline study, bi-weekly surveys with selected research participants, and an endline study. The questions focused on understanding a respondent's cooking behaviour in terms of fuel use, purchase, cooking method, cooking time, meal preferences, and perception (and experience) of cooking with an EPC. The findings will be presented in sections 3.3 and 3.4.

- **A baseline study** was developed and conducted in Kalobeyei settlement and Kalobeyei town among current mini-grid users. The survey was developed to serve as a framework for the follow-up surveys and to maintain consistency with other survey descriptions. A total of 102 responses were collected as part of the survey. The survey data was complemented with electricity consumption data provided by Renewvia Energy, the mini-grid operator. The analysis was captured in a baseline study report.
- **A bi-weekly survey** was developed and conducted among EPC users from March to July 2022. Respondents included the 20 test participants that were provided with an EPC at the start of the project, and 20 customers that volunteered to participate in research activities in exchange for a small discount for EPC purchases. All research participants were provided with a smart meter to track EPC energy consumption.
- **An endline survey** was developed and conducted at the end of the pilot in September 2022 among mini-grid users (both EPC owners and non-EPC owners) in Kalobeyei settlement and Kalobeyei town. The survey data was complemented with electricity

[14] *A 500 KES discount was applied for customers willing to participate in research activities.

consumption data provided by Renewvia Energy. The analysis was captured in an endline study report.

- **EPC Electricity Consumption Monitoring**: CLASP, in partnership with A2EI, provided 40 smart energy monitoring devices to measure electricity consumption contributed by EPC products. Twenty of these devices were distributed to the 20 participants involved in the initial end-user experience test. The next 20 devices were issued to the customers that purchased their EPCs and volunteered to participate in project research activities on a first come, first served basis, which included monitoring of their electricity consumption. To measure the electricity and time used while cooking with an EPC, participants needed to plug in their EPCs to the smart meter device, which was then connected to the socket.

3. Key research findings

This section will present the key findings/takeaways regarding the (3.1) EPC distribution activities in terms of sales trends, marketing, and after sales experiences; (3.2) payment model testing in terms of consumer preference, and actual performance in terms of repayment rates; (3.3) EPC appliance usage patterns and impacts in terms of end-user experiences, and impact on their cooking practices and perception towards cooking with an EPC; and (3.4) electricity consumption and mini-grid impact of EPC uptake.

3.1 EPC distribution

Sales trend

The distributor started selling the EPCs in mid-May 2022 and sold all 80 units by the end of the distribution period (October 2022)[15]. Of the sales made, 45% were to women and 54% were to men.[16] Initially, the project tasked the distributor to limit sales to Kalobeyei mini-grid users only in order to align with primary project objectives. However, the sales team found wide demand from people not connected to the mini-grid systems in and outside of Kalobeyei, primarily from people living in Kakuma town and connected to the Kenya Power and Lighting Company (KPLC) operated (diesel) mini-grid. In addition, the distributor saw decline in sales in the area after the initial peak. Therefore, to ensure the timely depletion of project EPC stock, the collection of rigorous data on end-user experience and electricity consumption, and to allow for a comparative analysis with alternative electricity sources, it was decided to expand the target customers and area by the end of June to residents in Kakuma refugee sub-camps and Kakuma town. The 20-week payment model was withdrawn for new customers in both KIS and beyond (Kakuma town and sub-camps) to allow for repayment within project timelines. Hence, from July people could select only the cash, four-week or 12-week payment models. See the EPC sales per month by power source in Figure 1.

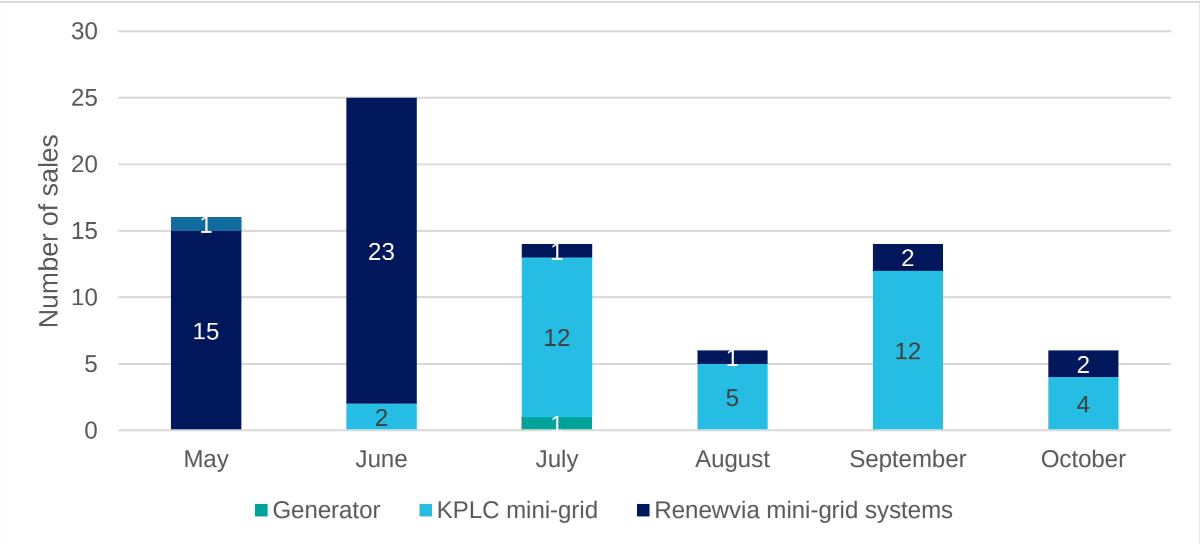


Figure 1. EPC sales per month per power source.

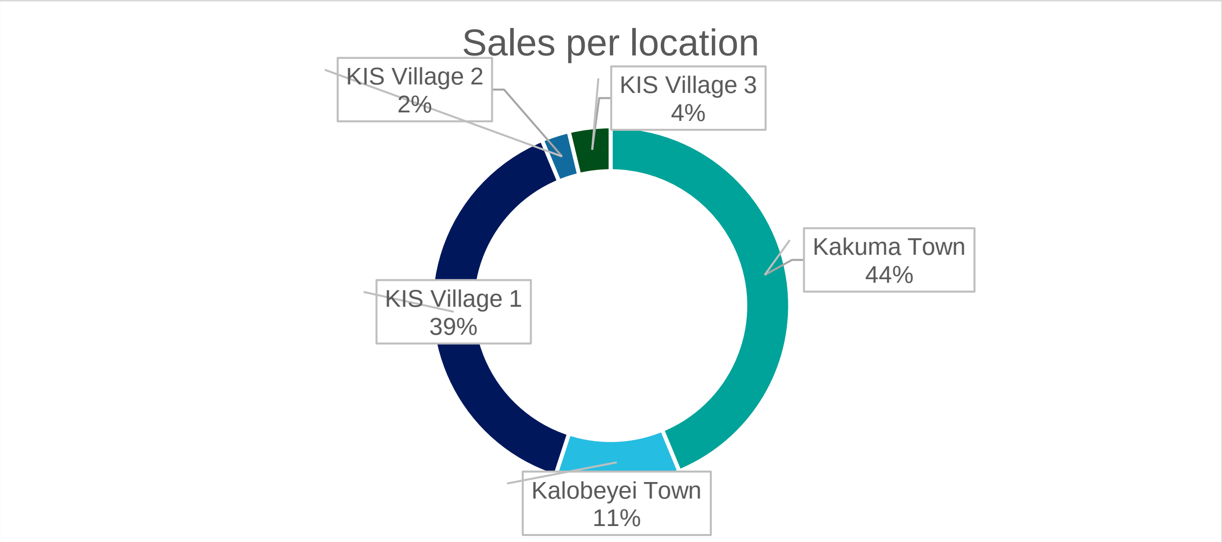
[15] Sales are considered as customers paying the deposit and starting their payment plan.
[16] One customer did not disclose their gender.

As seen in the graph, EPC sales were off to a successful start, as half of the stock was sold within six weeks (from mid-May to the end June). After that, sales slowed down and picked up again after the geographical scope was widened, which resulted in most sales being recorded in Kakuma town to customers connected to the KPLC mini-grid system.
The decline in sales in Kalobeyei can be explained by several factors, including:

- the exclusion of the 20-week payment plan from July onwards, or the fact that most customers with the ability to pay the (20-week) deposit had already purchased an EPC (although this was not explicitly surveyed);
- the EPC being considered too small for businesses, hence 'eliminating' a higher income segment; and
- the Kenyan general elections in mid-August, for which the distributor halted operations in July and started again in September (similar to many ventures in Kenya).

See Figure 2 for the geographical distribution of the sales. The high uptake among Kakuma town residents shows the market opportunity in grid-connected (peri-)urban areas. Although there was wide interest from people with solar systems, no sales were made to people with a solar system, as the capacity of the systems was often too small to meet the power demands of the EPC, especially when used in combination with other appliances. There is a solar component-based system supplier in Kakuma exploring the opportunity to sell EPCs with their systems, as inspired by the generated demand for EPCs through the pilot.

Figure 2. EPC sales per location.



Marketing

The cooking demonstrations in markets and neighbourhoods were most effective in driving direct sales, as they allowed people to directly engage with the product and interact with the sales representatives. Another important factor was the use of test participants as product ambassadors; they were able to share testimonials while supporting the cooking demonstrations, catering to different nationalities and languages. Oftentimes these were community leaders who also supported the promotion of the technology, which fostered trust among the audiences.

After sales service

While the selected EPC model for distribution met quality standards and was selected because of the commitment from the supplier to support the distributor partner on marketing, end-user training, and repairs, some technical issues arose during distribution. The most common issues were broken valves or malfunctioning display, or heating elements caused by factory faults or misuse of the product (six units had to be repaired). Throughout the project period, all technical issues with the EPCs were managed by the distributor, with support by the project on request.

One issue was the lack of local spare parts required for more advanced repairs. Therefore, these repairs needed to be done at Powerhive, based in Kisii, which is 12 hours by road from Kakuma, causing long turnaround times. The project facilitated the distributor in procuring spare parts in the last phase of the project to cater for future repairs beyond the project, but if a company were to distribute EPCs without project support, more investments would need to be made to build the capacity of technicians to do local repairs and have local spare parts available to ensure clear reverse logistics. In addition, more after sales training on effective utilization, operation, and maintenance of the EPCs would be beneficial to both the end-users and the distributors to avoid the need for repairs. Overall, this demonstrates the importance of thorough assessment of product quality and longevity, and product repairability, which depends on product complexity and local capacity to do repair and maintenance.

3.2 Increasing affordability: research on EPC payment models

The 20-week and 12-week payment models were the preferred payment options, with the 20-week model having more than half of the customers subscribed to it. The credit payment models made people sign up for purchase agreement and pay a deposit; however, it showed significant defaults in payment collection, as seen in Table 4.

Table 4: Comparative analysis of the payment models.

Indicator	PayMod I	PayMod II	PayMod III	PayMod IV
Prices	9,430 KES 75.51 EUR	9,890 KES 79.12 EUR	9,892 KES 79.14 EUR	9,975 KES 79.80 EUR
Deposit	-	4,946 KES 39.57 EUR	2,968 KES 23.74 EUR	1,495 KES 11.96 EUR
Payment term	Within a week	4 weeks	12 weeks	20 weeks
Proportion of customers (n=80)	16% [13 cust.]	8% [6 cust.]	30% [24 cust.]	46% [37 cust.]
Rate of deposit completion	100%	100%	100%	100%
Rate of full payment completion	85%	0%	0%	0%
Proportion of revenue achieved	92%	66%	43%	37%
Rate of defaulting customers	15%	100%	100%	100%

When identifying a potential customer, the sales agent/retailer filled out a KYC form to assess creditworthiness. The EPCs were dispatched after the deposit was paid and the payment contract was signed, which included a guarantor. Then the customer was expected to pay the instalments, as per subscribed payment model, on a weekly basis using Mobile Money platform M-PESA, a common payment modality in Kenya. The distributor sent frequent payment reminders through SMS and had an agreement in place with sales agents who had made the initial sales to the customer to receive an additional commission for completed sales. Despite the recollection efforts of the distributor, at the end of the distribution phase the recollection rates were low, as shown, and none of the outstanding balances were fully cleared. Those customers were considered to have defaulted by the end of the project. Several factors can be identified that contributed to the high default rates.

- **Low purchasing power due to/and competing financial commitments.** Many customers have competing financial requirements; hence they prioritize other needs over payment of the EPC and/or are confronted with shocks such as thefts, accidents, and diseases. This is also related to the high total price of the EPC compared to the average income of most residents in Kalobeyei and Kakuma.

  The project wanted to understand whether payment in instalments would address the high upfront payment barrier, in addition to costs savings resulting from fuel savings. It did in terms of allowing people to pay for the deposit, but the bottleneck showed to be inconsistent repayments. For years, however, several solar companies have been consistently selling energy solutions that are often more expensive than the EPCs, from solar lanterns to solar TVs, and even fridges on payment plans, in Kakuma and Kalobeyei area and plan to retain retail outlets in the area. This demonstrates that it is possible to do business in the market, hence the default rate is not necessarily only due to low purchasing power.

- **Common indebtedness culture**. Related to the ability to pay, a research report from the Oxford University Refugee studies centre[17] found that the culture of debt uptake is very common among Kalobeyei residents. The distributor found that most customers avoided clearing their debts and had to be persuaded. As seen in Table 4, all customers were able to meet the deposit costs; however, none of those who subscribed to the credit plans were able to clear the balances. Most customers paid for the weekly instalments up until the fourth week, where most defaults started arising, especially for the customers subscribed to the 20-week payment plan. Most customers who were contacted resisted potential repossession and improved their payments on the threat of repossession, showing they do value the product.[18]

- **Insufficient customer vetting.** The distributor was provided with the tools and training for conducting KYC (customer vetting), developing appropriate customer contracts, and collecting instalment payments. However, the focus of the distributor to deplete the stock within project timelines might have led to a situation in which the new customer vetting, in terms of ability and willingness to pay, had not been done as thoroughly as required. This can be seen by the poor instalment payments, more specifically after the expansion of scope whereby most customers paid the first instalment, with some customers paying only the deposit. This highlights the importance of 'ownership' of the distributor also in terms of carrying (part of) the financial risk.

[17] Sterck et all, (2020). Cash Transfer Models and Debt in the Kalobeyei Settlement. Online.
[18] Given the 'pilot' nature of the project and the project ultimately bearing the default risks, no EPCs were repossessed because of defaulting.

- **Ineffective processes and systems for payment collection.** The distributor found that it had not properly anticipated the cost of collections, the need for credit experts, and the time required to complete the project. The sales team was relying mostly on calls and SMSs to contact customers to encourage them to pay their debts. Commission agents were co-opted to collect payments when physical customer visits were necessary; however, many visits were found fruitless, as often customers were not found at home due to various engagements. The fact that the project catered for the EPC inventory might not have motivated more debt collection by the distributor, as the default risk was born by the project. In addition, besides repossession there is no way to temporarily turn off the device. This is common with solar or even cooking products sold on credit, which function on pay as you go systems.

Overall, the results indicate a mixed picture with regards to willingness and ability to pay, and it is unclear whether customers did not clear their balances because of inability to pay or whether there was insufficient leverage coming from the distributor. Most likely it is a combination of the above factors and varies per customer. This experience provides important learnings on the pricing of the technology in a remote, generally low-income area, the importance of communicating the cost saving potential of the technology (electricity and fuel costs) and use this to determine the instalment amount and repayment periods. Moreover, it demonstrates the challenges in operationalizing an effective credit system for local distributors in a low-income area, and the type of support and partnerships they would benefit from. This will be elaborated on in the final chapter with the roadmap for implementing e-cooking market development projects.

3.3 EPC appliance usage patterns and impacts

This section highlights the main findings from the analysis of data collected, with an emphasis on the impact of EPC usage in terms of end-user cooking experience across five research areas:

(i) Cooking events and time
(ii) Water usage
(iii) Use and cost of cooking fuel and meal preference
(iv) Awareness and ownership
(v) Usage experience, adaptation, and continuity

The different sections will outline the situation, as found in the baseline study, and the implications EPC usage has made on the various research areas, as analysed from the data collected from EPC users in Kalobeyei through bi-weekly surveys and (partially) from the endline survey, which included both EPC users and non-EPC users. The survey data sets are complemented with the energy monitor device data, which a selection of EPC users was equipped with to monitor real-time EPC use and electricity consumption, and to allow for comparison with self-reported survey data. Despite the geographical scope being widened mid-distribution, the research on EPC impact on end-user experience and mini-grid consumption focused on mini-grid customers.

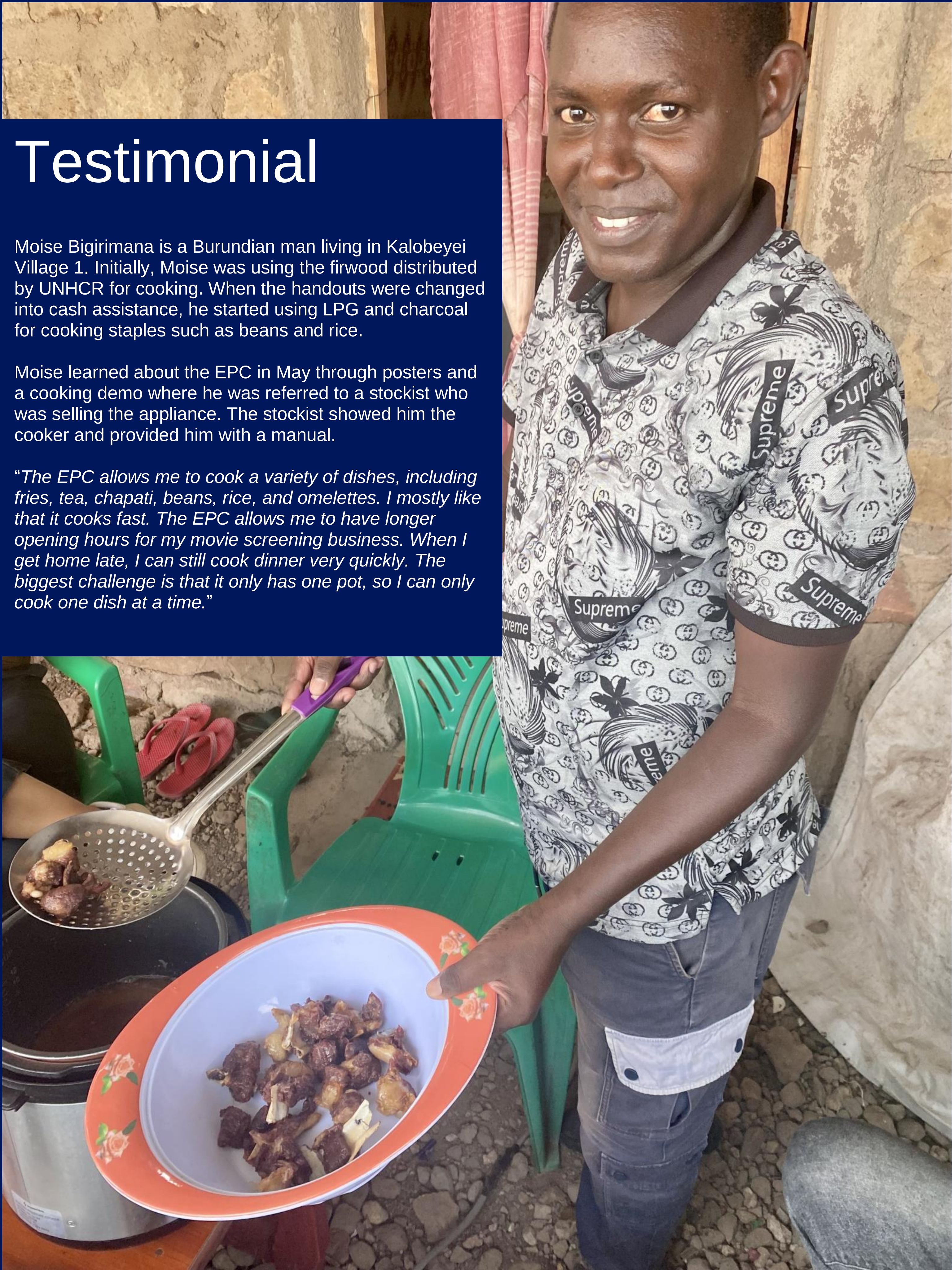
The composition of the analysed survey data sets is presented in Table 5. Due to the low number of business respondents (five or fewer in subsequent data collections after baseline), to ensure a statistically significant sample, and having determined no major differences between observed business and households' behaviour and usage patterns, the findings presented in this report are combined for all respondent types. Comparative analysis between the various studies has been provided for areas of assessment as deemed applicable and suitable.

Testimonial

Moise Bigirimana is a Burundian man living in Kalobeyei Village 1. Initially, Moise was using the firwood distributed by UNHCR for cooking. When the handouts were changed into cash assistance, he started using LPG and charcoal for cooking staples such as beans and rice.

Moise learned about the EPC in May through posters and a cooking demo where he was referred to a stockist who was selling the appliance. The stockist showed him the cooker and provided him with a manual.

"*The EPC allows me to cook a variety of dishes, including fries, tea, chapati, beans, rice, and omelettes. I mostly like that it cooks fast. The EPC allows me to have longer opening hours for my movie screening business. When I get home late, I can still cook dinner very quickly. The biggest challenge is that it only has one pot, so I can only cook one dish at a time.*"



For the bi-weekly survey, only feedback from 21 participants who participated in at least three surveys were included in analysis. All 21 participants were those that had been allocated with an EPC as part of the pre-pilot test. The base minimum of three surveys was used after establishing a minimal effect on the overall data results. The change in the number of participants was largely due to dropout incidents caused by the relocation of some participants to outside the study area.

Table 5: Overview of respondents per survey.

Respondent type per study	Number	Percentage to the number of respondents
Baseline survey with non-EPC users		
Households	91	75%
Businesses	11	25%
Total	**102**	
Bi-weekly survey with EPC users		
Households	16	76%
Businesses	5	24%
Total	**21**	
Endline survey inc. EPC users and non-EPC users		
Households	68	94%
Businesses	4	6%
Total	**72**	
The portion that participated in baseline	70	97%
The portion that participated in baseline and bi-weekly	23	32%
Number of EPC users	23	
Number of non-EPC users	49	

3.3.1 EPC impact on cooking events and time

Key impact findings

- **The number of cooking events remained similar, with EPCs being used twice a day on average.**
- **The research indicates that EPC usage saves overall cooking time and frees up time during cooking.**
- **Consistent and sufficient supply of electricity is critical for ensuring continuous EPC usage.**

Cooking events

The baseline survey found that households cook twice a day and spend an average of two hours cooking. Reported data from the bi-weekly surveys among EPC users indicates that, when users are cooking with their EPCs, they do so twice a day on average, similar to when they are cooking with charcoal or firewood. The energy meter data results also align with these findings as shown in Figure 3. A cooking event is defined as a consistent recording sequence by monitoring the energy consumption and power level.[19]

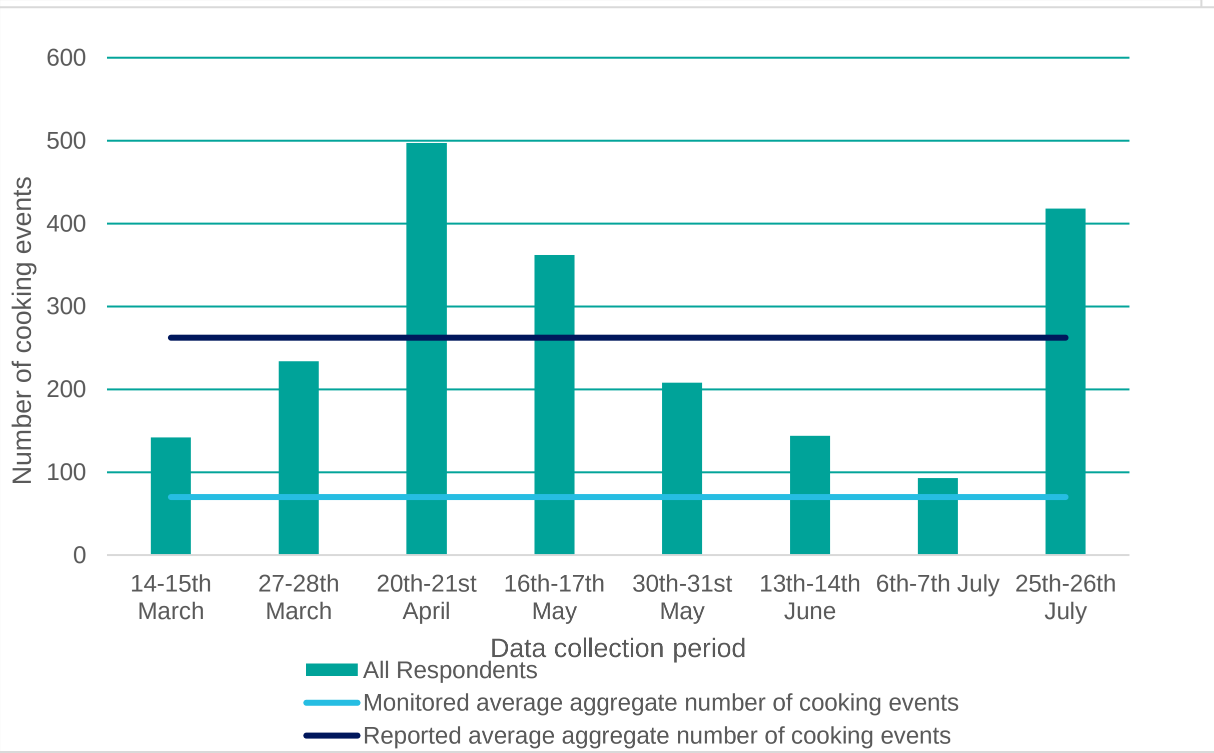


Figure 4. Reported versus monitored average aggregate number of cooking events.

Figure 4 shows the reported aggregate average number of cooking events by EPC users collected from the bi-weekly surveys compared to the metered aggregate average number of cooking events, over the same period. Overall, findings from the smart meter data indicate respondents used their EPCs on average 37 days over the 134-day appliance ownership period. The reported aggregate average number of cooking events is slightly higher (shown by the light blue line, i.e., 262), compared to the actual aggregate average number of cooking events monitored (shown by the dark blue line, i.e., 70). The difference in results can be an indication of an exaggeration from the respondents in their survey reporting. More investigation would be needed to determine other possible causes. Overall, for mini-grid demand projection calculations, it would be recommended to use the actual monitored values, as they provide a more accurate representation of real usage.

Usage should increase as customers become more comfortable and familiar with the appliance after repeated use. However, looking at the bar graphs, there is a clear indication that usage is not uniform across all periods. Some of the reasons inferred from interactions with customers during the endline survey suggest an unsteady supply of electricity, and reversion to using biomass fuels for cooking due to increased costs of living (particularly among those who still hold the perception that electricity is very expensive). In addition, electricity supply from the KIS mini-grid system was rationed during the pilot (May-June) for a system-wide capacity expansion. Once flagged by the project team, Renewvia Energy adjusted rationing hours to align with cooking schedules. The expansion was completed in July and enabled customers to have consistent supply once again, which correlates with an observed increase in the number of cooking events among the monitored EPC users.

[19] A2EI (2020). Retrieved from https://a2ei.org/resources/uploads/2020/12/ReadMe_CC_Data_Release.pdf.

Cooking time

From both baseline and endline surveys, residents self-reported to spend an average of 2.75 hours cooking. However, the time spent cooking varies significantly depending on the number of customers in case of a business, household size, the type of food being cooked, and the mode of cooking being used.

Energy monitor data from the bi-weekly survey participants indicate the average duration of a cooking event on an EPC is 20 minutes. This study did not collect quantitative data on the change in time spent cooking on days when an EPC was used versus other stoves. However, from the qualitative feedback, when asked about the main change in terms of cooking patterns since the start of the EPC pilot, most respondents noted the ability to multitask and time savings from shorter cooking times.

3.3.2 EPC impact on cooking water usage

Key impact findings

- **EPC usage showed average water savings of 22 litres a day due to efficient cooking, but further research is required.**
- **Water savings potential of EPCs is an important benefit in drought-stricken areas.**

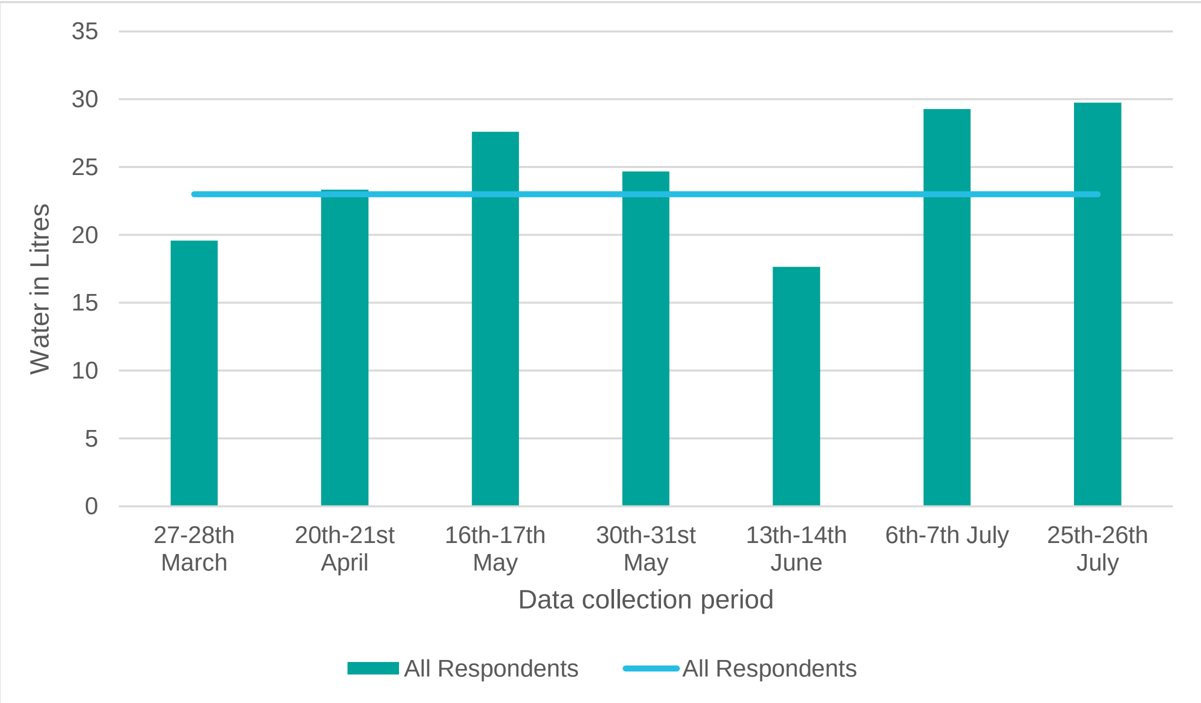


Figure 5. Self-reported amount of water saved in litres by EPC users.

For this study, cooking water is defined as water used primarily for cooking and does not include water for washing food and/or pans. From the baseline survey, respondents, particularly households, reported a weighted average of 40 litres of water per day for cooking. This number is significantly higher than expected and will require further investigation and comparison with findings from similar contexts. A study querying participant in three districts of Uganda and one province of Kenya about their water usage habits found that rural Ugandans use an average of 15.4± 0.5 litres per person, per day regardless of their perceived effort in terms of collection times or distances travelled.[20] Results from the bi-weekly surveys with EPC users indicate that respondents realized a weighted average of 22 litres a day in cooking water savings, as visible in Figure 5.

The water savings potential, although in reality might not be as much as the 22 litres reported, is particularly beneficial, as Kalobeyei is in a water-scarce region exacerbated by current drought conditions, attributable to climate change. Efficient use of water builds resilience and improves overall well-being of households, businesses, and the community. Additional research on the water savings potential due to cooking with EPCs is recommended, as the self-reported water saving levels in the surveys seem exaggerated. If further validated/quantified, water savings could also be a benefit to emphasize in marketing messages and be included in end-user trainings in terms of optimizing the water savings.

3.3.3 EPC impact on use and costs of cooking fuel and meal preference

Key impact findings

- **Research showed most EPC users reduced the use of charcoal and firewood for cooking.**
- **Fuel savings reflected is 200 KES/1.60 EUR per week.**
- **The multi-national and ethnic composition of the communities does not seem to significantly impact the uptake and use of EPCs, as the type of cooked meals did not change after EPC uptake.**

Use of fuel

The baseline survey found that most of the respondents were using charcoal as the primary cooking fuel, supplemented by wood as a secondary fuel. Very few households were using liquified petroleum gas (LPG) and/or biogas. On a weighted average, households use their primary cooking fuel daily and the majority pay for it with cash, usually delivered by sellers to their homesteads or sourced from the market. Others pay for fuel through the exchange of food rations or other goods. Charcoal is bought based on two sizes, either a sack or a basin.

Most of the EPC users (76%) reported using less primary cooking fuel (charcoal) in the bi-weekly surveys. Factors influencing the choice of fuel type to use for cooking are illustrated in Figure 6. There has been no change in consideration patterns exhibited by respondents when deciding the type of fuel to use for cooking, even after uptake of EPCs.

[20] Mellor.J, et al, 2012, Rural water usage in East Africa: does collection effort really impact basic access? https://www.ircwash.org/resources/rural-water-usage-east-africa-does-collection-effort-really-impact-basic-access

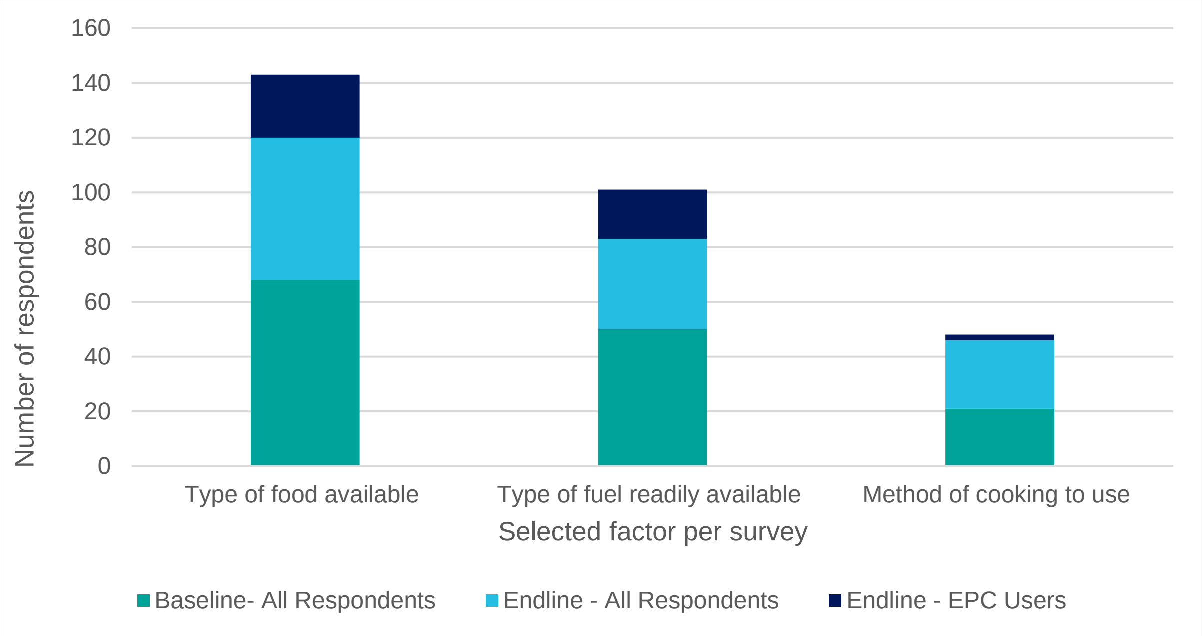


Figure 6. Ranking of factors influencing decision on type of fuel for cooking.

The type of foods cooked did not change after receiving EPCs, indicating compatibility of food types with EPCs. The multi-national and ethnic composition of the communities does not seem to significantly impact the uptake and use of the EPC. This can be explained by the fact that most refugees are allocated similar food rations from the World Food Program, and many refugees have become accustomed to common Kenyan staple foods. In addition, more food varieties exist in the local market, but only households with additional disposable income can afford to diversify their meals. See Annex 2. E-cookbook for examples of recipes cooked by the man and women in Kalobeyei that either received or purchased an EPC through the project.

Cooking fuel expenditure

To further quantify the reported fuel savings, the bi-weekly survey asked EPC users how often they bought fuel per week. Overall, the data showed the number of times EPC users are buying charcoal in a week reduced by an average of one time compared to non-EPC users. One purchase incident is equivalent to one basin of charcoal, which costs approximately 200 KES (as established in the baseline survey). This is equivalent to cooking fuel cost savings of 200 KES/1.60 EUR per week or 800 KES/6.40 EUR per month. Factoring in the calculated average household electricity cost of 109 KES/0.88 EUR per month for cooking with an EPC, this results in a reduction of 691 KES/5.52 EUR in cooking fuel expenditure.[21]

The fuel and associated cost savings potential are an important benefit of the EPC technology, creating a financial incentive for people to cook with electricity as opposed to biomass, while also enjoying other benefits presented in section 3.3.5.

[21] Based on a monitored average of 4kWh EPC use contribution to household electricity consumption per month, as presented in 3.4.1, and applying the residential tariff of 27.30 KES.

Testimonial

Hellen Njoroge is a Kenyan woman living in Kaloboyei Village 1. She moved to Kalobeyei in 2020 and set up a retail shop. Since she came to the settlement, she has been using LPG and charcoal to cook her meals because that is what is easily available in the local markets. She has a family of three, and she cooks on average two meals per day (lunch and dinner). In May 2022, Hellen attended one of the EPC cooking demonstrations in Village 1, which was organised by Solaria as part of the PEPCI-K project. She was instantly interested and bought an EPC.

"*Since I bought the EPC, my life has become so easy. I cook my meals using less time than I used to, I use less water, and the cooking space remains clean. The cost is also cheap. For example, when I use the 6kg LPG cylinder to cook, it goes for one month. I refill it with 1,700 KES, and the initial cost of purchasing the entire set was 6,000 KES. I paid 500 KES to be connected to the Renewvia Energy mini-grid, and I buy tokens of 500 KES per month. With these tokens I use electricity for the cooking, lighting, watching TV, and ironing. This means I am saving 1,200 KES per month when I use EPC instead of gas. This is a big saving on my finances, which I put into other uses.*

The food also takes less time to cook compared to gas/charcoal (most foods take half the time). For instance, if I cook Githeri (a mixture of maize and beans) using gas, I will use at least 1.5 to 2 hours, and the gas might not last for a month if I do this frequently, but if I use the EPC it takes 45 minutes, and the food is ready, and it tastes better.

Water has also become a big problem for us in Kalobeyei recently. Using the EPC helps in saving on water, as it uses less compared to using gas. The only disadvantage of the EPC is that it has one cooking pot. Otherwise, given the other benefits, I will encourage people to buy and use it instead of firewood and/or charcoal or gas."

3.3.4 EPC impact on awareness and ownership

Key impact findings

- **Overall awareness of EPCs is significantly increased due to marketing activities.**
- **A lack of access to finance and the high price of EPCs are the main barriers preventing people from purchasing EPCs.**
- **Time savings from fast cooking, cooking convenience, cost savings, and reduced smoke were mentioned as primary drivers of uptake of EPCs.**

The baseline, bi-weekly, and endline surveys asked about respondents' awareness of e-cooking. There is a major improvement between baseline and endline findings on EPC awareness and ownership. Most (93%) respondents at the end of the pilot (including non-EPC users) were aware of EPCs, and 69% knew they were available in the market – up from only 4% of respondents in the baseline survey. The main channels of awareness were the EPC cooking demonstrations, SNV staff, and sales agents. This indicates that the used channels were effective in creating awareness, and marketing efforts undertaken during the project lead to productive outcomes.

In terms of ownership, the primary reasons for not owning an EPC cited among those not owning an EPC were a lack of finances (41%) and the product being expensive (24%). This is further emphasized by findings on the perception of the affordability of EPCs and the costs of cooking with electricity. Time savings from fast cooking by EPC was a common motivation for users to purchase the appliance. Other reasons quoted included cost savings, it is easier to use, it does not emit smoke, the user has access to electricity, and the user can cook a variety of dishes.

3.3.5 EPC impact on usage experience, adaptation, and continuity

Key impact findings

- **Most EPC users are satisfied with their EPC, which is primarily attributed to faster cooking time and that it is a clean source of fuel.**
- **The least-appreciated attributes include small pot size and the lack of a spare pot.**

Most EPC users (>80%) reported improved quality of life since the start of the use of EPCs. Improved quality of life was realized through reduced time spent cooking, undertaking unsupervised cooking, availability of options to cook a variety of meals, and reduced use of water for cooking, among others. Almost all respondents (97%) expressed ease in adjusting to changed fuel and water purchases and cooking pattern changes attributed to cooking with an EPC, and were confident they would maintain new lifestyle trends, which can be seen as achieving adaptation to the use of new technology and continuity. The above is indicative of an overall positive user experience with EPCs, which can be taken as effective and compelling evidence for marketing and sales activities.

The overall EPC usage experience was found to be positive. A large share of the respondents (76%) found the EPC appliance to fit in with their cooking schedule and plans very easily. In addition, most of the respondents (71% on average) found the EPC appliance very easy to use consistently throughout the survey period. Of all respondents, 76% indicated to be 'very satisfied' or 'satisfied' with their EPC appliances, as shown in Figure 7.

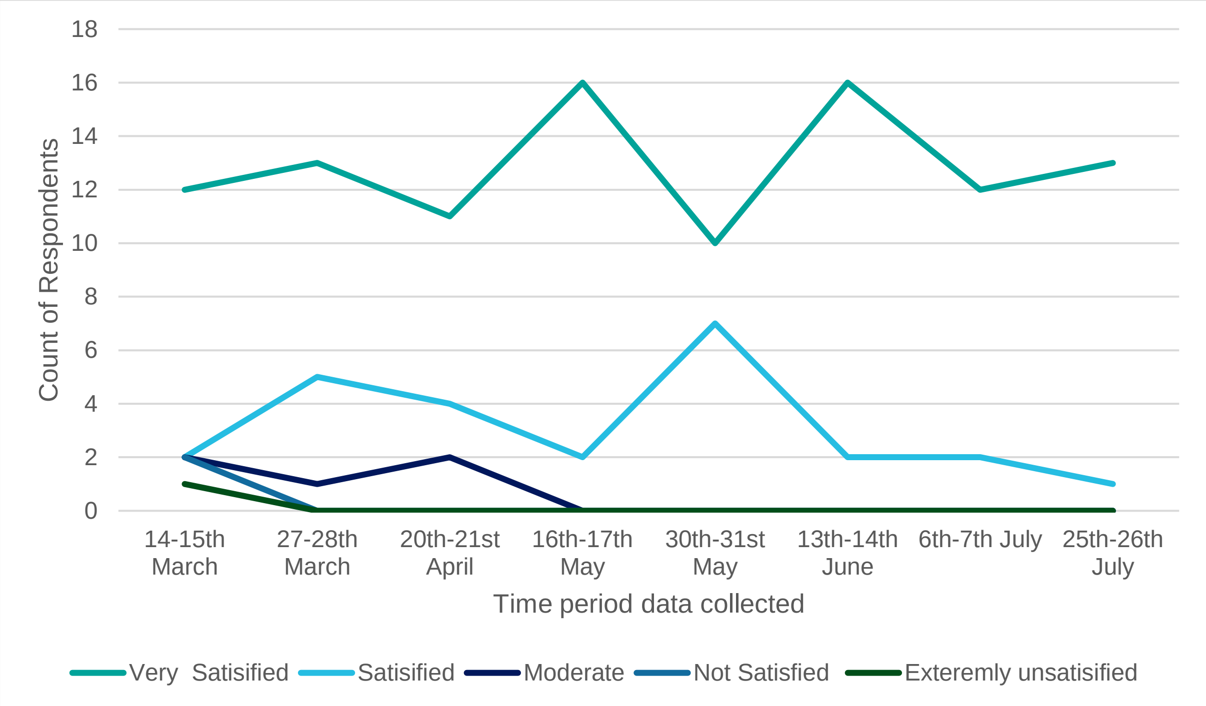


Figure 7. EPC user satisfaction rate.

The EPC aspect most consistently appreciated across all bi-weekly surveys of EPC users was that it cooks fast, hence saving users time that they can use to undertake other activities. This shows the productive use potential of cooking with an EPC as opposed to biomass cooking. This was closely followed by the fact that EPCs are a clean method of cooking without any smoke or soot. Interestingly, fuel cost savings ranked fifth, preceded by the requirement for minimal supervision and the 'other' category. Characteristics in the 'other' category included: 'EPC allows cooking a wide range of meals including cakes', and 'food is cooked without worry it will burn'. See Figure 8 for an overview of the survey responses.

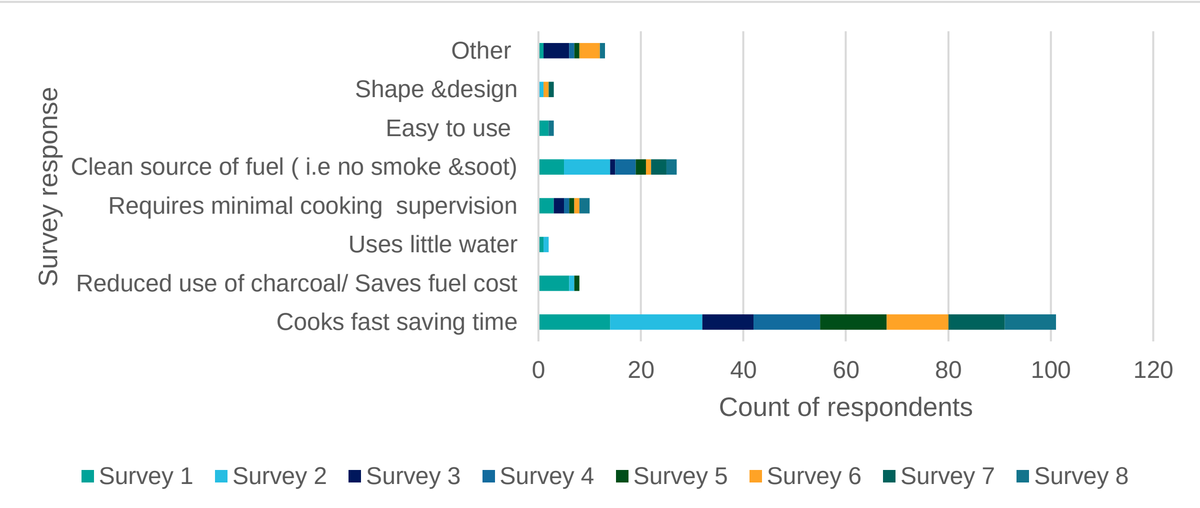


Figure 8. The most appreciated aspects of the EPC appliance.

The overall positive experience indicates that EPC appliances currently found in the market are mostly meeting users' needs and requirements, with few modifications needed to achieve 100% satisfaction among users. These relate primarily to the small pot size and the lack of a spare pot, as most respondents (75%) least-appreciated the small size of the EPC appliance (six litres), and the fact that it came with only one cooking pot. The six-litre capacity EPC appliance is the standard size found in the market in Kenya. As established from the respondents' profiles, the average household size in the refugee communities, particularly of South Sudanese origin (who are the majority in Kakuma), is seven people. Businesses also serve many customers. As such, the six-litre EPC is not seen as adequate to meeting their cooking needs in one go. At the time of the report writing, few manufacturers/suppliers are in the process of including eight-litre EPCs in their product offering for distribution in Kenya, which may be more suited for displaced market contexts as well.

3.4 Electricity consumption and mini-grid impact

This section presents the analysis regarding the electricity consumption and mini-grid data collection. The data was taken from energy meter devices from a total of 34 monitored participants. The participants were sourced from the test group that had received an EPC in the test phase, and from people who had bought an EPC, volunteered to participate in the research activities, and connected to the mini-grid system. The analysis also draws from data provided by the mini-grid developer and operator Renewvia Energy on aggregated electricity consumption per individual respondent, and overall min-grid consumption during the pilot period.

3.4.1 Impact EPC use on electricity consumption

Key impact findings

- **The monitored EPCs contributed on average 4kWh to total household electricity consumption per month for 18 bi-weekly surveyed households.**
- **Increased EPC use after grid expansion shows the importance of consistent and reliable electricity supply.**
- **There is high usage variety, showing potential to optimize usage among low users through (post-uptake) user trainings.**

Aggregate e-cooking energy and active devices per day

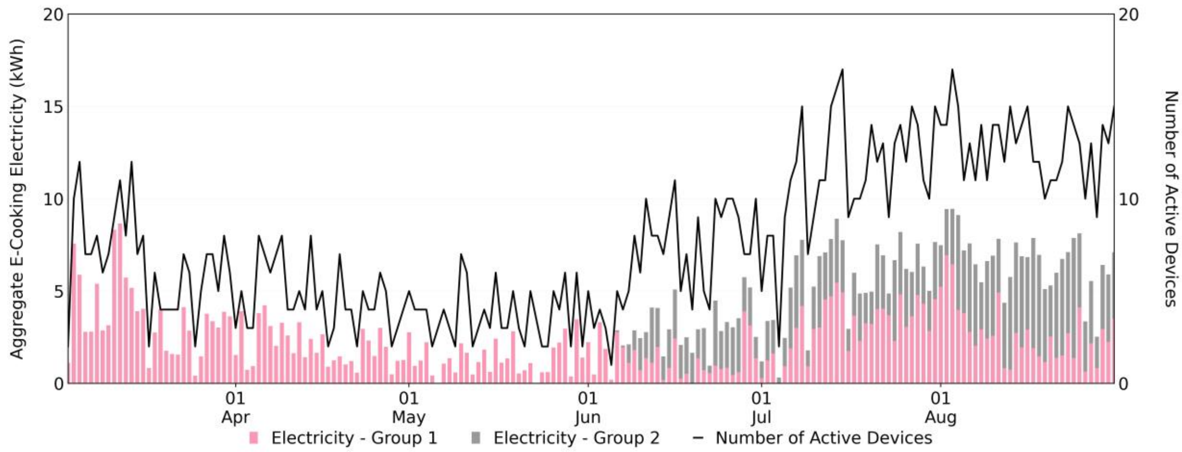


Figure 9. Aggregate e-cooking energy and active devices per day.

Figure 9 captures monitored e-cooking electricity data from two groups. Group 1, shaded pink, represents EPC users that participated in the initial EPC testing phase and were provided with an EPC at no cost. Group 2, shaded grey, represents a selection of EPC users who purchased their products from the distributor and volunteered to have their usage monitored. The commercial distribution of EPCs in Kalobeyei began at the end of May 2022. This is clearly illustrated in the chart, as new EPC products for monitoring are visible from June onwards.

Generally, the highest aggregate electricity load contributed by an EPC per day is slightly below 10Kw/h. There is a generally higher increase in aggregate electricity load contribution from June owing to the addition of new customers purchasing and using EPC products. The highest aggregate electricity load per day was observed in July. The availability of a stable electricity supply is one possible reason for the high electricity load, especially compared to May and June. During these months, the Renewvia Energy mini-grid system in KIS was undergoing expansion, necessitating power rationing that resulted in an unstable electricity supply. It is important to note this is not the complete load, as not all customers who purchased an EPC were provided with an electricity monitoring device.

Considering the EPC users who participated in the bi-weekly surveys, monitored EPCs contributed on average 4kWh per month per household to total household power consumption.

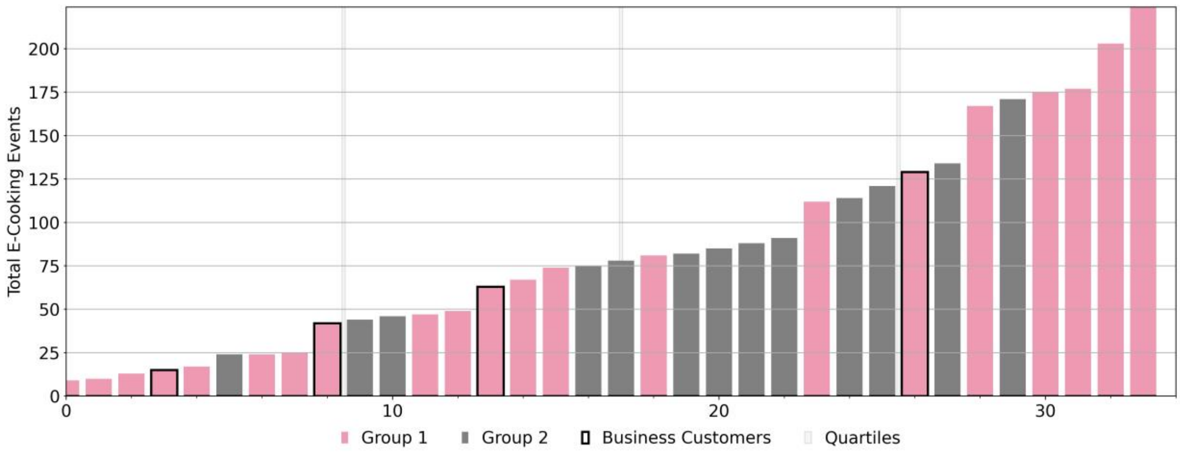


Figure 10. Energy monitoring devices ranked by total cooking events.

There is no direct correlation between length of ownership and utilization rate, as shown in Figure 10. Group 1, seen in pink, are people who received an EPC during the testing in March, and shows their total e-cooking events up to August (six months of ownership). Group 2, seen in grey, denotes owners that purchased their EPCs from May onwards until August (up to four months of ownership). Most respondents who purchased their EPCs fall within the third quartile, recording between 75 and 125 cooking events despite being users/owners for the shortest period. In comparison, most of the users in the fourth quartile recording between 125 and 215 cooking events are users who have owned EPCs for relatively more time. The trend showing an increase in utilization is likely attributed to the mini-grid expansion completed in June 2022, which ended power outages and rationing of Renewvia Energy during expansion works.

Figure 11 presents similar findings to Figure 10, only ranked in order of total energy consumption per energy monitoring device as opposed to cooking events.

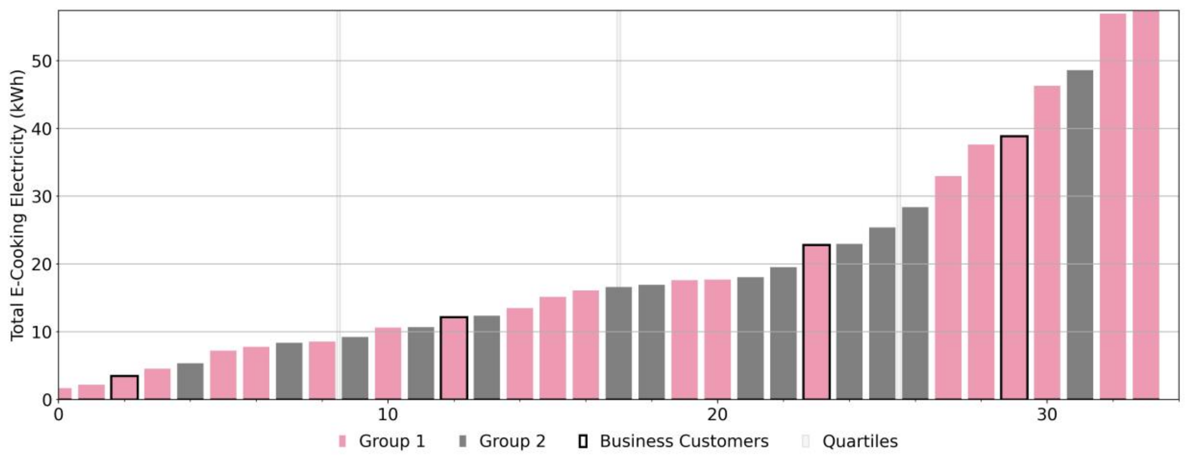


Figure 11. Energy monitoring devices ranked by total cooking energy consumption in kWh.

EPC energy load contribution

Table 6 illustrates monitored EPC usage profiles for users designated as low, medium, and high as observed in the pilot. This information is particularly useful for mini-grid developers, as it helps them to better account for their customer needs according to their projected load profiles in their planning decisions on power generation, distribution, expansion, and more. As seen in Table 6, the high user cooks with their EPC more than twice the number of days as the low user. For the medium user, there is a difference of 47 cooking events from the high user and 27 cooking events from the low user.

Row labels	Total cooking energy in kWh	Total cooking time in minutes	Average cooking event energy in kWh	Average cooking event duration in minutes	Total number of cooking events	Number of days of use
Low user	8.57	602	0.18	13	47	29
Medium user	16.11	1072	0.22	14	74	40
High user	22.97	1687	0.19	14	121	63

Table 6: EPC usage profiles for low, medium, and high users across monitored period.

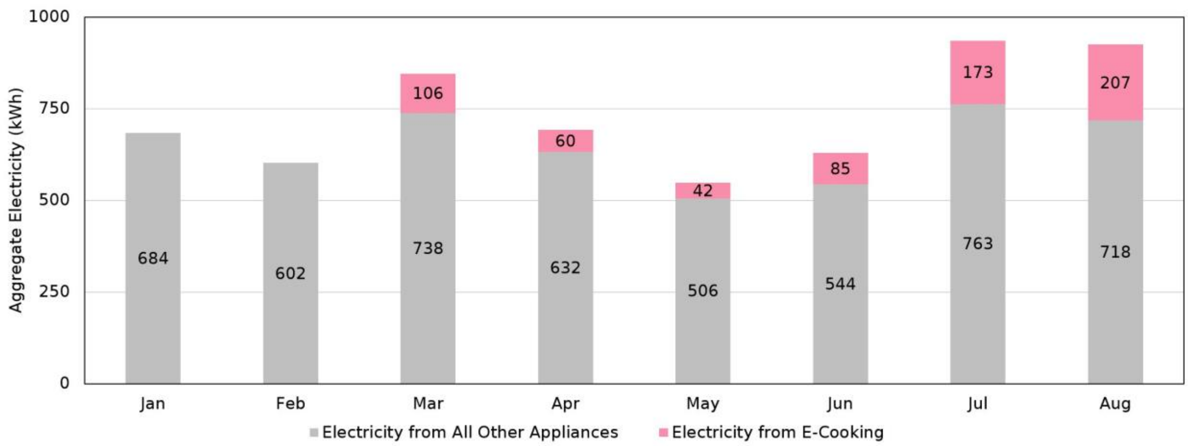


Figure 12. Contribution of e-cooking electricity load to total aggregated electricity consumption of monitored EPC users per month.

Figure 12 shows how electricity consumption from e-cooking contributes to overall aggregated electricity consumption of the 34 monitored EPC users. Note that energy monitoring of EPCs began in March, as per pilot start. The pink section of the graphs shows the additional energy contribution from the use of EPC appliances in households and businesses over the data monitoring period. The range between the highest and lowest contribution is 42 to 207 kWh, showing the inconsistent and irregular nature of EPC usage across time. The month with the lowest EPC aggregate electricity load is likely due to power rationing implemented at the time (May-June) to allow for the expansion of the mini-grid, and the gradual addition of new monitoring devices from June on.

The variations in usage per user and period demonstrates the opportunity to promote EPC utilization rate among current users through, for instance, end-user trainings post-EPC purchase and favourable daytime electricity tariffs to optimize usage and benefits.

4. Scaling e-cooking in Kakuma and Kalobeyei

This chapter presents the implications of EPC usage for an individual household and for estimated 50,000 households in Kakuma and Kalobeyei in low, mid, and high EPC usage scenarios[22]. See the scenarios in Table 7 and the generalised assumptions of which the scenarios are generated with in Table 8.

Scenarios (EPC usage)		Low	Mid	High
Meals per day	#	1	1	2
Days per month in use	#	12	24	30
Electricity usage				
Electricity per cooking day per HH	kWh	0.9	0.9	1.5
Electricity per cooking day for all HH (50,000)	MWh	45	45	77
Estimated required mini-grid capacity[23]	MWp	9	9	15
Monthly HH electricity bill per HH (including baseload use)	EUR	4	6	12
Payback time EPC				
Payback time EPC vs woodstove	# of months	22	11	4
Payback time EPC vs charcoal stove	# of months	35	18	7
CO2 avoided annually				
Indicative CO2 avoided all HH (electricity vs wood)	kt CO2	24	47	118
Indicative CO2 avoided all HH (electricity vs charcoal)	kt CO2	72	144	354

Table 7 Modelled EPC usage scenarios.

Assumptions				
Wood consumption traditional stove (dried wood)[24]	kg/meal	3		
Charcoal consumption traditional stove[25]	kg/meal	1.5		
Conversion factor wood-charcoal[26] *(kg dried wood/ kg charcoal)*		6		
Net calorific value (dried) wood[27]	MJ/kg	15.6		
CO2 emission factor woody biomass[28]	kg CO2/MJ	0.07		
Food cooked per meal for 3-6L EPC[29]		***Spinach***	***Beans***	***Rice***
Cooking Time [mins]	Min	19	67	23
Energy Consumption [kWh]	kWh	0.17	0.36	0.11
Electricity per meal (dishes combined)	kWh	0.64		
#of households in Kakuma & Kalobeyei (all HH)[30]	#	50,000		
Electricity baseload[31]	kWh/day	0.25		
Cost of EPC[32]	EUR	80		

[22] Based on modelled assumptions, not the actual usage observed in the pilot as presented in table 6.
[23] 5MWh=1MWp
[24] EnDev standardized impact measurement biomass stoves
[25] Ibid
[26] UNFCC. Tool 30. Page 5, point 16. Online.
[27] UNFCC. AMS-II.G: Energy efficiency measures in thermal applications of non-renewable biomass. Version 13.0. Page 8. Online.
[28] Ibid
[29] EPOC lab test
[30] Estimate for modelling purposes based on UNHCR statistics.
[31] Renewvia Energy.
[32] Estimated max. price inc. mark-ups for transport and distribution in Kakuma area

		Wood	*Charcoal*	*Electricity*
Cost of fuel[33]	EUR per kg/kWh	0.16	0.24	0.27
Cost per meal	EUR	0.48	0.36	0.17
Primary energy 1 meal	MJ	47	140	2.3
CO2 avoided per meal EPC vs fuel per meal	kg CO2	3	10	

Table 8 Modelling assumptions.

The calculations highlight the energy, cost and CO2 emissions saving potential from EPC usage at household level and at scale, including the required energy supply.

- A household is expected to consume 0.9-1.5 kWh per day on days it uses an EPC – all 50,000 households therefore would require 45-77MWh (depending on frequency of use) and a **roughly estimated capacity of 10-15MWp to reach whole Kakuma and Kalobeyei area**. Please note that this electricity consumption includes both the baseload and the electricity used by the EPC.
- The EPC repayment time for an individual household can range from 35 months/3 years in low usage scenario to 4-7 months in a high usage scenario.
- Indicative CO2 avoidance can range from 24-354 kilotonne CO2, demonstrating the environmental benefits and potential for carbon credit revenue (provided that the electricity for the EPCs comes from a renewable energy source).

Considering the 4kWh average EPC electricity use per month per household, as observed in the monitoring among surveyed households in the field, it is clear that the full potential for savings on energy costs, CO2 avoidance, and electricity demand creation through EPC use is not being met, compared to all the projected EPC use scenarios i.e., low, medium and high. This shows additional efforts are needed to encourage uptake, consistent and sustained use of EPC among households. From the modelled scenario's, the magnitude of the gains to be achieved, both at household level and for the environment, is evident and increases the more EPCs are replacing the use of wood and charcoal.

To optimize usage and reach scale, a sustainable EPC market needs to be carefully developed, especially when targeting a low income, vulnerable community as Kakuma residents (both host and refugee). The next chapter therefore presents a roadmap on targeted e-cooking market development in low-income settings with specific attention given to the implementation in displaced and/or mini-grid system contexts.

[33] Market observation estimate wood and charcoal price, Renewvia residential tariff.

5. A roadmap for e-cooking market development interventions

The pilot project results show that the activities have widely increased awareness of the benefits associated with e-cooking in the area, which is translated into active demand for the technology in Kalobeyei but also beyond. In addition, given the research findings on the positive impact of EPCs on host community and refugee community members' lives through an enhanced cooking experience, reduced exposure to smoke, fuel, time, and water savings, it is recommended to continue efforts to increase access to the technology in Kalobeyei and Kakuma. Other similar low-income displacement settings with reliable electricity supply can also benefit from the introduction and uptake of e-cooking technologies.

However, the activities and results have also generated substantial insights into the challenges that come with developing a market for e-cooking in a setting such as Kalobeyei, specifically on the types of assessments that need be done prior to designing an e-cooking market development intervention, what type of support distribution actors are required, and what other activities must be undertaken to ensure a conducive environment and optimalization of the positive impact of the uptake of the e-cooking technology.

E-cooking outlook in Kakuma and Kalobeyei

The pilot results showed positive feedback from the end-users. For Kalobeyei specifically, the expanded mini-grid system with a capacity to serve 3,000 customers and the generated demand among residents in Kakuma town provides potential for scaling. To build a sustainable supply chain, targeted support is required to the private sector and end-users to ensure the development of an inclusive business model that people with different income levels can access and effectively use. The distributor is currently seeking to develop partnerships with FIs to manage the credit management, and is in conversations with EPC suppliers to continue the EPC distribution independently. Other partner distributors SNV works with have also expressed interest in selling EPCs, and the project is actively looking into how best to support them, considering the presented steps in the roadmap, and searching for appropriate partnerships to further these efforts.

This section presents a roadmap for targeted e-cooking market development in low-income settings with specific attention given to the implementation in displaced and/or mini-grid system contexts (*in Italics*).

Pre-project design: feasibility assessments

Prior to designing a potential e-cooking market development project, in-depth feasibility assessments on the site selection, local demand, supply, and available and appropriate e-cooking technologies need to be conducted. See in Table 9 a description per assessment subject.

Table 9: Feasibility assessments.

Activity	Description
a. Site assessment	Assess the electricity access rates, electricity sources, and capacity and compatibility of each source to power electrical cooking devices and the *consistency* of electricity supply.[34]
	In case of (a) solar mini-grid system(s), conduct a load profile assessment to include various scenarios for load curves, capacity constraints, electricity costs, and potential savings.
	For a displacement setting, to assess the opportunity for a market-based intervention, the following factors need to be considered: the state of the energy market in terms of private sector presence and existing distribution channels, the freedom of refugees to work formally or informally, the available energy products in the market, whether people need to pay for cooking fuel (or can collect for free/receive handouts), the existence of market-based interventions as opposed to a donation-based access to (energy) products and services, which affects people's mindset to go to the market rather than waiting on donations.
b. Local demand-side assessment	Conduct detailed socio-economic and cultural consumer profiling, including cooking and electricity consumption patterns, to assess the potential for introduction of e-cooking and identification of the various customer segments. This encompasses understanding of current cooking practices, including fuel use, time, costs, fuel stacking practices, cooking purposes (household, commercial, or institutional), fuel quantities, and overall cooking experience in terms of exposure to smoke and cooking convenience, drivers, and barriers to uptake of alternative cooking technologies, income levels, access to finance, and access to electricity.
	Refugees in specific displacement settings are not a homogenous group, so consider differences in terms of culture, ethnicity, literacy levels (including financial literacy), income levels, meal preferences, occupations, household sizes, language, length of stay in the camp, etc.
c. Local supply-side assessment	Map out distributors and (formal and informal) FIs in the area (or identify distributors/FIs that could be interested in entering the target market), sensitize the distributors/FIs on e-cooking, and facilitate joint customer journey mapping sessions to develop different business and payment models, and the identification of technical assistance needs specific to the target area and groups.
	Refugees often do not have access to formal loan services due to Refugee-ID registration restrictions and lack of a credit record and collateral, hence informally organised FIs such as savings groups (VSLAs and chamas) should be explicitly included.

[34] In case there is no sufficient electricity supply, research the opportunities to promote electricity access through sources with capacity to power e-cooking devices. Examples are large standalone solar systems, solar mini-grid systems, battery solutions, etc.

	Include mini-grid operators as potential supply-side actors. An alternative to (only) relying on a third-party distribution model for mini-grid users would be for the mini-grid operators to sell appliances to their customers using the utility payment system for payments ('on-bill financing'). This would require for a mini-grid operator to be willing to venture out of their core business and invest resources into building capacities to distribute appliances, including e-cooking appliances, and cater for end-user training, after sales service, and appliance financing.
d. E-cooking technologies assessment	Map out the supply of e-cooking devices in the specific country/area, including manufacturers/suppliers, brands, types, quality (testing certificates), after sales support provision, and B2B/B2C payment options. Test a sample of e-cooking devices with the target group representatives to compare cooking performance and experience, including compatibility with meal types, household and eatery customer target sizes, and capacity of different electricity sources to power the appliance. It is highly recommended to do this with the identified potential distributors to ensure ownership and understanding of the selected technology, brand(s), and size(s). Select eligible technologies considering the various customer segments, test results, availability in the (national) market, including spare parts and repair capacity and compatibility with electricity sources. It is essential to deploy an end-user centric design approach, as the end-user experience and feedback will ultimately decide the success of the intervention, not the technology.

If pre-requisites are met, the assessment findings can inform the project design for the development of a sustainable value chain to promote access and sustained usage with optimized benefits for the end-users **in an inclusive manner.**

Project design: private sector support modalities

Given the market-based approach, most activities need to focus on identifying and developing the private sector support modalities. The technical (and financial) assistance needs to include (but is not limited to):

- Quality product sourcing
- Design of appropriate business models
- Operationalization of the business models
- Development and implementation of marketing messaging and strategy
- End-user training on e-cooking device benefits, (safe) product use, operation and maintenance, and payment model terms
- Conducting electricity source compatibility assessments per individual potential customer
- Building after sales service provision capacity

See Table 10 for a description per activity.

Table 10: Private sector support modalities.

Activity	Description
a) Quality product sourcing	It is recommended to have the distributors select the final technologies from the eligible technology list and have them lead the procurement of the inventory to ensure ownership and relation with the manufacturer/supplier. Allow them to propose distribution of technologies not on the eligibility list (to keep up with technology developments and innovations) but request for testing results by certified testing labs and clear strategy on after sales services, including spare parts.
b) Design of appropriate business models	To design appropriate business models, the customer segment profiles in terms of income levels, expenditure patterns in specific on fuel and electricity, access to finance, and payment modalities need to be considered. Assuming most of the people in the respective determined target groups are not able to pay in cash due to the high price of e-cooking devices, a model that allows for payment in instalments through a credit model is recommended. For the design of the credit model, ideally the repayment period and instalment amount align with the cost savings realized by fuel savings as modelled in Table 7. This requires a longer project implementation period or design that allows for longer repayment beyond project duration. Use of remote operating devices to switch the appliance on and off can support repayment and enable a 'pay as you cook' model.
	Communities in displacement settings are not homogenous in terms of income levels, and market-based approaches can run the risk of excluding those people who are completely reliant on humanitarian assistance and cannot meet their own meets in the market. Therefore, to make the market-based intervention ***inclusive****, use of smart subsidies for end-users can be deployed and targeted at those most vulnerable, which can be guided by humanitarian organisations working closely with the communities.*
c) Operationalization of the business models	For the operationalization of business model, distributors require in-depth practical support to operationalize a credit system model, as poor collection rates in the pilot have shown. It is recommended to support the distributor in partnering with FIs who can lead credit management, so the distributor focuses on marketing, end-user training, and after sales and the FI on customer vetting, onboarding, and credit collection, as this requires specific expertise. Alternatively, a project dedicates extensive time and resources to building the capacity of distributors to effectively operationalize a credit management system. In general, it is recommended for project design to have the distributor and/or FI carry (part of) the financial risk to ensure ownership and responsibility, which trickles down to the customer vetting and collection processes (as was not the case in the pilot).

	Carefully consider the importance of informally organised saving groups in refugee contexts as noted in point D.
d) Provision of financial literacy education	Provision of financial literacy education to new customers on how savings can be used to pay off the e-cooking device is crucial to enhance understanding of end-users on how the product can make financial sense and why it is important to pay the instalments.
	Refugees often do not have access to formal loan services due to registration restrictions and lack of credit record and collateral, hence informal FIs such as savings groups (VSLAs and chamas) should be explicitly targeted in these settings to function as FIs. These groups would benefit from support to develop a well-suited lending model to provide short-term loans (to their members who guarantee each other) to purchase the e-cooking device and provide financial literacy education to their members on how the e-cooking appliance can be used to save money or free up time to cater to income-generating activities, which feeds into paying back the appliance.
e) Development of smart subsidies to enhance inclusion	The use of smart subsidies can be considered to cater for the markups added for doing business in a marginalized area (including additional costs resulting from credit model management and cover for after sales capacity) and act as an incentive for the distributor to venture into e-cooking or, in case of end-user subsidy, an incentive to take up the appliance. Results-based finance (with an up-front payment component), a guarantee fund (of which unutilized funds can be put in a revolving fund to de-risk new inventory consignments), carbon finance,[35] and/or UNHCR cash-based assistance can, for instance, be explored to enable these smart subsidies. The key is to design the smart subsidies so that there is minimal market distortion and compromising the sustainability of the value chain after financial support is terminated.
f) Development of marketing messages and strategy	Appropriate marketing messages and strategy should be developed by the distributor, with support from the project, to promote the e-cooking product(s) tailored to the different target groups. The messages should be tailored to the various customer segments in terms of highlighting the benefits that speak to them, as should be informed by the testing and end-user feedback activities. The pilot found that people liked the fast-cooking time the most, for instance, hence this can be highlighted in the messaging. The type of channels to be deployed in the marketing strategy for awareness raising, fostering consideration and engagement, and conversions are very context-dependent but can be divided into public spaces, community mobilization, and media channels. Overall, it is recommended to deploy activities embedded in demonstration and product engagement so that

[35] See Gold Standard methodology for quantification of emission reductions from metered clean cooking devices. Online.

	people can experience the benefits for themselves and ask targeted questions on the product and payment options. The use of local 'influencers' such as community leaders in these activities (such as cooking demonstrations) can be very effective, as was found in the pilot.
	In a displacement setting, it is recommended to have simple messaging and rely mostly on visuals (through photos) that can cater to the multi-linguistic audiences with various literacy levels. Also have sales agents that can translate the tools if necessary to their respective communities. In terms of channels, it is highly recommended to use community leaders, and community mobilization spaces such as water points and food distribution centres.
g) End-user training on e-cooking device benefits, (safe) product use, operation and maintenance, and payment model terms	At the conversion stage, the distributor/FI (depending on the structure) should provide training to the end-user on how to use the e-cooking device in a safe manner to ensure optimal utilization, and how to conduct proper operation and maintenance to minimize the need for repairs. In addition, the terms of the payment model need to be clearly explained and need to include a financial literacy component on how potential savings realized through use of the e-cooking appliance feed into the instalment payment plan.
h) Conducting electricity source compatibility assessments per individual potential customer	Part of the pre-sales process should include an assessment of the electricity source of the potential customer in terms of compatibility and capacity of the source to power the e-cooking appliance, and estimated costs of use so that the customer can make an informed decision.
	In case of solar mini-grid systems, site agents should be closely consulted on a as-needed basis when adding additional devices, as for individual connections there might be concerns of overloading of lines and need for three-phase upgrades.
i) Building after sales service provision capacity	Distributors should develop a strategy early on and invest in building after sales services that encompass clear customer support processes and local repair capacity, including the availability of qualified technicians and spare parts. The funds required to do so should be considered in the development of the business model, as mentioned in the appropriate section.

Project design: Conducive environment activities

Other project activities need to focus on developing and maintaining a conducive environment for the market to continue to effectively develop in an inclusive manner with optimal outcomes for the end-users. This includes (but is not limited to):

- Sensitization of and engagement with (local) stakeholders
- Monitoring market development in terms of sales and customer feedback
- Continuous provision of market intelligence to the private sector in terms of demand for e-cooking and e-cooking market development trends
- Knowledge development and dissemination

See Table 11 for a description per activity.

Table 11: Conducive environment activities.

Activity	Description
a) Sensitization of and engagement with (local) stakeholders	Stakeholders must be engaged from an early stage and on a frequent basis during the market development intervention to foster product trust, acceptance, and buy-in, and to ensure synergies among various initiatives. This can be done by targeted workshops and e-cooking demonstrations, or by attending the meetings of the various stakeholder groups and presenting the promoted technologies and interventions.
	Especially in displacement settings there are a range of actors to be sensitized on the technologies and interventions, including humanitarian agencies, (host community-led) community-based organisations, community leaders from both host and refugee communities, local government, private sector energy distributors and suppliers, and FIs.
b) Monitoring market development in terms of sales and customer feedback	Once distribution has started, the project can keep track of market development progress in terms of tracking the number of Last Mile Entrepreneurs active in the value chain and, ultimately, the number of sales made and customer feedback. The pilot results show there is ample opportunity in optimizing the benefits of e-cooking devices for end-users through frequent follow-ups and additional end-user trainings post sale on effective utilization, ensuring that end-users can fully exploit all of the options an e-cooking device provides over a longer period. This includes training on all cooking options (boiling, frying, sauté) for a variety of meal types, and proper operation and maintenance to reduce the need for repairs. This would also improve the e-cooking technology utilization rate among existing users, which in turns increases the demand load.
	For interventions targeted at mini-grid system customers, there needs to be close collaboration with the mini-grid operator on e-cooking market development in terms of monitoring the supply capacity to absorb current and additional appliances, or whether there is a need for more careful demand management to influence the time of use (to avoid peaks).
c) Continuous provision of market intelligence to the private sector in terms of demand for e-cooking and e-cooking market development trends	As any market environment is not static, new developments can heavily influence supply and demand, including expanded electricity infrastructure (as what happened in KIS with the expanded mini-grid system), availability of new or improved e-cooking devices in the national market, entrance of FIs with interest to support credit management for e-cooking, etc. Therefore, the project needs to continuously engage in the local and national sectors and pro-actively inform the actors active in the value chain on developments so that they can anticipate accordingly. This also includes advocacy work for quality standards, labelling, favourable import, and VAT tax regulations.
	In humanitarian settings, it is important to be alert on changes in cash-based assistance in terms of amount and date of payout, as that will determine when many people move to the markets and can fulfil their payment plan commitments.

Knowledge development and dissemination	The promotion of e-cooking as a clean cooking technology in developing contexts is relatively new, hence there is much learning and knowledge exchange to be done to develop best practices and to continuously innovate. Therefore, a project must actively look to share experiences and learnings in sector platforms, and advocate for integrated energy planning in policy development on a local, national, and global level.

Annexes

Annex 1. Overview of tested EPC models

Model	Supplier(s)	Size (in litres)	Price range	Other specifics
Ecoa 	Burn	7.5L	10,000-12,000 KES/ 80-96 EUR	Pre-set time/dish options, tailored to Kenyan cuisine
Powerhive 	Powerhive	6L	7,000 KES/56 EUR	Pre-set time/dish options
Sayona 	Various (Sayona, Scode)	6L	7,000-11,000 KES/ 56-88 EUR	Manual timer
Von 	Various (Hotpoint, Naivas, Jumia)	6L	10,000-12,000 KES/ 80-96EUR	Pre-set time/dish options

Annex 2. E-cookbook

Introduction

This E-Cookbook was developed as part of the output for the Piloting Electric Pressure Cookers in Kalobeyei (PEPCI-K) project. PEPCI-K was implemented by SNV in partnership with CLASP in 2022 in Kalobeyei integrated settlement, Turkana, Kenya.

This e-Cookbook showcases examples of common meals prepared by community members in Kalobeyei Settlement within the Kakuma refugee camp. Eight meals are highlighted and prepared by eight project participants from different nationalities. Detailed are the recipes, the method of cooking, the approximate cooking time, and the number of people each dish can serve. The meals range from breakfast to lunch and dinner.




Recipe 1. Breakfast

English Name: Tea
Swahili Name: Chai

Ingredients (and quantities)

- ¼ kg Sugar
- 1 liter of Milk
- 5mg Tea leaves
- 2litres Water
-

Method of Cooking

- Mix the water and milk in the EPC pot
- Turn on the EPC and bring the above mixture to a boil
- Add tea leaves and sugar
- Stir to dissolve the sugar
- Let cook

Serves: Up to 7 people

Serving Tip: Can be served either hot or cold according to the desired temperature

Preparation + Cooking Time: 15 mins

Prepared By:

- Name: Chiza Dorothy
- Gender: Female
- Country of origin: Burundi

Recipe 2. Breakfast

English Name: Porridge
Swahili Name: Uji

Ingredients (and quantities)

- ¼ kg Sugar
- ½ kg porridge flour
- 2litres Water

Method of Cooking

- Mix cold water and porridge flour in a separate container
- Stir until the mixture is smooth
- Turn on the EPC, put water in the cooking pot, and bring to boil
- Add the flour mixture to the boiling water while stirring at the same time – avoids the formation of blots
- Allow cooking while stirring accordingly until achieved the desired thickness

Serves: Up to 7 people

Serving Tip: Can be served either hot or cold according to the desired temperature

Preparation + Cooking Time: 20 mins

Prepared By:

- Name: Chiza Dorothy
- Gender: Female
- Country of origin: Burundi

Recipe 3. Breakfast/Lunch/Dinner

English Name: Chapati
Swahili Name: Chapati

Ingredients (and quantities)

- Wheat flour – 2 kg
- Cooking oil
- Salt
- Sugar (optional)
- Water

Method of Cooking

- Warm the water
- Add salt to it and stir until it dissolves
- Add the flour and knead it to a soft texture
- Let it rest for 10 minutes
- Roll the dough and add oil to it
- Wrap it up then roll again
- Cut it into small pieces to make small balls of dough
- Roll these into perfect circles of the preferred size
- Heat your(cooking pot and brush it with oil
- Place your now circular dough on the cooking pot and let it cook on both sides
- Add oil to hydrate for three minutes until golden brown
- Repeat this for all dough balls made

Serves: 7 people

Serving Tip: Can be served either hot or cold according to the desired temperature. Serve with a stew of your liking

Preparation + Cooking Time: 1 hour 20 mins

Prepared By:

- Name: Christine Havai
- Gender: Female
- Country of origin: Kenya

Recipe 4. Lunch / Dinner

English Name: Chips & Meat
Swahili Name: Viazi na Nyama Karanga
<u>Ingredients (and quantities)</u>

- 1kg Irish potatoes
- ¼ kg Meat (beef)
- 2 red Onions
- 1 bunch of Coriander
- 3 Tomatoes
- 1ltr Cooking oil
- Salt
- Bell pepper /pepper (optional)
- Water

Method of Cooking

- Peel and wash the potatoes
- Cut potatoes into small pieces
- Heat cooking oil
- Put potato pieces into the hot cooking oil and let them fry for 25 minutes.
- Chop tomatoes and onions
- Chop meat into small pieces
- Put some oil in a pan and add the meat then fry until golden brown
- Add the onions, tomatoes, and coriander
- Simmer for five minutes

Serves: Up to 2 people

Serving Tip: Can be served either hot or cold according to the desired temperature

Preparation + Cooking Time: 1 hour 20 mins

Prepared By:

- Name: Bigirima Moise
- Gender: Male
- Country of origin: Burundi

Recipe 5. Lunch / Dinner

English Name: Ugali & Okra
Swahili Name: Ugali na Okra

Ingredients (and quantities)

- 1kg Maize flour
- 1 bunch of Kales
- Salt
- 50 ml cooking oil
- 2 Onions
- 3 Tomatoes
- 1 bunch of Dhania (coriander leaves)
- 3 Royco cube
- 2 bowls of Okra
- Water

Method of Cooking

- Fill the cooking pot with 2 liters of water
- Add small portions of maize flour once the water has boiled while stirring with a cooking stick
- Continue with the process above until the mixture hardens to the desired level
- Leave the mixture to continue cooking for sometime ,either covered or uncovered
- Once cooked, serve it on a tray or plate
- Pour some cooking oil into the pot and leave to heat for 3 minutes
- Add cleaned and diced okra into it
- Add onions, tomatoes, green pepper, coriander
- Add some salt and royco cubes for taste then stir to mix well
- Allow cook for about 10 mins

Serves: Up to 4 people

Serving Tip: Can be served either hot or cold according to the desired temperature

Preparation + Cooking Time: 1 hour 20 mins

Prepared By:

- Name: Irene Bahezento
- Gender: Female
- Country of origin: DRC

Recipe 6. Lunch / Dinner

English Name: Green bananas & Meat
Swahili Name: Matoke na nyama

Ingredients (and quantities)

- 6pcs Green bananas
- ½ Kg Meat
- 4 tomatoes
- 2 red onions
- 1 bunch of Dhania (Coriander)
- 2 Royco cubes
- Salt
- Cooking oil
- Water

Method of Cooking

- Peel the bananas
- Cut your meat into sizeable pieces
- Clean and chop the tomatoes, onions and coriander
- Put your oil with the lid off
- Set EPC on beans (38 minutes)
- Heat the pot at 38 with the lid off
- Add your meat to the heated oil and cook until crispy brown
- Add the onions and stir
- Add tomatoes and stir until nicely cooked
- Add bananas
- Add coriander
- Add the royco cubes and 2 cups of water
- Cook for 10 minutes

Serves: Up to 5 people

Serving Tip: Can be served either hot or cold according to desired temperature

Preparation + Cooking Time: 1 hour 20 mins

Prepared By:

- Name: Ntancoringira Beatrice
- Gender: Female
- Country of origin: Burundi

Recipe 7. Lunch / Dinner

English Name: Potatoes & Meat
Local Name: Viazi na Nyama

Ingredients (and quantities)

- ½ kg Meat
- 1 kg Potatoes
- 2 red Onions
- 4 Tomatoes
- 1 bunch of Coriander
- Cooking oil
- Salt
- Water

Method of Cooking

- Wash and chop the onions, tomatoes, and coriander
- Peel the potatoes and cut into small pieces
- Chop the meat into small pieces
- Add cooking oil and chopped onions into the cooking pot then shallow fry
- Add the chopped tomatoes to the pot
- Add coriander and the meat
- Finally add the potatoes and salt
- Add 1.5 liters of water and pressure cook for 18 minutes

Serves: Up to 7 people

Serving Tip: Can be served either hot or cold according to desired temperature

Preparation + Cooking Time: 1hour 20 minutes

Prepared By:

- Name: Samir Khadir
- Gender: Female
- Country of origin: Sudan

Recipe 8. Lunch / Dinner

English Name: Rice
Local Name: Mchele

Ingredients (and quantities)

- ½ kg rice
- Cooking oil
- Salt
- Water

Method of Cooking

- Wash the rice
- Add water into the cooking pot – (twice the amount of water as the rice measure)
- Add rice into the water and mix with a pinch of salt and a little cooking oil
- Close the lid of the EPC then turn on
- Set to the rice cooking feature

Serves: Up to 7 people

Serving Tip: Can be served either hot or cold according to desired temperature

Preparation + Cooking Time: 20 mins

Prepared By:

- Name: Sabina Achol
- Gender: Female
- Country of origin: South Sudan

The SNV Kenya and CLASP teams would like to acknowledge all the participants that prepared the food – those photographed below and those that opted not to. Your contribution was invaluable.

Ntancoringira Beatrice

Bigirima Moise

Irene Bahenzento

Samir Khadir

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