Understanding the Impact of Electric Pressure Cookers (EPCS) in East Africa: A Synthesis of Data from Burn Manufacturing's Early Piloting

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MECS Modern Energy Cooking Services

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ACKNOWLEDGEMENT

This analysis was the result of a collaboration between the Shell Foundation, Burn Manufacturing, and the MECS team based at Gamos and Gamos East Africa. Burn designed and implemented a series of pilots to explore the product/market fit of EPCs in East Africa from 2019-2022. UK Aid supported several of these early pilots via the MECS programme, with further support for the commercialization of EPCs in East Africa through the Shell Foundation. The data analysed in this report was curated by Burn and analysed independently by the Gamos and Gamos East Africa teams as core partners on the MECS programme. The data analysed in this report was curated by Burn and analysed independently by MECS.

Shell Foundation is a registered charity to help people in low-income communities escape poverty by creating and scaling business solutions to improve access to energy and transport.

burn life · saving · stoves designs produces and distributes fuel-efficient biomass, electric, hybrid, and liquid fuel cooking appliances. With over 2.8 million+ stoves sold since 2013, BURN has established itself as Africa's most trusted cookstove brand. Research with low-income households shows that Africa is ready for electric cooking and BURN is committed to helping families transition to zero-emission electric cooking.

MECS Modern Energy Cooking Services is an 8-year UKAid-funded programme to help households, businesses, and institutions who cook with biomass transition to modern energy. MECS is funded by UKAid and coordinated and implemented by Loughborough University and the World Bank's Energy Sector Management Assistance Programme (ESMAP).

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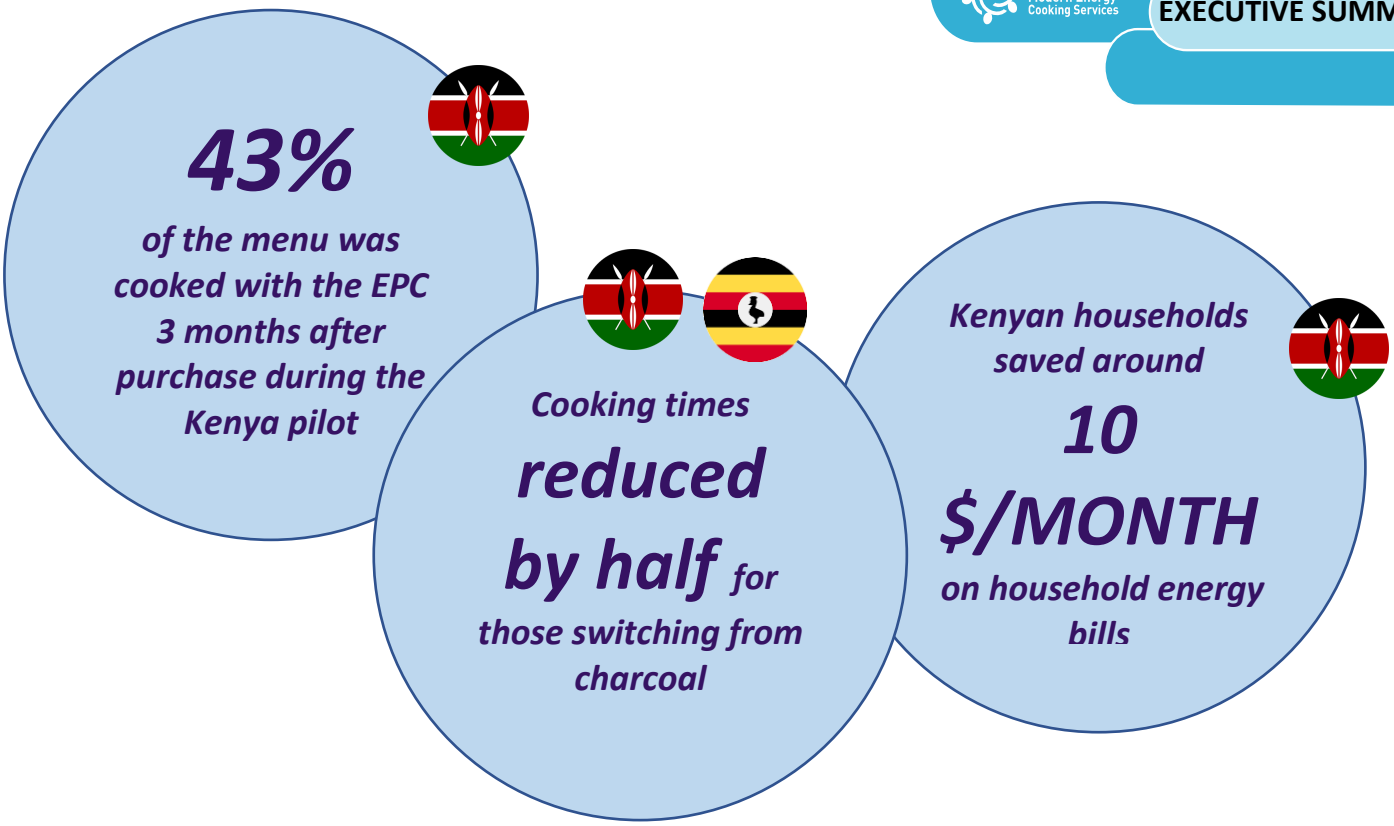
EXECUTIVE SUMMARY

This study sought to understand the impacts of Electric Pressure Cookers (EPC) in East Africa by exploring the experience of customers who have purchased Burn's early models of ecoa-branded Electric Pressure Cooker (EPC) in commercial pilots carried out in Kenya, Uganda and Tanzania.

Methodology

The analysis was commissioned by Shell Foundation and implemented by Gamos under the MECS program to understand the product/market fit of EPCs in East Africa by investigating the experiences of clients who had purchased Burn's early models of EPC in commercial pilots. Data was collected from 200 households in Uganda, 24 in Tanzania and 100 in Kenya, who participated in action research studies designed to understand the product/market fit of EPCs in East Africa.



Key findings

- There were considerable cost and time savings for households that acquired an EPC, in particular for those using charcoal as their primary fuel.
- The EPC is versatile, well matched with East African cuisine and highly valued by users. However, in most households it would need to be complemented by another appliance (or clean cooking device) to enable a transition completely away from biomass.
- This study highlighted the need for new organizations/country teams to carefully craft sales, marketing, and after-sales support services to enable new customers to understand the versatility of the EPC, or the usage rates (and therefore impacts) of EPCs will be low.
    - There was a considerable learning curve that needed to be overcome to maximize the benefits of the new appliance.
    - Burn's sales and marketing team refined their approach throughout the piloting and as a result, usage rates in the latest Kenya pilot were much higher (43%) than in Uganda (11%) or Tanzania (23%), where new country teams had just been established.

Photo credit: Burn Manufacturing

Key contextual factors in achieving impact

- The rates of access to reliable grid electricity and of reliance on unsustainably sourced polluting fuels are critical factors in defining market size.
- The frequency with which long-cook dishes that are well suited to an EPC, such as stews and beans, are cooked will influence cost savings and frequency of usage.
- High electricity tariffs can still support eCooking if the traditional fuel prices are high.
- Electricity supply should be low carbon, but even electricity generated from natural gas can lead to lower emissions than charcoal cooking.
- The upfront cost of EPCs underpins payback times and overall economic benefit. Bottlenecks in the supply chains and taxation policies can push the cost to the consumer up considerably.

CONCLUSION

This study showed that EPCs can save cooks time and money, however investment in training both end users and sales teams is critical for unlocking the impact that result from their sustained use. Burn's sales and marketing team have systematically refined their strategy to provide new customers with training and after-sales support to maximize the positive social, economic, and environmental impacts of EPCs.

INTRODUCTION

About Burn Manufacturing's Electric Programme

BURN Manufacturing designs, produces, and distributes Africa's best-selling, fuel-efficient biomass, electric, hybrid and liquid fuel cooking appliances. Not only do our products save money, fuel, and natural resources, but they also dramatically reduce harmful indoor smoke emissions which can cause significant health problems. With more than 2.8 Million+ stoves sold since commencing manufacturing operations in 2013, BURN has established itself as Africa's most trusted cookstove brand thanks to our unwavering commitment to innovative research and design, manufacturing excellence, and customer care. BURN has spent the last 3 years investing nearly $3 million in research, development and testing of its electric product suite, including the ECOA Electric Pressure Cooker (EPC). With pilots complete in Kenya, Uganda and Tanzania, and a validated consumer financing model in place, BURN is rolling out electric stoves to African countries with high grid access and affordable electricity. Our research with low-income grid-connected households shows that Africa is ready for electric cooking. BURN is committed to helping families transition up the "energy ladder" towards zero-emission electric cooking.

Figure 1: The ecoa Burn ECPC used during the pilots described in this report. Images courtesy of Burn Manufacturing.

METHODOLOGY

The analysis was guided by 3 key research questions:

What is the feedback from customers about the cost, performance, and other benefits of using BURN's EPC?

What is the usage profile of the EPC for different segments of the market?

What does the data flow say about energy use and time-saving?

METHODOLOGIES

The analysis involved cutting across data collected from customers before and after the introduction of the EPC using a variety of methodologies. These included surveys, cooking diaries, Kitchen Performance Tests (KPTs), and cross-referencing customer billing data from the utility. Data were collected from 200 households in Uganda, 24 in Tanzania, and 100 in Kenya.

DETAILED FINDINGS

Cost savings

- Figure 3 shows that when the total expenditure across all fuels is divided by the total number of respondents, the average household expenditure on cooking fuels at baseline was 3,400 KES/month (25.81 $/month), and 1,850 KES/month (18.2 $/month) at the 3 months survey, representing an overall cost saving of 45%.

- This implies that the average customer saved 1,550 KES/month (11.8 $/month), which means that within around 7 months they could pay back the upfront cost of the EPC (assuming 70 USD upfront cost).

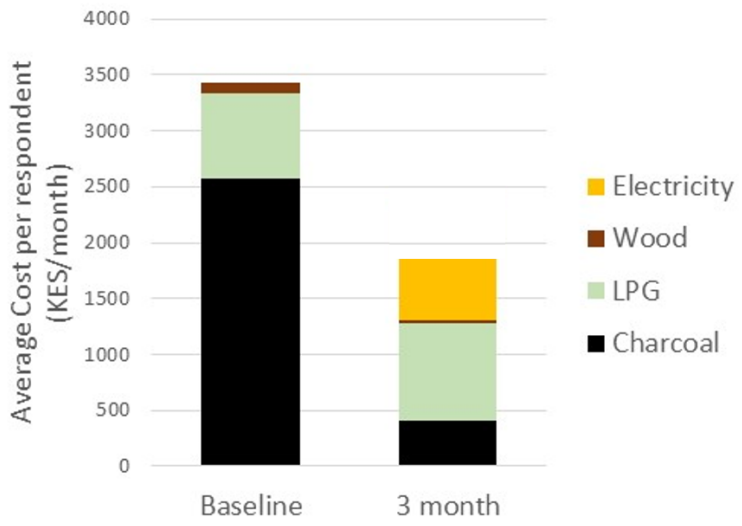


Figure 2: Average expenditures on cooking fuels and electricity for cooking from the Kitchen Performance Test (KPT) carried out with participants in Kenya.

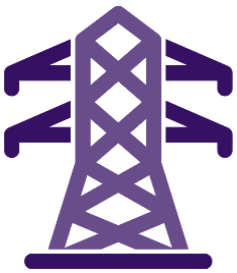
***77%** customers in Kenya reported a decrease in cooking fuel costs, with a median drop of 410 KES/week or 1,640 KES/month.*

[1]Google Finance 29/3/23:KES/USD = 131.57

EPCs could make a valuable contribution to

demand stimulation

by increasing electricity consumption by up to 100%, whilst still offering consumers net savings on cooking energy



- Data from the the Kenya pilot suggests that EPCs could increase electricity consumption for a typical customer by up to 100%. However, the resulting increase in expenditure is still lower than savings on cooking fuel.
- KPLC reports that average monthly consumption from households is 35 kWh/month, with 60% consuming less than 15 kWh/month.
- Kitchen Performance Test (KPT) data collected over three days (at the time of the 3-month surveys), gives an average electricity consumption of 1.16 kWh/day, equivalent to approximately 35 kWh/month, or 600 KES/month (6.5 $/month)[2].
- Comparing KPLC's customer billing data before & after EPC sales (Figure 4) suggests a monthly increase of 19.5 kWh/month, or 390 KSh/month (3.6 $/month).

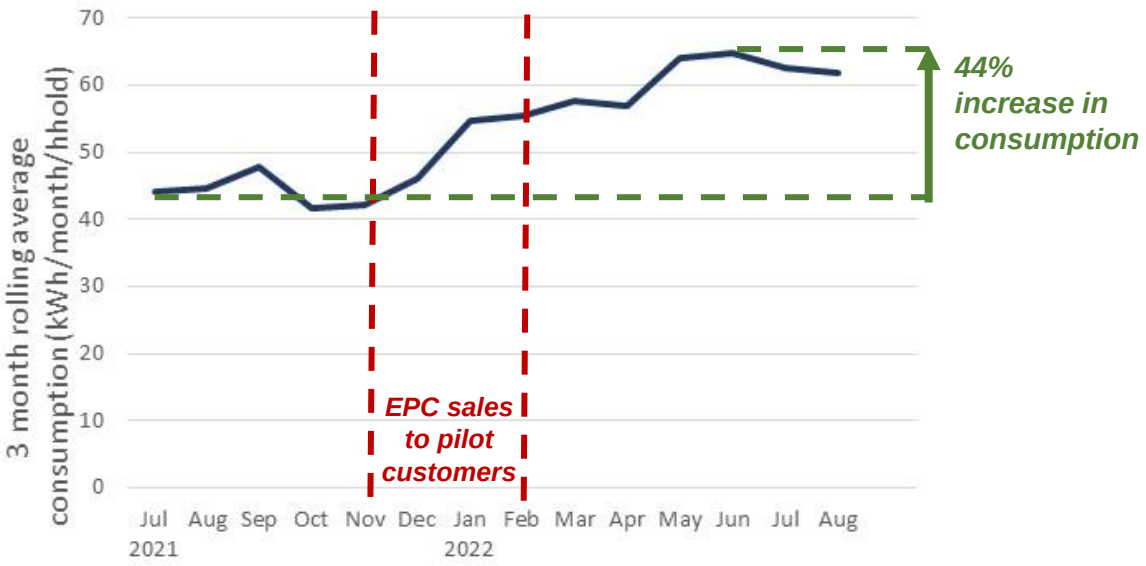
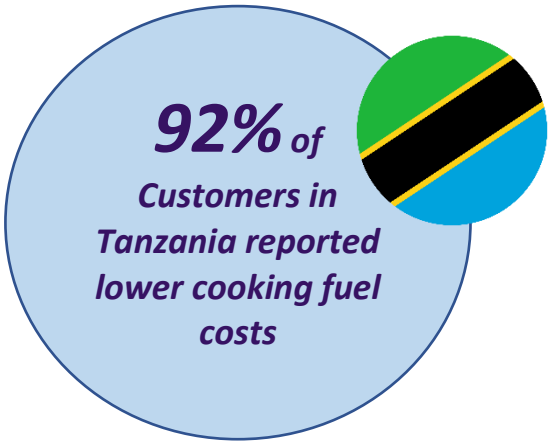


Figure 4: Trends in total household electricity consumption - 3-month rolling average (average across all 25 pilot customers where KPLC customer billing data was available, Kenya)

[2] Using a typical KPLC domestic tariff of 0.183 $/kWh (20 KSh/kWh)

- In Kenya there was almost unanimous agreement that cooking with an EPC was affordable (97%). Less than half of respondents felt that their electricity bills had increased at all.



- In Uganda, the vast majority agreed that cooking with electricity is cheaper than their normal fuel (84%, Figure 5), and even more agreed that it was affordable (91%, Figure 6).

- Meanwhile, in Tanzania, 92% of customers felt that their cooking fuel costs had decreased. After acquiring an EPC, only 13% of respondents felt that their electricity bills had increased.

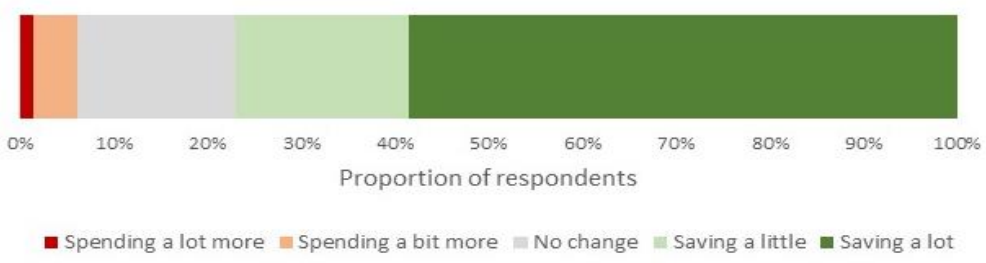


Figure 3:Perceived change in weekly fuel budget (3-month survey) in Tanzania

***84%** of respondents in Uganda agreed that cooking with electricity is cheaper than their normal fuel.*

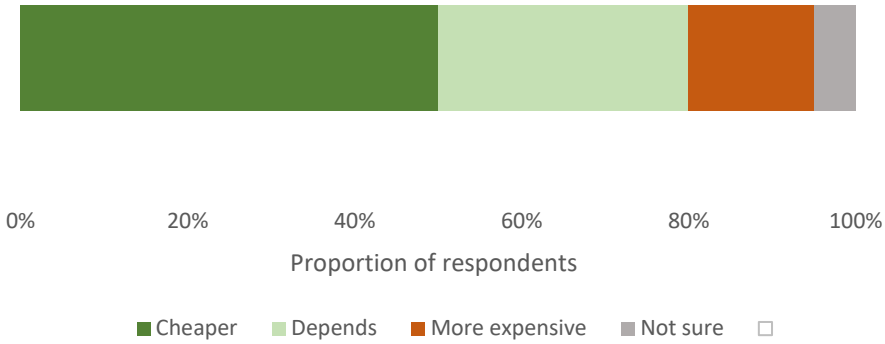


Figure 4: Is cooking with electricity cheaper or more expensive than using your normal fuel? (Uganda Exit survey)

In Uganda, the vast majority agreed that cooking with electricity is cheaper than their normal fuel (84%, **Figure 6**), and even more agreed that it was affordable (91%, **Figure 7**).

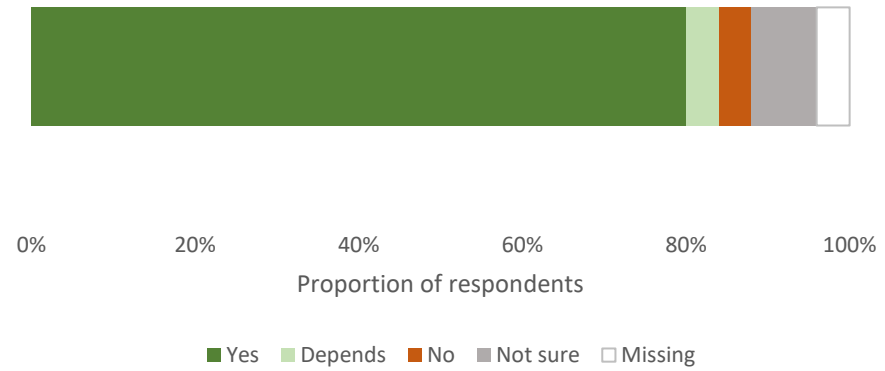


Figure 5: Do you think electric cooking is affordable? (Uganda Exit survey)

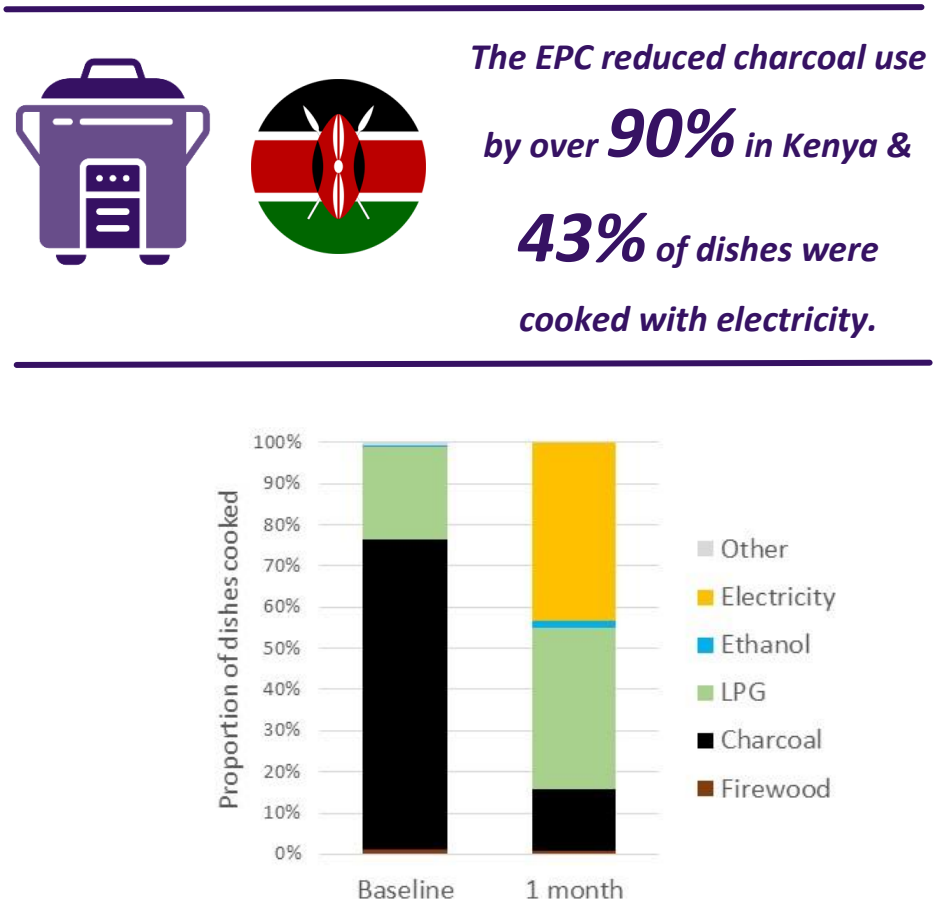


Figure 6: Fuels used to cook individual dishes (Kenya Cooking Diaries).

Figure 8 shows that by the time of the 1-month survey in Kenya, participants had substituted charcoal with both electricity and LPG. The use of charcoal dropped from 75% of all dishes to 15%, with a total of 43% of dishes cooked with electricity. Table 1 shows the ratios of energy use at the 3-month survey to the energy use at the baseline survey indicate that the adoption of the EPC reduced charcoal use by over 90%.

Table 1: Change in energy consumption and costs (Kenya KPT)

3-month data as a proportion of baseline data	Charcoal	LPG	Firewood
Relative consumption	9%	139%	44%
Relative cost	16%	114%	27%

EPCS were used less frequently in Tanzania and Uganda pilots, making up just 23% and 11% of cooking events respectively.

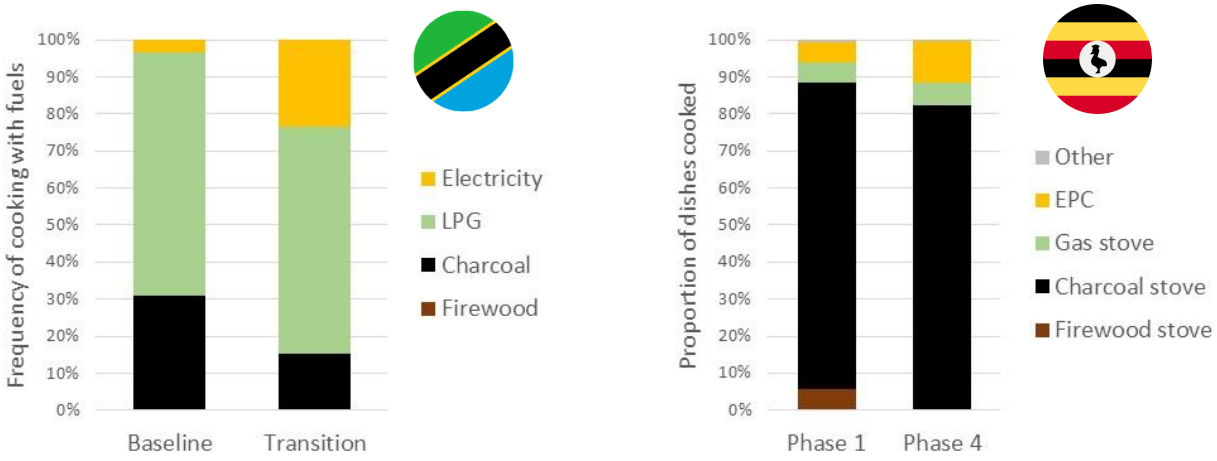


Figure 7: On the left, is the frequency of fuel used for cooking events in Tanzania (estimated from 3-month survey), and on the right, is Uganda (from cooking diaries)

Figure 9 shows that EPCs were used much less frequently in the Tanzania and Uganda pilots, making up just 23% and 11% of cooking events respectively. New sales teams who had not worked with EPCs before were responsible for setting up and supporting the EPC pilots in these countries. This was further exasperated in Uganda, where training and after-sales service were severely disrupted by covid lockdowns.

Relative costs were more difficult to calculate in these countries:

- In Uganda, EPCs were used in both the baseline and transition periods, making before and after comparisons difficult.
- In Tanzania, electricity consumption appeared to decrease after the introduction of the EPCs, which may be due to the use of inefficient electric appliances in the baseline period and/or inaccuracies in the self-reported data.

Findings from the MECS Electric Cooking Outreach (ECO) challenge fund offer a valuable reference point for Burn's data.

Sieff's (2022) comparison of results from the ECO pilot studies conducted in Tanzania, Nepal, and Myanmar showed that;

- The new electric appliances introduced during the studies were used for approximately one-third of cooking events on average (**Figure 8**), which is slightly lower than Burn's Kenya pilot (43%) and slightly more than their Tanzania pilot (23%).

- Electricity only became the primary cooking fuel in ECO pilots where multiple appliances were introduced (or where other electric appliances were already used before the pilot began, e.g., **Figure 8c**).

- As a result, Burn may want to complement its EPC with another appliance to electrify more of its customers' cooking energy demand, while ECO pilot studies highlighted the importance of LPG as a clean fuel stack.

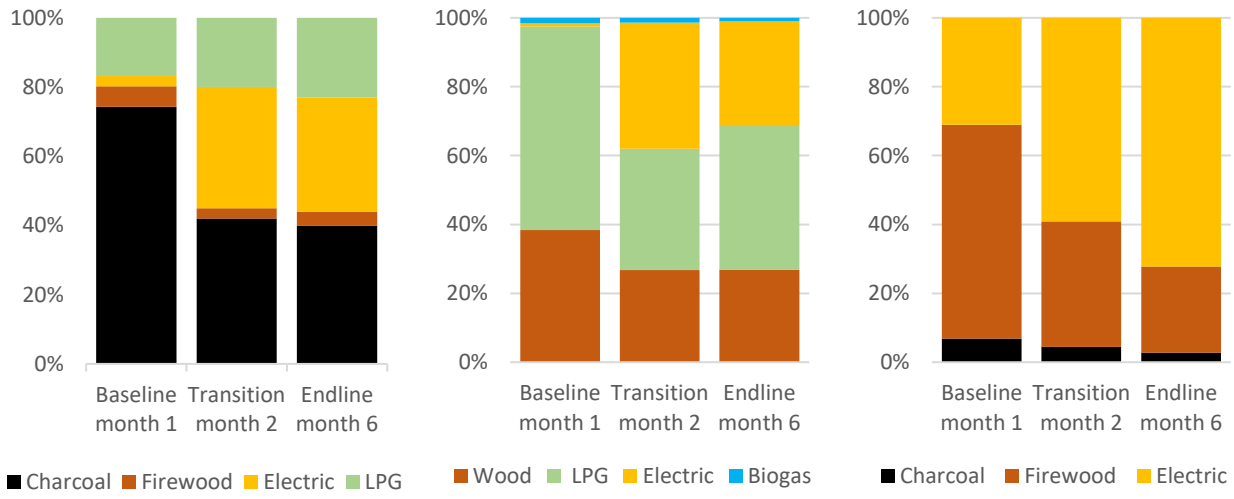


Figure 8: The percentage of dishes cooked per fuel in selected ECO pilot studies: a) SESCOM, Tanzania (left); b) average of all ECO pilots in Nepal (centre); c) Geres, Myanmar (right). Adapted from Sieff (2020).

Sieff. 2022. *Analysis of the Key Findings from the Electric Cooking Outreach (ECO) Challenge Fund Projects* UK: MECS.

Time savings and other benefits

- In Kenya, the 3-month surveys strongly highlighted time savings, taste, and safety as clear benefits of using the EPC (see **Figure 11**).

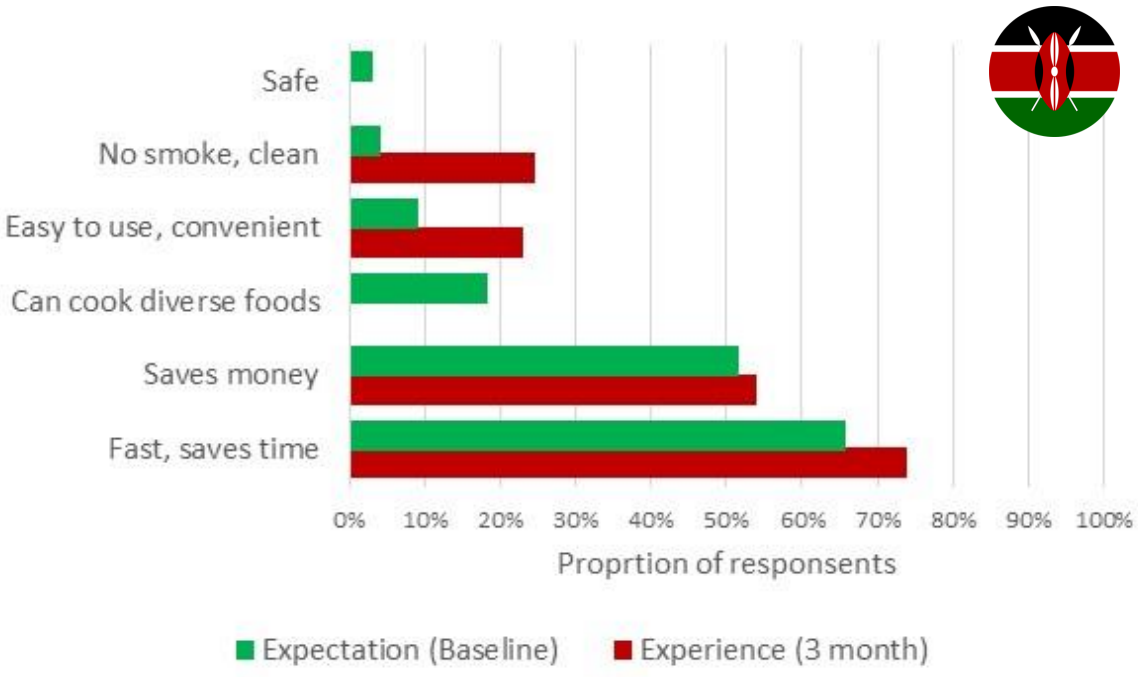


Figure 11: Comparing the experience of using EPC (3-month surveys) with expectations (Baseline) - Kenya.

88% ***of respondents in Kenya saying they spend less time cooking after purchasing the EPC***

- Analysis of the Kenya Cooking Diaries data showed that cereals with the EPC can save a lot of time compared to charcoal, while other foods such as porridge and meat stew are more modest.
- Analysis of the reported cooking times (Table 2) during the baseline and transition periods revealed that cooking was approximately 43% quicker after adopting the EPC, which equates to around 1 hour saved every day.

Table 2: Time taken to cook meals (Kenya Cooking Diaries)

	Baseline		1 month	
	Time; median (minutes)	**N**	**Time; median (minutes)**	**N**
Breakfast	20	210	15	1758
Lunch	26	140	19	1267
Dinner	66	216	30	1905
Total	112		64	

***Time savings vs. charcoal:* LPG 35%, EPC 68%**

1 hr saved every day

- EPCs appear to make the most difference when preparing dinners, which are the most labour-intensive meal, reducing the preparation time by over 50%.

- 97% of Kenyan respondents said that food cooked in an EPC taste good or very good. It also appears that after using the EPCs, people appreciated the clean cooking experience, along with the convenience of automation, pre-programmed buttons, and not needing to light a fire.

- The importance of the payment plan in enabling customers to make a purchase was highlighted by respondents in Tanzania (**Figure 1**2). Top of the aspirational reasons was wanting to improve the home environment, which covers cleanliness (clean kitchen and pots), and emissions (smoke).

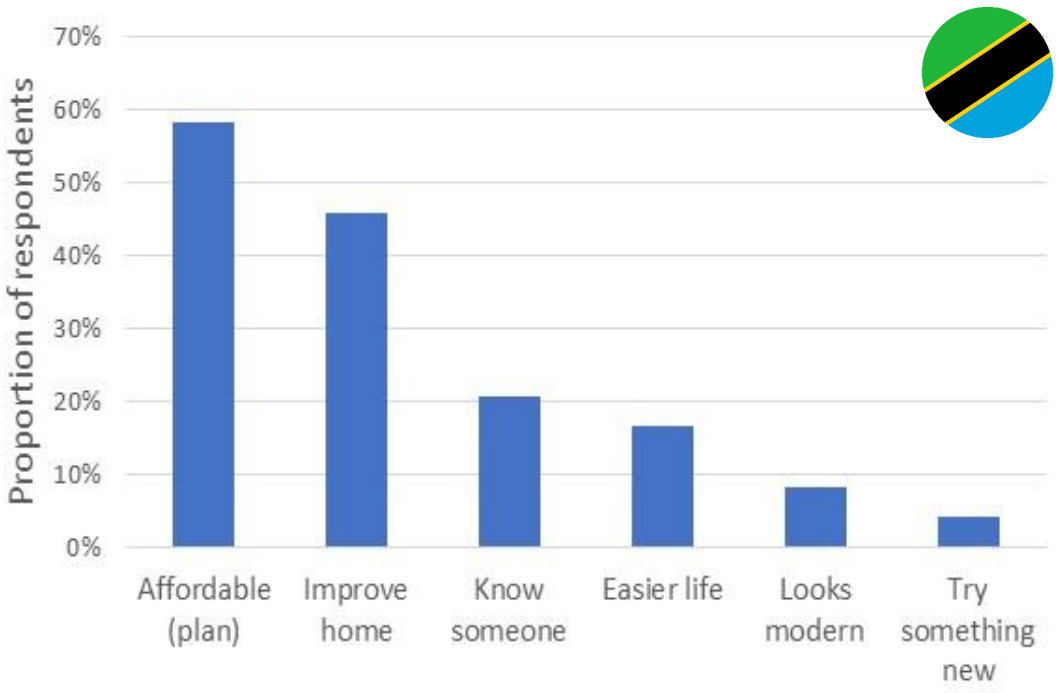


Figure 12: What made you purchase an EPC (Tanzania Baseline survey)

- In Tanzania, there was a unanimous view that the *ecoa* was safe, with 96% saying it was very safe.

***92%** of customers' rate their experience of using EPC as excellent.*

- In Tanzania, customers' experience of using the EPC was overwhelmingly positive: 92% rated their experience as excellent, and none were negative. **Figure** 13 suggests that customers did not find the EPC as easy to use as they had expected.

Figure 13: Comparing the experience of using EPC (3-month surveys) with expectations (Tanzania Baseline)

- However, the learning curve for EPCs increases beyond the first 3 months, so users should start with the easiest dishes before exploring more complex dishes.

- Demonstrations, recipe books, video recipes, recipe-sharing groups, and other interventions can help users start using their EPC as quickly as possible. Design adaptations such as the 'githeri button' on the Burn EPC can also help make the operation of the EPC as intuitive as possible.

***86%** of Ugandan respondents reported having more time to available after starting to cook with electricity*

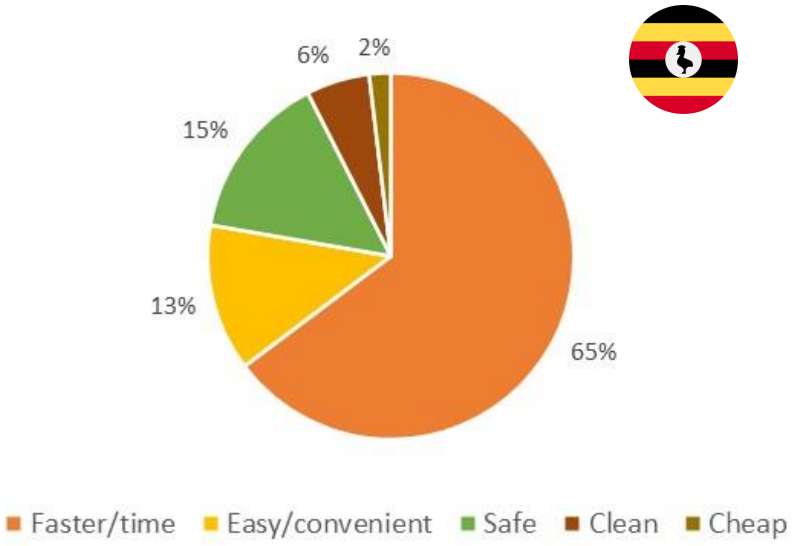


Figure 14: Reasons for preferring cooking with electricity over other fuels (Uganda Exit survey)

- In Uganda, 86% of respondents said that they had more time available once they started cooking with electricity. Some used the time to get on with other cooking tasks, such as washing up and preparing other food; others were able to get on with other household chores such as collecting water, washing clothes, and ironing; others used the time for income-generating activities. 90% indicated a preference for cooking with electricity, with 14 breaking down the key reasons behind this.

- The Uganda Cooking Diaries study found that median dish cooking times were almost half the time when using LPG or EPCs. Cooking some dishes on LPG or the EPC can save a lot of time compared to cooking on charcoal, but the time saving is more modest when cooking other foods such as soup and rice.

Photo credit: Burn Manufacturing

	Kenya	Tanzania	Uganda
n	65	24	90
Detractors/No	0%		1%
Passives/Undecided	5%		1%
Promoters/very likely/yes	95%	100%	98%

Table 3:Customer satisfaction results - all countries (3-month surveys)

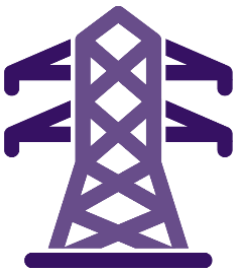
The results in **Table 3** indicate high levels of customer satisfaction show an NPS scores of >95% in every country which is considered excellent, as they indicate high levels of customer satisfaction. Results from Kenya and Tanzania.

Challenges

Although the EPC is well suited to African cuisine and many dishes can be cooked using an EPC, the customer feedback highlights a couple of notable constraints:

- Having only a **single pot** makes it difficult to cook meals comprising more than one dish, and certain dishes are not well suited to cooking in an EPC.

- **Lack of experience** and understanding of how to cook using an EPC, such as getting the right amount of water, overcooking, and burning food. Training materials for new users can be accelerated with cooking demonstrations at the point of sale, recipe books, and video recipes.



- **The quality of the power supply** does not stop people from cooking with electricity, but it does limit the intensity of eCooking. Even though the proportion of customers affected by outages was similar in Kenya and Uganda, the quality of supply appears to be poorer in Uganda, given that outages were more frequent.

- **Electrical safety** concerns were a priority among Ugandan customers (but this issue was not raised in Kenya). It is likely that these concerns relate to poor quality household wiring and damaged sockets and switches rather than EPCs themselves. Despite these concerns, electricity was still regarded as safer than other cooking fuels.

POTENTIAL IMPACTS OF SCALED UPTAKE

The study explored the costs and benefits of scaling-up of eCooking using primary data from Burn EPC pilots. The Kenya pilot was used as the basis for this analysis and the World Health Organisation's (WHO's) revised "Benefits of Action to Reduce Household Air Pollution" (BAR-HAP) tool was applied to quantify the expected financial costs, and health and environmental benefits of the scale-up.

The results of the impact modelling showed that:

- A large-scale national programme would cost $84 per household for equipment and associated costs but save $100 in reduced energy bills each year.
- Electricity tariffs are relatively high, but the EPC is highly efficient and charcoal prices are also high.

This transition to electric cooking would save households up to $100 per year in energy bills.

A scaled transition from charcoal to electric cooking could reduce greenhouse gas emissions by an estimated 1.1 million tonnes $CO2_{eq}$/yr

- From KPLC's perspective, the transition would bring a considerable increase in electricity demand, of some 285 GWh/year. The model does not look at power flows and thus the effect on loads is not known.

- Furthermore, health benefits would include 130 lives saved per year and more than 7000 cases of debilitating illness avoided per year. Some 1.4% of current unsustainable wood harvesting would be avoided (191,000 tonnes/yr).

- Some of these impacts may seem modest but this scenario is targeting only 12% of the national population (grid-connected charcoal users).

- BAR-HAP monetises GHG emission reductions using a social cost of carbon which they assume to be around $18/tCO2. This is higher than typically achieved in the voluntary carbon market (where $8 would be more usual), but there is a significant opportunity to monetise the carbon savings to support the EPC transition using carbon credits.

- The social benefits from avoiding time spent cooking are significant, reflecting time savings using an EPC (almost one hour per day), and the opportunity cost for peoples' time, as used in BAR-HAP.

- However, by far the largest benefit comes from reduced fuel costs to households. Charcoal prices in urban areas were assumed to be $0.73/kg (KES80/kg), reflecting purchases in relatively small quantities), and the average spend on charcoal in the baseline case is KES2500/month ($23/month). Even with electricity tariffs at 20 KES/kWh ($0.18/kWh), the energy savings from the use of more efficient electric devices leads households to save over $10 per month. The payback analysis showed that consumers would be able to pay off their investment in an EPC in less than eight months.

Households saved over $10 per month on cooking energy bills

- The overall position is one of a large net social benefit for the transition to EPCs, offering more than $1,700 net social benefit per household over the ten-years considered.

This impact analysis examined how EPC cooking could benefit Kenya's grid-connected charcoal users:

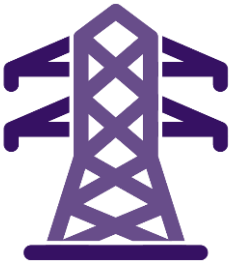
- The transition from charcoal to electric cooking offers financial benefits in the long run, but requires consumer finance or other support to break down the high initial investment.

- The modelling shows that the transition at scale would bring significant net social benefits for Kenya, based on WHO's physical impact and impact monetization methodologies.

- High electricity tariffs can still support eCooking if fuel prices are high.

- The price of EPCs is an important factor in determining payback times and economic benefit, as well as the supply chains and taxation policies.

Targeting contexts where large segments of the population reply on unsustainably sourced polluting fuels (notably firewood or charcoal).

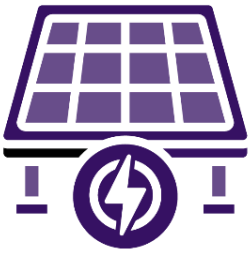


For grid eCooking: wide access to grid connection, and ideally reliable supply. E.g., Adding a household battery to support cooking on less reliable grids.

The price of EPCs is important for payback times and economic benefit, but supply chains and border controls can increase retail prices and create bottlenecks.

The relative price of electricity and traditional fuel is key. High electricity tariffs can still support cost-effective eCooking if fuel prices are high.

For use of an EPC, traditional and popular foods need to be suited to this device, e.g., beans and other long-boil dishes, such as stews.



The electricity supply (whether grid or mini-grid) should ideally be relatively low carbon.


Photo credit: Burn Manufacturing

Uganda also offers favourable market conditions:

- In Uganda, firewood and charcoal are the most widely used cooking fuels, with pressure on forests from intensive charcoal production. There has been limited use of LPG.
- Electricity access rates have been historically low but are growing steadily. The power supply is majority hydro, and there have been issues with load shedding in drought periods. But there has been a considerable investment and a more diverse energy mix is in the pipeline.

***70%** of urban households still rely on charcoal. However, a national task force has recently been established to promote alternatives.*

In Tanzania, prospects are similarly positive.

- In particular, the lifeline tariff for electricity is very low making eCooking financially attractive.
- Around 70% of urban households rely on charcoal and a presidential task force has recently been established to facilitate the adoption of alternatives.
- LPG though is seen by many as the most attractive alternative, in particular by high-level decision makers, and hence significant efforts would be needed to promote the transition to eCooking as a viable and complementary strategy.
- Natural gas makes up the largest share of electricity generation, however, it is one of the cleanest fossil fuels and the Julius Nyerere hydropower station is due to double the national generation capacity in 2023.

CONCLUSION

The results of this analysis showed that:

- There are considerable cost and time savings for households acquiring an EPC, in particular for households who are currently using charcoal as their primary fuel.

- There is a learning curve that needs to be overcome to maximise the benefits of the new appliance. However, if this can be achieved, the modern cooking experience combined with cost and time savings creates a strong driver for sustained use.

- With proper training and support, it is realistic to expect customers to cook around half their menu in an EPC, however most customers will need multiple appliances to cook exclusively with electricity.

- Burn's sales and marketing team have refined their approach throughout this early piloting and are now able to offer comprehensive training and after-sales support to new customers, which can enable them to make the most of their new appliance. This is evidenced by the high levels of sustained use seen in the Kenya pilot and moderate levels of use in Tanzania and Uganda.

Photo Credit: Burn Manufacturing

Photo Credit: Burn Manufacturing

***Key takeaways** from this study:*

- *Investment in training both end users and sales teams is critical for unlocking the social, economic, and environmental impacts that can be obtained from the adoption and sustained use of EPCs.*

- *Currently, EPCs are a niche technology in East Africa, so general awareness of how to cook popular local dishes is low. Hence, concerted efforts need to be made to ensure that consumers are fully aware of the range of dishes they can cook in an EPC and the specific adaptations they will need to make to their familiar recipes to achieve the same familiar taste.*

- *Only when consumers are equipped with information about how to utilize these new cooking devices will EPCs be able to make a significant contribution to lowering the usage of biomass in East African kitchens.*

The full working paper that supports this summary report is available from www.MECS.org.uk

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