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Impacts and Effects of Improved Wood Burning Stoves on Time Use and Quality: An Experimental Study in Rural Kenya

Baseline Results: FINAL



Prepared for the Clean Cooking Alliance by

Berkeley Air Monitoring Group

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**CLEAN
COOKING
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Executive Summary

Recent evidence has posited that lack of access in low and middle-income countries to clean, modern, and efficient energy to meet household demand for cooking, heating, and lighting may create an undue time burden, particularly for women. This “time poverty” may lead to economic hardship and a persistent drudgery trap, arising from the constant demands of fuel collection and preparation as well as from long hours cooking on an inefficient, polluting stove. Time poverty can be affected by the introduction of a new cooking technology, practice, or fuel through multiple possible causal pathways, each of which has complexities and measurement challenges. These pathways can impact both quantity and quality of time and can create shifts in time burdens among household members, often with gender dimensions.

This report summarizes the baseline data from an experimental study that aims to identify and understand any fluctuations in time use patterns and changes in the quality of time for 55 households in rural Kenya after a switch in cooking technologies. This in-depth quantitative and qualitative investigation was conducted in the study homes for four weeks before and 14 weeks after they were given either one or two new wood burning stoves. To fully understand and quantify the impact of the new technology along all the potential causal pathways, a broad in-depth exploration was implemented, using an explanatory sequential mixed-method design to first collect quantitative data and then apply qualitative research methods to explore and interpret them. The quantitative methods included surveys and sensor-based stove use monitoring, while the qualitative approach utilized participatory research methods, semi-structured cooking observations, and photo elicitation interviews¹.

Summary of Results

Primary research questions	Quantitative results	Qualitative insights
Who are the participants?	All women, mostly married, average 40 years old, with at least an elementary level education. All have small farms, 22% work outside the home, and 80% conduct income generating activities from home.	Some participants belonged to community lending organizations, enhancing their sense of empowerment.
How do they cook?	All depend on a traditional open fire, with 10% making limited use of other technologies/fuels. All kitchens were in enclosed spaces detached from the main house.	Participants commonly cook only one dish at a time; limit multitasking during cooking to related tasks such as food prep; and regularly received visits/help from family and neighbors. Cooking smoke has a negative impact on comfort and cleanliness but does not generally render kitchens unpleasant.

¹ Conducted during the post intervention stage only.

Is time poverty impeding women from reaching their potential?	Nearly 70% considered themselves to be very or extremely busy. If given more time, 35% would pursue income; 27% take up more household chores; 17% would rest.	Some 40-50% of waking hours are spent on unpaid care work. Many women felt that lack of spare time, low levels of education, poor health, and inconsistent incomes limited their potential.
What tasks do women consider to be drudgerous?	Women named collecting fuel and farming as simultaneously least enjoyable, most time-consuming, and hardest work. Favorite tasks were washing clothes, farming, and cleaning the house. Fewer than 10% dislike cooking.	Women identified several tasks as hard work, time consuming, <u>and</u> enjoyable. Perceptions of fuel collection were uniquely and strongly negative.
How much time burden comes from cooking?	Participants reported doing all the cooking and estimated they cooked for 6-7 hours/day, whereas sensor showed stoves running for about 5.3 hours.	Most women don't dislike cooking but would prefer to spend less time doing it. They would like to accomplish other chores, farm, relax, and have more family time.
How much time burden comes from fuel collection and preparation?	In most cases, the female cooks spend about 12 hours/week collecting fuel. 75% describe the practice as somewhat risky and dangerous, and 65% do not like anything about it.	Strong consensus that fuel collection is tedious, uncertain, and exhausting. Many feel trapped in this situation by poor financial circumstances. Fuel collection practices were in flux during this study due to new government policies limiting forest access.

Key Conclusions

- Women are overwhelmingly responsible for cooking and fuel collection; thus, any time saving from new technology should be experienced by them.
- Although cooking constitutes a major component of the participant's daily activities, over 90% viewed it either positively or had neutral feelings about it.
- In contrast, fuel collection is strongly viewed as drudgery, even though it has some redeeming characteristics, such as providing social time and exercise.
- Participants lead busy lives dominated by multiple physically demanding and time-intensive activities. They are not significantly sleep-deprived but would appreciate more time to rest and pursue leisure activities.
- Just under half the participants reported that they would pursue more income-generating activities if they had additional uncommitted time, suggesting that time required to complete household chores, of which cooking and fuel procurement are the largest components, does limit women's economic opportunities.
- The tasks that are the hardest work, such as working on the *shamba*², do not necessarily feel like drudgery to the participants. A key differentiator between hard work and drudgery appears to be the extent to which a task brings pride or accomplishment.

² Swahili for an area of cultivated land, often a small plot near to rural homes.

- The baseline results highlight an opportunity to reduce the burden of fuel collection with more fuel-efficient cooking technologies. A key endline question will be whether the intervention technology can sufficiently reduce fuel to alleviate this burden for participants.

1 Background and Introduction

Recent evidence has posited women work longer hours than men all over the world, often shouldering the burden of unpaid work, such as housekeeping and child care, which keeps them from income-generating opportunities, educational programs, as well as social, leisure, and wellness activities (1). This ‘time poverty’ can lead to economic poverty and a persistent drudgery trap.

The significant time demands and persistent drudgery created by a reliance on traditional biomass cook stoves have been well recognized (2,3). In communities dependent on biomass for their household energy needs, a time burden frequently arises from the constant demands of fuel collection and preparation as well as from long hours cooking on an inefficient, polluting stove.

Detecting time poverty and measuring its alleviation poses several challenges. The outcome of combating time poverty may not be a straightforward increase in disposable time but rather a more complex and subtle change in the quality and flexibility of activities during a particular time period. Integral to the concept of time poverty is the aligned concept of drudgery, for which any definition is culturally specific. Alleviating drudgery may have a higher impact on quality of life than strictly increasing disposable time.

Time poverty can be affected by the introduction of a new cooking technology, practice, or fuel through several possible pathways, each of which has complexities and monitoring challenges. (see Table 1 below).

Table 1: Potential impact pathways for the purchase of improved cooking devices on time poverty

Possible pathways to impact on time poverty	Notes on measurement complexities
Reducing the time required to collect fuel wood	Impacts will only be seen in populations that collect significant amounts of their cooking fuel from beyond their immediate plot of land. People also often leave the house to do more than one activity, such as to collect water, socialize, obtain food etc., so it may be difficult to isolate and quantify the change in fuel collection time. If the fuel is collected infrequently (i.e. less than monthly) and in very large amounts, it is challenging to measure the impacts the cookstove might have on fuel collection time.
Reducing time spent preparing fuel wood	It is often assumed that a more efficient wood burning stove will need less fuel wood and therefore less time will be spent to cut/prepare that fuel. However, some new technologies require much smaller pieces of wood than open fires, and so an increase in time spent preparing wood for the cookstove might be seen.

Reducing the time it takes to cook	An intervention stove is assumed to have proven ability to cook a standard meal quicker than the traditional /baseline option. Yet the effect of a new device or fuel on overall time spent cooking can be 'distorted' by people choosing to cook more/longer because the stove is 'comfortable' or because it is more fuel-efficient and thus more affordable.
Reducing the time required to actively tend the stove	This pathway focuses on the changes in the physical interaction between the cook and the cooking intervention. If the cook perceives the new device/fuel to be safer and more automated than the baseline alternative, then she may feel comfortable walking away from it and attending to other activities. Conversely time tending the stove may increase if the intervention stove requires more frequent feeding of smaller fuel or more active tending to remain alight.
Reducing the time to clean the kitchen/pots	If there is to be an impact from reduced time spent cleaning the kitchen, the majority of cooking needs to be conducted indoors. As the cleaning of pots alone may not be a significant time burden, reducing this need may not have a significant impact on net time available, but it can have a more substantial qualitative impact by reducing drudgery.
Increasing the time that the cook can spend with family and friends improves time quality	A cleaner cookstove can create an environment conducive to the family being near the cook as she prepares meals, increasing social interaction and reducing isolation. A safer stove, such as one that is stable and contains the fire, allows the cook to care for her children while cooking without fear of injury.
Reducing physical effort which lessens fatigue and promotes a sense of wellness	Reducing physical effort may extend woman's energy for other activities, even if the time itself doesn't change.

All potential pathways through which a new stove and/or fuel can affect time poverty need to be considered to provide a true representation of impact on all household members. Although a change in stove/fuel technology can reduce or increase net time available, it can also cause shifts in time demands among members of the household. For example, a new stove might reduce the time a teenage girl needs to spend collecting wood, allowing her more time to attend school, but if that same stove requires smaller pieces of fuel, the person who does the wood fuel preparation might experience an increased demand on their time. These shifts in time may have gender dimensions that are more influential on the household than the aggregate change in cooking or fuel collection time across the household, and only a broad in-depth exploration of all potential pathways will highlight and characterize these changes.

It can be hypothesized that a reduction in demands on a woman's time could potentially lead her to seek income-generating activities, occupational training, and/or further education, which

could enhance her sense of empowerment. A 2011 study in South Africa showed evidence of changes in time use after the introduction of electrification in previously firewood-dependent households, leading to a greater increase in women’s labor-force participation relative to men (4). It should be recognized, however, that there are many complex factors that affect the potential for enhancing women’s empowerment by alleviating time poverty, namely gender, social and cultural norms, access to opportunities, and the relevance and definition of the concept of empowerment across individual communities.

This report summarizes the baseline data from a study conducted in Kiambu County in Kenya. The study aimed to identify and understand any fluctuations in time use patterns as well as changes in quality of time for members of a household that had been given an improved wood burning cookstove for the duration of the study. This study is not designed to provide a robust analysis of impact on empowerment; however, a secondary aim was to explore at baseline the concept of empowerment in these communities and the women’s perception of whether they considered themselves empowered at a community level. Here, we present the methods and baseline results only. The full technical report will be available at the end of 2018.

2 Study Design

2.1 Design overview

To fully understand, and as much as is possible to measure, the impact that a new cooking technology can have on time use patterns, quality of time, and perceived levels of drudgery, a 3D evaluation was implemented, using an explanatory sequential mixed-method design (5). This approach first collects quantitative data and then uses qualitative research methods to explore and interpret the results. Further details on each data collection method are presented in section 2.2 below.

The in-depth quantitative and qualitative investigation was conducted in the study homes before and after they were given a Kuniokoa wood burning stove, manufactured in Kenya by BURN (Figure 1). The Kuniokoa was chosen for this study because it is produced and sold in the study region and designed to appeal to the study population, primarily by providing improved wood-burning efficiency and reduced cooking times. Please see <https://burnstoves.com> for further information.

One month after initial stove dissemination, the participants were offered another Kuniokoa. Two stoves were offered in order to ensure that the household would have sufficient cooking capacity to fully displace their open fire, if they chose to do so³.

³ With the benefit of hindsight, it is clear from the baseline data that the study participants do little or no simultaneous cooking, but this was not known at the time of the intervention, so the conservative decision was made to offer two stoves to each home.



Figure 1: The BURN Kuniokoa. (Left to right); 1) Dissemination of the stoves to study participants, 2) transporting stoves to the homes, 3) Kuniokoa in use during the stove demonstration.

2.2 Sample size and study population

A total sample size of 55 households who predominately used wood fuel for cooking and collect at least half of their own fuel throughout the year was selected from three rural communities, 50km northwest of Nairobi in the western area of Kiambu County, Kenya (Figure 2).

The sample size calculation was based on an anticipated effect size – the difference in time spent on wood fuel procurement before and after the stove intervention –of approximately 25%, and an estimated coefficient of variation (CoV) of 60%, supplemented with an additional 10% for loss to follow up.

See annex for full selection survey.

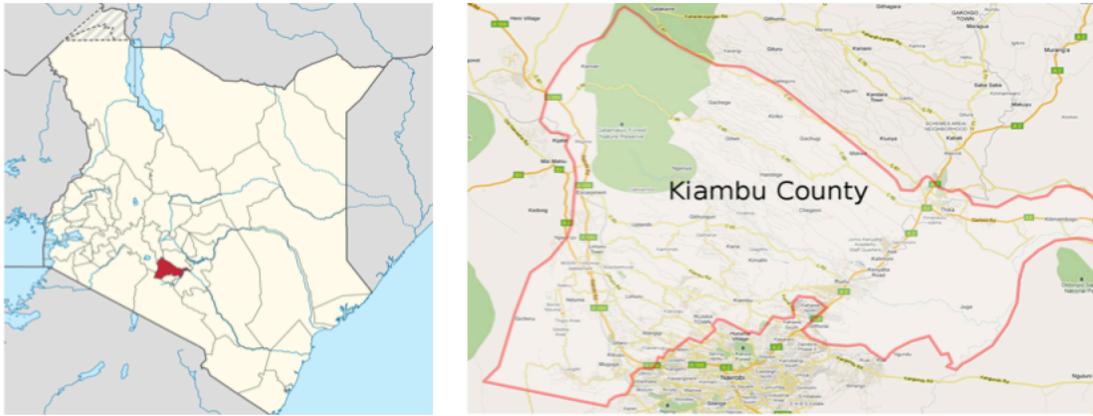


Figure 2: Maps showing the selected study site in Kenya

The three study communities, Githembe, Kambaa and Bathi, are all resource-poor settings that rely heavily on subsistence farming for their economy. Although all three have access to electricity, most households rely on wood as their primary cooking fuel. Githembe has the lowest socio-economic status of the three, possibly due to the fact that it is the most isolated and has the least exposure to outside influences. Bathi, the largest of the three communities, is located nearest to the forest and has a tarmacked road that provides easier access to commodities, paid work opportunities, and education in all seasons. It is often noticeably colder in Bathi than in the other two locations necessitating more frequent space heating.



Figure 3: Study communities

2.3 Study timeline

Starting in March 2017, the study was carried out over an 18-week period, during both the rainy and dry cold seasons.

Stove use monitoring and quantitative surveys (pre and post stove dissemination) were carried out in each home. Other data collection methods were conducted in subgroups of this population as detailed below (Table 2).

Table 2: Sample sizes, methods, and timing of data collection.

Number of households	Initial visit	2 weeks	4 weeks	4 weeks post	8 weeks post	12 weeks post	14 weeks post
	Baseline			Post Stove Dissemination			
55 HH	Baseline survey					Post installation survey	
55 HH			Give out stoves				
55 HH	Placement of SUMs	Download SUMs data	Download SUMs data	Download SUMs data	Download SUMs data	Download and removed SUMs	
5 HH (each visit)		Participatory 'macaroni' interview	Participatory 'macaroni' interview	Participatory 'macaroni' interview	Participatory 'macaroni' interview		
4 HH (each visit)		Cooking observations	Cooking observations	Cooking observations		Cooking observations	
8-10 HH							FGD
10 HH						Camera loan for 5-7 days for photo elicitation (PE).	Conduct two PE guided FGDs 1 week later.

SUMs: stove use monitors

2.4 Data collection methods

Sensor-based stove use monitoring was used alongside quantitative surveys, qualitative participatory methods, and structured observations by enumerators to meet the study aims.

2.4.1 Quantitative Survey

Building on the ‘Measuring Social Impact in the Clean Cooking Sector’ toolkit (6) developed by the Clean Cooking Alliance (Alliance) and the International Center for Research on Women (ICRW), the baseline quantitative survey was designed to investigate the time use patterns and the perceived level of drudgery in the study homes prior to the introduction of the study stove. Particular focus was given to the cooking and fuel procurement demands on all household members (see annex document for final version).

2.4.2 Stove Use Monitoring

Sensor-based stove use monitoring was implemented as a method to objectively measure changes in time spent cooking. Once the participants were recruited, stove use monitors (SUMs) were placed on all stoves/cooking devices in their homes that had been used within the previous four weeks. Two types of SUMs were utilized; temperature loggers outfitted with K-type thermocouples (Model SN-11, Wellzion) and iButtons (model DS1922T, Maxim, USA), both of which measure temperature as a proxy indicator for time the stove is in alight (Figure 4).



Figure 4: (Left) A stove fit with a K-type thermocouple (Model SN-11, Wellzion) and (right) a stove fit with a SUMS iButton (model DS1922T, Maxim, USA)

Stove use monitors were placed on all stoves in all 55 households for the four-week baseline period, and monitoring continued for the duration of the study. The resulting temperature profiles were then analyzed to determine the frequency and duration of stove use events for all household cooking devices (see details below). This data provides an objective assessment of stove use patterns, including how long each stove is alight. The method does not, however, tell us how long the cook is actively tending or cooking at the stove and/or unable to engage in other tasks. This method cannot provide information on other cooking-related tasks such as fuel collection and cleaning either, therefore these aspects were explored and assessed using the quantitative surveys and multiple qualitative methods.

Baseline cooking events were identified from the iButton and Wellzion temperature traces using SUMSARIZER (sumsarizer.com), an online analysis tool developed specifically for the cookstove sector. The data files were uploaded to the web server, where segments from each data file were randomly selected for the analyst to review and manually label perceived cooking events. Using the analyst's input, a machine learning algorithm then applied the patterns identified in the manually reviewed subset to the rest of the data files. As the SUMSARIZER developers note, the algorithm is most accurate when asked to identify cooking events in a homogeneous data set of similar cookstoves or temperature traces. In this project, therefore, the temperature traces from each type of stove monitored were processed separately. The dataset of identified cooking events was then analyzed in R (RStudio, Inc. Version 3.0.1). Cooking events under 10 minutes in duration were removed from the analysis to increase the confidence that only true cooking events were being captured in the analysis. Cooking events within 30 minutes of each other were grouped into single occurrences to account for fueling events.

2.4.3 Qualitative methods

The changes in how time is used after the introduction of an improved cookstove are complex and often unpredictable. Therefore, to ensure that any transition that occurs was rigorously documented and explored, qualitative research methods were employed during both the baseline and post-intervention period. In total, three qualitative methods were used over the duration of the study.

- **Participatory rural appraisal-based methods** were implemented before stove dissemination, not only to understand how the participant spends her time, but also to estimate what proportion of her time is taken up by each task. For this method, the participant was shown a set of images representing common daily activities and asked to select the images for any tasks she carried out during the previous day. She was then asked to allocate beans, each of which represents a time increment of 30 minutes, to each of the selected tasks. Masuda 2014 (7) concludes that having a respondent allocate a specific amount of time to activities mitigates the overestimation of time-activity patterns often found in open-ended recall exercises. The total number of beans allocated must be equivalent to the number of minutes the participant reported being awake on the previous day. The same approach was used in the post-intervention period.

Figure 5 below shows how the participants placed the ‘time beans’ on pictures of activities they had conducted during their most recent wood fuel collection day and also their most recent day without wood fuel collection activities. Weekend and festival days were excluded.



Figure 5: Participants placing ‘time-beans’ on pictures of activities she conducted during wood fuel collection and days when no wood fuel collection took place.

- **Semi-structured cooking observations** were carried out in selected households before stove dissemination to identify any cooking habits particular to the study community that could impact on the way and extent to which the Kuniokoa was used. A secondary aim was to document how time was spent on cooking activities, including a subjective

measure of the quality of that time and any multi-tasking that occurred. As much as possible, similar meals were observed in each home. The same approach was used during the post-intervention period, with the additional goal of corroborating SUM data during the cooking of foods that required a long simmering period. Further detail will be presented in the final follow up report.

- **Photo elicitation interviews** are a participatory research method where the participants are provided with a camera for a set period of time and asked to take pictures related to the topic of interest. Although to our knowledge this exact method hasn't been used in the cookstove sector, a similar method (Photovoice), has recently been successfully used to explore issues related to the introduction of new cookstoves in Kenya (8) and Malawi (9). The key difference between Photovoice and photo elicitation interviews is that Photovoice is usually related to an action plan, policy initiative or participatory research agendas, whereas photo elicitation is primarily a research tool.

Photo elicitation interviews allow the participants to present issues according to their own priorities and perspectives within the study focus, often highlighting connections, priorities, perceptions, or circumstances that had not previously been detected or understood.

Households were given a digital camera for five to seven days – including weekend days. Each participant was asked to take photos that show how she spent time during that period. The photos were downloaded and reviewed by the research team. A selection of representative and outlier images was brought to a focus group discussion (FGD), where the participants were encouraged to share information on their time use patterns, perception of time poverty and quality, and how these differ since the cookstove intervention. Photo elicitation interviews were conducted in the post-intervention period only.

3 Baseline Results

The baseline results are presented below, organized by data collection method. A synthesis of the results by topic, which compares the agreement or variance of results generated by different methods, follows in section 4.

3.1 Quantitative survey results

3.1.1 Demographic characteristics of the study population

A total of 55 households were recruited to the study in March 2018. The main participant was the person who did most of the cooking for the household. Cooks who were the domestic help were excluded. At 20%, the response rate was relatively low. This was driven by the fact that nearly 30% of the households approached were ineligible because of seasonal wood fuel collection patterns. A full break down of the outcomes of the recruitment process can be found in the annex document.

All participants were women, and the majority were married, with an elementary education and an average age of 40 (SD 10). The average HH size was 6 (SD 2), which is higher than the 2014 national average for rural households, which stands at 4.4 (10).

The primary earner in approximately two thirds of the households (n=32) worked as a farmer, and all of the participants had a small *shamba* (Swahili for “farm”) of approximately 1.2 hectares adjacent or near to the house, where they carry out small-scale farming.

22% (n=12) of the participants had paid work outside the home, mostly casual laboring on other people’s farms. Over 80% (n=45) conducted income-generating activities from within the home. This was primarily selling homegrown vegetables, often kale, and milk. For timekeeping, 85% (n=47) of the sample uses their phone to tell the time; only one person used the rising and setting of the sun.

Table 3: Demographic characteristics of the study population, showing percentages and sample sizes, with standard deviations where noted.

Characteristic	% (n)
Married	78% (43)
Completed elementary education or more	75% (41)
Paid work outside the home	22% (12)
Income generating activities from the home	82% (45)
Average age (mean)	40 (SD 10)
Average household size (mean)	6 (SD 2)

3.1.2 Perceptions of drudgery, time quality, and time poverty

To gain a broad understanding of the perceived time burden in their lives, the participants were asked to give their perception of how busy they were on a scale of 1-5. The left end of the scale presented the green smiling face with the number “1” and was captioned ‘very relaxed with plenty of free time,’ while 5 was described as ‘I’m extremely busy and never have enough free time’. The results show that the majority (67% n= 37) thought their lives were very or extremely busy, with no one reporting to be ‘relaxed with plenty of time’ (Figure 6). There was no relationship seen between age of cook or household size and perceived level of ‘busyness’ (ANOVA p= 0.603 age and p=0.571 household size)



Figure 6: Participant’s responses when asked on a scale of one to five how busy they were (1 = plenty of free time and 5 = extremely busy)

To understand the perceptions of drudgery and time quality related to their household tasks, participants were asked a series of questions about which tasks they enjoyed, which took up most of their time, and which they found to be the hardest work. The top three results are presented in Figure 7. For the two questions asking about activities they enjoyed or did not enjoy, up to three responses were allowed. Cooking was mentioned as one of the household activities enjoyed the most by 24% (n=13) of households. Only 4% (n=2) reported it was one of the activities they enjoyed the least.

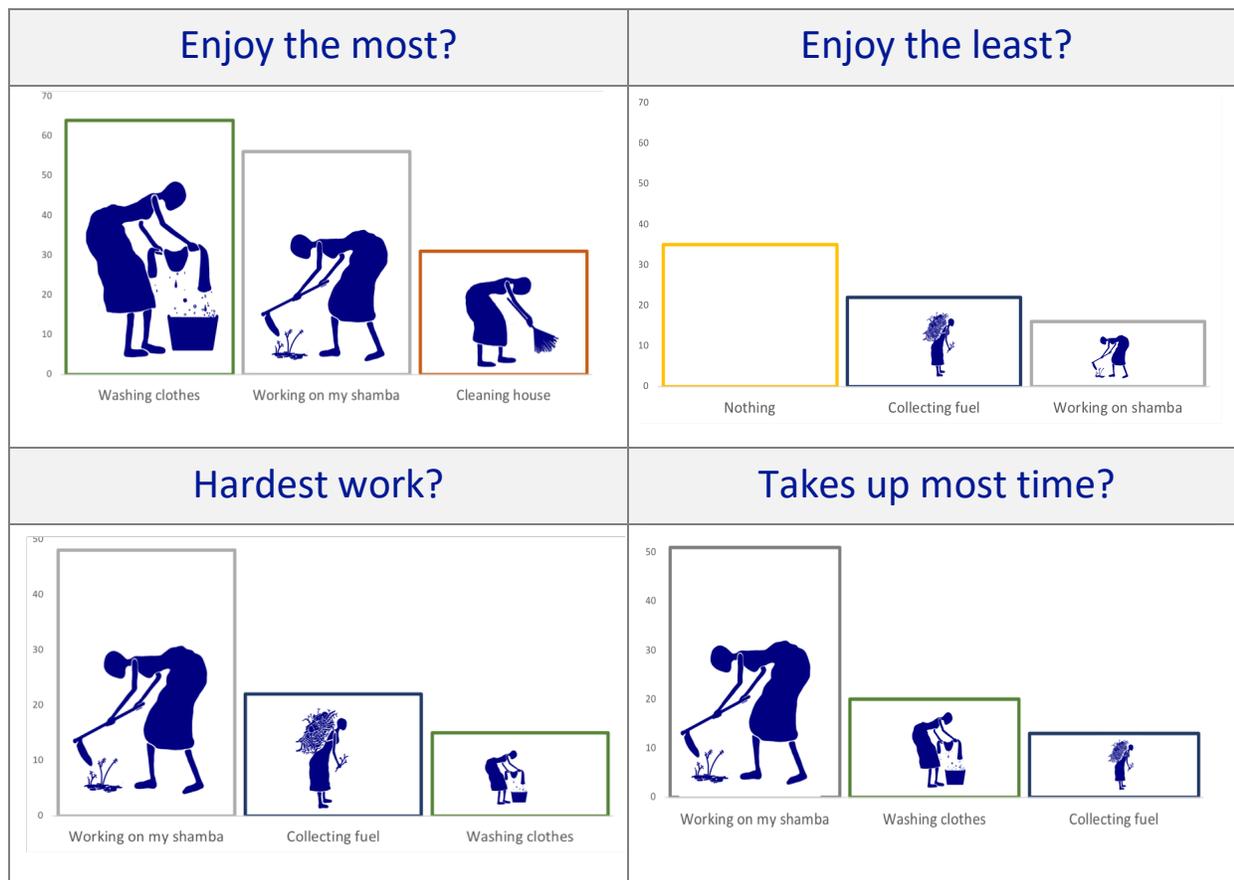


Figure 7: Participant’s responses when asked which tasks they most enjoy, which ones take up the most time, are the hardest work, and the ones they enjoy the least.

The participants were asked why they enjoyed the tasks they had listed. The reasons for enjoying washing clothes and cleaning the house were similar and related to a sense of pride they gained from a tidy, clean environment. Working on the *shamba*, although hard work, gave them satisfaction as it yielded food for the family and, in some cases, a source of income.

Over one third (35%) of participants reported that there were no tasks that they found unenjoyable. When there was a task that they found unenjoyable, collecting fuel (22%) and working on the *shamba* (16%) were the ones most frequently reported. The reoccurring reasons for not enjoying these tasks related to the amount of effort they require.

“Picking kales for sale is very tiresome, we have to pluck really early in the morning, we get really wet, and the extreme cold can lead to chest pains and pneumonia. Collecting wood fuel is also very hard, the load is too heavy, the distance to the forest and back is very far.”

When asked 'if you had more time available how would you like to spend it?', the most frequent response was 'income generating activities', followed by completing more household chores, specifically house cleaning, and sleeping/resting (Figure 8).

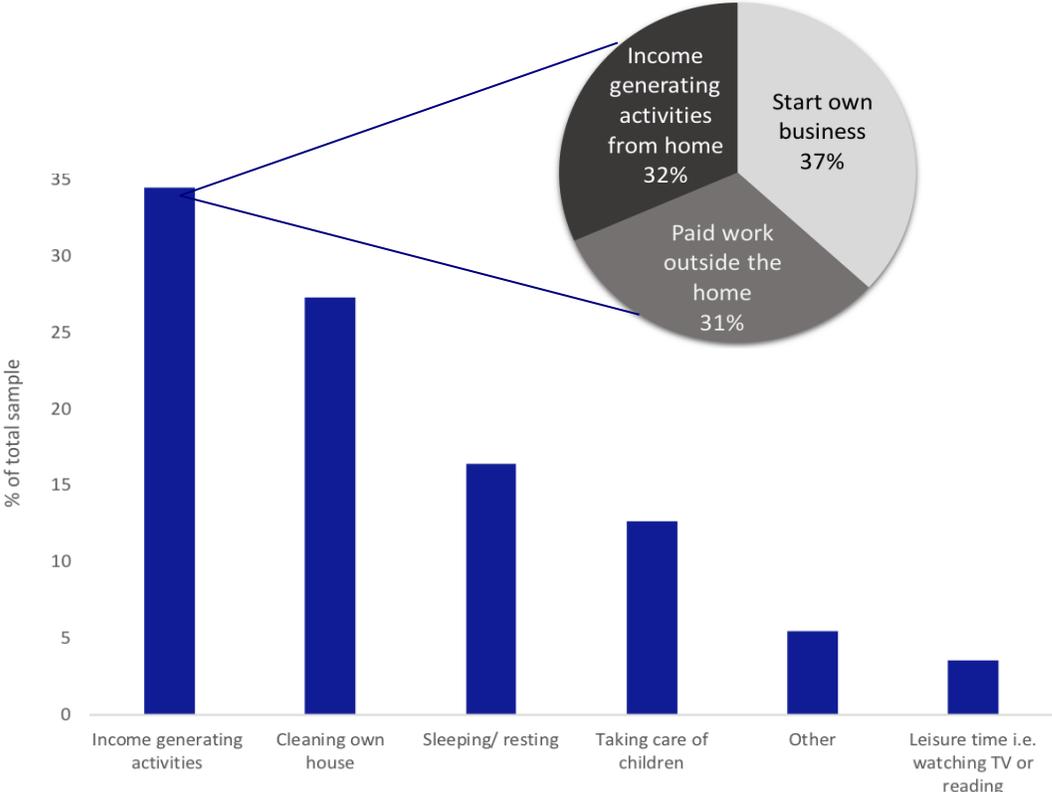


Figure 8: Responses to 'If you had more time available, how would you like to spend it?' (Multiple responses were allowed;(n=55)

Even with extra time, 22% (n=12) of participants felt as though there would be additional barriers to becoming involved in paid work. Most significantly, access to startup capital would create a barrier for several of the participants (n=7) who would like to start their own businesses or commence income-generating activities from home. Two participants also felt as though their husbands would oppose their plans.

To help characterize their perceptions of levels of effort associated with cooking, fuel collection, and fuel preparation, the participants were shown a graphic scale depicting tasks that require an increasing level of effort, from light effort to extreme exertion (see top axis images in Figure 9). They were then asked to point to the picture that most closely represented the amount of effort spent on each of three tasks: cooking, collecting firewood, and processing collected wood into fuel. As seen in Figure 9 below, there was the strongest agreement among the participants that fuel collection was extremely arduous. By contrast, opinions regarding the effort needed to

cook and to prepare fuel were much more evenly distributed across the scale, suggesting that affinity for these tasks (or lack thereof) is more strongly driven by personality or behavior.

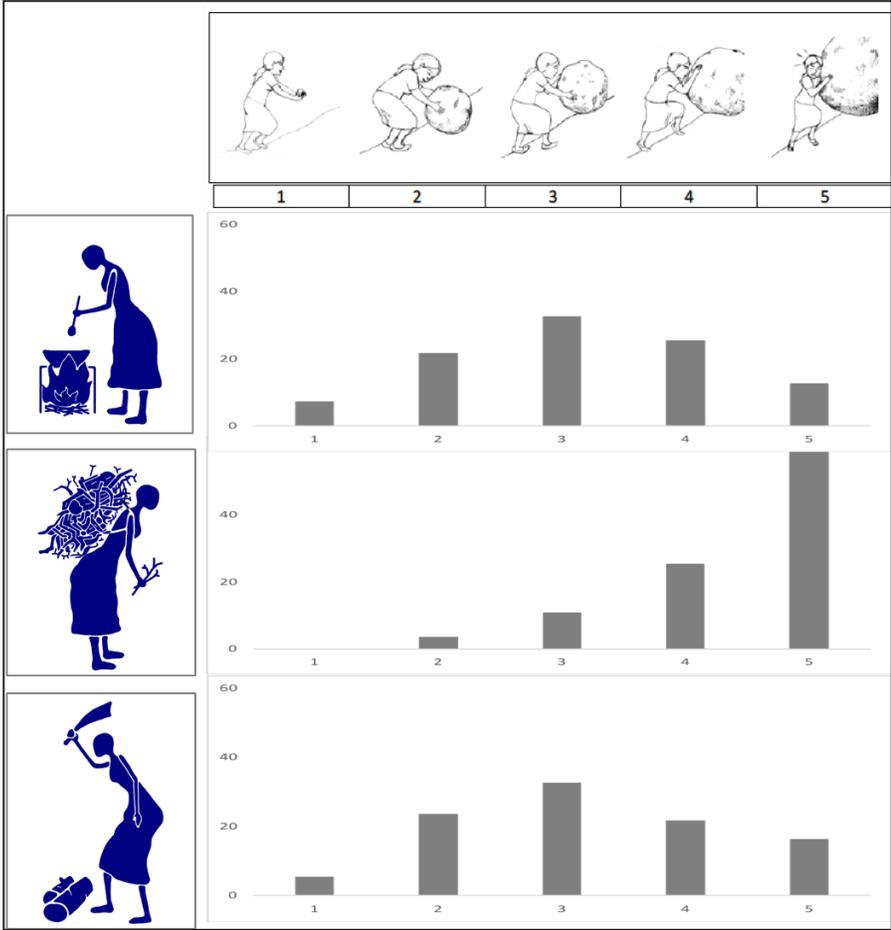


Figure 9: Participant’s responses when asked how much effort was required by cooking, firewood collection and preparation, according to the graphics along the top axis⁴.

Using the ‘smiley face’ graphic in Figure 10 below, the participants were asked to rate on a scale of one to five how much they enjoyed cooking, (1= love it and 5= strongly dislike). The figure shows that the majority (58%, n=32) reported to ‘love’ cooking, with only one person strongly disliking it.

⁴ Boulder graphic adapted from the The Social Impact Measurement Tool developed by International Centre for Research on Women (ICRW) in partnership with the Clean Cooking Alliance. <http://cleancookstoves.org/about/news/10-28-2016-measuring-social-impact-in-the-clean-cooking-sector.html>

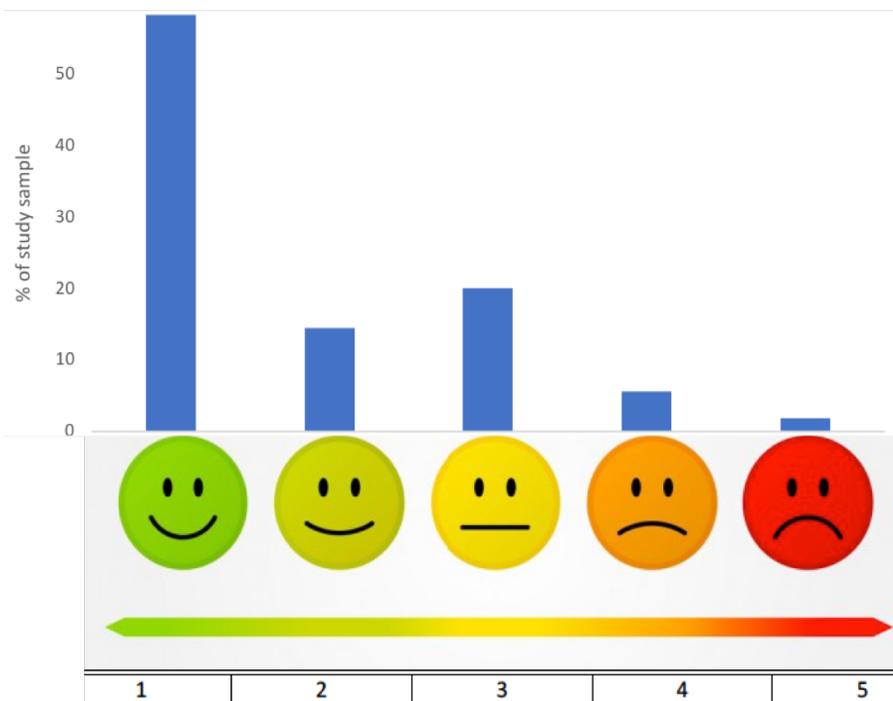


Figure 10: Participant’s responses when asked on a scale of one to five how much they enjoyed cooking (1 = I love it and 5 = I strongly dislike it)

3.1.3 Children’s involvement with household chores

Only one participant out of the 48 with school-aged children reported that her children sometimes had to miss school to help with household chores. Upon further questioning it was revealed that this circumstance occurred only two days per year to allow the mother to travel to get medicines for a disabled child. However, observations by the field team revealed that the teenage girls in several households cook after school and on weekends and are responsible for completing household chores. The contributions from adolescent children to household chores will be explored further during post-intervention data collection.

3.1.4 Stove Use Patterns

The participant was asked about household stoves currently used at least once per week. As per selection criteria, the primary stove in all households was a traditional wood stove, mostly three-stone fires. Secondary stove use was reported in only 10% (n=5) of homes. These were a range of stoves (LPG (n=2), Kenyan Ceramic Jiko (KCJ) (n=2), biogas (n=1)) used to make hot drinks, reheat food, and supply space heating. Figure 11 shows some of the most frequently seen baseline stove types.



Figure 11: Some of the most frequently seen baseline stove types

3.1.5 The amount and quality of the time spent cooking

The participants' kitchens were all in a building separate from the main house. When asked about the time they spend in their kitchens, 67% (n=37) of cooks described their kitchen as a 'pleasant' place to be, and 51% (n=28) say they usually cook alone.

In order to explore cooking time and multitasking habits, the cooks were asked the times at which they started and then stopped cooking, re-heating food, and/or making hot drinks on a per stove basis. They were asked to do this for each 'cooking event' on a typical day. The time it takes to prepare food beforehand or light the stove was not included. The participants were then asked what proportion of that time they leave the stove unattended while cooking, when neither food nor fire needs attention, again on a per stove per event basis. As presented in Table 4, participants actively cooked for almost 80% of the time that cooking was ongoing.

Table 4: Time spent cooking and time spent next to the stove: mean (SD).

	Average daily amount (SD)
Length of time participants report that food or drink is being cooked or re-heated, on a typical day.	7 hours (SD 2hrs 55 mins)
Length of time the cook spends next to the stove/fire activity tending the food and/or stove/fire.	5 hours 54 mins (SD 2hrs 42 mins).

Although not actively tending the stove, the participants often stay in or near to the kitchen during cooking, with 71% (n=39) reporting to carry out some other tasks in the kitchen area while cooking, mainly cleaning the kitchen (n=30) or preparing the next meal (n=11). During these times, 86% (n=47) also report that they sometimes just sit and relax next to the stove even though they could leave it unattended and do other tasks.

Simultaneous stove use is extremely rare. When the household had two stoves, they reported to use them at different times. For example, the LPG was used first thing in the morning to boil water for tea before the three stone fire was lit for the day's main cooking.

Cooking takes longer in the rainy season, according to 78% (n=43) of participants, mainly due to the extra time required to light wet wood. Other factors include the fires requiring extra tending to stay alight and taking longer to reach the required cooking temperature due to colder ambient temperatures. Finally, increased levels of smoke from wet wood sometimes cause the cooks to leave their kitchens more frequently, slowing the cooking process.

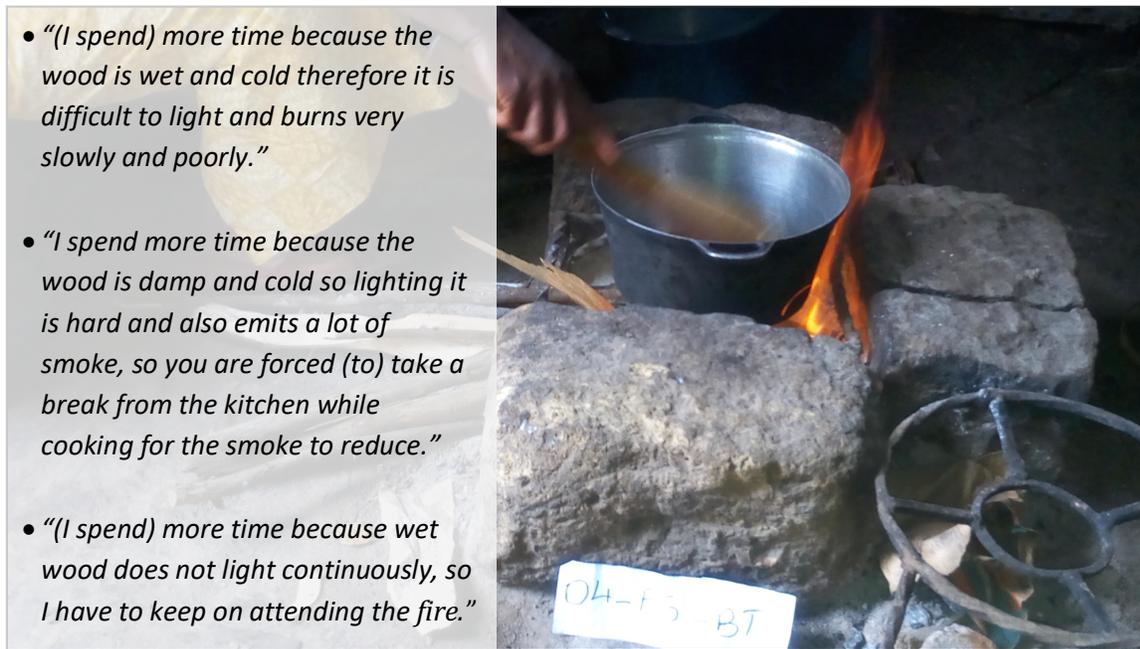


Figure 12: Participant perceptions on how wet fuel impacts cooking time

While most women don't dislike cooking, they would like to spend less time doing it. The women's reports emphasized that they would prefer to complete other tasks around the home, such as sweeping, washing clothes, and working on the *shamba*, but also to rest, and to spend time with children. To a lesser extent, women also described wanting to reduce their cooking time, so they could escape their kitchen's smoky environment. One woman wanted to leave her kitchen earlier as she didn't feel safe there at night.



Figure 13: Reasons for wanting to spend less time cooking

3.1.6 The amount and quality of the time spent collecting fuelwood

In 87% of the homes, the female cook was the only person who regularly collected the firewood. Male contribution to the task of fuel collection occurred in only 6% (n=3) of homes. Almost all women walk (98%) to the woods to collect fuel, spending an average of 11.8 hours (SD 9.7) on this task per week, including travel time, which accounts for just over half of the dedicated hours (6.6 hours per week, SD 6.0). The large variability in travel time can be attributed to geographical location, poor weather conditions, and at certain times of day, the necessity to take circuitous routes to avoid guards. During their daily activities, 18% (n=10) of participants reported combining fuel collection with other trips, most frequently accomplishing it as they return from working on their *shambas*.

Seasonal changes in fuelwood procurement

Perhaps unsurprisingly, 89% (n=49) of participants report that their fuel collection patterns change with the season. When the women were asked to describe how fuel collection differed by season, they often described stockpiling during the dry season when the wood is more plentiful and lighter to carry. The increased burden and risk of accidents associated with flooding, deep mud, and slipping are also minimized during the dry season, leading to more frequent trips during this time. The reduced demands from the *shambas* during the dry season also allow the women more time to collect fuel.

“It takes less time to cut and collect the wood during dry seasons, you can also carry more at this time because the firewood is dry. It takes time to walk to and from the forest during the rainy season because the paths are slippery.”

“We collect a lot of wood fuel during dry seasons because there is no shamba work, so we use the extra time to go to the forest even two times a day, and also to keep stock of dry wood to be used during rainy seasons.”



Perceived risks associated with fuelwood collection

Describing their experience in the forest, 75% (n=41) stated they felt there were risks and dangers associated with collecting wood fuel. The word cloud in Figure 14 shows the risks and dangers women believed were present during their trips to collect wood fuel. The size of each word indicates its relative frequency.



Figure 14: Reported risks and dangers present during fuel collection (left) and a photo showing the wood load many women carry on each trip (right).

To avoid these actual and perceived risks, 96% (n=53) of the women always travel in groups of at least two to three. They also avoid going into the woods early in the morning or later in the evening, preferring to go in the middle of the day (even though they find it very hot in the dry season), avoid collecting fuel deep in the forest, and stay near the perimeter fence.

“There are wild animals that can attack you, and men who attack women in the forest and rape them. The terrain is too steep, the risk of falling is high especially in the rainy seasons. There are also rivers, and sometimes they have to make improvised bridges to cross, which are not safe.”

“There are risks like wild animals, such as elephants, hyena, there are male rapists. So, we have to walk in groups and avoid the innermost parts of the forest.”

Perceptions of fuelwood collection

The participants were asked if they liked anything about collecting firewood and then requested to explain further why or why not. The majority, 65% (n=36), stated that they did not like anything about collecting firewood. There was an overwhelming feeling that the task is very tiresome, due to first having to look for firewood before carrying heavy loads over long distances. There was also a sense of being trapped in this situation by poor financial circumstances. In this open question, which didn't ask specifically about risks but more generally about disliked aspects of fuel collection, only a few women mentioned the risks of wild animal attacks or human assailants, suggesting that the drudgery and burden overshadow the dangers.

“If I had an alternative of being able to fill my LPG stove, I would not go for firewood because it's a very tiring task.”

“The wood is heavy to carry, the routes are slippery and steep, and the journey to and fro is quite far.”

Some 35% (n=19) reported that they liked to collect firewood, though this seemed to be more pronounced in the dry season, when the fuel was lighter and easier to carry. There is also a reoccurring sense of satisfaction from collecting wood, so they have adequate stores of a relatively cheap fuel to make cooking efficient. Five women relished the source of exercise it provides, and one appreciated the social contact it allowed her.

“I get to see different trees. Most of the time, I am at home alone, so [going to the forest] is a good chance to tell stories, catch up and laugh with my friends, as we collect firewood.”

“It's a form of exercise, and when I get the wood, it makes cooking easy because I have enough fuel.”



Challenges associated with forestry access

Recent Kenyan Government Policy Changes Impacting Household Energy

Prior to February 2018, it was possible to access forests for the purpose of collecting wood fuel with the purchase of an access ticket for 100KSH per month or 10KSH per load. However, in February 2018, in a response to deforestation and degradation exacerbated by drought conditions the government imposed a logging ban, initially for three months, which was then extended to nine months. This policy change meant that it was no longer permissible to collect wood fuel from community and public forests, forcing wood fuel users to either find alternative energy sources or continue collecting from the forest but risk being turned away, having collected loads confiscated, or possibly facing arrest.

Although the government has simultaneously reduced import taxes on LPG stoves and subsidized cylinder cost, which it predicts will almost double LPG consumption over three years (Senelwa, 2016), the study communities do not appear to have made significant moves in the transition to LPG. The few households with LPG use it to make hot drinks and prepare breakfast. The freely available, albeit challenging to procure, wood fuel still outweighs the advantages of LPG.

The survey revealed that fuel collection is not only time consuming, but that it has also become increasingly uncertain: 86% reported that they had been denied access to the wood fuel collection location during one or more recent trips. Changes in government regulation related to access to the forests (see box 1) have meant the women have been forced to change the way they collect fuel to avoid having the collected wood removed, their cutting equipment confiscated, or being arrested. These behavioral changes have included:

- changing routes to the forest to avoid police or forest rangers;
- collecting wood either before 8am or after 5pm when the guards are not present;
- collecting when going to farms located in the forest or when taking the animals to feed/graze in the forest;
- carrying the wood in sacks to conceal it, meaning they have to cut it during its collection into smaller pieces than before the ban;
- collecting smaller loads more frequently to limit their time in the forest and reduce the risk of arrest;
- picking up smaller twigs, either along the forest fence or on their own *shambas*; and/or
- using previously stored firewood or charcoal.

“We have to sneak in the forest using other routes to avoid the forest rangers and collect wood fuel quickly.”

“When I am denied access, I just pick around the forest fence outside.”

Anecdotal information from conversations during the scoping trip revealed that women believed that collecting wood early or late in the day or using less-traveled routes increased their vulnerability to attack in the forest. They described that even though it was the hottest time of the day, they preferred to collect fuel during the late morning when there were more people around to prevent attack. These comments suggest that the firewood ban is pushing women into adopting more risky behaviors, a topic that will be explored further at follow up.

3.1.7 The amount and quality of the time spent preparing fuelwood

All participants reported doing some level of fuel preparation after bringing the wood back to their homes. Two-thirds of the participants (66%, n=36) reported cutting or chopping the wood into smaller pieces before stacking and drying it. The mean time spent preparing wood post-collection is 128 minutes per week (SD 145), and as with the collection of the fuel, this task is overwhelmingly carried out by the women alone. However, as Figure 9 shows, this processing is not perceived as an unduly laborious task.

- 47% of participants reported that the time spent preparing the wood fuel was the same across all seasons.
- 51% felt it took more time in the rainy season mainly due to the fact the wet wood was heavy and takes longer to chop.

“More time because the wood is wet and heavy so stacking takes more time and also wood chopping will be done in the house, so with my son I have to be careful, therefore using more time.”

“Since the wood is filled with water chopping it is hard you have to use a lot of force... also stacking it to dry takes time since they are heavy.”



Figure 15: Changes in wood preparation across seasons

3.2 Stove Use Monitoring

Analysis of the baseline data showed that the traditional wood stoves had a mean cooking time of 320 minutes per day (SD=153). The stoves used as secondary cooking devices in the homes – biogas (n=1), Kenyan Ceramic Jiko (KCJ) (n=2), and LPG (n=3) – were lit for a mean cooking time of 110 (SD na) ,63 (SD 97), and 71 (SD 17) minutes per day, respectively (Figure 16).

The biogas stove had the highest mean cooking events per day (6.3, SD na), followed by the traditional wood stoves (4.8, SD 1.2), the LPG (2.4, SD 0.3), and finally the KCJ (2.1, SD 1.7 (Figure 17). It is important to note that the sample sizes of all secondary stoves are very small and have a much higher variability than the baseline/traditional stoves, meaning the results should be interpreted with caution. However, the high number of events on the biogas correlates with the fact that it is reportedly used for making hot drinks and re-heating food, tasks which can be frequent throughout any given day.

In homes that only cooked with traditional methods (no biogas, LPG, or KCJ), the mean cooking time per day was 322 minutes (SD 156) and the mean cooking events per day was 4.8 (SD 1.3).

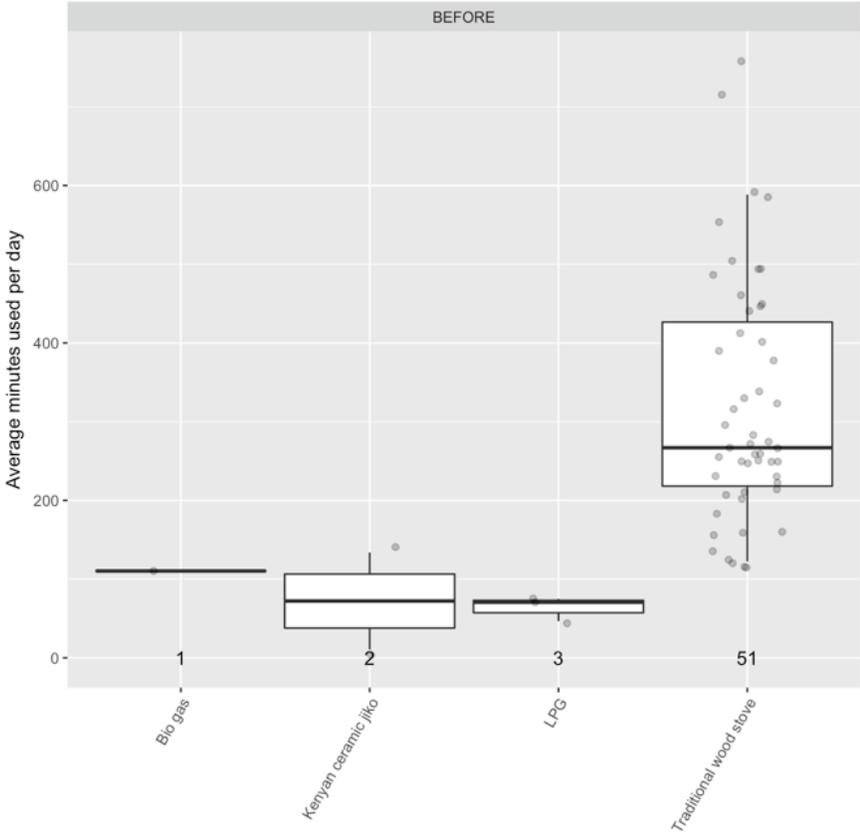


Figure 16: Box plot showing averages cooking events per day for each stove type. Medians are the central line, box ends represent the 25th and 75th percentiles, whiskers the 5th and 95th percentiles. The black number below each box shows the number of households contributing data.

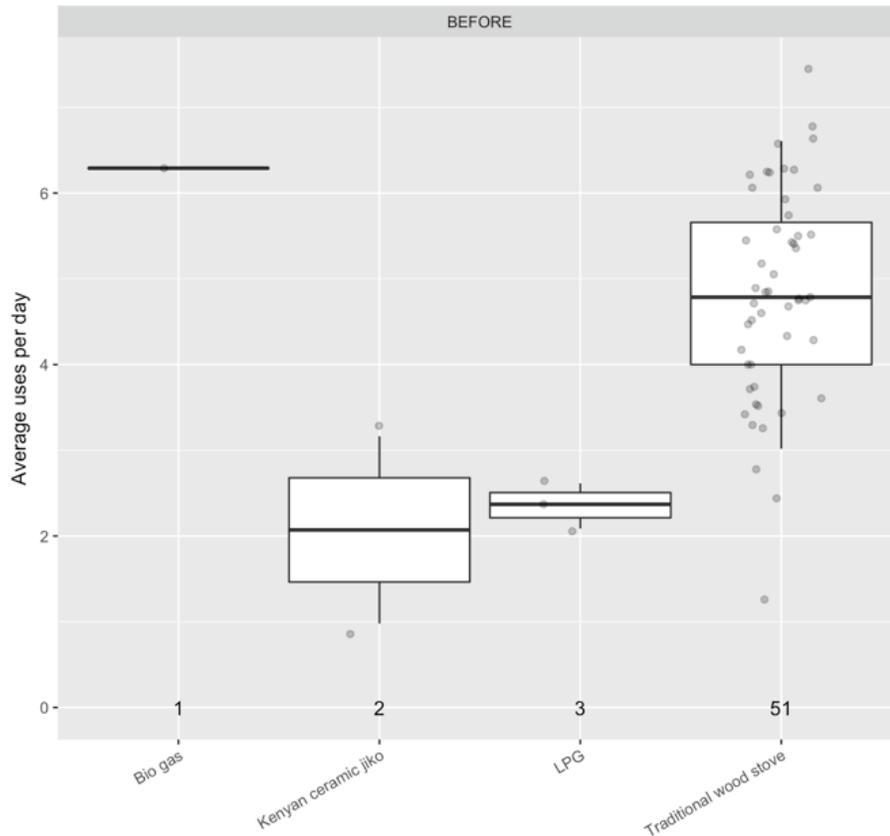


Figure 17: Box plot showing average cooking events per day for each stove type. Medians are the central line, box ends represent the 25th and 75th percentiles, whiskers the 5th and 95th percentiles. The black number below each box shows the number of households contributing data.

3.3 Cooking Observations

Eight structured observations were conducted during lunchtime cooking on the baseline stove, with the goal of collecting nuanced information about cooking practices and routines.

Specifically, the observations aimed to:

- explore the extent and nature of multitasking during cooking;
- understand the demands the cooks placed on their traditional stoves and subsequently might be expected of the Kuniokoa after dissemination; and
- characterize the overall quality of the cooking experience.

All observers were female and had experience cooking and living in rural Kenyan homes. All cooking events took place in kitchens located in an enclosed building separate from, but nearby, the main house. Overall the observations did not reveal any cooking habits that might be a significant barrier to Kuniokoa uptake and use, and they present a picture of relaxed and enjoyable cooking, in environments perceived to be relatively pleasant and comfortable by the observers.

Cooking technology requirements

All participants used a three stone fire to cook the observed meal, some of these with a tripod to support pots. Although no participant used any other stoves during the observation, a few had second stoves present. Fuel preparation commonly occurred during the cooking event, specifically wood was chopped to reduce its size prior to burning. Across all households, stoves were considered by the observer to be 'easy' to light, either from scratch or using charcoal embers from recent use. Stoves were lit just before cooking began.

The observed meals were considered to be a typical lunch, which involved frying and boiling, and required both high and medium-intensity flame. Half of the households cooked only one pot of food, while the others used up to four pots sequentially. When using multiple pots, it was done sequentially, never at the same time.

Time spent actively and passively cooking

The cooking observations revealed that cooks were comfortable leaving their baseline stove unattended during cooking for varying lengths of time. Shorter absences were spent washing vegetables or gathering ingredients and water; longer periods were used to tend to animals or fetch water. Further, cooks also multitasked within the cooking area, specifically to prepare food and clean utensils during the cooking event.

Lunchtime cooking involved social interactions in three-quarters of the homes. Some of these events were related to family members helping with fuel and/or food preparation⁵ for some of the time, while others were purely social visits, such as from neighbors. It should be noted that the presence of the observer could have led to an increased number of inquisitive visitors, and so we could expect the social interaction on a normal day to be perhaps less than what was observed.

Accounting for time spent outside the cooking area and time multitasking within it, the cooks spent just over three-quarters of the total cooking time actively and exclusively cooking in the cooking area. When socializing is included as a distraction, the portion of time spent actively and exclusively cooking drops to just over half of the total meal preparation time.

Quality of cooking time

Key aspects of the cooking environment were assessed by the observers, including conviviality, such as space available and levels of light, as well as physical comfort, such as ventilation, temperature, and safety. Relative to their own experiences and the context, the observers perceived the kitchens to be pleasant, light, airy, organized, and spacious cooking environments. They further assessed that in general, women appeared to enjoy cooking and felt comfortable and relaxed, a perception reinforced by the quantitative data showing that cooking was not one of the key household tasks that the women found to be the least enjoyable. Smoke levels and

⁵ NB: Four of the observation visits occurred during the school holidays, when help from teenage children was more available.

temperature were considered the least pleasant aspects of the kitchen environment, though not generally described as bad.

A review of the photos from the cooking observations confirmed that the kitchen areas were spacious, having room for storage of wood and kitchen utensils. All were covered and sheltered from wind, rain, and sun. In many cases there were seats available for the cook, as well as for family members and other visitors. Nonetheless, cooking smoke was clearly visible in many of the observers' photographs, as was extensive smoke damage on the ceiling and walls (see Figure 19).



Figure 18: Cooking areas during the cooking observations



Figure 19: (Left to right) 1) smoke damage on the ceiling of a participant's cooking area, 2) smoke levels in a participant's cooking area, 3) storage of kitchen utensils

3.4 Participatory research methods

Participatory methods were used to understand the relative proportions of total time awake taken up by various activities on days when fuel collection occurred and days when it didn't. Participants were asked what time they awoke and then slept for the night. Using a calculation of one bean being equivalent to a 30-minute period, they were then given the correct number of beans to represent this time period. A limitation of this approach is that it is not able to record simultaneous activity.

The average time awake was 16.5 hours (SD 0.8). Although women did not report a change in the total time awake between the two days, in some cases, they did describe rising much earlier on days they collect fuel to enter the forest before the guards arrive

Table 5 and Table 6 below present the results on heat maps, where the darker colored cells represent the most time-intensive activities. Although there was great variability in how the women spent their time awake, some patterns do emerge. Overall the figures show that cooking consistently takes an average of 10% of the daily time awake, one of the highest time demands of all activities. Yet, based on a 16.5-hour day, this is significantly less than the reported time spent cooking and the time the stove was lit, as recorded by the stove use monitors, which suggest a time allocation of at least 30%. On days firewood collection occurs, it is the overall dominant activity in terms of time, appearing to displace time spent at meetings (school, religious, *chama*⁶). On these days, there is also a small but notable increase in time spent reading and watching TV (on average approximately 30 minutes), perhaps as a result of the physical exertion.

⁶ A *chama* is an informal cooperative society that is normally used to pool and invest savings by people in East Africa, and particularly Kenya.

Table 5: Proportions (%) of time allocated to various activities throughout the day, on days when the participants do NOT collect wood fuel (% of total time awake).

Average % of time awake allocated to activities: No fuel collection day	
Agricultural work and caring for animals	13.6
Meetings (school, religious, <i>charma</i>)	11.6
Cooking (preparing food and/or drinks)	10.2
Caring for children and/ or elderly	8.8
Washing and bathing	8.4
Household chores	7.5
Eating and drinking	7.1
Collecting water	6.9
Sleeping/ resting	4.9
Paid work outside the home.	4.4
Going to the market and/ stores.	4.0
Reading/watching TV	3.7
Sanitation, including time spent defecating	3.4
Preparing wood fuel	3.2
Income generating activities in the home	2.5
Total time awake	100

Table 6: Proportions (%) of time allocated to various tasks throughout the day, on days when the participants do collect wood fuel (% of total time awake).

Average % of time awake allocated to activities : Fuel collection day	
Collecting and preparing wood fuel.	15.9
Agricultural work and caring for animals	14.9
Cooking (preparing food and/or drinks)	9.8
Washing and bathing	7.5
Reading and watching TV	6.9
Household chores	6.8
Caring for children and/or elderly	6.5
Eating and drinking	6.1
Collecting water	5.4
Sleeping/ resting	5.4
Sanitation, including time spent defecating	4.0
Paid work outside the home.	3.8
Meetings (school, religious, <i>charma</i>)	3.0
Going to the market and/ stores.	2.0
Income generating activities in the home	2.0
Total	100

Overall, around 40% of the participants' waking hours was spent on unpaid care work on days they did not collect firewood, rising to 46% on firewood collection days. This does not include the time spent on the *shamba* and caring for animals, as in many cases, that work is seen as income generating.

The time spent at 'meetings (school, religious, charma)' may have been inflated by three households attending long meetings that took over 20% of their time awake: two households attended a school meeting, and the other one had a meeting with a *chama* group.

3.5 Perceptions of empowerment

The baseline research also aimed to explore the secondary hypothesis that freeing up women's time and reducing drudgerous chores has the potential to provide the time and energy for her to seek income-generating activities, occupational training, and/or further education, which could enhance her sense of empowerment. The participants were asked what the idea of 'empowerment' means to them, what an empowered woman might look like in their community, and whether they considered the women in their community to be empowered.

Many of the responses suggest a belief that empowerment is gained through financial stability via reliable paid work or access to money via groups, such as *chamas*. Consequently, many stated that women who belonged to *chamas* were more empowered.

"Empowered women are in groups and can get money contributed by other members, so they are not always borrowing from others, and their homes are well organized."

"An empowered woman is able to do income-generating activities so as to take of the family."

"Empowerment means groups that gives people loans. [An empowered women] lives a good life as she has money, has a good farm and cattle, she can create employment through her farm, has a lot of income and takes her children to school."

"Empowerment means helping people get jobs. A woman who is empowered is settled, has a stable source of income, she is free from trouble. During the rainy season, she does not have to struggle working, that is doing casual jobs."

"It means strengthening of someone or something, an empowered woman is able to depend on herself and be stable financially."

A woman with free time and limited arduous household chores was also viewed as empowered by several participants. Poor health was consistently seen as a barrier to empowerment.

“Empowerment means being given strength through somebody helping you do a certain task like having a business. An empowered woman relaxes a lot, has more free time, has a good life because she does not use much strength doing manual work like collecting firewood.”

“An empowered woman is supported by the husband financially to start a business, so she looks financially stable, healthy, and is able to support the family”

When asked if they considered the women in their community to be empowered, there was a mixed response, which did not seem to vary by location or age of the participant, but more by how they defined empowerment. Those who said membership in a *chama* leads to empowerment generally felt that the women in the community were empowered.

“They are empowered because of groups, the merry go-round⁷ helps them have money to develop themselves, such as starting a small business, like selling sukuma wiki⁸.”

“Yes, because when they are in groups, they are able to invest amongst themselves, for example merry go-rounds where they contribute some cash.”

The women who felt that their peers were not empowered related it to the fact that the women in their community did not have reliable consistent sources of income, mainly due to low levels of spare time and low levels of education.

“No, [they are not empowered] because most women have no permanent means of generating income in their homes and are not aware of how to access women funds.”

“No [they are not empowered because] they are not financially stable. All they do is house chores like collecting wood and going to the farms.”

“[They are] not empowered because of the lack of jobs, most are housewives and lack education.”

4 Discussion of baseline results and study limitations

The review of baseline data at the midpoint of the assessment timeline affords a valuable opportunity to check how well the chosen explanatory sequential mixed-method design is able to measure and context the key parameters of the participant’s cooking and fuel procurement

⁷ This is a savings system here the members of a *chama* agree to contribute a fixed amount at each meeting for a fixed period such as one year

⁸Swahili for collard greens.

activities. In this section, several statistics are further investigated through a synthesis of all the data collected to date.

Time poverty

At the center of this baseline study is the question of how much time women spend on cooking, fuel wood collection and related activities, and whether those activities are primary drivers for time poverty and perceived as drudgerous.

The majority of the women perceive themselves to be very or extremely busy, and they aspirationally describe an empowered woman as one with plenty of free time and relief from the pressure of household responsibilities. Many of the baseline results support the conclusion that the participants are engaged in a wide range of demanding time-intensive activities that place a burden on them and limit their potential. The data from the small sub-sample involved in the participatory assessment showed that participants have an average of 16.5 hours during which they complete all their activities, sleeping for an average of 7.5 hours. While some days their schedules start before dawn, most participants reported that they go to bed as early as 9pm. More data will be collected on total time awake in the follow-up assessment, but these preliminary results don't indicate significant sleep deprivation⁹ in the study population. Nonetheless, approximately one sixth of the participants reported that they would use extra time to rest or sleep more.

The key pathways through which a new cooking technology can potentially influence time use patterns are cooking and fuel collection and preparation duration. The majority of cooking and fuel collection was completed by just one person in the study households, although anecdotal evidence suggests that teenage daughters cook more during school holidays and weekends, a phenomenon that will be explored further in the post intervention phase. There were no reports of cooking completed by male members of the family. Thus, most of the time burden from cooking falls on the woman of the household and, consequently, any savings from new technology should be experienced by her.

All participants reported using their traditional wood burning stove as their primary stove, and this scenario was confirmed by the SUMS data. Considering activity on all stoves within the home, the average reported amount of time per day that food and drink were being cooked or reheated was seven hours, which is similar to recent self-reported data from Malawi (12). The SUMS recorded that the traditional wood burning fires/stoves were used for an average of 5.3 hours per day. According to SUMS, the 10% of homes with secondary stoves used them for up to 1.9 hours per day. Nonetheless, it seems most participants overestimated their total cooking time, a result that is not uncommon but more often seen post intervention (13).

The results of the participatory time assessment told a different and seemingly conflicting story. Participants reported through their allocation of 'time beans' that just approximately 10% of their daily waking hours – (1.7 hours based on a 16.5-hour day) -- were taken up by cooking food and preparing hot drinks. While this is significantly less cooking time than the estimates derived from SUMS and surveys, it was nonetheless one of the most time-consuming activities of the

⁹ Recommended hours of sleep for an adult is 7-9 hours daily (11)

day. The significant discrepancy in perception of cooking time versus measured and self-reported time may be partially due to the limitations of the participatory method to show concurrent activities and will be further explored in the post-intervention data collection.

On the survey, participants reported spending 5.5 hours doing active and exclusive cooking or 80% of the total time the pots were on the stove. While they may have also socialized during this time, they were not actively multitasking to accomplish other chores. A very similar ratio of active cooking to total cooking was documented through the structured observations. The finding that women spend so little of their cooking time multitasking is maybe a result of both the tending requirements of the three stone fire and the fact that the kitchen is not located in the main house, making it harder to combine cooking with non-cooking activities.

As with cooking, the majority of the fuel collection and preparation was very much the responsibility the women in the home, male participation was minimal. Self-reported time spent collecting fuel including the time spent travelling to and from the forest was 11.8 hours per week. Based on a reported average of four trips per week, this means a participant is spending almost three hours each time she collects wood. However, like cooking, fuel collection is somewhat underestimated in the participatory methods, where the participants reported that on fuel collection days they spend an average of 11.8% (approximately two hours) of their waking hours doing this task.

At baseline, the survey and SUMs data suggests that the participants spend between approximately 30-40% of their waking hours on cooking. Fuel collection takes another 10%, although this does not happen daily. According to the participatory assessment, the total proportion of time spent on unpaid care work is just over 40%. Further, just under half the participants reported that they would pursue more income-generating activities if they had additional uncommitted time, suggesting that time required to complete all of their household chores, of which cooking and fuel procurement are the largest component, does limit women's economic opportunities.

Drudgery and time quality

The study also aims to explore the aligned concept of drudgery to understand what if any aspects of the participant's cooking and fuel procurement responsibilities that they perceive to be extraordinarily burdensome and why. From the analysis of survey responses, it emerges that the tasks that are the hardest work do not necessarily feel like drudgery to the participants: for example, working on the *shamba* was most frequently reported to be the hardest work and the one that takes up most time, yet 56% of the participants reported it to be one of the top three household activities they most enjoyed. A key differentiator between hard work and drudgery appears to be the extent to which a task brings pride, such as in a clean home and/or a well-dressed family, or accomplishment, such as growing food to feed the family or sell to the community.

Although cooking constitutes a major component of the participant's daily activities, over 90% viewed it either positively or had neutral feelings about it. The cooking observers also reported

a generally positive atmosphere while participants were cooking, although these encouraging observations should be viewed in the context of prevailing norms and, perhaps, expectations.

In contrast, fuel collection is strongly viewed as drudgery by the majority of women, even though it has some redeeming characteristics, such as providing social time and exercise. The key drivers of this perception of drudgery include the stress of the uncertainty and risks associated with the task, as well as the time it takes to complete, and the sheer physical exertion needed to accomplish it. The baseline results point clearly to an opportunity to reduce the burden of fuel collection through access to more fuel-efficient cooking technologies or to purchase fuel. A key question for the post-intervention investigation will be whether a reduction in the fuel demand (assuming one is achieved with the intervention technology) is sufficient to create a sense among the participants that this burden has been alleviated. Our recommendations for future research would be to investigate the impact of a fuel/ stove that would completely remove the imperative to collect fuel, i.e. to compare the impact of the more efficient biomass technology on the alleviation of fuel-collection drudgery to the impact of a gas, liquid fuel, or solar cooking technology.

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**BERKELEY AIR
MONITORING GROUP**

protecting health and climate

Impacts and Effects of Improved Wood Burning Stoves on Time Use and Quality: An Experimental Study in Rural Kenya

Annex to Baseline Results: FINAL



Prepared for the Clean Cooking Alliance by

Berkeley Air Monitoring Group

November 2018



**CLEAN
COOKING
ALLIANCE**



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Annex A: Screening Survey

Time Poverty Sample Screening: Kenya

LAUNCH_v2 VERSION

1. Introduce yourself and ask to speak with the person who organizes the cooking/home keeping. If she/he is not available make an appointment to come back

1 Jitambulisha na uulize kuzungumza na mtu anayeandaa upishi / anayetunza nyumba. Ikiwa yeye hayuko panga wakati wa kurudi.

2. Please say 'We are a research team from Eco Consulting conducting a study looking at the effect of new cook stoves on people's lives. We are independent evaluators and we are not promoting or distributing any stoves or fuels.. Through this study we want to understand the experiences and opinions in households like yours. We hope this will lead to better stoves and fuels to be used across Kenya.'

2. Tafadhali sema 'Sisi ni timu ya utafiti kutoka Eco Research tunafanya utafiti kuangalia athari za jiko mpya kwa maisha ya watu. Sisi ni watafiti huru na hatuuzi au kusambaza jiko lolote au fueli. Kupitia utafiti huu tunataka kuelewa uzoefu na maoni katika nyumba kama yako. Tunatarajia hii itasababisha jiko bora na fueli ambazo zitatumwa kote nchini Kenya'

1	Can I ask you some questions to see if you are eligible to take part? Je, ninaweza kukuuliza maswali fulani ili nione kama unafaa kushiriki?	Yes, continue Ndiyo, endelea	No, terminate La, sitisha
2	Are you the main cook in this household? Je! Wewe ndiye mpishi mkuu katika hii nyumba?	Yes, continue Q3 Ndiyo, endelea Q3	No, go to 2.1 La, nenda kwenye 2.1
2.1	Is most of the cooking in this household carried out by a maid? Je, upishi zaidi katika nyumba hii unafanywa na mjakazi?	Yes, terminate Ndiyo, sitisha	No, go to 2.2 La, nenda kwenye 2.2
2.2	Can we speak with the main cook? Tunaweza kuzungumza na mpishi mkuu?	Yes, continue to Q3 Ndiyo endelea Q3	No, terminate La, sitisha
3	<i>Continue once you are sure you are speaking with the main cook</i> [Endelea mara unapohakikisha unazungumza na mpishi kuu] Are you over 18 years old? Je, uko na zaidi ya miaka 18?	Yes, continue Ndiyo endelea	No, terminate La, sitisha
4	What is your primary cooking fuel? Je! Fueli yako ya msingi ya kupika ni gani?	Wood, continue Kuni, endelea	All else, terminate Zingine zote, sitisha
5	Do you or one of your family members collect <u>at least half</u> of your woodfuel used on your stoves at this time of year? We do not mean a farm hand or other people you employ to do this	Yes, continue Ndiyo, endelea	No, terminate La, sitisha



	Je, wewe au mmoja wa watu wafamilia yako hukusanya <u>angalau nusu</u> ya kuni zinazotumia kwa jiko lako wakati huu wa mwaka? Hatumaanishi mfanyikazi wa shamba au watu wengine unaowaajiri kufanya kazi hii				
6	Do you or one of your family members continue to collect at least half of your woodfuel used on your stoves/ fire throughout the year? By this we mean that you don't stop collecting wood in the rain season or cold, dry season? Je, wewe au mmoja wa watu wa familia yako huendelea kukusanya angalau nusu ya kuni zinazotumika kwenye jiko lako / moto mwaka mzima? Kwa hili tunamaanisha kwamba huachi kukusanya kuni wakati wa mvua au msimu wa baridi au jua?	Yes, continue Ndiyo, endelea	No, terminate La, sitisha		
7	What type of stove/fire do you use most of the time for cooking at this time of year? Ni aina gani la jiko / moto unaotumia muda mwingi kupikia wakati huu wa mwaka?	1	Three-stone fire Jiko la mawe tatu	4	Any charcoal stove Jiko lolote la makaa
		2	Local metal wood stove Jiko la kienyeji la chuma linalotumia kuni	5	Any LPG stove Jiko lolote la gesi
		3	Modified three stone fire Jiko la mawe tatu lililoboreshwa	6	Any other non-wood stove Jiko lolote lisilo la kuni
				7	Any 'improved' wood stove i.e. Kuniokoa/ Envirofit Jiko la kuni lililoboreshwa kama vile Kuniokoa/Envirofit
			Continue Endelea		Terminate Sitisha
7.1	What type of stove/fire do you use most of the time for cooking during the rainy season? Ni aina gani la jiko / moto unaotumia muda mwingi kupikia wakati wa mvua?	1	Three-stone fire Jiko la mawe matatu	4	Any charcoal stove Jiko lolote la makaa
		2	Local metal wood stove Jiko la kienyeji la chuma linalotumia kuni	5	Any LPG stove Jiko lolote la gesi
		3	Modified three stone fire Jiko la mawe tatu lililoboreshwa	6	Any other non-wood stove Jiko lolote lisilo la kuni
				7	Any 'improved' wood stove i.e. Kuniokoa/ Envirofit Jiko la kuni lililoboreshwa



			kama vile Kuniokoa/Envirofit
		Continue Endelea	Terminate Sitisha
8	Are you likely to travel or be away from home for a period longer than two weeks during the next 4 months? Je, kunauwezekano wako kusafiri au kuwa mbali na nyumbani kwa muda unaozidi wiki mbili kwa miezi 4 ijayo?	Yes, terminate Ndiyo, sitisha	No, continue La, endelea

Read: "You fit our criteria and I would now like to invite you to take part." Provide the participant with the correct consent form.
Soma: "Kulingana na mahitaji yetu unafaa kushiriki na ningependa kukualika kwa utafiti huu" patia mshiriki fomu ya idhini inayofaa.

Have they consented to take part in the study Je, wamekubali kushiriki katika utafiti?	No [FINISH] La [Maliza]	Yes Ndiyo	
If they refuse to consent please state why: Ikiwa wamekataa kupeana idhini tafadhali elezea kwa nini:			
Name of participant: Jina la mshiriki:			
Address of participant [Give enough details such as landmarks to be able to find the HH again] Anwani ya mshiriki [Toa maelezo ya kutosha kama vile alama ya kutambulisha ili uweze kupata hiyo nyumba tena]			
Telephone number Nambari ya simu			
ID number given [01_NK_KJ] Nambari ya utambulisho iliyopeanwa [01_NK_KJ]			
9	Which stoves have you used within the last month? Ni jiko zipi ulizotumia mwezi uliopita?	1	Three-stone fire Jiko la mawe tatu
		2	Kuniokoa Kuniokoa
		3	Local metal wood stove Jiko la kienyeji la chuma linalotumia kuni
		4	Traditional metal charcoal stove Jiko la jadi la chuma linalotumia mkaa
		5	Kenyan Ceramic Jiko (KCJ) Kenyan Ceramic Jiko (KCJ)
		6	Modified three stone fire Jiko la mawe tatu lililoboreshwa
		6.1	How many pots/ burners do they use? _____



			Je, unatumia sufuria ngapi/ mahali ngapi pa kupikia?
		7	Kerosene stove Stovu ya mafuta ya taa
		8	LPG stove Jiko la gesi
		99	Other [describe] Nyingine[Elezea]



Annex B: Results of recruitment process

Successful/Terminates	
Reasons	No
Households do not collect wood fuel during rainy seasons	68
Main cook not available for the next 4 months	13
Household buys more than half of the wood fuel	24
Household cuts more than half of the wood fuel from the farm [Especially in soko mjinga]	32
Wood not their primary fuel	9
Main cook is underage	6
Refusal -- said the kids might tamper with the SUMs or not willing to participate, hostile respondents	27
Elderly women who we felt the process would be hectic as they wanted a neighbor or another family member to assist [one was 73 years and the other above 65 years]	6
Elderly women with maids/daughter in laws doing the cooking and household chores for them	3
Elderly men who do not cook but only use wood fuel for heating water or keeping themselves or the house warm. <i>(They are cooked for by their daughter in laws)</i>	5
Households that collect wood fuel seasonally, sometimes they buy or cut from their farms	11
Households that are no longer collecting wood since logging has stopped and forest near them closed	9
Households with modern wood stoves e.g. CO2 balance	14
Renting respondents or those sharing kitchens	7
Dropped out or discontinued during SUMs placement and baseline survey	4
Back up household (recruited but not included in the survey)	5
Successful	55
Total Contacts made	298

Four households that we had recruited but were dropped off, as below

- Githembe- one household(03_HM_GT) was discontinued at the time of the Sums placement as one of the member of the household did not want the household to proceed with the survey, the second one the respondent had provided wrong



information during recruitment hence being included in the survey but at the time of the interview we discovered and so we had to remove this as well i.e. 03_DA_GT

- Kambaa – Household 03_FS_KB -the couple disagreed and the wife left the home so we were not sure when she will be back or this would reoccur hence we removed the SUM and discontinued the household since the wife was the main cook.
- Bathi- the respondent household ID 01_FS_BT was giving contradicting information or withholding, so it was difficult for one to complete the survey and the team felt it was better to replace this with a different household since we could not get all the information as required.



Annex C: Baseline Survey

Time Poverty Survey: Kenya

BASELINE: FINAL LAUNCH VERSION

MA- Multiple answers allowed.

SA - Single answer only.

Instructions to survey team are in italics in *[square brackets]* and should not be read out to the participant.

A. Socio Economic Information			
A0	Surveyor Initials		
A1	Please select the language this survey is being carried out in.	1	English
		2	Swahili
		99	Other [describe]
A2	HHID		
A3	Cell phone number <i>[If they have no cell phone please enter a 999]</i>		
A4	Time	hh:mm	
A5	Sex	1	Male
		2	Female
A6	Marital status	1	Married
		2	Single [never married]
		3	Separated
		4	Divorced
		5	Widowed
		6	Living together
		77	Refused
		88	Don't know
A7	Highest education level reached.	99	Other [describe]
		1	No formal education
		2	Primary/elementary incomplete
		3	Primary/elementary complete
		4	Secondary/high school incomplete
	5	Secondary/high school complete	



		6	Vocational/technical school		
		7	College/university [undergraduate]		
		8	Postgraduate		
		77	Refused		
		88	Don't know		
		99	Other [describe]		
A8	What is your age?		[years]		
A9	Occupation of primary wage earner?		[use occupation codes]		
A10	Do you have paid work outside the home?	1	Yes		
		2	No [Go to A11]		
A10.1	Occupation		[use occupation codes]		
A11	Do you do any income generating activities from the home?	1	Yes		
		2	No [Go to A12]		
A11.1	What income generating activities do you do from your home? <i>[Write down everything the participant says.]</i>				
A11.1	Approximately how much time per week do you spend doing this?	Hours		Minutes	
A12	How many children under 1 yr live in this home?		[infants]		
A13	How many people under 14 years old usually eat an evening meal in this household?		[people]		
A14	Including yourself, how many people 14 years and older usually eat an evening meal in this household?		[people]		
A15	How do you usually tell what time of day it is? SA	1	I use my phone		
		2	I use my watch		
		3	I use a clock in the house		
		4	I use another HH member phone		
		5	I use another HH members watch		
		6	I use a clock outside the house.		
		7	I use the rise/ setting of the sun		
		8	Radio/TV		



		99	Other [describe]
AN	<i>[Notes or observations on Section A]</i>		

B. Perception of current time burden			
B1	On a scale of 1 – 5 how ‘busy’ would say you are? If 1 is ‘Very relaxed with plenty of free time’ and 5 is ‘I’m extremely busy and never have enough free time’. <i>[Use ‘face’ visual aid B to help answer this]</i>		
B2	Of all your main regular household-related activities what aspects do you most enjoy? <i>[Select up to 3 Do not prompt]</i>	1	Childcare
		2	Cooking
		3	Collecting fuel
		4	Washing clothes
		5	Collecting water
		6	Cleaning the house i.e. sweeping
		7	Cleaning the kitchen/cooking utensils
		8	Working on my shamba
		9	Nothing [Go to B4]
		99	Other [describe]
B3	Why do you enjoy these activities the most? <i>[Write down everything the participant says.]</i>		
B4	Of all your main regular household-related activities which are the ones you least enjoy? <i>[Select up to 3 Do not prompt]</i>	1	Childcare
		2	Cooking
		3	Collecting firewood
		4	Washing clothes
		5	Collecting water



		6	Cleaning the house i.e. sweeping
		7	Cleaning the kitchen
		8	Working on my shamba
		9	Nothing [Go to B6]
		99	Other [describe]
B5	Why do you NOT enjoy these activities? <i>[Write down everything the participant says.]</i>		
B6	Of all your main regular household-related activities which one do you think takes up most of your time? <i>[SA Do not prompt]</i>	1	Childcare
		2	Cooking
		3	Collecting firewood
		4	Washing clothes
		5	Collecting water
		6	Cleaning the house i.e. sweeping
		7	Cleaning the kitchen
		8	Working on my shamba
		99	Other [describe]
B7	Of all your main regular household-related activities which one do you find the hardest work? <i>[SA Do not prompt]</i>	1	Childcare
		2	Cooking
		3	Collecting firewood
		4	Washing clothes
		5	Collecting water
		6	Cleaning the house i.e. sweeping
		7	Cleaning the kitchen
		8	Working on my shamba
		9	Nothing [Go to B9]
		99	Other [describe]
B8	Why do you find this the hardest work? Please describe <i>[Write down everything the participant says.]</i>		



B9	Do any of your children ever need to miss school to help with the household chores?	1	Yes
		2	No [Go to B10]
		3	I have no school aged children [Go to B10]
B9.1	Please describe which children miss school to do household chores, how often they miss school for this reason and which chores are they usually required to do? <i>[Write down everything the participant says.]</i>		
B10	If you had more time available, how would you like to spend it? <i>[MA Do not prompt]</i>	1	Social gatherings with friends or family.
		2	Paid work outside the home
		3	Income generating activities from home
		4	Income generating activities with local group
		5	Taking care of children
		6	Helping children with their studies
		7	Cleaning own house/domestic tasks
		8	Working in the field/garden
		9	Going to church /mosque/temple
		10	Visiting or caring for the sick/elderly.
		11	Sleeping/ resting
		12	Participating in community /social groups
		13	Going to the market/stores
		14	Personal care e.g. hairdressing
		15	Furthering education/training
		16	Leisure time i.e. watching TV or reading
99	Other [describe]		
B10.1	<i>[If answered code 4 to B10]</i> Do you know of any local groups that do this kind of activity? If yes what is their name and what do they do? <i>[Write down everything the participant says.]</i>		
B11	No	[Go to C1]	



	Assuming you had more time, do you think anything / anyone would <u>stop you from</u> spending your time in this way?	Yes	
B11.1	Who would stop you and why would they do this? <i>[Write down everything the participant says.]</i>		
BN	<i>[Notes or observations on Section B]</i>		

C. Cooking Patterns						
Stove codes	1	Three-stone fire	4	Traditional metal charcoal stove	7	Kerosene stove
	2	Kuniokoa	5	Kenyan Ceramic Jiko (KCJ)	8	LPG stove
	3	Local metal wood stove	6	Modified three stone fire	99	Other [describe]
Task Codes	1	Family meals	4	Cooking food to sell	99	Other [describe]
	2	Making tea	5	Preparing animal feed		
	3	Heating water	6	Space heating		
User codes	1	Main cook/respondent	3	Children- under 18	5	Sons/daughter- adult
	2	Husband	4	Mother/ mother-in-law	99	Other [describe]
<p>[Complete each column below according to the number of stoves/fires the HH is currently using AT LEAST ONCE PER WEEK. Note: If they have a stove with two combustion chambers that can be lit separately- treat this as two stoves.]</p>						
<p>[Please read]: The following questions are all about stoves you are using AT LEAST ONCE PER WEEK AT THIS TIME OF YEAR.</p>				Primary Stove	Secondary Stove	Third Stove
C1	What is your primary stove, by this we mean the stove you use most of the time?			C1.1		
C2	What other type of stoves do you use at least once per week? [Enter 66 if none]				C2.2	C2.3
C3	In a typical week, how many days do you use this stove? [days]			C3.1	C3.2	C3.3
C4	What are the most common 2 tasks for which this stove is used? [Up to 2 per stove. Use task codes]			C4.1	C4.2	C4.3
C5	Who normally does these tasks on each stove? [SA Use user codes]			C5.1	C5.2	C5.3
<p>[Please read] I am now going to ask you about the time you spend cooking on this stove. This is only the time you spend actually cooking, re-heating food or making hot drinks. Do not include the time it takes to prepare food beforehand or light the stove.</p>						
C6	On a typical day, what time do you first start cooking, re-heating food or making hot drinks on this stove ?	Time start [hh:mm]		C6.1	C6.2	C6.3

	<p>What time do you usually finish cooking this food and/or hot drinks?</p> <p><i>[If the stove is only used 1-2 times per week- it would not be used on a 'typical day' so please enter 66 and move to the next column or if this is the last stove C9]</i></p>	Time stop [hh:mm]	C6.4	C6.5	C6.6
	<p>How much of that time do you leave the stove unattended while cooking, when neither food nor fire needs tending?</p>	[hh:mm]	C6.7	C6.8	C6.9
C7	<p>On a typical day, what time do you start cooking on this stove for the second time- this includes cooking meals, re-heating food or making hot drinks?</p>	Time start [hh:mm]	C7.1	C7.2	C7.3
	<p>What time do you usually finish cooking this food and/or hot drinks?</p> <p><i>[If they don't use this stove on a second occasion please enter a 99 and move to the next column or if this is the last stove C10]</i></p>	Time stop [hh:mm]	C7.4	C7.5	C7.6
	<p>How much of that time do you leave the stove unattended while cooking, when neither food nor fire needs tending?</p>	[hh:mm]	C7.7	C7.8	C7.9
C8	<p>On a typical day, what time do you start cooking on this stove for the third time- this includes cooking meals, re-heating food or making hot drinks?</p>	Time start [hh:mm]	C8.1	C8.2	C8.3
	<p>What time do you usually finish cooking this food and/or hot drinks?</p> <p><i>[If they don't use this stove on a third occasion please enter a 99 and move to the next column or if this is the last stove C10]</i></p>	Time stop [hh:mm]	C8.4	C8.5	C8.6
	<p>How much of that time do you leave the stove unattended while cooking, when neither food nor fire needs tending?</p>	[hh:mm]	C8.7	C8.8	C8.9

C9	On a typical day, what time do you start cooking on this stove for the fourth time- this includes cooking meals, re-heating food or making hot drinks?	Time start [hh:mm]	C9.1	C9.2	C9.3
	What time do you usually finish cooking this food and/or hot drinks? <i>[If they don't use this stove on a fourth occasion please enter a 99 and move to the next column or if this is the last stove C10]</i>	Time stop [hh:mm]	C9.4	C9.5	C9.6
	How much of that time do you leave the stove unattended while cooking, when neither food nor fire needs tending?	[hh:mm]	C9.7	C9.8	C9.9
C10	[Ask If respondent reported any time leaving ANY of the above stoves unattended] What do you usually do when you leave your stove unattended while cooking?	1	Childcare		
		2	Cleaning		
		3	Caring for animals		
		4	Preparing cooking fuel		
		5	Tidying the house		
		6	Resting/reading/watching TV		
		99	Other [describe]		
C11	How much time do you spend washing pots and the kitchen area each day?		Time in hours		
C12	Do you do other tasks in the cooking area while cooking?	1	Yes		
		2	No [Go to C13]		
C12.1	What tasks are these? [MA Do not prompt]	1	Cleaning the kitchen		
		2	Preparing the next meal		
		3	Watching the children		
		4	Preparing cattle feed		
		99	Other [describe]		
C13		1	Yes		

	Do you sometimes just sit and relax near your stove even when you COULD leave it unattended?	2	No
C13.1	Why do you/don't you do this?		
CN	<i>Notes and observations for Section C</i>		

E. Cooking in the rainy season			
E1	During the rainy season do you spend more, less or the same amount of time cooking??	1	More
		2	Less
		3	Same [Go to F1]
E1.1	Why do you spend [more/less] time cooking in the rainy season? <i>[write down everything the participant says.]</i>		

F. Cooking location			
F1	Where do you mostly cook food at the moment? <i>[SA]</i>	1	Inside main house
		2	Inside a building separate from the main house.
		3	On a veranda or porch
		4	In an uncovered area / courtyard
		5	Shelter with two open sides separate from main house
		99	Other [describe]
F2	When cooking is happening would you say your cooking area is a pleasant or an unpleasant place to be? Please explain why <i>[write down everything the participant says.]</i>		
F3	Are there people often with you in the cooking area or are you usually cooking alone?	1	Other people
		2	Alone [Go to F4]
F3.1	Who is usually in the cooking area with you while cooking is taking place? <i>[MA Do not prompt]</i>	1	My mother/mother-in-law
		2	My adult daughters/daughter in law
		3	Other adult female family members
		4	My husband
		5	Other adult male family members
		6	Young children
		99	
F4	Where do you mostly cook food during the rainy season? <i>[SA]</i>	1	Inside main house
		2	Inside a building separate from the main house.
		3	On a veranda or porch
		4	In an uncovered area / courtyard

		5	Shelter with two open sides separate from main house
		99	Other [describe]

G. Attitude to cooking

G1	On a scale of 1 – 5 how much do you enjoy cooking? If 1 is love it and 5 is strongly dislike. <i>[Use 'face' visual aid B to help answer this]</i>		
G1.1	Would you like to spend less time cooking?	1	Yes
		2	No
		3	Don't mind/don't know [Go to G2]
G1.2	Why [would you / would you not] like to spend less time cooking? <i>[write down everything the participant says.]</i>		
Level of Effort Required for Cooking			
<i>[Read the following]</i> Think about the level of effort required cooking, including the effort of lighting the fire, tending to the fire, and managing the food. I am going to ask you to use these pictures <i>[show Visual Aid A]</i> to tell me about this level of effort. They represent a task that requires no effort, up to a task that requires an extreme amount of effort.			
G2	Please point to the picture that matches the amount of effort you spend on cooking.		<i>[Enter number of picture participant pointed to]</i>

H. Fuel Collection

<i>[Read the following]</i> In this section we are going to ask you about collecting woodfuel. By woodfuel we mean wood, as well as twigs, leaves and crop residue. We will ask you about preparing (e.g. cutting and chopping) your woodfuel in the next section. This section is just about collecting woodfuel.			
H1	About what amount of your woodfuel do you purchase at this time of year? <i>[Read out options and select one]</i>	1	None- all collected [skip]
		2	About 1/4
		3	About 1/2
		4	About 3/4
H1.1	On average, at this time of year how often do you [or whoever BUYS the wood fuel] make this trip? <i>[Enter the frequency for the appropriate time period]</i>		Times per day
			Times per week
			Times per month
			Times per year
			Other [describe]

H1.2	On average, how long does each trip take?		hours		mins
H1.3	Who usually purchases the woodfuel you use for cooking at the moment? <i>[SA Do not prompt]</i>	1	Yourself		
		2	Husband		
		3	My husband and I together		
		4	I go together with other female members of the household		
		5	Other adult female members of the family		
		6	Other adult male members of the family		
		7	Female children		
		8	Male children		
		99	Other [describe]		
H2	Who usually collects the woodfuel used for cooking in this household at this time of year? <i>[SA Do not prompt]</i>	1	Yourself		
		2	Husband		
		3	My husband and I together		
		4	I go together with other female members of the household		
		5	Other adult female members of the family		
		6	Other adult male members of the family		
		7	Female children		
		8	Male children		
		99	Other [describe]		
H2.1	Do people mostly collect wood alone or in groups?	1	Mostly alone		
		2	Usually in groups		
H3	On average, at this time of year how often do you [or whoever collects the wood fuel] make this trip? <i>[Enter the frequency for the appropriate time period]</i>		Times per day		
			Times per week		
			Times per month		
			Times per year		
			Other [describe]		
H4	On average, how long does each trip take?		hours		mins
H4.1	How much of this time is travelling to and from the location you collect wood?		hours		mins
H4.2	How much of this time is actively cutting or chopping the wood?		hours		mins
H4.3		1	Cut a full tree		

	At this time of year do you usually cut a full tree, cut branches from the tree or pick up from the ground? [SA]	2	Cut from tree
		3	Pick from ground
		4	Mixture of both
		99	Other[describe]
H5	What form of transport is usually used to collect the wood fuel? SA	1	Walking
		2	Walking pushing cart
		3	Donkey and cart
		4	Donkey-no cart
		5	Motorbike
		6	Bicycle
		7	Truck/car
		99	Other [describe]
H6	Do you [<i>or whoever collects the woodfuel</i>] ever get to the location where you cut wood fuel and be denied access?	1	Yes
		2	No [Go to H7]
H6.1	Please describe to me what happens in these cases? For example, who denies the access, for what reason, how often does this happen, how do you get the cooking fuel you need? [<i>Write everything the participant says</i>]		
H7	Are there any dangers/risks associated with collecting wood fuel?	1	Yes
		2	No [Go to H8]
H7.1	What are these dangers or risks? Are there times of the day/ year when they are worse? What do you [<i>or whoever does the fuel collection</i>] do to avoid or reduce this risk?		
H8	Is the woodfuel collected at the same time as carrying out other activities i.e. collecting water or returning from the field?	1	Yes
		2	No [Go to H9]
H8.1	If yes, what activities do you [<i>or whoever collects the woodfuel</i>] usually combine the collection of woodfuel with? [<i>Write down everything the participant says. Do NOT prompt</i>]		
H9	Does the way you collect your woodfuel for cooking change with seasons?	1	Yes
		2	No [Go to H10]
H9.1	In what way does it change? [<i>Probe about frequency and amount collected as well as aspects such as ease of collection and distance walked, changes in duration etc.</i>]		
H10	Do you like anything about collecting woodfuel?	1	Yes
		2	No

H10.1	Why do you [like/ not like] collecting woodfuel? <i>[Write down everything the participant says. Do NOT prompt]</i>	
Effort to collect woodfuel		
<i>[Read the following]</i> Think about the level of effort required for woodfuel collection . I am going to ask you to use these pictures [show Visual Aid A] to tell me about this level of effort. They represent a task that requires no effort, up to a task that requires an extreme amount of effort.		
H11	Please point to the picture that matches <u>the amount of effort you</u> [or whoever collects the woodfuel] <u>spends on woodfuel collection</u>	<i>[Enter number of picture participant pointed to]</i>
HN	<i>Notes and observations for section H</i>	

J. Fuel Preparation

<i>[Read the following]</i> In this section we are going to ask you about preparing woodfuel, by which we mean activities like cutting or chopping the wood smaller to make it suitable for your stoves, or stacking and drying it.			
J1	Does the woodfuel you collect for cooking need any such preparation after getting it home but before being used in your stoves?	1	Yes
		2	No [Go to J2]
J1.1	What preparation do you [or whoever does this task] do? <i>[MA]</i>	1	Cut or chopped smaller
		2	Stacked and dried
		3	Other [describe]
		99	Don't know
J1.2	Who usually prepares the woodfuel you use for cooking? <i>[SA Do not prompt]</i>	1	Yourself
		2	Husband
		3	My husband and I together
		4	Other adult female members of the family
		5	Other adult male members of the family
		6	Female children
		7	Male children

		99	Other [describe]	
J1.3	On average, how often do you/ they spend time preparing woodfuel? <i>[Enter the frequency for the appropriate time period]</i>		Times per day	
			Times per week	
			Times per month	
			Times per year	
			Other [describe]	
J1.4	On average, how much time is spent each time it is prepared?		Hours	Mins
J1.5	In the rainy season, does woodfuel preparation take more, less or the same amount of time?	1	More time	
		2	Less time	
		3	Same [Go to L2]	
		4	Don't collect in rainy season	
L1.6	Why does it take more/less amount of time? <i>[Write down everything the participant says. Do NOT prompt]</i>			
L1.7	<i>[If necessary, please add any notes that will help us understand the wood fuel preparation process in this household]</i>			

Effort to prepare fuel

[Read the following] Think about the level of effort required for **fuel preparation**. I am going to ask you to use these pictures *[show Visual Aid A]* to tell me about this level of effort. They represent a task that requires no effort, up to a task that requires an extreme amount of effort.

L2	Please point to the picture that matches <u>the amount of effort you [or whoever does this task] spends on fuel preparation</u>	<i>[Enter number of picture participant pointed to]</i>
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LN	<i>Notes and observations for Section L</i>	
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[Use this section only if respondent reported cooking food to sell on ANY of their stoves- CODE 4 to question C4]

M1	Would you like to make more money from cooking food to sell?	1	Yes
		2	No [Go to N1]
M1.1	What factors prevent you from making more money from cooking food to sell? <i>[Write down everything the participant says. Do NOT prompt]</i>		

MN	<i>[Notes and observations on section M]</i>

N. Round Up Questions			
N1	<p>Before we finish I'd like to ask you about the idea of 'empowerment' and what it means to you. What would you say the word means? What would an empowered woman look like in this community? <i>[Please do not prompt. Write everything they say- please document in their words]</i></p>		
N2	<p>Do you think the women in community are empowered? If not what do you think stops them from becoming so? Say anything you like there is not right or wrong answer I'm just interested in your opinion. <i>[Please do not prompt. Write everything they say- please document in their words]</i></p>		
N3	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Time finished</td> <td style="width: 50%;">hh:mm</td> </tr> </table>	Time finished	hh:mm
Time finished	hh:mm		
NN	<p>Post interview notes <i>[Use this space to write any other comments / observations about this interview. Please include details on who was present at the interview and whether you think they influenced the answers and if so how/why.]</i></p>		

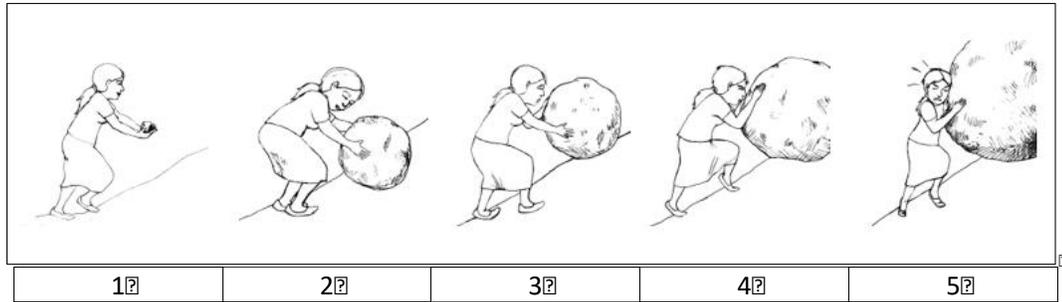
Thank you!!

Annex D: Visual aids used in survey



2124 KITTRIDGE STREET #57, BERKELEY, CA 94704

Time Poverty Survey: Kenya
Visual Aid: A



2124 KITTRIDGE STREET #57, BERKELEY, CA 94704

Time Poverty Survey: Kenya
Visual Aid: B



Annex E: Methodological Lessons Learned at baseline

A secondary aim of this project was to contribute to the knowledge base on how best to assess time, empowerment, and other gender-related outcomes of cooking technology and fuel interventions. The interim review of the methods served to consider the value, role, and feasibility of various qualitative data collection methods and make any course correction for post intervention possible within time and budgetary constraints.

- It is important to characterize the roles of each household member's contribution to cooking related tasks, in order to assess which of them are affected by the intervention. The survey results indicated that the study participants – all the female heads and main cooks of their households – were almost solely responsible for cooking-related work. However, anecdotal results from the cooking observations suggest that adolescents, especially girls, also make some contributions, perhaps particularly when they have school holidays. The post-intervention survey collected additional detail on their roles and contributions.
- With hindsight, the value of collecting data on total waking hours for the entire study population is apparent. As much data as possible was subsequently collected on this topic in the post-intervention phase.
- The baseline results have raised many questions about the optimal sample size, method protocol, and analysis approach for the 'macaroni' participatory assessment. The results to date show much more variability than expected, suggesting a larger sample size is needed, potentially making the method less cost-effective as an assessment tool in the future. It could also be that the 30-minute increment each bean was designated to represent is too long, causing participants to overestimate shorter tasks and subsequently underestimate the longer ones with their remaining beans. Finally, an experiment to analyze the data from a fuel collection day together with a non-fuel collection day as a 48-hour unit is also planned for the final report, in order to see if this longer period reduces some of the variability seen.