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USAID ALTERNATIVES TO CHARCOAL CONSUMER PREFERENCES SURVEY REPORT

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COVER PHOTO: A2C enumerator conducting a household interview in Lusaka District, Zambia.
Credit: USAID Alternatives to Charcoal

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ACRONYMS AND ABBREVIATIONS

A2C	Alternative to Charcoal Activity
ATF	Alternative Technologies and Fuels
CPS	Consumer Preference Survey
GPS	Geographic Positioning System
ICS	Improved Cookstove
LPG	Liquefied Petroleum Gas
MCHF	Modern Cooking for Healthy Forests Activity (Malawi)
MCHZ	Modernizing Cooking and Heating in Zambia Project
MECS	Modern Energy Cooking Services Programme
ZMK	Zambian Kwacha

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EXECUTIVE SUMMARY

The objectives of this Consumer Preference Survey were to better understand consumer's knowledge, usage, perceptions, preferences, usage patterns, aspirations and expenditures related to various fuels and technologies used for cooking in the home. Understanding these dynamics and preferences is a critical first step to successfully promoting the adoption of ATFs. Consumers were stratified into low, medium and high income households to better understand how household economics impacts preferences for ATFs. Another key objective of the survey was to differentiate if and how education, age and/or gender influence any of the above factors.

Results confirm that charcoal is the most widely known fuel, and charcoal use is ubiquitous across all income groups. The traditional mbaula is the best known, and most used, appliance on the market, costing around ZMW 50 ($2). While preference for, and use of, charcoal declines as incomes increase, it is still used in combination with other ATFs through the practice of fuel stacking. It is notable that a majority of high income households (60%) report using charcoal *every day*. This debunks the assumption that only low and middle income households rely on and prefer charcoal, and further confirms how embedded charcoal is as the preferred fuel of choice.

Charcoal can be bought in a range of sizes from small plastic bags costing ZMW 6, through to large sacks costing ZMW 314, allowing nearly unmatched flexibility. Charcoal is available in all local markets and many people purchase it at home from mobile sellers. Users point to its affordability, accessibility and cooking attributes (faster/better) as primary reasons they use it. Understanding these dynamics is critical for A2C and other actors in the sector when designing consumer focused interventions.

After charcoal, electricity is most frequently used ATF in Lusaka and already plays a significant role in the household fuel stack. This is driven by the relatively low cost of electricity in Zambia (second lowest in the region according to the Energy Regulatory Board) and high electrification rates. Not only is the fuel readily accessible and reasonably affordable, it is considered not just acceptable, but aspirational. However, adoption of electric cooking does fall dramatically as income levels decrease. The majority of respondents, regardless of income, also expressed the cost of electricity is what they like least about it. Given these dynamics, it is hard to ignore electricity as a key solution to addressing Lusaka's consumption of charcoal, even if load shedding is a reoccurring barrier to availability.

With widespread charcoal use and relatively high electricity use, it is clear from the consumer preference survey that fuel stacking is not just common, but the norm across all income groups. Typically, charcoal is used in combination with other fuels like electricity or wood. Stacking occurs throughout the day (different fuels for certain meals) and throughout the week (different fuels on different days). As income levels increase the proportion of electricity in the stack also increases, and as incomes decrease, the proportion of charcoal and firewood in the stack increases. LPG is almost non-existent in the cooking stack and when present it is mostly confined to the higher income groups.

It was also observed that consumers preference for a cooking technology/fuel was primarily informed by time saving and cost. This can be seen for example in the preference for cooking with charcoal later in the day and rather cooking on an electric appliance (where available) for breakfast preparation when speed is important.

Through the consumer preference survey, we have been able to identify and describe three consumer segments based on different income levels (low, medium, high). While each has a distinct profile, they are best viewed on a continuum where each overlap with the next. In all cases households are practicing significant fuel stacking through a combination of charcoal, electricity and firewood. **High income** households are already conducting a significant amount of cooking with electricity (69% cook with electricity and charcoal) and own a number of electric appliances. They could therefore be targeted for increased electricity consumption, potentially on more efficient appliances, such as electric pressure cookers. Alongside this, 36% aspired to use LPG, so an opportunity exists to facilitate fuel switching (from charcoal and/or electricity).

Although **medium income** households include electricity in their fuel stack, they have a significantly higher use of charcoal (30% only use charcoal). Electricity and LPG are the aspirational fuels for this income group and 87% are already connected to the grid, but only 53% are currently cooking with electricity. Therefore, the strategy for this group could be two pronged. Firstly, increase electricity use amongst those who already practice electric cooking. And secondly, encourage those that are cooking exclusively with charcoal to either switch to electricity, LPG, or other alternatives like pellets.

In the **low-income group**, the shift to charcoal as the predominate fuel is even more pronounced, with 45% of households only cooking with charcoal, 25% cooking with firewood and charcoal and only 18% cooking with electricity and charcoal. However, 60% are connected to the national grid and 16% aspired to use LPG as a cooking fuel. Given the low ability to pay in this group, as well as low awareness levels for ATFs, the most appropriate strategy may be to promote low-cost improved charcoal cookstoves. As most households are using charcoal in combination with other fuels, and on several appliances, the focus should be on identifying strategies to encourage a shift in the mix of fuel stacking, namely reduced use of charcoal and increased use of alternatives.

Accessibility, affordability and acceptability (the 3As) each play a critical role in the adoption of ATFs. However, one of the key barriers to ATF uptake is clearly affordability, as demonstrated by the pervasive fuel stacking practiced by all households across income groups. This is clearly illustrated by electricity use, where a high number of households (even in the low-income group) are connected to the grid, but the proportion cooking with electricity falls dramatically as income decreases. As these households are connected to the grid, it is unlikely that accessibility is the primary issue, and given the strong aspirations for electric cooking in all income groups, it must be deemed acceptable. Alongside this, affordability is cited as the number one concern amongst users of electricity. Results also revealed that even when consumers are aware about an ATF, adoption was extremely limited. For example, 100% of high income households are aware of LPG, yet only 9% are currently using it.

While charcoal, electricity and LPG feature prominently in the Consumer Preference Survey, other ATF options such as pellets, ethanol and briquettes are not highlighted in as much detail. Generally, this relates to the very low awareness and adoption levels of these ATFs. We hope providers of these ATFs can draw lessons from the survey results to better understand consumers' knowledge, preferences, aspirations, willingness to pay and spending in order to increase the purchase and use of these ATFs.

In summary, the survey confirms that focusing on a combination of accessibility, affordability and acceptability are all essential if A2C is going to positively impact the current mix of fuels being used by households and reduce the use of charcoal.

INTRODUCTION

Zambia's deforestation rate is among the highest in the world, with an estimated 200,000 hectares cleared annually. The use of charcoal is a primary driver of deforestation and forest degradation in Zambia due to its dominant role in household cooking across all income levels. The goal of the USAID/Zambia Alternatives to Charcoal (A2C) project is to reduce charcoal energy consumption in urban and peri-urban areas of Zambia (inclusive of Lusaka), and catalyze an increase in the use of low emission charcoal alternative technologies and/or fuels. By reducing charcoal consumption and increasing the use of alternatives A2C aims to reduce deforestation directly attributable to charcoal production. A2C will achieve these goals by ensuring that alternative technologies and fuels are accessible, affordable, and culturally acceptable. While the range of cooking fuels and technologies available to urban Zambian consumers has steadily grown and diversified over the years, the popularity and preference of using charcoal for cooking in a traditional burner, commonly referred to as the 'mbaula', persists (see Figure 1).

Figure 1. The "Mbaula", a charcoal burning stove common in Zambia

A range of alternative technologies and fuels (ATFs) to charcoal do exist in Zambia, including stoves powered by electricity and/or solar, liquid petroleum gas, processed biomass (e.g., pellets), gel fuel as well as more efficient (improved) charcoal cook stoves. However, the widespread adoption of each of these technologies in Zambia is currently hindered by poor enabling conditions and market barriers that keep costs prohibitively high and limit access, while specific social and cultural barriers for different consumer segments limit their cultural acceptability as an alternative to charcoal. These challenges must be addressed if ATFs are to replace charcoal as the low-cost household energy of choice in Zambia.

The objectives of this Consumer Preference Survey were to better understand consumers' knowledge, usage, perceptions, preferences, usage patterns, aspirations and expenditures related to various fuels and technologies used for cooking in the home. Understanding these dynamics and preferences is a critical

first step to successfully promoting the adoption of ATFs. Another key objective of the survey was to differentiate if and how education, age and/or gender influence any of the above factors. Results are intended to inform A2C's programmatic interventions, provide relevant data about consumer preferences to private sector stakeholders operating in Zambia, and elucidate potential reforms that government can enact to improve the enabling environment for ATFs.

METHODOLOGY

The survey instrument employed for this study was adapted from an Urban Cooking Energy Consumer Market Research and Baseline Survey conducted by the Modern Cooking for Healthy Forests (MCHF) Activity in Malawi and financed by USAID and UKAID.

A mix of closed and open-ended survey questions from the Malawi survey were adapted and refined for the Zambian context and uploaded onto tablets. Fourteen (14) local enumerators were then identified and trained on the survey instrument and best practices in data collection. The survey instrument was then pre-tested within several wards in urban Lusaka. This resulted in refinements to the questionnaire to improve the clarity, length, and organization of questions. The survey was delivered to a total of 420 households between April 23-30, and a second round between 3-5 May,

An open-source tool (Epicollect) was used to collect responses as well as other data including pictures, audio and GPS locations. Enumerators also made notes on the types of fuel and cooking appliances in respondent's homes to verify their use, and as a verification to ensure they had a shared understanding/meaning of the ATFs mentioned in the interviews. To further ensure common understanding of the ATFs referred to, the enumerators were provided with note cards with pictures of the different fuels and stove types available on the Zambian market (see Annex 1).

Afterward the survey was completed, a workshop was held with the enumerators during which they reflected on lessons learned, challenges encountered and recommendations for how to improve future research

SAMPLING PROTOCOL

The sample size calculations were based on a cluster sampling approach designed to obtain a sample that was as representative as possible of Lusaka District. It assumed that Lusaka district contains approximately 582,935 households distributed across 33 wards. These estimates were projections based on population data from the 2010 census (more recent demographic data was not available). The survey sample was based on a random sampling process of 21 out 33 wards across Lusaka District. A sample size of 420 households was selected from the 21 wards in order to obtain a 5 percent margin of error and 95 percent confidence level.

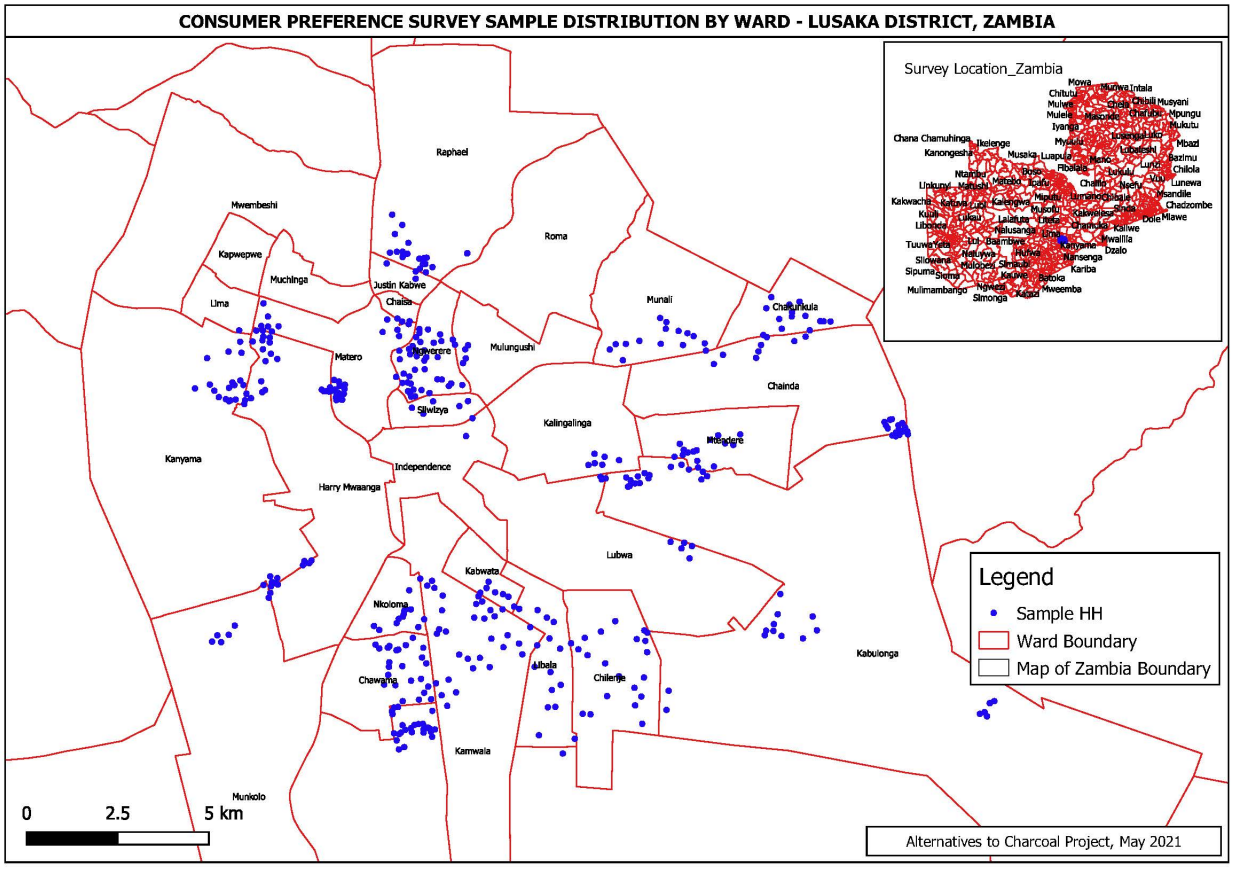
Selection of households to sample relied on the following methods:

- Each selected ward was divided into four (4) zones of roughly equal size using main streets as dividers.
- Six (6) landmarks in each of the four zones were identified.
- One landmark was randomly selected as a starting point for the enumerator.

- Five (5) household interviews were conducted from each selected starting point. Depending on the density of houses within a specific ward, the intervals between selected household was set at 15 to 20 minutes apart walking distance.
- The left/right hand rule was applied throughout to ensure even distribution across households.
- Households were substituted with another if consent was denied, there was no one knowledgeable about the subject matter based on the criteria that only the person responsible for cooking and/or buying fuel should be interviewed, or the interview could not happen as there was no one at the household.

Where any of the above situations rendered an interview impossible at the selected household, and it was not possible to arrange a convenient call back that day, enumerators moved to a different location, and selected a substitute by way of continuing with left/right hand rule. This was recorded along with the reason for substitution. The map below (Figure 2) illustrates the survey sample distribution by ward.

Figure 2: Locations of surveys conducted by ward in Lusaka District, Zambia.



ETHICAL CONSIDERATIONS

Written consent was obtained from each survey participant to ensure transparency and consent. Respondents signed two copies of the consent form, and one was left with the respondent for their records. The consent form also included contact details for the project in case the respondent had a

question or concern afterwards. Renumeration of any kind to respondents, including in-kind gifts, were strictly prohibited.

DATA ANALYSIS

Data were analyzed using descriptive statistics intended to summarize individual household variables and identify emerging patterns. Quantitative data were analyzed across three income groups: High, Middle and Low (see Demographics section below for further details). Qualitative data - including content from interviewed respondents and enumerator reports - were analyzed using NVivo Pro 11.

SURVEY RESULTS

DEMOGRAPHICS

Table 1: Respondent demographics

Variable		Income level (%)		
		High	Middle	Low
Sex	Male	14	15	9
	Female	76	85	91
Age	<25	20	25	23
	25 – 34	38	33	25
	35 – 44	24	20	19
	45 – 54	11	14	13
	55 – 65	4	4	14
	>65	4	5	7
Marital Status	Never Married	36	23	19
	Married	59	57	50
	Divorced	1	7	5
	Separated	2	1	5
	Widowed	2	12	21
Education level	Primary	14	34	51
	Secondary	57	50	36
	Tertiary	28	12	4
	None	1	4	8
Household size	1 - 3	16	20	20
	4 – 8	65	69	70
	9 – 14	19	11	9
	15+	0	0	1
Income source	Agricultural activities	2	0	2
	Formal work/ Employment	61	29	13
	Business/ self-employment	29	50	48
	Informal work	5	15	27
	Pension	1	1.5	1
	Seasonal employment	1	3	5
	Support from children/family	1	2	4

Consumers were stratified into three distinct income groups (low, medium, high) to better understand how levels of income affect current practices and future aspirations. ***High income*** households are most likely to have between 4 and 8 family members, with an average household size of 6 people. However, of all the income groups, they were also most likely to have large families (9 – 14 people), likely due to caring for other relatives. Respondents in high income households were generally young women (under 34), married (59%) and well educated (28% tertiary education). Typically, they are formally employed (61%) indicating a reliable income stream, or self-employed (29%), earing more than ZMW 3,000 per month.

Medium-income households are also most likely to have between 4 and 8 family members with an average of 6 people per household. Respondents were typically young (under 34), married (57%) women

who had attained at least secondary level education (50%). They are most likely to be self-employed (50%), or in formal employment (29%), earning between ZWM 1,000 – 3,000 per month. ***Low income*** households have 6 family members on average and respondents were also generally young (under 34) women. Respondents were mostly married (50%) but there was an increased chance that they had been widowed (21%). Typically, they had a primary level education (51%), with a significant proportion reaching secondary level education (36%). These households usually earn income from self-employment (48%) or informal work (27%), earning less than ZMW 1,000 each month.

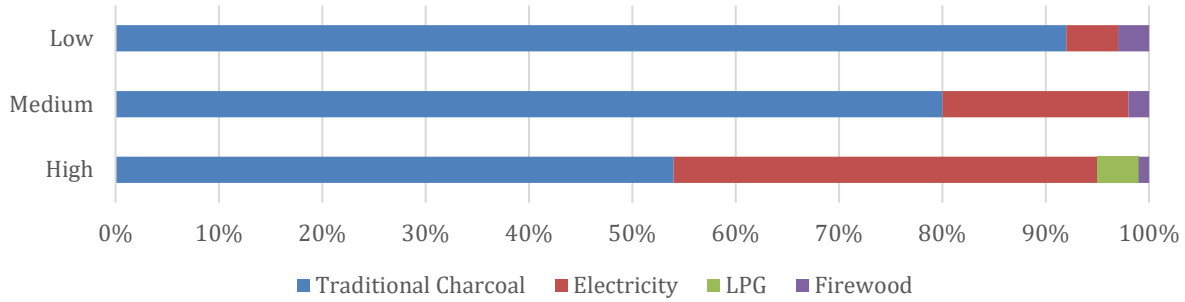
Overall, the level of household income correlated with education levels (higher incomes linked to higher education levels), age (lower incomes linked to older respondents), marital status (lower incomes linked to higher chances of the respondent being widowed) and source of income (formal employment decreased as incomes decreased).

KNOWLEDGE AND USE OF FUELS

Table 2: Percentage of respondents that know of each fuel

		Income level (%)		
		High	Middle	Low
Which fuels do you know of?	Electricity	99	98	95
	LPG	99	68	46
	Traditional Charcoal	97	98	96
	Sustainable Charcoal	90	16	5
	Firewood	75	85	89
	Pellets	65	12	7
	Briquettes	38	9	3
	Sawdust	24	21	10
	Agricultural Residues	11	32	16
	Paraffin	5	65	49
	Solar	2	57	43

Figure 1: Which fuel do you use the most?



Fuel Knowledge: Electricity was known by all respondents in all income groups, as were charcoal and firewood. LPG knowledge was relatively high across income levels but decreased with lower income households. The results suggest that awareness of electricity and LPG as alternative fuels to charcoal is not a barrier. However, knowledge of other alternatives is strongly disaggregated by income, with higher income groups being aware of biomass pellets (65%), and middle and low income groups were more aware of solar and paraffin.

Fuel Usage: The fuel was most frequently used across all income groups was charcoal, with electricity being the second most used fuel. Importantly, 54% of respondents in the high income group reported charcoal as the most frequently used fuel. Charcoal usage increased as incomes fell, while electricity use increased as incomes rose. Only 4% of respondents reported using LPG most of the time and these were limited to the high income group. These results reveal several important points. First, the use of charcoal is not limited to just middle- or low income households. Even high income households who have awareness of, and the ability to purchase, electricity or LPG are not doing so, with respondents in the group split 50/50 between charcoal and electricity. Second, the use of LPG is extremely low even though respondents are aware of it as a potential fuel option.

FUEL USAGE BY TYPE

Table 3: Electricity usage and opinions regarding electricity

Electricity Use		Income level (%)		
		High	Middle	Low
Do you purchase for household use?	Yes No	98 3	87 13	60 40
Do you use electricity to cook?	Yes No	82 18	53 47	24 76
How long have you used electricity?	0 – 6 months 1 – 2 years 2 – 3 years More than 3 years	1 2 2 95	1 3 4 91	0 3 5 92
What do you like most about electricity?	Cooks faster Easy to use Cleaner Other	76 10 3 14	60 10 7 23	40 7 8 45
What do you like least about electricity?	Expensive Load Shedding Other	70 15 15	74 9 17	58 7 34

Households in all income groups use electricity to cook, but this decreases drastically as income levels fall. Electricity users in all income groups have typically used it for three or more years, suggesting that once a fuel has been adopted it is unlikely that users will switch. In addition, most electricity users cook with it every day, but this is more likely as incomes increase. It is important to note that while 63% of low income households use electricity every day, this only relates to those that use electricity for cooking (24%). Therefore, a quarter of low income households use electricity and just over half of them use it every day, meaning approximately 15% of low income households are using electricity for cooking on a daily basis.

Figure 2: Frequency and use for cooking: electricity

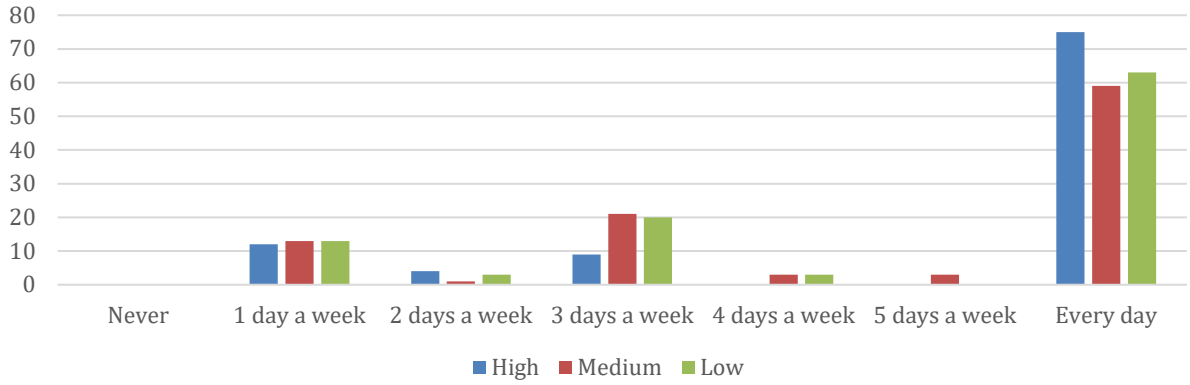
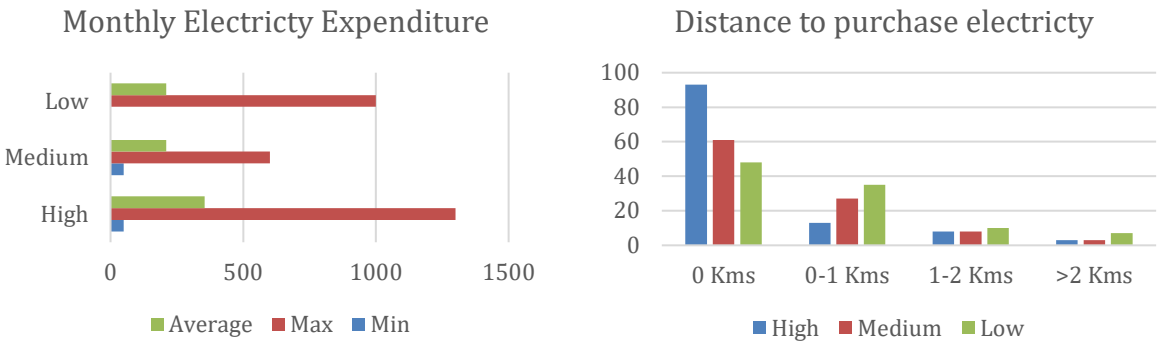


Figure 3: Monthly electricity expenditure and distance traveled to purchase electricity



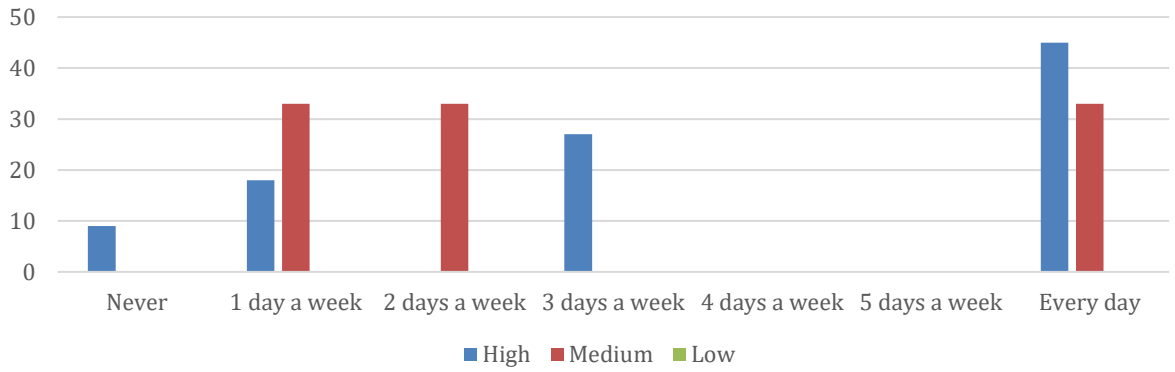
The majority of ***high income*** households (98%) purchase electricity for household use, while 82% use it for cooking. On average they spend ZMW 355 per month on electricity for all their household needs and typically don't need to travel to purchase electricity, as they pay for it digitally (79%). 87% of ***middle income*** households purchase electricity for household use, while significantly less use it for cooking (53%). On average they spend ZMW 210 each month on household electricity needs and most purchase it digitally (62%) or travel up to 1 km (27%). Finally, 60% of ***low income*** households purchase electricity for household use, but only 24% use it for cooking. On average they spend the same amount as middle income households (ZMW 210) each month but are less likely to purchase it digitally (48%), with 30% traveling up to 1km to purchase units. The reasons given for liking electricity were uniform across income levels and are that it cooks faster and is easy to use. Across all income groups the main reason for not liking electricity was cost, with load shedding also featuring as a barrier.

Overall, high income households spend the most on electricity each month, with low- and middle income households spending the same on average each month. As income levels decrease the distance travelled to purchase units increases, suggesting that access to financial services and digital payment methods is limited in low income groups.

Table 4: LPG use and opinions regarding LPG

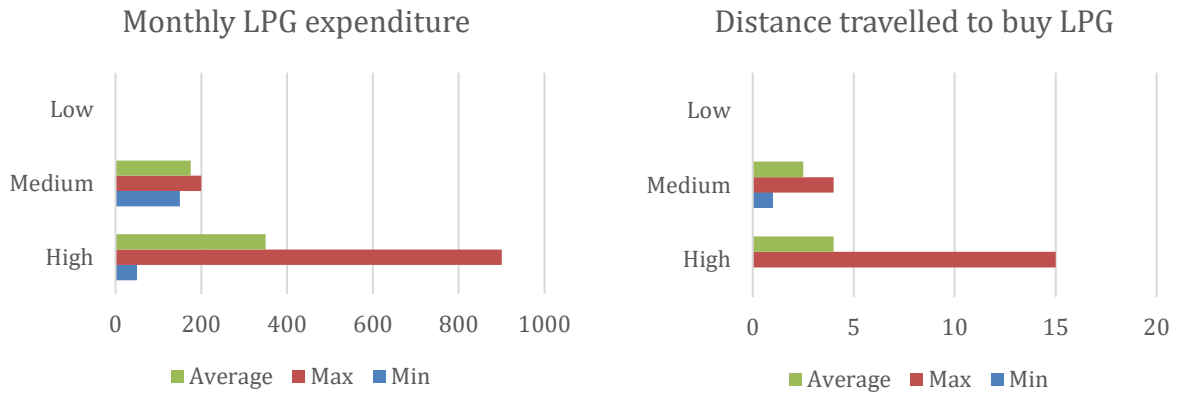
LPG Use		Income level (%)		
		High	Middle	Low
Do you use LPG to cook?	Yes	9	2	0
	No	91	98	100
What size cylinders do you buy?	5 Kg	27	66	0
	7 Kg	27	0	0
	9 Kg	18	33	0
	19 Kg	27	0	0
How long have you used LPG?	0 – 6 months	10	33	0
	1 – 2 years	0	0	0
	2 – 3 years	20	0	0
	More than 3 years	70	67	0
What do you like most about LPG?	Cooks faster	40	35	0
	Affordable	10	0	0
	Easy to use	10	67	0
	Not smoky	10	0	0
	Other	30	0	0
What do you like least about LPG?	Safety	60	0	0
	Transporting cylinders	20	67	0
	Availability	10	0	0
	Other	10	33	0

Figure 4: Frequency of LPG use



The sample size for LPG was extremely limited, with only 14 out 425 households across all income groups reporting using LPG. Consequently, any conclusions should be treated with caution as these numbers only reflect the practices and opinions of a small sample. LPG use is clearly minimal amongst all income groups and non-existent in the low income group. Generally, respondents had been using it for 3 or more years, but there are indications that some adoption has been more recent. Most households do not use it every day, but rather use it sporadically during the week to supplement other fuels (see discussion on fuel stacking below).

Figure 5: Monthly LPG expenditure and distance traveled to buy LPG



Among the few households using LPG, cylinder sizes ranged more among high income households, while middle income households preferred smaller (5kg cylinders). Similar to electricity, cooking time and ease of use were the top reasons why respondents liked LPG, however middle income households placed more emphasis on ease of use. Interestingly, higher income households had more concerns around the safety of LPG, while middle income households stated the transport of cylinders was what they liked least about LPG. High income households spent on average ZMW 350 on LPG each month, while medium income households spent ZMW 175 on average.

Table 5: Charcoal use and opinions regarding charcoal

Charcoal Use		Income level (%)		
		High	Middle	Low
Do you use charcoal to cook?	Yes	99	99	96
	No	1	1	4
Do you purchase for household use?	Yes	97	99	98
	No	3	1	2
How long have you used charcoal?	0 – 1 year	3	2	2
	1 – 2 years	1	1	1
	2 – 3 years	7	1	2
	More than 3 years	90	94	97
What do you like most about Charcoal?	Affordable	40	37	30
	Cooks faster/better	27	25	31
	Only fuel I can get	0	11	15
	Other	33	32	24
What do you like least about Charcoal?	Makes utensils dirty	22	17	16
	Too involving/complicated	16	11	9
	Takes too long to prepare a meal	16	5	15
	Expensive	5	17	20
	Worried about smoke	3	10	2
	Other	38	40	38

Charcoal use was ubiquitous across all households, regardless of income levels and most users have been using it for longer than 3 years. However, frequency of use was dependent on income levels, with 97% of low income households using it every day and 60% of high income households using it every day. When set against the electricity use figures, it is clear households are practicing fuel stacking.

Low income groups tend to spend slightly less per unit of charcoal, on average, than middle and high income groups. The cost of charcoal ranges from ZMW 6 for a small plastic bag, up to ZWM 314 for a large 50Kg bag with raised top (estimated weight of 120Kg). In the ***high income*** segment, households typically purchase once per month (51%) from the local market (56%) or a mobile seller (17%). They buy in a range of different sizes but are most likely to purchase larger bags (43% buy the largest two bag sizes). Households in the ***middle income*** segment purchase their charcoal daily (29%) or monthly (45%) from the local market (71%) or mobile sellers (10%). Linked to the purchase frequency, this group is most likely to buy small plastic bags (18%) or mid-to-large bags (44%). In the ***low income*** group, households mostly purchase charcoal daily (54%) from the local market (80%) in small or medium plastic bags (45%). Charcoal users across all income groups typically travel 1-2 kms to purchase their charcoal.

Reasons across all income groups for liking charcoal centered around affordability and its cooking properties (faster/better). However, the reasons for not liking charcoal differed between income groups and even consensus within groups was not as strong as other ATFs. In the high income group, cleanliness, complication and time taken to prepare a meal were the primary dislikes. In the middle income group, cleanliness, expense and complication were cited as the main reasons for disliking charcoal. While in the low income group, expense, time taken to make a meal and cleanliness were the primary dislikes. However, in all three income groups respondents indicated 'other' most frequently. Generally, these responses were centered around charcoal giving people headaches, making them dizzy, or challenges lighting the fuel, particularly in the rainy season. Variable quality of charcoal was also an issue for many respondents.

Figure 6: Frequency of charcoal use

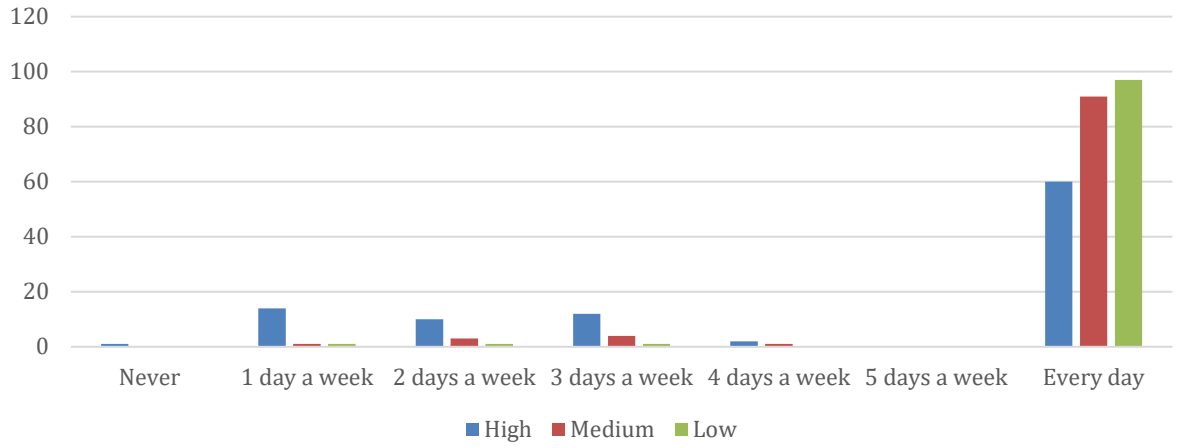


Figure 7: Charcoal prices

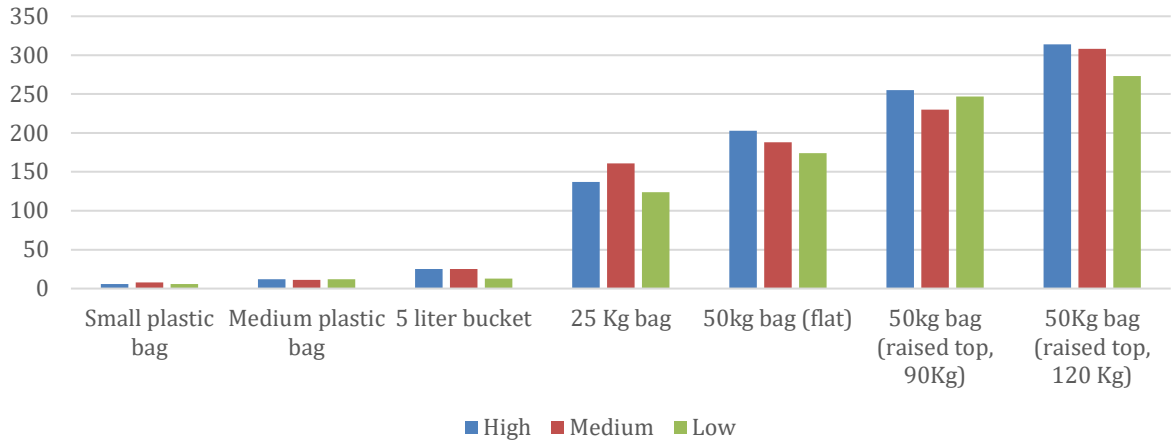
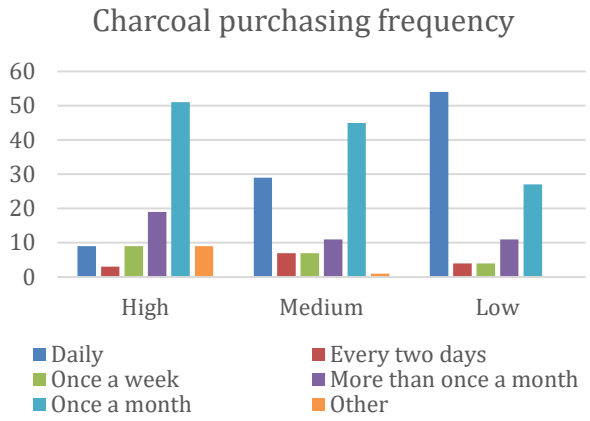


Figure 8: Charcoal purchasing frequency and charcoal purchase location



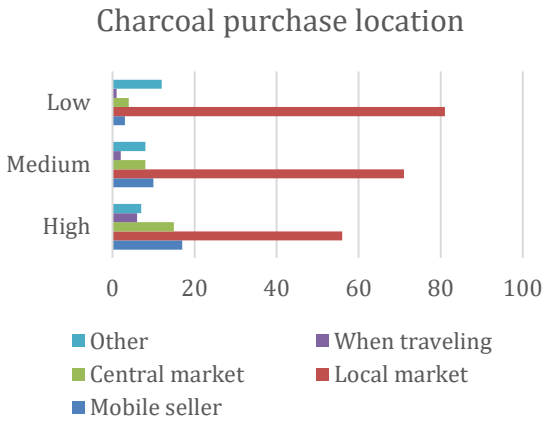


Figure 9: Unit of charcoal most commonly purchased

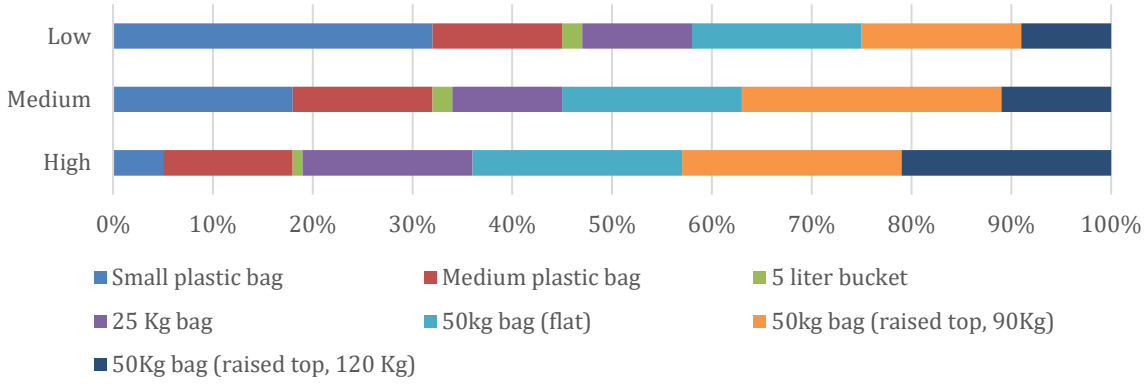


Figure 10: Distance travelled to purchase charcoal

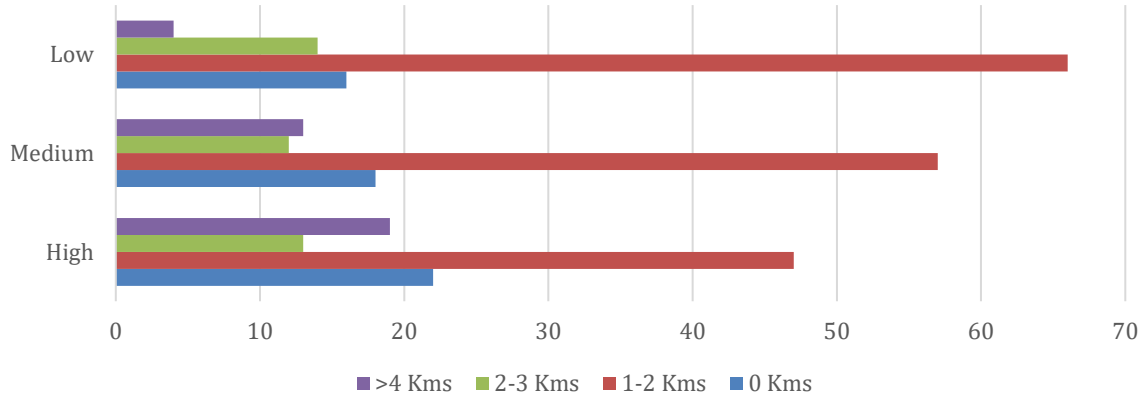


Table 6: Firewood use and opinions regarding firewood

Firewood Use		Income level (%)		
		High	Middle	Low
Do you use firewood to cook?	Yes No	11 89	28 72	31 69
Do you purchase for household use?	Yes No	11 89	27 73	27 73
How long have you used firewood?	0 – 1 year 1 – 2 years 2 – 3 years More than 3 years	15 0 0 85	13 3 8 76	14 8 4 75
What do you like most about firewood?	Affordable Cooks faster Other	70 15 15	24 51 25	32 48 20

What do you like least about firewood?	Concerns with smoke Makes utensils dirty Other	62 31 8	62 30 8	56 31 13

Firewood use was reported in all income groups but was most common in low income households. Generally, they have used it for more than 3 years, but a not insignificant number have started using it in the last year, possibly reflecting increases in charcoal costs and the unreliability of grid electricity. Typically, households use it sporadically during the week, with only about 30% using it daily.

Figure 11: Frequency of use of firewood

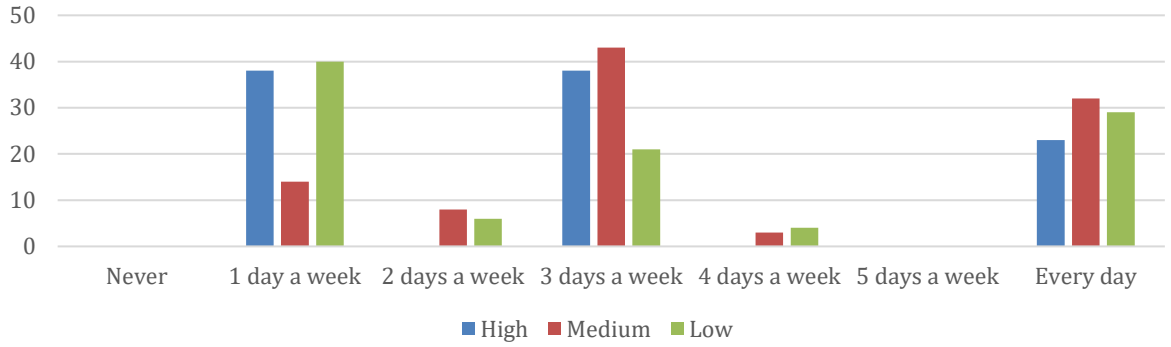
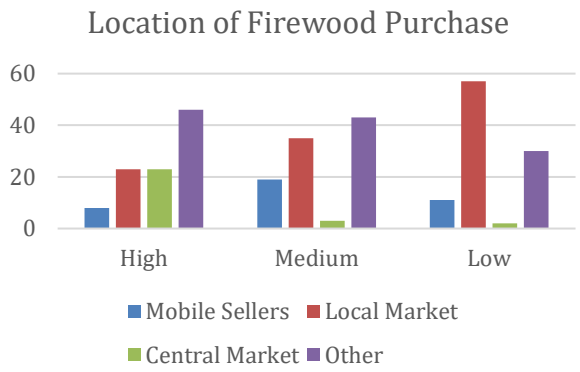


Figure 12: Location of firewood purchase and monthly exenditure on firewood



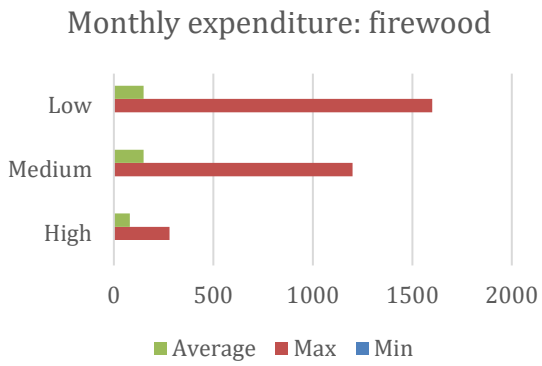
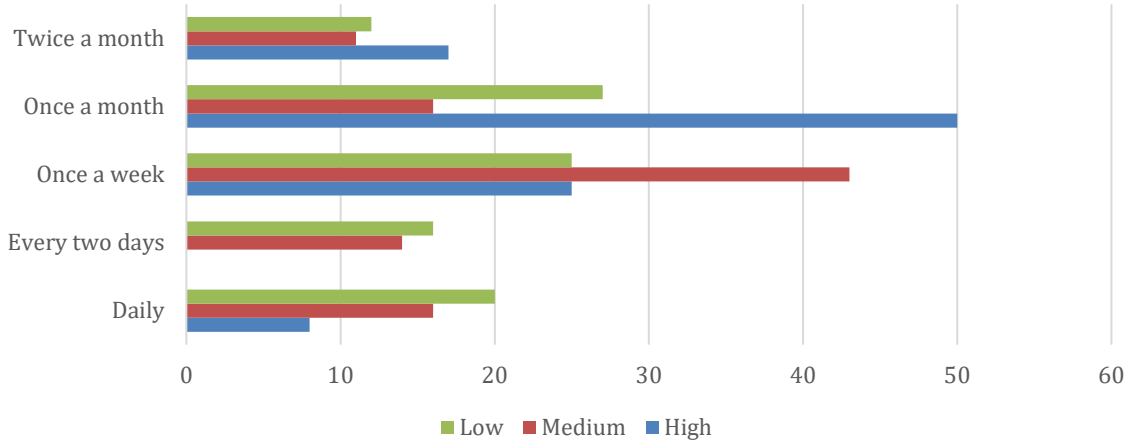


Figure 13: Frequency of firewood purchase



Only 11% of ***high income*** households use firewood, typically gathering it for free from the local area (46%). When they do pay, they usually spend on average ZMW 80 each month and purchase it once a month (50%). Affordability (70%) is the primary driver of firewood use in this group, but most are concerned about the smoke (62%) and dislike that it makes utensils dirty (31%). Close to a third of ***middle income*** households collect/purchase firewood for cooking, mostly doing so from the surrounding area (43%) and paying on average ZMW 150 per month through weekly purchases. They primarily like that it cooks faster but have concerns about smoke and dislike that it makes utensils dirty. Approximately a third of ***low income*** households purchase/collect firewood, they generally purchase it at the local market (57%), paying on average ZMW 150 a month. Affordability and speed of cooking are the main attributes that low income households like. They share the same concerns as the other income groups.

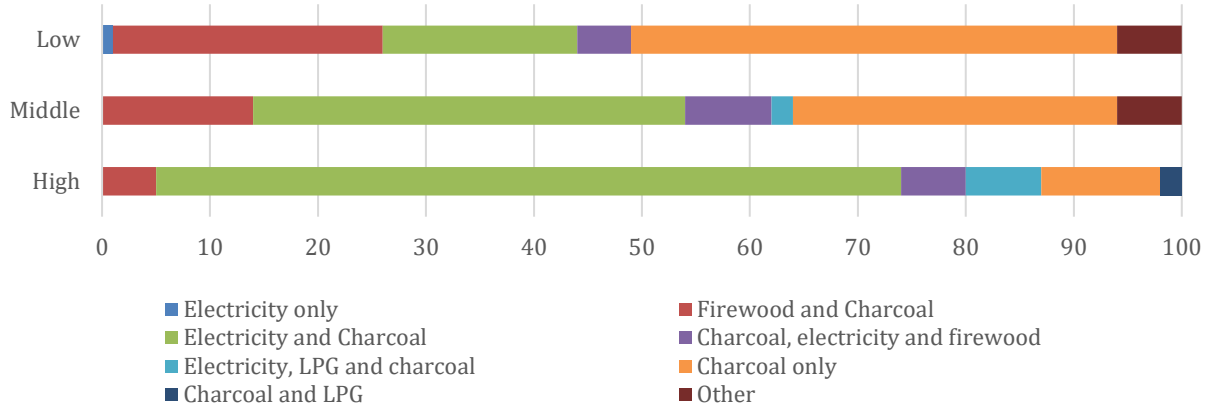
Generally, higher income households spend less on firewood and are more likely to source it from the surrounding areas. Whereas low income households are more likely to purchase from a local market and typically spend more each month. Higher income levels are correlated with less frequent purchases, most probably due to larger volumes purchased each time.

To summarize fuel usage data, electricity use falls as income levels decrease, while charcoal use decreases as income levels increase. LPG use is negligible, and firewood is used by all income groups sporadically during the week, possibly for certain cooking/heating tasks. However, the reality is that all households are practicing fuel stacking to meet their various cooking and financial needs.

FUEL STACKING

"Fuel stacking" refers to using multiple fuel combinations within the same household for cooking. Fuel stacking is driven by the perceived inability of any single fuel or appliance to meet all the cooking needs of a household. Time, efficiency, uneven fuel availability and cultural preference all contribute to fuel stacking, as does fuel and appliance affordability.

Figure 14: Household fuel stacking



It is clear from the consumer preference survey results that fuel stacking is a widespread practice, regardless of income levels, although the combinations of fuels used does vary by income level. The combination of charcoal and electricity is most seen in high- and middle income groups. While charcoal only is the preference for low income groups, it is closely followed by a combination of firewood and charcoal. The exclusive use of electricity, or LPG, is almost non-existent, regardless of income type. There is clearly a tradeoff between charcoal, firewood and electricity that shifts as income levels change.

KNOWLEDGE OF APPLIANCES

While fuels and appliances are closely related, there are many appliances that can be powered from a single fuel. For example, electricity opens up a variety of appliance options, including electric cookers with an oven, kettles, microwaves, electric pressure cookers, hotplates and induction cookers. The affordability, acceptability and availability of these appliances varies greatly and will impact consumers' ability and willingness to pay. Furthermore, awareness of a relatively small number of fuels is likely to be higher than the wide array of possible appliance options, some of which have more specific functions than others,

In ***high income*** households' electrical appliances (with the exception of the induction cooker) had the highest awareness levels, as did improved charcoal cookstoves. Only around 50% of high income households know about LPG cooking devices; with knowledge about improved biomass cookstoves (pellets) being even lower. The most widely known appliances are the kettle (92%), the electric cooker with oven (90%) and the microwave (85%). These were closely followed by the improved charcoal cookstove (84%) and the electric hotplate (76%). Knowledge of efficient electrical appliances like the rice cooker (71%) was also fairly high in this group.

Table 7: Appliances that respondents have knowledge of

Which appliances do you know of?															
	Kettle	**Electric cooker with oven**	**Microwave**	**Improved cookstove**	**Electric hotplate**	**Pressure cooker**	**Rice cooker**	**Eclectic mini cooker**	**Electric fryer**	**LPG cylinder burner**	**LPG cooker**	**Paraffin stove**	**LPG hotplate (portable)**	**Rocket stove (firewood)**	**Induction cooker**	**Improved biomass stove**
High	92	90	85	84	76	71	71	70	62	53	52	51	48	48	27	20
Middl	87	80	73	87	72	53	44	66	49	47	47	53	41	48	15	20
Low	75	63	51	86	63	33	31	45	30	27	28	38	16	33	6	11

The dynamics in ***middle income*** households are the similar to the high income households, with greater levels of knowledge around electrical appliances and lower levels for LPG appliances. The three most widely known appliances are the kettle (87%), the improved charcoal cookstove (87%) and the electric cooker with oven (80%). These were closely followed by the microwave (73%) and the electric hotplate (72%). Knowledge of efficient electrical appliances like the rice cooker fell to around 50% of respondents in this income group.

In ***low income*** households the most widely known appliances are the improved charcoal cookstove (86%), the kettle (75%) and the electric cooker with oven (63%). Other, more efficient, appliances were much less well known, like the rice cooker (31%) and the electric fryer (30%). However, awareness of LPG appliances was lower still at less than 30%.

Overall, knowledge of electrical appliances was higher across all income groups, as compared to LPG appliances and other more efficient electrical appliances. However, knowledge of efficient electrical appliances did fall significantly as income levels decreased. Interestingly, there seems to be some disconnect between a household's knowledge of LPG as a fuel (high) and their knowledge of LPG appliances (low).

USE OF APPLIANCES

While knowledge of appliances is important, the appliances that consumers actually use provides a more significant indication of their availability, affordability and acceptability. Respondents were asked to indicate all the appliances they currently use to build up a picture of which are used within, and across, the various income groups.

The most commonly reported appliances in ***high income*** households are the traditional mbaula (85%) and the electric cooker with oven (66%). These are followed by the microwave (26%) and the improved charcoal cookstove (25%). Even though awareness about other appliances, such as the electric hotplate, pressure cooker and LPG cylinder burner were high, this has not translated into uptake by this income group. In general, use of LPG appliances is very low, while the use of improved charcoal cookstoves is surprisingly high at 25% of households.

Table 8: Appliances that respondents use

Which appliances do you use? (*Multiple options submitted)*														
	Mbaula	Electric cooker with oven	Kettle	Microwave	Improved Cookstove	Rice Cooker	LPG Hotplate (portable)	Three stone fire	Electric Hotplate	Electric fryer	Electric mini cooker	Pressure cooker	LPG Cooker	LPG Cylinder burner	Other
High	85	66	38	26	25	9	7	7	7	6	6	5	2	1	0
Middle	81	26	15	3	14	1	0	17	12	0	8	2	0	1	3
Low	80	8	5	0	13	0	0	16	3	0	1	0	0	0	0

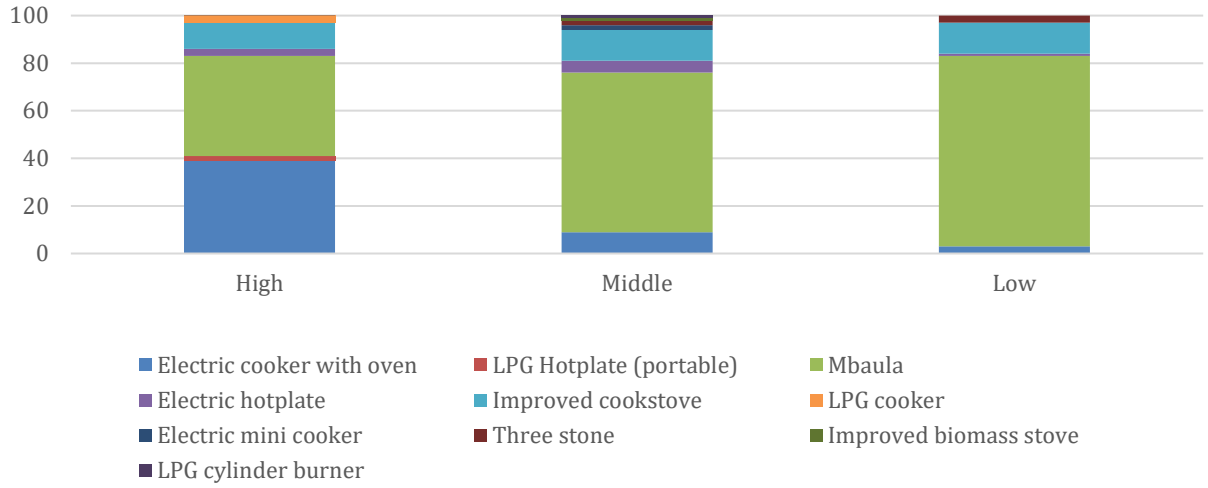
In the ***middle income*** group the most commonly reported appliances are the traditional mbaula (81%), the electric cooker with oven (26%) and the three stone fire (17%). Improved charcoal cookstove use was also surprisingly high (14%), while this group had the highest use of electric hotplates (12%). Use of efficient electrical appliances was almost non-existent in this group, despite around 50% of respondents claiming to be aware of them.

Finally, in the ***low income*** group, the most commonly used appliances were the traditional mbaula (80%), three stone fire (16%) and the improved charcoal cookstove (13%). All of these devices are powered by biomass (wood and charcoal), indicating that alternatives are either unaffordable, unavailable, or unacceptable to them. LPG and efficient electrical appliances are not used at all in this income group.

In summary, as income levels increase households use a wider range of appliances and practice a greater degree of appliance stacking. That being said, the traditional mbaula is the most commonly used appliance across all income groups. LPG and efficient electrical appliances are not used by most households and where they are, they are generally confined to the higher income group. All three income groups indicated a surprisingly high use of improved charcoal stoves.

MOST AND LEAST FREQUENTLY USED APPLIANCES

Figure 15: Appliances used the most



Respondents were subsequently asked to indicate the one appliance that they used most often, as well as the one appliance that they used least often. In all income groups the most used appliance was the traditional mbaula. However, this increased as incomes decreased with 42%, 67%, 80% of households reporting this in high, medium and low income households respectively. in ***high income*** households the electric cooker with oven came a close second (39%). In ***middle income*** households the second most used appliance was the improved charcoal cookstove (13%). Similarly, in ***low income*** households the second most often used appliance, after the traditional mbaula, was the improved charcoal cookstove (13%). Overall, use of electrical appliances was most strongly correlated with high income households, with low and middle income households typically using appliances that are powered by charcoal. It is interesting to note that low-cost electric hotplates do not feature strongly in any income group, with the highest occurrence in middle income households.

The least used appliances for each income group are not reported here, however, the drivers of why they weren't used provides context in understanding household barriers and needs. The main reasons given by the ***high income*** group were the cost of fuel, load shedding and the length of time taken to prepare a meal on the appliance. These clearly align to issues around affordability, availability and acceptability. Whereas ***medium income*** households indicated that fuel cost, fuel consumption and ease of use were key drivers when deciding when not to use an appliance. The first two clearly align with affordability issues, while the last relates to acceptability. ***Low income*** households provided nearly identical responses to the medium income households.

However, when asked why they continue to use these appliances the ***high income*** group indicated that they were used to either cooking food that takes a long time (36%) or takes less time (29%). ***Medium income*** households stated that they continue to use these devices for water heating (33%) and for cooking food that takes less time (34%). While ***low income*** households still used these devices for food

that takes less time to cook (29%) and a variety of other reasons (28%), mostly related to fuel cost, fuel consumption and length of time taken to prepare a meal.

ROLES AND RESPONSIBILITIES

Table 9: Cooking and fuel-related roles and responsibilities in households

Roles and Responsibilities		Income level (%)		
		High	Middle	Low
Who does most of the cooking?	Myself	53	71	79
	Another Adult	14	9	6
	Spouse	8	9	7
	Other relation	3	2	1
	Maid	9	2	0
	Own Child	6	5	5
	Another Child	7	4	3
Who decides on which cooking appliance to purchase?	Myself	33	37	53
	Myself and spouse	26	30	21
	Another family member	27	15	11
	Spouse	3	4	5
	Other	10	14	1
Who purchases the fuel?	Head of Household (HHH)	13	22	40
	HHH and spouse	20	25	22
	Spouse only	24	20	15
	HHH and another family member	9	17	8
	Another family member	28	12	10
	Daughter/son	0	1	1
	Other relation	5	3	4
	Don't know/Not sure	1	0	0

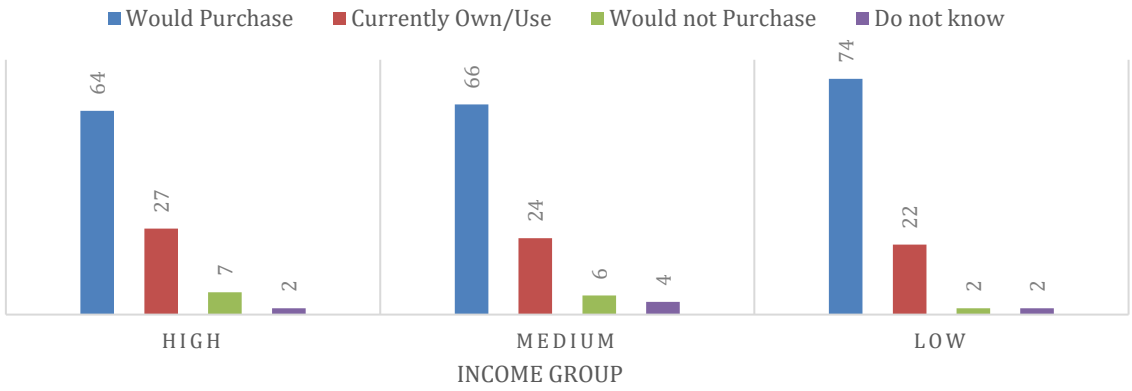
In all income groups the respondent (typically female) was most likely to do the cooking. However, this increased as income levels decreased. In high income households the cooking is shared more evenly amongst household members. Decisions on appliance and fuel purchases are generally concentrated with the respondent (female) or the respondent and the spouse. As income levels increase, decision-making about what type of appliance to purchase is more evenly shared between the respondent and spouse. Fuel purchases are increasingly carried out by the head of household as income levels decrease and conversely the spouse is more involved as income levels increase. Overall, the respondent conducts most of the cooking is not as involved in the fuel and appliance purchases, which involve a wide range of family members, but most often include the spouse.

IMPROVED COOKSTOVES

While improved charcoal cookstoves are still reliant on charcoal as a fuel source, they do offer opportunities for significantly reducing consumption through efficiency gains. Although more expensive than the traditional mbaula, they are often less expensive than other appliances powered by alternative

fuels (electricity, pellets, LPG). Coupled with the fact that charcoal is already widely accessible, acceptable and affordable, the barriers to adoption may be lower than some other ATFs.

Figure 16: Perspectives on improved cookstoves (ICS)



As seen elsewhere in this report, a relatively high number of households in all income groups already own an improved charcoal stove (22-27%), with the vast majority of the remaining households expressing a desire to purchase one (64-74%); this demand is highest in the low income segment (74%). The motivations for purchasing a charcoal improved cookstoves (ICS) are uniform across the income levels with fuel efficiency and safety being the key drivers. Linked to these motivations, all income groups indicated the same attributes they would be looking for in a charcoal ICS, which are fuel efficiency, affordability, and speed of cooking.

Table 10: Motivation for purchasing cookstoves

First Reason	**Fuel Efficient**	**Fuel efficient**	**Fuel efficient**
Second Reason	Current stove not efficient	Current stove not efficient	Current stove not efficient
Third Reason	Safe to use	Would like to try one	Safe to use

Table 11: Desirable attributes in improved charcoal cookstoves

	High Income	**Medium Income**	**Low Income**
First Reason	Fuel efficient	Fuel efficient	Fuel efficient
Second Reason	Affordable	Affordable	Affordable
Third Reason	Fuel is cheap	Cooks faster	Cooks faster

When asked about willingness and ability to pay for an ICS, households indicated that prices between 190 and 240 Kwacha would be too expensive, prices between 120 and 165 would require some thought and between 75 – 120 Kwacha would represent good value for money. Set against 50 Kwacha for a traditional Mbaula, this represents a willingness to pay up to three times as much for the features they desire. 77% of ***low income*** households would be prepared to pay cash for a charcoal ICS but only 35% know where to get one. Fewer households in the ***middle income*** group would be willing to pay cash (58%) and 39% already knew where to get one. In the ***high income*** segment 83% would be willing to pay cash, but they have the lowest awareness about where to purchase (24%).

Figure 17: Ability and willingness to pay for improved cookstoves

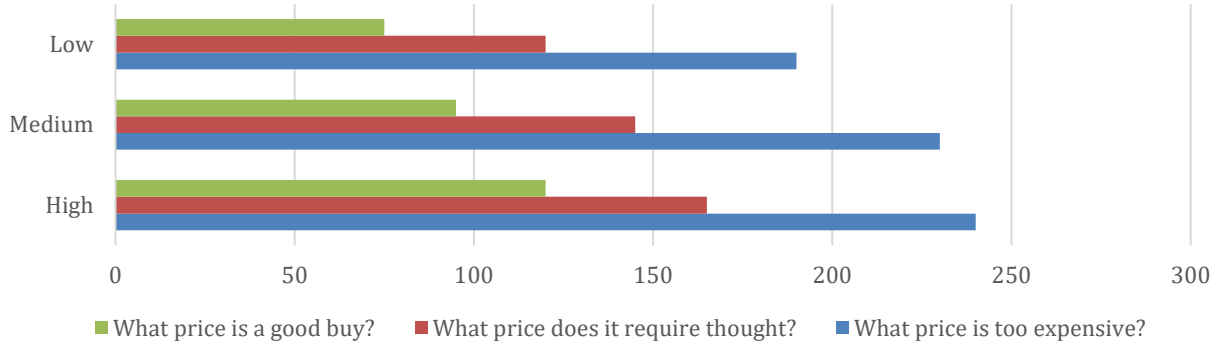
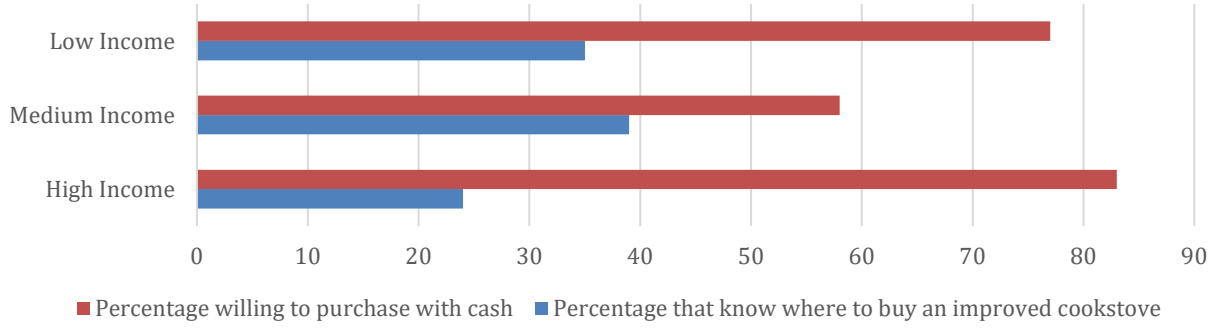


Figure 18: Knowledge of improved cookstoves and willingness to pay for them



MEAL PREPARATION

All households across all three income groups generally prepared breakfast, lunch and dinner. However, the fuel and stove choices between the meals and income groups did vary. In the ***high income*** segment households were most likely to prepare breakfast on an electric cooker with oven (48%), followed by the traditional mbaula (20%). However, the mbaula was most commonly used for lunch (48%) and dinner (43%). The ***middle income*** segment followed a similar, but more pronounced pattern with 51% using the electric cooker with oven at breakfast, while lunch (67%) and dinner (69%) were typically prepared on the mbaula. The clear preference in the ***low income*** group was for the mbaula at breakfast (75%), lunch (76%) and dinner (80%). After the mbaula and electric cooker with oven, the improved cookstove featured moderately highly in all income groups and for all meals (9 – 14%).

For low income consumers who rely heavily on charcoal for all their meal preparations – price is a key driver of choice because of their limited choice of appliances. This however does not necessarily mean low income consumers are less concerned with time, but rather than their limited choices lock them into the one fuel type and they have to manage their time around what is affordable/available.

Table 12: Meals cooked with specific appliances

		Electric cooker (Electricity)	Electric hotplate (Electricity)	Electric Mini cooker (Electricity)	Improved cookstove (Charcoal/biomas	Kettle (Electricity)	LPG burner (LPG)	LPG hotplate (LPG)	LPG cooker (LPG)	Mbaula (Charcoal)	3 stone (firewood)
High	Breakfast	48	5	5	9	5	1	1	1	20	0
	Lunch	30	2	2	11	0	0	1	2	48	0
	Dinner	34	3	2	11	0	0	2	2	43	0
Middle	Breakfast	51	7	4	12	5	1	0	0	20	2
	Lunch	8	2	1	14	1	1	0	0	67	2
	Dinner	10	4	2	12	1	0	0	0	69	2
Low	Breakfast	2	4	0	11	3	0	0	0	75	2
	Lunch	2	1	0	13	0	0	0	0	76	4
	Dinner	2	2	0	11	0	0	0	0	80	4

PERCEPTIONS AND MOTIVATIONS

Figure 19: Preferred fuels

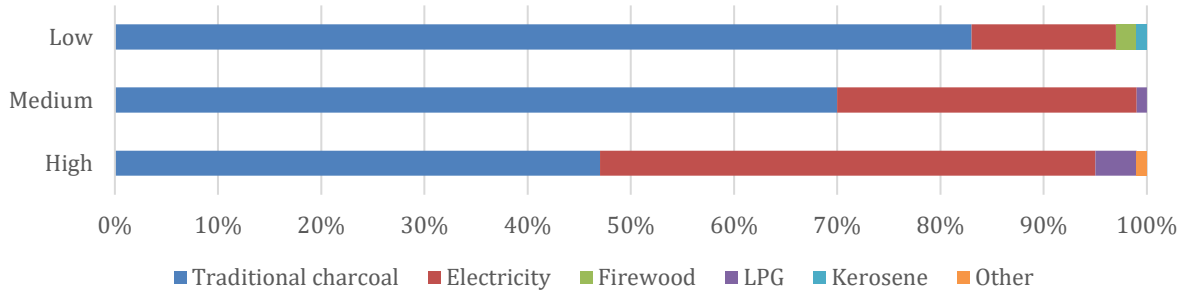


Table 13: Why households prefer charcoal and electricity

		High	Medium	Low
Reasons for preferring charcoal	First	Affordable	Affordable	Affordable
	Second	Accessible	Cooks faster	Cooks faster
	Third	Cooks better	Accessible	Accessible
Reasons for preferring electricity	First	Cooks Faster	Cooks faster	Cooks faster
	Second	Easy to use	Easy to use	Clean to use
	Third	Accessible	Clean to use	Cooks better

Out of all the fuels that households used there is a clear preference for charcoal and electricity. However, this varied considerably between income groups. The ***high income*** segment was generally split in the middle with 48% preferring electricity and 47% preferring charcoal. In the ***low income*** segment this shifted towards favoring charcoal (70%) over electricity (29%) and was even more pronounced in the ***low income*** segment with 83% favoring charcoal and 14% preferring electricity. The reasons given for preferring charcoal were identical across income segments with affordability, speed of cooking and accessibility being the main drivers of preference. Reasons for preferring electricity were not as uniform across income segments but speed of cooking was the primary driver for all income groups. High- and medium-income households also like that it is easy to use. While medium and low income households like that is clean to use and that it "cooks better".

Figure 20: Fuels that respondents would most like to use

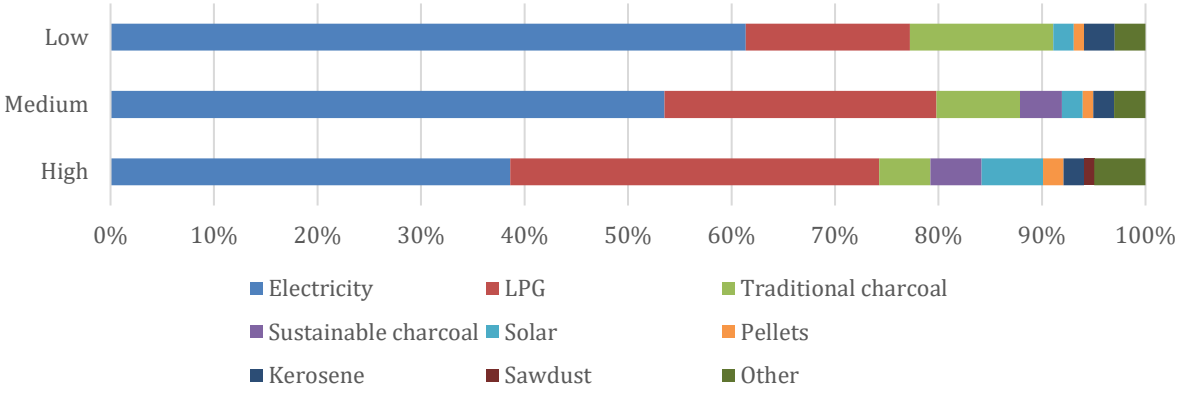


Table 14: Why households would like to use LPG and electricity

		High	Medium	Low
Reasons for preferring LPG	First Second Third	Affordable Cooks faster Not smokey	Cooks faster Clean Not smokey	Cooks faster Clean Modern
Reasons for preferring electricity	First Second Third	Cooks faster Easy to use Modern	Cooks faster Easy to use Modern	Cooks faster Clean Easy to use

While there is a clear preference for charcoal out of the fuels people already use, this does not carry through when households were asked which fuel they would prefer to use, out of all fuels they are aware of. There is clearly a desire to use electricity and LPG in all income groups, but as incomes decrease the desire to use LPG also decreases slightly and is replaced by electricity. The preference in the ***high income*** group is for electricity (39%) and LPG (36%) with electricity being seen as cooking faster, easy to use and modern. While LPG is considered affordable, cooks faster and not smokey. In the ***middle income*** group electricity (53%) and LPG (26%) are the desired fuel choices. The reasons for wanting to use these fuels are virtually the same as the high income group. For ***low income*** households 62% would like to use electricity and 16% LPG. Low income households believe LPG cooks faster, is clean to use and they view it as modern.

Figure 21: Fuels that respondents least like to use

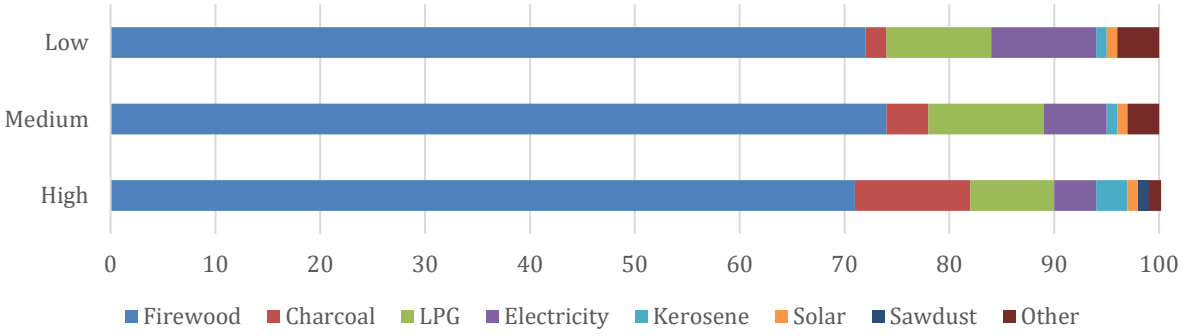


Table 15: Why respondents don't like particular fuels

		High	**Medium**	**Low**
Reasons for not liking firewood	First Second Third	Smoke concerns Dirty utensils Complicated	Smoke concerns Dirty utensils Complicated	Smoke concerns Dirty utensils Transporting fuel
Reasons for not liking LPG	First Second Third		Not safe Expensive Availability	Not safe Expensive Complicated
Reasons for not liking charcoal	First Second Third	Not safe Takes too long Dirty utensils		

There was less consensus amongst income groups when asked which fuel they would least like to use. All income groups agreed that firewood was the least preferred fuel, primarily due to concerns over smoke, utensils getting dirty and cooking with firewood being complicated. However, the high income group also disliked using charcoal (11%), while the middle and low income groups cited LPG (11% and 10% respectively) due to safety concerns, affordability, availability and a perception that it is complicated to use.

Figure 22: Appliances that respondents prefer out of the ones they use

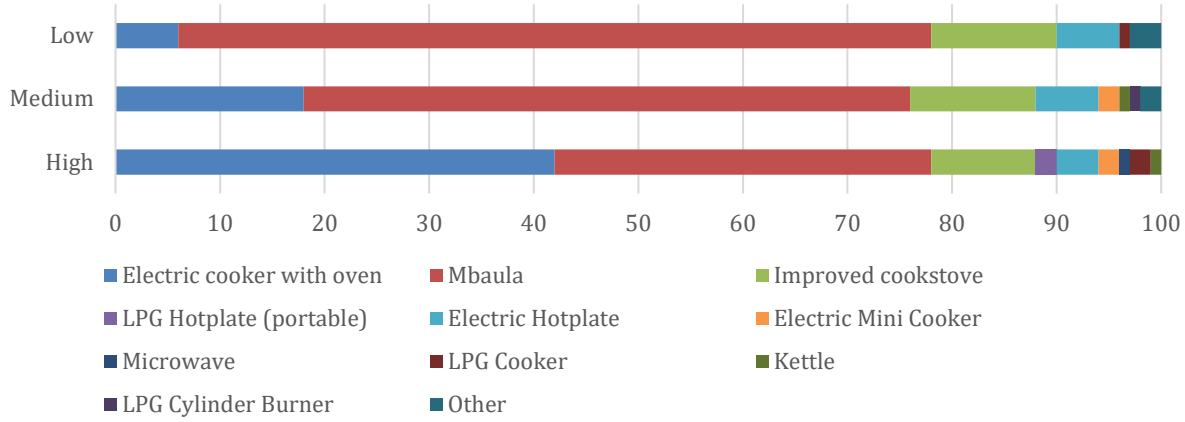


Table 16: Reasons why respondents prefer the appliances they most prefer of the ones they use

		High	Medium	Low
Reasons for preferring Mbaula?	First Second Third	Affordable Fuel is cheap Accessible	Affordable Accessible Less smoke	Affordable Cooks faster Accessible
Reasons for preferring electric cooker with oven?	First Second Third	Cooks faster Cleaner Accessible	Cooks faster Cleaner Less smoke	
Reasons for preferring the improved charcoal cookstove?	First Second Third			Fuel efficient Cooks faster Cleaner

Appliance preference closely mirrors fuel preference, with the most preferred appliances being those that use either electricity or charcoal. Similarly, preferences shift as income levels change, with high income households more likely to prefer electric appliances over those that use charcoal. As incomes decrease, the preference for charcoal powered devices increases. The ***high income*** segment prefers to use the electric cooker with oven (42%), the mbaula (36%) or an improved charcoal cookstove (10%). Whereas the ***middle income*** segment prefers to use the mbaula (58%), electric cooker with oven (18%) or an improved charcoal cookstove (12%). This trend continues with the ***low income*** segment which prefers to use the mbaula (72%), improved charcoal cookstove (12%) or the electric cooker with oven (6%). The main drivers for using the mbaula across the income groups are affordability and accessibility. For the electric cooker with oven it's the speed of cooking and the fact that its cleaner that drives preference.

Figure 23: Appliances that respondents prefer of the ones they know

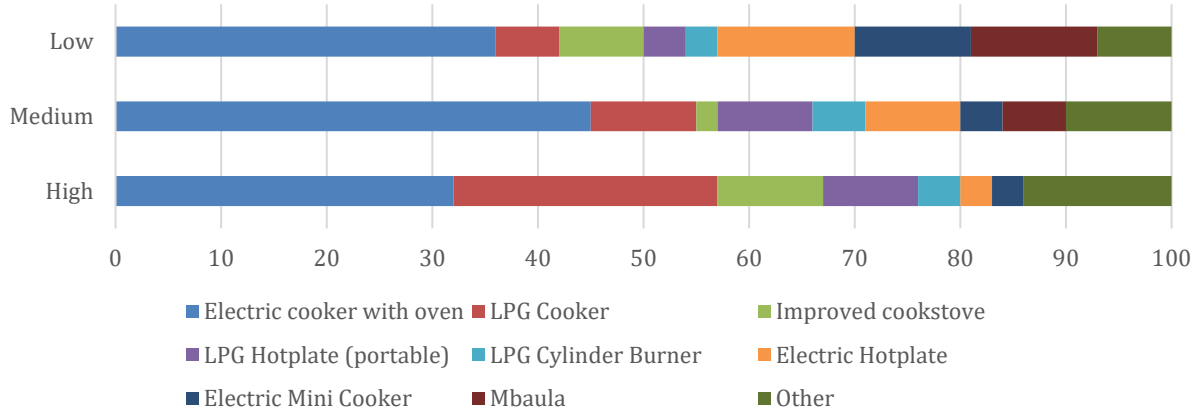


Table 17: Reasons why respondents prefer specific appliances

		High	Medium	Low
Reasons for wanting to use the electric cooker with oven?	First Second Third	Cooks faster Cleaner Modern	Cooks faster Cleaner Safe to use	Cooks faster Cleaner Less Smoke
Reasons for wanting to use the LPG Cooker?	First Second Third	Fuel efficient Cooks faster Modern	Cooks faster Cleaner Less Smoke	
Reasons for wanting to use the electric hotplate?	First Second Third			Cooks faster Cleaner Safe to use

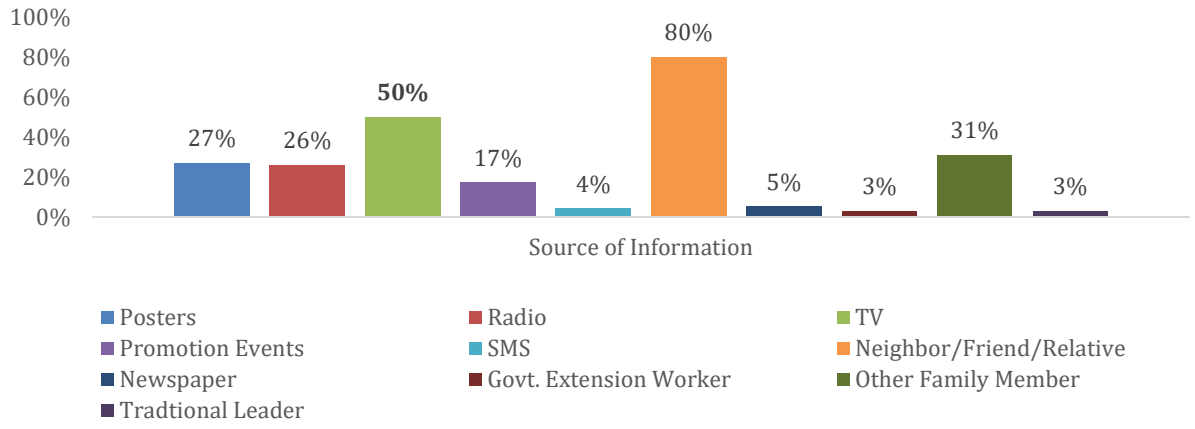
When asked which appliances households would like to use out of all that they were aware of, the results mirrored the fuel responses, with respondents across all income groups displaying a desire to use appliances that are powered by electricity or LPG. The most desirable appliance across all income groups was the electric cooker with oven (32% high, 45% middle, 36% low income). In the high and medium groups, the second most desirable appliance was the LPG cooker (25% and 10% respectively). Whereas in the low income group the second most desirable device was the electric hotplate (13%). Overall LPG appliances represented 38% of high income responses, 24% of middle income responses and 13% of low income responses. The reasons for selecting LPG appliances are not as consistent as with electric or charcoal appliances, potentially indicating that consumers are not sure what the benefits are of using LPG.

ACCESS TO INFO AND EXPOSURE TO ATFS

Across all households the main source of information on alternative fuels and appliances was from neighbors, friends and relatives (80%), followed by TV (50%). This suggests that word of mouth is a key information channel, which is presumably driven by users discussing their experience with various ATFs. This would suggest the role of community influencers and early adopters is a critical marketing strategy. It's not clear whether information through TV was delivered in the form of advertisements, or from

consumers gaining experience from films and shows they watch. Regardless, it is a powerful and trusted source of information across all income groups. Radio and posters are also important information sources.

Figure 24: Sources of information where respondents learned information relating to ATFs



When asked how they would most like to receive information on ATFs, the influence of friends, neighbors and relatives dropped dramatically, with most households across all income groups preferring to receive information through TV. In the high income group this was followed by SMS messages to their mobile phones (10%), in the middle income group it is promotional events (16%), while in the low income groups it is neighbors, friends and relatives (15%). In terms of actual messaging, price was the most important information required by high and low income groups, while the middle income group want to know how to use the ATF. General advantages and disadvantages of ATFs featured strongly in all income groups, followed by where to purchase them. Surprisingly, cleanliness did not feature highly in any income group, even though it is frequently cited as a reason why households prefer a certain fuel or appliance.

Figure 25: Sources of information respondents would most like to receive ATF information from

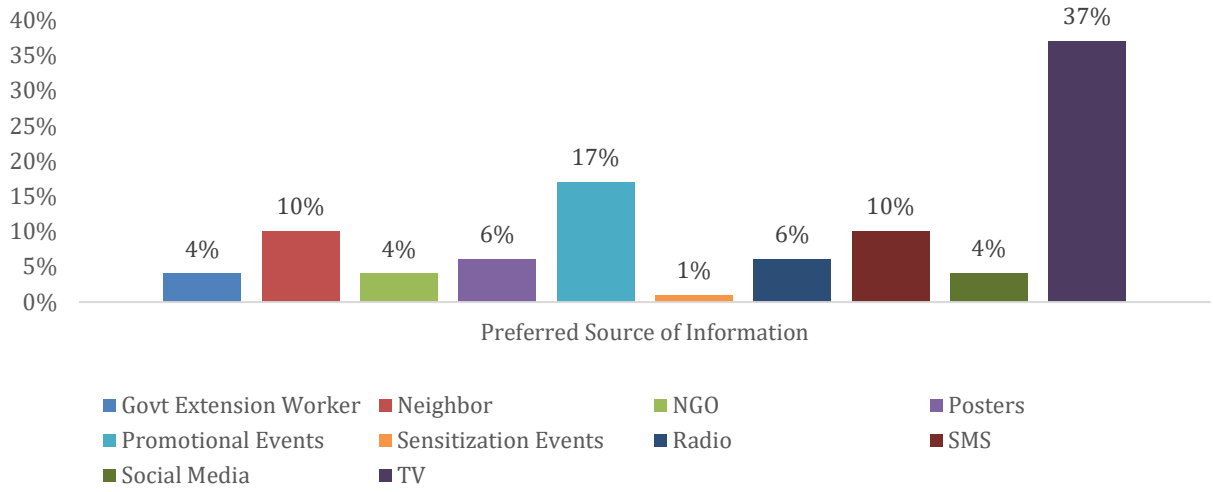
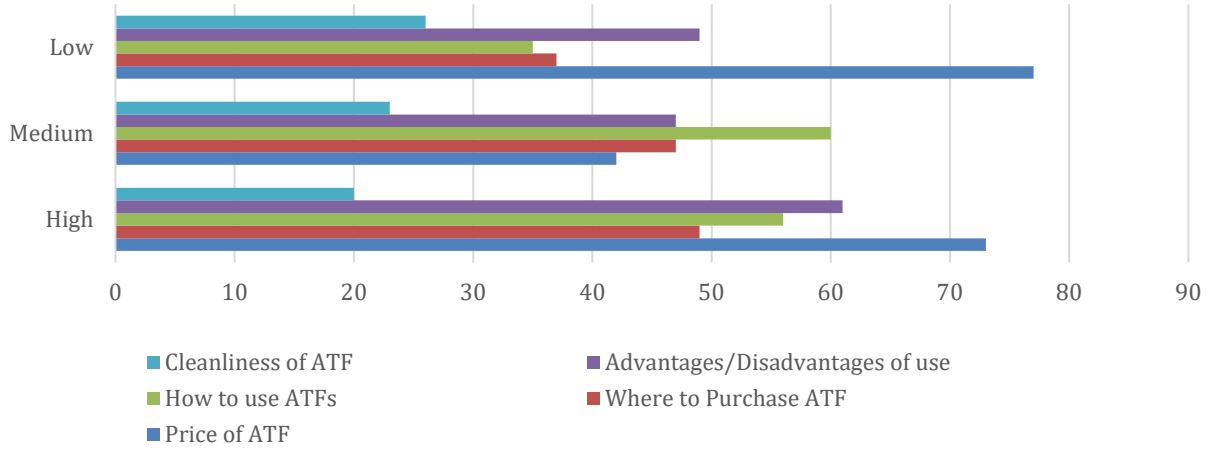


Figure 26: Information that respondents would find helpful in making an ATF purchase decision



DISCUSSION

CHARCOAL

No discussion on consumer preferences for ATFs can begin without first addressing charcoal. It is clearly the most widely known fuel and charcoal use is ubiquitous across all income groups. The traditional mbaula is the best known, and most used, appliance on the market, costing around ZMW 50 (a little over $2). While preference for, and use of, charcoal declines as incomes increase, it is still used in combination with other ATFs through the practice of fuel stacking. In fact, even in high income households it is the most used fuel, with 60% continuing to use it daily to meet their cooking needs. It can be bought in a range of sizes from small plastic bags costing ZMW 6, through to large sacks costing ZMW 314, allowing nearly unmatched flexibility. Charcoal is available in all local markets and many people purchase it at home from mobile sellers. Users point to its affordability, accessibility and cooking attributes (faster/better) as primary reasons they use it. For any ATF to be widely adopted it needs, as closely as possible, to mirror these dynamics, or clearly communicate how its advantages out weight its disadvantages, when compared to charcoal in the traditional mbaula.

ELECTRICTY

Based on the findings of this study, electricity is the number one ATF in Lusaka and already plays a significant role in the household fuel stack. This is driven by the relatively low cost of electricity in Zambia (second lowest in the region according to the Energy Regulatory Board) and the high connection rates, ranging between 60% - 98% depending on income levels. Not only is the fuel readily accessible and reasonably affordable, it is considered not just acceptable, but aspirational. Coupled with high awareness about, and accessibility of, electric cooking appliances, that cover a range of uses and prices, it is clear to see why it has become such a widely used cooking option. However, adoption of electric cooking does fall dramatically as income levels decrease and charcoal use is still prevalent in the high income group. Furthermore, "load shedding" is a significant, mainly seasonal, issue which negatively impacts consumers ability and willingness to adopt electric cooking. Given these dynamics, it is hard to ignore electricity as a key solution to addressing Lusaka's consumption of charcoal, even if the Government of the Republic of

Zambia is intending to reduce electric cooking to 20% in urban areas by 2030 through the World Bank funded Modernizing Cooking and Heating in Zambia (MCHZ) project. While this target is based on the assumption that LPG use will increase from close to 0% to 40% in the same time period, it is hard to see this materializing with the Indeni refinery currently out of operation and forex challenges associated with importing either large volumes of raw petroleum product, or LPG.

FUEL STACKING

"Fuel stacking" refers to using multiple fuel combinations within the same household for cooking. Fuel stacking is driven by the perceived inability of any single fuel or appliance to meet all the cooking needs of a household. Time, efficiency, uneven fuel availability and cultural preference all contribute to fuel stacking, as does fuel and appliance affordability.

It is clear from the consumer preference survey that fuel stacking is not just common, but the norm across all income groups. Typically, charcoal is used in combination with other fuels like electricity or wood. Stacking occurs throughout the day (different fuels for certain meals) and throughout the week (different fuels on different days). As income levels increase the proportion of electricity in the stack also increases, and as incomes decrease, the proportion of charcoal and firewood in the stack increases.

It is unlikely that accessibility is the primary driver of these dynamics, as at least 60% of low income households have access to electricity, while low income households typically travel further to purchase/collect firewood. It is also unlikely that acceptability is a primary driver, as most households in all income groups aspired to use either electricity or LPG. Therefore, as electricity is generally accessible and acceptable, it is likely that the primary driver of fuel stacking is related to affordability, both of the fuel and the corresponding appliance. However, it is still unclear whether cooking with electricity is more expensive than charcoal, or if that is a strongly held myth. Zambia has the second cheapest electricity in the region and a recently published study by the MECS project concluded that cooking with electricity, even on a hotplate at the highest tariff level, was at least cost competitive with cooking on charcoal using the traditional mbaula[1]. However, electrical cooking appliances are significantly more expensive than the traditional mbaula and may provide a barrier to adopting electricity.

The Alternatives to Charcoal project needs to clean the cooking stack by introducing higher tier, cleaner and more efficient ATFs to displace charcoal. It also needs to increase the use of existing ATFs in the stack, such as electricity and LPG. But it's important to recognize that, given the prevalence of charcoal use across income levels, charcoal consumption is unlikely to be drastically reduced in the short to medium term. Therefore, more efficient charcoal cookstoves may have an important part to play in reducing charcoal consumption in the cooking stack.

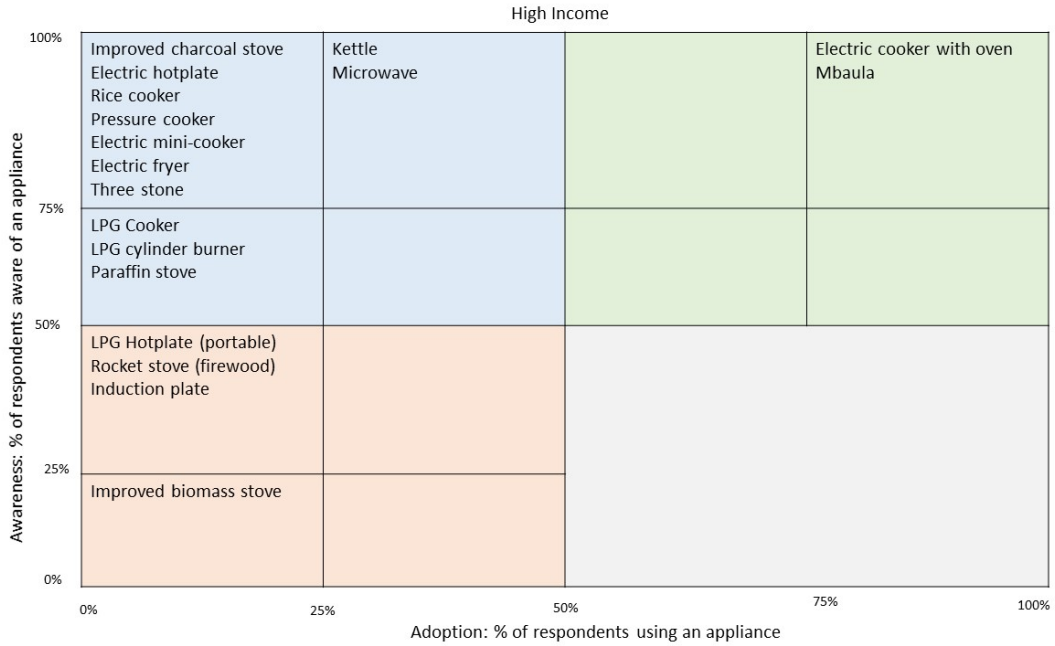
[1] [1] MECS Kitchen Laboratory – Zambia: Initial Testing for Zambian eCookbook. https://mecs.org.uk/wp-content/uploads/2021/06/MECS-Kitchen-Laboratory-%E2%80%93-Zambia.pdf

APPLIANCE AWARENESS VERSUS ADOPTION

Understanding levels of awareness and the corresponding level of adoption is key to promoting ATFs across all income groups and moving consumers away from charcoal. The study found that consumers across all income groups generally displayed high knowledge about cooking appliances, and by inference, fuels. However, this has failed to translate into adoption in most instances, suggesting challenges with affordability, accessibility, or acceptability. While this trend has generally held true across the income groups, it is clear that awareness about appliances decreases as income levels decrease; the same is true for adoption, but to a lesser extent. The tables below set out level of awareness (% of respondents reporting knowledge of an appliance) against level of adoption (% of respondents reporting use of an appliance). The table can be divided into four main quadrants: (1) low awareness and low adoption, (2) high awareness and low adoption, (3) high awareness and high adoption, and (4) low awareness and high adoption; this forth category is unlikely to materialize.

For the high income group, the electric cooker with oven and the mbaula were the only appliances that achieved both high awareness and high adoption, matching the fuel stacking observed earlier in the report. The largest concentration of appliances is found in the high awareness and low adoption category, with electrical appliances particularly well known and LPG appliances to a lesser extent. The Alternatives to Charcoal project needs to focus on converting the relatively high levels of awareness into adoption, by designing interventions that overcome affordability, accessibility, and acceptability barriers.

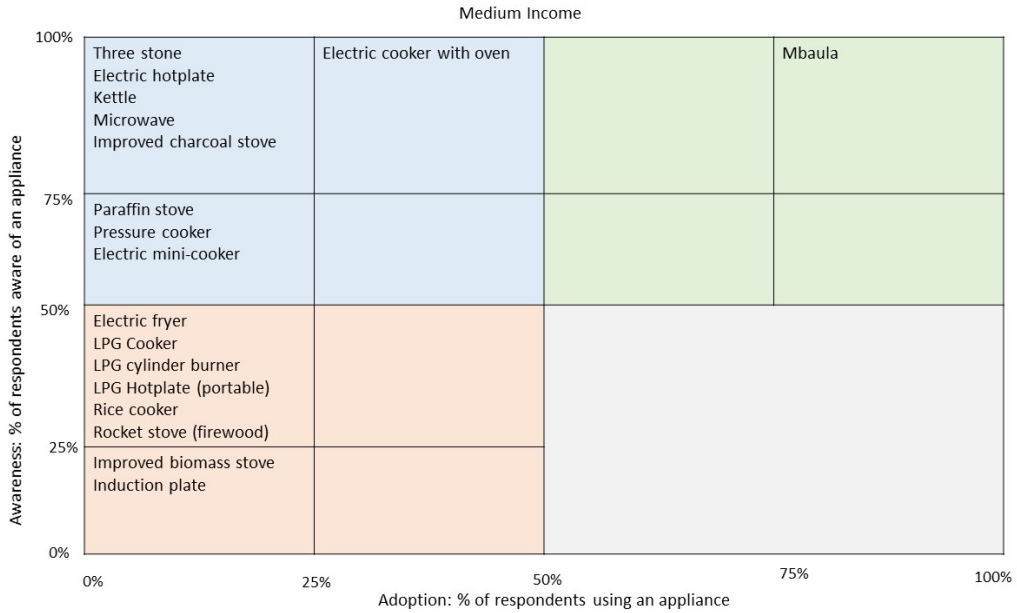
Figure 27: Awareness and adoption of appliances: high income respondents



In the medium income group, the only appliance in the high awareness and high adoption category is the traditional mbaula. The electric cooker with oven slips into the high awareness and low adoption category, although it has higher adoption rates than other appliances in this category. The high awareness and low adoption category contains most appliances. However, in this case LPG and efficient electrical appliances are not featured at all. The low awareness and low adoption group contains LPG

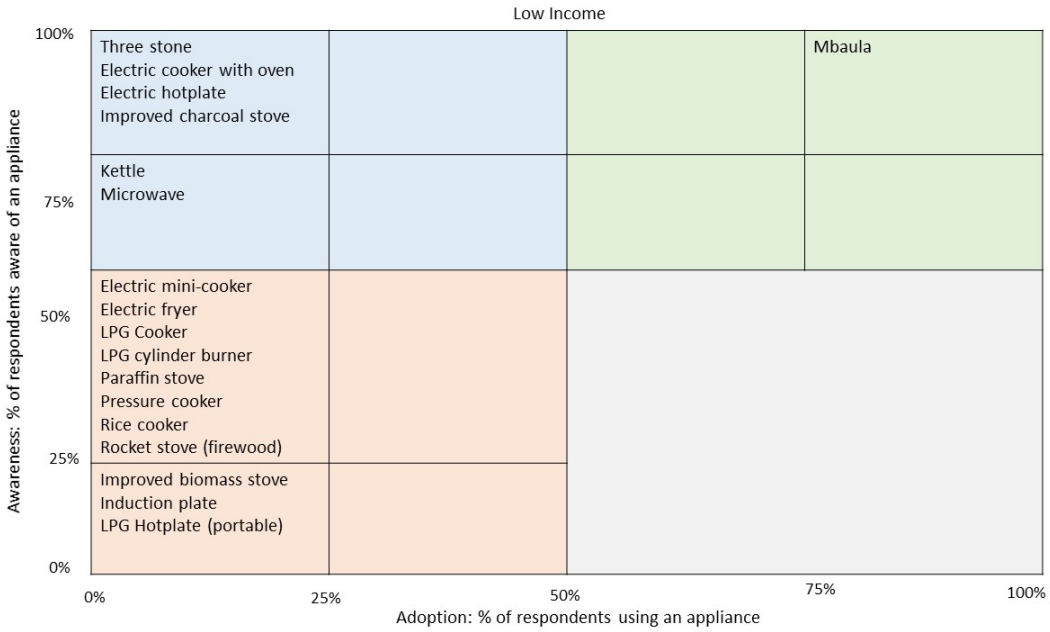
appliances, as well as efficient electrical appliances and improved wood/biomass cookstoves. The Alternatives to Charcoal project needs to utilize two strategies for this group. Firstly, increase awareness about appliances (particularly LPG) and secondly convert new and existing awareness into adoption, pushing appliances into the high awareness and high adoption group.

Figure 28: Awareness and adoption of appliances: medium income respondents



The only appliance in the high awareness and high adoption category for the low income group is the traditional mbaula. The high awareness and low adoption category contains a combination of electric devices, such as the electric cooker with oven and electric hotplate, as well as biomass (charcoal and wood) powered appliances, such as the three stone fire and the improved charcoal stove. However, the majority of appliances are clustered in the low awareness and low adoption category. These include all LPG appliances, as well as more efficient electrical appliances. For this income group, a significant amount of effort needs to be placed on increasing awareness about ATFs, before putting in place mechanisms to convert awareness into adoption.

Figure 29: Awareness and adoption of appliances: low income respondents



ACCEPTABILITY, AFFORDABILITY AND ACCESSIBILITY

Acceptability: Cooking with traditional charcoal, using a mbaula (brazier), is largely driven by long-held norms of cooking in Zambia. Although some consumers cited taste as a driver of choice (particularly with charcoal), this was not a dominant theme. Rather, consumers preference for a cooking technology/fuel was primarily informed by time saving and cost. This can be seen for example in the preference for cooking with charcoal later in the day and rather cooking on an electric appliance (where available) for breakfast preparation when speed is important.

The acceptability of the stove/fuel type were also informed by tenancy and housing style and many respondents voiced this through sentiments of the 'portability' of the mbaula and ease of cooking on it outside or while seated. With many low- and middle income consumers living in small accommodations, often without a kitchen with fittings such as stoves, the ease of use of the mbaula in different places around the home adds to its appeal. Others, however, had no option but to use charcoal because tenancy agreements did not permit the use of electricity for cooking purposes. Further, some consumers indicated that when cooking for larger families – the mbaula was better adjusted for cooking with large pots. By contrast, LPG and electric stoves are often limited to the size (and number) of pots that can be used on them. Some consumers were willing to cook with anything as long as it fulfilled its task and some were reluctant to transition to other technologies because they had become accustomed to their current cooking technologies, not necessarily that there were specific attributes of the technology they were attracted to.

Notwithstanding the widespread use of charcoal, consumers across all income groups aspired to use electric cookers because they viewed them as more convenient to use mostly because of their instant

ignition which enabled them to cook meals faster and leads to less heat loss. They also aspired to use electric cookers because the four plate electric cookers enable them to cook multiple dishes simultaneously and the oven coincided with their aspirations to bake either for business purposes or for personal satisfaction.

Of the substitutes charcoal consumers were aware of, they cited risks pertaining to safety (with regards to LPG and Paraffin) and the cost of the substitute (with regards to electricity) as factors restricting the use of such alternatives. The sources of information for reasons pertaining to the risk of fuels originated from shared stories and experiences that developed a narrative that perpetuated the fear and distrust for LPG.

Accessibility: To be competitive, ATFs need to match the accessibility dynamics of charcoal, which is present in all local markets and often delivered to the consumers door by mobile sellers. It comes in different sizes to meet a variety of different needs and it can be found all year round, although quality deteriorates in the rainy season and prices can also increase. After charcoal, electricity is the next most accessible AFT with 60% or more of urban households connected to the national grid and most, particularly in middle- and high income groups, purchasing it digitally, meaning no need to travel. However, use of digital purchasing does decrease as incomes decrease, suggesting a greater accessibility challenge for the low income group, probably driven by lower access to mobile money services. Electric appliances are also widely available, and a number of different options exist. One of the major accessibility barriers for electric cooking is the seasonal occurrence of "load shedding" which is driven by low water levels at hydro-electric dams. During a particularly poor rainy season the state utility, Zesco, requested that households reduced electric cooking and switched to other alternatives. This period saw an increase in both charcoal and LPG consumption. Other ATFs such as LPG and pellets are either less accessible, or perceived to be so by consumers, which is a major barrier that must be overcome. In terms of LPG, at the time of writing, Indeni refinery was not operational, meaning no LPG is being produced nationally and 100% is being imported; with a corresponding increase in cost.

Affordability: One of the key barriers to ATF uptake is clearly affordability, as demonstrated by the pervasive fuel stacking practiced by all households across income groups. This is clearly illustrated by electricity use, where a high number of households (even in the low income group) are connected to the grid, but the proportion cooking with electricity falls dramatically as income decreases. As these households are connected to the grid, it is unlikely that accessibility is the primary issue, and given the strong aspirations for electric cooking in all income groups, it must be deemed acceptable. Alongside this, affordability is cited as the number one concern amongst users of electricity.

To better understand ability to pay it is helpful to understand fuel expenditure as a percentage of household income. In high income households, earning more than 3,000 per month, they are currently spending on average 11% of their income on either electricity or LPG, or 9% of income on charcoal. In middle income households (1,000 – 3,000 per month) this increases to approximately 14% for users of electricity, 14% for users of charcoal and 11% for users of LPG. In low income households (<1,000 per month), users of electricity are spending on average 21% of their incomes on electricity and users of charcoal are spending 19% of their income on cooking. What is clear, is that as incomes decrease, households spend a larger portion of their income on energy needs. What is also surprising is that expenditure on different fuels is very similar within each income level, suggesting that the cost gap

between cooking on charcoal, electricity or LPG might not be as wide as consumers perceive. This aligns with the previously mentioned MECS study which found that cooking with electricity was at least cost competitive with charcoal. However, these figures do not adequately account for fuel stacking dynamics and should be treated as indicative only.

Tied to household income levels, is type of employment, which can dictate the frequency and likelihood of regular income streams. High income levels are most likely to be formally employed, which indicates regular and known income levels. Middle income consumers are more likely to be self-employed, which is likely to provide relatively more erratic incomes both in terms of amounts and frequency. While low income households are most likely to be self-employed, or earn their income informally and is therefore highly erratic.

Affordability is a particular challenge when it comes to the up-front cost of purchasing appliances, which are often above consumers ability to pay, even if there are long term cost savings compared to charcoal when using the ATF. When promoting ATFs to consumers in each group, private sector companies need to tailor their offering accordingly, with options such as PAYG opening up greater possibilities in lower and middle income groups who receive smaller and more irregular income streams. Whereas salary deduction schemes might be more appropriate for those in formal employment.

SEX AND EDUCATION

While income levels are generally a good proxy for other variables like age, sex and education levels, some critical dynamics can be overlooked if these variables are not investigated separately. For this analysis we focused on questions related to current fuel and appliance preferences, as well as fuel and appliance aspirations.

Sex: Out of the fuels respondents already use, men and women both prefer traditional charcoal, as was the case in all three income groups. However, this was stronger in female respondents (70%) than male respondents (55%). Electricity was the second most common choice for both men and women, but men (45%) were more likely to prefer it than women (25%). With regards to fuel aspirations, both men and women indicated their preference for electricity, followed by LPG. Overall women showed a stronger desire to use electricity (54%) over LPG (22%), whereas men were more divided, with 41% aspiring to use electricity and 38% LPG. In terms of appliances currently in use, women showed a strong preference for the mbaula (60%) over the electric cooker with oven (16%), mirroring the fuel use findings. Men followed suit but were once again equally divided with 41% preferring each. Appliance aspirations for both men and women centered on the electric cooker with oven and the LPG cooker. 34% of men and 38% of women cited the electric cooker with oven as their most desired appliance. Whereas 27% of men and 10% of women cited the LPG cooker. Overall, female respondents, who typically do most of the cooking, showed preferences for charcoal and aspirations to use electricity. Men generally held the same views, although held stronger preferences for LPG.

Education: Out of all the fuels already in use, preference for electricity increased as education levels increased; conversely, as education levels decreased the preference for charcoal increased. Aspirationally, electricity was the most desired fuel at all education levels, but desire to use LPG increased as education levels increased. All education levels aspired to use the electric cooker with oven

the most. But the second most aspirational appliance amongst the secondary and tertiary levels was the LPG cooker, while for those with primary education it was the electric hotplate and for those with no education it was either the electric hotplate, or the electric mini-cooker.

CONSUMER PROFILES

Through the consumer preference survey, we have been able to identify and describe three consumer segments based on different income levels (low, medium, high). While each has a distinct profile, they are best viewed on a continuum where each overlap with the next. As income levels increase, consumers show increasing use of electricity, as well as aspirations for increased electricity and LPG use. Knowledge and use of appliances also increase with income, particularly for electrical appliances. But overall, knowledge of appliances is not generally converted into adoption in all of the consumer segments.

Table 18: Consumer profile of high income segment

	High Income Segment
Demographics	6 people / household, married, well educated, formally employed (>3000/month)
Fuel Knowledge	High for electricity, LPG, charcoal and firewood; moderate for pellets and briquettes
Fuel most used	Charcoal
Fuel stacking	Mainly electricity and charcoal (69%), charcoal only (11%)
Fuel Expenditure*	Electricity ZMW 355, LPG ZMW 350, firewood ZMW 80, charcoal ZMW 276
Fuel Aspirations	39% electricity (faster, easy to use, modern) and 36% LPG (affordable, faster, not smokey)
Appliance knowledge	High for electrical appliances including efficient devices, moderate for LPG devices
Appliance most used	Traditional Mbaula (42%)
Appliance Aspirations	Electric cooker with oven (32%), LPG Cooker (25%), improved charcoal stove (10%)
Improved cookstove	27% already own, 64% would buy, paying between 120 – 165, preferably in cash
Access to info	Predominantly receiving info from friends, neighbors and relatives, as well as TV

*Average monthly amount for users of each type of fuel- cannot be summed across fuels to arrive a total monthly fuel expenditure

High income households are already conducting a significant amount of cooking with electricity and own a number of electric appliances. They should therefore be targeted for increased electricity consumption, potentially on more efficient appliances, such as electric pressure cookers. Alongside this, a number may be convinced to either introduce LPG to their cooking stack or increase existing consumption. Improving accessibility should greatly increase adoption and consumption of LPG. Awareness needs to be increased about LPG appliance options, so that consumers can make informed decisions about which meet their needs. Knowledge of pellets is also high, but corresponding knowledge about improved biomass stoves is low, this is a gap that companies should look to address. Messaging around ATFs should focus on speed of cooking, ease/flexibility of use and affordability. Messaging should be delivered primarily through social influencers and TV. Due to the high level of formal employment, salary deductions might prove an

attractive financing mechanism for this consumer segment, as well as the private sector. Demand for low-cost improved charcoal cookstoves is high and is a potential opportunity for the private sector.

Table 19: Consumer profile of middle income segment

	Middle Income Segment
Demographics	6 people / household, married, secondary education, self-employed (1000 - 3000/month)
Fuel Knowledge	High for electricity, LPG, charcoal and firewood; moderate for solar and paraffin
Fuel most used	Charcoal
Fuel stacking	Electricity and charcoal (40%), charcoal only (30%)
Fuel Expenditure*	Electricity ZMW 210, LPG ZMW 175, firewood ZMW 150, charcoal ZMW 207
Fuel Aspirations	53% electricity (faster, easy to use, modern) and 26% LPG (clean, faster, not smokey)
Appliance knowledge	High for electrical appliances, moderate for LPG as well as efficient devices
Appliance most used	Traditional Mbaula (67%)
Appliance Aspirations	Electric cooker with oven (34%), LPG Cooker (10%), LPG Hotplate (10%)
Improved cookstove	24% already own, 66% would buy, paying between ZMW 95 – 145, preferably in cash
Access to info	Predominantly receiving info from friends, neighbors and relatives, as well as TV

*Average monthly amount for users of each type of fuel- cannot be summed across fuels to arrive a total monthly fuel expenditure

Although medium income households include electricity in their fuel stack, they have a significantly higher use of charcoal. Electricity and LPG are the aspirational fuels for this income group and 87% are already connected to the grid, but only 53% are currently cooking with electricity. Therefore, the strategy for this group should be two pronged. Firstly, increase electricity use amongst those who already practice electric cooking, so they do less of their cooking with charcoal. And secondly, encourage those that are not cooking with electricity to either switch to electricity, or LPG. With regards to appliances, middle income households aspire to use an electric cooker with oven, but this might be outside their ability and willingness to pay. However, they are the only group where electric hotplates featured in the top three aspirational appliances and this may represent the best appliance opportunity, given their income levels. LPG was the aspirational choice for 26% of middle income households and should be explored further by the private sector. Consumers in this segment believe electricity to be expensive, but like that it cooks faster and is easy to use. They also believe LPG to be expensive, find availability a challenge and have concerns about safety. For companies promoting other ATFs, such as pellets, they need to first address awareness levels and communicate how their products provide the same benefits as other known ATFs (fast, easy to use, clean, modern).

Table 20: Consumer profile of low income segment

	Low Income Segment
Demographics	6 people / household, married, primary education, self-employed (<1000/month)
Fuel Knowledge	High for electricity, charcoal and firewood; moderate for LPG, solar and paraffin
Fuel most used	Charcoal
Fuel stacking	Charcoal only (45%), firewood and charcoal (25%), electricity and charcoal (18%)
Fuel Expenditure*	Electricity ZMW 210, firewood ZMW 150, charcoal ZMW 194
Fuel Aspirations	62% electricity (faster, easy to use, clean) and 16% LPG (clean, faster, modern)
Appliance knowledge	High for electrical devices & charcoal ICS, low for LPG & efficient devices
Appliance most used	Traditional Mbaula (80%)
Appliance Aspirations	Electric cooker with oven (36%), electric hotplate (13%)
Improved cookstove	22% already own, 74% would buy, paying between ZMW 75 – 120, preferably in cash
Access to info	Predominantly receiving info from friends, neighbors and relatives, as well as TV

*Average monthly amount for users of each type of fuel- cannot be summed across fuels to arrive a total monthly fuel expenditure

In the low income group, the shift to charcoal as the predominate fuel is even more pronounced, with 45% of households only cooking with charcoal, 25% cooking with firewood and charcoal and only 18% cooking with electricity and charcoal. However, 60% are connected to the national grid, using electricity for lighting, phone charging and entertainment only. They have high awareness for electricity, charcoal and firewood, but only moderate awareness of LPG as a cooking fuel. This dynamic is even more pronounced with appliances, with most households being aware of electric cooking appliances and the improved charcoal cookstove, but low awareness levels about LPG cooking devices. It is interesting to note the difference between awareness of LPG as a cooking fuel (moderate) and the awareness of LPG cooking devices (low). This might, in part, explain the relatively low aspiration to cook with LPG (16%), as consumers are unaware of the appliance options available to them and how these meet their needs. This is supported by the fact that the top two aspirational appliances are both electric. Affordability is a key barrier in this group and is likely to be driving the low electric cooking use, when compared to the relatively high levels of grid connection. This applies to both the appliance and the fuel. An opportunity exists to increase awareness related to the cost of cooking on charcoal versus electricity to encourage more households to switch to electric cooking. Due to the high upfront costs of adopting LPG and the low awareness levels, this ATF might be difficult to promote in this income group. However, technology innovations like PAYG LPG could help to tip the balance through consumer financing. In fact, for any ATF to be successful in this group, it needs to mirror charcoal use as closely as possible. This group is most likely to buy charcoal in small, daily use, quantities due to their low- and erratic-income levels. While ability to pay for improved charcoal cookstoves appears to be low in this group, there is significant demand (74%). Therefore, an opportunity exists to promote a low cost, more efficient charcoal stove, similar to the Kenyan Ceramic Jiko.

RECOMMENDATIONS

The following section provides recommendations based on the survey results and analyses presented in this report. Recommendations are organized into three categories, each one representing a different audience. The first set of recommendations are intended for the USAID Alternatives to Charcoal project to consider when designing programmatic strategies and interventions. The second set of recommendations are geared towards private sector actors operating in Zambia's clean cooking sector. Finally, policy and regulatory-oriented recommendations are proposed for the Government of Zambia (GRZ).

USAID ALTERNATIVES TO CHARCOAL

- **Electricity: The promotion of electric cooking as an alternative to charcoal needs to be explored further by the project.** Electricity use, and aspiration to use, is high amongst all income groups. Electricity is also widely available and already accepted by consumers as an efficient cooking technology. Therefore, A2C needs to determine its strategy for supporting electricity as one of the leading ATFs which can significantly reduce charcoal consumption. Consideration needs to be given to electricity accessibility (supply and reliability), as well as appliance affordability and acceptability. Some key challenges include load shedding, the actual and perceived cost of using electricity to cook, and future changes in electricity generation. Additionally, the project should explore what role landlords play in low income households with respect to disallowing electricity for cooking.

- **LPG: Despite being widely known, LPG use is minimal, so strategies need to be put in place to address the considerable barriers that are limiting uptake, including cost, availability and safety concerns.** After electricity, households demonstrated a desire to use LPG, which decreased as income levels decreased (16-36%). Load shedding is also likely have an impact on potential uptake of LPG, and should be factored into when and how the project promotes LPG adoption. A2C also needs to focus less on creating awareness about LPG and instead address why awareness of LPG is not translating into uptake, and more carefully consider which groups it promotes LPG to.

- **Improved Charcoal Cookstoves: Use of, and demand for, improved charcoal cookstoves is relatively high, A2C needs to put in place strategies to capitalize on this.** Improved cookstove ownership is surprisingly high across income groups (22-27%) and desire to purchase is also high (74-64%), with households considering a purchase if products were priced at around 120 – 165 ZMW. Given that improved cook stoves are generally more affordable than other ATF's and the fuel (charcoal) is already readily available, A2C should consider including Improved Charcoal Cookstoves as part of the suite of ATFs supported by the project to reduce charcoal consumption in urban areas. It is recommended the issue be discussed during FY22 work planning and a position paper on the issue be produced for submission to USAID.

- **Other ATFs: Knowledge and use of ATFs outside of electricity, charcoal and LPG is minimal, so A2C needs to work closely with the private sector to increase awareness and adoption.** Outside of the high income group, very few consumers are aware of options such as pellets and briquettes, while ethanol does not feature at all. Yet, even when consumers demonstrate awareness, this has not translated into adoption. Therefore, A2C needs

to work closely with the private sector to improve marketing efforts, drawing on lessons learned from more widely known ATFs, such as electricity and LPG.

- **Fuel Stacking: Use of multiple fuels and appliances is the norm, so A2C needs to better understand the drivers and identify strategies to enhance use of ATFs already in the stack.** Most households are using charcoal in combination with other fuels and on several appliances. The project must acknowledge that eliminating household use of charcoal altogether (in any income group) is not practically achievable. Rather the focus should be on identifying strategies to encourage a shift *in the mix* of fuel stacking, namely reduced use of charcoal and increased use of alternatives.

- **Consumer Segments: Households can be split into three broad consumer segments based on income levels.** A2C needs to identify bespoke strategies that will be most effective for each segment. Typically, high income households have high awareness levels and higher levels of ATF adoption. This falls as income levels fall and is likely to be driven predominantly by affordability issues. A2Cs interventions should be designed to take these dynamics into account.

- **Sex and Education: A2C should ensure its interventions are designed with both men and women in mind, as well as being aware of the influence education can exert.** While income levels are a fairly reliable proxy for these variables, they do hide some important nuances, so A2C needs to ensure these are captured and used to inform intervention strategies. For example, men seem to have a slight preference for LPG over women. This is also true with education, as more educated consumers have a higher preference for LPG.

- **Affordability: The cost of the fuel and appliance seem to be major barriers to adoption, so A2C needs to better understand how the cost of cooking on ATFs compares to charcoal.** Consumers cite affordability as a major barrier to adoption and increased use. However, evidence is emerging (this study, MECS, CEDAIR) that cooking with electricity could be at least cost competitive with charcoal. Therefore, A2C should explore this in more detail to quantify the cost competitiveness of alternatives, as compared to charcoal, and work with the private sector to develop communication campaigns that clearly convey the cost savings.

- **SBCC: Reasons driving consumer preferences need to be incorporated into all SBCC and communications materials.** Respondents liked that electricity and LPG are fast, easy to use and clean. While they liked that charcoal is affordable, accessible and cooks faster, but they did not like that charcoal is not safe, takes too long to prepare a meal and makes utensils dirty. A2C needs to build these themes into its SBCC campaigns and speak directly to the issues that consumers care about. Attention should be paid to the role influencers can play, as most people receive their information from friends, neighbors and relatives. Promotional events can also play an important role in allowing consumers to interface with both the ATF and the supplier.

- **Awareness versus Adoption: Sensitization and awareness raising about ATFs is important, but it needs to be more targeted.** Results indicate that even when there is a high level of awareness around a particular ATF (such as LPG) this does not translate into actual use. In other words, it is not a lack of awareness about alternatives that is driving the limited uptake of ATFs. A2C needs to focus on addressing why people do not like certain ATFs, and conversely what characteristics about the fuels and appliances consumers do like and aspire to

use. Lessons learnt from the Consumer Preference Study must be incorporated into all communication and marketing materials.

PRIVATE SECTOR

- **Consumer Segments: ATF providers need to clearly align their products with the appropriate consumer segment.** Given the differences in consumer profiles in each segment, private sector companies need to be clear about which segment fits best with their product, or design/retail products that meet the needs of a particular segment. For example, high income households may be best suited to electric pressure cookers, while pellets in an improved biomass stove could be best suited to middle income households and improved charcoal cookstoves to low income households. Attention needs to be paid to how sex and education affect aspirations. Once the segment has been identified, resources should be deployed into locations, and communication channels, that will reach the target audience.

- **Awareness versus Adoption: The private sector needs to place more emphasis on converting awareness into adoption.** Barriers to acceptability, affordability and accessibility need to be identified and overcome for awareness to be converted into adoption. Wherever possible, replicating the dynamics of the charcoal sector will likely increase adoption.

- **LPG: The largest gap between awareness and adoption is in the LPG sector, therefore LPG suppliers must implement several strategies to bridge this divide.** Among consumers there appears to be a disconnect between awareness of the fuel and awareness of the appliances. Therefore, companies should more clearly communicate the range of appliance options and how these meet the needs of consumers. Safety and accessibility concerns were commonly cited by consumers across all income groups and can be addressed through targeted awareness raising as well as increased distribution of cylinders and LPG appliances. Consumers also demonstrated less uniformity when asked about the benefits of LPG, suggesting these are not clearly known to them. Awareness of, and aspiration to use, LPG is significantly higher in the high income segment, so particular attention should be paid to this group. One potential approach would be to provide a home delivery service for LPG canister refills to reduce the accessibility barrier. Additionally, technological innovations like pay-as-you-go LPG may open up a substantial new market in lower income groups.

- **Other ATFs: Knowledge and use of ATFs outside of electricity, charcoal and LPG is minimal, so the private sector needs to learn lessons from these fuels.** Suppliers of ATFs such as pellets, ethanol and briquettes must adapt consumer preference lessons from other ATFs and apply it to their products. For example, consumers like that electricity and LPG cooks fast, is easy to use and clean. Wherever possible suppliers of other ATFs should replicate these themes in their messaging. Similarly, users of charcoal like that it is affordable, accessible and cooks faster.

- **Consumer Financing: Affordability is a key barrier to adoption of ATFs, so the private sector needs to identify consumer financing mechanisms.** A2C should engage with private sector stakeholders to identify how the project can support a range of consumer financing options. These include but are not limited to introducing and/or scaling up pay-as-you go technologies and appliances, supporting integration with micro-finance institutions and solar companies, establishing clean cooking savings and loans schemes, and developing salary deduction schemes that link private business to ATF providers so employees can more easily afford to purchase ATFs and fuel. The choice of financing mechanism needs to match the

appropriate consumer segment and align as closely as possible to a consumer's ability and willingness to pay, which is informed, in part, by how much they spend on fuel compared to their income.

- **Improved Charcoal Cookstoves: Awareness of, and demand for, these appliances is high amongst all income groups, so the private sector should consider ways they can capitalize**. While the ability to pay for these appliances is relatively low, there is significant demand for a mid-range efficient charcoal cookstove, that closely matches current practices, but reduces fuel consumption. A2C will analyze results from focus group discussions, this study and the market analysis to provide more detailed information about the primary factors limiting the adoption of improved cookstoves, both from a demand and supply perspective. Results should be shared and discussed with private sector partners to identify how A2C can work to address these barriers most effectively. These discussions will also inform a position paper to be drafted by A2C that justifies the rationale for supporting adoption of Improved Charcoal Cookstoves to reduce charcoal consumption and clarifies the types of support to be provided.
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GOVERNMENT OF THE REPUBLIC OF ZAMBIA

- **National Clean Cooking Strategy: A2C should support the GRZ to develop a national clean cooking strategy to guide all stakeholders in the sector**. A national strategy needs to recognize that fuel use is not binary, with households commonly practicing fuel stacking. It also needs to take into consideration that income levels significantly dictate the types and frequency of fuels used. As such, it should embrace a range of fuels and technologies that meet the affordability, accessibility and acceptability requirements of a wide range of consumers. It should embrace the significant gains made by electric cooking and address the barriers that have kept LPG use low. It should recognize and enact regulations that create an enabling environment for the apparent demand for low-cost improved charcoal cookstoves, such as the Kenyan Ceramic Jiko, as well as developing less known ATFs, such as ethanol, which could enhance the countries energy security, while providing clean, modern and affordable cooking solutions. A2C's support could include working with GRZ to develop a Terms of Reference for a National Clean Cooking Strategy, support for a launch event to draft the Strategy, gathering feedback from private sector on the Strategy and convening of validation workshops.

- **Electricity: The leading ATF in Lusaka is electric cooking, and the government should deliberately design policies to increase its use.** While we recognize issues with electricity supply and reliability, electricity is the leading ATF in Lusaka. This report has found that decreasing electricity use for cooking is correlated with increasing use of charcoal, followed by firewood. In addition, the MECS study found that cooking with electricity on a hotplate is at least cost competitive with charcoal, while the USAID funded CEADIR Cost Benefit Analysis concluded that cooking with electricity on a single burner hotplate had the lowest financial cost to households, as well as the lowest economic costs to Zambia. It also concluded that cooking with LPG had the highest financial cost to households. Given these dynamics, the role that electric cooking can play in reducing charcoal consumption cannot be ignored. In fact, any strategy to reduce electric cooking risks pushing consumers back to charcoal, particularly given the reality that cooking with other major alternatives, such as LPG, is likely to be more costly to households, who are highly price sensitive. A2C should encourage electric cooking as part of the

broader suite of ATF alternatives that are being promoted by the project, emphasizing the responsible use of electricity and its potential role as part of the household fuel stack in order to reduce the use of charcoal.

- **LPG: GRZ should put in place clear strategies to improve the enabling environment for LPG.** Use of LPG for household cooking is negligible, yet demand exists, particularly in higher income households. Therefore, the GRZ needs to implement practical changes to improve the affordability (waiving VAT/duty, recommencing production at Indeni), availability (cross filling of canisters) and acceptability (safety awareness campaigns) of LPG as a residential cooking fuel. Likewise, GRZ should coordinate with LPG dealers to increase awareness campaigns on the various uses of LPG as a source of energy as well as training on the use of LPG equipment.

- **LPG Regulations: GRZ regulatory bodies, such as ERB, should examine how to improve regulations/policies/permitting to encourage growth of the LPG sector.** A2C can play a role in convening regulators to focus on issues around distribution, storage and transportation of cylinders. Likewise, regulating cross-cylinder (re)fueling to ensure safety and inventory control should be an option to be examined by the ERB and the private sector as a strategy to potentially increase the availability and accessibility of LPG.

ANNEX 1: ATERNATIVE TECHNOLOGIES AND FUELS IN ZAMBIA

Traditional Charcoal  Lightweight black carbon residue produced by strongly heating wood in minimal oxygen to remove all water and volatile constituents used for cooking and heating on a brazier.	**Briquettes**  A compressed block of charcoal dust or other biomass material used for heating and cooking. Briquette are used on both traditional brazier and Improved cook stoves
Firewood  Wooden material that is gathered and used for fuel. Generally used unprocessed and is in some sort of recognizable log or branch form, compared to other forms of wood fuel like pellets or chips.	**Pellets**  Solid fuels made from compressed organic matter or biomass mainly agricultural residues and compacted sawdust.
Paraffin Stove 	**Mbaula (Brazier)** 

Uses Kerosene as a fuel and available as either wick or pressurized stoves	A perforated container with multiple openings used to burn charcoal or other solid fuel for cooking and heating.
3 Stone Stove  With 3 stone Stove a cooking vessel is placed very close to the fire itself, limiting excessive waste of heat. Uses firewood, briquettes, and twigs as fuel.	**Mud Stoves**  The **stove** consists of one or two openings through which fuel wood is fed and ash is removed, with raised lumps where pots can rest.
LPG Cylinder Burner  Gas cylinder with nozzle and pot supporter. LPG Cylinder burners provide easy cooking anywhere.	**LPG Cooker**  Use bottled gas and has strong flame and ignites instantly
LPG Hotplate  A Portable self-contained tabletop small gas cooktop appliance with one or more heating elements	**Ethanol Gel Fuel**  Made when biomass is converted to sugars, which are then fermented and distilled into ethanol. Provides instant energy upon ignition.

Electric Hotplate  A Portable self-contained tabletop small Electric cooktop appliance with one or more heating elements	**Electric Fryer**  *Appliance that use deep frying* method of cooking where food is submerged into oil at high heat.
Electric Mini Cooker  A portable tabletop two plate appliance with an oven.	**Microwave Oven**  An electric appliance that heats food by passing *microwave* radiation through it.
Induction Plate  Electric appliance uses electromagnetic coils to heat the cookware that prepares your food.	**Pressure Cooker**  Airtight pots that generate high-pressure steam to cook food faster than traditional pots and frying pans.
Electric kettle	**Rice Cooker**

 Appliance for boiling water quickly, saving energy and time.	 Kitchen appliance designed to bring rice to a boil, sense when it needs to simmer, and then lower the heat so it doesn't overcook
Solar Water Geysers  Uses heat from the sun to heat water using convection transfer of energy.	**Electric Cooker**  Consists of an *electric cooktop* for preparing meals and an *electric range* oven that cooks and bakes your food
Improved Cook Stoves  Improved cook stoves are biomass stoves designed to maximize thermal and fuel efficiency, operate safely, and minimize emissions harmful to human health	

ANNEX II: CONSUMER PREFERENCE SURVEY INSTRUMENT

CAPI ID:

Survey Start Time:

GPS Coordinates:

Enumerator Name:

Interview Date:

Select Ward:

Select Residential Area:

Are you willing to participate in this Survey?

- ○ Yes (If Yes, continue with interview)
- ○ No (If No, end interview and thank respondent for their time))

SECTION A: DEMOGRAPHICS

a.1. Name of respondent

a.2. Sex of respondent

○ Male ○ Female

a.3. Age of respondent

a.4. Marital status of the respondent

- ○ Married
- ○ Widowed
- ○ Divorced
- ○ Separated
- ○ Never Married
- ○ No Response/Do not know

a.5. Highest level of education attained by respondent?

- ○ Primary School
- ○ Secondary School
- ○ Tertiary Education
- ○ None

a.6. How many people live in this Household?

a.7. What is the relationship of the respondent to the household head (HHH)?

- ○ Household Head
- ○ Spouse
- ○ Daughter/Son
- ○ Brother/Sister
- ○ Mother/Father
- ○ Other relation
- ○ House help/Maid

a.8. What is the sex of the HH head?

○ Male ○ Female

a.9. What is the age of the HH head?

a.10. What is the highest level of education attained by the HH head?

- ○ Primary School

- Secondary School
- Tertiary Education
- Non

a.11. What is the main source of income for the household?

- Formal work/ Employment
- Seasonal employment
- Informal work
- Business/ self-employment
- Agricultural activities
- Other (specify)

a.12. What is your monthly average household Income?

- Less than K500.00
- K500.00 - K1,000.00
- K1,000.00 - K3,000.00
- More than K3,000.00

SECTION B: ENERGY SOURCES AND STOVES

b.1. Fuel/Energy Types

b.1.1. Which of the following fuels or energy sources do you know of? (Multiple Selection Answer)

- Electricity
- Liquid Petroleum Gas (LPG)
- Traditional charcoal
- Sustainable charcoal
- Firewood
- Pellets
- Briquettes
- Sawdust
- Paraffin
- Other agricultural residues
- Solar

b.2.a. Which fuel/energy source do you use the MOST for cooking/heating water in your HH?

- Electricity
- Liquid Petroleum Gas (LPG)
- Traditional charcoal
- Sustainable charcoal
- Firewood
- Pellets
- Briquettes
- Sawdust
- Other agricultural residues
- Paraffin
- Solar
- Not Applicable
- Other specify

b.1.2.b. Which fuel/energy source do you use the LEAST for cooking/heating water in your HH?

- Electricity
- Liquid Petroleum Gas (LPG)
- Traditional charcoal
- Sustainable charcoal
- Firewood
- Pellets
- Briquettes
- Sawdust
- Other agricultural residues
- Paraffin

- Solar
- Not Applicable
- Other specify

b.2. Who is responsible for buying fuel/energy used for cooking/heating water in your HH?

- Me only
- Me and my spouse
- My spouse only
- Another family member only
- Other relations
- Not sure/Don't know

b.2. Fuel/Energy Usage

b.2.1 Do you use Electricity for cooking/heating water?

○ Yes ○ No

b.2.1.a How long have you been using Electricity?

- 0 to 6months
- 6months to 1year
- 1 to 2 years
- 2 to 3 years
- More than 3 years
- Don't know

b.2.1.b How often in a week do you use Electricity?

- Everyday
- 1 day a week
- 2 days a week
- 3 days a week
- 4 days a week
- 5 days a week
- Never

b.2.2 Do you use Liquefied Petroleum Gas (LPG) for cooking/heating water?

○ Yes ○ No

b.2.2.a How long have you been using Liquefied Petroleum gas (LPG)?

- 0 to 6months
- 6months to 1year
- 1 to 2 years
- 2 to 3 years
- More than 3 years
- Do not know

b.2.2.b How often do you use Liquefied Petroleum Gas?

- Everyday
- 1 day a week
- 2 days a week
- 3 days a week
- 4 days a week
- 5 days a week
- Never

b.2.3 Do you use Traditional Charcoal for cooking/heating water?

○ Yes ○ No

b.2.3.a. How long have you been using Traditional Charcoal?

- 0 to 6months
- 6months to 1year
- 1 to 2 years
- 2 to 3 years
- More than 3 years

- Do not know

b.2.3.b. How often in a week do you use Traditional Charcoal?

- Everyday
- 1 day a week
- 2 days a week
- 3 days a week
- 4 days a week
- 5 days a week
- Never

b.2.4 Do you use Sustainable Charcoal for cooking/heating water?

○ Yes ○ No

b.2.4.a. For how long have you been using Sustainable Charcoal?

- 0 to 6months
- 6months to 1year
- 1 to 2 years
- 2 to 3 years
- More than 3 years
- Do not know

b.2.4.b. How often in a week do you use Sustainable Charcoal?

- Everyday
- 1 day a week
- 2 days a week
- 3 days a week
- 4 days a week
- 5 days a week
- Never

b.2.5 Do you use Firewood for cooking/heating water?

○ Yes ○ No

b.2.5.a. For how long have you been using Firewood?

- 0 to 6months
- 6months to 1year
- 1 to 2 years
- 2 to 3 years
- More than 3 years
- Do not know

b.2.5.b. How often in a week do you use Firewood?

- Everyday
- 1 day a week
- 2 days a week
- 3 days a week
- 4 days a week
- 5 days a week
- Never

b.2.6 Do you use Pellets for cooking/heating water?

○ Yes ○ No

b.2.6.a. How long have you been using Pellets?

- 0 to 6months
- 6months to 1year
- 1 to 2 years
- 2 to 3 years
- More than 3 years
- Do not know

b.2.6.b. How often in a week do you use Pellets?

- Everyday
- 1 day a week
- 2 days a week

- 3 days a week
- 4 days a week
- 5 days a week
- Never

b.2.7 Do you use Briquettes for cooking/heating water?

○ Yes ○ No

b.2.7.a. For how long have you been using Briquettes?

- 0 to 6months
- 6months to 1year
- 1 to 2 years
- 2 to 3 years
- More than 3 years
- Do not know

b.2.7.b. How often in a week do you use Briquettes?

- Everyday
- 1 day a week
- 2 days a week
- 3 days a week
- 4 days a week
- 5 days a week
- Never

b.2.8 Do you use Sawdust for cooking/heating water?

○ Yes ○ No

b.2.8.a. For how long have you been using Sawdust?

- 0 to 6months
- 6months to 1year
- 1 to 2 years
- 2 to 3 years
- More than 3 years
- Do not know

b.2.8.b. How often in a week do you use Sawdust?

- Everyday
- 1 day a week
- 2 days a week
- 3 days a week
- 4 days a week
- 5 days a week
- Never

b.2.9 Do you use Agricultural residues for cooking/heating water?

○ Yes ○ No

b.2.9.a. For how long have you been using agricultural residues?

- 0 to 6months
- 6months to 1year
- 1 to 2 years
- 2 to 3 years
- More than 3 years
- Do not know

b.2.9.b. How often in a week do you use agricultural residues?

- Everyday
- 1 day a week
- 2 days a week
- 3 days a week

-
- 4 days a week
- 5 days a week
- Never

b.2.10. Do you use Paraffin for cooking/heating water?

○ Yes ○ No

b.2.10.a. For how long have you been using Paraffin?

- 0 to 6months
- 6months to 1year
- 1 to 2 years
- 2 to 3 years
- More than 3 years
- Do not know

b.2.10.b. How often in a week do you use Paraffin?

- Everyday
- 1 day a week
- 2 days a week
- 3 days a week
- 4 days a week
- 5 days a week
- Never

b.2.11 Do you use Solar for cooking/heating water?

○ Yes ○ No

b.2.11.a. For how long have you been using Solar?

- 0 to 6months
- 6months to 1year
- 1 to 2 years
- 2 to 3 years
- More than 3 years
- Do not know

b.2.11.b. How often in a week do you use Solar?

- Everyday
- 1 day a week
- 2 days a week
- 3 days a week
- 4 days a week
- 5 days a week
- Never

b.2.12.a. Do you use any Other Energy source for cooking/heating water?

○ Yes ○ No

b.2.12.b. What is the name of the other fuel/energy source you use?

b.2.12.c. For how long have you been using the other fuel/energy source?

- 0 to 6months
- 6months to 1year
- 1 to 2 years
- 2 to 3 years
- More than 3 years

- Do not know

b.2.12.d. How often do you use other fuel/energy sources?

- Everyday
- At least 3 days per week
- Once a week
- Never

b.3. Cooking Stoves/Appliances

b.3.1 Which of the following fuel-efficient cook stoves/appliances do you know of? (Multiple selection answer)

- Improved Cook stove (Improved Mbaula)
- Improved biomass stove
- Rocket stove (Firewood)
- Electric hotplate
- Induction plate
- Electric cooker (oven with plates)
- Rice cooker
- Microwave
- Electric mini cooker Kettle
- Pressure cooker
- Electric fryer
- LPG Cylinder burner
- LPG hotplate (portable burner)
- LPG cooker
- Paraffin Stove

b.3.2 Which type of cooking stove/appliance do you use? (Multiple selection answer)

- Mbaula
- Improved Cook stove
- Improved biomass stove
- Three Stone
- Mud-stove
- Electric Hotplate
- Induction Plate
- Electric Cooker (Oven with plates)
- Rice Cooker
- Microwave
- Electric mini cooker
- Kettle
- Pressure Cooker
- Electric Fryer
- LPG Cylinder burner
- LPG Hotplate (Portable burner)
- Other specify (if other, go to next question)

b.3.2.a. Of the cooking stove/appliances above, which do you use most?

- Mbaula
- Improved Cook stove
- Improved biomass stove
- Three Stone

- Mud-stove
- Electric Hotplate
- Induction Plate
- Electric Cooker (Oven with plates)
- Rice Cooker
- Microwave
- Electric mini cooker
- Kettle
- Pressure Cooker
- Electric Fryer
- LPG Cylinder burner
- LPG Hotplate (Portable burner)
- Other Specify

b.3.2.b. For how long have you been using this type of cooking stove/appliance?

b.3.3.b. Why do you choose to use that cooking stove/appliance the most? (Multiple selection answers)

- Easier to use
- Cooks faster
- More efficient/uses less fuel
- Cleaner
- It uses cheap fuel
- It is cheap to purchase
- Easily accessible
- Safety
- Load shedding
- Other specify (if other, go to next question)

b.3.3 Of all the stoves/appliances mentioned, which one do you use least often?

- Mbaula
- Improved Cook stove
- Improved biomass stove
- Three Stone
- Mud stove
- Electric Hotplate
- Induction Plate
- Electric Cooker (Oven with plates)
- Rice Cooker
- Microwave
- Electric mini cooker
- Kettle
- Pressure Cooker
- Electric Fryer
- LPG Cylinder burner
- LPG Hotplate (Portable burner)
- LPG Cooker
- Paraffin stove
- Not Applicable

b.3.3.a For how long have you been using this type of cooking stove/appliance?

b.3.4.b. Why do you choose to use that cooking stove/appliances the least? (Multiple selection answer)

- Hard to use/complicated

- Takes longer to prepare meals
- Uses too much fuel
- The fuel it uses is expensive
- The stove/ appliance is expensive to purchase
- Not easily accessible
- Safety
- Load shedding
- Other specify (if other, go to next question)

b.3.4.d. What is the main use for the cooking stove/appliance that you least use?

- Cooking foods that take longer
- Cooking foods that take less time
- Heating water
- Heating the home
- Making beverages
- Not sure/Don't know
- Other specify (If other, go to next question)

b.3.4 Who does most of the cooking in your household?

- Self
- Spouse
- Own child
- Another adult
- Another child
- House help/maid
- Not sure/Don't know
- Other relation

b.3.5 Take photo of 1st Main cooking stove/appliance

b.3.6 Take photo of 2nd Main cooking stove/appliance

b.3.7 Take photo of 3rd Main (back-up) cooking stove/appliance

b.4. Cooking Stove/Appliance Purchase

b.4.1. Who decides on which cooking Stove/Appliance to purchase?

- Me only
- Me and my spouse
- Me & another family member
- My spouse only
- Another family member only
- It was a gift
- Other relations
- Don't know

b.4.2. Where do you usually purchase the cooking stove(s)/appliance(s)?

- Local Artisan
- Formal shop (e.g. Supermarkets)
- Informal shop (e.g. Individual seller)
- Traditional Market Place
- Not sure/Don't know
- Other specify

SECTION C: MEAL PREPARATION

c.1. Breakfast Preparation

c.2. Do you do any cooking or water heating using fuel/energy for breakfast preparation?

○ Yes ○ No ○ Not sure/Don't know

c.3. Which cooking stove/appliance do you prefer to use for breakfast preparation?

- ○ Mbaula
- ○ Improved cook stove
- ○ Three stone
- ○ Mud stove
- ○ Electric Hotplate
- ○ Induction plate
- ○ Electric Cooker (Oven with plates)
- ○ Rice Cooker
- ○ Microwave
- ○ Electric mini cooker
- ○ Kettle
- ○ Pressure cooker
- ○ Electric Fryer
- ○ LGP Cylinder burner
- ○ LGP Hot plate (Portable burner)
- ○ LPG Cooker
- ○ Paraffin stove
- ○ Other specify

c.4. Why do you prefer this cook stove/appliance at breakfast?

c.1.4 What fuel/energy source does the cook stove/appliance use?

- ○ Electricity
- ○ Liquefied Petroleum Gas (LPG)
- ○ Traditional charcoal
- ○ Sustainable charcoal
- ○ Firewood
- ○ Briquettes
- ○ Pellets
- ○ Sawdust
- ○ Other agricultural residues
- ○ Kerosene
- ○ Solar
- ○ Other specify (if other, go to next question)

c.5. Lunch Section

c.6. Do you do any cooking or water heating using fuel/energy for preparation of Lunch?

○ Yes ○ No ○ Not sure/Don't know

c.7. Which cooking stove/appliance do you prefer to use for lunch preparation?

- ○ Mbaula
- ○ Improve cook stove
- ○ Improved biomass stove
- ○ Three stone
- ○ Mud stove
- ○ Electric Hotplate
- ○ Induction plate
- ○ Electric Cooker (Oven with plates)

- Rice Cooker
- Microwave
- Electric mini cooker
- Kettle
- Pressure cooker
- Electric Fryer
- LGP Cylinder burner
- LGP Hot plate (Portable burner)
- LPG Cooker
- Paraffin stove
- Other specify

c.8. Why do you prefer this cook stove/appliance at Lunch?

c.9. What fuel/energy source does the cook stove/appliance use?

- Electricity
- Liquefied Petroleum Gas (LPG)
- Traditional charcoal
- Sustainable charcoal
- Firewood
- Briquettes
- Pellets
- Sawdust
- Other agricultural residues
- Kerosene
- Solar
- Other specify (if other, go to next question)

c.10. Dinner Section

c.11. Do you do any cooking or water heating using fuel/energy for preparation of Dinner?

○ Yes ○ No ○ Not sure/Don't know

c.12. Which cooking stove/appliance do you prefer to use during Dinner preparation?

- Mbaula
- Improve cook stove
- Improved biomass stove
- Three stone
- Mud stove
- Electric Hotplate
- Induction plate
- Electric Cooker (Oven with plates)
- Rice Cooker
- Microwave
- Electric mini cooker
- Kettle
- Pressure cooker
- Electric Fryer
- LGP Cylinder burner
- LGP Hot plate (Portable burner)

- LPG Cooker
- Paraffin stove
- Other specify

c.13. Why do you prefer this cook stove/appliance at Dinner?

c.14. What fuel/energy source does the cook stove/appliance use?

- Electricity
- Liquefied Petroleum Gas (LPG)
- Traditional charcoal
- Sustainable charcoal
- Firewood
- Briquettes
- Pellets
- Sawdust
- Other agricultural residues
- Kerosene
- Solar
- Other specify

C.4. Cooking from Home for Business

c.4.1. Do you have a business that requires cooking or heating water?

○ Yes ○ No ○ Not sure/Don't know

c.4.2. What is the business?

c.4.3. Which cooking stove/appliance do you prefer to use during preparation of meals for your business?

- Mbaula
- Improve cook stove
- Improved biomass stove
- Three stone
- Mud stove
- Electric Hotplate
- Induction plate
- Electric Cooker (Oven with plates)
- Rice Cooker
- Microwave
- Electric mini cooker
- Kettle
- Pressure cooker
- Electric Fryer
- LGP Cylinder burner
- LGP Hot plate (Portable burner)
- LPG Cooker
- Paraffin stove
- Other specify (if other, go to the next question)

c.4.4. Why do you prefer this cook stove/appliance for your business?

c.4.5. What fuel/energy source does the cook stove/appliance use?
- Electricity
- Liquefied Petroleum Gas (LPG)
- Traditional charcoal
- Sustainable charcoal
- Firewood
- Briquettes
- Pellets
- Sawdust
- Other agricultural residues
- Kerosene
- Solar
- Other specify

SECTION D: FUEL PURCHASING

d.1. Purchasing Electricity

d.1.1. Do you purchase electricity for your HH use?

○ Yes ○ No ○ Not sure/Don't know

d.1.2. Who in the HH purchases the electricity units?
- Me only
- Me and my spouse
- Me & another family member
- My spouse only
- Another family member only
- Other relations
- Not sure/Don't know

d.1.3. How much do you spend on electricity in a month (ZWM)

d.1.4. What is the approximate distance in Kilometers (KMs) from home to where electricity units are purchased? (Answer zero if purchase is digital)

d.1.5. What do you like most about cooking with electricity?
- Affordable/ costs less
- Easier to use
- Cooks faster
- Cleaner to use
- Modern
- Easily accessible
- Not smoky
- Cooks better

- Can leave to cook without having to watch over
- This is the only fuel I can get
- Other specify (if other reasons, go to the next question)

d.1.6.a. What do you like least about cooking with electricity?

- Power cuts
- Variable power
- Expensive
- Takes longer to prepare a meal
- Other specify (if other, go to next question)

d.2. Purchasing LPG Gas...

d.2.1. Do you purchase LPG Gas Cylinder(s) for your HH use?

○ Yes ○ No ○ Not sure/Don't know

d.2.2. Who in the HH purchases the LPG Gas Cylinders?

- Me only
- Me and my spouse
- Me & another family member
- My spouse only
- Another family member only
- Other relations
- Not sure/Don't know

d.2.3. What size LPG Gas Cylinder (in KG) do you buy?

- 2kg
- 3kg
- 4kg
- 4.5kg
- 5kg
- 6kg
- 7kg
- 7.5kg
- 9kg
- 19kg

d.2.4. How long does one LPG Gas Cylinder last in weeks?

d.2.5. How much do you spend on LPG Gas in a month (ZWM)

d.2.6. What is the approximate distance in Kilometers (KMs) from home to where you purchase the LPG Gas Cylinders?

d.2.7. What do you like most about LPG Gas as a fuel/energy source?

- Affordable/ costs less
- Easier to use
- Cooks faster
- Cleaner to use
- Modern
- Easily accessible
- Not smoky

- Cooks better
- Can leave to cook without having to watch over
- This is the only fuel I can get
- Other specify

d.2.7.a. What do you like least about using LPG for cooking/heating water?

- Availability is erratic
- Transporting cylinders is difficult
- Worried about safety of gas
- Other (if other, go to next question)

d.3. Purchasing Firewood

d.3.1 Do you purchase and/or gather Firewood for your HH use?

○ Yes ○ No ○ Not sure/Don't know

d.3.2. Who in the HH purchases the Firewood?

- Me only
- Me and my spouse
- Me & another family member
- My spouse only
- Another family member only
- Other relations
- Not sure/Don't know

d.3.3. How often do you buy the firewood?

- Daily
- Every two days
- Once a week
- Once a month
- Twice a month
- More than Twice a month

d.3.4. Where do you buy the firewood?

- Local market
- Central market
- Mobile sellers (on a bicycle)
- Buy when travelling
- Other (if other, go to the next question)

d.3.5. What is the unit price of the firewood?

d.3.6. How long does a unit of Firewood last in weeks?

d.3.7. What is the unit of firewood that you most commonly buy?

- Small bundle
- Medium bundle
- Large bundle

d.3.8. What is the total amount of money spent in a week on firewood?

d.3.9. What do you like most about using Firewood?

- Affordable/ costs less

- Easier to use
- Cooks faster
- Cleaner to use
- Modern
- Easily accessible
- Not smoky
- Cooks better
- Can leave to cook without having to watch over
- This is the only fuel I can get
- Other specify (if other reasons, go to the next question)

d.3.10. What do you like least about using firewood for cooking/boiling water?

- Not safe
- Expensive
- Takes longer to prepare a meal
- Availability is erratic
- Transporting the fuel is difficult
- It is too involving/ complicated
- Makes cooking utensils dirty
- Worried about smoke
- Other specify (if other, go to next question)

d.4. Purchasing Traditional Charcoal

d.4.1. Do you purchase Traditional Charcoal for your HH use?

○ Yes ○ No ○ Not sure/Don't know

d.4.2. Who in the HH purchases the Traditional Charcoal?

- Me only
- Me and my spouse
- My spouse only
- Me & another family member
- Another family member only
- Other relations
- Not sure/Don't know

d.4.3. How often do you buy the Traditional Charcoal?

- Daily
- Every two days
- Once a week
- Once a month
- More than once a month
- Other (if other, go to next question)

d.4.4. Where do you purchase Traditional Charcoal?

- Local market
- Central market
- Mobile sellers (on a bicycle)

- Buy when travelling
- Other (if other, go to next question)

d.4.5. What is the approximate distance from home to where the Traditional Charcoal is purchased? (KMs)

d.4.6. What is the unit of Traditional Charcoal that you most commonly buy?

- Small plastic bag/heap
- Medium Plastic Bag/heap
- 5-liter bucket with raised top
- 25kg bag
- 50kg bag flat
- 50kg bag with raised top (90kg)
- 90kg bag with raised top (120kg)
- Other specify (if other, go to next question)

d.4.7. What is the unit price of the Traditional Charcoal? (ZMW)

d.4.8. How long does a unit of Traditional Charcoal last?

- Half a day
- A day
- 2 days
- 5 days
- 1 week
- 2 weeks
- 3 weeks
- 1 month
- More than 1 month

d.4.10. What do you like most about using Traditional Charcoal?

- Affordable/ costs less
- Easier to use
- Cooks faster
- Cleaner to use
- Modern
- Easily accessible
- Not smoky
- Cooks better
- Can leave to cook without having to watch over
- This is the only fuel I can get
- Other specify (if other, go to next question)

d.4.11. What do you like the least about using Traditional Charcoal?

- Not safe
- Expensive
- Takes longer to prepare a meal
- Availability is erratic
- Transporting the fuel is difficult
- It is too involving/ complicated
- Makes cooking utensils dirty
- Worried about smoke
- Other specify (if other, go to next question)

d.5. Purchasing Biomass

d.5.1. Do you purchase Biomass for your HH use?

○ Yes ○ No ○ Not sure/Don't know

d.5.2. Who in the HH purchase biomass?

- Me only
- Me and my spouse
- My spouse only
- Me & another family member
- Another family member only
- Other relations
- Not sure/Don't know

d.5.3. What type of Biomass do you purchase?

- Pellet
- Briquette
- Woodchips
- Other (if other, go to next question)

d.5.4. How often do you buy the biomass?

- Daily
- Every two days
- Once a week
- Once a month
- More than once a month
- Other (if other, go to next question)

d.5.5. Where do you purchase the biomass?

- Local market
- Central market
- Mobile sellers (on a bicycle)
- Buy when travelling
- Other specify (if other, go to next question)

d.5.6. What is the approximate distance from home to where the Biomass is purchased? (KMs)

d.5.7. What is the unit of Biomass that you most commonly buy?

- Small jumbo/heap
- Medium jumbo/heap
- Large jumbo/heap
- 5litre bucket with raised top
- 5litre bucket flat
- 25kg bag
- 50kg bag flat
- 50kg bag with raised top
- 90kg bag
- Other specify (if other, go to next question)

d.5.8. What is the unit price of the Biomass? (ZMW)

d.5.9. How long does a unit of Biomass last in weeks?

d.5.10. What is the total amount of money spent in a week on Biomass?

d.5.11. What do you like about Biomass as a fuel/energy source?

- Affordable/ costs less
- Easier to use
- Cooks faster
- Cleaner to use
- Modern
- Easily accessible
- Not Smokey
- Cooks better
- Can leave to cook without having to watch over
- This is the only fuel I can get
- Other specify (if other, go to next question)

d.5.12. Do you have any problems using Biomass for fuel/energy?

○ Yes (if yes, go to next question) ○ No

d.5.13.a. If yes, what is the main problem?

- Not safe
- Expensive
- Takes longer to prepare a meal
- Availability is erratic
- Transporting the fuel is difficult
- It is too involving/ complicated
- Makes cooking utensils dirty
- Worried about smoke
- Other specify (if other, go to next question)

SECTION E: PERCEPTIONS AND MOTIVATIONS

e.1. Cooking Fuels

e.2. Of the fuel/energy you use for cooking, which is your most preferred type?

- Electricity
- Liquefied Petroleum Gas (LPG)
- Traditional Charcoal
- Sustainable charcoal
- Firewood
- Pellets
- Briquettes
- Sawdust
- Other agricultural residues
- Kerosene
- Solar
- Other specify (if other, go to next question)

e.2.a. What is the FIRST most important reason why you prefer this cooking fuel/energy?

- Affordable/ costs less
- Easier to use
- Cooks faster
- Cleaner to use

- Modern
- Easily accessible
- Not Smokey
- Cooks better
- Can leave to cook without having to watch over
- This is the only fuel I can get
- Other specify
- Not Applicable

e.1.2.a. What is the SECOND most important reason why you prefer this cooking fuel/energy?

- Affordable/ costs less
- Easier to use
- Cooks faster
- Cleaner to use
- Modern
- Easily accessible
- Not Smokey
- Cooks better
- Can leave to cook without having to watch over
- This is the only fuel I can get
- Other specify
- Not Applicable

e.1.2.d. What is the THIRD most important reason why you prefer this cooking fuel/energy?

- Affordable/ costs less
- Easier to use
- Cooks faster
- Cleaner to use
- Modern
- Easily accessible
- Not Smokey
- Cooks better
- Can leave to cook without having to watch over
- This is the only fuel I can get
- Other specify
- Not Applicable

e.1.3. Of all the cooking fuel/energy types you know, which cooking fuel/energy type would you MOST like to use if you could?

- Electricity
- Liquefied Petroleum Gas (LPG)
- Traditional Charcoal
- Sustainable charcoal
- Firewood
- Pellets
- Briquettes
- Sawdust
- Other agricultural residues
- Kerosene
- Solar
- Other specify (if other, go to next question)

e.1.4.a. What is the FIRST most important reason why you prefer this cooking fuel/energy?

- Affordable/ costs less
- Easier to use
- Cooks faster
- Cleaner to use
- Modern
- Easily accessible
- Not Smokey
- Cooks better
- Can leave to cook without having to watch over
- This is the only fuel I can get
- Other specify
- Not Applicable

e.1.4.b. What is the SECOND most important reason why you prefer this cooking fuel/energy?

- Affordable/ costs less
- Easier to use
- Cooks faster
- Cleaner to use
- Modern
- Easily accessible
- Not Smokey
- Cooks better
- Can leave to cook without having to watch over
- This is the only fuel I can get
- Other specify
- Not Applicable

e.1.4.c. What is the THIRD most important reason why you prefer this cooking fuel/energy?

- Affordable/ costs less
- Easier to use
- Cooks faster
- Cleaner to use
- Modern
- Easily accessible
- Not Smokey
- Cooks better
- Can leave to cook without having to watch over This is the only fuel I can get
- Other specify
- Not Applicable

e.1.5. Of all the cooking fuel/energy types you know, which is your LEAST preferred cooking fuel/energy?

- Electricity
- Liquefied Petroleum Gas (LPG)
- Traditional Charcoal
- Sustainable charcoal
- Firewood
- Pellets
- Briquettes
- Sawdust
- Other agricultural residues
- Kerosene

- Solar
- Other specify (if other, go to next question)

e.1.6.a. What is the FIRST most important reason why you least prefer this cooking fuel/energy?

- Not safe
- Expensive
- Takes longer to prepare a meal
- Availability is erratic
- Transporting the fuel is difficult
- It is too involving/ complicated
- Makes cooking utensils dirty
- Worried about smoke
- Other specify
- Not Applicable

e.1.6.b. What is the SECOND most important reason why you least prefer this cooking fuel/energy?

- Not safe
- Expensive
- Takes longer to prepare a meal
- Availability is erratic
- Transporting the fuel is difficult
- It is too involving/ complicated
- Makes cooking utensils dirty
- Worried about smoke
- Other specify
- Not Applicable
- Other specify

e.1.6.c. What is the THIRD most important reason why you least prefer this cooking fuel/energy?

- Not safe
- Expensive
- Takes longer to prepare a meal
- Availability is erratic
- Transporting the fuel is difficult
- It is too involving/ complicated
- Makes cooking utensils dirty
- Worried about smoke
- Other specify
- Not Applicable
- Other specify

e.3. Cooking Stoves/Appliances

e.4. Of the cooking stoves/appliances you use, which is your MOST preferred?

- Mbaula
- Improve cook stove
- Improved biomass stove
- Three stone
- Mud stove
- Electric Hotplate

- Induction plate
- Electric Cooker (Oven with plates)
- Rice Cooker
- Microwave
- Electric mini cooker
- Kettle
- Pressure cooker
- Electric Fryer
- LGP Cylinder burner
- LGP Hot plate (Portable burner)
- LPG Cooker
- Paraffin stove
- Other specify (if other, go to the next question)

e.2.2.a. What is the FIRST most important reason why you prefer this cooking stove/appliance?

- Affordable
- Fuel Efficient
- Cooks faster
- Cleaner to use
- Modern
- Easily accessible
- Less or no smoke
- The fuel used is cheaper
- Portable
- Safe to use
- Cannot easily break/ durable
- Other specify
- Not Applicable

e.2.2.b. What is the SECOND most important reason why you prefer this cooking stove/appliance?

- Affordable
- Fuel Efficient
- Cooks faster
- Cleaner to use
- Modern
- Easily accessible
- Less or no smoke
- The fuel used is cheaper
- Portable
- Safe to use
- Cannot easily break/ durable
- Other specify
- Not Applicable

e.2.2.c. What is the THIRD most important reason why you prefer this cooking stove/appliance?

- Affordable
- Fuel Efficient
- Cooks faster
- Cleaner to use
- Modern
- Easily accessible

- Less or no smoke
- The fuel used is cheaper
- Portable
- Safe to use
- Cannot easily break/ durable
- Other specify
- Not Applicable

e.2.3. Of all the cooking stoves/appliances you know, which stove/appliance would you MOST like to use if you could?

- Mbaula
- Improve cook stove
- Improved biomass stove
- Three stone
- Mud stove
- Electric Hotplate
- Induction plate
- Electric Cooker (Oven with plates)
- Rice Cooker
- Microwave
- Electric mini cooker
- Kettle
- Pressure cooker
- Electric Fryer
- LPG Cylinder burner
- LPG Hot plate (Portable burner)
- LPG Cooker
- Paraffin stove
- Other specify (if other, go to the next question)

e.2.4.a. What is the FIRST most important reason why you would MOSTLY like to use this cooking stove/appliance if you could?

- Affordable
- Fuel Efficient
- Cooks faster
- Cleaner to use
- Modern
- Easily accessible
- Less or no smoke
- The fuel used is cheaper
- Portable
- Safe to use
- Cannot easily break/ durable
- Other specify
- Not Applicable

e.2.4.b. What is the SECOND most important reason why you would MOSTLY like to use this cooking stove/appliance if you could?

- Affordable
- Fuel Efficient
- Cooks faster
- Cleaner to use

- Modern
- Easily accessible
- Less or no smoke
- The fuel used is cheaper
- Portable
- Safe to use
- Cannot easily break/ durable
- Other specify
- Not Applicable

e.2.4.c. What is the THIRD most important reason why you would MOSTLY like to use this cooking stove/appliance if you could?

- Affordable
- Fuel Efficient
- Cooks faster
- Cleaner to use
- Modern
- Easily accessible
- Less or no smoke
- The fuel used is cheaper
- Portable
- Safe to use
- Cannot easily break/ durable
- Other specify
- Not Applicable

e.2.5. Of all the cooking stoves/appliances you know, which is your LEAST preferred stove/appliance?

- Mbaula
- Improve cook stove
- Improved biomass stove
- Three stone
- Mud stove
- Electric Hotplate
- Induction plate
- Electric Cooker (Oven with plates)
- Rice Cooker
- Microwave
- Electric mini cooker
- Kettle
- Pressure cooker
- Electric Fryer
- LGP Cylinder burner
- LGP Hot plate (Portable burner)
- LPG Cooker
- Paraffin stove
- Other specify (if other, go to the next question)

e.2.4.a. What is the FIRST most important reason why this is your least preferred stove/appliance?

- Expensive to buy
- Difficult to use
- Takes longer to cook
- Involves getting dirty

- Not Easily accessible
- Makes utensils dirty
- Not modern
- Too much smoke
- Its fuel used is expensive
- Other specify
- Not Applicable

e.2.4.b. What is the SECOND most important reason why this is your least preferred stove/appliance?

- Expensive to buy
- Difficult to use
- Takes longer to cook
- Involves getting dirty
- Not Easily accessible
- Makes utensils dirty
- Not modern
- Too much smoke
- Its fuel used is expensive
- Other specify
- Not Applicable

e.2.4.c. What is the THIRD most important reason why this is your least preferred stove/appliance?

- Expensive to buy
- Difficult to use
- Takes longer to cook
- Involves getting dirty
- Not Easily accessible
- Makes utensils dirty
- Not modern
- Too much smoke
- Its fuel used is expensive
- Other specify
- Not Applicable

SECTION F: IMPROVED COOK STOVES

f.1. Do you have an improved cooking stove?

○ Yes ○ No

f.2. How often do you use an improved stove in a week?

- Everyday
- 1 day a week
- 2 days a week
- 3 days a week
- 4 days a week
- 5 days a week
- Never

f.3. If improved cooking stoves were readily available and affordable to you, would you buy?

○ Yes ○ No ○ Not sure/Don't know

○ Not Applicable (Already owns improved stove)

f.4. a. If yes, what is the FIRST most important reason why you would buy?

- Just to try them out
- Current stove is not fuel efficient
- Can afford to buy
- Fuel efficient
- Portable
- Affordable
- Safe to use
- Other specify
- Not Applicable

f.4.b. If yes, what is the SECOND most important reason why you would buy?

- Just to try them out
- Current stove is not fuel efficient
- Can afford to buy
- Fuel efficient
- Portable
- Affordable
- Safe to use
- Other specify
- Not Applicable

f.4.c. If yes, what is the THIRD most important reason why you would buy?

- Just to try them out
- Current stove is not fuel efficient
- Can afford to buy
- Fuel efficient
- Portable
- Affordable
- Safe to use
- Other specify
- Not Applicable

f.5.a. If no, what is the FIRST most important reason why you would NOT buy?

- Not interested
- Satisfied with current cook stove
- Cannot afford
- Other specify
- Not Applicable

f.5.b. If no, what is the SECOND most important reason why you would NOT buy?

- Not interested
- Satisfied with current cook stove
- Cannot afford
- Other specify
- Not Applicable

f.5.c. If no, what is the THIRD most important reason why you would NOT buy?

- Not interested
- Satisfied with current cook stove
- Cannot afford
- Other specify
- Not Applicable

f.6. What attributes would influence you to buy an improved cooking stove? (Multiple selection answer)

- Affordable
- Fuel Efficient
- Cooks faster
- Cleaner to use
- Modern
- Easily accessible
- Less or no smoky
- The fuel used is cheap
- Portable
- Cannot easily break/ durable
- Other specify (if other, go to next question)

f.7. At what price would you consider the improved cook stove too expensive to buy? (ZMW)

f.8. At what price would the improved stove start to get expensive, so that you would have to give some thought to buying it? (ZMW)

f.9. At what price would you consider the improved cook stove to be a good buy for the price? (ZMW)

f.10. At what price would you consider the improved cook stove too low that quality would be a concern? (ZMW)

f.11. How would you prefer to pay for an improved cooking stove?

- Cash
- Loan
- Mobile Money
- Other specify

f.12. In your area, do you know where improved cooking stoves are sold?

○ Yes ○ No ○ Not sure/Don't know

f.13. Where in your area are improved cook stoves sold?

- At a Local Artisan
- At a Formal shop (Pick n Pay, etc.)
- At an Informal shop (Local kantemba)
- At a Market place
- Other specify (if other, answer next question)

SECTION G: ACCESS TO INFORMATION & EXPOSURE TO ALTERNATIVE FUELS/ENERGIES

g.1. How did you learn about the alternative fuels you know of? (Multiple selection answer)

- Posters
- Radio
- TV

- Promotional events
- SMS
- Newspapers
- Neighbor/ friend/ relatives
- NGO extension worker
- Govt extension worker
- Other family member
- Traditional leaders
- Other specify (if other, go to next question)

g.2. How would you prefer to get more information on alternative fuels?

- Posters
- Radio
- TV
- Promotional events
- SMS
- Newspapers
- Neighbor/ friend/ relatives
- NGO extension worker
- Govt extension worker
- Other family member
- Traditional leaders
- Other specify (if other, go to next question)

g.3. What information on alternative cooking fuels would help you to decide to use it? (Multiple selection answer)

- Price of the fuel/energy
- Efficiency of the fuel/energy
- Where to purchase the fuel/energy
- How to use the fuel/energy
- It's advantages and disadvantages
- If it is clean
- Other specify (if other, go to next question)