

CAMBODIA

# COOKSTOVE DISCRETE CHOICE MODELING REPORT

November 2021



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This material has been funded by UKAid from the UK government; however, the views expressed do not necessarily reflect the UK government's official policies.



## 1. EXECUTIVE SUMMARY

### Cooking practices in Cambodia Context

A sample of 217 households from within and surrounding Phnom Penh, including some in Kandal province, were asked about various aspects of their cooking practices, cooking fuel use, and preferences about electric cookstoves.

Most households used electricity provided by the national grid, and the remainder used electricity provided by local mini-grids. No households used a generator or solar panels to produce electricity. Most households had formal direct electrical connections and had cooked with electricity before.

Load shedding was reported to occur at least once during a typical year at three-quarters of households and occurred more frequently during April, May, July, and August than other months. Most load-shedding events lasted approximately 30 minutes.

Female heads of household most frequently made decisions for the household about buying new cooking devices. The final decision is often made by male head of the household because most of them are income earners. However, joint decisions between both spouses were nearly as common.

Households used a variety of heat sources for cooking. LPG was used by most households as the primary source of heat for cooking, specifically with 0.25-kg tanks. Wood, charcoal, and electricity were infrequently the primary heat source used for cooking. No households reported using biogas (methane produced from on-site biogas digesters) or other cooking fuels. More modern heat sources (electricity, LPG, charcoal and then wood, in order from most modern to least modern) tended to be used together.

Electricity used for cooking had the highest mean monthly cost, followed by LPG, charcoal and wood. Charcoal and wood were typically bought in larger quantities less frequently, while LPG was bought in smaller quantities more frequently; this disparity was likely caused by the high unit cost of LPG compared to charcoal and wood. Electrical cooking had a similar monthly heat energy use to LPG cooking. Also, monthly heat energy used for cooking per person was highest when cooking with wood, followed by charcoal. Cooking with LPG and electricity showed markedly lower and similar heat energies used for cooking per person.

Households reported that LPG was the easiest to access of the four heat sources used for cooking by households in this study. Electricity was also nearly as easy to access. Although charcoal and wood were markedly more difficult to access, nearly half of households still perceived wood to be easy or somewhat easy to access.

Electricity was perceived to be the safest of the four heat sources to cook compared with other fuel sources. Most importantly, more than half of households perceived LPG to be unsafe or somewhat unsafe. Despite LPG being perceived to be the least safe of the four heat sources

for cooking, the majority of households still use LPG for cooking, with many using it as their primary source of heat for cooking.

When asked about the health impacts of smoke from cooking fuels, most households agreed that smoke from cooking fuels can strongly impact public health. Specifically, cooking with wood and charcoal is considered harmful to people's health by between two-thirds and one half of households, respectively.

Regarding the costs of different heat sources used for cooking, cooking with wood is considered to be expensive by only one-third of households, while cooking with LPG and electricity are considered to be expensive by three-quarters of households.

### Consumer Preferences for Cookstove Characteristics

Discrete choice modelling was used to describe respondent preferences for six different cookstove attributes: number of burners, cooking cost per meal, ability to cook using different processes, safety features, payment method, and price of cookstove.

After creating a high-quality mixed logit regression model with all respondents' responses, preferences for cooking cost per meal, ability to cook using different processes, safety features and payment method were found across all respondents. These preferences are summarized and discussed below, and shown in Figure E1:

- Each safety feature was strongly preferred over other attribute levels
- Payment methods were the next most preferred attribute, with both instalment methods and the pay-as-you-go method showing similar preferences. Thus, paying upfront (the reference attribute level) was markedly less preferred than these alternative payment methods.
- Respondents only preferred being able to fry foods on a cookstove; they did not prefer being able to boil and fry, or boil, fry, steam, and grill foods on a cookstove.
- Having a high mean cooking cost per meal was the only attribute level to show a negative coefficient, which indicates respondent aversion. Thus, respondents are averse to high mean per-meal cooking costs.

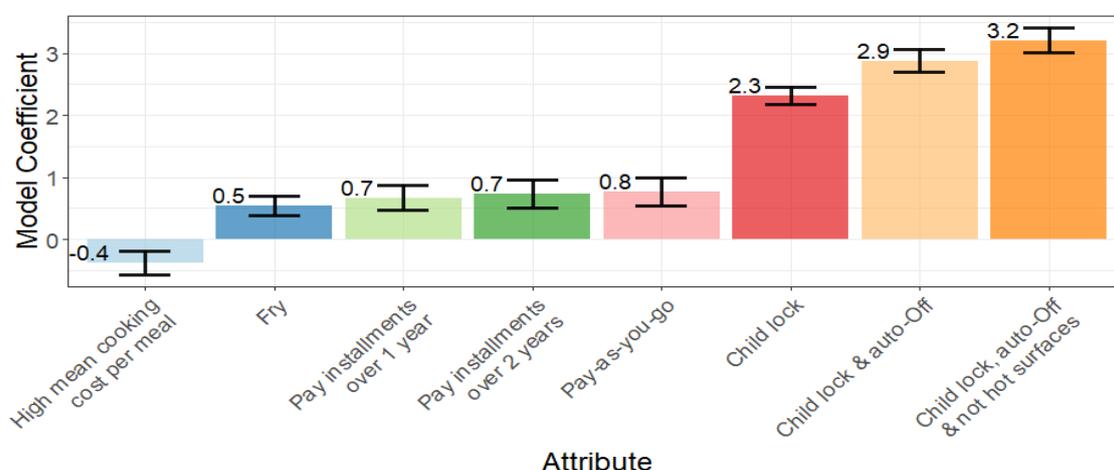


Figure E1: Model coefficients of the discrete-choice mixed logit regression model with all respondents, describing preferences for different attributes of cookstoves, with errors.

No preferences were found for having two or three burners, indicating that respondents are satisfied with a single burner. This result contradicts anecdotal evidence that households prefer two-burner electric cookstoves with the pay-as-you-go method, despite their higher price. Additional research, ideally with households actually using electric cookstoves to gain hands-on experience, is thus needed to clarify consumer preferences for this particular cookstove attribute.

Also, no preference was found for cookstove price, likely indicating a type of bias in the responses called attribute non-attendance. Because a preference for price was not found, estimates of willingness to pay for different cookstove attribute levels could not be calculated.

## Disaggregating Consumer Preferences for Cookstove Characteristics

The preferences for different cookstove attribute levels were investigated in more detail by disaggregating the data based on respondent gender and age, and the household's primary heat source used for cooking, number of people in a household (adults and children), and poverty metric.

When disaggregating by respondent gender, too few males ( $n = 21$ ) responded to yield sensible results with a mixed logit model. Thus, with respondents being 90% female, disaggregation by respondent gender was not possible.

Respondent ages were grouped into three ranges: 17 to 35, 36 to 50, and 51 to 70, which are referred to as "younger", "middle-aged", and "older", respectively. After creating high-quality mixed logit regression models for each age range, preferences for the ability to cook using different processes, safety features and payment methods were found.

When disaggregating by the household's primary heat source used for cooking, too few households used charcoal or electricity as their primary heat source for cooking ( $n = 6$  and  $5$ , respectively) to allow the mixed logit model to converge. For households that used wood as their primary heat source for cooking, the model converged, but no model coefficients were statistically significant, likely due to the low number of households that use wood as their primary heat source for cooking ( $n = 12$ ). Thus, with 89% of households using LPG as their primary heat source for cooking, disaggregation by the household's primary heat source used for cooking was not possible.

When disaggregated by poverty metric, preferences for payment methods followed household poverty metrics; for example, more impoverished households preferred paying via instalments over 1 or 2 years, while less impoverished households had no preferences for alternative payment methods. Thus, more impoverished households should be given access to alternative payment methods whenever possible.

## Suggestions for Encouraging Electrical Cooking in Cambodia

The results of this study allow us to make the following suggestions to the sector to help bring electrical cooking into Cambodian households:

- Highlight the safety of electrical cooking devices compared to LPG, and sell electrical cooking devices that have a child lock, auto-off and no hot surfaces;
- Sell electrical cooking devices that have similar characteristics to LPG cookstoves (e.g., quick on/off and high heat output);
- Target women when marketing cookstoves because they cook most meals in Cambodia;
- Focus on electrical cooking devices that have one burner so that these new cooking devices can be easily integrated into current Cambodian fuel-stacking practices; and
- Offer payments via instalment plans or the pay-as-you-go method to appeal to Cambodian cooks that are most likely to adopt electrical cooking, particularly more impoverished households.

When considered together, these suggestions imply that induction cook stoves may be the best fit for Cambodian households. However, additional research is required to verify this suggestion.

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## 2. INTRODUCTION

### 2.1 Project Goal

This study investigates how to rapidly accelerate a transition from cooking with biomass to 'clean' cooking (i.e., with electricity) in Cambodia. The Modern Energy Cooking Services (MECS) programme partnered with iDE to deepen our understanding of modern energy cooking services in the Cambodian context. Topics investigated in this study include future customer needs and preferences, government policy landscape, practices and trends in cooking and the supply chains for modern energy cooking solutions (mecs) in and for Cambodia, specifically around electric cooking.

### 2.2 Research Objective and Background

This study explores Cambodian household cook's preferences for cooking process, design, and functionality of cooking devices. This data is used to quantify and segment the market and customer demand, cooking practices and preferences toward cooking devices. The specific parameters, levels, and attributes of the discrete choice model used in this study is contextualized to Cambodia specifically.

This study builds upon an extensive body of knowledge. Prior to this study, other studies of these and related topics have been performed in Cambodia via the MECS and iDE Collaboration and include the following:

- [MECS-TRIID \(Modern Energy Cooking Services - Technology Research Innovation for International Development\) study](#): an initiative that investigated and developed new solutions and approaches to modern forms of cooking services.
- [Cooking Diaries study](#): a study that aimed to provide a deeper understanding of the Cambodian context around cooking habits and preferences to evaluate key components that are necessary for a modern energy cooking services transition in Cambodia, specifically with electricity.
- [Deepening understanding of the Cambodian context around cooking habits and practices of people living with disabilities \(PwD\) and Elders study](#): a study that addressed gaps in research to gain a deeper understanding of the Cambodian context around cooking habits and practices of people living with disabilities (PwD). This study evaluated key components that are necessary for a more inclusive transition to modern energy cooking services (mecs) in Cambodia, specifically with electricity.
- [Supply Side Research Summary](#): a short country level study that aimed to describe supply side factors (e.g., production, distribution, and adoption of electric cooking solutions) in more detail, and identify opportunities for interventions that can strengthen Cambodia's enabling environment for electric cooking supply chains. This study focused on identifying opportunities to increase the availability and affordability of electric cooking solutions.
- MECS-ECO study: a study and pilot-testing of a range of electric cooking solutions and service delivery models that were designed to trigger market demand. The goal of this study was to explore the potential of electric cooking to address the transition to clean, efficient cooking, and identify approaches to effectively test and scale up new electric cooking products in the Cambodian market.

### 3. METHODS



A survey was developed and administered during this study to describe how Cambodian cooks perceive and have experienced cooking in their households. Topics addressed in the survey included cooking processes; cookstove design and functionality; cooking appliance choices, including cooking processes, fuel consumptions and associated perceptions; the availability of and experiences with electricity; intra-household decision-making about cooking; experiences with other non-cooking equipment and devices, including computers and smartphones; and respondent and household demographics. All survey data was recorded using KoBo Toolbox software, and each survey required approximately one hour to complete.

#### 3.1 Discrete Choice Experiment

A critical component of this survey was a discrete choice experiment, a quantitative research method that explores selections between hypothetical choices and creates a mathematical model called a discrete choice model (DCM) that can be used to predict how people make choices between different options. Based on a number of input parameters, the model can predict how people make choices between different options. DCM question sets are set up using choice cards that are based on key parameters and ask the respondent to choose one of the two presented cards. The results provide an understanding of the strength of preference for each attribute, reflecting how important it is in decision making.

DCM survey questions explored people's preferences for cooking devices with regard to the cooking processes that could be used on the device (e.g., boiling, frying, steaming), and the design and functionality of the device. Selecting the attributes and levels in DCM is critical. Although secondary literature can be used to identify an initial set of attributes, additional primary research is almost always necessary in low-resource settings like Cambodia to ensure that the final set of attributes is appropriate and valid to the context being studied. Also, to ensure that the data analysis and the information that we received in this context was sufficiently accurate to answer the research questions of this study, the number of attributes should not exceed six, and the number of levels per attribute should not exceed four.<sup>1</sup> Informed by literature specifically about Cambodia and the experience of the iDE Innovation Lab, the final selection of attributes and levels was selected as shown in Table 1.

Table 1: Attributes and levels used to describe cookstoves in the DCM

Parameter	No. levels	Level 1	Level 2	Level 3	Level 4
Cooking process	4	Boil only	Fry only (stir-fry, deep fry, shallow-fry)	Boil/Fry	Boil/fry/steam/grill
Number of hobs used simultaneously	3	1 hob	2 hobs	3 hobs	-
Cost of cooking (Average cost per meal)	3	Low cost	Medium cost	High cost	-
Safety feature	4	None	Child lock	Child lock & Auto turn-off	Child lock, auto turn off, and no hot surfaces
Payment	4	Pay upfront	Pay-go	Pay instalments over 1 year	Pay instalments over 2 years
Product Price	4	50 USD	75 USD	120 USD	150 USD

The rationale for including each of these attributes and levels is described in more detail based on learnings from the Cooking Diaries study below:

- Cooking process: From the Cooking Diaries study, we found that households preferred using a cooking appliance that can be used to cook with different cooking processes (e.g., boiling, frying, steaming). For example, households in the Cooking Diaries study enjoyed cooking with an electric wok because they could boil, fry or steam food and also cover the wok with a lid if needed.
- Number of hobs used simultaneously: In Cambodian households, two different foods are typically cooked at the same time in addition to rice. Thus, identifying the number of hobs that is desirable to Cambodian cooks is valuable.

- Power consumption: One of the barriers to using electricity for cooking that was identified in the Cooking Diaries study is that people worry about the large electricity consumption (and thus high cost) of electrical cooking devices.
- Safety feature: Another barrier that was found in the Cooking Diaries study was that households tended to worry about the safety of electrical cooking devices, especially in households with young children. Households reported that children are curious about electrical appliances, and thus, parents are concerned about the dangers that electrical cooking devices might introduce to their households.
- Payment: During the exit interviews of the Cooking Diaries study, we tested the willingness of households to purchase the electrical cooking device that was provided to them during that study. We found that households had different preferences for paying for the device (e.g., upfront, in instalments) due to their income level and the price of the device. We found that households are generally willing to pay in instalments because this process allowed them to spread out the intensity of a large purchase over time, which allows them to retain money for emergency situations. Regarding the PayGo concept in Cambodia, Cambodian people are familiar with the mobile PayGo concept; however, only a small portion of Cambodians in rural areas are aware of the PayGo system with regard to biomass fuel/energy introduced by ATEC company. Thus, when ATEC and iDE worked together on the MECS-ECO and another project, we explained the PayGo system for electrical cooking devices to respondents.
- Price: The price of a cookstove provides a basis for estimating how much people might be willing to pay for additional features. However, this attribute is somewhat confounded with the Payment method described above because they are both directly related to the price of the cookstove. The levels of this attribute were chosen so that they appeared reasonable to respondents, ranging from the prices of simple cooking devices to those of more expensive devices, such as an EPC. This attribute also lets us calculate willingness-to-pay estimates for each other attribute in the DCM if the results for this attribute are statistically significant.

With the maximum recommended number of attributes and levels,<sup>1</sup> we used a D-optimal study design to reduce the number of possible combinations of attribute levels (and thus DCM questions required) by balancing survey administration logistics, respondent fatigue, and the statistical power of the results. Using the choiceDes package in R, a D-optimal design containing 16 DCM questions with an adequate D-efficiency of 0.07 was developed and used to create the DCM questions administered in the survey.

## 2.4 Study Location

The study location included urban, peri-urban, and rural areas that are described below in more detail:

- Urban: within Phnom Penh city, in the crowded population (e.g., around the town market)
- Peri-urban: outskirts of Phnom Penh city (not further than 1 hour travel), a province close to Phnom Penh (Kandal), people have access to wood (purchased and/or available around their houses), charcoal, LPG, and electricity connection, a bit far from the crowded population.

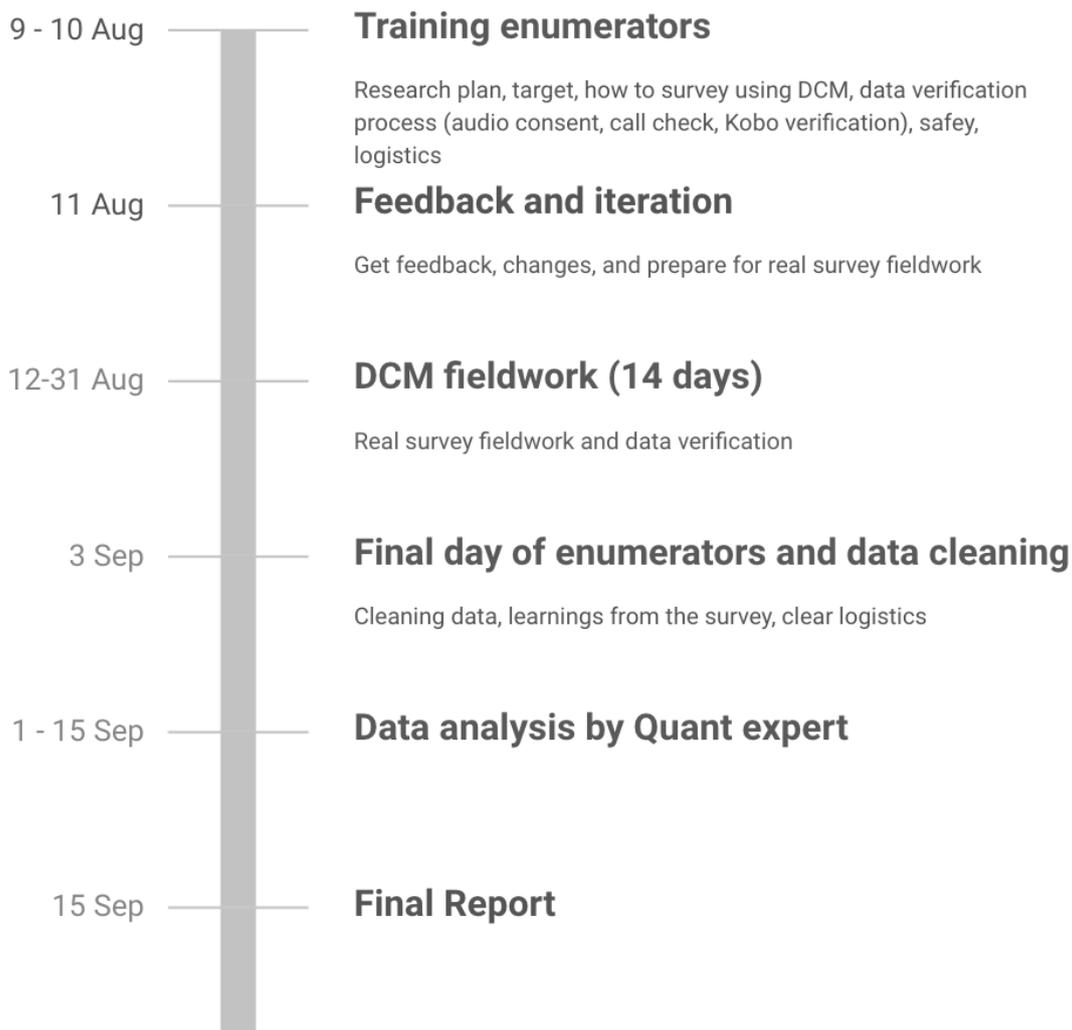
- Rural: outskirts of provinces around Phnom Penh, limit access to electricity, or connect to grid, or electricity from private companies. Have access to wood and charcoal easily or use biomass as their main source of fuel, far from the crowded population.

Urban areas included Chamkamon, Toul Kork, and Doun Penh; and peri-urban and rural areas included Prek Thmei, Ta Khmao, and Dangkor. These locations were selected to provide a diversified sampling frame of the target population in regions where enumerators lived, making surveying easier and faster, especially during the COVID-19 pandemic.

## 2.5 Recruitment

The snowball method was used to recruit respondents. A total of 217 respondents that cook or participate in cooking activities in the household were surveyed in this study. Decision makers who did not participate in cooking but affected the household's adoption of new cooking technologies were also included. Demographics of the study sample are described in the Results section.

## 3.3 Timeline



### 3.4 Training and piloting

Enumerators were trained for 3 days about the study’s methods, research protocols, survey administration, and DCM choices. At the end of this training, the enumerators conducted role plays, and a short testing. Afterwards, we made adjustments to the protocol, survey forms, translation, and DCM card designs so that participants could fully understand the survey as well as the DCM choices.

After the training, we conducted a pilot which the enumerators tested in the field with 12 participants. Then we collected feedback, checked the data, and made final changes to the survey.

## 4. RESULTS

### 4.1 Overview of data

#### 4.1.1 Geographical locations

Face-to-face interviews were conducted using Kobo Toolbox software. A sample of 217 households was surveyed in urban, peri-urban, and rural areas of Phnom Penh city, in the outskirts of Phnom Penh, and in Takhmao town of Kandal province, which is close to Phnom Penh (Figure 1).

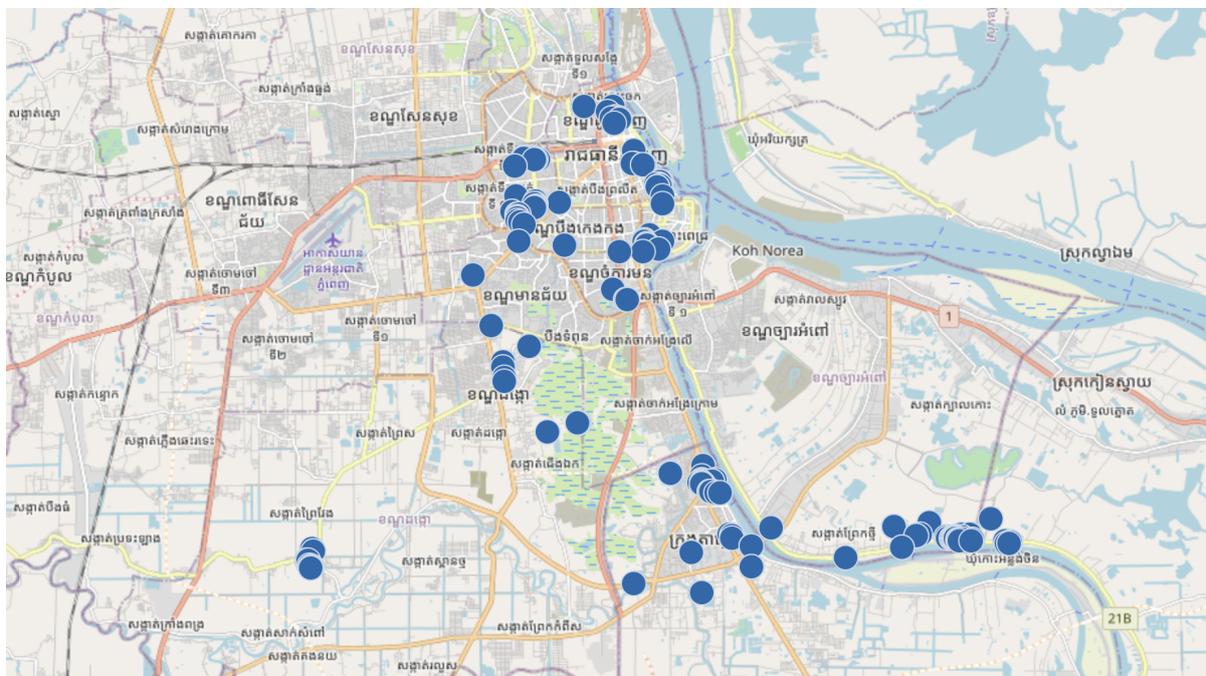


Figure 1: Locations of 217 interviews in and around Phnom Penh

#### 4.1.2 Household demographics and characteristics

Respondents ranged in age from 17 to 70 years with a mean of 43 ( $\sigma = 12$ ), and were mostly female (90%). Education among respondents was generally low: approximately half had only

attended primary school or had no formal education (44% and 11%, respectively); 27% had attended secondary school, 12% had attended high school, and 6% had attended university. A total of 41% of respondents were the heads of household, 40% were their spouses, and the remainder were mostly their children (9%) or parents (5%). Of the heads of household for which their gender is known ( $n = 177$ ), 42% were female. Each household had 4.5 members on average ( $\sigma = 2.3$ ), of which 4.0 were adults ( $\sigma = 1.9$ ) and 0.5 were children ( $\sigma = 0.8$ ; Figure 2). Nearly two-thirds of households (65%) did not have children. Enumerators attempted to interview the primary cook of each household when possible. Sample characteristics matched local population characteristics, indicating that results can be generalized to the local populations within and surrounding Phnom Penh, and within Kandal province.<sup>2</sup>

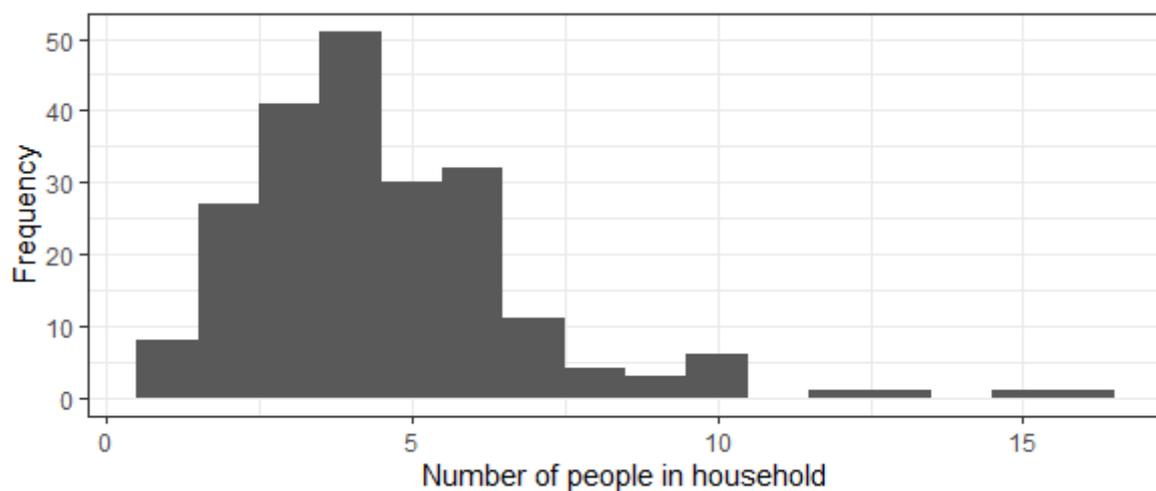


Figure 2: Distribution of the number of people in each household

The types of structures that households reside in were widely varied. Most were houses (63%), and the others were rented rooms (27%) or apartments (10%). Of the houses, most were made of concrete (44%), 26% were made of half-concrete/half-wood, 22% were only made of wood, 7% were made only with zinc, and 1% were villas. Water was available within most households via piping (79%) but typically required purification before drinking. Other households primarily drank bottled water (13%), pumped water from their own borehole (6%), or drank filtered water, unfiltered surface water, or rainwater (1% each). All 217 households owned an improved latrine. A poverty metric based on the Schreiner's Simple Poverty Scorecard for Cambodia<sup>3</sup> was also constructed based on the number of household members, the education level of respondents, the materials used to construct each house, and the appliances owned by each household. This metric ranged in value from 16 to 58 and had a mean of 42.5, a median of 42, and a standard

deviation of 11.3. As shown in Figure 3, the poverty metric was skewed towards higher values, indicating that few households were poor compared to the others in this study.

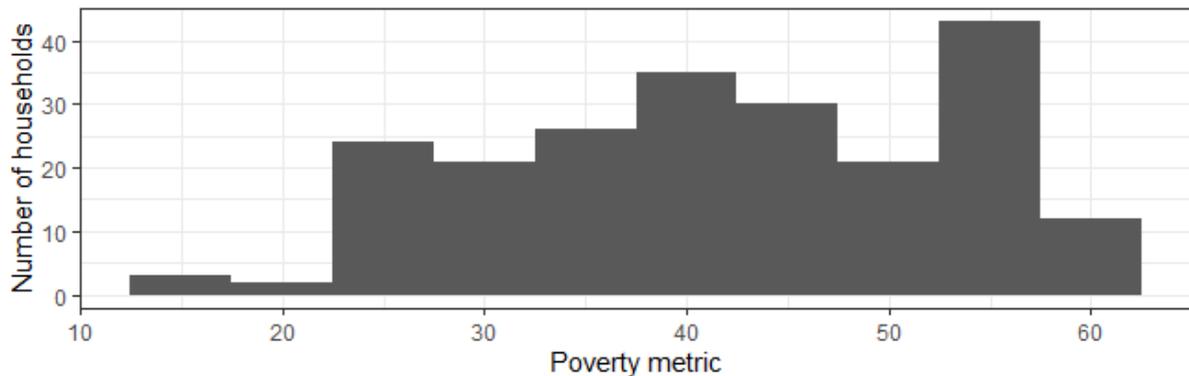
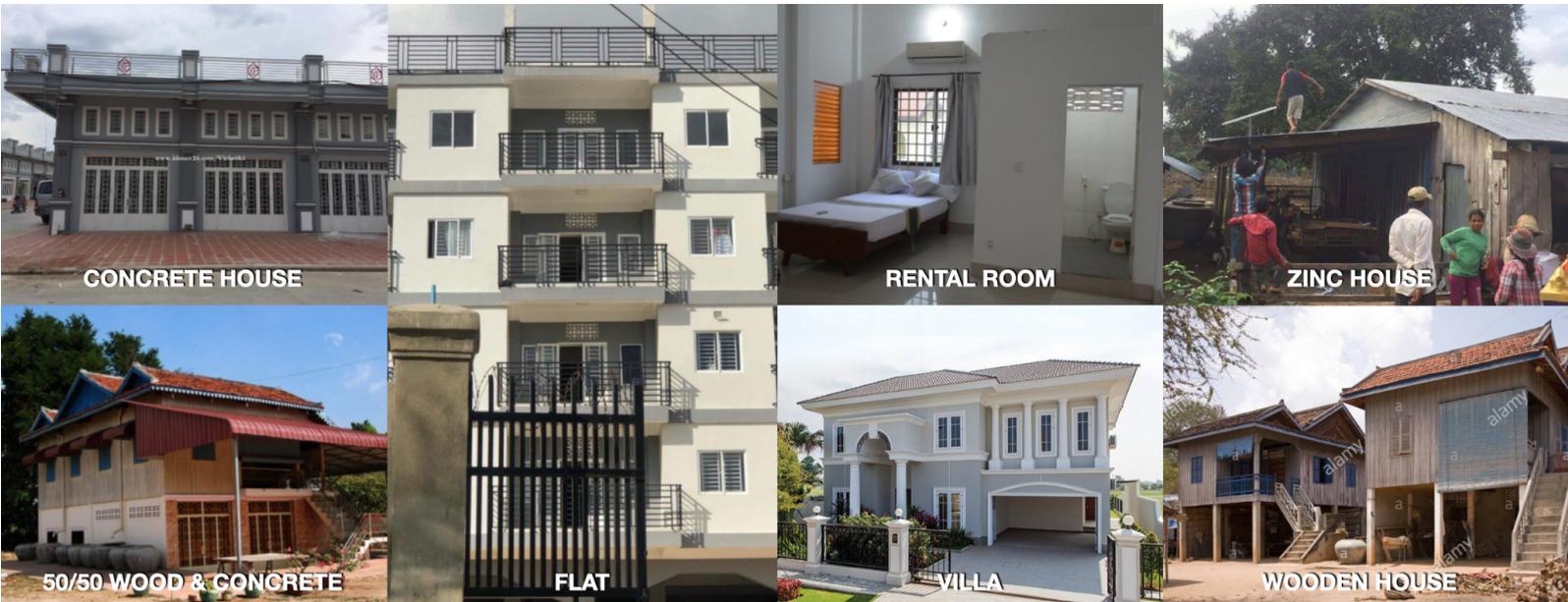


Figure 3: Histogram of poverty metric for studied households

### 4.1.3 Heads of household

Understanding who makes a household’s decisions about cooking practices, and specifically buying new cooking devices, can be used to target marketing and education about cooking practices and devices. Female heads of household most frequently made decisions for the household about buying new cooking devices (47%). However, joint decisions between both spouses were nearly as common (42%). Male heads of household and other household members infrequently made such decisions (8% and 2%, respectively).

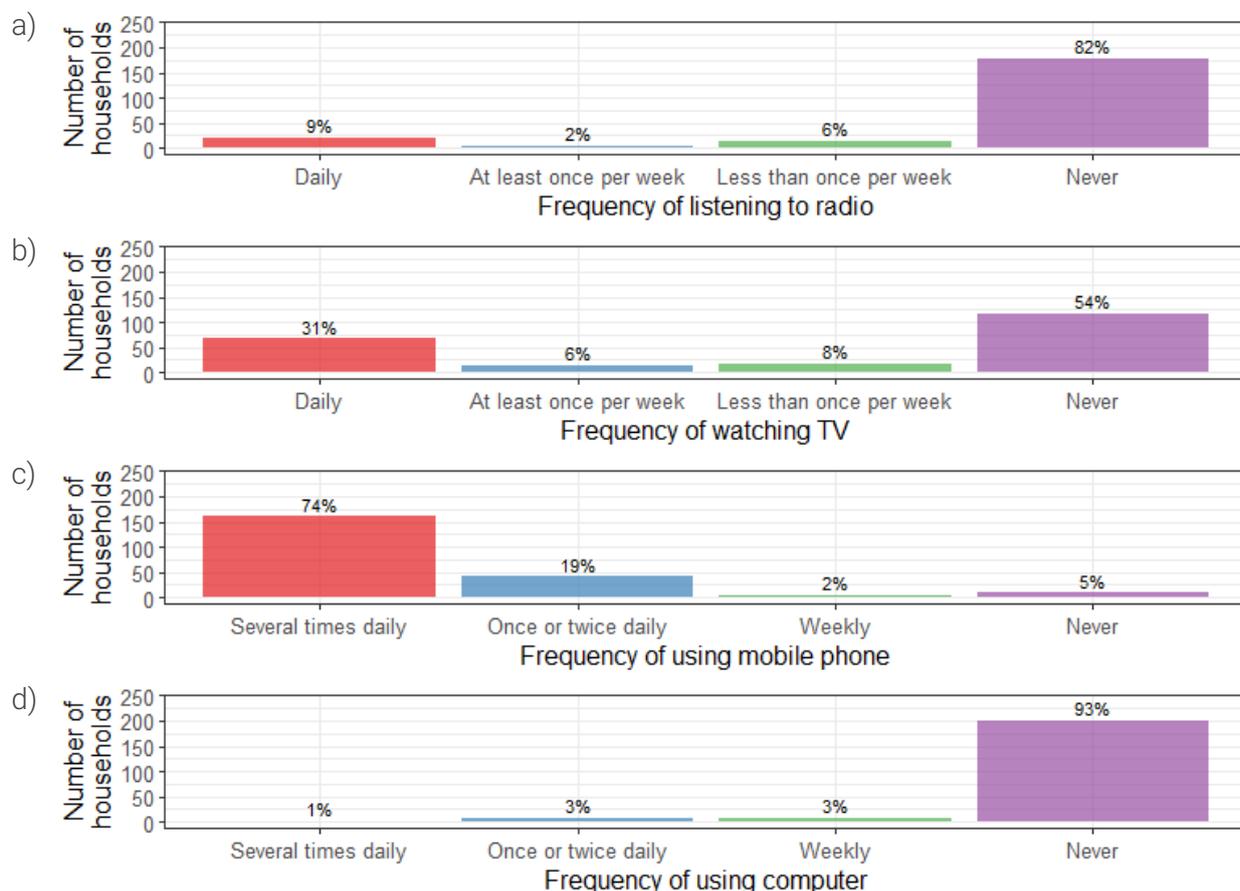
Respondents were also asked about the jobs worked by their heads of household. Heads of household most frequently owned a retail business (35%) or worked as a labourer (e.g., construction, short-term jobs that pay hourly or daily and are required to perform a specific task; 20%). Other heads of household worked as a government official (12%), an employee of a

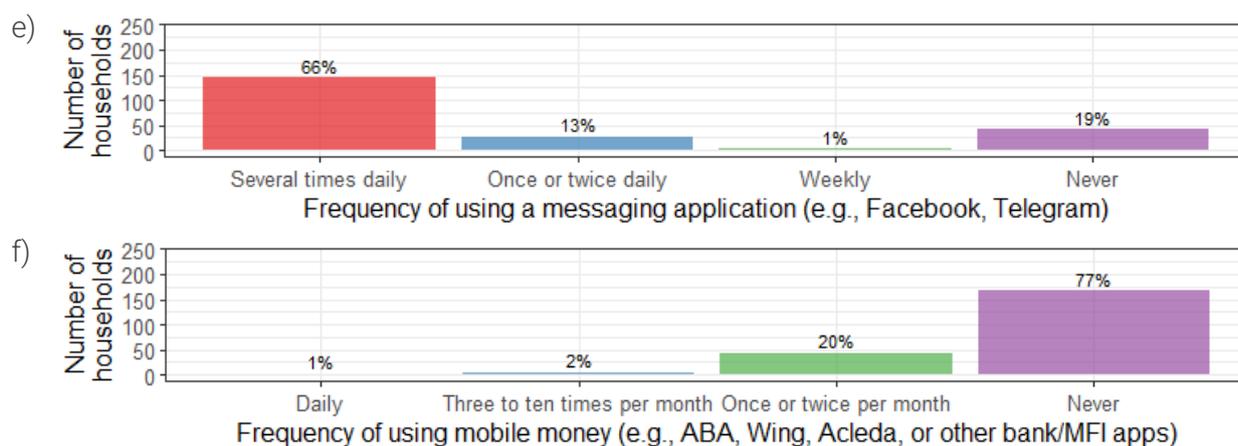
private company (12%), a farmer (8%), a factory worker (3%), an employee of an NGO (1%), or owned a wholesale business (1%). Few heads of household were unemployed (6%).

### 4.1.4 Experience with technologies

Respondents generally used modern technologies regularly, perhaps indicating a willingness to adopt new technologies. Mobile phones were commonly used several times daily (74%), as were messaging services like Facebook and Telegram (66%; Figure 4). Most households had a smartphone (83%), few had a basic phone (12%), and very few had no phone (5%). Mobile money had also been used by only 30% of households and was used most frequently once or twice per month among those households; this result indicates a lack of adoption of mobile money among respondents. In addition to mobile technologies, approximately one-third of households watched TV daily (31%), while nearly half never watched TV (54%). Radios and personal computers were used by few households (18% and 7%, respectively). The intense use of mobile phones coupled with the lack of use of TVs, radios, and personal computers indicate that households are likely best communicated with (e.g., marketed to) via social media and texting, not TV, radio, or the Internet.

Figure 4: Frequencies of using different technologies: a) radio; b) TV; c) mobile phone; d) computer; e) messaging application (e.g., Facebook, Telegram); and f) mobile money (e.g., ABA, Wing, Acleda, or other bank/MFI apps). Frequencies of use within each figure are arranged from most frequent to least frequent from left to right. Note that each figure has the same vertical scale but may have different horizontal scales.





## 4.2 Household appliances

Households owned a variety of food-related appliances (Table 2). Single-burner LPG stoves were the most common, followed by electric rice cookers, electric kettles, basic stoves that used wood or charcoal for fuel, and refrigerators. Some households also owned multiples of these devices depends on household size, business purposes, and conveniences.

Table 2: Number of food-related appliances owned by heat source

Heat Source	Food-related Appliance	Frequency of Households Owning Number of Appliance			
		One	Two	Three	Four
Wood	Three-stone fire	4			
Wood or Charcoal	Basic stove	54	20	10	2
	Improved biomass cookstove	3			
	Portable single-burner stove	149	37	5	3
LPG	Portable double-burner stove	45	5		
	Oven with multi-burner stove	5			
	Rice cooker	122	6	3	
	Refrigerator	76	3		
	Kettle	56	3		
	Induction cookstove	10			
Electricity	BBQ	10			
	Microwave	4			
	Single/double-burner hotplate	3			
	Oven (no stove)	3			
	Slow/multi/pressure cooker	3			

Freezer	2	1	1
Oven with multi-burner stove	1		
Wok	1		
Fruit juicer	1		

Households also owned a variety of non-food-related electrical devices: a light (99%), a mobile phone (96%), a fan (98%), a television (61%), speaker system (42%), a computer (14%), an air conditioner (12%), a battery-powered radio (12%), a laundry machine (5%), and a hair dryer (1%). Note that these results describe ownership, not use, which is described in Figure 4.

### 4.3 Household electricity supply

#### 4.3.1 Sources of electricity

Most households used electricity provided by the national grid (83%), and the remainder used electricity provided by local mini-grids (18%). One household reported using rechargeable batteries for electricity, and no households used a generator or solar panels to produce electricity. Most households had formal direct electrical connections (88%), and most households (83%) had cooked with electricity before.

#### 4.3.2 Availability of electricity supply

Load shedding, or the intentional interruption of an electricity supply to avoid excessive load on the generating plant, is known to occur unexpectedly or on a schedule in this region of Cambodia. Load shedding was reported to occur at least once during a typical year at 74% of all households and occurred more frequently during April, May, July, and August than other months (Figure 5). Because load shedding is frequently associated with higher temperatures due to increased use of air conditioners, the lack of load shedding in June is surprising and cannot be explained by the available data.

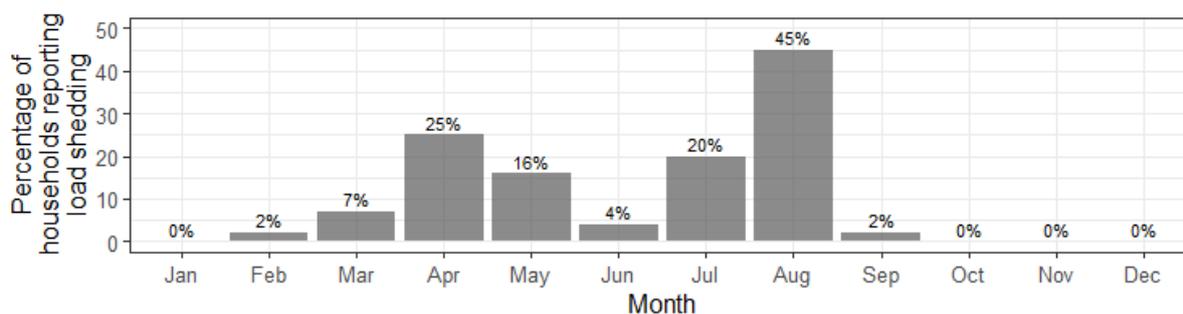


Figure 5: Percentage of households reporting load shedding by month

Load shedding most frequently occurred once every two weeks (34%), followed by once every month (31%; Figure 6). A few households reported much more frequent load shedding once every week or once every few days.

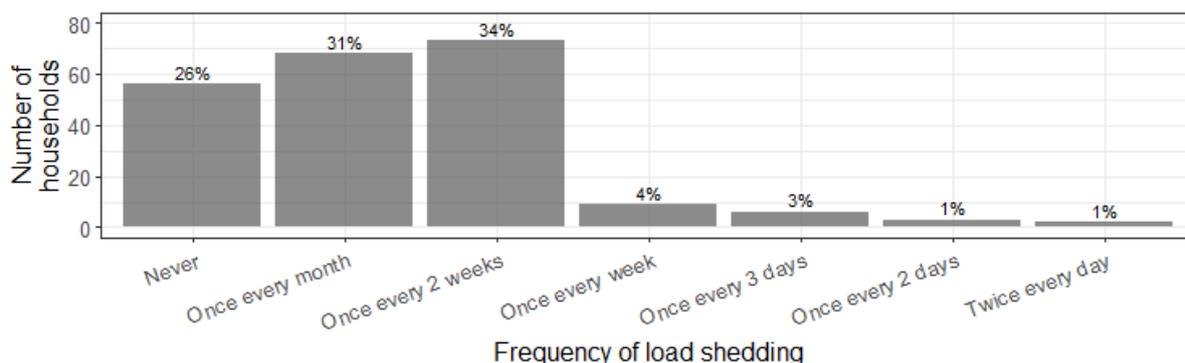


Figure 6: Frequency of load shedding  
 Most load-shedding events lasted approximately 30 minutes (63%), and others typically lasted between 1 and 4 hours (33%; Figure 7).

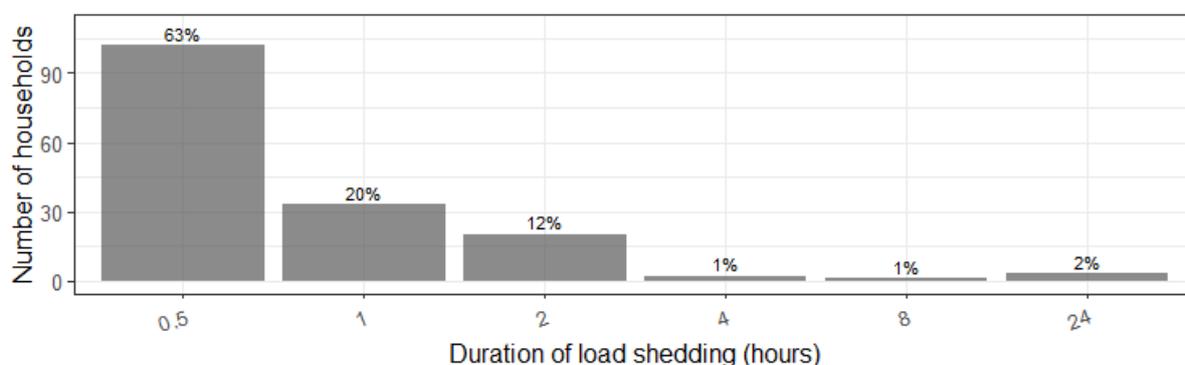


Figure 7: Frequencies of different durations of load shedding

Nearly all households (90%) did not receive information about a load-shedding schedule; 7% did receive such information, and 2% received such information only sometimes. Those households that did receive information about a load-shedding schedule (n = 16) learned about upcoming load shedding from the Internet (44%), TV (31%), neighbours (19%) or the radio (6%).

## 4.4 Cooking practices

### 4.4.1 Cooks and timing

The head of household cooked the majority of the meals in nearly half of households (46%), followed by their spouse (41%). Parents, elders, other family members, and a paid cook cooked much less frequently (7%, 4%, 8%, and 3%, respectively). Women cooked the most meals by far (90%); however, 14% of households had at least one male cook; these results agree with previous MECS learnings from TRIID and ECO. In Cambodia, it is also common for a grandmother to stay at home and look after grandchildren while the parents work. Also, other family members may share cooking responsibilities at different times of the day.

Most households cooked two or three meals per day at home (63% and 25%, respectively). Only 12% cooked one meal per day at home, and less than 1% cooked four meals per day at home. Households spent an average of 1 hour 40 minutes cooking each day ( $\sigma = 42$  minutes) and an

average of 48 minutes cooking each meal ( $\sigma = 18$  minutes). Most households cooked between 1 and 2 hours per day (85%); however, 14% cooked 3 hours per day.

The mean number of hours cooked per day varied with the primary heat source used for cooking: cooking with electricity required slightly more time to cook on average compared to the other heat sources (Table 3), and the Kruskal-Wallis test indicates that the differences shown are statistically significant at a confidence level of  $p < 0.05$ . However, these differences are negligible in practice (18 minutes max). Also, cooking times include fuel preparation and lighting; for example, when cooking with charcoal, households typically start a fire, proceed with other cooking duties (e.g., chopping vegetables) while the fire grows, and then return to cooking when the fire reaches cooking temperature.

Table 3: Different metrics by primary heat source used for cooking with statistical significance of group differences.

Metric	Primary Heat Source Used for Cooking						p-value of Kruskal-Wallis test
	Wood	Charcoal	LPG (0.25-, 6- and 15-kg tanks)			Electricity	
Number and percentage of respondents	12 (6%)	6 (3%)	135 (62%)	18 (8%)	40 (18%)	5 (2%)	-
Mean number of hours cooking per day	1.5	1.7	1.6	1.7	1.8	1.8	0.02
Mean number of people in household	4.6	3.8	4.6	3.9	4.9	2.8	0.03

Also, the number of people in a household tended to be smaller when cooking with electricity compared to other primary heat sources used for cooking. These variations cannot be explained by the available data.

The number of hours cooking per day across all households was weakly correlated with the number of people in the household (Pearson  $R^2 = 0.27$ ; Table 4). Disaggregated by primary heat source used for cooking, the number of hours cooking per day was moderately correlated with the number of people in households that cooked primarily with wood and 6-kg LPG tanks, and weakly correlated with those that cooked primarily with 0.25-kg LPG tanks.

Table 4: Correlation between the number of hours cooking per day with primary heat source used for cooking with statistical significances.

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Primary Source Used for Cooking	Heat	Correlation between number of hours cooked per day and number of people in household	
		Pearson R <sup>2</sup>	p-value
Wood		0.6**	0.03
Charcoal		0.2	0.7
LPG (0.25-kg tank)		0.24***	0.005
LPG (6-kg tank)		0.62***	0.006
LPG (15-kg tank)		0.18	0.3
Electricity		-0.0	1

\*:  $p < 0.10$ ; \*\*:  $p < 0.05$ ; \*\*\*:  $p < 0.01$

On average, households typically started cooking breakfast just before 7am (6:52am,  $\sigma = 1$  hour 47 minutes), lunch just before 11am (10:41am,  $\sigma = 1$  hour 3 minutes), and dinner at approximately half past 5pm (5:37pm,  $\sigma = 1$  hour 5 minutes; Figure 8). Cooking breakfast tended to begin across a wider range of times than lunch or dinner and frequently overlapped with other households cooking lunch.

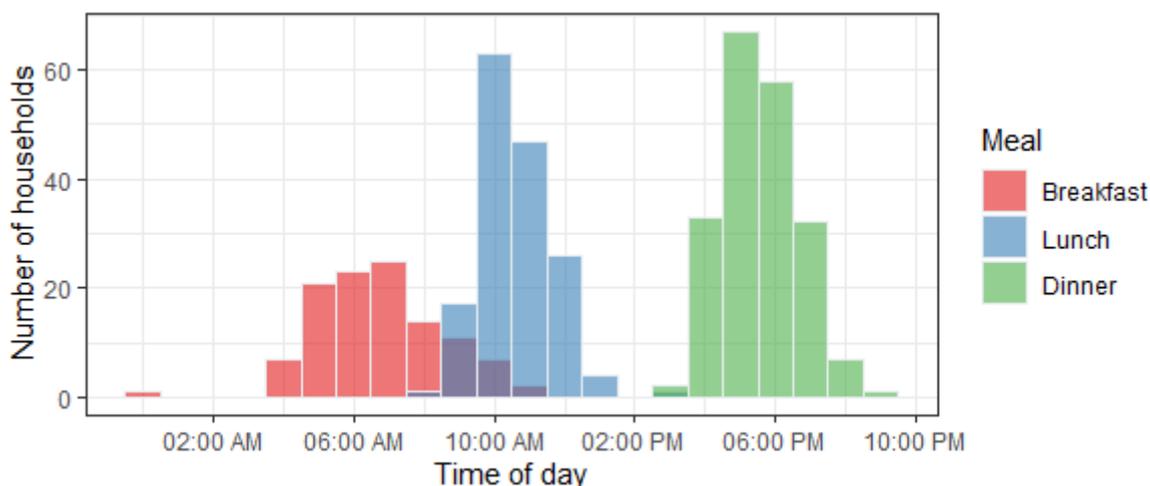


Figure 8: Typical start times for cooking breakfast, lunch, and dinner

#### 4.4.2 Heat sources used for cooking

Households used a variety of heat sources for cooking (Figure 9). LPG, followed by electricity, were the most common heat sources used for cooking. However, charcoal and wood were also used by some households. No households reported using biogas (methane produced from on-site biogas digesters) or other cooking fuels.

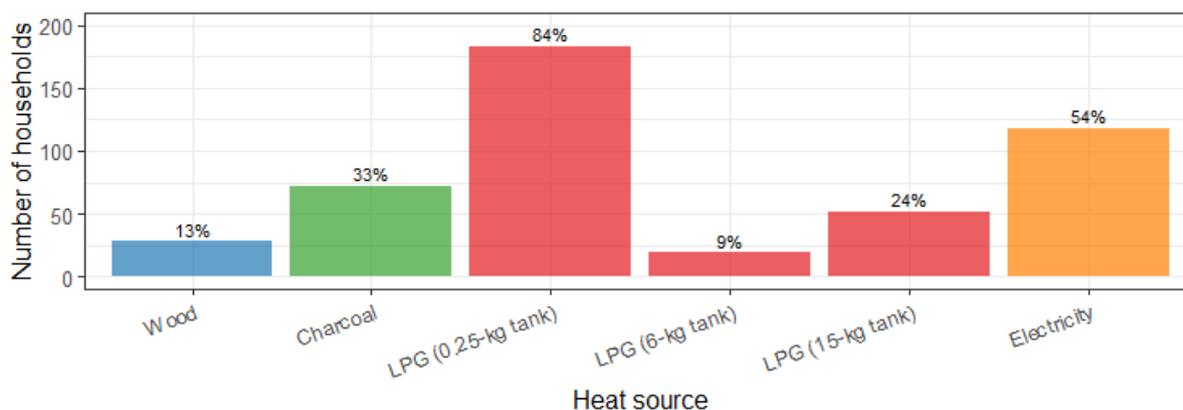


Figure 9: Frequency of using different heat sources for cooking

Despite using a wide variety of heat sources for cooking, most households used LPG as their primary source of heat for cooking (89%), specifically with 0.25-kg tanks (62%; Figure 10). Also, 27% of households only used LPG for cooking (58 of 217 in total; 47 used 0.25-kg tanks, 4 used 6-kg tanks, and 7 used 15-kg tanks). Wood, charcoal, and electricity were infrequently the primary heat source used for cooking, and no households used only wood, charcoal, or electricity as their only heat source for cooking.

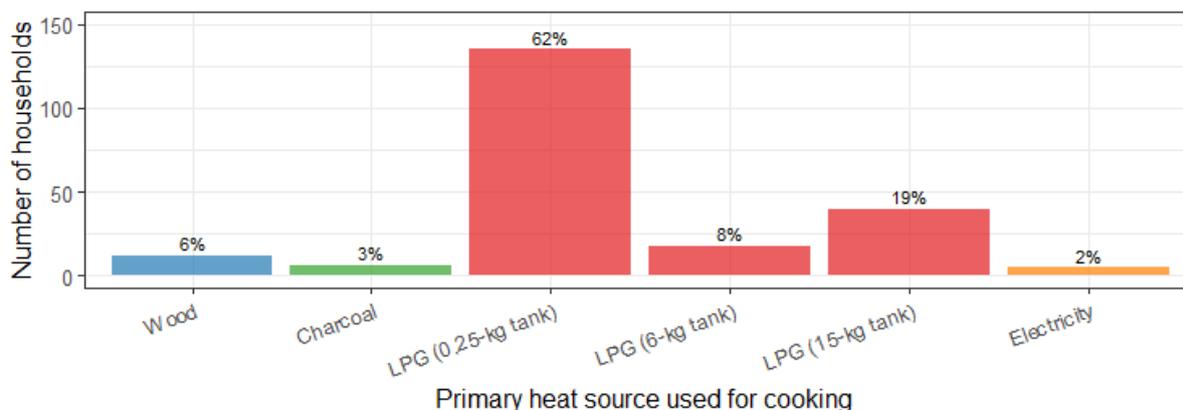


Figure 10: Primary heat source used for cooking

The difference between Figures 8 and 9 highlight that households can use multiple heat sources for cooking; this practice is commonly referred to as “fuel stacking”. As shown in Table 5, households that primarily use wood for cooking also use all three other heat sources (charcoal, LPG, and electricity). Interestingly, all households that primarily use charcoal for cooking also use LPG, specifically in small tanks; some of those households also use electricity. Households that primarily use LPG for cooking primarily tend to also use electricity (51-68%), followed by charcoal (29-38%); few of these households also use wood (5-15%). Thus, LPG and electricity are most commonly used together when fuel stacking. Lastly, households that primarily use electricity for cooking also tend to use LPG, some use charcoal, but none use wood.

Table 5: Frequency of using different heat sources for cooking by primary heat source used for cooking.

Primary Heat Source Used for Cooking	Frequency of Using Other Heat Sources for Cooking					
	Wood	Charcoal	LPG (0.25-kg tank)	LPG (6-kg tank)	LPG (15-kg tank)	Electricity
Wood	-	4 (33%)	9 (75%)	0 (0%)	2 (17%)	5 (42%)
Charcoal	0 (0%)	-	6 (100%)	0 (0%)	0 (0%)	2 (33%)
LPG (0.25-kg tank)	11 (8%)	39 (29%)	-	1 (1%)	7 (5%)	69 (51%)
LPG (6-kg tank)	3 (17%)	7 (39%)	9 (50%)	-	2 (11%)	10 (56%)
LPG (15-kg tank)	2 (5%)	15 (38%)	19 (48%)	0 (0%)	-	27 (68%)
Electricity	0 (0%)	1 (20%)	4 (80%)	0 (0%)	1 (20%)	-

Overall, fuel-stacking frequencies show that more modern heat sources (electricity, LPG, charcoal and then wood, in order from most modern to least modern) tend to be used together. Conversely, less modern heat sources tend to be used with more modern heat sources; this latter grouping is likely used by households that cannot afford to switch over completely to cooking with more modern heat sources

Fuel stacking is performed by most households (73%) with the largest proportion of households (41%) using two heat sources for cooking (Table 6). The most common fuel-stacking combinations are LPG + electricity (28%), charcoal + LPG + electricity (17%), and charcoal + LPG (11%; Table 7).

Table 6: Frequencies of fuel stacking

Number of Heat Sources Used for Cooking	Frequency
1	59 (27%)
2	88 (41%)
3	46 (21%)
4	22 (10%)

Table 7: Frequencies of the five most common fuel-stacking combinations

Fuel-Stacking Combination	Frequency
LPG and Electricity	61 (28%)
Charcoal, LPG, and Electricity	37 (17%)
Charcoal and LPG	24 (11%)
Wood, LPG, and Electricity	9 (4%)
Wood and LPG	8 (4%)

Heat sources that were used for cooking were also used for other purposes. For example, approximately three-quarters of households (72%) reported heating water for bathing using the same heat sources that were used for cooking. Some households used wood to heat water (12%), and others used charcoal to heat water (23%) and grill food (1%). No households used wood or charcoal to heat their homes. Approximately half of households reported using electricity for lighting (54%), and some households used electricity for laundry (14%), juicing (7%), salon tools (3%) and charging power banks (n = 1).

#### 4.4.3 Heat energies used for cooking and associated costs

Various statistics of purchasing cooking fuels are shown in Table 8. LPG had the highest mean monthly cost, followed by charcoal and wood. Charcoal and wood were typically bought in larger quantities less frequently, while LPG was bought in smaller quantities more frequently; this disparity was likely caused by the high unit cost of LPG compared to charcoal and wood. The heat energies used for cooking with electricity are not reported because electricity used for cooking could not be disaggregated from electricity used for other purposes. Note that the mean amount purchased describes how much of each cooking fuel was purchased at a time, not per month.

Table 8: Purchasing statistics for different heat sources used for cooking

Statistic	Heat Source Used for Cooking		
	Wood	Charcoal	LPG
Mean monthly cost (\$ USD)	\$6	\$28	\$10
Mean amount purchased (kg)	18	17	5
Mean unit cost (\$ USD/kg)	\$0.17, or free via collecting	\$0.48	\$1.25
Most common amount purchased (kg)	5	10	1
Most common purchase frequency	Once per year	Once per month	Once per week

The heat energies provided by different fuels vary based on their efficiency of heat transmission to foods and their material properties, if applicable. For each of the four fuels identified in the survey, heat energy uses have been calculated from reported fuel consumptions. The assumed unit usable heat energy of each fuel is shown in Table 9.

Table 9: Assumed usable heat energies and densities of cooking fuels

Heat Source Used for Cooking	Usable Heat Energy <sup>4</sup>	Density <sup>5</sup> (kg/m <sup>3</sup> )
Wood	16 MJ/kg	500
Charcoal	30 MJ/kg	-
LPG	45 MJ/kg	-

The heat energy used for cooking per month was highest with charcoal, markedly lower for LPG, and very low with wood (Figure 11). Wood's heat energy use was low due to few households using it frequently.

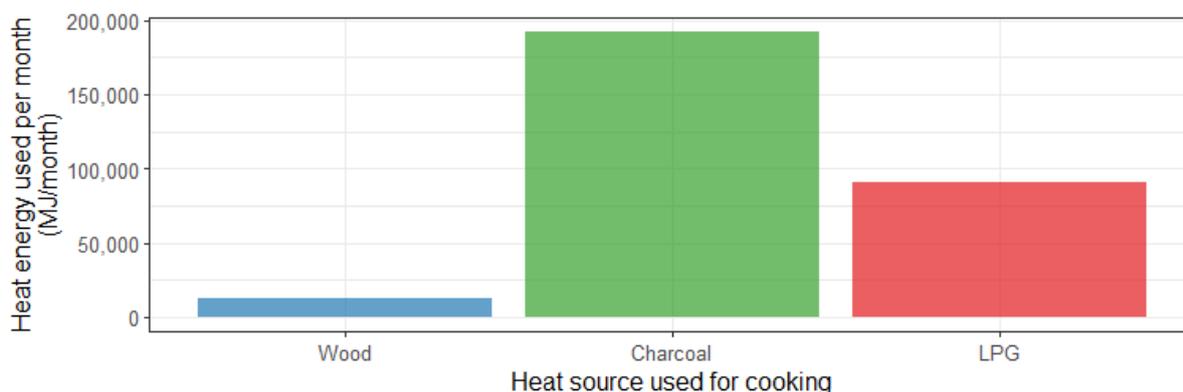


Figure 11: Monthly heat energy used for cooking by heat source

Monthly heat energy used for cooking per person was highest when cooking with wood, followed by charcoal (Figure 12). Cooking with LPG showed markedly lower and similar heat energies used for cooking per person.

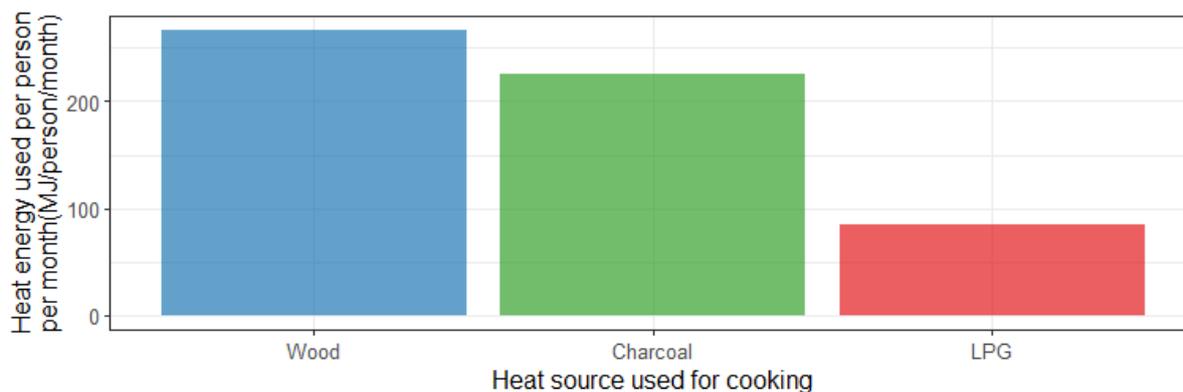


Figure 12: Monthly heat energy used for cooking per person by heat source

## 4.5 Beliefs and attitudes

### 4.5.1 Perceptions of heat sources used for cooking

Households reported that LPG was the easiest to access of the four heat sources used for cooking by households in this study (Figure 13). Electricity was also nearly as easy to access. Although charcoal and wood were markedly more difficult to access, nearly half of households (43%) still perceived wood to be easy or somewhat easy to access.

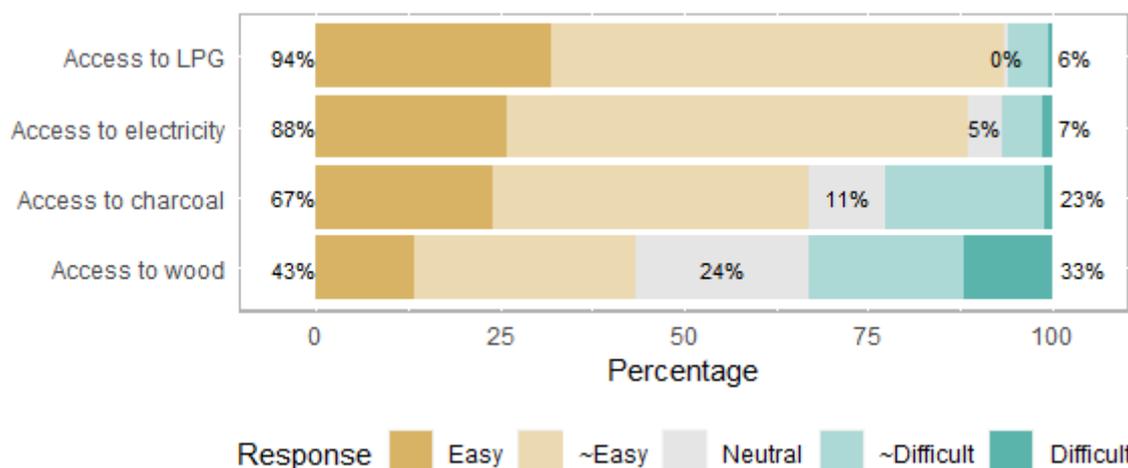


Figure 13: Perceived ease of access to different heat sources used for cooking, arranged from easiest to most difficult to access.

Electricity was perceived to be the safest of the four heat sources to cook with: few households believed that cooking with electricity was unsafe or somewhat unsafe (12%; Figure 14). More than twice as many households believed that charcoal was unsafe (26%), and wood was perceived to be less safe than charcoal (39%). Most importantly, LPG was perceived to be markedly less safe than the other three heat sources used for cooking: 58% of households perceived LPG to be unsafe or somewhat unsafe.

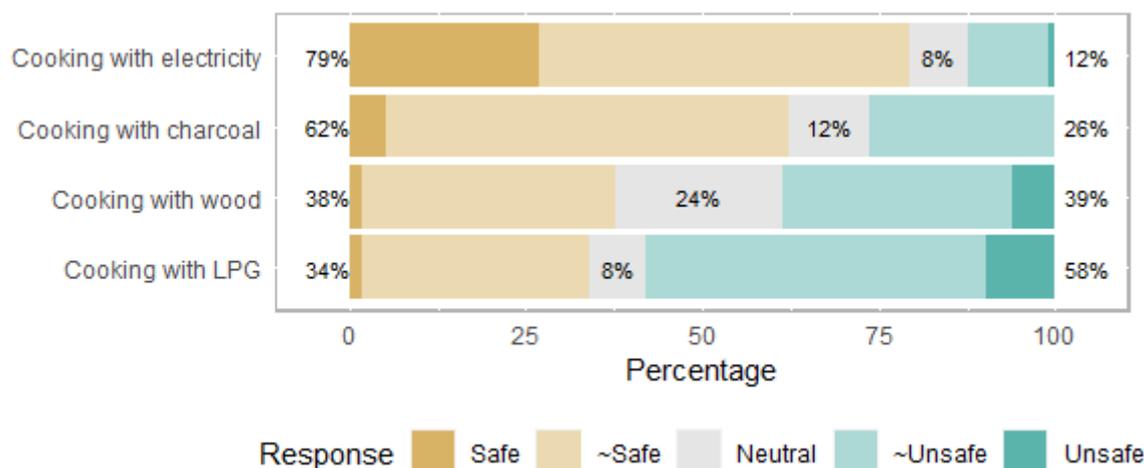


Figure 14: Perceived safety of different heat sources used for cooking, arranged from safest to least safe.

Despite LPG being perceived to be the least safe of the four heat sources for cooking, the majority of households still use LPG for cooking, with many using it as their primary source of heat for cooking (Figures 8 and 9). This clear preference for cooking with LPG despite its perceived danger must be due to the notable benefits of cooking with LPG, which include instant on/off, high heat output, and accessibility (Figure 13).<sup>6</sup>

The smoke produced when cooking with certain fuels has been documented to be a significant public-health risk. When asked about the health impacts of smoke from cooking fuels, most households agreed that smoke from cooking fuels can strongly impact public health (87%; Figure 15). Specifically, cooking with wood and charcoal is considered harmful to people’s health by between two-thirds and one half of households, respectively (67% and 49%). Collecting, preparing, and cooking with wood is also considered inconvenient and “a burden” by many households (68% and 79%). Conversely, charcoal is considered convenient by nearly two-thirds of households (65%). Despite the negative perceptions of wood and charcoal, most households agree that certain foods taste better when cooked with wood or charcoal than when cooked with LPG or electricity (86%). Regarding the costs of different heat sources used for cooking, cooking with wood is considered to be expensive by only 35% of households, while cooking with LPG and electricity are considered to be expensive by 72% and 79% of households, respectively.

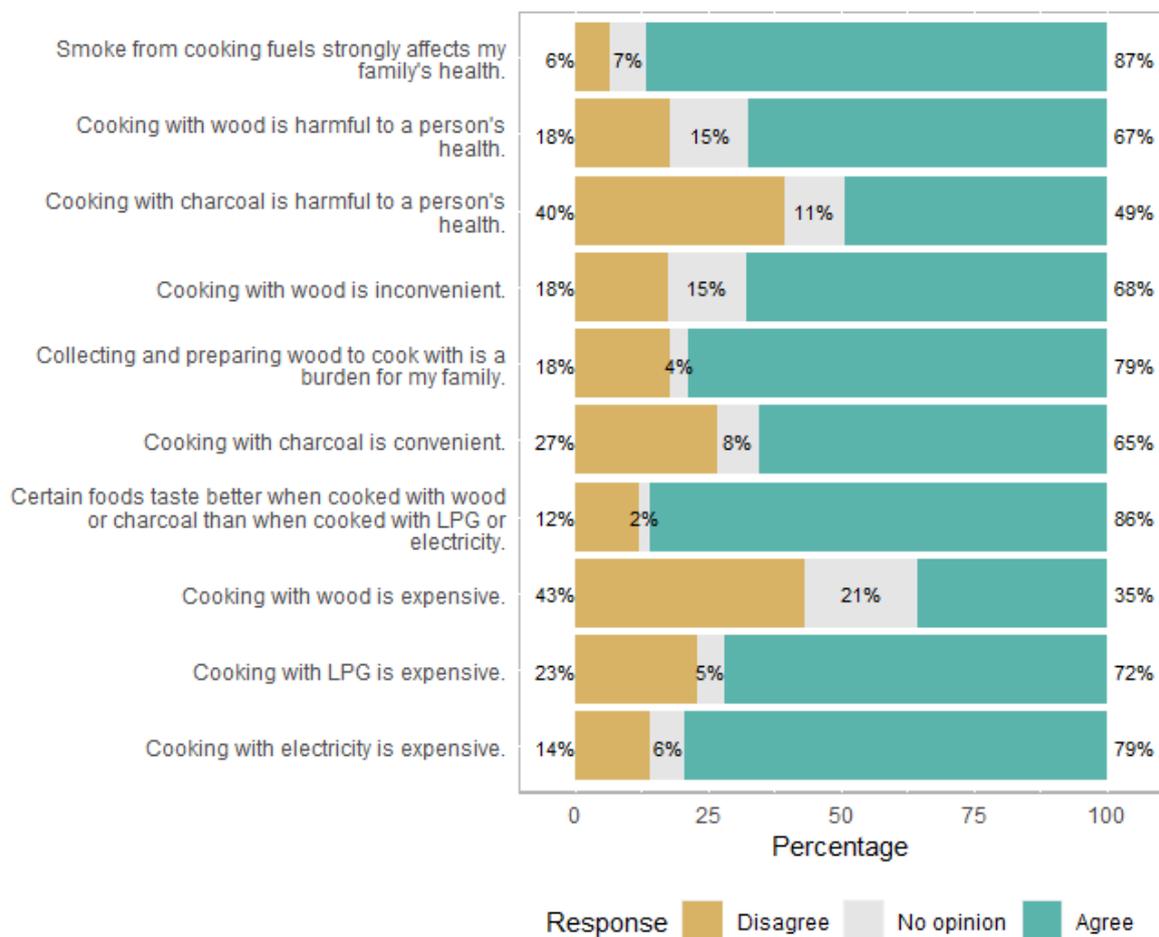
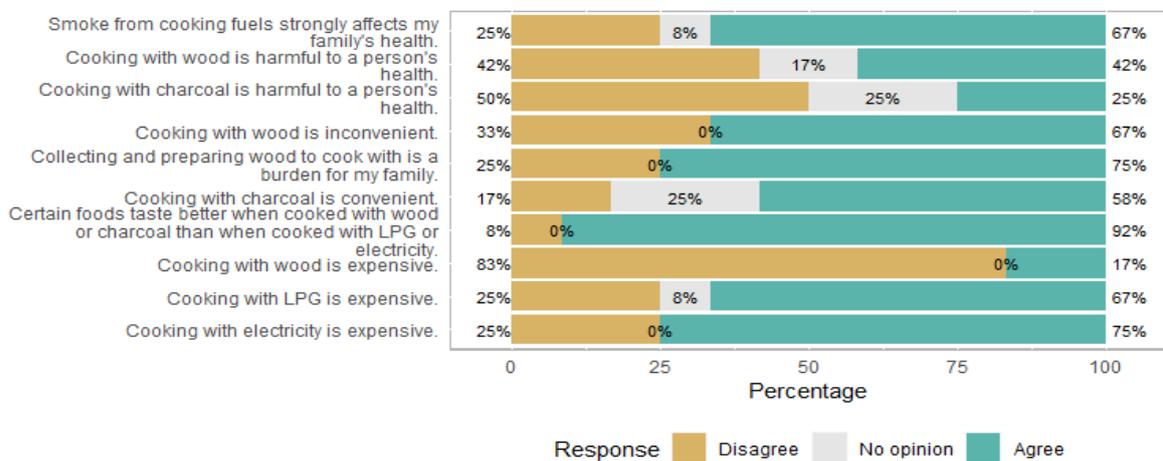


Figure 15: Perceptions of different heat sources used for cooking with regard to health, convenience, taste, and cost. Responses are loosely grouped by topic. Disaggregating households by primary heat source used for cooking shows some important differences in perceptions of different heat sources; however, the low sample sizes for households that primarily use wood, charcoal and electricity for cooking should be considered when evaluating the following results. Between 25% and 33% of households that primarily use wood and

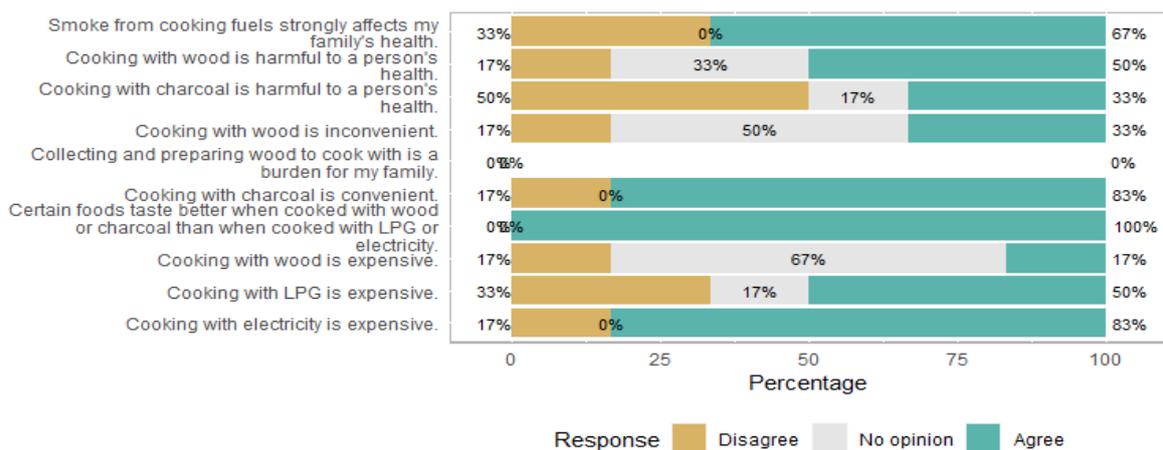
charcoal perceive their cooking fuels to affect their family’s health, while almost no households (0% to 4%) that use LPG or electricity do. Also, households that primarily use electricity for cooking do not perceive electrical cooking to be expensive, while households that use other primary heat sources for cooking do perceive electrical cooking to be expensive. Conversely, most households that cook primarily with LPG (74%) perceive it to be expensive, while only between 40% and 67% of households that primarily use other heat sources perceive LPG to be expensive.

Figure 16: Perceptions of different heat sources used for cooking with regard to health, convenience, taste, and cost, disaggregated by primary heat source used for cooking: households that primarily use a) wood; b) charcoal; c) LPG; and d) electricity. Responses are loosely grouped by topic.

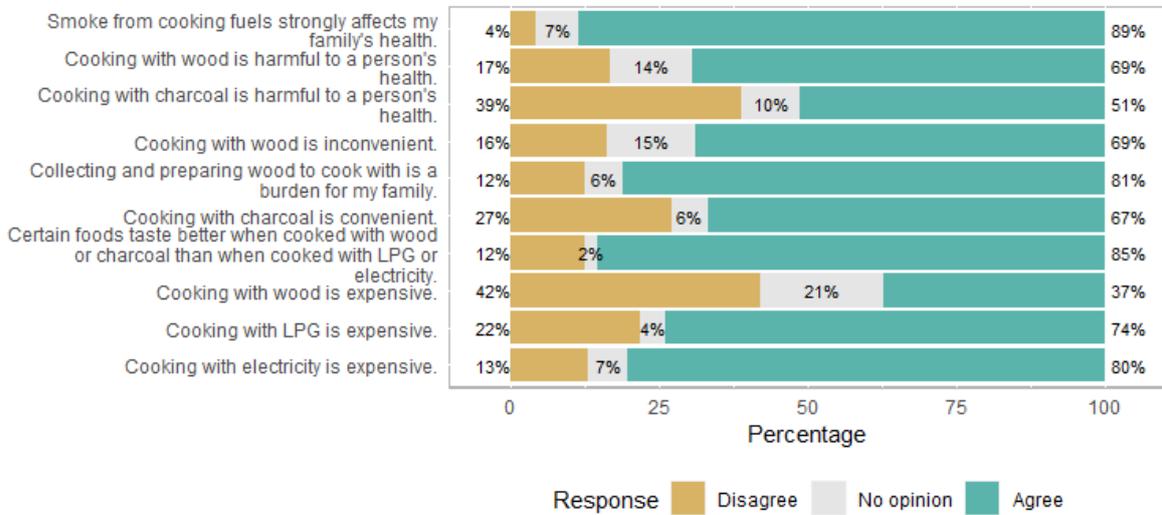
a) Wood (n = 12)



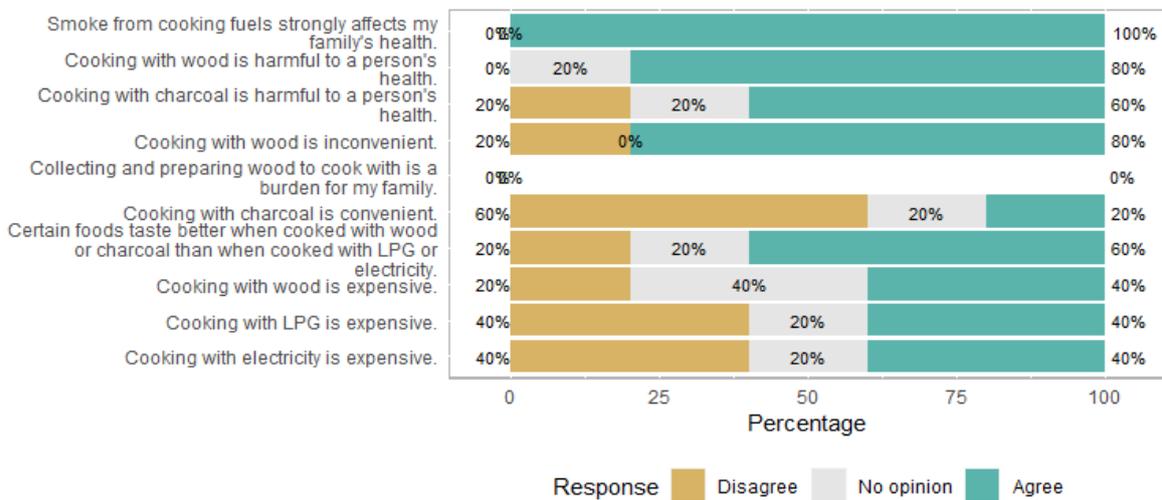
b) Charcoal (n = 6)



c) LPG (n = 193)



d) Electricity (n = 5)



### 4.5.2 Preferred purchasing methods

Approximately one-third of households preferred to pay for large purchases using instalments (35%), while others preferred to pay in full up front (65%). Of households that preferred to pay using instalments, nearly all (95%) preferred monthly instalments, and very few preferred paying using instalments every 3 months (4%) or weekly (1%).

### 4.6 Consumer preferences for cookstove characteristics

Discrete choice modelling was used to describe respondent preferences for six different cookstove attributes that did not describe any particular heat source and had either three or four possible levels:

- Number of burners: 1, 2 or 3
- Cooking cost per meal: Low, medium, or high
- Ability to cook using different processes: Boil, fry, boil & fry, or boil, fry, steam & grill
- Safety features: None, child lock, child lock & auto-off, or child lock, auto-off & no hot surfaces

- Payment method: pay upfront, pay as you go, pay in instalments over 1 year, or pay in instalments over 2 years
- Price of cookstove: \$50, \$75, \$120, or \$150 USD

For each attribute except price, a reference level was chosen as follows: one burner, low cooking cost per meal, being able to boil food only, no safety features, and paying the full cost of a cookstove upfront. All preferences described below are in reference to these levels for each corresponding attribute.

Respondent preferences for each attribute level are described by model coefficients, where a larger coefficient indicates a stronger preference for an attribute level, and a negative coefficient indicates an aversion to an attribute level. The statistical significance of each coefficient is critical: if the  $p$ -value shown is greater than 0.10, the coefficient is deemed not statistically significant and is not reported as a result.

After creating a high-quality mixed logit regression model with all respondents' responses (McFadden pseudo- $R^2 = 0.32$ ), preferences for cooking cost per meal, ability to cook using different processes, safety features and payment method were found across all respondents (Figure 17, Table 10). These preferences are summarized and discussed below:

- Each safety feature was strongly preferred over other attribute levels: for example, having a child lock was preferred nearly three times as much as paying for a cookstove using the pay-as-you-go method, and including an auto-off feature and having surfaces that did not get hot continued to increase respondent preference. Safety features were thus particularly important to respondents, particularly compared to the reference attribute level of having none of the safety features shown.
- Payment methods were the next most preferred attribute, with both instalment methods and the pay-as-you-go method showing similar preferences. Thus, paying upfront (the reference attribute level) was markedly less preferred than these alternative payment methods.
- Being able to fry foods on a cookstove was slightly less important to respondents than the payment method. Also, it is important to highlight those respondents only preferred being able to fry foods on a cookstove; they did not prefer being able to boil and fry, or boil, fry, steam, and grill foods on a cookstove.
- Having a high mean cooking cost per meal was the only attribute level to show a negative coefficient, which indicates respondent aversion. Thus, respondents are averse to high mean per-meal cooking costs. No preference was found for moderate cooking costs per meal.

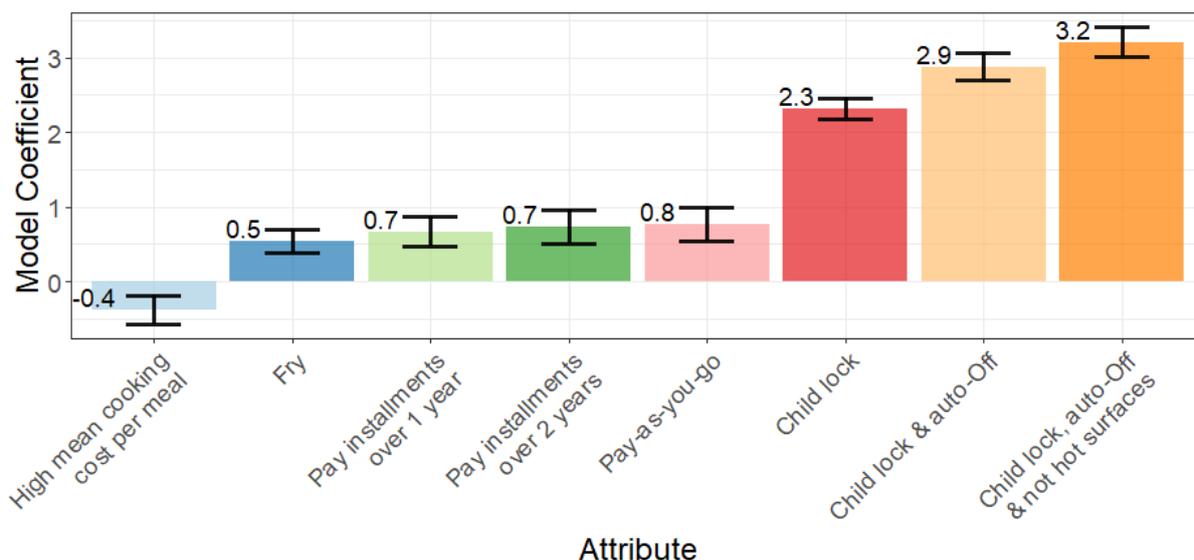


Figure 17: Model coefficients of the discrete-choice mixed logit regression model with all respondents, describing preferences for different attributes of cookstoves, with errors.

Table 10: Preferences for cookstove attribute levels across all respondents

Factor	Preference for Factor			
	Coefficient		Standard Deviation	
(intercept)	0.1	(0.2)		
Two burners	0.3	(0.2)	0.03	(0.5)
Three burners	0.2	(0.3)	-0.3	(0.2)
Moderate mean cooking cost per meal	-0.2	(0.2)	0.6 <sup>***</sup>	(0.2)
High mean cooking cost per meal	-0.4 <sup>*</sup>	(0.2)	0.8 <sup>***</sup>	(0.2)
Can fry foods	0.5 <sup>***</sup>	(0.2)	0.3	(0.3)
Can boil & fry foods	0.3	(0.2)	0.3	(0.3)
Can boil, fry, steam & grill foods	0.3	(0.2)	0.7 <sup>***</sup>	(0.2)
Has child lock	2.3 <sup>***</sup>	(0.2)	0.3	(0.2)
Has child lock & auto-off	2.9 <sup>***</sup>	(0.3)	0.8 <sup>***</sup>	(0.1)
Has child lock, auto-off & no hot surfaces	3.2 <sup>***</sup>	(0.2)	1.2 <sup>***</sup>	(0.2)
Paid for with pay-as-you-go method	0.8 <sup>**</sup>	(0.3)	0.3	(0.2)
Paid for with instalments over 1 year	0.7 <sup>***</sup>	(0.2)	0.4 <sup>*</sup>	(0.2)
Paid for with instalments over 2 years	0.7 <sup>***</sup>	(0.2)	0.1	(0.4)
Price of cookstove	0.005	(0.004)	0.01 <sup>***</sup>	(0.002)
Number of DCE questions asked	3,472			
McFadden pseudo-R <sup>2</sup>	0.32			

\*:  $p < 0.10$ ; \*\*:  $p < 0.05$ ; \*\*\*:  $p < 0.01$

No preferences were found for having two or three burners, indicating that respondents are satisfied with a single burner. This result contradicts anecdotal evidence that households prefer

two-burner electric cookstoves with the pay-as-you-go method, despite their higher price. However, the relatively high frequency of fuel stacking described above may imply that respondents are used to cooking with single burners and perhaps expect to continue this practice with the new device that they considered during this discrete choice experiment. Additional research, ideally with households actually using electric cookstoves to gain hands-on experience, is thus needed to clarify consumer preferences for this particular cookstove attribute.

Surprisingly, no preference was found for cookstove price. Because many other discrete choice experiments about cookstoves have shown preferences for price, and price is likely to play a strong role in low-resource contexts like Cambodia, this result is likely due to attribute non-attendance (ANA), a type of heuristic where respondents ignore at least one attribute when deciding which option to select in a discrete choice question. ANA likely occurred in this study due to the relatively high number of attributes (6) and levels per attribute (3 or 4), and the simple fact that the price of each cookstove option was located at the bottom of each question's page. Having fewer attributes (ideally 5 or fewer) and levels (ideally 3 or fewer per attribute) reduces respondents' cognitive load, allowing them to focus on the attributes and levels shown in each discrete choice question and thereby increasing the quality of results and typically statistical significance.<sup>1</sup> Because a preference for price was not found, estimates of willingness to pay for different cookstove attribute levels could not be calculated.

#### **4.6.1 Disaggregating consumer preferences for cookstove characteristics**

The preferences for different cookstove attribute levels were investigated in more detail by disaggregating the data based on respondent gender and age, and the household's primary heat source used for cooking and the number of people in a household (adults and children).

##### **Gender**

When disaggregating by respondent gender, too few males ( $n = 21$ ) responded to yield sensible results with a mixed logit model. Thus, with respondents being 90% female, disaggregation by respondent gender was not possible.

##### **Age**

Respondent ages were grouped into three ranges: 17 to 35, 36 to 50, and 51 to 70, which are referred to as "younger", "middle-aged", and "older", respectively. After creating high-quality mixed logit regression models for each age range (McFadden pseudo- $R^2 = 0.29$  to  $0.37$ ), preferences for the ability to cook using different processes, safety features and payment methods were found across all respondents (Table 11). These preferences are summarized and discussed below:

- Only middle-aged and older respondents preferred being able to fry foods, implying that younger respondents consider boiling foods adequate when considering the purchase of a new cookstove.
- All age ranges preferred all safety features and having more safety features, as in the all-respondents results. However, younger respondents did not prefer the safety

features as strongly as middle-aged and older respondents, indicating that younger respondents are slightly less concerned with safety when cooking with electricity and are likely more accepting of electrical cooking than middle-aged and older respondents.

- Only middle-aged respondents preferred the pay-as-you-go method, only older respondents preferred paying instalments over 1 year, and both middle-aged and older respondents preferred paying instalments over 2 years. Thus, younger respondents did not prefer any alternative payment method overpaying for a cookstove in full upfront. Also, older respondents preferred paying instalments over two years more than middle-aged respondents.

No preferences for the number of burners, cooking cost per meal, or the cookstove price were found.

Table 11: Preferences for cookstove attribute levels disaggregated by household's primary heat source used for cooking

Factor	Preference ( $\beta$ ) for Factor by Age Range		
	17 to 34	35 to 49	50 to 70
(intercept)	0.1	0.2	0.1
Two burners	0.2	0.6	0.2
Three burners	0.0	0.1	0.5
Moderate mean cooking cost per meal	-0.1	-0.5	-0.1
High mean cooking cost per meal	-0.1	-0.4	-0.5
Can fry foods	0.1	0.7***	0.9***
Can boil & fry foods	0.2	0.3	0.4
Can boil, fry, steam & grill foods	-0.2	0.3	0.8
Has child lock	2.4**	2.6***	2.6***
Has child lock & auto-off	2.7***	3.3***	3.5***
Has child lock, auto-off & no hot surfaces	3.3***	3.5***	3.6***
Paid for with pay-as-you-go method	0.5	1.0*	0.9
Paid for with instalments over 1 year	0.2	0.7	1.3**
Paid for with instalments over 2 years	0.3	0.9*	1.3**
Price of cookstove	0.003	0.009	0.003
Number of DCE questions asked	848	1,488	1,120
McFadden pseudo-R <sup>2</sup>	0.29	0.37	0.31

\*.  $p < 0.10$ ; \*\*.  $p < 0.05$ ; \*\*\*.  $p < 0.01$

### Primary Heat Source Used for Cooking

When disaggregating by the household's primary heat source used for cooking, too few households used charcoal or electricity as their primary heat source for cooking ( $n = 6$  and  $5$ , respectively) to allow the mixed logit model to converge. For households that used wood as their primary heat source for cooking, the model converged, but no model coefficients were

statistically significant, likely due to the low number of households that use wood as their primary heat source for cooking ( $n = 12$ ). Thus, with 89% of households using LPG as their primary heat source for cooking, disaggregation by the household's primary heat source used for cooking was not possible.

### Number of People in Household

Respondents were categorized into three groups based on the number of people in their household: 1 to 3, 4 to 5, and 6 to 16, which are referred to as "small", "medium-sized", and "large" households, respectively. Because half of all households (53%) had between 4 and 6 people, the small- and large-household groups had to contain households with more varied numbers of people to ensure that a sufficient number of respondents were in each group. The demographics of each of these groups are similar except that large households tend to have more children (Table 12).

Table 12: Demographics of small, medium-sized, and large households, shown as mean  $\pm$  standard deviation or mode with ranges.

Size of Household	Age	Education Level	Number of Children	Job of Respondent
Small	44 $\pm$ 14 (20 thru 70)	Primary (None thru University)	0 (0 or 1)	Retail business owner
Medium	42 $\pm$ 10 (17 thru 67)	Primary (None thru University)	0 (0 thru 2)	Retail business owner
Large	44 $\pm$ 13 (19 thru 67)	Primary (None thru University)	1 (0 thru 6)	Retail business owner

After creating high-quality mixed logit regression models for each age range (McFadden pseudo- $R^2 = 0.32$  to  $0.35$ ), preferences for the cooking cost per meal, the ability to cook using different processes, safety features and payment method were found across all respondents (Table 13). These preferences are summarized and discussed below:

- A preference for lower mean cooking costs per meal was only found for small households. While it is likely that everyone prefers cheaper cooking costs in general, these results show that smaller households specifically prefer this attribute when considering a new cookstove, while medium-sized and larger households do not.
- The preferences of small and medium-sized households for the ability to fry foods were equal, while large households preferred the ability to boil, fry, steam, and grill foods. Thus, larger households prefer cookstoves that perform multiple functions, while smaller households are satisfied with a cookstove that can only fry food.
- All household sizes preferred all safety features and having more safety features, as in the all-respondents and age-based results. However, smaller households did not prefer the safety features as strongly as medium-sized and larger households, indicating that smaller households are slightly less concerned with safety when cooking with electricity and are likely more accepting of electrical cooking than medium-sized and larger households.

- Small households preferred the pay-as-you-go method, while medium-sized households did not prefer any alternative payment method overpaying in full upfront. Older respondents preferred paying instalments over both 1 or 2 years but preferred the longer term more.

Table 13: Preferences for cookstove attribute levels disaggregated by the number of people in a household

Factor	Preference ( $\beta$ ) for Factor by Number of People in Household		
	1 to 3	4 to 5	6 to 16
(intercept)	-0.2	0.6	0.1
Two burners	0.4	0.4	0.1
Three burners	-0.1	0.3	0.6
Moderate mean cooking cost per meal	-0.8**	-0.1	0.4
High mean cooking cost per meal	-0.6*	-0.1	-0.5
Can fry foods	0.6*	0.6*	0.6
Can boil & fry foods	0.3	0.3	0.4
Can boil, fry, steam & grill foods	0.1	0.1	1.1*
Has child lock	2.2***	2.3***	3.1***
Has child lock & auto-off	2.7***	3.0***	3.8***
Has child lock, auto-off & no hot surfaces	3.0***	3.4***	4.3***
Paid for with pay-as-you-go method	1.0**	0.6	0.6
Paid for with instalments over 1 year	0.6	0.7	1.1*
Paid for with instalments over 2 years	0.5	0.7	1.5**
Price of cookstove	0.004	0.004	0.005
Number of DCE questions asked	1,216	1,296	944
McFadden pseudo-R <sup>2</sup>	0.32	0.34	0.35
*: $p < 0.10$ ; **: $p < 0.05$ ; ***: $p < 0.01$			

## Poverty Metric

Household poverty metrics were grouped into three ranges based on the interquartile range of the metric (16 to 35, 36 to 53, and 54 to 58), which are referred to as “low-income households”, “medium-income households”, and “high-income households”, respectively. Approximately half (45%) of respondents were medium-income, one third (33%) were low-income, and 17% were high-income. After creating high-quality mixed logit regression models for each group (McFadden pseudo-R<sup>2</sup> = 0.31 to 0.35), preferences for the number of burners, the ability to cook using different processes, safety features and payment methods were found (Table 14). These preferences are summarized and discussed below:

- Medium-income households preferred a two-burner stove.
- Low- and medium-income households preferred being able to fry foods. No other preferences for cooking processes were found.

- All groups preferred all safety features and having more safety features, as in the all-respondents results. However, medium-income households preferred all safety features less than Groups 1 and 3 did.
- Only Groups 1 and 2 preferred alternative payment methods. Group 1 preferred paying in instalments over 1 or 2 years similarly, and Group 2 preferred the pay-as-you-go method slightly more than paying instalments over 1 year. These preferences follow the poverty metric.

No preferences for the cooking cost per meal or the cookstove price were found.

Table 14: Preferences for cookstove attribute levels disaggregated by household's poverty metric

Factor	Preference ( $\beta$ ) for Factor by Poverty Metric		
	Group 1 (16 to 35)	Group 2 (36 to 53)	Group 3 (54 to 58)
(intercept)	0.1	0.1	0.0
Two burners	0.01	0.5*	0.2
Three burners	0.1	0.2	0.3
Moderate mean cooking cost per meal	0.1	-0.3	-0.7
High mean cooking cost per meal	-0.4	-0.2	-0.6
Can fry foods	0.6*	0.7**	0.4
Can boil & fry foods	0.3	0.3	0.2
Can boil, fry, steam & grill foods	0.7	0.3	-0.5
Has child lock	2.7***	2.0***	2.8***
Has child lock & auto-off	3.5***	2.7***	3.2***
Has child lock, auto-off & no hot surfaces	3.7***	2.9***	3.7***
Paid for with pay-as-you-go method	0.9	0.9**	0.4
Paid for with instalments over 1 year	1.1**	0.6*	0.6
Paid for with instalments over 2 years	1.3**	0.6	0.3
Price of cookstove	0.006	0.006	0.002
Number of DCE questions asked	1,088	1,504	736
McFadden pseudo-R <sup>2</sup>	0.34	0.31	0.35
*: $p < 0.10$ ; **: $p < 0.05$ ; ***: $p < 0.01$			

## 5. CONCLUSION

This study has highlighted several opportunities and challenges with bringing electrical cooking into Cambodian households. Although LPG is currently the most frequently used heat source for cooking, electricity is also frequently used for cooking, primarily with electric rice cookers, and in non-cooking applications (e.g., lights, fans, televisions). Thus, electricity is available and accepted by Cambodian households. A challenge that may be difficult to mitigate is load shedding, which can be frequent in Cambodia.

Electricity was perceived to be the safest of the four heat sources used for cooking, particularly compared to LPG, which was viewed by more than half of households to be unsafe. This difference in perception between electricity and LPG may provide an opportunity to market electrical cooking appliances, particularly because LPG cooking has diffused and been adopted widely across Cambodia, and electrical cooking has only been adopted by a few households. However, the continued and ubiquitous use of LPG as a household's primary heat source for cooking are likely due to its notable benefits, which include instant on/off, high heat output, accessibility, and lower costs compared to electricity.<sup>6</sup> These features must be replicated in electrical cookstoves to encourage Cambodian cooks to adopt electrical cooking.

Marketing of cookstoves can be targeted based on the results of this study. To appeal to Cambodian cooks, the ideal electrical cookstove should have many safety features, including a child lock, auto-off, and no hot surfaces; be able to fry foods; keep cooking costs per meal low by cooking efficiently; have one burner; and be able to be purchased using instalment plans or the pay-as-you-go method. Cookstoves should also be marketed primarily to women, the typical cooks in Cambodian households. When marketing specifically to younger cooks, the ideal electrical cookstove must only be able to boil foods, not fry them; and safety features may not be highlighted as strongly due to their relatively lower preferences. When marketing to larger households, the ideal electrical cookstove must be able to boil, fry, steam, and grill foods, not only fry them.

Although the results of this study do not allow estimates of willingness to pay to be calculated, it is logical that cookstove pricing must be kept as low as possible to remain affordable to Cambodian cooks. A balance must thus be struck between preferred cookstove features and affordability.

When considered together, the results of this study imply that induction cook stoves may be the best fit for Cambodian households: they are priced similarly to traditional electric cookstoves, have many of the desired safety features, and provide high heat output, mimicking LPG cookstoves. However, additional research is required to verify this suggestion.

The safety and convenience of electrical cooking can improve the safety and health of Cambodian cooks and households. By considering the preferences and perceptions of Cambodian cooks, we hope that the results of this study help improve the acceptance of electrical cooking in Cambodia and provide a baseline for more detailed studies of cookstove preferences and economics in the future.

## 6. REFERENCES

1. Mangham LJ, Hanson K, McPake B. How to do (or not to do) ... Designing a discrete choice experiment for application in a low-income country. Health Policy Plan [Internet]. 2009 Mar 1 [cited 2020 May 21];24(2):151–8. Available from: <https://academic.oup.com/heapol/article/24/2/151/591265>
2. National Institute of Statistics, Ministry of Planning, Kingdom of Cambodia. General Population Census of the Kingdom of Cambodia [Internet]. UNFPA Cambodia. 2019 [cited 2020 Jun 4]. Available from: <https://cambodia.unfpa.org/en/publications/general-population-census-kingdom-cambodia-2019>
3. Schreiner M. Simple Poverty Scorecard® Tool Cambodia [Internet]. 2021. Available from: <https://www.simplepovertyscorecard.com/KHM-2017-ENG.pdf>
4. Heat values of various fuels - World Nuclear Association [Internet]. [cited 2021 Sep 9]. Available from: <https://world-nuclear.org/information-library/facts-and-figures/heat-values-of-various-fuels.aspx>
5. Density of wood in kg/m<sup>3</sup>, g/cm<sup>3</sup>, lb/ft<sup>3</sup> - the ultimate guide - EngineeringClicks [Internet]. 2018 [cited 2021 Sep 9]. Available from: <https://www.engineeringclicks.com/density-of-wood/>
6. Scott N, Leary J, Hlaing WW, Myint A, Sane S, Win PP, et al. eCook Myanmar Discrete Choice Modelling. 2019.

## 7. APPENDIX

### 7.1 KOBO SURVEY QUESTIONNAIRE

Warm up conversation. Check how the participant is doing physically and mentally. Check if it's a good time to have a conversation. Keep reminding them of the purpose of this study. Remember to smile, and patiently keep the conversation alive and friendly.

#### Enumerators

- Sokea
- Chhaya
- Dane

#### Consent and verification

A1. We are doing a project with Loughborough University (UK) on cooking practices. Would you be willing to take part in a household cooking survey? This is part of an international research programme. You will be asked about how you cook. We will not record your name, so your answers will be confidential. The survey should take around 30 minutes.

A2. Do you consent to taking part in the survey?

- Yes
- No

A3. If yes, please record your voice saying, "I consent to taking part in the survey"!

[Click here to upload a file. \(< 5MB\)](#)

A4. Phone Number:

A5. Record your current location

- latitude (x.y °)
- longitude (x.y °)
- altitude (m)
- accuracy (m)

#### DCM Survey

» Respondent and household data

B1. Age

(Do not interview anyone under age 17)

B2. Gender

- male
- female

B3. What is the highest level of school you have attended?

- None
- Primary school
- Secondary school
- High school
- Vocational Training
- University degree

B4. What is your relationship to the head of the household

- head of household
- spouse
- father/mother
- Grandparent

- grandchild
- son/daughter
- brother/sister
- child-in-law
- parent-in-law
- brother-in-law/sister-in-law
- Living alone independently
- other (specify manually)

B5. How many people are living in your household? (been living and eating together during the past 2 months and not absent for more than 9 months in the last year)

B6. How many children under 5 are living in your household?

» Household Social Status

B7. Job of household head:

- Government Official
- Private company staff
- NGO staff
- Business owner - retail
- Business owner - wholesale
- Factory worker
- Labour worker
- Farmer
- Jobless

B8. What is the house type?

- Concrete house
- Wooden house
- Half concrete half wooden house

- Zinc house
- Rental room
- Villa
- Flat
- Condominium

B9. What is your main source of drinking water for members of your household?

- Piped into dwelling
- Piped into yard
- Bottled water
- Filtered water
- Rainwater
- Surface (river/pond)
- Tube well/borehole
- Dug well
- Spring
- Tanker truck
- Cart with tank
- Other (Specify if other)

B10. Do you have a complete structured latrine/improved latrine that belongs to you?

- Yes
- No

C1. What are all the different sources of electricity that you use in your household/ enterprise?

- National Grid connection
- Local Mini Grid
- Electric Generator

- Solar Home System
- Solar Lantern/Lighting System
- Rechargeable Battery
- no electricity
- Other (Please specify sources of electricity)

C2. Is this connection informal or connected directly from the provider?

- Direct connection
- Informal

#### » Power availability (and experience)

C3. Does your household have a working (none e-cooking device)

Television

- Mobile phone
- Refrigerator
- fan
- air conditioner
- electric lights
- Radio (battery powered)
- music system (Speakers)
- Computer/Laptop
- None of the above
- Other (Please specify other working none e-cooking device)

C4. In which months do you typically experience load-shedding?

- Jan
- Feb
- Mar

- Apr
- May
- Jun
- Jul
- Aug
- Sep
- Oct
- Nov
- Dec
- No blackouts

C5. How frequent are blackouts during these months?

- once a month
- twice a month
- once a week
- twice a week
- every other day
- every day
- twice a day
- many times a day

C6. How long are blackouts during these months?

- 30 mins
- 1 hour
- 2 hours
- 4 hours
- 8 hours
- 1 day
- several days
- a week

- more than a week

C7. Do you receive information about a "load-shedding" schedule (load shedding is the set hours of electricity available from the grid)?

- Yes
- No
- Sometimes

C8. How do you get this information?

- TV
- radio
- internet
- neighbours
- other (Specify other source of information)

### » Cooking and Kitchen Details

D1. How many meals does this household cook per day?

D2. In general, according to the number of times you said above, how many hours per day are spent cooking in this household?

D3. Who does the majority of the cooking in this household? (relationship to head of household)

- Head of household
- spouse
- Parent
- Elders
- Other family member
- Maid/cook
- Other (Specify other main cook in the household)

D4. Enter gender of person who does majority of the cooking:

- Male
- Female
- Both

D5. What time of day does the household usually start cooking breakfast?

Skippable if the respondent doesn't cook at this time!

hh:mm

D6. What time of day does the household usually start cooking lunch?

Skippable if the respondent doesn't cook at this time!

hh:mm

D7. What time of day does the household start cooking dinner?

Skippable if the respondent doesn't cook at this time!

hh:mm

D8. Currently, which of the following fuels do you use for cooking?

- Electricity
- Bottle gas
- Cylinder gas - 6kg
- Cylinder gas - 15kg
- biogas
- Charcoal
- Wood
- No food cooked in household
- Other (Please specify)

D9. Currently, what is your MAIN cooking fuel?

- Electricity
- Bottle gas
- Cylinder gas - 6kg
- Cylinder gas - 15kg

- biogas
- Charcoal
- Wood
- No food cooked in household
- Other
- Please specify

» Currently, how many of the following Biomass appliances do you have in your household (in working condition)

- E1. Basic stove (wood, charcoal, etc.)
- E2. Improved biomass cookstove
- E3. 3 stone

» Currently, how many of the following LPG appliances do you have in your household (in working condition)

- E4. Gas burner (portable) - single
- E5. Gas burner (portable) - double
- E6. Gas cooker (rings and oven)

» Currently, how many of the following Electric appliances do you have in your household (in working condition)

- E7. Electric hotplate - 1 hob
- E8. Electric hotplate - 2 hob
- E9. Induction cook stove - 1 hob
- E10. Induction cook stove - 2 hob
- E11. Electric Cooker (rings and oven)
- E12. Electric kettle
- E13. Electric oven

- E14. Microwave
- E15. Toaster
- E16. Rice cooker
- E17. Electric slow/multicooker (pressure cooker)
- E18. Electric BBQ & Grill E19. Fridge
- E20. freezer
- E21. Other (Please write in text - name of appliance X unit)

Skippable

» Other questions

E24. Have you ever in your life cooked with electricity?

- Yes
- No

E25. In addition to cooking food and boiling water for drinks, do you boil or heat water for bathing?

- Yes
- No

## F. Cooking appliance choices - process

» DCM Choice Part 1

F1. Choice 1

	A	B
Number of hobs used simultaneously	 <b>3 hob</b>	 <b>2 hob</b>
Cost of cooking (average cost per meal)	 High cost	 High cost
Cooking Process	 Fry only (stir-fry, deep fry, shallow- fry)	 Boil/fry/steam/grill
Safety feature	 None	 Child lock + Auto turn-off
Payment	 ២ឆ្នាំ Pay installments over 2 year	 Pay upfront
Product Price	<b>50</b> USD	<b>150</b> USD

F2. Choice 2

	A	B
Number of hobs used simultaneously	 <b>3 hob</b>	 <b>2 hob</b>
Cost of cooking (average cost per meal)	 High cost	 High cost
Cooking Process	 Boil only	 Boil/fry/steam/grill
Safety feature	 Child lock	 None
Payment	 ១ឆ្នាំ Pay installments over 1 year	 ២ឆ្នាំ Pay installments over 2 year
Product Price	<b>75</b> USD	<b>50</b> USD

F3. Choice 3

3	A	B
Number of hobs used simultaneously	 <b>3 hob</b>	 <b>2 hob</b>
Cost of cooking (average cost per meal)	 <b>Low cost</b>	 <b>High cost</b>
Cooking Process	 <b>Boil only</b>	 <b>Boil/Fry</b>
Safety feature	 <b>None</b>	 <b>Child lock + Auto turn-off + No hot surfaces</b>
Payment	 <b>Pay upfront</b>	 <b>Pay upfront</b>
Product Price	<b>75</b> USD	<b>75</b> USD

F4. Choice 4

4	A	B
Number of hobs used simultaneously	 <b>1 hob</b>	 <b>2 hob</b>
Cost of cooking (average cost per meal)	 <b>High cost</b>	 <b>High cost</b>
Cooking Process	 <b>Fry only ( stir-fry, deep fry, shallow- fry )</b>	 <b>Boil only</b>
Safety feature	 <b>Child lock + Auto turn-off + No hot surfaces</b>	 <b>Child lock</b>
Payment	 <b>PayGo</b>	 <b>PayGo</b>
Product Price	<b>150</b> USD	<b>150</b> USD

F5. Choice 5

5	A	B
Number of hobs used simultaneously	 <b>3 hob</b>	 <b>1 hob</b>
Cost of cooking (average cost per meal)	 Low cost	 Low cost
Cooking Process	 Boil/Fry	 Boil only
Safety feature	 Child lock + Auto turn-off	 None
Payment	 PayGo	 Pay installments over 1 year
Product Price	<b>50</b> USD	<b>120</b> USD

F6. Choice 6

6	A	B
Number of hobs used simultaneously	 <b>2 hob</b>	 <b>2 hob</b>
Cost of cooking (average cost per meal)	 Low cost	 Low cost
Cooking Process	 Boil/Fry	 Fry only (stir-fry, deep fry, shallow-fry)
Safety feature	 None	 Child lock + Auto turn-off
Payment	 Pay installments over 1 year	 PayGo
Product Price	<b>150</b> USD	<b>75</b> USD

F7. Choice 7

7	A	B
Number of hobs used simultaneously	 <b>2 hob</b>	 <b>1 hob</b>
Cost of cooking (average cost per meal)	 <b>Medium cost</b>	 <b>High cost</b>
Cooking Process	 <b>Boil only</b>	 <b>Boil/fry/steam/grill</b>
Safety feature	 <b>Child lock + Auto turn-off + No hot surfaces</b>	 <b>None</b>
Payment	 <b>Pay installments over 2 year</b>	 <b>PayGo</b>
Product Price	<b>120</b> USD	<b>120</b> USD

F8. Choice 8

8	A	B
Number of hobs used simultaneously	 <b>3 hob</b>	 <b>3 hob</b>
Cost of cooking (average cost per meal)	 <b>Low cost</b>	 <b>Medium cost</b>
Cooking Process	 <b>Boil/fry/steam/grill</b>	 <b>Boil/fry/steam/grill</b>
Safety feature	 <b>Child lock + Auto turn-off + No hot surfaces</b>	 <b>Child lock</b>
Payment	 <b>Pay installments over 1 year</b>	 <b>PayGo</b>
Product Price	<b>150</b> USD	<b>120</b> USD

## G. Fuel consumptions and Perceptions » Current Electricity consumption

G1. How much do you pay each month on electricity bills? (KHR)

» Current LPG consumption

G2. What size of refill did you buy last time? (kg)

G3. How much did this cost?

G4. How long does this size of rell typically last (weeks)

» Current Charcoal consumption

G5. How much did you spend last time you bought charcoal? (KHR)

G6. How much did you buy?

G7. How long does this last? (days)

» Current Wood consumption

G8. How much did you spend last time you bought wood? (KHR)

G9. How much did you buy?

G10. How long does this last? (days)

» Perception on different fuels

H1. How easy is it to access LPG?

- Very difficult
- Difficult
- Don't know/No opinion
- Easy
- Very easy

H2. How safe is LPG?

- Very unsafe

- Unsafe
- Don't know/No opinion
- Safe
- Very safe

H3. How easy is it to access charcoal?

- Very difficult
- Difficult
- Don't know/No opinion
- Easy
- Very easy

H4. How safe is charcoal?

- Very unsafe
- Unsafe
- Don't know/No opinion
- Safe
- Very safe

H5. How easy is it to access wood?

- Very difficult
- Difficult
- Don't know/No opinion
- Easy
- Very easy

H6. How safe is wood?

- Very unsafe
- Unsafe
- Don't know/No opinion
- Safe
- Very safe

H7. How easy is it to access electricity?

- Very difficult
- Difficult
- Don't know/No opinion
- Easy
- Very easy

H8. How safe is electricity?

- Very unsafe
- Unsafe
- Don't know/No opinion
- Safe
- Very safe

H9. How easy is it to access other types of fuel?

- Very difficult
- Difficult
- Don't know/No opinion
- Easy
- Very easy

H10. How easy is it to access other types of fuel?

- Very unsafe
- Unsafe
- Don't know/No opinion
- Safe
- Very safe

» Non-Cooking use of Fuels

I1. What else do you use electricity for

- lighting

- Laundry machine

- Juice extractor

- Salon tools

- other (Please specify)

I2. What else do you use charcoal for

- water heating

- space heating

- other (Please specify)

I3. What else do you use wood for

- water heating

- space heating

- other (Please specify)

» Attitudes towards Fuels

J1. I think smoke from cooking fuels is a big health problem in my family.

- Disagree

- No opinion

- Agree

J2. I think cooking with firewood is not convenient.

- Disagree

- No opinion

- Agree

J3. I think firewood is expensive for cooking.

- Disagree

- No opinion

- Agree

J4. I think charcoal is convenient to use for cooking.

- Disagree
- No opinion
- Agree

J5. I think cooking with charcoal is harmful to a person's health.

- Disagree
- No opinion
- Agree

J6. I think cooking with firewood is harmful to a person's health.

- Disagree
- No opinion
- Agree

J7. I think electricity is expensive for cooking.

- Disagree
- No opinion
- Agree

J8. I think LPG is expensive for cooking.

- Disagree
- No opinion
- Agree

J9. I think certain food tastes better when cooked with charcoal or wood compared to gas or electricity.

- Disagree
- No opinion
- Agree

J10. I think collecting and preparing firewood is a burden for my family.

- Disagree
- No opinion

- Agree

### K. Cooking appliance choices - the stove

#### » DCM Choice Part 2

#### K1. Choice 9

	A	B
Number of hobs used simultaneously	 <b>2 hob</b>	 <b>1 hob</b>
Cost of cooking (average cost per meal)	 Medium cost	 Low cost
Cooking Process	 Boil/Fry	 Boil/fry/steam/grill
Safety feature	 Child lock + Auto turn-off + No hot surfaces	 Child lock + Auto turn-off + No hot surfaces
Payment	 Pay installments over 1 year	 Pay upfront
Product Price	<b>50</b> USD	<b>50</b> USD

K2. Choice 10

	10	A	B
Number of hobs used simultaneously		 <b>3 hob</b>	 <b>2 hob</b>
Cost of cooking (average cost per meal)		 <b>High cost</b>	 <b>Low cost</b>
Cooking Process		 <b>Boil/Fry</b>	 <b>Boil/fry/steam/grill</b>
Safety feature		 <b>Child lock + Auto turn-off</b>	 <b>Child lock</b>
Payment		 <b>Pay installments over 2 year</b>	 <b>Pay installments over 2 year</b>
Product Price		<b>120</b> USD	<b>75</b> USD

K3. Choice 11

	11	A	B
Number of hobs used simultaneously		 <b>2 hob</b>	 <b>3 hob</b>
Cost of cooking (average cost per meal)		 <b>Medium cost</b>	 <b>Low cost</b>
Cooking Process		 <b>Fry only ( stir-fry, deep fry, shallow- fry )</b>	 <b>Boil only</b>
Safety feature		 <b>Child lock</b>	 <b>Child lock + Auto turn-off + No hot surface</b>
Payment		 <b>Pay upfront</b>	 <b>PayGo</b>
Product Price		<b>50</b> USD	<b>50</b> USD

K4. Choice 12

12	A	B
Number of hobs used simultaneously	 <b>1 hob</b>	 <b>3 hob</b>
Cost of cooking (average cost per meal)	 Medium cost	 Medium cost
Cooking Process	 Boil only	 Fry only (stir-fry, deep fry, shallow- fry)
Safety feature	 Child lock + Auto turn-off	 None
Payment	 Pay installments over 2 year	 Pay upfront
Product Price	<b>150</b> USD	<b>150</b> USD

K5. Choice 13

13	A	B
Number of hobs used simultaneously	 <b>1 hob</b>	 <b>1 hob</b>
Cost of cooking (average cost per meal)	 Medium cost	 Low cost
Cooking Process	 Boil/fry/steam/grill	 Fry only (stir-fry, deep fry, shallow- fry)
Safety feature	 Child lock + Auto turn-off	 Child lock + Auto turn-off + No hot surface
Payment	 Pay installments over 1 year	 Pay installments over 2 year
Product Price	<b>75</b> USD	<b>75</b> USD

K6. Choice 14

	A	B
Number of hobs used simultaneously	 <b>1 hob</b>	 <b>1 hob</b>
Cost of cooking (average cost per meal)	 <b>Low cost</b>	 <b>Medium cost</b>
Cooking Process	 <b>Boil/Fry</b>	 <b>Boil/Fry</b>
Safety feature	 <b>Child lock</b>	 <b>None</b>
Payment	 <b>Pay installments over 2 year</b>	 <b>PayGo</b>
Product Price	<b>150</b> USD	<b>75</b> USD

K7. Choice 15

	A	B
Number of hobs used simultaneously	 <b>1 hob</b>	 <b>2 hob</b>
Cost of cooking (average cost per meal)	 <b>High cost</b>	 <b>Low cost</b>
Cooking Process	 <b>Fry only ( stir-fry, deep fry, shallow- fry)</b>	 <b>Fry only ( stir-fry, deep fry, shallow- fry)</b>
Safety feature	 <b>Child lock</b>	 <b>Child lock + Auto turn-off</b>
Payment	 <b>Pay installments over 1 year</b>	 <b>Pay installments over 1 year</b>
Product Price	<b>50</b> USD	<b>120</b> USD

## K8. Choice 16

16	A	B
Number of hobs used simultaneously	 <b>1 hob</b>	 <b>1 hob</b>
Cost of cooking (average cost per meal)	 <b>High cost</b>	 <b>Low cost</b>
Cooking Process	 <b>Boil only</b>	 <b>Boil/Fry</b>
Safety feature	 <b>Child lock + Auto turn-off</b>	 <b>Child lock</b>
Payment	 <b>Pay upfront</b>	 <b>Pay upfront</b>
Product Price	<b>50</b> USD	<b>120</b> USD

## L. Experience of Technology

» Technology knowledge

L1. How often do you listen to the radio?

- not at all
- less than once a week
- at least once a week
- daily

L2. How often do you watch television?

- not at all
- less than once a week
- at least once a week
- daily

L3. How often have you used your mobile phone in the last month?

- not used
- weekly
- once or twice a day
- several times a day

L4. How often have you used your personal laptop (or desktop computer) in the last month?

- not used
- weekly
- once or twice a day
- several times a day

» Phone and internet

L5. What type of phone do you most commonly use?

- Smart phone
- Basic phone

L6. How often do you currently use Facebook or Telegram or other messenger apps?

- Never use
- no longer used
- weekly
- once or twice a day
- several times a day

L7. Have you used Mobile Money to send money (ABA, Wing, Acleda, or other Bank/MFI apps)?

- 1 or 2 times a month
- 3 - 10 times a month
- daily
- not used

#### » Intrahousehold decision making

M1. If you were going to purchase a new cooking device, who in your household would be the main decision maker?

- male head of house
- female head of house
- joint decision
- another relative
- other

#### » Payment Preferences

M2. How do you prefer to pay for high value purchases:

- pay total cost up front
- pay on instalments

M3. What frequency of payments on instalment would you prefer?

- weekly
- monthly
- every 3 months

Remember to THANK THE RESPONDENT!