



Focus Group Discussions

Rwanda

Working paper

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Energy 4 Impact

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Executive summary

This report was commissioned by Loughborough University, the lead implementing partner on the Modern Energy Cooking Services (MECS) programme.

It presents the learnings from a series of focus group discussions (FGDs) conducted in Rwanda to investigate Rwandan Households (HHs) current cooking practices and how they aspire to cook in the future. The aim was to get a deeper understanding of how people cook, their cooking energy types and how their practices affect their choice of cooking technologies. The study used qualitative evidence to gather opinions about whether modern energy cookstoves (mostly eCooking) could fulfil Rwandan HHs cooking needs.

Sixty HHs across six different clusters within Kigali city and the Bugesera district participated in these FGDs between July and August 2022 and provided their feedback on various cooking practices.

The most popular dishes identified during the FGDs were similar whether in urban, peri urban or rural clusters, with the only difference being the frequency in which dishes are prepared. Generally, dishes consisted of a combination of “staples” and “stews”, or “imvange” (which literally means 'a bit of everything'), occasionally served with “specials”. Foods referred to as “long cooking foods” were also identified.

In urban and peri-urban clusters, LPG and charcoal were the two main cooking fuels, supplemented by electricity, firewood, and biogas. In rural clusters, firewood and charcoal were the main fuels, supplemented by electricity, LPG, and biomass waste. Charcoal was preferred for reasons including its perceived low cost, the taste it gives to the food, its high market availability even in small amounts, and perception of how safe it is to use it. LPG was preferred for reasons such as the fact that it does not emit smoke, it cooks quickly, its stoves usually have multiple hobs, and it is easy, clean, convenient and “fancy” to use. Reasons for cooking with electricity (eCooking), particularly electric pressure cookers (EPCs), included lack of smoke, the fact that it is automated so you can multitask while cooking, it is easy reload the meter, it imparts a good flavour to food, and it is easy, clean, convenient and “fancy” to use. Firewood was preferred for its perceived low cost, mostly in rural clusters where it is freely collected, but also for its cheap stoves and fast cooking.

Boiling was reported as an essential cooking process in all clusters, mainly because it is healthy compared to other cooking processes which involve using oil such as deep and wet frying, low cost in the context it requires less ingredients, particularly oil which is rather expensive, and easy compared with other cooking processes since a cook only need to put food items and ingredients in a pot and just boil. Both wet-frying and pressure-cooking processes were found useful, although the former was used more regularly than the latter, even when considering only HHs that own an EPC. In fact, perception of risk safety associated with electric hazards is still important to the point that EPC (or any other eCooker) is only used when the HHs heads or any other responsible person in the HH are present. Deep-frying and grilling were carried out once or less than once a week while baking was rarely used.

It was observed that each dish type is often associated with a particular cooking process, which in turn it tends to be linked to a particular cooking fuel. For instance, staples and long-cooking dishes were often boiled, usually on a charcoal stove or EPC, stews were wet fried on LPG or EPC, and specials were deep-fried on LPG.

While traditional stoves were seen as relatively cheap, costing less than US\$10, modern cooking appliances could cost from around US\$40 for a 6kg cylinder with one burner stove to US\$120 for a 20kg cylinder with a two-burner stove. On the Kigali market, eCooker costs also varied from US\$35 for a one-hob hotplate to US\$80-130 for an EPC, depending on the size and brand.

The cost of modern cooking appliances was deemed expensive by FGDs participants. In fact, participants from urban and peri-urban clusters estimated that only between 20% and 50% of their communities' HHs could afford them at the current prices, while those from the rural cluster estimated less than 10%. As a solution, participants suggested they would welcome innovative financial models to reduce the price weight, including paying in instalments over up to a year.

In the future, participants aspired to use cooking appliances with features that included the ability to allow them to do other HH chores while cooking, that emit no smoke, cook food quickly, last a long time, are clean, convenient, and safe to use, and are sold through financing models to reduce the cost shock.

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1. Introduction

1.1. Background of the study

Energy 4 Impact (E4I) was contracted through Loughborough University, the lead implementing partner for the five-year Modern Energy Cooking Services (MECS) programme, to be the in-country partner for Rwanda. The programme aims to accelerate the global transition from traditional biomass-based cooking to modern-energy cooking solutions. The focus group discussion (FGD) component is one of the research pieces E4I did undertake in Rwanda to understand consumer environments and to gather new insights into consumers' wishes and cultural cooking practices in Rwandan households (HHs).

The study used qualitative evidence to gather opinions about whether modern energy cookstoves (mostly e-cookers) could fulfil Rwandan HHs' cooking needs. The FGDs investigated Rwandese HHs' current cooking practices and how they aspire to cook in the future. This involved getting a deeper understanding of how people in Rwanda cook, which types of energy they use and how their practices affect their choice of cooking technologies. This FGD report is based on feedbacks collected by E4I between July and August 2022. E4I carried out six different sessions with 60 participating HHs across six different clusters within Kigali city and the Bugesera district.

1.2. The cooking landscape in Rwanda

In Rwanda, there is still a huge reliance on traditional fuels for cooking. In rural areas, firewood accounts for 93% of cooking fuel. Even in urban areas, firewood represents 26.3% of cooking fuel, with charcoal being the most common (65%). With firewood and charcoal as the prevalent cooking fuels, the use of traditional cooking technologies is also common in Rwanda. Traditional stoves are the most commonly used (53%), followed by charcoal or open fire stoves (with 16%) (NISR, 2018)¹.

As a result, access to clean cooking acts as a significant bottleneck when it comes to improving the health and well-being of Rwandan HHs. The government of Rwanda (GoR), through its Rwanda Energy Policy, recognises both the environmental and health threats presented by the overexploitation of biomass – in particular, firewood and charcoal. HH air pollution (HAP) from solid fuel use is the fourth-leading risk factor for morbidity and mortality in Rwanda, and respiratory infection is the leading cause of loss of life

¹ NISR, 2018. EICV5: Rwanda Poverty Profile Report, National Institute of Statistics of Rwanda

(IHME, 2021)². It is estimated that annually, more than 7,383 premature deaths in Rwanda are attributable to HAP, with total welfare losses of US\$674 million per year (World Bank and IHME, 2016). On average, 76% of HHs spend at least seven hours per week acquiring fuel, either by collecting or purchasing, and preparing the fuel for their stoves, with a disproportionate burden on HHs using firewood. Women and girls also disproportionately bear the burden of fuel collection and cooking-related activities. As a result, women and children are more susceptible to HAP and the associated adverse health effects, and chores relating to cooking take a considerable amount of their time, which could be used for other productive activities such as education or employment (World Bank, 2020)³.

1.3. eCooking in Rwanda

According to the Rwandan government's Biomass Energy Strategy, electricity is an alternative source of energy for cooking, particularly for the hospitality sector and high-income segments of the population. Progress in electricity generation and electricity access in recent years has meant that Rwanda experiences significant surpluses of energy during off-peak hours, while power supply and demand become more closely matched in peak evening hours. This, in addition to the challenge of low electricity demand across the country, indicates that using electricity for cooking through "smart" electricity tariffs around meal hours might help to absorb the excess baseload electricity in the daytime while also helping reduce the dependence on biomass. The inclusion of eCooking appliances within the recent clean cooking results-based-finance window by the Development Bank of Rwanda (BRD) (BRD, 2021a)⁴ has been seen as a positive development.

All around Kigali city, there are several shops selling eCooking appliances. However, there is a lack of after-sales service and little awareness of their benefits, which has hampered their adoption. Encouragingly, there is growing interest from private companies such as Electrocook and Burn Manufacturing in manufacturing EPCs in Rwanda, which would considerably reduce most of the barriers to adoption of eCooking.

² IHME, 2021. Country profile/Rwanda. Institute for Health Metrics and Evaluation

³ The World Bank, 2020. Rwanda – Energy Access and Quality Improvement Project

⁴ BRD, 2021. Priority sectors – Energy. Banque Rwandaise de Developement

1.4. Aims of the study

The aims of this study are to get feedback on current cooking situations, needs and priorities around cooking fuels, and to gather opinions about whether modern energy cookstoves (mostly eCookers) could fulfil those needs. In addition, we were interested to learn more about HHS' current cooking practices and how they aspire to cook in the future. When we talk about modern energy cookstoves, we are referring to cookstoves using LPG, electricity, and (bio)ethanol. The objectives of the study are to:

- Discuss current cooking energy products/services and why they are important
- Understand participants' preference towards various cooking appliance features that influence their decision and aspirations to buy
- Understanding participants' impression of eCookers

2. Methodology

2.1. Study set up

The study was conducted through an FGD in six clusters that were grouped into urban, peri urban and rural zones for analysis. Each group consisted of 10 participants representative of their HHs. Materials such as flip charts, stickers, grouping gender (male and female) and/or main fuel (charcoal and LPG), were used to collect the participants' opinions. A special emphasis was put on eCooking. Various eCookers including EPC and infrared cookstoves were showcased to participants and afterwards discussions on their knowledge and awareness about eCooking were held.

2.2. Study area

The study was carried out in the city of Kigali, which is composed of urban and peri urban areas, as well as in the Bugesera district, which is considered to be rural. The map below (Figure 1) indicates the location of clusters where the FGDs were conducted.



Figure 1: Location of the six clusters where the focus group discussions were held

3. Analysis

3.1. Data overview

Sixty HHs were randomly selected from six clusters where we previously conducted the cooking diaries and the discrete choice modelling studies. HH heads or their representatives attended the three-hour group discussion, and each gave their thoughts into reasons behind cooking practices and behaviours, and the status of modern cooking in their communities.

It should be noted that the FGD data only considered fuels used to cook a meal, either breakfast, lunch, or dinner. **Cooking energy used for tasks such as heating water in a kettle or reheating in a microwave was not recorded, because users reported that they do not generally consider using this as cooking.** Furthermore, these are considered supplementary tasks carried out erratically, so it would be difficult to track.

3.2. Popular dishes prepared in the clusters

During the FGDs various types of dishes were identified and described. Interestingly, the most popular are similar whether in urban, peri urban or rural clusters. The only difference between these clusters is the frequency in which some dishes are prepared. They consist of a combination of “staples” and “stews”, followed by “imvange” (which literally means 'a bit of everything,') and, occasionally, “specials”. Another type, referred to as “long-cooking”, was also identified.

- **Staples** are usually boiled and considered to be the main component of the meal. These include rice, Irish potato, sweet potato, cassava, yam, banana, pasta, *ubugali* (cassava paste), and *kawunga* (maize flour paste).
- **Stews** are an important part of the meal but considered as supplementary to staple food. These can be beans, peas, vegetables, beans and vegetables, meat, or groundnuts, wet-fried with onions and tomatoes.
- **Imvange** is a mixed dish prepared by boiling staples and stews together, and sometimes wet-fried. An imvange could consist of staples such as Irish potato, sweet potato, banana, cassava, yam, and pasta mixed with any stew (e.g., cassava and beans, Irish potato and peas, banana, and vegetables, etc.). A combination of banana or Irish potato with meat is called *agatogo*.
- **Special** foods are prepared on special occasions by deep frying or grilling and served as sides to staples and stews. These can be potato, cassava, or banana chips.

- **Long-cooking** foods are usually prepared for more than 60 minutes. These include beans and *isombe*,⁵ which are prepared in quantity to be consumed over a couple of days. A portion of beans is taken from the precooked quantity as needed and used for stew preparation, whereas with *isombe* the portion is only reheated.

3.3. Urban group

3.3.1. Used cooking fuels

The urban group consisted of 30 HHs from the Gikondo, Kimironko, and Nyamirambo clusters. The cooking energy pool used by participants from urban cluster consists of LPG, charcoal, firewood, electricity, and biogas. LPG and charcoal are the main fuels used within these HHs. Figure 2 highlights fuel stacking practices, where each HH uses at least two different fuels for cooking.

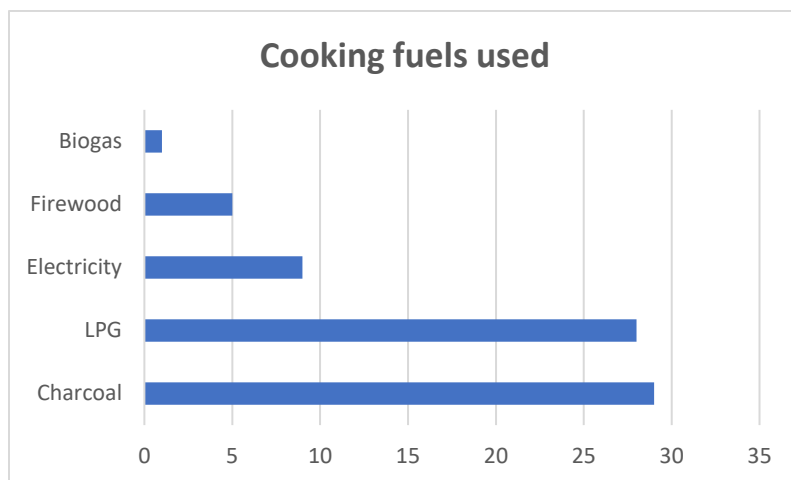


Figure 2: Cooking fuels used by households from urban clusters

The reasons behind their choices of cooking fuels were indicated as follows:

A. Reasons for using charcoal:

- The food cooked on charcoal tastes good. In fact, charcoal users argued that due to the progressive increase in heat (not instantaneously) coupled with low heat that charcoal generates, the food is cooked slowly and keeps its original taste.

⁵ Isombe is a type of stew made primarily of cassava leaves

- Low cost. **Users reported that they believe charcoal is cheaper than other available fuels, although they admit they never looked into any deeper analysis of cooking costs.**
- Best for long-cooking dishes. Participants generally believed that it is cheaper to cook long-cooking dishes such as beans and *isombe* on charcoal than any other fuel they use.
- Available in any amount. It was argued that sometimes cooking fuel gets exhausted when they are low on cash and the fact that they can just purchase a small amount to cook for a day is an advantage.
- Past habits. Some participants said that they are not aware of the energy or economic advantages of charcoal, but they prefer it because they grew up watching their parents using it.

B. Reasons for using LPG

- Fast cooking. LPG heats to a naturally higher temperature and an LPG stove can instantaneously reach its maximum heat, so it takes less time to cook food than many other fuels, including charcoal.
- Does not emit smoke. When it comes to cooking, one of the preoccupations of urban FGD participants, as well as other cooks in general, is the smoke emissions, and LPG stoves have an advantage in this respect.
- Easy to use. Lighting a modern LPG stove is as basic as turning a knob. Adjusting the heat is also done by turning the knob and there is no interface the user needs to work out. All this convenience is much appreciated by cooks.
- Adjustable heat. All good cooks know that different types of dishes require different amount of heat. Cooks from urban FGDs also expressed the need to adjust the heat depending on the time they have or how many other HHs chores they have to get through, so the ability to adjust the heat is highly sought after.
- Multiple hobs. Many LPG stoves on the market have multiple hobs, allowing cooks to save time by cooking several dishes at once. Although urban cooks acknowledged they do not always need multiple hobs stoves, they said that it comes handy when they are cooking for many people or when they are in a hurry.
- Convenient. LPG users indicated that they find it easy and labour-saving to use compared with appliances that use other traditional fuels, which they often struggle to light or clean.

C. Reasons for using electricity

- It makes food taste good. Like charcoal, electric pressure cookers (EPCs) increase heat progressively and the maximum temperature is relatively low compared to firewood or LPG, so food is cooked slowly, is well cooked and tastes good. The EPC's sealed pot and pressure cooking also helps retain most of the food's nutrients and flavour.
- Low cost. EPC users reported that it is cheaper to cook with it than any other fuel. This makes sense as they had data loggers to measure electricity consumption.
- Easy to recharge the meter. Unlike other fuels, when electricity gets exhausted while cooking, it is easy and fast to buy new units for the prepaid utility meter.
- Fast cooking. When using eCookers other than the EPC, it has been observed that cooking takes less time.
- Convenient. Users indicated that they found EPCs easy and labour-saving to use compared with appliances that use other traditional fuels, which they often struggle to light or clean.
- Allows multitasking. Users can set a timer which turns the appliance off automatically when the cooking is done, which meant they could do other HHs chores at the same time.

It is interesting to note the difference in fuel usage attitude between those using charcoal as a main fuel and those using LPG as a main fuel. In fact, only a small proportion (6%) of those who use LPG as a main fuel do not use charcoal (Figure 3), while a large proportion (42%) of those who use charcoal as a main fuel do not use LPG (Figure 4). This was explained by the difference in limitations of each fuel (LPG and charcoal) according to opinions of its non-users. The disadvantages of using charcoal, such as slow cooking or the fact it makes the pots dirty, as highlighted by urban cooks, are not severe. This meant its usage was dish-specific, but charcoal remained stacked into the cooking fuel pool. On the other hand, the disadvantages of using LPG such as high cost, low availability or safety hazards linked to explosion are considered severe by cooks. This resulted in lower usage frequencies, and in most cases, it was only operated by HH heads rather than house cooks.

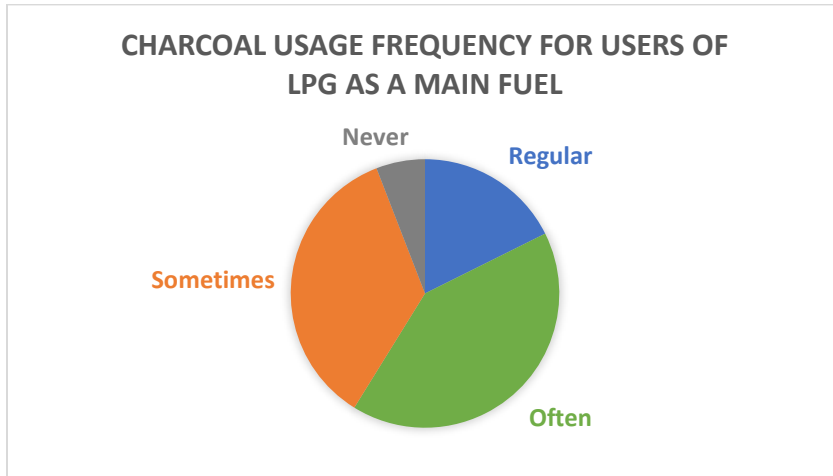


Figure 3: Charcoal usage frequency for those who use LPG as a main fuel

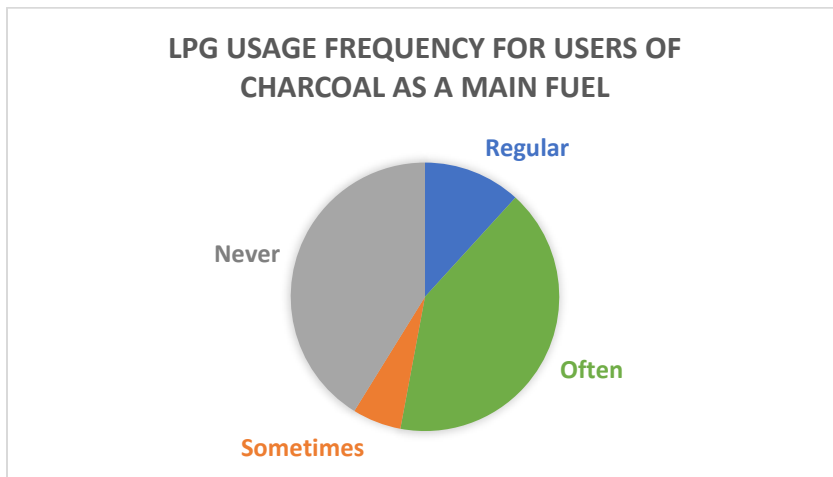


Figure 4: LPG usage frequency for those who use charcoal as a main fuel

Limitations of various cooking fuels reported by urban FGDs participants include:

A. Limitations of using charcoal

- Slow to cook. Participants reported that cooking with charcoal takes a long time, which is inconvenient as they often have multiple dishes to cook in a limited time. Charcoal stoves were reported as not helpful when preparing breakfast in the morning.
- Dirties the pots. The emitted smoke, although there is not much of this when the charcoal quality is good, was said to dirty the pots, leading to more time spent in the kitchen cleaning pots.
- Harmful to the environment. Participants said they aware of the environmental degradation caused by the continued use of charcoal, particularly in cutting trees and the emissions released

when producing it. This was mentioned as one of the reasons they are including modern cooking fuel into their pool.

- Safety hazards associated with carbon monoxide emission. Another danger of using charcoal, reported by the FGD participants is the death risks associated with carbon monoxide released by charcoal, particularly when the stove is left in a non-aerated indoors space.
- Difficult to light. Charcoal users indicated that it takes them between five and 15 minutes on average to light charcoal stoves, and that is only when they managed to get adequate tools.
- Variable quality standards. Another problem faced by charcoal users is the substandard charcoal on the market. Sometimes unable to tell them apart, they end up paying a high price for low-quality charcoal.
- Respiratory diseases. Participants are aware of the harmful effects charcoal can have on the health, but few of them had really experienced them. Some of them said they have been coping with it by cooking outdoors.
- Requires ventilated space. Due to smoke emissions, users suggested that it would be unbearable to cook on charcoal in a confined space.
- Requires good storage. Charcoal is only effective when dry and since most of the HHs purchase it in large quantities to last a whole month, there is a need for a good storage.

B. Limitations of using LPG

- Expensive. The cost of LPG was reported to be higher than the other traditional cooking fuel (charcoal and firewood) used by urban FGDs' participants. That means that if it weren't for its other benefits, they would not be using LPG.
- Price volatility. Another significant limitation for participants is the ever-changing price of LPG. In fact, participants who used charcoal as a main fuel reported that they cannot commit to relying on LPG, as they never know how much it will cost in the future.
- Low availability. It was reported that selling points are still not enough in urban clusters and that sometimes they must walk for more than 2km to purchase it when the smaller neighbourhood shops go out of stock. Nevertheless, they highlighted the growing practice of LPG home delivery.
- Safety hazards associated with explosions. One of the factors in the reluctance to adopt and use LPG is the risks of explosion when mishandled. Some participants indicated that LPG is only used

by HHs heads, or in their presence, to minimize these risks. Others mentioned that although they often use LPG, they are never comfortable about it.

- Non-metered cylinders. Another limitation highlighted is the fact that LPG users are never aware of how much gas remains, which means it can run out while cooking, sometimes late in the night without the possibility of refilling. Even when it is possible to refill, it takes long enough for the food to be spoiled. LPG meters exist on the market but are expensive for many HHs.
- Brand compatibility issues. Distributors and retailers of various LPG cylinders do not accept a different brand to theirs. This is a real inconvenience for the user, who sometimes has to walk a long distance looking for their brand shops or, even worse, cannot find one at all for quite some time.
- Impacts on food taste. Participants, particularly those who do not use LPG as a main fuel, reported that the taste of some foods is altered when cooked on LPG, so they use it less often.
- Burns the food. Due to the high temperature of LPG, users say that sometimes, when trying to minimize the cooking time, they end up burning the food. This occurs more often than they would like and is an inconvenience for them.

C. Limitations of using firewood

- Harmful to the environment. Similarly to charcoal, participants acknowledged the environmental degradation caused by the firewood use through both cutting trees and smoke emissions released when cooking. Consequently, they are trying to move away from using it.
- Low availability. Firewood users indicated that sometimes they do not use it enough as they would like because they cannot get hold of it. Because there are not any forests or woodlots locally, or because there are strict regulations around cutting them down, there are no regular shops selling firewood.
- Dirties pots and cooking area. As well as the pots used for cooking, the kitchen walls and roof become dirty from the smoke emitted by firewood. This is a major inconvenience for cooks, particularly those who have chosen to walk away from using firewood.
- Causes respiratory diseases. Participants indicated that they are aware of the respiratory harmful effects of using firewood, and that it has been a decisive factor for some who have stopped using it. Those who still use it also acknowledged the threat but stated that it is a price they are willing to pay for firewood cheaper cost.

- Takes time to prepare. Firewood users and other knowledgeable participants highlighted the time-consuming nature of collecting, drying, and chopping wood before they get to use it.
- Risk of fire hazards. Since firewood is generally used indoors, users reported that if there is low hanging electric wiring or other flammable material nearby, chances of fire hazards are rather high.

D. Limitations of using electricity

- Lack of awareness. When asked why they do not use electricity for cooking meals, many participants reported that growing up they never saw their parents or neighbours using eCooking.
- Expensive cost. Some participants indicated that the information they have on the few eCookers they know of is that they are energy consuming and expensive to cook with.
- Safety risks associated with the power circuit. Although they acknowledged they didn't know much about it, participants mentioned they were worried about the electrical hazards of eCooking.
- EPC's single pots. One of the often-mentioned issues of EPCs is that users must remove and clean the pot before they can cook another dish. This increases cooking time, particularly when preparing multiple dishes.

E. Limitation of using biogas

- Low power. The only biogas user present at the FGD said he was inconvenienced by the time it takes to cook a whole meal, and that he always had to start cooking early, particularly when preparing multiple dishes.

3.3.2. Cooking processes

Boiling was reported the most important and most-used cooking process followed by wet frying (Table 1). Both methods were used on a daily basis. Deep frying and grilling, however, were used once a week or less. HHs that own an EPC found it useful and said they used pressure cooking as often as wet frying.

Table 1: Cooking processes used by participants from urban clusters

Cooking process	Importance	Benefits	Limitations
Boil	Essential	Food is healthy, well-cooked and keeps many of its nutrients, it's cheaper, less time consuming and easy	
Wet fry	Useful	Food tastes and smells good, and can help if you want to gain some weight	Oil not healthy
Deep fry	Not essential	Food tastes and smells good, and can help if you want to gain some weight	Oil not healthy, expensive
Grill	Not essential	Food is healthy	No adequate appliances
Pressure-cook	Useful	Food tastes good and keeps most of its nutrients	

3.4. Peri urban group

3.4.1. Used cooking fuels

The peri-urban areas consisted of Gahanga and Kanombe clusters with a total of 20 HHs. The cooking fuels used by participants in this group are charcoal, LPG, electricity, and firewood. It was stated that charcoal was used significantly, and it was observed that HHs use at least three different fuels, as shown in Figure 5.

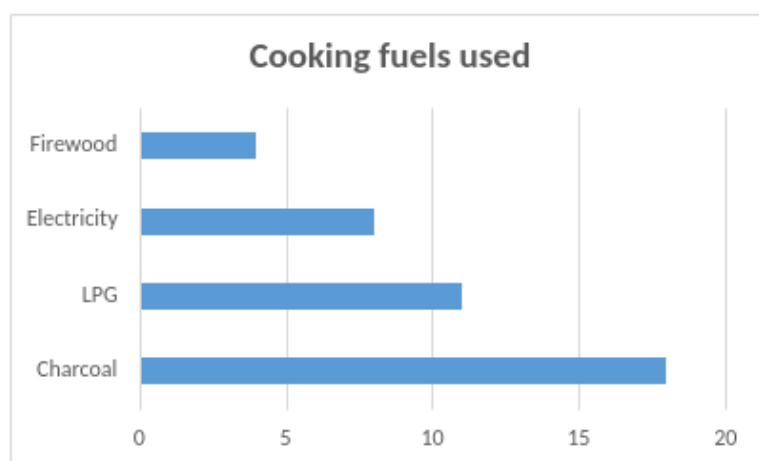


Figure 5: Cooking fuels used by households from peri-urban clusters

The reasons behind their choices of cooking fuels were indicated as follows:

- **Reasons for using charcoal:**
 - Food taste good. Even though it takes time to cook on charcoal, participants still prefer using it as it imparts a traditional flavour, especially when using good-quality charcoal. Participants also considered cooking with electricity to improve food taste.
 - Cheaper. All participants mentioned that charcoal, electricity, and firewood are cheaper than LPG, although they admitted they had never looked into a deeper analysis of cooking costs.
 - Available in any amount. Charcoal can easily be available in peri-urban areas, and you can buy small amounts of charcoal according to their income and cooking needs.
 - Safe to use. Compared with LPG and electricity, participants said they felt safe when using charcoal. This is because LPG and electricity pose a high risk of burns and explosions. In fact, householders in Gahanga do not allow their domestic helpers to use electricity and LPG when they are away and unable monitor usage, and usually emphasize that their helpers use charcoal in their absence.

- **Reasons for using LPG**
 - Fast-cooking. The fact that LPG has naturally higher temperature and that LPG stoves can instantaneously reach its maximum heat, the food is cooked in little time compared to many other fuels. including charcoal.
 - Fancy. It's fun to cook with gas, it doesn't require a lot of set-up and just switches on and off.
 - Leaves pots and space clean. LPG gas burns cleanly in stoves and doesn't not deposit any soot on the cooking pots, which makes them easier to clean.

- **Reasons for using electricity**
 - Food tastes good. Cooking with electricity is quicker than charcoal, and it's easy to adjust the heat while cooking. For example, an EPC heats up gradually and its maximum heat temperature is low compared with firewood or LPG. This slow cooking means food is well-cooked and tastes good. Furthermore, EPC's sealed pot and pressure cooking helps retain most of the food's nutrients and flavour.

- Low cost. EPC users reported that it is cheaper to cook with it than any other fuel. This makes sense as they had data loggers to measure electricity consumption.
- Fast cooking. When using eCookers other than the EPC, it has been observed that cooking takes less time.
- **Reasons for cooking with firewood**
- Cooks for a crowd. With firewood, participants mentioned they can cook for a lot of people; it's easier to use a double saucepan on a traditional stove than with other fuels like gas and electricity
- Cheap: Firewood is cheap to buy, and it can sometimes even be free
- Good for long-cooking dishes

It's worth noting, again, the difference in fuel usage attitude between those using charcoal as a main fuel and those using LPG as a main fuel. In fact, only 30% of those using LPG as a main fuel never use charcoal (Figure 6), while up to 70% of those using charcoal as a main fuel never use LPG (Figure 7). This was explained, again, by the difference in limitations of each fuel (LPG and charcoal) according to opinions of its non-users. In fact, limitations of using charcoal, such as cooking slow or dirtying the pots, as highlighted by peri-urban cooks, are not severe. On the other hand, limitations of using LPG include high cost, low availability, or safety hazards linked to explosion, and are considered severe by cooks, which means it is used less frequently and, in most cases, operated only by the head of the HH rather than house cooks.

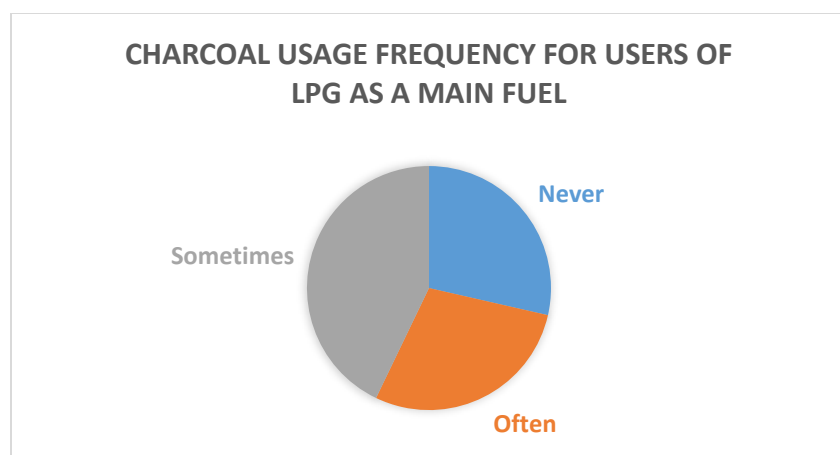


Figure 6: Charcoal usage frequency for users of LPG as a main fuel

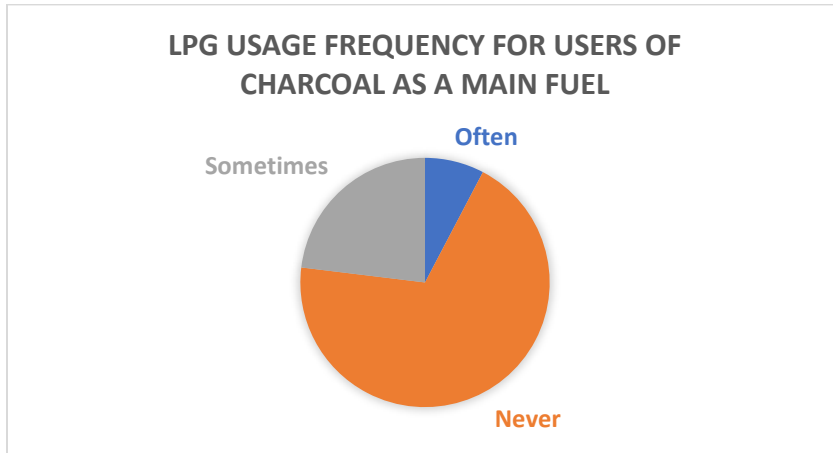


Figure 7: LPG usage frequency for users of charcoal as a main fuel

A. Limitations of using charcoal

- Cooks slow. Participants reported that cooking with charcoal takes a long time, which is inconvenient for them as they often have multiple dishes to cook in a limited time. Charcoal stoves were reported as not helpful in morning time when preparing breakfast.
- Dirties the pots. Charcoal emits smoke that deposits black soot on the pots, which makes cleaning difficult and time consuming.
- Harmful to the environment. Participants reported that charcoal is not good for the environment and when trees are cut down to make charcoal the environment is exposed to floods and drought. They also added that cooking with charcoal results in emissions that are not good for the environment.
- Respiratory related diseases. Cooking with charcoal causes coughs, lung damage and eye irritation. Most of the participants have experienced some of these challenges. However, much they cook with charcoal they are also concerned about their health.
- Expensive. Both participants of Kanombe and Gahanga reported that the cost of charcoal is affected by season. During the dry season, for example, charcoal is less expensive while in the rainy season it is more expensive.

B. Limitations of using LPG

- Affects the taste of food. Participants have a perception that using LPG affects food taste. Its odour is different to charcoal and firewood, which made the FGD participants use it less.

- Price volatility. FGD participants reported the price of LPG is unstable and unpredictable. In fact, participants of Gahanga highlighted that charcoal is more affordable than LPG.
- Low availability. It was reported that there are not enough selling points in Gahanga and that sometimes they must walk for more than 3km to purchase it when the smaller neighbourhood shops go out of stock. Nevertheless, they highlighted the growing practice of LPG home delivery.
- Safety hazards linked to explosion. Participants mentioned that LPG is risky to use and can easily explode if not handled with care. The heads of the HHs are afraid of accidents caused by LPG and don't allow it to be used in their absence, insisting on using charcoal instead to minimize risks.

C. Limitations of using firewood

- Harmful to the environment. Participants reported that charcoal is not good for the environment, as it emits greenhouse gases. They also mentioned burning charcoal requires cutting down trees which affects agriculture activities and exposes the land to soil erosion.
- Low availability. Firewood users indicated that sometimes they do not use it enough as they would like because they cannot get hold of it. Either because there are no forests or woodlots nearby, or because there are strict regulations in cutting them down, there are no regular firewood-selling shops.
- Dirty pots and cooking area. Smoke emitted from firewood dirties the kitchen walls and roof as well as the cooking pots. This inconveniences cooks, particularly those who have chosen to walk away from using firewood.

D. Limitations of electricity usage

- Safety risks associated with power circuits. Although they acknowledged not knowing much about it, participants mentioned their worries of electrical hazards resulting from eCooking.
- Unreliable electricity. Power is not reliable – for example, participants mentioned that within Kigali there are a lot of power cuts, which can last for some time. They would prefer to use another, more easily available alternative such as charcoal.

3.4.2. Cooking processes

Participants from peri-urban clusters said boiling was an essential and preferred cooking process and is used on a daily basis. Wet frying and pressure cooking were considered useful while grilling and deep frying were not essential to the participants. Table 2 indicates the level of importance, benefits, and limitations of the cooking process to the participants.

Table 2: Cooking processes used by participants from peri urban clusters

Cooking process	Importance	Benefits	Limitations
Boil	Essential	Food is healthy, well cooked, keeps many of its nutrients, it is cheaper to cook this way and less time consuming	
Wet fry	Useful	Food taste and smells good and can help if one you want to gain some weight	Oil not healthy
Deep fry	Not essential	Food tastes and smells good and can help if you want to gain some weight	Oil not healthy, expensive
Grill	Not essential	Food is healthy	No adequate appliances
Pressure-cook	Useful	Food tastes good, keeps most of its nutrients and it's time efficient	

3.5. Rural group

3.5.1. Used cooking fuels

The Bugesera cluster, where FGD was conducted, was considered a rural setting. Ten participants attended the FGD, five male and five female. The cooking energy pool used by participants from the Bugesera cluster consisted of charcoal, firewood, electricity, LPG and biomass waste (Figure 8). Charcoal and firewood are the main fuels used within these HHs. It was observed that the use of electricity and LPG in rural settings has a place in fuel stacking.

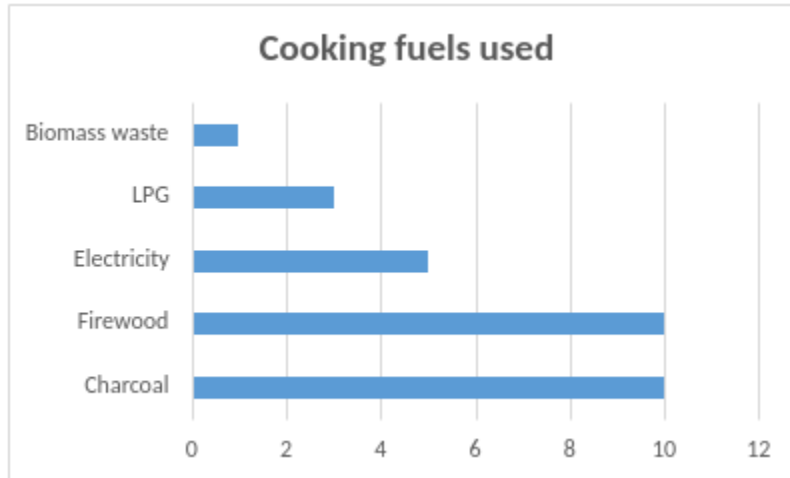


Figure 8: Cooking fuels used by participants from rural cluster

A. Reasons for cooking with charcoal

- Food tastes good. Cooking with charcoal improves taste because it keeps the natural flavour that comes from heated charcoal.
- Cheaper. All participants mentioned that charcoal, electricity, and firewood are cheaper than LPG, although they admit they have never looked into any deeper analysis of cooking cost
- Easy to cook with. Participants reported that cooking with charcoal is very easy and doesn't have any technical requirement
- Allows multitasking. Although other participants from other clusters didn't mention that using charcoal allows multitasking, participants from Bugesera did. This is because they have been using charcoal for a long time and know how long it takes to cook a particular dish.
- Availability. Participants mentioned that charcoal is available in their areas from local vendors.

B. Reasons for cooking with firewood

- Cooks fast. Participants reported that cooking firewood is faster. When burnt well it's very easy to cook a meal in a short time compared with charcoal.
- Cheap and available. Firewood is a free resource in many rural areas, and the majority of the people these areas fetch firewood for free, from bushes and small forests.

C. Reasons for cooking with electricity

- It's a useful alternative. It was observed that as the use of electricity in rural communities increases participants have been introduced to the idea of using EPCs as an alternative in case other fuels are not available.
- Low cost. Participants reported electricity being cheaper.
- Cooks fast. Participants confirmed that cooking with electricity is very fast and mentioned that you can adjust the maximum temperature so as to cook within the fastest time possible.
- No smoke emissions and easy to cook with. Electricity is clean, it doesn't produce smoke like charcoal or firewood. Participants mentioned it's very health to use.
- Requires little space. When cooking with electricity you don't need a big space, and participants said that even within a small house it's very easy to cook with. They compared this to charcoal and firewood, where you need to either have a kitchen or cook outside.

D. Reasons for cooking with LPG

- Cooks fast. Participants highlighted that LPG cooks faster than charcoal or firewood.
- No smoke emissions. Cooking with LPG does not emit any smoke and is clean when compared to firewood and charcoal. Participants also reported that it is very health to use and not associated with the headaches, eye irritation and coughs caused by smoke.
- Easy to cook with. Participants also mentioned cooking with LPG is easy, and that regulating heat is easy to manage.
- Allows multitasking. Cooking with LPG allows the cook to do more than one thing at once. For example, participants mentioned that you can cook while washing utensils or clothes.

Figure 9 indicates that both charcoal and firewood are regularly used by all participants. Despite the reported high cost, electricity and LPG were sometimes used by these HHs as alternative fuel. Limitations to adopt LPG and end electricity are discussed below.

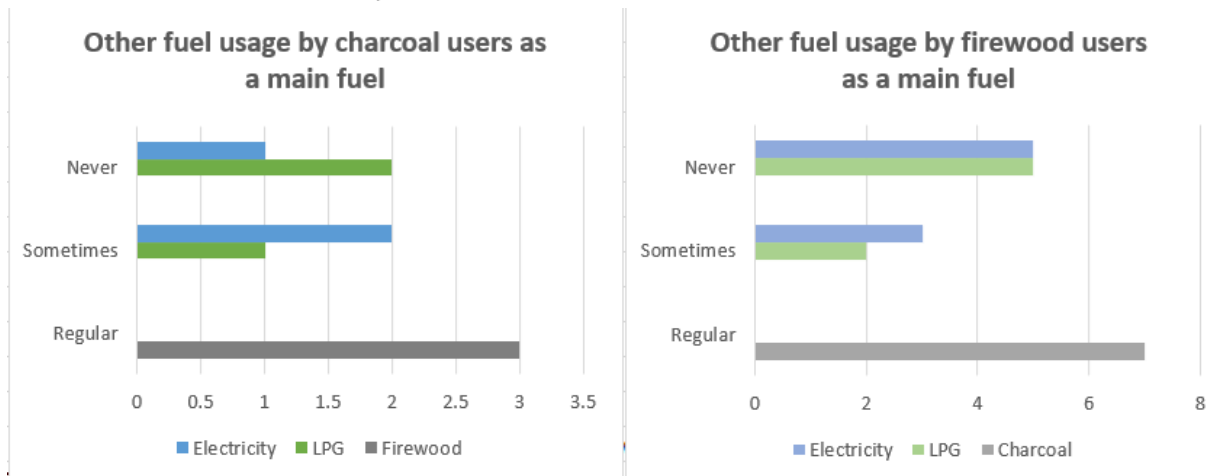


Figure 9: Comparison of cooking fuels used by users of charcoal and firewood as main fuels

A. Limitations of using charcoal

- Low availability. Most of the time charcoal is scarce in the rural community due to high demand in urban and peri-urban areas. Participants reported that charcoal traders prefer to sell to urban areas because it yields a higher profit than in rural areas. Availability is also seasonal. During the rainy season charcoal is scarce since it takes longer to be burnt and it can be poorer quality.
- Expensive. Participants highlighted that charcoal is expensive because of seasonal variation, and unavailability of charcoal in rural areas. Some considered charcoal to be more expensive than firewood, which is a free resource in rural communities.
- Harmful to the environment. Participants mentioned that using charcoal affects the environment. Some said that most of the trees in their community have been cut down for firewood and this has influenced agriculture activities and exposed land to slides and erosion.
Safety hazards. The smoke from the use of firewood has a detrimental effect on health, and participants have experienced severe headaches, red eyes, eye irritation and coughs.

Limitations of using LPG

- Safety hazards linked to explosion. Participants mentioned that use of LPG exposes the user to severe accidents.
- Wears the pots. Participants reported that with use of LPG, the pots get damaged easily and don't last very long. However, this might be caused by the quality of pots used.

B. Limitations of using firewood

- Health effects. The smoke from using firewood has a detrimental effect on health. Participants have been exposed to severe headaches, red eyes, eye irritation and coughs.
- Accidents. The use of firewood risks burning down the house. Participants mentioned incidents of fire in their neighbour's home in which people lost lives and others had severe burns. Women participants also mentioned the risk of violence while collecting firewood.
- Damage to the environment. Participants mentioned that using charcoal affects the environment. Some participants said that most of the trees in their community have been cut down to make firewood, which has influenced agriculture activities and exposed land to slides and erosion.
- Cleanliness. Cooking with firewood causes soot on cooking pots, which makes them difficult and time-consuming to clean. Participants mentioned most of their cooking utensils have turned black due to charcoal and firewood.
- Depletes nutrients. It was highlighted by participants that cooking with firewood requires adding a lot of water to food during the cooking process, which at some point depletes the food nutrients, and that the most common cooking process is boiling.
- Time consuming. Collecting firewood takes time.
- Difficult to light.

C. Limitations of using electricity

- Safety hazards linked to power circuit. Participants are afraid of using electricity for cooking due to the risk of fire risk and getting burnt if electricity is not handled properly. Participants were also not aware of health and safety standards.
- Unreliable. Participants also reported that electricity from the mini grid is not reliable because power is supplied at a fixed schedule. This means different productive users have a different time to power their appliance so it's not possible to cook whenever you want.
- Expensive. Some participants reported using EPCs for cooking. It was mentioned that the use of electricity as cooking fuel is very expensive due to the high tariff charged by the mini grid developer Arc Power. It's worth noting cooking with electricity in rural community is a new concept and has been primary used for lighting.

3.5.2. Cooking processes in rural cluster

Boiling was the most preferred and essential cooking process highlighted by the participants of Bugesera cluster and was used on a daily basis. Wet frying and pressure cooking were also useful to the participants. Deep frying was considered not essential, though it makes food taste good. The process is not common in the rural settings, mainly due to the associated cost of buying oil and ingredients, as well health concerns when compared to boiling and wet frying. Table 3 below indicate the level of importance, benefit, and limitation of the cooking process to the participants.

Table 3: Cooking processes used by participants from rural cluster

Cooking process	Importance	Benefits	Limitations
Boil	Essential	Cooks well, cooks fast, is easy to do, provides healthy soup for kids	
Wet fry	Useful	Food tastes and smells good	
Deep fry	Not essential	Food tastes good	Oil is unhealthy and expensive
Grill	Not essential		
Pressure-cook	Useful	Cooks fast, allows multitasking	

3.6. Perspectives on appliance financing

Modern cooking appliances, LPG stoves and eCookers (EPC particularly) have been reported as expensive for an average Rwandan HH. In fact, LPG stoves range from US\$18 to US\$45. In addition to the stove, upfront investment for the LPG cylinders is also required, with costs from US\$20 to US\$45 for cylinders between 6kg and 15kg. Since these products are often sold in bundles, the upfront cost of a 6kg cylinder including a burner is around US\$40, a 12kg cylinder including a two-burner stove costs around US\$82, a 15kg cylinder with a two-burner stoves costs around US\$92, and a 20kg cylinder with a two-burner stove costa around US\$120. eCooker costs also vary, with an EPC on the Kigali market, for instance, ranging from US\$80 to US\$130 depending on the size and brand.

After an overview of these appliance costs, participants were asked how many people in their community they thought would buy these products at those prices. Urban and peri-urban participants responded that, on average, only between 20% and 50% of their community members would buy them, while those from rural areas said between 7% and 10%. Urban participants said that the price would have to be, on average, between US\$30 and US\$50 before the remaining % of the community would buy them. This amount was US\$20 and US\$40 for peri-urban participants and around US\$50 for rural participants.

Finally, participants were asked that if they could purchase the appliances at the above-mentioned prices on credit and pay in instalments over time, how long would they need to repay it. Participants said that they would appreciate this kind of financing mechanism. Urban and peri-urban participants suggested that between five and 10 instalments would be preferred, while those from rural clusters suggested between seven and 12 instalments.

3.7. Appliance feature preferences

3.7.1. Feature preferences for non-specific appliances

During the FGDs, participants from different clusters were asked about their preferences towards cooking appliance features. They were asked to rate the importance of the features they would like their appliances to have. In every FGD, they were divided into two groups, one composed of users of charcoal as a main fuel, and another composed of users of LPG as a main fuel.

Figure 10 shows that only charcoal users as a main fuel rated the cost of the appliance and fuel, the existence of financing models and usage safety as important, since charcoal stove is relatively the safest appliance used by all participants. Interestingly, the cost of appliance and fuel and the financing models were not rated as important by participants who use LPG as a main fuel as they were, financially speaking, relatively well-off compared to charcoal users. Features such as ease of cleaning, ability to control the lid, and having multiple hobs were mentioned as important by only those using LPG as a main fuel. Note that these features are characteristics of LPG stoves and that might even be the reason the users chose LPG in the first place. On the other hand, appliance features that still posed common challenges were rated as important equally by both groups of users. These include being easy to use and light, its portability and its durability. Some features, such as the ability to multitask while cooking, the number of people it can cook for, and the smoke emitted, although rated by both users were more of a concern for LPG users.

Some charcoal users reported they were used to smoke and so didn't find it worrying. The capacity to cook fast, although rated by both users, was judged more of a concern by charcoal users.

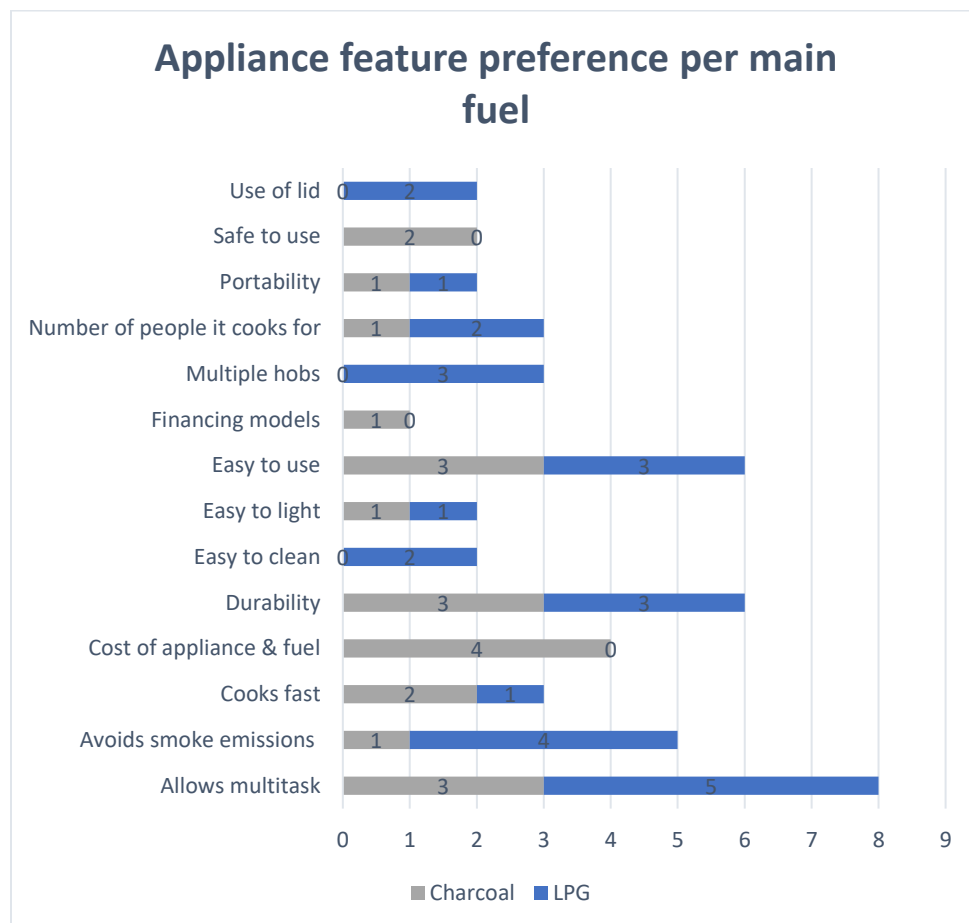


Figure 10: Appliance feature preference per main used fuel

3.7.2. Priority features of EPC

During the FGDs, eCookers, particularly EPCs, were discussed to gain an overview and general understanding of eCooking. Some clusters, including Nyamirambo (an urban area), Gahanga (peri-urban), and Bugesera (rural) had participants who owned and had experience of cooking with an EPC. Participants were asked to discuss the EPC's features to find out which ones are the most important to them. Priority was rated on a scale of 0 to 3 as follows:

- 0 = does not make a difference to this group
- 1 = will be valued but will not change buying decision
- 2 = will be valued and they will be willing to pay a premium for this

- 3 = critical – they will never buy a device that does not have this

Feature/quality	Priority for urban	Priority for peri urban	Priority for rural	Comments
Larger capacity – e.g., 8 litres compared with 6 litres	2	2	2	Ideal capacity seemed to be 8 litres although if different, they would go for a larger rather than a smaller capacity
Additional pot included	2	2	0	While it was important for others, rural cooks seemed indifferent to this. It did not bother them to use only one pot
Low power rating – e.g., 700w-900w compared with 1kw	2	2	2	They all suggested that the lower the power rating, the better
Can cook with lid off	2	2	3	Although they all were keen to use the lid the way they want, rural participants said they would otherwise not buy it
Backup support and maintenance services	2	2	2	They all wished they had access to this. They said it is like an assurance or confidence of the distributor in an otherwise untrusted appliance
Trusted brand	2	2	0	Rural cooks said they usually do not mind which brand it is as long as the appliance is cheap
Non-stick coating on pan	2	1	0	Seemed important to urban cooks only. Others mostly want an EPC for its automation capabilities
Simple knob interface – e.g., compared with lots of buttons	2	2	0	Again, rural cooks said they do not mind the interface type so long as the appliance is cheap

3.8. Gender perspective

During the FGDs, it was observed that in urban clusters women were more concerned about clean cooking than men. 90% of the participants, both in urban and peri urban clusters, were women. In the rural cluster of Bugesera, both women and men were concerned about clean cooking appliances and fuels used. It came out clearly that women in this rural cluster would consider features involved in cooking operations since they are regularly involved in cooking, while men, who reported only cooking sometimes, looked at features that would allow them to cook as fast as possible and continue with their other activities (Table 4). Women participants were also concerned with their health when cooking since they spend more of their time on it.

Table 4: Appliance features preferences by women and men from rural (Bugesera) cluster

Women	Men
Use of lid	Durability
Avoids smoke emissions	Allows multitasking
Portability	Doesn't burn food
Easy to clean	Easy to light
Easy to use	Easy to clean
	Multiple hobs
	Cooks fast

4. Conclusion

Findings discussed in this FGDs report strongly suggest that there is a huge opportunity for eCooking, particularly EPC, in the Rwandan market. Participants from all clusters have indicated that boiling and wet frying are the two favorite cooking processes. Portability, the allowance of multitasking, the ability to independently use the lid, ease of lighting and of use in general, ease of cleaning and the absence of smoke emissions have all been reported as features preferred by all participants. All the above-mentioned appliances features, and cooking processes are adaptable to, or characteristics of, an EPC, which indicates that EPC is adaptable to Rwandan cuisine. The EPC users present in the FGDs also testified that EPC electricity consumption was low, meaning it was cheaper than their traditional fuels and LPG. EPC has, therefore, become an integral part of their routine kitchen appliances.

Nevertheless, some challenges still need to be addressed to maximize the market opportunities. While the reported high cost of EPC can be addressed by implementing innovative financial mechanisms such as pay-as-you-go, pay-as-you-cook, result-based financing and other financial inclusion models, manufacturers need also to step up and produce appliances to that meet the durability standards highly regarded by consumers. The remaining shortcomings such as the lack of multiple hobs or adaptability to deep frying would, for the moment, be bridged by the almost institutionalized stove-stacking behaviour.

Despite the popularity of EPC that we observed among its users, there is still an immense gap when it comes to eCooking awareness. The government, development partners and, above all, manufacturers, and suppliers of eCookers must double the efforts to promote and raise awareness of eCooking technology to bridge that gap and offer a sustainable pathway to its adoption.