



Rwanda eCooking Market Assessment

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EnDev/MECS eCooking Market Assessments

- Part of a series of publications produced jointly by Energising Development (EnDev) and the Modern Energy Cooking Services (MECS) Programme.
- Strategic insight on the current state of electricity access and clean cooking, identifying the key opportunities and challenges to the scale up of eCooking in 8 countries across sub-Saharan Africa and South Asia.



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Overview

- Summary of the opportunity for eCooking in Rwanda
- Clean cooking & electricity access
- Deep dive into:
 - Enabling environment
 - Consumer demand
 - Supply chain
- Recommendations for strategic interventions

Summary

- Over the last decade, Rwanda has been enjoying **strong economic growth** rates, creating a favourable environment for new businesses and lifting people out of poverty.
- The Government of Rwanda (GoR) are actively working towards economic development and reforms in the financial and business sectors which is demonstrated in the **country moving from 139 to 38 on the annual World Bank Doing Business Report** between 2010 and 2016.
- A lot of progress has been made on **electrification** with **coverage increasing from 10% in 2010 to 66.8% in 2021**. The total installed generation capacity in Rwanda is currently **235.6 MW** (11% imported, the rest domestically generated: 50.6% hydrological resources, 43.3% thermal, and 5% solar).
- However, most of the population still rely on polluting fuels such as **firewood and charcoal** for cooking.
- Currently 0% of Rwandans use electricity as their primary cooking fuel.
- **Rwandan cuisine is largely compatible with electric cooking appliances**, such as Electric Pressure Cookers (EPCs) and rice cookers therefore there is a high potential to transition households to incorporating electric cooking in the future fuel mix.
- There has been **interest expressed by the GoR and the private sector** to pursue this opportunity, however, it is currently in its early stages.

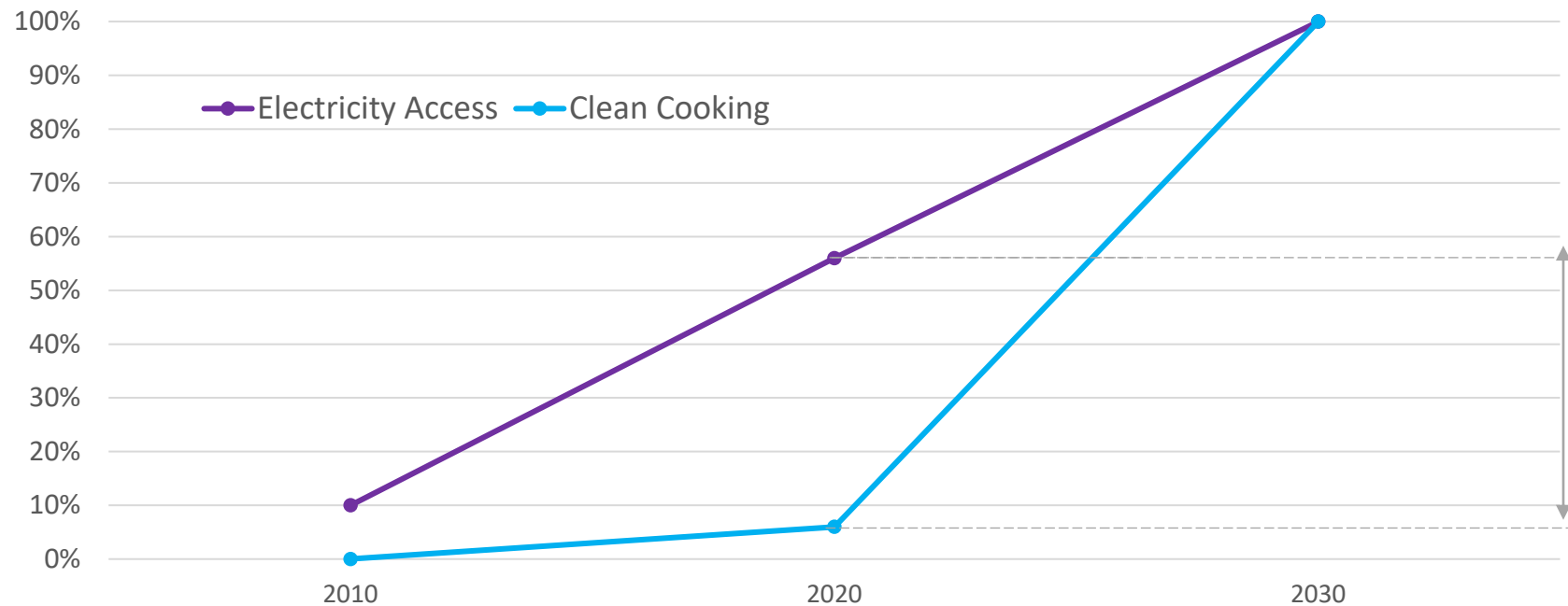
The clean cooking challenge

- Biomass consumption remains high.
- At **85%**, biomass energy is the most important source of energy in Rwanda.
- **Households use 91% of biomass**, with the remaining consumption shared between industry (4%), non-energy usage (2%) and commercial and the public sector (both 1%).
- **Reducing reliance on firewood**, and in doing so improving health, developing economic opportunities by reducing the time spent collecting wood, and preserving the country's forests is a **priority for the GoR**.
- **Women and girls are disproportionately affected** due to smoke exposure and the drudgery of collecting fuel and cooking, which results in missed educational and economic opportunities.
- Historically, Improved Cookstoves (ICS) (for firewood, as well as pellets and briquettes) have been heavily promoted in Rwanda. Currently, **LPG** is heavily **promoted for urban centres** while **ICS** remain the main strategy **for rural areas**.
- **Sustainable uptake** of more efficient cooking fuels and technologies **has been a major challenge**.

The opportunity for eCooking

- The GoR has set a goal to reduce the number of households using wood and other biomass fuels **from 83% in 2017 to 42% by 2024**. It hopes to achieve universal clean cooking access by 2030. Under the [Nationally Determined Contribution](#) (NDC) framework, the GoR have also committed to disseminating modern efficient cook stoves to 80% of the rural population and 50% of the urban population by 2030.
- In addition to LPG, other promoted alternatives to meet the overall 42% target include biogas, **electricity**, and improved high-efficiency biomass cookstoves (including pellet- and briquette-burning stoves).
- **High urban access** to electricity (>90%) and reliable supply.
- **Increased private sector interest** in eCooking for both on- and off-grid contexts, reflected in the recent uptick in eCooking pilots, interventions and research in the country (e.g., Energy 4 Impact & MECS, Electrocook & ARC Power).
- **Inclusion of eCooking** in the largest Clean Cooking Results-based Financing (CC-RBF) to date.
- EPC largely compatible with popular ‘heavy foods’.
- **Strong ecosystem for innovation** and political will for change.

Clean cooking and electricity access in Rwanda



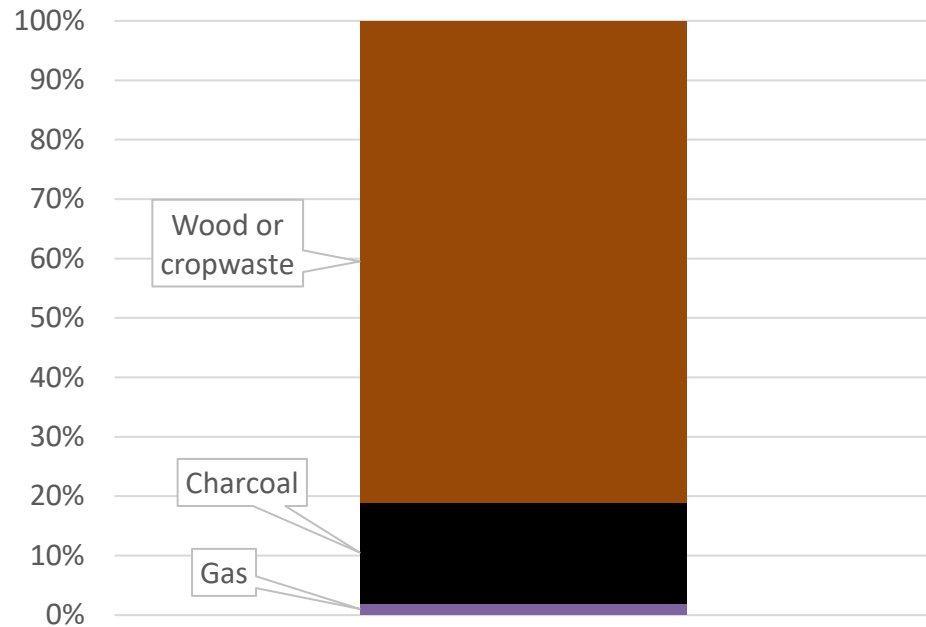
50%

connected to electricity,
but still primarily cooking
with polluting fuels in
2020

Source: [MININFRA \(2021\)](#) & CFET (2020) National Survey on Cooking Fuel Energy and Technologies in Households, Commercial and Public Institutions in Rwanda; Ministry of Infrastructure and Ministry of Finance: Kigali, Rwanda.

Cooking energy

0% cook primarily with electricity

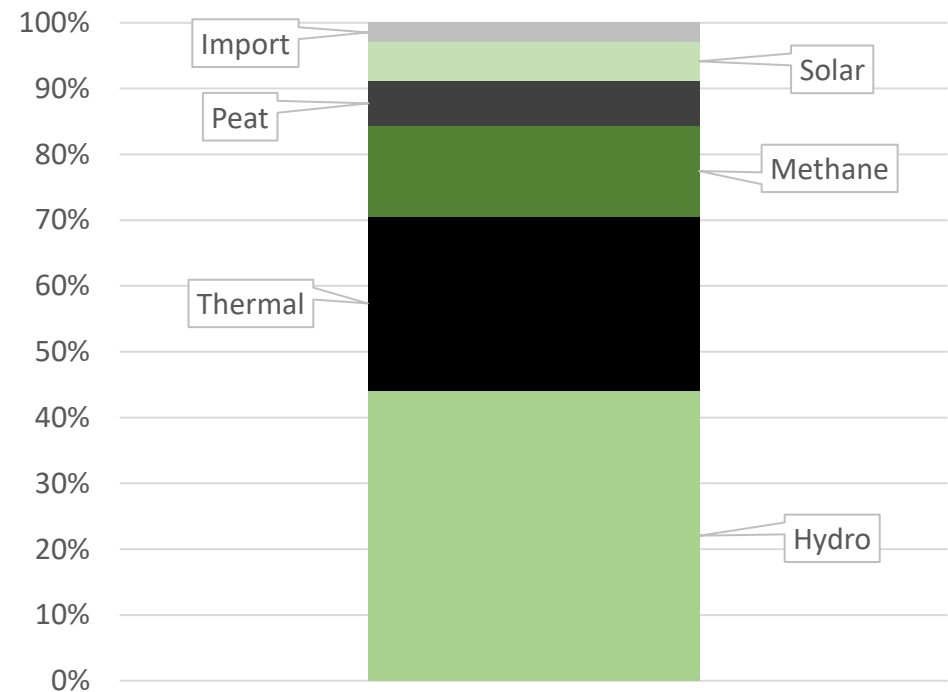


17% cook primarily with commercialized polluting fuels (charcoal)

98% cook primarily with polluting fuels

Electricity generation (on-grid)

~57% renewable



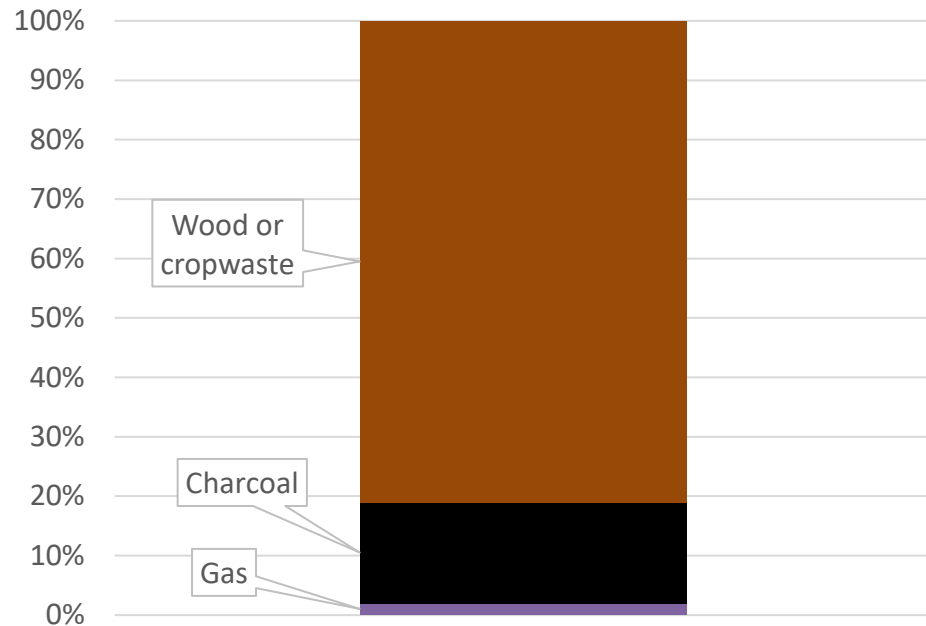
~80MW surplus power generation

High reliability: SAIDI*SAIFI = 29hrs/year

*SAIDI stands for System Average Interruption Duration Index. SAIDI = total duration of interruptions for a group of customers.

Cooking energy

0% cook primarily with electricity



17% cook primarily with commercialized polluting fuels (charcoal)

98% cook primarily with polluting fuels

Electricity generation (off-grid)

- ~6000 households connected to mini-grids (6 solar, 10 hydro mini-grid developers)
- ~2.3m off-grid lighting/appliance customers (mostly SHSs)
 - 18.4% of total electricity connections

MECS eCooking GMA viability scores/rankings

- GMA = Global Market Assessment
- Scored all low- & middle-income countries using international indicators for:
 - economics (clean fuels, market size, financial sector strength)
 - human (policy, health, gender, development, business environment)
 - infrastructure (electricity access, reliability, RE share)
- MECS.org.uk/GMA

Rwanda

Overall:
0.83 - **76th/130**

On-grid eCooking:
0.467 - 96th/130

Mini-grid eCooking:
0.344 - 97th/130

Off-grid eCooking:
0.494 - 17th/130

Key opportunities

- Rapid expansion of access to electricity in last 10 years
- High urban access to electricity (>90%) and reliable supply
- Increased private sector interest in eCooking for both on- and off-grid contexts, reflected in the recent uptick in eCooking pilots, interventions and research in the country
- Inclusion of eCooking in the largest Clean Cooking Results-based Financing (CC-RBF) to date
- EPC largely compatible with popular ‘heavy foods’
- Strong ecosystem for innovation and political will for change
- Fluctuations in LPG prices due to international market supply-demand shifts (e.g., prices going up significantly in recent months, pushing many to switch back to charcoal or firewood)

Key challenges

- LPG actively promoted by the GoR and an aspirational fuel for many
- Electricity commonly perceived as ‘too expensive for cooking’ and changing the taste of certain foods
- A relatively high cost of electricity (a domestic rate per kWh stands at RWF255 (~\$0.25) for users <100kWh per month)
- Low awareness of eCooking and low availability of electric cooking appliances, particularly EPCs
- Low income, particularly in rural areas (GDP per capita in 2020 estimated at \$816)

Potential impacts of scaled uptake in most viable market segment

If 40% of Rwanda's grid-connected charcoal users (2.9m ppl, 0.7m HHs) switched to eCooking, the WHO's BAR-HAP tool suggests that:

- 669 DALYs/yr avoided
- 0.54m tonnes/yr CO₂eq emissions reduced
- 0.21m tonnes/yr reduction in unsustainable wood harvest
- 133m hrs/yr of women's time saved (191hrs/HH/yr)
- 14 months payback for eCooking appliances (\$80/HH upfront cost, \$75/HH/yr savings on fuel energy costs)
- 236 GWh demand for electricity stimulated



Enabling environment

Enabling environment

- **eCooking policy outlook:** Strong policy in place in both the electricity access and clean cooking sectors. However, clean cooking and electrification are largely treated as two separate problems calling for different policy interventions. There is a need to connect clean cooking and electrification policies through evidence-based advocacy and stakeholder engagement on the advantages in doing so.
- **Key policy stakeholders:** Ministry of Infrastructure (MININFRA), Rwanda Energy Group (REG)- consists of Energy Utility Corporation Limited (EUCL) and Energy Development Corporation Limited (EDCL), Rwanda Utilities Regulatory Authority (RURA), District governments, Rwanda Standards Board (RSB)

RISE (Regulatory Indicators for Sustainable Energy) scores:

73%	60%	90%	62%
Electricity Access	Clean Cooking	Renewable Energy	Energy Efficiency

eCooking cuts across all 4 pillars

Targets:

Electricity access

100% electricity access by 2024
(grid/off-grid)
100% renewable grid electricity N/D

Clean cooking

100% clean cooking access by 2030
58% access to improved clean cooking by 2024
40% LPG access by 2024
Modern efficient cook stoves in 80% of the rural population and 50% of the urban population by 2030
No specific eCooking targets

Key government/NGO programmes creating the enabling environment in which eCooking can scale

- Energy Sector Strategic Plan (ESSP); Rural Electrification Strategy (RES); National Electrification Plan (NEP), Nationally Determined Contribution (NDC)
- Rwanda Energy Access and Quality Improvement Project (EAQIP) funded by the World Bank: USD 150 million (a USD75 million grant and a USD75 million loan) for its largest clean cooking operation in Africa.
- Clean Cooking Fund (CCF), which is hosted by the World Bank's ESMAP, will provide USD20 million for clean cooking, with USD10 million provided as a grant and USD10 million extended as a loan. The project will leverage an additional USD30 million in public and private sector investments. eCooking is covered.
- Biomass Energy Strategy which sets out a strategy to reduce reliance on wood and charcoal (as well as making their use more sustainable).
- National Strategy for Transformation (NST): the sector objective is to halve the number of households using traditional cooking technologies to achieve a balance between supply and demand of biomass through promotion of energy efficient technologies.
- Energy and Environment Partnership Trust Fund (EEP Africa), hosted and managed by the Nordic Development Fund (NDF) and the Austrian Development Agency; a clean energy financing facility, EEP Africa provides early-stage grant and catalytic financing to innovative clean energy projects, technologies and business models in 15 countries across Southern and East Africa. In Rwanda, the fund is currently financing projects in different subsectors including hydropower, solar PV, and clean cooking

Key government/NGO programmes creating the enabling environment in which eCooking can scale

- **SNV-implemented EnDev's programme** (2019-2020) supported local workshops and produced and disseminated 20,000 ICS. As an expansion to the programme, EnDev signed a co-financing agreement with the EU (until October 2025) under the project “Reducing climate impact of cooking in Rwanda through improved cooking energy systems” (ReCIC) to support the achievement of the BEST strategy.
- **GIZ**, through the **EnDev Programme**, have also supported clean cooking projects. Until 2011, EnDev Rwanda supported the biogas sector by building digesters to supply rural households. The target group for the domestic biogas programme was households in rural areas that own cattle in a stable near the homestead.
- **MECS** focus exclusively on modern energy cooking services. In Rwanda, it has provided funding for studies on socio-technical transitions to eCooking and a market assessment of modern energy cooking in Rwanda, including through ongoing household cooking diary studies being conducted by **E4I**.
- **Electrocook** a company supported by EEP Africa and the Nordic Fund, was set up in 2020 with the mission to distribute 5000 EPCs. They are partnering with **ARC Power** to run a pilot with 50 households connected to one of ARC Power's mini-grids in Nyamata, Bugesera district (testing of an innovative financing mechanism to incorporate the EPC costs into the electricity tariff over a determined period). Another pilot, in partnership with Access to Energy Institute (A2EI), is planned for on-grid areas with 150 households.

Key barriers/drivers in the enabling environment

- While the primary focus of the GoR is to boost commercial and industrial uses of electricity in the country, the current low household demand for electricity might be further triggered by making energy efficient and affordable eCooking appliances more available, which would also help with the current oversupply of electricity.
- Rwanda has received a significant amount of funding to support the development of its energy sector and transition the country to clean energy, including for cooking. The CC-RBF is expected to speed up the progress substantially over the next few years.
- eCooking is in very early stages in Rwanda and there has not been any active efforts by the GoR to promote it. However, eCooking is included in the CC-RBF and the current studies and pilots conducted by MECS and E4I, and private sector players (e.g., ARC Power and Electrocook) should build the necessary evidence to spark further interest among policymakers and international stakeholders involved in Rwanda's energy sector.



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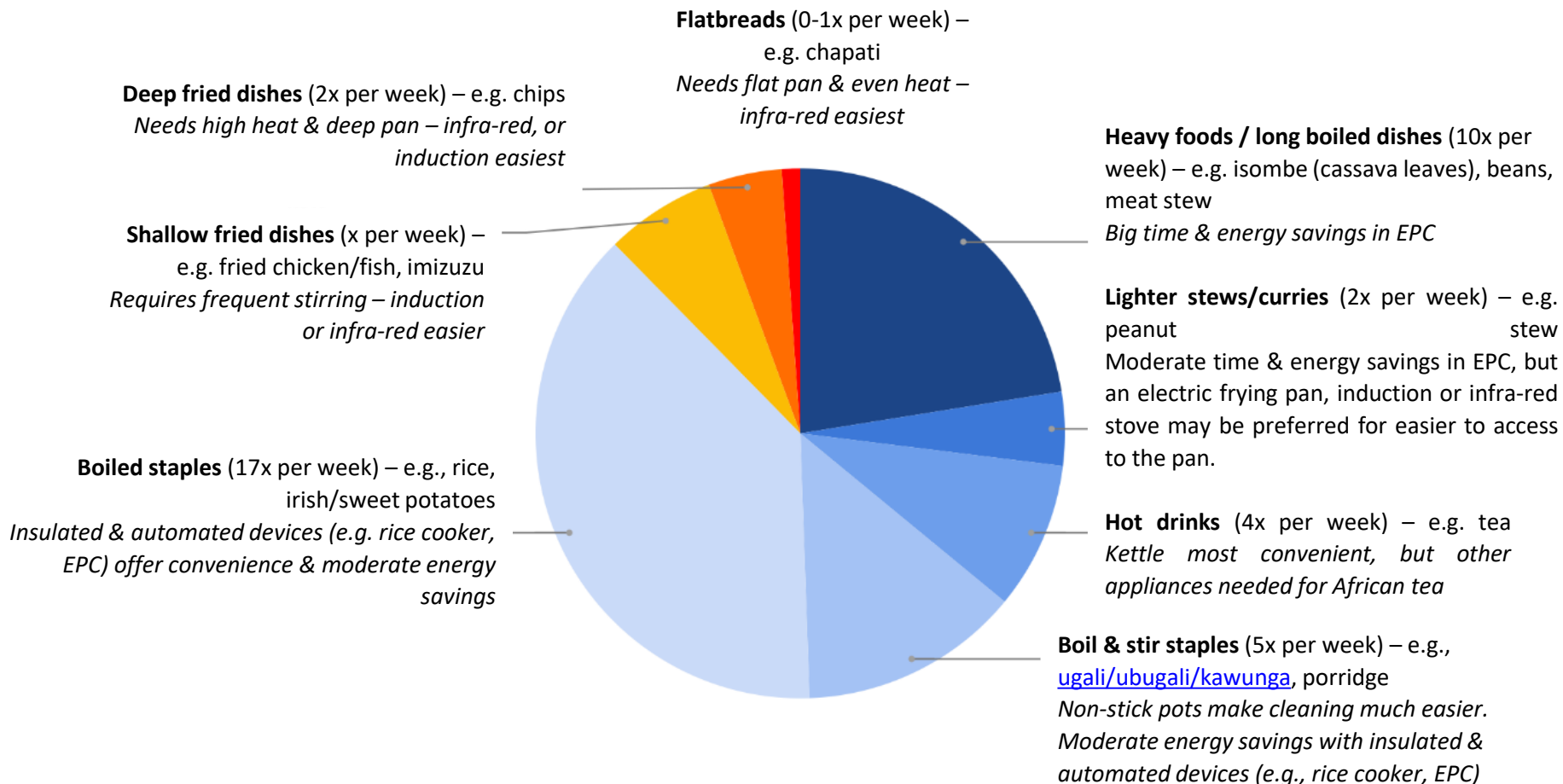


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Consumer demand

Consumer demand

In an average week, a typical Rwandese household might prepare:



Popular meal combinations in Rwanda

- *Ugali/ubugali/kawunga, boiled veg and meat stew* – ugali, ubugali and kawungu are thick porridges that are boiled and vigorously stirred. They're very easy to cook in an EPC or rice cooker (as are boiled vegetables) and the non-stick pot is much easier to clean, although most people won't believe you until you show them so may prefer an induction or infra-red stove. Meat stew is a 'heavy food' that requires boiling for over an hour to soften the meat, so there are big time and energy savings with an EPC.
- *Imizuzu, boilo and salad* – Similar to above as Imizuzu is a thin porridge made from millet flour, boilo is a meat soup that is typically boiled for over an hour. Salad doesn't require cooking.
- *Rice, cabbage and plantain* – A rice cooker is an obvious choice here, but the cabbage and plantain usually require frying, meaning that an infra-red/induction stove will likely be the preferred option so that a shallow pan that is easier to stir can be used.
- *Porridge/igikoma and tea* - EPCs can cook porridge and African tea very easily (without pressurizing), however many people will choose a sufuria (saucepan) on an infra-red/induction stove instead.

Most viable energy-efficient appliances: **EPCs, rice cookers, induction, infra-red, kettles, microwaves**

Demand creation

- Key marketing messages:
 - Energy-efficient appliances offer substantial time and cost savings and enable multi-tasking.
 - Reduction of smoke as well as reduction of cooking time (especially for long-cooking foods).
 - EPCs are the cheapest and most convenient way to cook heavy foods.
- Key demand creation programmes:
 - Currently none. Electrocook planning to run awareness campaigns and lobby the GoR to actively include eCooking in their policies and promote uptake (e.g., through tariff breaks).

Key market segments

- *Urban charcoal users* – 65% of households located in urban areas use charcoal as cooking fuel. In rural areas, that number stands at 6%. Unlike firewood, charcoal is almost always purchased, creating an attractive existing expenditure to convert into electricity units. Charcoal prices oscillate depending on the season (dry/rainy) and have been on the rise also because of the Covid-19 pandemic. Charcoal is typically preferred for heavy foods, as it burns slowly and many people believe it is the cheapest way to cook them. EPCs offer a highly attractive modern alternative that can greatly reduce expenditures on cooking fuel, however the upfront cost is a substantial barrier for many who use charcoal, which can be purchased in small quantities. As majority of the urban charcoal users are grid-connected, there is an opportunity to transition them to cleaner fuels, including electricity (currently 0.19% of households use it for cooking). However, the relatively high electricity tariff for households is another barrier to be considered.

Key market segments

- *LPG users* – 5.6% of urban households use LPG, and only 0.2% of rural ones do. In 2018, only eleven importers were supplying the country with cooking gas. The importers transport all LPG by road tankers of 10-20 metric tons through either Kenya or Tanzania. The retail shops vary from petrol service stations, supermarkets, and independent distributors, who sell the gas in different sizes ranging from 6kg to 50kg. There is an active push by the GoR to promote uptake of LPG in urban areas. However, the recent increases in the price of LPG have been pushing households to switch back to charcoal and/or firewood.

Key demand side barriers/drivers

- Limited awareness of the range of the available modern energy-efficient electric cooking appliances and their compatibility with Rwandan cuisine.
- Deep-rooted social-cultural perceptions built over histories of biomass dependency and widely-promoted intermediary technologies such as improved biomass cookstoves, including the perception that food cooked with electricity doesn't taste the same and that electricity is 'too expensive for cooking'.
- Cooking with energy-efficient electric appliances such as an EPC can be much cheaper than popular cooking fuels, yet the high upfront cost of energy-efficient appliances is prohibitive for the low- and middle-income households that would stand to benefit the most.
- Mobile money relatively widely adopted (61% penetration, growing year on year).



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Supply chain

Supply chain

- **Key domestic eCooking appliance manufacturers:**
 - None.
- **Key eCooking appliance distributors:**
 - (Von) Hotpoint, Mika, Black and Decker, Femas, Smifer, and Bosch, among others. These brands are imported from Dubai, China and Europe via Dubai, and distributed through local retail stores.

Innovative eCooking pilot projects

- **ARC Power**, a South African start-up established in Rwanda in 2017, developed a financial model to show the viability of e-cooking for rural mini grids in Sub Saharan Africa. ARC Power piloted the use of EPCs (in 5 households connected to the mini-grid) and electric hotplates (also 5) and have been selling procured electric cooking appliances to their customer, along with heat-retention bags (a local version of the 'wonderbag').
- **Electrocook** are partnering with ARC Power to run a pilot with 50 households connected to one of ARC Power's mini-grids in Nyamata, Bugesera district. In this pilot, Electrocook will be testing an innovative financing mechanism to incorporate the EPC costs into the electricity tariff over a determined period. Another pilot, in partnership with Access to Energy Institute (A2EI), is planned for on-grid areas with 150 households. The company is in the process of sourcing EPCs from Midea, a manufacturer based in China.
- **E4I** have been funded by MECS to pilot EPCs and infrared stoves in 25 grid-connected households in Kigali. Various tariffs (with electricity top ups) have been tested and a Cooking Diary study conducted. Analysis of the collected data is currently underway.

Key supply side barriers/drivers

- Early piloting of innovative consumer financing mechanisms underway to enable low-income households to unlock low-cost cooking with energy-efficient appliances.
- Limited availability of EPCs and other energy-efficient electric cooking appliances, with no local manufacturing and therefore complete reliance on imports, which additionally raises the price of appliances.
- Limited access to after-sales services for modern energy-efficient electric cooking appliances.
- Reliability of electricity high in urban areas, lower in rural areas where connections exist. Majority of rural customers connected to off-grid solutions, such as SHSs (10W-50W) which currently cannot support electric cooking appliances.

Popular appliances in Rwanda today

- Task-specific appliances such as rice cookers and kettles are popular amongst higher-income urban households.
- EPCs are not commonly used and have only recently broken into the market. Today, no more than 5 different models are on sale through retail channels.
- Hotplates are not commonly used though kitchen stoves with a combination gas and electric plates are available.
- Induction and infra-red stoves have yet to see any uptake, as LPG is more readily available and strongly promoted with LPG stoves widely available.

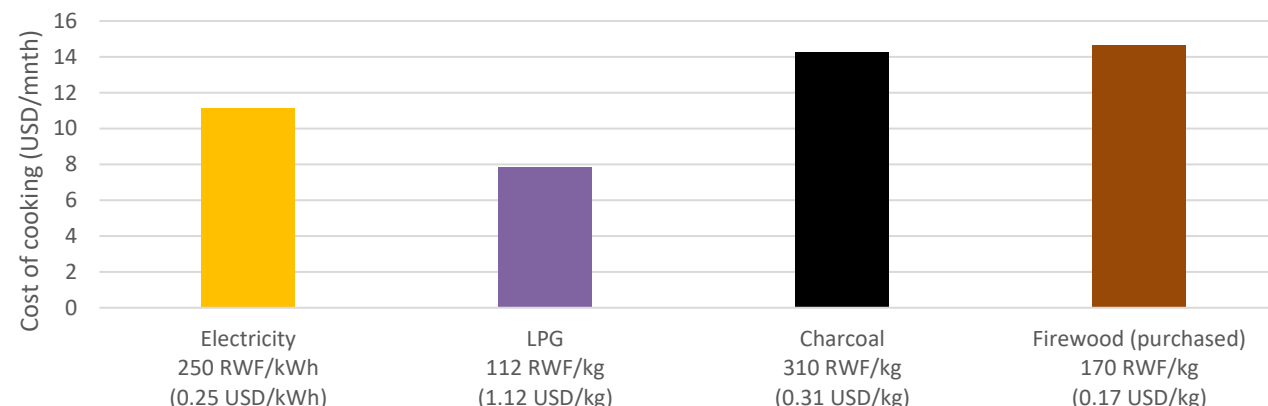
Table 1: Import volumes and typical retail prices for selected eCooking appliances in Rwanda.

Appliance	Sales volumes (Jul-Dec 2019 import data)	Typical retail price (MECS & E4I Survey – online retailers in Kigali)
Oven/cooker (gas/electric)	No available data	RWF200,000-500,000 (USD200-500)
Hotplate (1 burner)	No available data	RWF35,000 (USD35)
Rice Cooker	No available data	RWF40,000-60,000 (USD40-60)
Kettle	No available data	RWF40,000-70,000 (USD40-70)
Electric Pressure Cooker (EPC)	No available data	RWF80,000-100,000 (USD80-100)
Microwave	No available data	RWF100,000-150,000 (USD100-150)
Induction/infra-red stove (1 burner)	No available data	RWF85,000 (USD85)

Relative cost of eCooking vs. popular cooking fuels

- The table below indicates that eCooking is likely to be slightly cheaper than purchased biomass, but slightly more expensive than LPG.
- Mini-grid tariffs are roughly double the highest tier of the regular grid tariff, meaning that cooking all your food with electricity would be more expensive than other fuels, however cooking part of the menu with energy-efficient appliances will likely still be cost effective (e.g., heavy foods with EPCs).

Grid electricity tariffs:
• Lifeline (0-15kWh/month): RWF89/kWh (USD0.090/kWh)
• Regular (>15-50kWh/month): RWF212/kWh (USD0.21)
• Regular (>50kWh/month): RWF249/kWh (USD0.25)
Mini-grid tariffs:
Private sector avg.: RWF560/kWh (USD0.56/kWh)





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Recommendations for strategic interventions

Recommendations

	Current status	Recommended interventions
Market segments	<p>On-grid</p> <p>Majority of urban population now connected to the national grid but uptake of electric cooking appliances has been low. Grid reliability in urban areas is high. Utility are willing to stimulate demand for surplus power. However, electricity tariffs are relatively high as compared to the wider region. Limited evidence on the cost-benefits of cooking with energy efficient eCooking appliances. E4I currently conducting a pilot with 25 households using EPCs and infrared stoves.</p>	<p>Support utility to develop a cooking with electricity demand stimulation programme and to consider tariff breaks for households adopting electric cooking.</p> <p>Support knowledge creation on the economics of cooking with electricity and the socio-cultural acceptance of eCooking solutions.</p> <p>Advocate for tax exemptions for AC electric cooking appliances.</p>
	<p>Mini-grid</p> <p>One (small) pilot has been conducted on a solar mini-grid and another (larger) one is underway (Electrocook and ARC Power). Tariffs are major barrier.</p>	<p>Explore viability of carbon finance to enable dedicated subsidised cooking tariffs. Explore various tariff structures jointly with financing of the appliances.</p>
	<p>Off-grid (SHS)</p> <p>No pilots of eCooking conducted on SHSs to date. Most SHSs are sold in rural areas and do not exceed 50Wp. However, most are sold on PAYG and could potentially include super energy efficient cooking appliances as upgrades.</p>	<p>Advocate for tax exemptions for DC electric cooking appliances.</p> <p>Support SHS companies interested in piloting DC EPCs.</p>

Recommendations

	Current status	Recommended interventions
TToC dimensions	<p>Supply chain</p> <p>Product fit of EPCs established with early pilots, but limited availability in retail outlets. No mainstream financing options available to buyers in retail stores.</p>	<p>Raise awareness of the CCF RBF to develop local supply chains for (affordable) EPCs. Leverage existence of private eCooking distributors and support development of reliable supply chains.</p>
	<p>Consumer demand</p> <p>Early pilots indicate cultural compatibility of EPCs with local cuisine with product adjustments likely needed (e.g. extra pot). Social acceptability has been high in pilots, but most consumers unaware of this new appliance. Cost remains a barrier but opportunities to alleviate it under CCF RBF.</p>	<p>Set up consumer awareness campaigns involving a blend of live cooking demonstrations, TV and social media to shift perceptions around affordability of eCooking.</p> <p>Leverage trust placed in GoR’s messaging and new technology support.</p> <p>Support development of financing schemes for electric cooking appliances (capex), in addition to the CCF RBF (e.g., through bank loans, MFIs, SACCOs etc.).</p>
	<p>Enabling environment</p> <p>Current policy framework supportive of clean cooking & electrification in separate strategies, but does not connect the two. LPG the dominant fuel being pushed for urban areas, however, a mix of LPG and electricity could be highly desirable to curb the use of charcoal, particularly in light of rising LPG prices.</p>	<p>Support MININFRA and REG on leveraging the fast expanding and good quality grid network for clean cooking.</p> <p>Support the development of joined up energy policy that connects the clean cooking and electricity access domains through evidence-based advocacy.</p>



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Find out more

Visit www.MECS.org.uk or <https://endev.info> for:

- The full Rwanda eCooking Market Assessment
- The full set of 8 country studies
- Cross-country comparison
- Impact modelling methodology
- Guiding framework

