



# AN INTRODUCTION TO ECOOKING APPLIANCES AND THEIR USE IN LOW AND MIDDLE INCOME COUNTRIES (LMICs)

Sustainable Energy for All (SEforALL) and  
Modern Cooking Energy Services



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# 2

## ACRONYMS AND ABBREVIATIONS

**AC** — Alternating Current  
**AQL** — Acceptable Quality Limit (sampling for inspections)  
**APR** — Annual Percentage Rate (finance)  
**AVR** — Automatic Voltage Regulator  
**BEE** — Bureau of Energy Efficiency (India)  
**CAPA** — Corrective and Preventive Action  
**CAPEX** — Capital Expenditure  
**CE** — Conformité Européenne (EU product conformity mark)  
**CLASP** — Collaborative Labeling and Appliance Standards Program  
**CoC** — Certificate of Conformity (customs/market access)  
**CSV** — Comma-Separated Values (file format)  
**DC** — Direct Current  
**DFI** — Development Finance Institution  
**DoC** — Declaration of Conformity (manufacturer's)  
**DR** — Demand Response  
**DSM** — Demand-Side Management  
**DSA** — Debt Sustainability Analysis (sovereign finance)  
**EEL** — Energy Efficiency Index (EU oven label metric)  
**EMC** — Electromagnetic Compatibility  
**EMI** — Electromagnetic Interference  
**EoL** — End of Life (product)  
**EPC** — Electric Pressure Cooker  
**EPR** — Extended Producer Responsibility (recycling/take-back)  
**EU** — European Union  
**FDA** — U.S. Food and Drug Administration (food-contact compliance)  
**GDPR** — General Data Protection Regulation (EU data privacy)  
**GHG** — Greenhouse Gas  
**Global LEAP** — Global Lighting and Energy Access Partnership (comparative testing programme by CLASP)  
**HAP** — Household Air Pollution  
**HS Code** — Harmonized System code (customs classification)  
**IDA** — International Development Association (World Bank's concessional arm)

**IEC** — International Electrotechnical Commission (standards body)  
**IMF** — International Monetary Fund  
**IP** (Ingress Protection) — Enclosure protection rating (e.g., IPX4)  
**ISO** — International Organization for Standardization  
**ITB** — Invitation to Bid (procurement)  
**JSON** — JavaScript Object Notation (data format)  
**kW** — kilowatt (power)  
**kWh** — kilowatt-hour (energy)  
**KPI** — Key Performance Indicator  
**LCA** — Life Cycle Assessment  
**LFGB** — German Food, Commodities and Feed Act (food-contact compliance)  
**LPG** — Liquefied Petroleum Gas  
**LV** — Low Voltage (distribution level)  
**MCB** — Miniature Circuit Breaker  
**MDB** — Multilateral Development Bank  
**MEP/MEPS** — Minimum Energy Performance (Standard/Standards; regulatory floor)  
**M&E** — Monitoring & Evaluation  
**MFI** — Microfinance Institution  
**MoU** — Memorandum of Understanding  
**MTBF** — Mean Time Between Failures  
**NDC** — Nationally Determined Contribution (climate target)  
**NGO** — Non-Governmental Organization  
**NPS** — Net Promoter Score  
**NPV** — Net Present Value  
**OPEX** — Operating Expenditure  
**PAYGo** — Pay-As-You-Go (consumer finance model)  
**PF** (Power Factor) — Ratio of real to apparent power  
**PFAS** — Per- and Polyfluoroalkyl Substances (non-stick coatings policy context)  
**PTFE** — Polytetrafluoroethylene (Teflon®)  
**QA** — Quality Assurance  
**QC** — Quality Control  
**RBF** — Results-Based Financing  
**RCD** — Residual Current Device (RCCB; safety)  
**RFP** — Request for Proposals  
**RFQ** — Request for Quotation  
**RMA** — Return Merchandise Authorization  
**RoHS** — Restriction of Hazardous Substances (EU)  
**SDG** — Sustainable Development Goal  
**SLA** — Service Level Agreement  
**SS** (Stainless Steel) — e.g., 304/316 grades for food contact  
**TCO** — Total Cost of Ownership  
**THD** — Total Harmonic Distortion (power quality)  
**TOU** — Time-of-Use (tariff)  
**UKCA** — UK Conformity Assessed (UK product conformity mark)  
**UL** — Underwriters Laboratories (standards/certification)  
**V** — Volt  
**VAT** — Value Added Tax  
**VFM** — Value for Money  
**W** — Watt (power)  
**WEEE** — Waste Electrical and Electronic Equipment (producer responsibility)

# 3

## EXECUTIVE SUMMARY

This report examines the role of electric cooking (eCooking) in low- and middle-income countries (LMICs). From a scan of eCooking appliances on the global market, it attempts to propose a typology and a definition of their ability to undertake different cooking tasks. The report is designed to equip programme planners, procurement teams, policy-makers, and other stakeholders with the knowledge needed to make well-informed decisions about electric cooking (eCooking) appliances in the context of low- and middle-income countries (LMICs).

Cooking with electricity is a normal activity in industrialised economies for domestic, commercial and institutional consumption. While a global industry of electric cooking appliances exists, cooking with electricity remains a niche activity in the low and middle income countries of Africa and developing Asia. Significant progress has been made in improving electricity access over the last decade, and although 650 million remain without access and a similar amount have limited access, integrated energy planning is laying the foundation for a decade of scaled uptake of modern energy for cooking. Plans include increasing access, ensuring renewable energy generation, reducing transmission losses and improving energy efficiency. These combined targets of SDG7 provide the foundation for this report, creating a world where eCooking can be a cost-effective transition to clean cooking and where it can contribute to the reduction of inequality.

As such the report itself builds on that foundation and contributes directly back into the aims of SDG 7 – ensuring access to affordable, reliable, sustainable, and modern energy for all—by addressing one of the most energy-intensive and culturally embedded daily activities: cooking. Electric cooking (referred to as eCooking throughout this report) offers an opportunity to capitalise on the electrification progress (SDG7.1.1) while advancing the SDG7.1.2 goal on access to modern and clean cooking.

- ▶ **7.1:** Ensuring universal access to modern energy services by making electric cooking viable and attractive for diverse households and institutions. Improved predictable demand can enhance utility profitability, ensuring that investment in new connections gives a viable return.
- ▶ **7.2:** Increasing the share of renewable energy—by enabling electric cooking powered by clean generation, including solar PV and wind-backed grids, creating demand that gives better investment returns pivoting existing cooking fuel expenditure into the electricity provision.
- ▶ **7.3:** Doubling the global rate of improvement in energy efficiency—through promotion of high-efficiency appliances like EPCs and induction cookers.

Electric cooking represents both a significant opportunity and a complex challenge for SDG 7 implementation. The potential benefits are clear:

- ▶ Reduction of household air pollution and related health burdens
- ▶ Lower greenhouse gas and black carbon emissions compared to traditional biomass cooking
- ▶ Time savings for households, particularly women and children, who often bear the brunt of fuel collection
- ▶ Strong synergy with ongoing electrification investments, including grid, mini-grid, and off-grid systems

Adoption requires that appliances be technically appropriate, financially accessible, culturally acceptable, and sustainably supported. This report aims to bridge a knowledge gap between technical specifications and real-world deployment by providing a practical, evidence-based guide to appliance selection, contextualisation, and scale-up.

The report's research began with a scan of appliance sales in Africa, and considered the objective of the work to become a one-stop shop and guideline for project implementers. It soon became clear that the emerging database would only partially cover the market, and that the dynamics of the market would rapidly outpace any intention to be comprehensive. The authors pivoted from trying to provide a comprehensive database, to analysing the one in front of them, and determining and clustering the characteristics of the appliances. As an outcome of that process, the report presents the technical features, benefits, and limitations of the most relevant eCooking appliance categories:

### 'Cooktops'



Surfaces and chambers that can heat cookware, sold as incredibly versatile.

- ▶ Hotplates (resistive coil stoves) – simple, low-cost, compatible with all cookware, but least efficient.
- ▶ Infrared stoves – works with any cookware, faster than hotplates but less efficient than induction.
- ▶ Induction stoves – very efficient, responsive heat control, but require magnetic cookware.
- ▶ Inbuilt oven-hob units – fixed installations with full-sized oven and hobs.
- ▶ Tabletop oven-hob combinations – portable units combining small oven with hotplates or infrared hobs.

### 'Self contained'



Appliances – sold inclusive of the cookware required to cook a meal, can cook a wide range of meals but perhaps not everything (depending on cultural foods).

- ▶ Electric Pressure Cookers (EPCs) – extremely efficient for one-pot dishes, automate long-cook meals.
- ▶ Rice cookers – designed for boiling/stewing grains; some models have steaming trays, can do more than just rice.
- ▶ Slow cookers – low-power simmering for extended periods; suitable for stews and soups, often surprisingly inefficient energy wise.
- ▶ Electric multicookers – flexible appliances with multiple cooking modes (pressure, sauté, slow cook, steam).
- ▶ Microwave ovens – fast reheating and cooking; often said not to produce good 'flavour' hence its use for reheating.
- ▶ Air fryers / fan-assisted ovens – circulate hot air for frying-like results with less oil; more efficient than conventional ovens for small batches.
- ▶ Steam cooking appliances – including steam-jacketed pots for bulk institutional cooking (schools, hospitals, caterers).

### 'Task specific' appliances



The report does not comment extensively on task specific appliances such as kettles and 'toasters'. These are very popular in developed economies particularly in office and commercial kitchens, however, they cannot substitute for all the cooking undertaken on, say, a charcoal stove. Kettle use to preboil water is becoming popular.

Each appliance type is assessed against energy efficiency, speed, safety, durability, cultural suitability, and cost-effectiveness. The report also touches on broader institutional appliances, such as steam-jacketed pots, for bulk cooking in schools, hospitals, and community kitchens – however the full range of commercial and institutional orientated equipment is not covered. Within each category specific appliances will vary in their performance – consumer associations, energy efficiency labelling and actions such as the Global LEAP Awards can differentiate specific brands and models within any one category. This guide does not go to that depth.

The conclusions of the analysis are as follows:

- ▶ **Cooktops are very versatile, but require cookware that matches the desired cooking style.** For instance high temperature cooking of flat breads such as Roti require flat cookware and good heat transfer. Induction stoves require specific cookware to work, and therefore any focus on ‘cooktops’ should also consider the cookware.
- ▶ **Self contained appliances are often more ‘efficient’ (energy per acceptable meal) than cooktops** Many self contained appliances such as EPCs, rice cookers and airfryers consistently deliver very high efficiency, but while they can do more than their name suggests (rice cookers can cook more than rice) their use as a primary appliance depends on the cultural cooking style.
- ▶ **Task specific appliances such as kettles for boiling water are very energy efficient, but constrained in their role within the overall cooking processes.**
- ▶ **Within any category the ‘system energy efficiency’ and the ‘energy efficiency per acceptable meal’ can vary significantly.** While energy efficiency labels can be created for some products such as ovens and more recently induction stoves in India, the standardised tests address energy conversion to heat in a replicable set up. In day to day use, the ‘system’ efficiency of say an infrared stove will depend on the cookware – is there wasted heat from uncovered surfaces. And the ‘meal’ efficiency will include human behaviour – whether the cook leaves the lid off the pan, perhaps purposely to reduce the fluids in the stew. Self contained appliances tend to constrain humans from wasteful behaviour more than cooktops.
- ▶ **Cultural fit is critical** – Appliances must align with staple food preparation methods, texture preferences, and cooking traditions to be adopted at scale. This is particularly important if a programme of action is promoting one item per household.
- ▶ **Fuel and appliances stacking should be considered as part of an integrated energy plan both nationally and at a household level.** If LPG is widespread and yet too expensive for ‘long cook’ staples, self contained appliances can be, and will likely be, used alongside the LPG. This could reduce the cost of refills for the LPG and/or stop households from lighting a biomass stove to stack alongside the LPG. In a transition from other fuels to eCooking, fuel stacking should be considered as one of the planned variables of behaviour for target cooks.
- ▶ **Infrastructure compatibility drives feasibility** – Grid stability, mini-grid capacity, and off-grid energy supply determine the range of viable appliances.
- ▶ **Sustainability depends on after-sales service** – Access to spare parts, repair facilities, and warranties is essential for maintaining appliance functionality and consumer trust.

The shift to electric cooking in LMICs is a transformative step toward achieving universal clean energy access, but success depends on careful appliance selection, integration with energy infrastructure, and supportive financial and policy frameworks. This report offers a structured approach to appliance choice that considers technical performance and use. By factoring the characteristics identified in this study, programme planners can accelerate the transition to clean cooking, reduce environmental and health burdens, and contribute meaningfully to the achievement of SDG 7.

4

# INTRODUCTION

## 4.1 ECOOKING IS A NORMAL OCCURRENCE IN DEVELOPED ECONOMIES

The use of electric cooking devices in high-income economies is a normal occurrence. Depending on the fuel mix within the country and the relative cost of electricity to gas, a majority of kitchens have at least a partial use of electricity (kettles, coffee maker, microwave), a sizeable proportion use it for cooking their main meals and in Sweden for example, 50% only use electricity for all their cooking needs. Electric cooking is therefore a norm in developed economies and has led to a global industry producing stoves and appliances for more than 6 decades<sup>1</sup>. As the world moves towards net zero carbon emissions electricity is set to displace gas<sup>2,3</sup> and there have been consistent initiatives to improve energy efficiency of cooking appliances, resulting in innovations that save the consumer energy costs.

Consequently a global industry of electric cooking appliances exists and appliances are available on international and local markets. To date cooking with electricity has been a niche activity in the low and middle income countries of Africa and developing Asia. This was historically because of shortfalls in electricity provision and access. Significant progress has been made in improving electricity access over the last decade, and although 650 million remain without access and a similar amount have limited access, integrated energy planning is laying the foundation for a decade of scaled uptake of modern energy for cooking.

Integrated energy planning and universal access provisions as part of international efforts to reach SDG7 include increasing access, ensuring renewable energy generation, reducing transmission losses and improving energy efficiency. These combined targets of SDG7 provide the foundation for this report; through broader infrastructure investment in clean grid and off-grid electricity such actions are creating a world where eCooking can be a cost-effective transition to clean cooking and where it can contribute to the reduction of inequality.

As such the report must be seen in this context. It builds on that broader infrastructural activity and contributes directly back into the aims of SDG 7 – ensuring access to affordable, reliable, sustainable, and modern energy for all—by addressing one of the most energy-intensive and culturally embedded daily activities: cooking. Electric cooking (referred to as eCooking throughout this report) offers an opportunity to capitalise on the electrification progress (SDG7.1.1) while advancing the SDG7.1.2 goal on access to modern and clean cooking.

- ▶ **7.1:** Ensuring universal access to modern energy services<sup>4</sup> by making electric cooking viable and attractive for diverse households and institutions. Improved predictable demand can enhance utility profitability, ensuring that investment in new connections gives a viable return.
- ▶ **7.2:** Increasing the share of renewable energy<sup>5</sup> —by enabling electric cooking powered by clean generation, including solar PV and wind-backed grids, creating demand that gives better investment returns pivoting existing cooking fuel expenditure into the electricity provision.
- ▶ **7.3:** Doubling the global rate of improvement in energy efficiency<sup>6</sup> —through promotion of high-efficiency appliances like EPCs and induction cookers.

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1. [MECS Leach 2025](#)

2. [CooksafeCoalition 2022](#)

3. [CLASP 2025](#)

4. [SDG 7.1 – Access to energy | Sustainable Energy for All](#)

5. [SDG 7.2 – Renewable energy | Sustainable Energy for All](#)

6. [SDG 7.3 – Energy efficiency | Sustainable Energy for All](#)

## 4.2 IN LOW AND MIDDLE INCOME ECONOMIES THERE IS STRONG NEED FOR A CLEAN COOKING TRANSITION

A significant portion of the world's population, especially in low- and middle-income countries, still relies on open fires and traditional cookstoves, such as those fuelled by wood, charcoal, straw, dung, or kerosene, for daily cooking. The extensive use of these solid fuels and basic stoves leads to high levels of indoor air pollution, posing serious health risks—particularly for women and children. Household air pollution from these sources is a major contributor to illness and premature death, with young children especially vulnerable. Additionally, the demanding daily routines of gathering fuel and tending fires can cause musculoskeletal problems and increase the risk of burns.

Collecting biomass fuel presents a range of physical and emotional difficulties for women and their families. While gathering firewood, women often face the risk of injuries, and the activity can expose them to unsafe situations, increasing feelings of anxiety and emotional strain. In areas where local sources of firewood have dwindled, women are forced to travel farther and spend more time securing fuel, taking away valuable hours that could be devoted to other productive or fulfilling tasks.

Beyond health consequences, the use of traditional biomass for cooking also has a notable impact on global carbon emissions, contributing to climate change. Biomass cooking is responsible for a measurable share of worldwide emissions, comparable to major industries. Inefficient combustion in traditional stoves releases black carbon, while harvesting wood for fuel or charcoal production accelerates environmental degradation. In some regions, the majority of wood used for cooking is sourced unsustainably, leading to deforestation, local forest depletion, and heightened climate impacts.

Traditional fuels and cookstoves also create economic challenges for households, both in terms of time spent and financial outlay. Studies have demonstrated that, in many cases, cooking with fuels like charcoal can be more expensive than using electricity, especially in urban areas where charcoal prices are high and electricity is relatively affordable. As a result, shifting to electric cooking can ease both economic and environmental burdens on families.

In low- and middle-income countries (LMICs) urbanization has accelerated over the past decade, with a growing proportion of the population now living in cities and towns. This shift has been accompanied by substantial improvements in electricity access: according to recent global estimates, more than 90% of urban residents in LMICs now have access to electricity. While the reliability and resilience of the electricity supply needs to be enhanced, expanding urban infrastructure has enabled utilities and governments to extend electrical grids to new neighbourhoods and informal settlements, making modern energy services more widely available. As a result, the expanding urban footprint presents new opportunities for integrating electric cooking solutions and advancing clean energy transitions in these rapidly developing regions.



of urban residents in LMICs now have access to electricity.

## 4.3 ELECTRIC COOKING OPPORTUNITY

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Electric cooking (commonly referred to as eCooking) offers one pathway to replace biomass cooking and reduce negative effects associated with its use. One of the key advantages of eCooking is that it leverages infrastructure which is essential to modern life. SDG 7.1.1 focuses on access to electricity. Government, private sector and agencies are investing in achieving SDG 7.1.1, and so to lean on that investment as the source of energy for clean cooking is potentially a double win. It enhances the daily life of the user, mitigating the combustion byproducts associated with biomass cooking, thereby enhancing indoor air quality. eCooking provides significant advantages for women and children by alleviating them from the time-consuming tasks of collecting traditional cooking fuels, thereby enabling them to utilize their time more productively. Additionally, eCooking offers convenience and a user-friendly cooking experience, enhancing overall cooking experience. This is a win for the user.

But in the long run, eCooking presents an opportunity also for government, investors and the planet. On reliable, ever-improving electrical infrastructure, eCooking can create a demand that can give a better return on the investment in grid connections. All too often investment in improving access is met with limited demand. There is much discussion on productive and anchor loads to justify connecting to the grid or creating a mini grid. eCooking can create a predictable steady load. In many cases it pivots user expenditure on polluting fuels into the expenditure on electricity. It enables an increasing opportunity to decarbonize cooking as more electricity becomes generated from renewable sources, contributing to clean energy transition and climate change mitigation.

## 4.4 A RAPIDLY CHANGING INFORMATION RESOURCE

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When this report started in 2024, finding consolidated data on eCooking appliances, including information on available appliances, how they work, and their costs, which is essential for informing their promotion and uptake, was challenging. When investors, clean cooking project developers, and users contemplate the transition to eCooking, they require access to pertinent information to guide their decisions. In 2024, when choosing an eCooking appliance, users had to endure the inconvenience of navigating multiple websites or conducting extensive research both online and offline in order to make an informed purchase decision.

Since then by 2025, the new Large Language Models often called AI have become widely used, and can scan the internet and present summaries of what is available. (see Annex 1 for the changes experienced during the writing of this report). Despite the availability of AI searching and summarizing, it is difficult for planners who themselves may not be familiar with eCooking appliances to know what they are looking for. While AI can bring to the foreground the product features, how do the planners know what to look and search for?

This guide attempts to document what the essential features of different appliances are, and to help guide the choices that investors, clean cooking project developers, and users will need to make.

## 4.5 PURPOSE

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The objective of this report is to guide readers in selecting the most suitable eCooking appliance for their needs. The information presented supports both programme planners and consumers in making informed decisions when promoting or purchasing appliances—and, critically, in guiding appliance choices for eCooking programs.

## 4.6 TARGET USERS OF THE REPORT

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The intended users of the information contained in this report include prospective buyers, project developers, implementers and investors engaged in initiatives on electric cooking in LMICs or those with an interest to extend their operations to this region.

## 4.7 LIMITATIONS

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As stated in the purpose, this paper focuses on the appliances and their shape, form, cooking process and energy requirements, their 'characteristics' in order to give the reader some background understanding of how to choose an appliance to promote in an eCooking programme. What this paper does not do is try to cover all aspects of designing a viable scaled eCooking programme.

- ▶ It does not seek to compare the running cost of these appliances against other fuels and equipment. Both alternative fuel costs and electricity tariffs are very context specific, so the report gives an indication of the relative energy efficiency of the appliance but not its operating cost compared to the alternatives.
  - ▷ We recommend any programmatic planning undertakes a contextualized cost comparison with alternative fuels, and undertakes user experience and taste tests to confirm the appliances can cook the local cuisine.
- ▶ It has limited 'real-world' case studies. The landscape of eCooking use is changing rapidly, and there is a growing body of work that documents real world use. As such it has limited reference to infrastructure challenges such as load shedding, quality of supply nor does it have comprehensive guidance on how to overcome upfront costs and affordability through tools such as PAYGO, Microfinance, Results Based Finance and Carbon finance.
  - ▷ We recommend that any programmatic planning consider the real world landscape, working with the utility or off-grid provider to ensure the suitability of the electricity access and with the finance and development sector to identify mechanisms to mitigate upfront costs.
- ▶ It has limited guidance on stimulating an enabling environment for scaled programmes.
  - ▷ We recommend that any programmatic planning consider connected and related legal and policy frameworks such as the tax regime (VAT exemptions, import duties, etc), appliance standards (and their enforcement – quality control), government planning for energy and 'clean cooking' use and government subsidies.
- ▶ It does not seek to give 'programmatic considerations' for programme implementers or government buyers. A programme should include work packages such as an appliance distribution campaign; procurement guidelines (e.g. what specifications to prioritise); recommended minimum standards or quality criteria; considerations for scaling PAYGO or results-based finance programs.
  - ▷ We recommend that any programmatic planning consider more than just appliance acquisition, and use this document only to guide the specific appliance discussions during the planning or inception phase.
- ▶ It does not seek to give guidance on user education and behaviour change. While this document may be used as a basis for consumer understanding of appliance characteristics programmatic planning should include strategies for user training, cooking culture, and how awareness will affect uptake, including behavioural barriers (e.g. unfamiliarity with electric devices, preferences for smoky flavors, etc.) and whether to, and how to, conduct community demonstrations or awareness campaigns.
- ▶ The document only partially covers off-grid contexts and appliances. DC appliances, solar + battery systems, and the role of inverters are mentioned, but without sufficient clarity for a reader to act on that knowledge. Off-grid systems are changing very quickly as the learning curve created by research

and development, 'learning by doing', economies of scale and spillover effects from other industries create a steep price change. For instance, as the cumulative installed capacity has increased, the price of solar declined exponentially. For more than four decades, the price of solar panels declined by 20% with each doubling of global cumulative capacity. There will likely be similar effects on batteries, especially now with spillover effects from electric vehicles.

- ▶ It does not explicitly consider the maintenance ecosystem and local repair capacity for each appliance. What happens when appliances break?
  - ▷ We recommend that part of the suitability criteria of the place for a particular programme include an assessment of the after-sales support models available in the target country? Are spare parts or trained repairers available locally? Is local assembly or refurbishment viable? How might the appliances be disposed of at the end of life – is there an extended producer responsibility mandated in the country of action?
- ▶ Finally, this document does not explicitly have a gender lens or equity focus. It partially covers some aspects (e.g. appliance weight) but a programmatic design should explicitly consider a gender, equity and disability lens.
  - ▷ We recommend that the programme include analysis of how appliance choice, portability, or financing mechanisms affect women differently, especially in rural or peri-urban areas. This should highlight gendered use patterns and design inclusivity. Disability should also be considered, particularly given that poor eyesight is common and modern appliances sometimes have small displays.

## 4.8 METHODS

The evolving nature of this report is relevant to its final shape and form. In 2024, an online search was conducted for eCooking appliances available in LMIC markets. Relevant information found was assembled in a database.

Based on our knowledge of cooking processes and the cultural demands of different menus around the world, the database compiled and assessed selected key information<sup>7</sup>; on the variety of forms of eCooking appliances that are currently available in LMIC markets. We scanned and analyzed for what might be considered as important when choosing an eCooking device.

Originally, we planned to publish the database, however it soon became evident that it would go out of date rapidly and would require significant resources to keep updated. The planning and method applied was also overtaken by the advent of Large Language Models (often called AI) have become part of the daily lives of professionals. As Annex 1 illustrates, AI models can achieve in a few moments what it was taking days and weeks to accomplish in 2024. We therefore have not published the database from which the characteristics were derived, although this can be made available on request.

During 2025, as the report was being finalised and it became apparent that the supply of eCooking appliances was evolving rapidly, the narrative pivoted away from creating a database of appliances, to learning and summarising the key characteristics that stakeholders in procurement should be looking for.

The scan of the literature and a set of interviews were used to identify the key characteristics of eCooking appliances that are important in informing the decision to purchase a cooking device. This guided the following report.

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7. 19 characteristics – Heating appliance, Power Rating, Temperature range, Capacity, Materials, DC/AC, Maintenance, Warranty, Weight of the cookers, Safety Features, Life span, Smart and connected features, Energy Storage, Data monitoring/ reporting, Cooking operations, Availability, Energy Efficiency, Certification, Cost (Purchase Price)

## 4.9 SCOPE OF THE REPORT

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There are a wide range of appliances that use electricity to generate heat for food preparation. These appliances are diverse, addressing different cooking needs. Some eCooking appliances are designed for specific culinary tasks, like toasters, kettles and rice cookers. Others, such as induction hobs, infrared hobs, and multicookers can be used in the preparation of a wide array of foods, to mimic the function of the traditional biomass stoves that eCooking programs aim to displace.

The electric cooking sector is characterized by recent innovation, and the application of different technologies to cooking appliances such as microwaves, electric pressure cookers, and solar electric cookers. Consequently, although the report includes appliances commonly found on the market at the time of writing, there may be some omissions, especially as new products are continually coming to market.

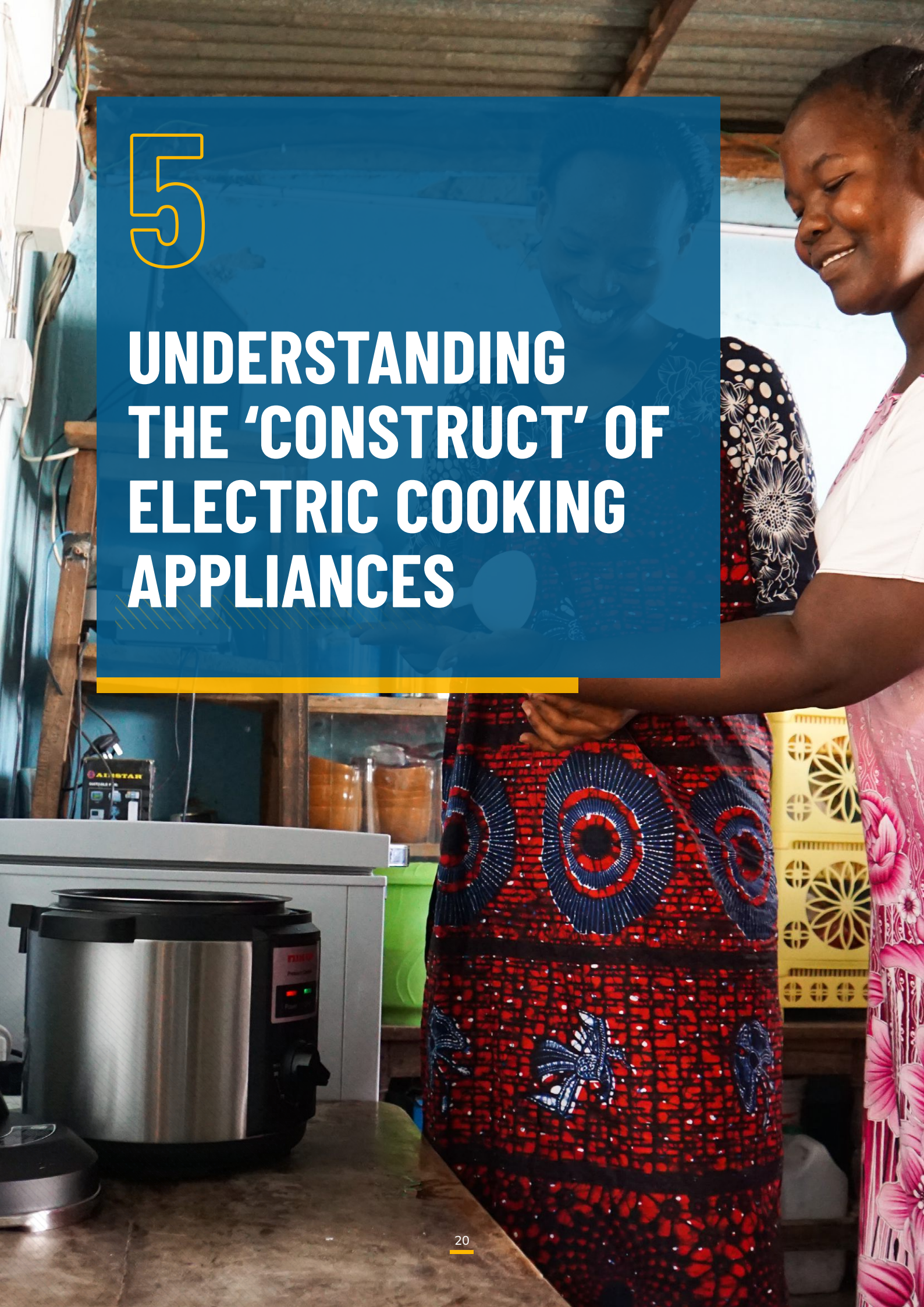
The appliances described in the report can be found across the globe. The focus here is on LMIC markets. Differences in the style of cooking on different continents means that a wide variety of devices can be found across Africa and Asian markets.



**THE ELECTRIC COOKING SECTOR IS CHARACTERIZED BY RECENT INNOVATION, AND THE APPLICATION OF DIFFERENT TECHNOLOGIES TO COOKING APPLIANCES SUCH AS MICROWAVES, ELECTRIC PRESSURE COOKERS, AND SOLAR ELECTRIC COOKERS**

# 5

## UNDERSTANDING THE 'CONSTRUCT' OF ELECTRIC COOKING APPLIANCES



In this opening chapter, we consider some of the common characteristics of electrical cooking appliances. This lays the base for subsequently moving on to discuss what appliances are on the market and how to assess their cooking effectiveness and economic value.

## 5.1 “IT IS TEMPERATURE THAT COOKS FOOD, NOT JUST ENERGY”?

Cooking happens when food is heated and held at a certain temperature long enough to trigger chemical changes. Energy is needed to **raise the food’s temperature**, but once that temperature is reached, only a small amount of energy is needed to maintain it.

### Example:



Beans brought to a boil can continue cooking inside an insulated container (like a “Wonderbag”) without added energy—because the heat stays trapped.

### Takeaway:



- A good electric cooking appliance should:
- ▶ Heat food efficiently
  - ▶ Minimize heat loss
  - ▶ Maintain the right temperature with as little energy input as possible

It is important to understand that it is being held at temperature that cooks food not additional energy per se. A device called a wonder bag or haybox illustrates this easily. If beans are brought to a cooking temperature, say 100 degrees, and the pot is then put in a highly insulated environment which retains that heat thereby keeping the beans at that cooking temperature, the beans continue to soften and cook. No further energy is required to cook those beans as long as the heat losses from the bag or box are minimal and the temperature does not drop below a required cooking temperature\*.

\*We are being slightly vague about what that cooking temperature is because different foods require different temperatures to be ‘cooked’, and different temperatures convert raw foodstuff to edible food at different rates resulting in different tastes. Cooking is a daily human activity with multiple nuances, and that has a whole global discipline of study and intuitive learning by everyday cooks.

Cooking is a culturally and personally specific activity, that gives cooking tastes and behaviours a certain inertia resistant to change. For this document we explain how appliances can cook the food, but whether the resulting taste is acceptable to the cook and the eaters will need to be explored in taste tests.

The core point of this section is to note that raw food can be raised to a cooking temperature and held at that temperature, and it will cook. Any energy input after the initial raise in temperature is required only to maintain the temperature, and therefore depends on losses.

The lack of flames in electrical cooking can mean that no airflow is required. Traditional cooking fuels (wood, charcoal, gas) need airflow to support combustion, which leads to heat loss as hot air escapes around the pot. Electric cooking, by contrast, does not rely on burning fuel, so airflow is not necessary—and this can significantly improve efficiency.

### Example:



**Induction stoves** heat the pot directly using magnetic fields, and **microwaves** heat food internally by exciting water molecules.

### Takeaway:



Electric cooking appliances are often more efficient because they don't waste energy heating the air or surrounding space.

One of the great advantages of electrical cooking is that the transfer of heat from appliance to pot is not dependent on air flow. All other fuel based stoves require air flow to operate. LPG, Ethanol, Biogas, briquettes, charcoal, wood, all require an airflow to combust. That air flow can be minimized or increased in conjunction with the input of fuel (low gas setting or reduced number of sticks) to change the combustion rate and control the heat going into the pan, but they all have some air flow to ensure they work.

By definition, that air flow is an opportunity for wasted energy. Hot air which has been part of the combustion is likely to go up the side of the pot or pan, and doesn't raise the food's temperature.

This is a basis for the efficiency of cookstoves. Three stone fires have open sides, and it is obvious the hot air is leaking into the room. That lack of coherent air flow also causes incomplete combustion of the biomass, leading to smoke. Improved biomass cookstoves seek to mitigate the side leakage, and ensure the air has a regular controlled flow through the combustion chamber, and can therefore increase the energy efficiency of the stove. However, when that hot air is being applied to the pot, there is still room for the air to transfer to the room without transferring its energy to the pot. Gas burners make small flames that are focused on the pot, and transfers its combustive heat as directly as it can. Nevertheless, hot air goes up the side of the pan and out into the room.

While air flow is needed to maintain the combustion with all combustible fuels, electrical appliances don't have such a constraint. Heat transfer can occur without specific air flow. While there are opportunities for losses in heating the air (for instance above an uncovered portion of a hotplate, see below), there are opportunities for heat transfer that are independent of any air flow – the key examples are induction stoves which generate the heat in the pan through a magnetic field and microwaves which heat the food 'from the inside out'.

It is perhaps worth noting that air flow, while not necessary for electric based cooking, can sometimes improve efficiencies and increase the effectiveness of cooking food. The prime example of this is a fan assisted oven that circulates the air around the food, which has an energy transfer to cooked food efficiency twice that of non fan ovens of the same size and design – this is a key principle in the air fryer.

We also note that this lack of required airflow changes the nature of the device, and makes some of the testing procedures for biomass and gas stoves efficiencies redundant.

## 5.2 HOW HEAT IS GENERATED

Electric cooking appliances use various methods to convert **electricity into heat**:

- ▶ **Resistive heating** (used in hotplates, rice cookers): Electricity passes through a coil, which heats up and transfers heat to the pot.
- ▶ **Induction**: A magnetic field directly heats the pot (but only works with compatible cookware).
- ▶ **Microwave radiation**: Excites water molecules inside the food, heating it from within.

### Takeaway:



Each method has trade-offs in terms of efficiency, cost, and required cookware.

All of the appliances we will discuss below are designed to take food, raise its temperature and make it edible. (We include the concept of 'reheating food' – taking cold food and making it hot and tasty).

As such they all have a means for converting electricity into heat to raise the temperature. These are variously shown on the diagrammatic explanation of each appliance as the 'heating element'. The simplest of these is a resistive element. When electricity is passed through a resistive material it creates heat. So the simplest devices use a 'resistive heater' to create the heat. The heat then has to be transferred to the pot or pan that holds the food, and that in turn passes the heat onward to the food. This handover of heat from element to pot to food is where energy can be lost as the heat transfer is not 100% and some energy is lost to the environment.

There are other more sophisticated sources of heat. An induction stove creates a high frequency fluctuating magnetic field that creates a similar changing field in an 'induction ready pot', and the pot gets hot. The fluctuating magnetic field of the stove itself doesn't get hot (except where the pot touches and reheats the stove surface a little). In a microwave, the frequency of the radiating waves is such that they excite polar molecules in the food and the food itself heats up.

The heat transferred to the food raises the temperature of the food. It takes energy to do this – to move the food from one state of temperature to another state. However once the cooking temperature is reached, we return to our first statement above. Energy is only required to maintain that temperature, and if the losses are minimal, say due to a Wonderbag, then further input of energy is minimal.

These points will become clearer once we discuss actual appliances below, but for instance the electrical pressure cooker has energy input to **raise** the food to temperature (constant on), but once at pressure it **switches itself off** (until it senses a small 5 degree drop in temperature when it will add a small amount to energy just to 'top up the temperature' before switching off again, i.e. intermittent on and off, mainly off). I.e. energy is required to raise the temperature of the food, but not necessarily required to maintain the temperature of the food.

## 5.3 ENERGY INPUT TO MAINTAINING THE COOKING TEMPERATURE ONLY NEEDS TO BALANCE THE ENERGY LOSSES FROM THE COOKING ENVIRONMENT.

Once food reaches the right temperature, the key is to keep it there—without using more energy than necessary.

This depends on:

- ▶ **Insulation:** Prevents heat from escaping
- ▶ **Control:** Allows the cook (or the appliance) to adjust power to avoid wasting energy
- ▶ **Automation:** Lets the appliance manage heat input automatically, especially in devices like electric pressure cookers (EPCs)

### Takeaway:



Appliances with insulation and good temperature control are more efficient and easier to use—especially for longer cooking tasks.

Building on this last point in the previous section, we will see in the appliances below a range of cooking environments that experience energy loss in different ways. As the example immediately above states, the energy losses from an electric pressure cooker are generally low. It has an air gap between pot and outer surface and so the losses at pressure are mitigated, and so the energy input for even a long duration cook at pressure is minimal.

Proponents of gas stoves and electric heating stoves, often suggest that a stove top pressure cooker can be added to the stove and this is as 'effective' as an electric pressure cooker. This is not quite the case. An average domestic pressure cooking pot (at pressure and without an air gap wall), radiates 400W or more, and so while the heating element can be turned down, it rarely can be turned off. That 400W needs to be added to keep the pressure cooking at temperature. (Although this is where consumer behaviour becomes significant – if the pot is taken off the stove and placed in an insulated environment, the pot would maintain pressure with minimal added energy.)

## 5.4 INSULATION, CONTROL, AUTOMATION, AND PRECISION

Several times above we have referred to the advantage of some insulation that would maintain the temperature and mitigate the need for further input of energy (thereby improving the energy efficiency of the appliance). Insulation is easier in an electrical device because no airflow is required to maintain the heat input. Imagine creating a double skinned pot to be used with a gas or biomass stove. The air flow up the sides of the pot would still be an energy loss, and for the insulation to achieve any benefit, one would need human intervention to turn the gas or adjust the woodfuel to match the minimal losses (or as discussed above insulation can be used on any stove by moving the pot (as in a hay box or wonderbag) but this also requires human intervention).

**Manual control:** without insulation a pot that needs to simmer for an hour requires the stove user to adjust the fuel consumption, or energy input, to exactly balance the losses. To turn down the heat so the pot doesn't boil over. This control of the heat input in a gas stove is relatively easy, the turning of the knob restricts the gas flow through a control valve for that burner. It is a matter of seconds to adjust the control. Control on a charcoal or wood fire is more difficult. On three stone fires, we have seen excellent control being exercised by the cook by either moving the pot to one side, thereby reducing the heat transfer into the pot, or taking out or putting in sticks into the fire chamber.

Almost all eCooking appliances have clear controls. Thermostats are often built into oven controls, such that the cook sets a required temperature and leaves the oven to switch the heating elements on and off to maintain that temperature (The same is true for gas ovens). Most cooktops have setting of low, medium and high (or 1 to 10), which can create a lower temperature heating effect. In cheaper devices this is often just an on and off function, where the control is pre-set to come on at full current and voltage and then switch off for a given period to average out the temperature of the heating plate. In more sophisticated appliances, the control may constrain the current and voltage to create a constant but lower heat in the heating element. In very sophisticated appliances, a timer is included such that the cook can heat at a maximum rate for a given time period and then the appliance will adjust itself to a lower setting.

**Automation.** Nevertheless, most controls require the user to take decisions, and be present at the moment of 'change' (adjustment from one setting to another). This manual adjustment of the heat input can be automated even where combustion and air flow are required. A gas oven can be set at a required temperature, and a mechanical thermostat can regulate the gas flow to maintain the temperature (to balance the energy going in and being lost). This is more difficult with gas stoves, and very difficult with biomass stoves. Nevertheless 'automation' is therefore feature of eCooking appliances that can be valuable. It releases the cook to do other things. As stated above, in very sophisticated appliances, a timer is included such that the cook can heat at a maximum rate for a given time period and then the appliance will adjust itself to a lower setting. In an electric pressure cooker, the device itself senses the pressure and automatically switches itself on and off as described above.

**Precision.** There is obviously a difference between how precise an automated appliance may be with the temperature and timing. For many years the automated controls of ovens were based on mechanical thermostats, driven by bimetallic on-off switch. These are good for plus minus 5 to 10 degrees centigrade, although they can get worse with age. For an oven at 180 to 200 such an error margin makes little difference to the cake baking, however for a hotplate trying to balance energy loss and keep a pot simmering, the range of error makes for a considerable loss of energy. Many controls have now switched to digital thermostats, and can be more precise, although still with some hysteresis.



Most cooktops have setting of low, medium and high  
**(OR 1 TO 10),**  
which can create a lower temperature heating effect.

## 5.5 WHAT TO LOOK FOR WHEN ASSESSING APPLIANCES

Given the above conceptual description of how eCooking enhances the cooking processes, what does this mean for choosing an electric cooking appliance especially for bulk purchase or program rollout?

KEY OVERARCHING CHARACTERISTIC	IMPLICATIONS FOR DEVICE ASSESSMENT
The temperature of the food must be raised for it to cook	There should be an efficient and effective input of energy to the actual food.
The temperature of the food needs to be held during the cooking process	There should be an easy way of balancing any losses of heat from the food, by either putting in more energy or by minimising losses.
<b>LOSSES COULD COME FROM:</b>	
▶ radiant heat from hot bodies (the pot),	What radiant losses might you expect – is there any insulation?
▶ convection loss from air flow,	Is there an air flow, how might this affect the cooking? Note in some cases air flow is good for moving the hot air around the food.
▶ evaporative losses (no lid) or	Evaporative losses can be a necessary part of the cooking process, sauce 'reduction' but in most cooking it is an unnecessary loss of energy
▶ conductive loss.	Is the device isolated from surfaces (i.e. has rubber or plastic feet to reduce downward conduction losses)
<b>REGARDING PUTTING MORE ENERGY IN TO HOLD THE TEMPERATURE....</b>	
▶ 'Control'	Are the controls easy to use, and turning down the input is instant.
▶ 'Automation'	Is the temperature control automated, such that the device regulates the energy input during cooking
▶ 'Precision'	Does the device hold the temperature very precisely or is there a large margin of error (due to either automation or human error).

Features that support efficient cooking include:

KEY FEATURE	WHY IT MATTERS
Efficient heating method	Saves energy and costs
Good insulation	Reduces heat loss and improves safety
Easy-to-use controls	Helps manage temperature effectively
Automation features	Allows "set-and-forget" cooking
Sturdy design and pot fit	Maximizes heat transfer and durability

Having these overarching guidelines of what to look for, the next section presents a brief description of the most commonly found appliances.






A woman with curly hair, wearing a white long-sleeved shirt, is shown in profile from the chest up. She is standing in a retail store, reaching out with her right hand to scan a product on a shelf. The shelf is filled with various items, including what appears to be a coffee machine. The background is slightly blurred, showing more shelves and products. A blue semi-transparent box is overlaid on the left side of the image, containing a large yellow number '6' and the text 'SCANNING THE SHELVES' in white. The page number '28' is visible at the bottom center.

6

## 'SCANNING THE SHELVES'

## 6.1 OVERVIEW OF ELECTRIC COOKING APPLIANCES.

This section provides a brief description of the most commonly found appliances. They have been divided into three groups:

Cooktop 	Self contained 	Task specific 
<p>Appliances that can cook a wide range of dishes; with a flat cooking surface, they can be used with a range of pots and pans to perform almost all cooking styles:</p> <ul style="list-style-type: none"><li>▶ Hotplate</li><li>▶ Infrared</li><li>▶ Induction</li><li>▶ Stand-alone or inbuilt oven plus hob units</li><li>▶ Table top or mini ovens with hobs</li><li>▶ concave' versions for improved cookware fit</li></ul>	<p>Appliances that have some limitations on the number of cooking styles they can perform and may not, therefore, be the first choice for cooking some dishes, but bundle the main cooking pot or chamber as a part of the appliance:</p> <ul style="list-style-type: none"><li>▶ EPC</li><li>▶ Multi-cooker</li><li>▶ Rice cooker</li><li>▶ Slow cooker</li><li>▶ Table top or mini ovens</li><li>▶ Air fryer</li><li>▶ Microwave</li><li>▶ Frying pan</li></ul>	<p>Appliances, that have even more limitations than the restricted group.</p> <ul style="list-style-type: none"><li>▶ Kettle</li><li>▶ Toaster</li><li>▶ Soup maker</li></ul>

It should be noted that the three clusters of appliances and the key word used for each cluster have been created for the purposes of this report. They are at the time of publication used variously. Consumers and professionals tend to interchangeably use hotplate, stovetop, induction, infrared, etc. For this report we have called this cluster 'cooktops' and defined them as appliances that offer a flat surface for heating a pan or pot. Even this definition does not fully work as some of the new multicookers can disassemble to offer a flat heating surface.

The second cluster identified from the data were those that might be considered 'self-contained'. While cooktops require the consumer to purchase a pot or pan, the 'self-contained' appliances tend to come with a pot within which food can be cooked. Again this could be questioned, since table top ovens and microwaves often do not come bundled with pots and pans. However rather than create a fourth category we believe that the defining label 'self contained' is a good enough descriptor.

The third category of task specific appliances captures the essence of the group. It can be everything from toasters to kettles to egg boilers.

The clustering and titles are intended to give planners a language by which to discuss their appliance needs.

## 6.2 COOKTOP APPLIANCES

### 6.2.1 ELECTRIC HOTPLATE COOKERS

 **Key strengths:** Low cost, simple to use, works with any cookware

 **Main uses:** Boiling, frying, simmering, general stovetop cooking

Hotplates use an electric coil or element to heat cookware through direct contact. They are widely available and compatible with any flat-bottomed pot or pan. While they are inexpensive and easy to use, they are less efficient than other electric options due to poor conductive heat transfer and as pans get older and have more dents, the combined effect is even lower efficiency.

#### Pros:



- ▶ Very affordable and widely available
- ▶ Works with all cookware types
- ▶ Simple design, easy to operate and repair

#### Limitations:



- ▶ Not very energy-efficient; significant heat lost to surroundings
- ▶ High surface temperatures can cause burns
- ▶ Low power versions barely heat the dented pan
- ▶ Often quite imprecise temperature control

Electric hotplate cookers, or electric hobs, are cheap compared to other appliances, versatile and compact, making them currently the most widely used eCooking appliances. They are portable and standalone cooking appliances that consist of one or more flat heating surfaces. Hotplates come in various designs, with either spiral coils or solid plates (as in Figure 1), sizes, and configurations. They can be used with any pot or pan, and the efficiency greatly depends on the fit of the pan to the ring and whether the bottom of the pan is flat.



Figure 1: Examples of Hotplates<sup>8</sup> (a) Bomann<sup>9</sup> hotplate (b) Severin hotplate.

8. [https://www.amazon.de/-/en/650331/dp/B01N9PN0NN/ref=zg\\_bs\\_g\\_3310801\\_d\\_sccl\\_3/262-4309730-8481848?th=1](https://www.amazon.de/-/en/650331/dp/B01N9PN0NN/ref=zg_bs_g_3310801_d_sccl_3/262-4309730-8481848?th=1)

9. [https://www.amazon.de/-/en/SEVERIN-hotplate-stepless-temperature-1091/dp/B007HMQQ18/ref=zg\\_bs\\_g\\_3310801\\_d\\_sccl\\_1/262-4309730-8481848?psc=1](https://www.amazon.de/-/en/SEVERIN-hotplate-stepless-temperature-1091/dp/B007HMQQ18/ref=zg_bs_g_3310801_d_sccl_1/262-4309730-8481848?psc=1)

## 6.2.2 INFRARED STOVES

 **Key strengths:** Works with any cookware, cheaper than induction, simple design

 **Main uses:** Boiling, frying, sautéing, general stovetop cooking

Infrared stoves use resistive heating elements with a glass-ceramic top, transferring heat by radiation and conduction. They are compatible with all pot types and shapes, making them versatile for households with mixed cookware. They generally cost less than induction units but can be slower to heat and less efficient at a given power rating.

### Pros:



- ▶ Works with any flat-bottomed cookware, tolerates a slightly curved base.
- ▶ Less susceptible to dents and distortions in pans than hotplates
- ▶ Usually lower cost than induction
- ▶ Simple design and easy to operate
- ▶ Stable cooking surface

### Limitations:



- ▶ Slower to heat than induction at a given power input
- ▶ Less efficient than induction with more heat loss during heat transfer
- ▶ High surface temperatures pose burn risk

Electricity is passed through a resistive filament in a quartz or halogen lamp to create very high temperatures at which infrared radiation is emitted, which gives the red glow that is characteristic of an infrared ring. They are available as portable units with single or double rings. They can be used with any pot or pan, and the efficiency greatly depends on the fit of the pan to the ring (although this is less susceptible to whether the bottom of the pan is flat than a hotplate).



**Figure 2:** Examples of Infrared (a) Unbranded Infrared cooker <sup>10</sup> (b) Bushburgh high powered infrared<sup>11</sup>

10. [Generic Infrared Intelligent Electric Cooker \(1 Year Warranty\) | Jumia Nigeria](#)

11. [BUSHBURGH Intelligent Infrared Electric Stove – 3500W | Jumia Nigeria](#)

## 6.2.3 INDUCTION COOKERS

 **Key strengths:** Very efficient heat transfer, fast, safe cooking surface

 **Main uses:** Stir-fries, flatbreads, curries, boiling, sautéing

Induction stoves heat pots directly using magnetic fields, wasting little energy. They are fast to respond, easy to control, and safer to touch since the cooktop itself stays relatively cool. However, they require compatible cookware (ferrous/magnetic) and generally use higher power than some other electric options.

### Pros:



- ▶ Highly efficient and responsive
- ▶ Precise temperature control
- ▶ Safer to touch surface during operation
- ▶ Heats the kitchen less than gas or resistive stoves.

### Limitations:



- ▶ Requires magnetic (ferrous) cookware
- ▶ Typically high-power draw (1,500–2,200 W)
- ▶ More expensive than basic resistive stoves

Induction cookers generate a magnetic field between the cooktop and the cookware placed on it. This magnetic field induces a current in the ferrous (iron-based) cookware, creating heat directly within the cookware itself. The heating surface remains cool to the touch until a pot is placed on top of it (the surface may become hot after cooking due to reflective heat from the pot). The cookware used on induction stoves should be made from magnetic materials such as stainless steel or carbon steel. It offers rapid and precise heating, with the ability to adjust temperature levels instantly. Buying specialized cookware to use on the induction can add a significant cost to the upfront cost of the appliance.



Figure 3: Examples of Induction Cookers: (a) Bartscher<sup>12</sup> Induction cooker (b) CaterChef<sup>13</sup> Induction cooker

12. [https://www.xxlgastro.de/induktionskocher-2-felder-3500w-230v-605x360x-h-60mm/1001439?gad\\_source=1&gclid=Cj0KCQjwwMqvBhC-tARIsAIXsZpbqzXltzAf63Y0IzEbDkRKiwJuf4AgqNz2IfCopWkAP41BAo6qNBAAmF1EALw\\_wcB](https://www.xxlgastro.de/induktionskocher-2-felder-3500w-230v-605x360x-h-60mm/1001439?gad_source=1&gclid=Cj0KCQjwwMqvBhC-tARIsAIXsZpbqzXltzAf63Y0IzEbDkRKiwJuf4AgqNz2IfCopWkAP41BAo6qNBAAmF1EALw_wcB)

13. [https://www.xxlgastro.de/induktionsherd-edelstahl-digitale-zeitschaltuhr-2700w-10-3-h-x38x22cm/1016427?gad\\_source=1&gclid=Cj0KCQjwwMqvBhCtARIsAIXsZpbwbKYlgA3XDseh9P9PugfRSuDcYiVT3oUy\\_n8oFlzplFA7SpjGc5oaAsTMEALw\\_wcB](https://www.xxlgastro.de/induktionsherd-edelstahl-digitale-zeitschaltuhr-2700w-10-3-h-x38x22cm/1016427?gad_source=1&gclid=Cj0KCQjwwMqvBhCtARIsAIXsZpbwbKYlgA3XDseh9P9PugfRSuDcYiVT3oUy_n8oFlzplFA7SpjGc5oaAsTMEALw_wcB)

## 6.2.4 INBUILT OVENS WITH HOBS

 **Key strengths:** Multi-function (baking, roasting, stovetop cooking) in one unit

 **Main uses:** Baking bread and cakes, roasting meats, stovetop boiling, frying, sautéing

Inbuilt ovens with hobs combine a conventional electric oven and one or more cooking zones (hotplates, infrared, or induction) in a single, fixed kitchen unit. They are common in upper and high income countries, versatile and well-suited to households that bake regularly, but they require more space, a permanent installation, and higher upfront investment.

### Pros:



- ▶ Can bake, roast, boil, and fry in one appliance
- ▶ Often higher build quality than portable devices
- ▶ Suitable for large families and varied cooking styles
- ▶ Stable, durable cooking performance

### Limitations:



- ▶ High purchase cost
- ▶ Requires permanent space and installation
- ▶ Higher electricity demand; may need dedicated wiring
- ▶ Less portable—unsuitable for small or shared kitchens

Inbuilt Ovens with hobs – A standing heavy oven and hob combinations can be built into a modern kitchen. These are mainly for the wealthier segments of society, but are available in Africa, particularly Kenya and Zambia. In the figure, the Beko offers an electric oven, one electric hotplate, and three gas burners, while the Ariston offers an electric oven with 4 infrared ceramic hobs. These ovens mostly have a grill function as well as baking. Regarding inbuilt options, it is possible to purchase the hobs without the oven e.g. the Bosch Electric Ceramic Hob.




**Figure 4:** Examples of Inbuilt Kitchen Ovens with hobs: (a) Beko<sup>14</sup> “Cooker 3 Gas + 1 Electric” (b) Ariston<sup>15</sup> 4 hob infrared, (c) Bosch<sup>16</sup> Electric Ceramic Hob


14. [BEKO Cooker 3 Gas + 1 Electric – FSM63330DXDSL Semi inox | hotpoint.co.ke](https://www.hotpoint.co.ke/products/beko-cooker-3-gas-1-electric-fsm63330dxdsl-semi-inox)

15. [Ariston CE6VM3\(X\)R/A6V530\(X\)EX 4 Plate Ceramic Cooker | hotpoint.co.ke](https://www.hotpoint.co.ke/products/ariston-ce6vm3(x)r/a6v530(x)ex-4-plate-ceramic-cooker)

16. [Bosch PKF375CA2E 2 Electric Ceramic Hob – 30CM | hotpoint.co.ke](https://www.hotpoint.co.ke/products/bosch-pkf375ca2e-2-electric-ceramic-hob-30cm)

## 6.2.5 TABLE TOP OVENS WITH HOBS

 **Key strengths:** Compact multi-function unit; portable baking and stovetop cooking

 **Main uses:** Baking bread and cakes, roasting meats, boiling, frying, sautéing

Tabletop ovens with hobs combine a small electric oven and one or two cooking zones (hotplates or infrared) in a single portable unit. They are useful in homes without built-in kitchens or where space is limited. While versatile, they can be generally less energy-efficient than dedicated appliances (mainly due to the smaller hotplate surfaces and lower power) and have smaller oven capacity than inbuilt ovens.

### Pros:



- ▶ Combines baking, roasting, and stovetop cooking in one device
- ▶ Portable and space-saving
- ▶ Suitable for households without a permanent kitchen setup
- ▶ Lower cost than inbuilt oven-hob units

### Limitations:



- ▶ Smaller oven chamber limits batch size
- ▶ Cooking zones may be slower than standalone cooktops
- ▶ Can be bulky for small counters

Similarly, there are a number of small worktop mini ovens which can have two hobs on the top. Once again the hobs can be hotplates, infrared or induction (although induction has yet to reach LMICs).



**Figure 5:** Examples of Table top ovens with hobs: (a) Haden<sup>17</sup> Table Top Oven With 2 Hot Plates (b) Cookworks<sup>18</sup> Mini Oven/grill With Hob,


Indeed, the combination ovens with hobs can be considered the most versatile single appliance – the oven and grill function can cook and brown meat in a way a hob on its own would find difficult. The function is similar to an air fryer, and air fryers are becoming very popular (see below).

17. [Haden Table Top Oven With 2 Hot Plates | Jumia Nigeria](#)

18. [Cookworks Mini Oven/grill With Hob | Jumia Nigeria](#)

## 6.2.6 “CONCAVE” COOKTOPS ADAPTED FOR COOKWARE

 **Key strengths:** Low cost, simple to use, works with any cookware

 **Main uses:** Boiling, frying, simmering, general cooktop cooking

There are a limited number of hotplates (resistive electric coil), infrared and induction cooktops that put the ‘cooking surface’ as a slight concave in order to fit particular preferred cookware. In Ethiopia an industry has arisen for coffee pots (see below), and in India and China there are infrared and induction heaters designed for woks.

Some of the production of these very culturally specific forms are inexpensive and easy to use, but there are cases in Ethiopia where safety systems have been compromised to reduce costs. India and China made devices pass international standards, and the infrared and induction versions can be as efficient as a flat infrared or induction with the specialist cookware.

### Pros:



- ▶ Very affordable
- ▶ Works with preferred shapes of cookware
- ▶ Simple design, easy to operate and repair

### Limitations:



- ▶ Less efficient than induction with a flat bottomed cookware
- ▶ High surface temperatures pose burn risk

Electric resistance cookers or infrared are cheap compared to other appliances, versatile and compact, making them currently the most widely used eCooking appliances. These semi specialist appliances are not widely available, and are the imagination and output of specialist appliance manufacturers. Like their flat cousins, they are portable and standalone cooking appliances that consist of the concave surface. One example is the concave Ethiopian electric stove, locally made and specifically designed to cradle the rounded base of a Jebena coffee pot and designed for slow, even heating during traditional coffee ceremonies.



**Figure 6:** Examples of “Concave” cooktops: (a) Eritrean and Ethiopian Traditional Fanelo Electrical Stove<sup>19</sup> | Medeja (b) Concave Infrared ‘Wok’ Cooker<sup>20</sup>, (c) Induction Wok Pan Cooktop<sup>21</sup>

Woks are of course common in Asian cooking, and chefs appreciate the ability to toss and stir the food, while maintaining the heat both at the base and up the sides. Concave induction cooktop require an induction ready wok, while infrared cooktops will work with all materials.

19. [Eritrean and Ethiopian Traditional Fanelo Electrical Stove | Medeja – Asli Store](#)

20. [Concave 304 Stainless Steel Housing Infrared Cooker For All Material And Shape Of Pan](#)

21. [GastroGear Induction Wok Pan Cooktop 1700W](#)

## 6.3 SELF CONTAINED APPLIANCES


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Self contained appliances are where the device can cook a significant part of the typical menu, but not all of it. Deep pans on some devices make it difficult to cook chapatis and flat breads, and often low temperature cut offs do not allow deep frying or even shallow frying above 160 degrees. One needs 200 degrees to cook Indian Roti, and/or to brown meat and seal in the flavour. However, while the trade off is that they cannot cook ALL meals, they can cook MOST, and in some cases do it at a higher energy efficiency than the above hotplates, infrared and even induction hobs. Higher energy efficiency can lead to significant cost savings each month.



**HOWEVER, WHILE THE TRADE OFF IS THAT THEY CANNOT COOK ALL MEALS, THEY CAN COOK MOST, AND IN SOME CASES DO IT AT A HIGHER ENERGY EFFICIENCY THAN THE ABOVE HOTPLATES, INFRARED AND EVEN INDUCTION HOBBS.**

### 6.3.1 ELECTRIC PRESSURE COOKERS (EPCS)

 **Key strengths:** Extremely energy-efficient, versatile, fast

 **Main uses:** Beans, stews, grains, meats, soups

EPCs combine heat, pressure, and insulation to cook food faster and more efficiently than any of the cooktops. Once pressure is reached, the appliance switches to standby, only using energy occasionally to maintain temperature. Most EPCs have multiple cooking modes—such as sautéing, steaming, and slow cooking—making them well-suited for a wide range of dishes.

#### Pros:



- ▶ High energy efficiency due to insulation and pressure cooking
- ▶ Set-and-forget automation
- ▶ Excellent for long-cook dishes like beans or stews
- ▶ Can shallow fry

#### Limitations:



- ▶ Usually limited to one-pot meals
- ▶ Cannot deep fry or brown food well unless additional modes are included
- ▶ Requires compatible inner pot (non-interchangeable)

EPCs are the most efficient modern cooking appliances due to a combination of insulation, automation, and cooking under pressure which raises the boiling point of food. This also means they can cook some foods quicker than non-pressure options\*. Most EPCs have diverse cooking functions, including pressure cooking, slow cooking, sautéing, shallow frying, steaming and so on. The bespoke removable pots fit the EPC neatly, so there is good heat transfer from element to pot, as good as induction even though most are resistive heating elements. Dents could affect performance, and they cannot be used with any other pots. Pots are typically made of stainless steel or come with a non-stick coating.



Figure 7: Examples of Electric Pressure Cookers: (a) AUFLA EPC<sup>22</sup> (b) Philips<sup>23</sup> EPC.

\*We note that ‘pressure cooking pots’ can be used with any of the hobs in section 4.2, to cook the foods faster than a normal pot with a lid. However the electric pressure cooker has several safety features not found in the cooktop/manual pressure cooker combination, and has control of the energy going into the pot during the pressure phase, enabling the cook to set it up, press the button or set the timer, and walk away. This contrasts with a pressure cooker on a hob which MUST have the heat input turned down once it reaches pressure.

22. <https://images.app.goo.gl/nWzas7fvuwhRyJsDZ>

23. <https://images.app.goo.gl/ezu95GLS2w7n8ttq7>

## 6.3.2 ELECTRIC MULTICOOKERS

 **Key strengths:** Versatile, programmable, user-friendly

 **Main uses:** Stews, rice, steamed dishes, slow-cooked meals

Multicookers often resemble EPCs but do not cook under pressure. They use a resistive heating element and tight-fitting inner pot. These devices offer multiple modes—such as slow cook, sauté, bake, or even yogurt making. Some higher-end models come with interchangeable pots or grill trays for more varied cooking.

### Pros:



- ▶ Multi-functional: one device replaces several kitchen tools
- ▶ Safer and simpler than pressure cookers
- ▶ Good energy transfer from pot fit

### Limitations:



- ▶ Slower cooking than EPCs under pressure
- ▶ Not all models reach high enough temperatures for searing

Electric multicookers, akin to EPCs, are highly versatile appliances and employ resistive heating elements onto a tight fitting pot. Unlike EPCs, they do not seal to create pressure. The appliance combines several kitchen appliances into a single unit, typically featuring functions such as slow cooking, rice cooking, sautéing, steaming, and more. Some models of electric multicookers even have a yogurt-making function.



**Figure 8:** Examples of Electric multicookers (a) Power Pac<sup>24</sup> multicooker (b) Power Pac<sup>25</sup> Multicooker.

A new generation of multicookers, which has yet to reach Africa, come bundled with several good fitting pots. Although they still use resistive heating elements, the tight fit makes the heat transfer more effective than the stand alone hotplates shown in 4.2.1. They also come with shallow grill pans and can reach high temperatures. Most manufacturers have chosen a rectangular form, and acceptance of this has yet to be tested with African consumers, and has tight control of temperature but it does not use insulation.

24. <https://powerpac.com.sg/products/3-3l-steamboat-multi-cooker-ppmc282>

25. <https://powerpac.com.sg/products/1-2l-multi-cooker-steamboat-noodle-cooker-with-stainless-steel-pot-ppj3013>




**Figure 9:** Examples of new generation electric multicookers(a) Cuisinart 5-in-1<sup>26</sup> multicooker not yet available in Africa, but Cuisinart can be found in Kenya and Nigeria.

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26. <https://www.amazon.co.uk/Cuisinart-Cooker-Non-Stick-Midnight-GRMC3U/dp/B09HCJN3KL>

### 6.3.3 RICE COOKERS

 **Key strengths:** Simple, efficient, affordable

 **Main uses:** Rice, porridge, steamed vegetables

Designed specifically to cook rice, many rice cookers can also prepare porridge, boiled grains, and some steamed dishes. Most use low power and include basic automation that switches to “keep warm” after cooking.

#### Pros:



- ▶ Easy to use
- ▶ Low power demand (good for solar or weak grids)
- ▶ Often comes with steaming basket for vegetables

#### Limitations:



- ▶ Sometimes cannot do any frying (even light sauté of onions)
- ▶ Not suitable for high-temperature cooking
- ▶ Limited versatility unless premium model

Combining the benefits of insulation and automated control, rice cookers offer high efficiency. Although specifically designed for rice, they can be used to prepare a range of dishes that can be cooked with lower power, i.e. not enough for frying. Pots can be integrated or pulled out, making them easier to clean. Premium designs offer sophisticated control and higher power means they can cook more foods.



Figure 10: Examples of rice cookers (a) Pyramid Rice cooker with steamer<sup>27</sup> (b) Multifunctional digital rice cooker<sup>28</sup>

27. [Pyramid Multifunctional Rice Cooker With Aluminium Steamer- 3 Lt | Jumia Nigeria](#)

28. [Generic 5L Multifunctional Digital Rice Cooker | Jumia Nigeria](#)

### 6.3.4 SLOW COOKER

 **Key strengths:** Low power, hands-off operation

 **Main uses:** Stews, soups, legumes, broths

Slow cookers use low, consistent heat over many hours—ideal for busy households who are prepared to set it up and then get on with other things. They are insulated and typically come with programmable timers. While energy use is spread out, overall efficiency is lower than EPCs due to long cooking times.

#### Pros:



- ▶ Safe to leave unattended for hours
- ▶ Great for tough cuts of meat and hearty dishes
- ▶ Often used in households where cooking is done while away

#### Limitations:



- ▶ Too slow for many users
- ▶ Limited to liquid-heavy meals
- ▶ Not suitable for frying or crisping

While slow cookers often look like rice cookers, they are designed to heat the pot, and retain its heat for long periods of time. They are often very low powered, the premise being that the cook sets the timer, leaves for work, and comes home to a cooked meal. While they employ a heating element transferring heat into a bespoke well fitting pot, and have insulation to retain the heat, the duration of the cooking is generally several hours, and the insulation is weak enough that overall the efficiency of the device is lower than a hotplate.



Figure 11: Examples of electric slow cookers (a) Slow Cooker<sup>29</sup> (b) Cookworks<sup>30</sup> slow cooker.

29. <https://www.jumia.com.ng/generic-slow-cooker-removable-easy-clean-ceramic-bowl-6.5-litre-160143276.html>

30. <https://www.jumia.com.ng/6.5l-slow-cooker-cookworks-mpg2577702.html>

### 6.3.5 TABLE TOP OR MINI OVENS

 **Key strengths:** Small baking/grilling solution

 **Main uses:** Baking, roasting, reheating, browning food

These are compact ovens, sometimes with integrated hotplates on top as described above under cooktops. Many table top ovens do not have hotplates, hence their inclusion in this 'self contained' listing. They use resistive heating in the oven and can grill or bake food. Versions with fans (convection ovens) are significantly more efficient.

#### Pros:



- ▶ Can bake, roast, and crisp food
- ▶ Versatile for certain cooking tasks
- ▶ Some include hotplate hobs on top for boiling or frying

#### Limitations:



- ▶ Less efficient than pressure-based appliances
- ▶ Longer cooking times
- ▶ Limited space in the oven

Already mentioned above as sometimes having hotplate surface hobs built in, there are many examples of ovens on the market that don't have hotplates. They look very similar to microwaves, but work differently. They often use a heating element in the top of the oven to grill or bake. Some contain elements in the sides and base. They are not suitable for boiling, steaming etc. and hence have a restricted use across the average menu. They heat food from the outside, often causing it to brown. The presence of a fan to create convective heating is very important to energy efficiency. Fan ovens use half the energy used by a similar oven without a fan. This is the principle used in air fryers (see below), and some mini ovens with fans are now being rebranded as air fryers.



Figure 12: Examples of electric table or mini ovens (a) Century<sup>31</sup> (b) Pyramid<sup>32</sup>.

31. <https://www.jumia.com.ng/century-37l-large-electric-oven-cov-8320-c-62218774.html>

32. <https://www.jumia.com.ng/pyramid-22litreslarge-electric-ovenbakingtoastinggrilling-43635077.html>

### 6.3.6 AIR FRYERS

 **Key strengths:** Energy-efficient alternative to frying

 **Main uses:** Chips, chicken, pastries, baked goods

Air fryers circulate hot air to cook food with little or no oil, mimicking the texture of fried food. Internally, they are like mini convection ovens with strong fans. Models vary in size and shape, with some offering dual chambers for cooking two foods at once.

#### Pros:



- ▶ Energy-efficient for browning and crisping
- ▶ Healthy alternative to deep frying
- ▶ Fast cooking times

#### Limitations:



- ▶ Limited internal space (good for small meals)
- ▶ Can dry out food if misused

Air fryers are a relatively new generation of kitchen appliance. They are effectively mini ovens with fans, but are being presented in various shapes with various ways of hosting the food. They cook food by circulating hot air around the food at high speed. They use a forced convection mechanism to produce a crispy layer on the outside of the food, similar to the results achieved by deep frying but with significantly less oil. Air fryers are versatile appliances that can be used to cook a wide range of foods, including fries, chicken wings, nuggets, vegetables, and even baked goods. Some models come with additional features, such as grilling and roasting capabilities. Air fryers have gained popularity as a convenient and healthier cooking appliance, offering a balance between the desire for crispy, flavorful food and the goal of reducing oil consumption. Their versatility and ease of use make them a valuable addition to many kitchens. The COSORI in the figure below is an example of a mini oven 'rebranded', while the Philips is more representative of the new generation of air fryers.



Figure 13: Examples of Airfryers (a)COSORI<sup>33</sup> airfryer (b)Philips<sup>34</sup> airfryer.

33. [COSORI-Convection-Dehydrator](#)

34. [Philips-HD9630-98-Turbostar-Airfryer](#)

### 6.3.7 MICROWAVE OVENS

 **Key strengths:** Speed, efficiency for reheating

 **Main uses:** Reheating, soft vegetables, some grains

Microwaves use electromagnetic waves to heat food from the inside. They are fast and efficient for reheating leftovers or steaming, but not ideal for frying, browning, or baking.

#### Pros:



- ▶ Excellent for reheating and quick meals
- ▶ Compact and widely understood
- ▶ Some cooking (e.g. vegetables, reheated stews) is very efficient

#### Limitations:



- ▶ Limited cooking styles
- ▶ Texture and taste may differ from stovetop methods
- ▶ Not ideal as a sole cooking solution in many contexts

The heart of a microwave oven is the magnetron, a device that generates short radio waves (electromagnetic waves). These microwaves are directed at the food placed inside the oven. Food absorbs the microwave radiation, which causes the molecules of fat and water to vibrate, and it is this vibration that generates the heat that cooks the food. Because radiation can pass through layers of food before being absorbed, it can appear to cook “from the inside”.



**Figure 14** Example microwave cooker (a) Hisense Microwave<sup>35</sup> (b) LG Microwave cooker<sup>36</sup>

The microwave is best suited to reheating food. Left overs, stews and cold street food, can be refreshed with a very quick and minimal input of energy. A skilled cook can do a lot with a microwave, creating dishes from raw ingredients – however there is a mythology that it does not taste the same as food heated from the outside (i.e. in a pot or oven), and this experience of taste, whether real or not, is what holds back the wider use of microwaves.

35. [Hisense 20 Litres Manual Microwave Oven \(H20MOMS14\) – Silver | Jumia Nigeria](#)

36. [LG 20L Digital Microwave Oven. LED Display & Lighting. Auto Defrost & Cook | Jumia Nigeria](#)

### 6.3.8 ELECTRIC FRYING PANS

 **Key strengths:** Familiar cooking style

 **Main uses:** Frying, sautéing, shallow cooking, pan-based dishes

Electric frying pans use a built-in heating element under a flat or gently curved metal base to cook food through direct contact with the hot surface. Their enclosed shape and thermostatic controls make them suitable for a wide range of everyday dishes, particularly those that require frying or browning.

#### Pros:



- ▶ Familiar cooking method for many cuisines
- ▶ Excellent for frying, sautéing, and shallow cooking
- ▶ Good temperature control and even heating on flat surfaces

#### Limitations:



- ▶ Not usable with deep pot foods such as stews
- ▶ Fixed shape and size can limit the types of quantities cooked
- ▶ Some models have uneven heating at the edges



**Figure 15:** Example electric frying pan (a) Ambiano Electric Dual Nonstick Frying<sup>37</sup> (b) VonShef Large Multi Cooker 6L<sup>38</sup>

The heating element beneath the metal pan base converts electrical energy into heat, which is then transferred to the food by conduction. A thermostat regulates the temperature, allowing controlled frying or simmering. Because heat is applied from below, electric frying pans are particularly good for browning and shallow frying. Note, depending on the depth, some are advertised as suitable for stews, and almost all are also suggested as mini pizza ovens.

37. <https://www.jumia.com.ng/ambiano-electric-dual-nonstick-frying-and-cooking-pan-combo-chef-308224288.html>

38. <https://www.amazon.co.uk/VonShef-Large-Multi-Cooker-Temperature/dp/B007FPSQTA?th=1>

### 6.3.9 SUMMARY: SELF-CONTAINED APPLIANCES AT A GLANCE

APPLIANCE TYPE	STRENGTHS	KEY LIMITATIONS	SUITABILITY
EPC	Highly efficient, programmable	Deep pot, limited frying	Excellent for one-pot meals
Multicooker	Versatile, multi-function	No pressure cooking	Good for varied menus
Rice Cooker	Simple, low power	Narrow range of meals	Great for rice/steaming
Slow Cooker	Low-energy, hands-off	Very slow cooking	Good for unattended meals
Tabletop Oven	Can bake/brown food	Low efficiency	Useful for urban settings
Air Fryer	Crispy results, low oil	Small capacity	Great for fast frying
Microwave	Very fast, low energy	Limited cooking range	Ideal for reheating
Frying pan	Good for frying	Limited volume for non flat foods	Very understandable

## 6.4 TASK SPECIFIC APPLIANCES

Examples: Kettles, soup makers, toasters, sandwich presses, deep fryers

These appliances are designed for specific tasks. While they are efficient in their role, they are not substitutes for full cooking appliances. For example, electric kettles are commonly used to pre-boil water, which can improve overall energy efficiency when used with other appliances.

### Pros:



- ▶ Efficient for their task
- ▶ Often inexpensive
- ▶ Good support tools for multi-step cooking

### Limitations:



- ▶ Limited to one function
- ▶ Not suitable as primary appliance

We will not write in detail about task specific appliances as there are many and new ones are emerging all the time. However, it is worth noting that kettles have become common in Africa. Kettles are very energy efficient devices because they heat the water from an element at the base, almost as though it were touching the water. Pre-boiling water in such an efficient appliance before using it in any on the hob appliances. Soup makers are being offered combining the heating efficiency of a kettle with a blender. Coffee makers are also increasingly seen among wealthier households. Pizza ovens, grills and toasters are for sale online and in retail shops, and consumers will need to be aware of the limitations of any of these devices. Deep fryers are becoming popular, with the element sitting in the oil transferring heat to the oil very efficiently and a basket being lowered into the oil. They are particularly useful for small businesses serving hot deep fried food.



**Figure 16:** Examples of task specific appliance (a) Boscon<sup>39</sup> kettle (b) Tower<sup>40</sup> soup maker, (c) George Foreman grill<sup>41</sup> (d) generic deep fryer

Task-Specific    Efficient for one job    Not multi-functional    Good as a support device

39. <https://www.jumia.com.ng/boscon-electric-kettle-bos-ek20s-317149640.html>

40. <https://www.jumia.com.ng/tower-go-healthy-electric-soup-maker-117291659.html>

41. <https://www.jumia.com.ng/george-foreman-evolve-5-portion-fat-reducing-health-grill-203512904.html>

7

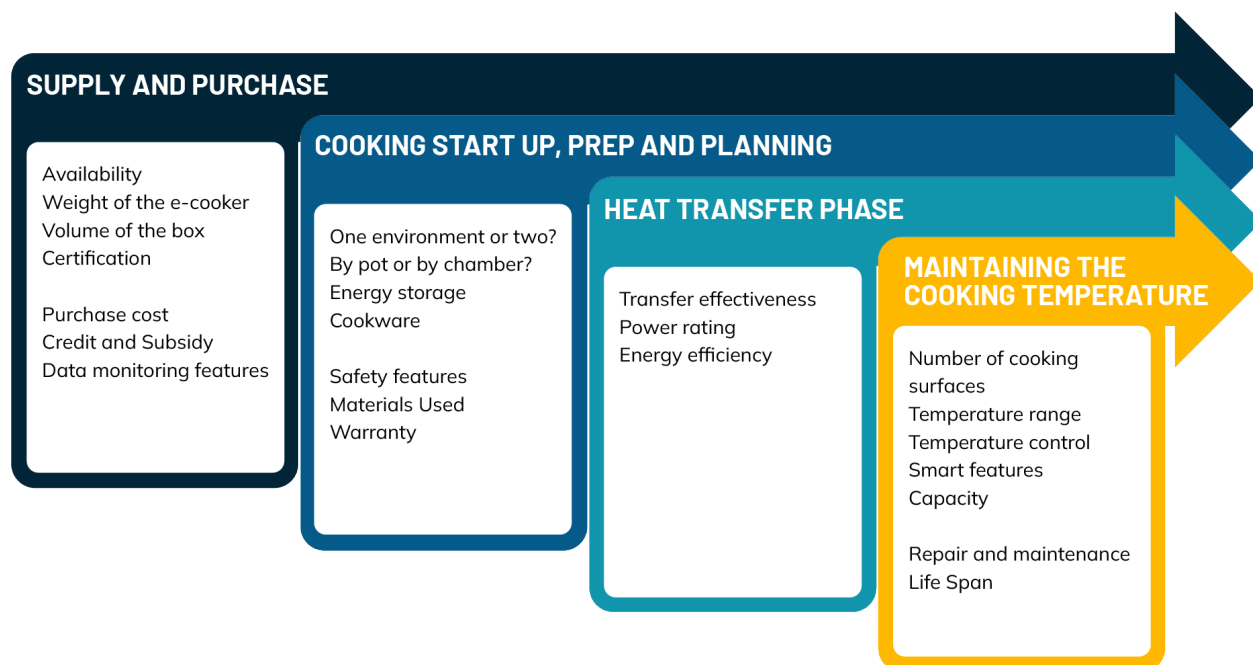
# ECOOKING APPLIANCE CHARACTERISTICS THAT INFLUENCE CHOICE.



When we looked at the appliances in the database, the research identified characteristics of appliances that seem important to both users and clean cooking project implementers. They cover diverse aspects of eCooking appliances, including their functionalities, safety features, power ratings, materials, and purchase cost.

The following diagram summarises the characteristics, clustered by the stages of acquisition and use.

Figure 17: characteristics, clustered by the stages of acquisition and use.



## 7.1 SUPPLY AND PURCHASE

This section lists some of the characteristics programme planners should consider when stimulating a supply chain for eCooking appliances. In a few cases, the characteristic may also be influential on the consumers' choice.

- 1. Availability:** Poor availability of appliances impedes the adoption of eCooking appliances. Therefore, understanding where consumers can easily purchase appliances is essential when implementing clean cooking projects.
- 2. Weight of the eCooker:** While stand alone ovens and appliances with built in energy storage are heavy, most eCooking appliances can be moved easily and can fit in limited kitchen space. A lightweight cooker is a versatile option for users who may need to relocate it occasionally. In cramped kitchens, smaller appliances can be stowed away when not in use. Moreover, weight can affect the price, especially if delivered to the consumer. Additionally, the weight of eCookers can be perceived as a sign of both quality and durability.
- 3. Volume of the box:** However, while weight may be important to the consumer and local delivery, the volume of the box is what determines how many appliances will fit into a container for shipping and importing. Two appliances of approximately the same size can be packaged/boxed in very different ways causing an extra few centimeters to the dimensions of the box. This could be the difference between 800 appliances in a container and 700 appliances – the fixed shipping cost for a container then has to be spread over fewer devices.

4. **Certification:** Choosing a cooker with proper certification from recognized organizations or agencies ensures that the appliance meets essential safety and quality standards and gives consumers confidence in the quality of the appliance.
5. **Purchase cost of appliance:** The purchase cost of appliances is an important characteristic in purchasing decisions and is recognized as a significant barrier to adoption. This depends not only on the type of appliance, but also on various characteristics including brand or manufacturer, size and capacity, number of features, energy efficiency, additional accessories, and market-based characteristics such as distribution costs. Innovative financing solutions, such as installment plans, subsidies, or micro-finance options can help make appliances more affordable to a broader demographic.
6. **Credit and Subsidy:** Is the appliance offered on a Pay-As-You Go basis by the retailer, or does the consumer have to arrange their own loan from a bank or a SACCO? Is the price of the appliance subsidized by government, results based financing or some other subsidy scheme.
7. **Connected Features and Data monitoring features:** Wi-Fi or Bluetooth connectivity enables users to remotely monitor, control, and automate cooking processes via smartphones or smart home devices. Perhaps more importantly, appliance use data can be sent to servers over GSM networks. Users can then browse energy consumption data through online platforms. This feature is becoming increasingly important as it enables programs seeking carbon revenue to use metered verification methodologies.

## 7.2 COOKING – START UP, PREP AND PLANNING

This section loosely considers the appliance from the consumers point of view and their kitchen context. How effective will the appliance be given the specific context, the supply of electricity, the kitchen environment and the intentions of the cook (cultural styles).

8. **'Heat to food' environment.** There are perhaps two main 'cookware' – a pot or pan, and an oven or air fryer chamber, drawer or basket. Hobs transfer heat to the pot or in the case of induction, generate the heat in the base of the pot. The food sits in the pot and is heated mainly from the base upward, although some rice cookers make a point of heating the sides to get even cooking. Ovens and air fryers heat the chamber that the food is sitting in, cooking the food either by infrared, conduction or convection of heat onto the outer layer of the food. A cake for example needs an oven to get the heat coming in from base, sides and top.
9. **Energy storage (electrical/ thermal):** integrating energy storage with cooking appliances is one means of mitigating the effects of blackouts on weak or unstable grids. In off-grid applications, eCooking appliances with energy storage means they can be used when the energy source is not available. Electrical energy can be stored as chemical energy such as batteries or thermal energy, as in thermal stores and phase change materials. The power rating and the control and automation of the appliance will affect the efficacy of the any battery storage. Some devices are designed to store heat in the food so it continues to cook even if no further energy is added.
10. **Power supply compatibility, AC or DC:** All grid connected consumers will need AC appliances. In off-grid areas, most mini-grids distribute AC electricity. There is an opportunity to design stand alone solar systems to meet cooking loads, and DC systems would require DC appliances. Using AC appliances on a DC system requires an inverter to convert DC power from batteries and PV systems into AC power, adding complexity and cost.

- 11. Cookware:** Most of the self contained appliances come with bespoke cookware. The pots are designed to fit exactly to the appliance. As such they can vary in material, being stainless steel, aluminium and/or having a non-stick surface. They can be lightweight and susceptible to denting, or robust, and capable of being handled roughly. Most of the EPC, Rice cookers and Multicookers come with steaming baskets. Some of the cooktop hobs may come with cookware. Induction hobs only work with induction ready cookware and therefore are often bundled with a set of pots and pans. This affects the price. Induction ready cookware can have varying quality and this affects the energy efficiency.
- 12. Safety features:** Perceived safety concerns include risk of electric shock, risk of explosion in the case of EPCs, fire hazards, risk of burns and so on. Safety features are typically outlined in manufacturers' specifications and documentation, including product manuals and warning labels. Common safety features found in eCooking appliances particularly EPCs include automatic shut-off functions, overheat protection mechanisms, and child lock mechanisms. Hotplates can create surfaces that children could touch, while Induction produces heat on the stove only by reflective heat from the pot. The absence of naked flames stands in contrast to most other fuels.
- 13. Materials Used:** The materials used can affect the cooker's performance, appearance, durability, and efficiency. Common materials include stainless steel, glass, ceramic, aluminum, insulation material, and plastics. Materials used for pots should not pose any risks to health, e.g. non-stick coating that flakes off. Furthermore, selecting materials that resist rusting or corrosion enhances its longevity.
- 14. Warranty.** Warranties serve as a safety net, covering repair or replacement costs in case the cooker develops any defects or malfunctions within a specified timeframe. Warranties can serve as a verification of quality, instilling confidence in both retailers and consumers. Consumers typically prefer supermarkets or authorised dealers as they offer warranties or sometimes extended warranties from the brands, they sell. Most devices come with a two year warranty, although some come with five years. When purchasing, the consumer or distributor should assess how realistic it is to get the device back to the supplier for repair, and/or whether a repair scheme is in place that the supplier will pay for. Warranties rely on the consumer using the device within its design parameters.

## 7.3 HEAT TRANSFER PHASE

In this section, we imagine the processes of cooking beginning. What will be the concerns of the user? By necessity we repeat some of what was said above.

- 15. Heating Technology (transfer effectiveness) :** This refers to the mechanism by which electrical energy creates the heat that is transferred to the food<sup>42</sup>. The choice of technology can significantly impact performance, efficiency, and safety. For cooktop appliances, this includes how the heat generated by the element reaches the pot. As stated above, this includes resistive heating, infrared and induction, transferring most of the heat by conduction, radiation and magnetic fields created in the cookware respectively. Most self contained appliances, e.g. EPC, rice cookers and multicookers use resistive heating elements conducting the energy from the hot element to a well fitting pot. (there are induction based EPCs on the market but they hold little advantage because

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42. As stated in the introduction, it is heat leading to temperature that cooks food, not energy per se. If food is heated and then held at an appropriate temperature for a long time, food will 'cook'. Temperature is a measure of how much energy is in the system already, and so if pot of stew is heated to 99°C and then is taken off the stove and placed in a heat retaining bag (like a wonderbag), the food in the pot continues to cook, until the losses bring the temperature (the energy in the system) down to about 60 degrees. 'Cooking' creates change in the structure of molecules, creating chemical reactions to alter flavors and textures. Therefore the heating technology (and the power rating) are important for the **heating up phase** (from room temperature to cooking temperature). Once at cooking temperature, heat transfer depends very much on the losses of heat – i.e. what input is required to keep the food at the cooking temperature.

conductive heat transfer with a good fitting pot is almost as good as induction on a pot). Ovens and air fryers tend to use resistive heating elements and infrared elements to create the heating in the chamber. A fan is important for utilizing convection to ensure an even spread of the heat to all surfaces of the food.

**16. Power rating:** The power rating reflects the rate at which electrical energy is used when on maximum heating. Power rating is a useful means of assessing the speed at which the food is initially heated and compatibility with household electrics (low quality wiring may not be able to support high power appliances). However, while the power rating can be important for the initial heating up phase, it has little influence on the appliances ability to simmer food, or utilize pressure cooking. EPCs, Ovens, air fryers all regulate the temperature by switching the power on and off – so the power required is mainly governed by the loss of heat from the device – which is why EPCs with their insulation are so energy efficient. They can maintain the pressure cooking phase with minimal input of new electrical energy.

**17. Energy efficiency:** the idea of energy efficiency within eCooking appliances is complex. Most people refer to the heating phase, and take the energy required to bring a mass of food from room temperature to 90 degrees. However, 90 degrees is at the start of the cooking process. Simmering water with vegetables – the energy required is dependent on the size of the pot, the radiant losses of the pots sides, the lid and losses from the top, and how much energy is being put in (an imbalanced system). For instance if the power is till on maximum when the water is supposed to be simmering, the surplus power will just be translated into steam and evaporative losses. This is why energy efficiency is often talked about only as between room temperature and 90 degrees. However, a rice cooker, or an EPC both insulate the pot, and then monitor the temperature, switching the power on for short bursts only to maintain that temperature. The energy consumption then for 5 kg of cooked rice in a rice cooker is far less than 5kg of cooked rice in a pot on an induction hob with lid. Both will likely give the same efficiency for the heating phase, but the efficiency for ‘cooking the food’ is very different. **This is a challenge for personnel who operate in the clean cooking sector.** They are used to talking about the energy efficiency of say a charcoal stove (conversion of biomass into heat that raises the temperature of a pot of food). It is a measure of the proportion of energy used by the appliances that is transferred to the heating phase; it is usually expressed in the Energy Efficiency Index or as a percentage %. Care needs to be taken when comparing the efficiency of different types of appliances as some technologies require less energy to be transferred to the food (e.g. EPCs, microwaves).

## 7.4 MAINTAINING THE COOKING TEMPERATURE

Picking up on that last point about taking time to ‘cook food’, this section is about how the appliances maintain the temperature during the cooking phase.

**18. Number of cooking surfaces:** Many people choose meals with several dishes. It may be a sauce for the staples or perhaps two different vegetables, but cooks like to have the option of multiple cooking surfaces. The EPC assumes a one pot meal, or if necessary, sequential use of the washing it between dishes. The rice cooker offers rice and vegetables by assuming the vegetables are steamed over the rice in the same pot. If a hob has only one heating element then it too will likely rely on sequential cooking, which runs the risk of food getting cold. There are strong preferences in surveys for at least 2 heating surfaces.

- 19. Temperature range:** The temperature range determines how versatile the cooker is. The broader the range, the more cooking operations the cooker can perform such as low temperature for simmering and high temperature for searing and frying. Different cooking processes require specific temperature ranges.
- 20. Temperature control:** Appliances that can perform multiple operations including baking, broiling, roasting, simmering and so on, enable users to prepare a wide array of dishes efficiently, catering to diverse culinary preferences and requirements. The ability to control cooking temperatures enhances the versatility of eCooking appliances and reduces energy wastage. Consumers prioritize appliances that can effectively handle a variety of cooking processes and tasks they are familiar with.
- 21. Smart features:** Smart features offer enhanced convenience and control in the kitchen. This includes the customer interface (e.g. digital displays), and automated control features e.g. pre-programmed recipes and cooking guides to ensure consistent and well-cooked meals.
- 22. Capacity:** cooking capacity directly impacts energy usage and efficiency in the kitchen (Baker et al., 1980). Using an electric cooker with a larger capacity than necessary (as in with stand alone ovens) for the amount of food being prepared can result in energy wastage as the appliance consumes energy to heat a larger chamber than required and the surrounding appliance. The same is true for a large pot cooking for one person. By selecting an electric cooker with an appropriate cooking capacity, users can optimize energy usage and minimize wastage.
- 23. Repair and maintenance:** While one could put this under the heating phase, in terms of maintaining a cooking environment, the ability to repair appliances depends on the local availability of replacement parts and technical capacity to perform repairs. Repair facilities impact the appliance's reliability, cost-effectiveness, safety, and overall user satisfaction. Maintenance of eCooking appliances is generally restricted to cleaning and keeping them in a suitable environment. Simple devices like hotplates are more likely to be locally repairable; sophisticated devices with microprocessors less so.
- 24. Lifespan:** Similarly one can interpret the 'maintaining the cooking environment' as a comment on life span. Appliances often fall into prevailing linear production models ("take, make, waste") and the pervasive "throw-away" culture of mass consumerism. However, longer lifespan translates into cost savings on repairs and reduced levels of electronic waste, enhancing cost-effectiveness.

The study found that some of this information was more readily available than others. For example, almost all appliances gave the size / capacity of the chamber or pot for the food and the power rating, and almost none gave any indication of expected life span. The life of a product is central to the cost-effectiveness of the product, so it is clearly an important factor in purchasing decisions, but the study highlights how this information is not available.

## KEY QUESTION: CAN THE APPLIANCE HEAT FOOD EFFICIENTLY?



To cook food, the appliance must be able to generate and transfer heat effectively. These features affect how fast and efficiently that happens.

**Heating method:** How does the appliance convert electricity into heat?

Resistive heating: Common in hotplates and rice cookers; simple but less efficient.

Induction: Heats pots directly using magnetic fields; efficient but needs special cookware.

Microwave: Heats food from the inside; good for reheating, less so for all cooking styles.

**Power rating:** The power rating (in watts) tells you how fast an appliance can heat food. Higher wattage = faster cooking, but may not suit homes with weak wiring or low power connections.

**Energy efficiency:** Some appliances (like electric pressure cookers) are much more efficient because they:

- ▶ Cook food quickly under pressure
- ▶ Have insulation to reduce heat loss
- ▶ Use automation to control temperature precisely

Tip: Efficiency is not just about heating up—it's also about maintaining temperature without wasting energy.

## KEY QUESTION: CAN THE APPLIANCE MAINTAIN COOKING TEMPERATURE EFFECTIVELY?



Once food is hot, the goal is to keep it cooking with as little energy as possible. These features help manage that.

**Temperature control:** The ability to lower, maintain, or adjust temperature matters for simmering, boiling, or frying. Manual knobs, digital settings, or automated systems all affect ease and precision.

**Cooking capacity:** Appliances come in different sizes. Bigger isn't always better—large units may waste energy if only used to cook small portions. Choose based on typical household or program needs.

**Number of cooking surfaces :** Some meals require cooking multiple dishes at once. Multi-burner hotplates or having a combination of appliances can help meet these needs.

**Smart Features:** Some appliances offer automation, pre-set menus, timers, or remote control via apps. These can improve ease of use—but may not be necessary for all users.

**Lifespan and maintenance:** Durability affects long-term affordability. Unfortunately, few products list expected life span. Look for:

- ▶ Robust build quality
- ▶ Availability of spare parts
- ▶ Local repair options
- ▶ Manufacturer warranty (2–5 years is common)

## KEY QUESTION: IS THE APPLIANCE PRACTICAL TO SUPPLY, INSTALL, AND USE IN LMIC CONTEXTS?



These features affect how well the appliance fits local infrastructure, markets, and user needs.

**Power supply compatibility (AC vs. DC):** Most grid-connected homes use AC appliances. Off-grid or solar homes may need DC-compatible appliances, or an inverter (which adds cost and complexity).

**Energy storage:** Some appliances (or systems) include built-in batteries or thermal storage to keep cooking during blackouts or when solar energy is unavailable. Still rare but growing.

**Appliance weight and portability:** Weight matters for transport, storage, and especially for women who often move cookers in and out of kitchens. Ideally:

- ▶ < 7 kg for portable units (e.g. EPCs, single hotplates)
- ▶ Fixed cookers (e.g. ovens, microwaves) should be installed safely and permanently

**Purchase cost:** Appliances range from <\$20 (basic hotplates) to >\$1,000 (high-end smart ovens). Consider:

- ▶ What users in your target community can afford
- ▶ Energy savings over time
- ▶ Suitability for financing options (e.g. Pay-As-You-Go)

**Certification and safety:** Look for basic safety certifications (e.g. CE, UL, ISO 9001). Useful safety features include:

- ▶ Auto shut-off
- ▶ Child locks
- ▶ Overheat protection
- ▶ Pressure relief valves (for EPCs)

**Availability and supply chain:** An appliance may look good on paper—but is it available locally? Consider:

- ▶ Where it's stocked (retail, online, distributor)
- ▶ Import/shipping costs and packaging volume
- ▶ Whether your project needs local assembly, repair, or bulk shipment

**Connectivity and Data Monitoring:** Some newer appliances track energy use or allow remote monitoring. This is useful for:

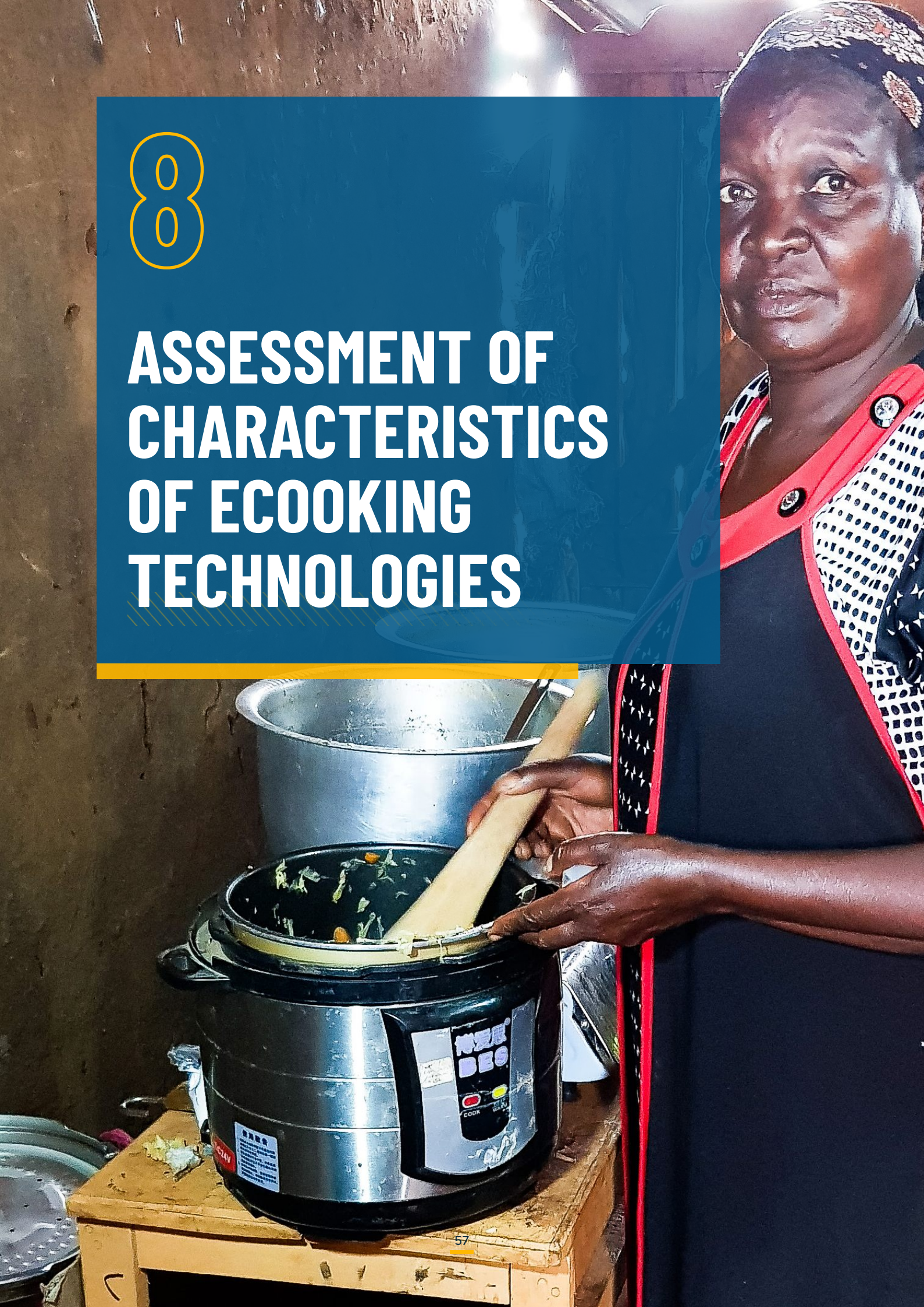
- ▶ Results-based finance
- ▶ PAYGO systems
- ▶ Carbon credit programs

## 7.5 SUMMARY TABLE: WHAT TO LOOK FOR IN AN ECOOKING APPLIANCE

CATEGORY	KEY CHARACTERISTIC	WHY IT MATTERS
Heating	Heating method	Affects efficiency and power needs
	Power rating	Influences speed and grid compatibility
	Energy efficiency	Reduces ongoing energy costs
Cooking Performance	Temperature control	Enables versatile cooking
	Cooking capacity	Right-sizing avoids waste
	Cooking surfaces	Supports multi-dish meals
	Smart features	Adds convenience (optional)
	Life span & maintenance	Affects total cost and reliability
Practicality	AC/DC compatibility	Determines where it can be used
	Energy storage	Enables off-grid use or blackout resilience
	Weight/portability	Important for women and small kitchens
	Cost and affordability	Must suit user incomes and financing models
	Certification and safety	Ensures safe, long-term use
	Availability	Affects procurement and support
	Connectivity	Useful for PAYGO or carbon credit models

8

# ASSESSMENT OF CHARACTERISTICS OF ECOOKING TECHNOLOGIES



In this section we revisit each of the characteristics, and dig deeper in the database to add observations that might guide the choice of appliance.

## 8.1 SUPPLY AND PURCHASE – INSIGHTS FROM THE DATA SCAN

### 8.1.1 AVAILABILITY

The study was restricted to appliances available online, so it is important to emphasise that nothing can be said about the availability in retail stores or other channels. In 2024, Alibaba and Amazon emerged as the principal online platforms for the retail of eCooking appliances, ahead of Flipkart, AliExpress, Jumia (Africa) and Jiji (Africa), which were identified as regional online retailers. The appliances sold on these platforms were often also available on the websites of manufacturers.

Although the two main online platforms ship their products to over 100 countries including SSA<sup>43</sup> access to these products in such markets would be impeded by various characteristics such as import restrictions and prohibitive shipping costs. Availability of cookers in the online markets is volatile, and is likely to change substantially. The online platforms also do not reflect what the consumer will eventually need to pay for the products as shipping costs are usually variable and subject to change.

The findings draw attention to the fact that a vibrant online marketplace specifically for eCooking appliances can achieve a wider reach than has been previously feasible with other clean cooking solutions, such as locally made improved cookstoves that are only available in local markets.

### 8.1.2 WEIGHT OF THE ECOOKING APPLIANCES

Less than half of the appliances in the database provided information on their weight. Rough weight ranges are:

- ▶ Portable **hotplates, infrared and induction** single ring cookers were all around 2kg in weight, although infrared cookers appear to be slightly heavier.
- ▶ The more common **EPCs** (4-6 litre) weighed around 5kg, but larger models, such as 8 litre capacity weighed around 8 kg.
- ▶ Most **rice cookers** were in the 2-3 kg range.
- ▶ **Multicookers** are around 4 kg in weight, and the weight does not vary much with size.
- ▶ The weight of small **microwave** ovens (e.g. 17 litre) is typically 10kg, rising to over 20 kg for larger capacity models (e.g. 32 litre)
- ▶ Small **air fryers** weigh 2-3 kg, but larger, dual zone models can be over 8 kg.

Women are mostly responsible for cooking in SSA. The maximum acceptable weight for the average woman to carry with straight arms and above the waist is said to be approximately 7kg (Snook and Ciriello 1974). For portable cookers, it would not be safe to have designs that exceed this weight.

Based on this threshold weight, it appears that portable hotplates, infrared and induction cookers can be regarded as safely portable, as can rice cookers and multicookers. While most EPCs and air fryers are portable, larger capacity appliances may be too heavy for moving conveniently and safely. Microwaves should be regarded as fixed appliances.

A decision on whether to opt for a fixed or portable cooker will depend on various characteristics such as kitchen location and size. In rural settings in particular, where kitchens are often situated outdoors, there is a general preference for biomass stoves to be portable for outdoor cooking. However, it is rare to see eCooking conducted outside the house. Portable appliances enable individuals to move it around indoors as some households do have a dedicated kitchen and even if they do portability allows for safe storage after use.

43. Amazon- <https://www.amazon.com/gp/help/customer/display.html?nodeId=GCBBSZMUXA6U2P8R>, Alibaba- <https://reads.alibaba.com/shipping/#:-:text=With%20Alibaba.com%2C%20carrying%20out.from%20anywhere%20in%20the%20world>.

Conversely, heavier electric cookers and multi-ring worktop hobs, designed for fixed placement, are more popular in urban communities where kitchens are typically attached to or located within households. Additionally, the ownership dynamics of cooking spaces play a pivotal role in the choice of fixed or portable eCooking appliances. Portable appliances may be better suited to shared kitchens, utilized by different individuals or families.

### 8.1.3 VOLUME OF THE BOX

The physical size—or volume of the box—that an eCooking appliance comes in is an often-overlooked but important factor, particularly when purchasing in bulk for programs. Larger or irregularly shaped packaging increases shipping and storage costs, affects warehouse space requirements, and can pose challenges for last-mile distribution, especially in rural or remote areas. Smaller, stackable boxes are easier to transport, may reduce import tariffs based on volumetric weight, and lower the logistical burden on implementing organizations. In programmes where hundreds or thousands of units are distributed, even small differences in packaging volume can significantly impact total delivery costs and feasibility. For this reason, compact packaging should be considered a design and procurement priority alongside cost, efficiency, and performance.

### 8.1.4 CERTIFICATION

The specific certifications awarded to appliances varied by the type and intended use of the appliance.

The certifications offered on the database included;

- ▶ ISO 9001 (Quality Management System): While not specific to electric cookers, ISO 9001 certification ensures that the manufacturer has an effective quality management system in place, contributing to overall product quality.
- ▶ FCC Compliance (Federal Communications Commission): If the electric cooker includes any wireless communication or electronic components, FCC compliance ensures that it meets electromagnetic interference standards.
- ▶ UL Certification (Underwriters Laboratories): A widely recognized certification in North America that ensures safety and performance compliance with applicable standards.
- ▶ CE Marking (Conformité Européenne): Required for electric cookers sold within the European Economic Area, indicating conformity with safety, health, and environmental protection standards.
- ▶ RoHS Compliance (Restriction of Hazardous Substances): Ensures that the electric cooker is free from certain hazardous materials, such as lead, mercury, cadmium, and other substances, in accordance with European Union regulations.

These certifications offer consumers reassurance, indicating that the appliances are certified and approved by relevant authorities, meeting necessary requirements. As each of these certifications represent compliance with standards relating to different issues (e.g. quality, electromagnetic interference, etc.) appliances can have multiple certifications.

Among the appliances in the database, only a handful provided information about their certified standards. Specifically, the Conformité Européenne (CE) mark, the Certification Body (CB) Scheme, Administrative Procedure Act (APA) compliant designation, China Telecommunication Equipment Licensing (Ctel) certification, and the International Organization for Standardization (ISO) 9001-2008 Quality Management Systems certification were each represented by one eCooking appliance, while the Bureau of Indian Standards (BIS) certification was associated with four appliances.

It is important to clarify that the absence of certification information does not necessarily imply lack of certification. Rather, it may indicate that such information was not provided on the online platforms used for assessment.

## 8.1.5 COST (PURCHASE PRICE)

The pricing of the cookers varied significantly, depending on brand, type, and capacity. Prices at the point of sale include VAT which is charged in accordance with local legislation in the consumer's country. However, the cost of delivery is not included in the online purchase price.

To try to make comparison of cost across appliances, keeping in mind each type are likely to vary due to many characteristics including brand, energy efficiency, capacity and other characteristics considered in this report we analysed at the average price per watt (USD/W). Based on the limited database and keeping in mind these were online prices as at 2024 and without import and VAT duties specific to LMIC countries, price variations were observed across different types of eCooking appliances. For Electric Pressure Cookers (EPCs), the average price per watt stood at USD 0.086. Induction cookers had a slightly higher average of USD 0.135 per watt, while multicookers and air fryers showed lower averages of USD 0.078 and USD 0.077 per watt, respectively. Hotplates exhibited the lowest average price per watt at USD 0.03 but will cost a lot more over time as the efficiency is less than the others.

However given the limitations of the exercise we do not recommend relying on these figures. Note that the core message of this report is that different appliances can undertake different cooking through different processes, and that part of the programme plan must be to see ensure all characteristics of the appliance are suitable for the context. As such the single characteristic of price is only useful as part of the system whole. Programme planners will need to make their own up to date context specific assessment when issuing the tender and evaluating the responses.

Also linking appliance cost to 'affordability' should' be done with caution, since affordability is subjective, contingent upon multiple factors such as household income, savings, seasons, and potential fuel cost savings. Programmes should promote appliances likely to be affordable for the average income level of the target community, and which have a monthly electricity cost of between 6% (highly affordable) to 30% (barely affordable) of household income. The monthly cost will likely be a substitution of current expenditure on alternative fuels, and in multiple studies of urban and peri urban settings, eCooking has a monthly cost less than the alternative, particularly the energy efficient eCooking appliances. The higher efficiencies offer a lower monthly cost, although they may cost more initially. The range of eCooking appliances spans from less than USD 10 to over USD 1000, indicating the flexibility to implement eCooking solutions in diverse communities with varying economic circumstances. Low cost appliances tend to be less efficient.

It is essential to recognize that the information derived above on the cost of the eCooking appliances on the database is susceptible to change over time.

## 8.1.6 CREDIT

Access to credit plays a critical role in enabling households—especially in low- and middle-income contexts—to afford eCooking appliances. While some devices offer long-term savings on energy, high upfront costs can remain a barrier. Credit solutions such as Pay-As-You-Go (PAYGO) models, microloans, or appliance financing through energy service providers allow users to pay over time in small, manageable installments. Successful credit schemes typically:

- ▶ Are aligned with users' income cycles (daily, weekly, or seasonal)
- ▶ Include built-in payment flexibility for emergencies
- ▶ Offer integrated support (e.g. bundled appliances with energy access plans)

For programs aiming to scale electric cooking, partnering with microfinance institutions, cooperatives, or PAYGO providers can dramatically improve appliance uptake. Some suppliers are aware of this and have made deals with banks and MFIs, and some sell on a PAYGO basis. Consider this aspect as part of the supply assessment.

## 8.1.7 SUBSIDY

In some contexts, especially among the poorest households or in early market-building phases, credit alone is not enough. Subsidies can be necessary to bridge the affordability gap and ensure inclusive access. These may be:

- ▶ Upfront subsidies to reduce purchase price
- ▶ Results-based financing (RBF) tied to verified appliance distribution or usage
- ▶ Cross-subsidies built into broader energy access programs

Well-designed subsidies should be targeted, temporary, and aligned with national electrification and clean cooking goals. Poorly designed subsidies, by contrast, risk distorting the market or displacing commercial solutions. Programmes should also ensure that subsidies do not incentivize low-quality products or undercut local retailers. Has the supplier already signed up to a subsidy programme and had the appliance approved by the authorities?

## 8.1.8 CARBON FINANCE

One of the increasingly popular 'results based subsidies' is around the carbon savings these appliances can bring. When compared to biomass based cooking, and even with LPG, there are saving in carbon based climate emissions. There are two main markets the voluntary sector where industries voluntarily purchase the carbon savings to offset their own climate emission generation, and compliance markets. Compliance markets are based on the Paris Agreement, and are growing rapidly. It would not be appropriate nor possible to summarise the conditions required for a carbon based project but programme planners should explore whether carbon finance can form the basis of a subsidy. There are currently examples where the upfront cost of an appliance has been reduced for the user from \$120 to \$15, with the balance paid to the supplier through carbon finance.

## 8.1.9 CONNECTED FEATURES

A couple of appliances in the database had data storage functionality. This is particularly useful where appliances are provided through Results-Based Finance or Carbon Finance programmes. For example, BURN, ATEC and UpEnergy appliances on the database were capable of monitoring and storing data on energy usage and times, which can be uploaded in different ways, e.g. via bluetooth, or over the mobile phone network. This data can then be used for verification of appliance use in project reporting. Measured energy use is especially valued in carbon finance projects, and the Gold Standard now includes a metered methodology that makes use of this unique capacity of eCooking appliances.

Closely related to energy monitoring is PAYGO technology, which also relies on the appliance communicating to a central server over the mobile network. This technology enables users to pay in instalments over the period of a payment plan. When payments are received, a token is sent to the unit, which enables it to continue functioning; so if no payment is received, the unit will not function.

Manufacturers are beginning to take advantage of internet of things (IoT) technology to enable users to communicate with domestic appliances remotely. One appliance found was equipped with wifi connectivity so that it could be controlled remotely by a mobile phone app. However, it remains to be seen whether this technology becomes widely adopted.

# 8.2 COOKING START UP, PREP AND PLANNING – A DEEPER DIVE INTO THE DATA

## 8.2.1 COOKING ENVIRONMENT.

**Pot or pans** – suitable for liquids or fried foods. Cooktops transfer heat to the pot, or in the case of

induction, generate the heat in the base of the pot. The food sits in the pot and is heated mainly from the base upward, although some rice cookers make a point of heating the sides to get even cooking.

**Ovens and air fryers** heat the chamber that the food is sitting in, cooking the food either by infrared, conduction or convection of heat onto the outer layer of the food. A cake, for example, needs an oven to get the heat coming in from base, sides and top.

Some air fryers now have a chamber or drawer that can take fluids, and any oven could take a casserole dish with liquids. Any hob could be used with a specialist pot (often called a Dutch oven) to create an oven environment, but without the fan distribution of air.

**Table 7.1:** Cookware pots and chambers

	<b>APPLIANCE CLASS</b>	<b>POTS</b>	<b>SHALLOW FRYING PAN</b>	<b>CONVECTIVE FAN CHAMBER</b>	<b>STEAMING</b>
Cooktop	Hotplate	x	x		x
	Infrared	x	x		x
	Induction	x	x		x
	Stand-alone or inbuilt oven plus hob units	x	x	x	x
	Table top or mini ovens with hobs	x	x	x	x
Self Contained	EPC	x	Can fry but not shallow	Some appliances	Some appliances
	Multi-cooker	x	Some appliances	Some appliances	Some appliances
	Rice cooker	x			Some appliances
	Slow cooker	x			
	Table top or mini ovens without hobs			x	
	Air fryer			x	
	Microwave				
	Note Microwave heats food directly	Must not use metal	Can be done but difficult	Not applicable	Can be done but difficult
	Frying Pan		x		Some appliances

## 8.2.2 ENERGY STORAGE

The database included a couple of examples of stand alone home cooking systems that incorporate energy storage. The Surya Nutan system generates electricity from PV panels, which is then converted to heat that is stored in a thermal battery. Other systems store electricity in chemical batteries. Thermal batteries are much heavier than chemical batteries. Thermal batteries can only be used directly with conventional cookware, whereas, in principle, any eCooking appliance can be used with chemical batteries through an inverter (to convert DC current from a battery to AC). It should be noted that all of these systems are at early stages of development and have yet to prove themselves in appliance markets.

## 8.2.3 POWER SUPPLY COMPATIBILITY, AC OR DC

The database included a small number of innovative products designed for off-grid consumers. These DC cooking appliances, both induction and resistive element, were offered as part of solar PV systems with battery energy storage. DC appliances have been developed for these home systems as a means of reducing costs, as this eliminates the need for inverters that would otherwise be needed to power conventional AC devices. It should be noted that lower voltage direct current with high power, requires very thick wiring, and this can be a key constraint.

## 8.2.4 COOKWARE

Some appliances require specific cookware. The most discussed is the need for induction stoves that require 'induction ready' cookware – pots and pans with enough iron in them to create a magnetic field. What is less discussed is that the quality of the induction ready cookware affects the heat transfer and the overall energy efficiency<sup>44</sup>.

Most of the self contained appliances come with a bespoke pot. An electric pressure cooker requires a good seal between the pot and the lid, and so swapping out another pot not specifically made to fit is not only difficult but dangerous if the pot only partially seals. The purchase of 'second pots' for electric pressure cookers is important for their scaled use. Other self contained appliances such as rice cookers and multicookers also come with a bespoke pot, but given the lack of pressure can accommodate similar pots from a different maker. Since the baseline transfer of heat is often a resistive element then the pots bottom surface is the most critical dimension if new pots are swapping out with the old pots that came with the appliance.

Indeed the bottom surface of cookware and its dimensions is a key feature of energy efficiency that is barely considered in eCooking discussions, and applies variously to the cooktop appliances. If a pot with a flat surface is placed on a resistive heating element of exactly the same diameter, then heat transfer is effective and losses are limited. Indeed in a lab a resistive heater can be made to give a similar energy efficiency to an induction stove (plus minus 5%) – but only if the size of the pot is matched to the size of the heater and the bottom surface is completely flat. As soon as the pot is smaller than the resistive heating element or the infrared heater, then there are energy losses where the heat generated is not going into the pot. In real life people use a variety of pots and pans of differing dimensions. Also in real life pots get damaged and can have an uneven bottom surface. Bumps and dings in pots can reduce the overall energy efficiency as it reduces the connection between the pot and the element. Infrared heaters can overcome minor deformities' as the radiating heat jumps the gap, but resistive element heaters reduce their heat transferring characteristics if there are 'air gaps'.

One of the key advantages of an induction stove is that its excitation of heat within the pot through the fluctuating magnetic field effectively 'adjusts' to the diameter of the pot – ie a small pot doesn't create a wastage of energy in the exposed surface of the appliance. Similarly, it can cope with an uneven base more easily than resistive heater, although similar to an infrared heater. At an extreme, induction stoves can heat a pot at a distance above the appliance, although that distance varies according to the quality

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44. [Scott 2025](#)

of the appliance. (Heating at a distance seems to have no practical use, but illustrates that an uneven base of an induction ready pot is not an issue that reduces energy efficiency substantially).

Task specific appliance generally connect the heating element to the foodstuff and don't rely on extra cookware. Eg Kettles have the water container built in and the heating surface touches the water, sandwich makers are shaped to host the sandwich, toasters have slots to direct the infrared directly at the bread.

## 8.2.5 SAFETY FEATURES

Nearly one half of products in the database provided information on safety features, indicating that some manufacturers recognize that the presence of safety features in eCooking appliances significantly impacts their social acceptability and usage.

Safety features are aimed at addressing various potential hazards, which can be categorized as **thermal** accidents such as scalding and overheating, **slipping** incidents, **electricity** related, and **pressure**-related issues:

### Thermal

- ▶ cool-touch handles, commonly found on rice cookers and multicookers;
- ▶ over-heating protection e.g. thermostat cutoff; double protection system incorporating thermal fuse and micro-switch, thermistor protection.
- ▶ concealed heating plate (e.g. all appliances except for hotplates, infrared and induction cookers)
- ▶ child lock.
- ▶ a power "ON" light positioned on the cooker's front to remind users when the appliance is powered on and avoid accidental burns from hot surfaces (e.g. hotplates and infrared cookers).
- ▶ Warning lights to alert users to hot surfaces e.g. cooktops on hotplates and infrared cookers retain heat after being turned off.

### Slipping

- ▶ non-skid feet or anti-slip footpads ensuring stability during use.

### Electricity

- ▶ detachable power cord designed to release easily if snagged;
- ▶ an overflow guard directing spills for convenient cleanup and protecting circuitry from damage;
- ▶ protection against voltage fluctuations.

### Pressure

- ▶ pressure relief valve
- ▶ interlocking mechanism for locking the lid under high pressure,
- ▶ safety lock for the lid.

One additional safety issue is the risk to health posed by PFOA, a chemical previously used in non-stick coatings, but no longer (at least in north markets).

Note that not all of these features are relevant to all appliances. For instance, only EPCs need to have protection against pressure levels exceeding safe limits, only EPCs need to be equipped with automatic pressure limiters and relief valves. Induction cookers have internal rectifiers and capacitors that make them relatively tolerant of minor mains fluctuations. However, large or prolonged undervoltage may cause them to shut down, and surge protection is recommended — as for any electronic appliance.. Residual heat poses a risk of burns for both infrared cookers and hotplates, as their cooktops retain heat even after being turned off, so it is useful for these appliances to come with warning lights to alert users when surfaces are not safe to touch.

## 8.2.6 MATERIALS – WHAT TO LOOK FOR WHEN PURCHASING

Why it matters. Materials drive safety, durability, efficiency, hygiene, and end-of-life options. Rather than cataloguing every alloy and polymer, this section highlights what a purchaser can check quickly on spec sheets, labels, and the product itself.

### Body & chassis

Stainless steel vs painted/coated steel. Stainless (e.g., 304) resists corrosion and dents better but costs more; painted/powder-coated steel is cheaper and sturdy, but chips can expose metal to rust.

- ▶ *Look for: even, hard coating; no sharp edges; rubber feet.*
- ▶ *Avoid: thin panels that flex, blistered paint, visible rust at seams.*

Aluminium housings. Light and corrosion-resistant; can scratch more easily.

Look for: anodized or hard-coated finishes.

### Cooking surface (induction & infrared tops)

Glass-ceramic (vitroceramic). Excellent thermal shock resistance, flat, easy to wipe, allows IR/induction coupling.

Tempered glass. Cheaper and shiny, but less tolerant of prolonged high heat; more prone to shatter if damaged.

“Monocrystalline” black glass. Usually a marketing term for dense glass-ceramic with deep black finish.

- ▶ *Look for: stated max load/weight, scratch-resistant rating, beveled/rounded edges, clear spill-containment lip.*
- ▶ *Avoid: wavy/uneven tops, loose trim rings, unclear surface type on the spec sheet.*

### Insulation & “cool-touch” design

Double skins and air gaps. EPCs and rice cookers should have an air cavity between outer shell and inner vessel. Air gaps, foams, and reflective liners reduce heat loss and improve safety.

- ▶ *Look for: “cool-touch” claims, outer skin that stays comfortable to touch during a demo, minimal heat bleed around lid and vent.*

### Food-contact vessels (pots, bowls, liners)

Stainless steel (often 304; occasionally 316). Durable, dishwasher-safe, tolerates scouring; slightly slower to heat.

Aluminium (bare or hard-anodized). Lightweight, quick to heat; needs good surface treatment to resist wear.

Non-stick coatings (PTFE or ceramic-sol-gel). Easy release, but can scratch or wear.

- ▶ *Look for: stated grade (e.g., “304 stainless”), even wall thickness, encapsulated/heavy base to resist warping, spare inner pots available, food-contact compliance (e.g., LFGB/FDA).*
- ▶ *Avoid: vague “stainless-like” claims, easily scratched non-stick, coatings that bubble or smell strongly when first heated.*

### Handles, knobs & plastics

Heat-resistant polymers (e.g., phenolic/Bakelite, PA, PBT) and silicone grips stay cooler and improve grip.

- ▶ *Look for: riveted/screwed fixtures (not flimsy clips), finger guards, lid handles with heat breaks.*
- ▶ *Avoid: handles that wobble or get uncomfortably hot in use.*

### Seals, gaskets & valves (especially EPCs)

Silicone gaskets tolerate heat and cleaning better than generic rubber. Pressure valves should be

stainless or high-temp polymer.

- ▶ *Look for: easily removable gasket for cleaning, replacement parts listed, clear instruction on valve maintenance.*
- ▶ *Avoid: porous or sticky seals, hard-to-source spares.*

### **Electrical & thermal safety cues**

Power cord and plug. Firm strain relief, appropriate regional plug, earth/ground on metal-bodied units. Thermal protection. Stated over-temperature cut-off/thermal fuse.

- ▶ *Look for: credible marks (e.g., CE/UKCA/UL/ETL as applicable), ingress protection where steam is present, tidy internal routing visible through vents (no loose fiberglass or frayed insulation).*

### **Cookware compatibility (all hobs; critical for induction)**

Induction. Requires ferromagnetic bases—simple magnet test applies. Flat, thick bases distribute heat and reduce noise.

- ▶ *Look for: minimum pan diameter the sensor will detect, flatness specs, stainless or clad bases for stability.*

### **Hygiene & cleanability**

Smooth seams and radiused corners reduce grime traps.

- ▶ *Look for: detachable lids/liners, wipe-clean joints, dishwasher-safe pots and accessories.*
- ▶ *Avoid: deep crevices around controls and under trim rings.*

### **Repairability & spares**

Fasteners over glue. Screwed assemblies are easier to service.

- ▶ *Look for: availability of spare pots, gaskets, valves, knobs; exploded diagram in manual; stated parts support period.*

### **Environmental & end-of-life**

Recyclable metals (stainless, aluminium) retain value; mixed, glued plastic-metal composites are harder to process.

- ▶ *Look for: take-back or WEEE-style compliance where relevant, modular designs (separable pot, cord, electronics), minimal black or mixed plastics if recycling is a program priority.*

## **8.2.6.1 QUICK BUYER CHECKLIST**

- ▶ **Body:** stainless or well-coated steel with solid feel; no flex or sharp edges.
- ▶ **Top (if glass):** clearly labeled glass-ceramic; beveled edges; load rating stated.
- ▶ **Inner pot:** “304 stainless” or hard-anodized aluminium; even thickness; spare liner available.
- ▶ **Coatings:** reputable brand, abrasion-resistant, PFAS-free options if preferred; metal-utensil use clarified.
- ▶ **Insulation:** cool-touch exterior on EPCs/rice cookers; minimal heat bleed.
- ▶ **Plastics:** heat-resistant handles/knobs; silicone gaskets; BPA-free food-contact parts.
- ▶ **Safety:** regional certification marks; grounded plug; thermal cut-off.
- ▶ **Compatibility:** magnet sticks to cookware for induction; base is flat and stable.
- ▶ **Cleanability:** removable parts, smooth seams, dishwasher-safe items.
- ▶ **Spares & service:** gaskets/liners/valves listed; screws not glue.
- ▶ **End-of-life:** recyclable metals, separable modules, take-back info.

Note: While induction requires compatible cookware, pot material and base construction influence performance across all eCooking appliances (heat distribution, sticking, speed). Where possible, test the appliance with the intended pots before committing.

## 8.2.7 WARRANTY

Product warranties are important in giving consumers the confidence to purchase new and untested products. In LMIC markets it is particularly important as consumers who face challenges of upfront financing for the appliances can resort to microloans to enable purchase of the appliances. Often the repayments are funded from reduced expenditure on traditional dirty fuels; hence the appliance needs to function reliably to guarantee the availability of funds for serving the loan.

Less than half of the products in the database came with a warranty. The most common warranty period was one year, although a few products offered a five year warranty. The warranty period offered for hotplates was slightly longer than that offered for EPCs, which was also slightly longer than that offered for induction cookers. In reality though sending a product back to the manufacturer to access the warranty can be a challenge, and some stated warranties are worthless.

Certain companies do offer warranties for their primary product as well as extend coverage to other integral components. For instance, stand-alone solar eCooking packages, inclusive of solar panels and batteries, are furnished with distinct warranties for the cooker, solar panels (25 years), and batteries (5-10 years). If the project is accessing carbon finance, it is in the suppliers interest to ensure the product keeps working, and so in recent deals, 6 or more years are included in the warranty to ensure 6 years of carbon finance.

eCooking appliances from Organisation for Economic Co-operation and Development (OECD) countries are mandated by law to give the consumer a minimum **2-year guarantee** if they were sold to a consumer online or via other means of distance communication (by telephone, mail order)<sup>45</sup>. However, eCooking appliances from Chinese manufacturing companies do not generally have these attractive warranty packages.

## 8.3 HEAT TRANSFER PHASE

This section repeats points made in the introduction and section6, but attempts to go a little bit deeper on the engineering aspects for clarity, based on insights from the database.

### 8.3.1 HEATING TECHNOLOGY

**Resistive Heating Technologies** are made of resistive heating elements that produce heat when electricity flows through them. These elements include nichrome and iron-chromium-aluminum alloys. These elements are embedded in protective sheathing (spiral coil hotplates) or cast heating plates (e.g. EPCs, rice cookers). They can be used with a wide range of cookware materials but the thermal inertia of the sheathing and heating plates means that they are slow to respond to changes in power when compared to gas and induction. They are known for their easy adaptation in various cooking appliances and environment, manufacturing, and durability. Electrical energy is converted to heat at 100% efficiency in a piece of wire, but the cooking efficiency depends on the design of the appliance; for example, cheap, spiral coil hotplates can have efficiencies as low as 50%. Even though some self-contained appliances use resistive heating technologies, a good fit between pot and heating plate as found in electric pressure cookers, can lead to 80% or more heat transfer.

**Radiant heating.** Infrared stoves pass radiation through a glass top that feels hot. When a pot is placed on the heating surface, heat passes by radiation and conduction into the pot. If the pot is smaller than the heating surface, then energy is wasted, so efficiency can be low, but it depends on how it is used (as with hotplates). Thermal inertia is quite high, so they are not highly responsive. Microwaves radiate energy at a different frequency. The electrical conversion efficiency of the magnetron is typically around 65%, but then the cooking efficiency depends on the food being cooked, and how effectively it absorbs

45. [https://europa.eu/youreurope/business/dealing-with-customers/consumer-contracts-guarantees/consumer-guarantees/index\\_en.htm](https://europa.eu/youreurope/business/dealing-with-customers/consumer-contracts-guarantees/consumer-guarantees/index_en.htm)

the radiation. Energy transfer can be easily controlled but as the food remains inside a closed oven it is difficult to see how the food is cooking.

**Induction Technologies** use oscillating magnetic fields to heat cooking pots directly. The pots must be induction compatible and made from ferrous materials such as iron and stainless steel that generate heat when coupled with the magnetic field generated by the induction cooktop. They should also have a flat bottom to enhance coupling with the magnetic field, i.e. big dents in pots will affect performance although not as much as resistive contact heating. Induction cookstoves are highly efficient, mainly because they minimize wastage by heating only the base of the pot. They are responsive, offering close temperature control.

**Convection heating appliances** transfer heat through movement of hot air. They use resistive heating elements to heat up the air and a fan that circulates hot air around the food inside the cooking chamber. Air fryers are efficient and responsive, mainly because they heat up a smaller volume that has a lower thermal mass than conventional ovens. Circulating air means they cook food evenly.

**Table 7.2:** Distribution of heating appliances amongst the studied types of eCooking appliances

	APPLIANCE CLASS	RESISTIVE HEATING	RADIANT HEATING	INDUCTION	CONVECTION
Cooktop	Hotplate	x			x
	Infrared		x		x
	Induction			x	x
	Stand-alone or inbuilt oven plus hob units	x	x	Some appliances	x
	Table top or mini ovens with hobs	x	x	Some appliances	x
Self Contained	EPC	x		Some appliances	
	Multicooker	x	Some appliances	Some appliances	
	Rice cooker	x			
	Slow cooker	x			
	Table top or mini ovens without hobs	x			x
	Air fryer	x			x
	Microwave	Not applicable	Not applicable	Not applicable	Not applicable
	Note Microwave heats food directly	x			
	Frying Pan			x	Some appliances

The descriptions above illustrate how the heating technology affects many characteristics, especially efficiency, cookware compatibility, and control.

As stated before, for hotplates and infrared cookers, the size of the cookware should match the dimensions of the heating element or cooking zone on the appliance for optimal heat transfer and efficiency. Induction cookers achieve higher efficiencies because no heat is wasted from hot surfaces not covered by the pot. Induction is the only technology that may lead to additional costs for consumers who do not already possess ferromagnetic cookware, as they would need to invest in induction ready cookware. Not all stainless steel cookware performs well, so some manufacturers bundle appropriate cookware with their induction stoves.

### 8.3.2 POWER RATING

Different eCooking appliances exhibit a wide range of rated electrical power, from multicookers, which are designed to draw low power over a long period of time, up to induction cookers, which can quickly reach high temperatures (see Table 3.2).

- ▶ Single ring, portable **hotplates** are a popular choice across Africa, typically rated at 1000W, but more modern models can be rated up to 1500W. A small unit rated at 500W was advertised for making hot drinks (Database 2024, and the reviews said it was not powerful enough). Double ring portable units are also a popular choice; units with a small ring and a large ring are typically rated at around 1700W. Multi-ring cooktop hobs have much higher ratings (e.g. 5000W), and all electric ovens with 4 hotplate rings are higher still, at around 9 kW, which therefore requires bespoke wiring. Fixed cooktop and ovens in developed economies are often on their own circuit and have an isolated fuse.
- ▶ Although single ring **induction** cookers range from 1500W to 3000W, most are typically rated at 2000W. Double ring portable units are typically rated at 2800W. Multi ring worktop hobs tend to come with high power rings with a combined power rating of around 10 kW.
- ▶ Single ring portable **infrared** cookers are typically rated at 2000W, although smaller units are available at 1000W. Double ring portable units can be found at 2500W.
- ▶ **EPCs** are most commonly available in 4 – 6 litre sizes, although as they become more popular, both smaller (e.g. 2.5 litre) and larger (e.g. 10 – 12 litre) models are appearing on the market. Even larger models for commercial use are also becoming available, but are outside of the scope of this report.
- ▶ Simple **rice cookers** range in size and power from 300W (e.g. 0.6 litre) up to 700W for larger models (e.g. 2 litre). However, sophisticated models incorporating digital control and some multicooker functions are also labelled as rice cookers and have higher power ratings (e.g. 1000W).
- ▶ **Multicookers** generally range from 600W to 1200W. However, the multicookers category is becoming more diverse as products evolve. High end rice cookers incorporate some multicooker functions, and crockpots (or slow cookers) can do some functions but at even lower power ratings, typically around 400W (and even lower for small capacity appliances).
- ▶ **Microwave** ovens generally range from 700W to 1000W. However, high end combination ovens also have a grill, which can be a resistive heating coil or a quartz heater, which means that power ratings can be confusing – it is important to distinguish the rating of the microwave oven and the rating of the grilling element.
- ▶ **Air fryers** are another category that is evolving as they become more popular. Single drawer units are most common, although double drawer units are now available with power ratings of around 2400W.

**Table 7.3:** Power range distribution of some eCooking appliances

		<b>MINIMUM (W)</b>	<b>TYPICAL (W)</b>	<b>MAXIMUM (W) (BUT SOLD AS DOMESTIC APPLIANCE)</b>
Cooktop	Hotplate (single ring)	500W (small ring for making tea/ coffee)	1000W	1500W
	Infrared	1000W	2000W	2200W
	Induction Cooker (single ring)	1500W	2000W	3000W
	Stand-alone or inbuilt oven plus hob units	Single ring 500W	Combinations, 2000W	Up to 6kW if all on at once
	Table top or mini ovens with hobs	Single ring 500W	Main ring only or oven 1000W	Oven and all rings 2500W
Self Contained	EPC	500W 24V DC model. 700W small EPC (e.g. 2.5 litre)	1000W	1600W large EPC (e.g. 10 litre)
	Multicooker	200W crock pots; 600W	800W	1500W
	Rice cooker	300W	500W	1000W
	Slow cooker	100W	400W	1000W
	Table top or mini ovens without hobs	800W	1000W	2000W
	Air fryer	900W	1700W	2000W
	Microwave	700W	900W	1000W
	Frying pan	900W	1700W	2000W

The power rating of an eCooking appliance needs to match the type and quality of grid infrastructure of the consumer’s home. For weak grids, high-power ratings may strain the electrical system, leading to potential hazards. Micro-grids and mini-grids may not be able to support high powered appliances, which can lead to breakdowns or complete shutdowns of the system. Furthermore, assessing the state of the wiring infrastructure in the consumer’s home is important. High power ratings combined with inadequate or faulty wiring can pose severe risks, including electrical malfunctions, fire incidents, or electrocution.

Although not an issue of power, it is worth noting that grids in LMIC regions typically operate at a frequency of 50Hz, meaning that care needs to be taken if intending to use appliances designed for 60Hz, which are compatible with the American grid (some appliances are sensitive to frequency, while others are not).

### 8.3.3 INTERPRETING “ENERGY EFFICIENCY” FOR COOKING APPLIANCES

Energy-efficient eCooking appliances consume less electricity, leading to reduced energy bills. This will attract people to adopt and continue using eCooking appliances as they realise the cost of cooking is affordable. The initial investment in an energy-efficient appliance can often be offset by long-term savings on energy costs.

Lower energy consumption also means a reduced carbon footprint. Energy-efficient eCooking appliances contribute to sustainability efforts by reducing greenhouse gas emissions and promoting environmentally friendly practices. On average, there has been an annual energy reduction of 2.2% in the energy consumption of new eCooking appliances due to Energy Efficiency Appliance and Equipment Standards and Labelling Programmes. Given that the grid requirements in LMIC align with those in the EU, the EU Ecodesign standard (EU) No 66/2014 serves as the benchmark for energy efficiency standards in LMIC regions.

However, energy use in cooking isn't just “energy in vs. energy out.” What ultimately matters to households and institutions is **energy per acceptable meal**—i.e., how much electricity (or gas, or indeed biomass) is required to produce food that is safely cooked, evenly heated, and with the desired texture and moisture. Two appliances can consume the same kWh yet deliver very different results: one may burn, dry out, or scorch; another may hold temperature precisely and finish faster with less waste. This section introduces the practical view and explains why mandatory labels are straightforward for some products (e.g., ovens) but remain tricky for many others.

Why simple kWh metrics aren't enough. In the sections above, we have attempted to explain that the use of energy is not just its creation through electrical input and its transfer, but its use to cook food. As such an appliance energy efficiency (its **energy per acceptable meal**) depends on:

**Control and stability:** Efficiency hinges on how well an appliance reaches **and holds** the target temperature (simmering an induction ring, maintaining pressure in an EPC, or keeping a steady 180 °C in an oven). Overshoot/undershoot of temperature can add time and kWh without improving the meal.

**Heat delivery to food, not just the vessel:** Pan–hob coupling, airflow patterns (air fryers), pressure/steam dynamics (EPCs, rice cookers), and cavity evenness (ovens/mini-ovens) determine how much of the input energy actually cooks the food rather than the room.

**Task and load size:** Preheat and standby losses are amortised over batch size. A small, well-insulated cavity (air fryer/mini-oven) can beat a large oven for small loads; the reverse can be true for bigger roasts.

**Cookware and accessories:** Base flatness, ferromagnetism for induction, pot thickness/coatings, baskets and racks—all change real efficiency and food quality.

**User safety and outcome quality:** “Efficient” but uneven heating may force re-runs, stirring, or extra cycles—raising both kWh and frustration.

**Energy Labelling:** Unlike appliances such as light bulbs, televisions or fridges which convert electricity into a given standardised performance, this complexity of cooking an acceptable meal makes mandatory ‘five star’ energy labelling labels hard for many cookers.

- ▶ **Scope diversity:** “Cooking appliance” spans single-ring hotplates, induction hobs, EPCs, rice cookers, slow cookers, air fryers, and hybrid multicookers—all with different physics. One common test cycle can be unfair or meaningless across types.
- ▶ **Multi-mode devices:** A multicooker may sauté, slow-cook, bake and air-fry. Which single metric

should go on a label, and how easily could it be “optimised for the test” rather than for real cooking?

- ▶ **Recipe dependence:** Energy—and quality—depend on food type, load size, and target outcome (e.g., soft vs. crispy). A single “representative meal” risks misrepresenting many users.
- ▶ **System dependence:** Induction efficiency depends on the user’s pan; air-fryer results depend on basket design and food geometry; ovens vary with tray placement and convection.
- ▶ **Rapid innovation:** Frequent updates to controls, firmware, coatings, and insulation outpace regulatory cycles. A rigid label can lag the market or incentivise narrow “teaching to the test.”
- ▶ **Administrative burden vs. benefit:** For small appliances with modest absolute energy use per cycle, the cost of certifying many modes may outweigh the consumer value of a single letter grade.

So while there are ongoing attempts to introduce energy labelling there remain challenges. India recently introduced an energy label for induction hobs India’s BEE Star Label – Schedule 34 (Induction Hobs) sets a 1–5 star class using  $E_{hob} = Wh$  per 1,000 g water on standardized cookware, plus minimum thermal efficiency  $\geq 80\%$  and standby  $\leq 0.8 W$ . The label content includes  $E_{hob}$  efficiency (raising the temperature), standby, diameter, etc. [beestarlabel.com](http://beestarlabel.com). This is an energy efficiency label for hobs—something the EU/UK don’t currently have (they label oven cavities, not hobs).

Hobs & small appliances generally have no statutory label see table below. For context: the US also references IEC 60350-2 for hob performance in its federal test work. However, *where a label exists*, you can shortlist by the class/metric (here,  $E_{hob}$  and ), but you need to look to independent tests for control at low power, noise, usability, and real-recipe outcomes. Ovens for instance established labels (class and kWh/cycle) and are useful for shortlisting. But buyers still need independent data on temperature accuracy, stability, and evenness to predict cooking outcomes.

Consumer associations bridge the gap to assist procurement and users to choose appliances that give good energy per acceptable meal. Comparative testing and sector programs fill the gap by reporting task energy + outcome quality (e.g., pressure-holding in EPCs, low-power control on induction, airflow evenness in air fryers). Some national schemes (e.g., the Indian induction star ratings) demonstrate that **task-based** labels are possible, but they still benefit from being complemented by real-recipe evaluations.

This is not a new idea. In North America, the UL 1026 household cooking safety standard historically used hamburger patties as a standardized food load in several temperature/abnormal-operation checks (specifying meat/fat ratio, puck size, and target core temps). However, the standard was about safety and abnormal conditions, not energy efficiency. The purpose here is safety conformance, not ranking products on kWh or cooking quality. Modern performance standards for ovens/grills (e.g., IEC 60350-1) don’t use burgers; they measure heating/evenness/energy with defined loads and recipes. Interestingly, grills are a part of built in hobs and ovens, but don’t really feature in our database of stand alone appliances.

So because energy efficiency labels rarely capture cooking quality, independent testers use standardised foods and loads or protocols to compare like-for-like performance. Typical methods include:

- ▶ Fixed-load recipes (e.g., frozen chips in air fryers; sponge/roast cycles in ovens; rice batches; beans/stews in EPCs).
- ▶ Parallel reporting of kWh, time to finish, temperature accuracy/holding, evenness/crispness/texture, and capacity handling.
- ▶ Usability and safety checks (controls, noise, exterior temperatures, cleaning, spare parts). This approach aligns with how buyers actually cook and with our earlier table of “what to check” per appliance.

Many developed economies have consumer associations that offer comparisons and many of their

protocols include standardised foods<sup>46</sup>. Internationally the Global LEAP EPC (Electric Pressure Cookers) Test Method (v1 2020; v2 2025) measured time/energy to heat and pressure-cook, keep-warm consumption, sauté temperature stability, and voltage robustness (low/high), plus safety checks (valves, gaskets, exterior temperatures). This directly captures both “getting hot” and “holding steady,” which we flagged as crucial for the cooking process although it didn’t use a standardised food.

The 2024–25 Global LEAP Induction Cooktops Competition went one step further combining lab screening with multi-month usability testing in Kenya and India (standard menus, real homes) and published a 2025 buyers’ guide. It’s not a statutory label; it’s a comparative program that complements labels by reporting user experience, cooking quality, and reliability in real contexts—things a single metric like Ehob can’t cover.

This complex view of ‘cooking energy efficiency’ does not sit well with governments attempting to guide the quality of appliances coming into their markets. They often create new standards, but those standards focus on safety not performance in documenting the energy per acceptable meal. Electrical safety and food touching surfaces are captured in many standards, but a slightly confusing Minimum Energy Performance has gain traction among standards bureaus. **MEPS: Minimum Energy Performance Standards** are the mandatory efficiency “floor” a product must meet to be sold. They sit alongside (but are different from) energy labels (which rank products) and consumer tests (which compare real-world cooking quality). Where labels exist (e.g., EU/UK ovens), they use a measured metric (the Energy Efficiency Index, EEI) to grade products A–G (or legacy A+++...D). MEPS and labels often use the same test, but MEPS set a threshold, labels create a league table above that threshold. At an extreme the US federal test procedure for microwaves measures standby/off energy only (no active cooking mode), so standards target those modes—illustrating why some cooking products have narrow MEPS and still need comparative, real-food testing for usefulness.

So what can we say about energy efficiency as a guide to procurement?

1. Treat efficiency as **kWh per acceptable outcome**, not kWh per heat-up alone.
2. When labels exist, use them to screen, then rely on independent tests for control/quality.
3. For unlabelled categories, prioritise protocols that pair measured energy with standardised cooking tasks and quality scores—and, where relevant, field usability.
4. For programmes and procurement, specify both a task-energy metric and minimum outcome/quality thresholds (temperature stability, evenness, keep-warm limits), to avoid “gaming” a single number. In practice, MEPS + labels + consumer tests together give the full picture for cooking appliances.

Relatively few appliances in the database even attempted to provide specific energy efficiency information. Some gave a specific figure (e.g. 80%), others a range (e.g. 50-70%), and others use an energy labelling classification, such as Class A (e.g. Regulation (EU) 2017/1369).

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46. Eg [How we test air fryers – Which?](#)

Table 7.4: Energy labelling and consumer testing

APPLIANCE	OFFICIAL ENERGY LABEL IN DEVELOPED ECONOMIES?	WHAT THE LABEL MEANS (IF ANY)	HOW CONSUMER TESTERS DO ENHANCED COMPARISONS	QUICK BUYER CHECKS
Hotplate (single ring)	No	—	kWh to bring fixed volume to boil + hold a simmer; low-power stability; surface temps & safety; cleanability.	Minimum power steps for gentle simmer, stable pan support, easy-wipe surface, robust cord/strain relief.
Infrared (radiant/ceramic ring)	No	—	As for hotplates; responsiveness and steady low-heat performance.	True glass-ceramic top, stated load rating, beveled edges/spill lip, even heat across circle.
Induction cooker (single ring)	No	—	Time/kWh for boil & simmer; minimum pan size detection; low-power stability; noise; standby draw.	Magnet sticks to cookware, minimum pan diameter, fine power steps, max power on local voltage, cable length.
Stand-alone or inbuilt ovens (hob not labelled)	<b>Yes (oven cavities only)</b>	Efficiency class and kWh per cooking cycle (based on an Energy Efficiency Index using standard cycles, normalised to cavity volume).	Temperature <b>accuracy &amp; stability</b> vs setpoint; heat distribution/evenness; preheat time; energy per standard bakes/roasts; door heat leakage; cleaning.	Real cavity litres, fan vs conventional modes, door seal quality, window glazing, shelving guides, probe/thermometer option.
Table-top / mini ovens <b>with hobs</b>	Usually <b>No</b>	—	Preheat speed; temp accuracy/holding; toast/bake/roast results; kWh per task; plus hob boil/simmer tests.	Usable cavity (fits tray/pan size), thermostat accuracy, double-glazed door, hob ring wattage & control granularity.
Table-top / mini ovens <b>without hobs</b>	Usually <b>No</b>	—	As above (preheat, accuracy, evenness, kWh per standard recipes).	Rack positions, timer precision, interior coating durability, fan noise.
EPC (Electric Pressure Cooker)	No	—	Time/kWh for beans/stews/rice; pressure build/hold quality; keep-warm consumption/hr; safety valve behaviour; cleanability.	Thick insulated body (“cool-touch”), silicone gasket with spares, reliable pressure valve, inner-pot material (304 SS or hard-anodised Al).

Multicooker (non-pressurised or combo)	No	—	Mode-by-mode tests (bake/air-fry/slow/saute): doneness + texture vs time/kWh; temperature range & steadiness; capacity handling.	Real usable volume, temperature set-range, sensors/probe, basket/pot coating quality, dishwasher-safe parts.
Rice cooker	No	—	White/brown rice quality & consistency; overflow control; keep-warm stability; kWh per batch; reheat performance.	Thick/heavy inner pot, coating abrasion resistance, steam vent design, spare inner pots available.
Slow cooker	No	—	Long-run temperature profiles (Low/High/Warm); hot-spotting; energy over 6–8 hr cook; lid seal effectiveness.	Tight-fitting glass lid, ceramic vs metal pot (thermal inertia), true “Warm” below simmer, removable pot for cleaning.
Table-top ovens (no hobs)	Usually <b>No</b>	—	Same as mini ovens: temp accuracy/holding, evenness, preheat, kWh per standard bake/roast.	Interior size for common trays, thermostat accuracy in reviews, interior light, easy-clean enamel.
Air fryer	No	—	Standardised loads (e.g., frozen chips) to compare <b>speed + kWh + evenness + crispness</b> ; batch capacity handling; noise; cleaning.	Usable basket litres (not just stated), even airflow (dual-zone or not), temp accuracy, drawer/basket coating durability.
Microwave	No (EU/UK consumer label)	In the US there is a label but it applies only to standby mode.	Heating <b>evenness</b> (surrogate foods), speed to safe core temp, defrost quality, standby draw, usability.	Inverter heating vs on/off cycling, turntable size, interior litres, sensor reheat/defrost, door seal & ease of cleaning.
Frying Pan	No		Time/kWh to heat to frying temperature; temperature distribution/evenness across surface; heat-up time, stability at target setpoints; practical cooking tests (e.g. pancakes, eggs, stir-fries) for browning and control; standby draw	Flat, even cooking surface; stable thermostat; non-stick coating quality; weight and handle ergonomics; lid fit and steam venting; ease of cleaning (removable parts, dishwasher safe); power rating vs local voltage

As a general rule though we can also consider a comparison between categories of devices as created by MECS UK, as a starting point for choices. They scanned multiple users across multiple countries, and calculated from the measurements Table XX, which presents energy consumption compared to a hotplate cooktop. Note this is across diverse menus in real world situations – this is not lab testing of

energy efficiency. It takes into account control, automation, human behaviour – all the characteristics this report discusses – the comparative figures are the outcome of real people trying to cook real meals.

**Table 7.5:** Relative Energy efficiency of different classes of eCooking appliances

DEVICE	ENERGY USED EXPRESSED AS PROPORTION OF ENERGY USED BY HOTPLATE (%)
<b>LONG COOK</b>	
Curry/slow cooker	107%
<b>THERMAL HOBS</b>	
Hotplate	100%
Infrared	105%
<b>DIRECT HEATING DEVICES</b>	
Induction	79%
Rice cooker	75%
Frying pan	83%
<b>PRESSURIZED DEVICE</b>	
EPC	56%

### 8.3.4 SMART FEATURES

To reiterate: Smart features generally enhance two aspects of the user experience: the user interface, and automated control functionality.

The user interface includes tools for the user to issue commands to the appliance, such as touchpads, touch control, and sliding touch controls, and digital displays to provide the user with information on the cooking process (e.g. temperatures, cooking progress, pressure, energy use). Cookers with glass lids that enable users to manually observe and monitor the progress of the cooking process provide an alternative to digital displays (e.g. rice cookers, multicookers).

Automated control features are at the heart of providing a more convenient experience for cooks, but they also reduce energy wastage, leading to improved efficiency. These are only available on more sophisticated appliances with microprocessor control. Features generally perform the following range of functions:

- ▶ **Delayed start time** – enabling the user to time the cooking of a meal so that it is ready at a later time.
- ▶ **Programmable cooking time.** The user can set a cooking time after which the appliance will turn off and prevent food spoiling.
- ▶ **Automatic off** – the appliance automatically turns off when a cooking program is complete, which avoids burning the food if the cook is away from the kitchen.
- ▶ This is commonly linked to a **'keep warm'** function that programs the appliance to deliver small amounts of heat at intervals in order to keep the food at a given temperature.
- ▶ **Automatic cooking programs.** EPCs were the first appliances to offer a range of preset programmes designed to provide the ideal cooking processes for common types of food, but these are beginning to be offered by other appliances.
- ▶ It can be important that any buttons offering preset programmes a language users will understand. Pointing to a meal or dish that is culturally relevant.
- ▶ **Temperature control** can be achieved on all appliances but in different ways. For example, hotplates

use a mechanical bimetallic strip to turn the power on and off, but modern appliances with microprocessor control can measure temperature (somewhere on the appliance rather than in the food itself) and regulate the power to achieve much closer temperature control. EPCs can also control the operating pressure.

- ▶ Induction cookers can be damaged if inappropriate cookware is used, so they usually come with a ‘**pan detection**’ function that ensures the induction coil will only be excited if an appropriate pan is used.
- ▶ Some **automatic maintenance** features were mentioned, such as a preset function for cleaning the gasket and inner pot of a slow cooker.

### 8.3.5 COOKING PROCESSES

Table 7.6 presents cooking processes that can be performed by different appliances. This should be regarded as a rough guide because it may well be technically possible to carry out additional processes in a specific appliance, even if it was not specifically designed to do so. For example, it is possible to fry an egg in a rice cooker, but it doesn’t get hot enough to fry properly so will not taste very nice. Nevertheless, the table illustrates how consumers will want to choose appliances that match their cooking style. For instance, consumers interested in deep frying would not choose EPCs and multicookers, as they cannot get hot enough for deep frying. In contrast, induction cookers and hotplates offer versatility, catering to a wide range of cooking processes. While some appliances had preset functions, sometimes corresponding to different cooking processes.

**Table 7.6:** Distribution of eCooking appliances amongst eCooking appliances

COOKING PROCESSES	HOTPLATE	INFRARED	INDUCTION	EPC	RICE COOKER	MULTICOOKER	MICROWAVE	AIR FRYER*
Poaching	x	x	x	x	x			
Simmering and Stewing	x	x	x	x	x	x		
Boiling	x	x	x	x			x	
Braising	x	x	x	x		x		
Steaming	x	x	x	x	x		x	
Shallow Frying	x	x	x	x			x	x
Deep Frying	x	x	x					x
Baking				x			x	x

## 8.4 MAINTAINING THE COOKING TEMPERATURE

### 8.4.1 NUMBER OF COOKING SURFACES

Many cooks would like to cook different dishes at the same time, and then combine them into a meal at the end of the process. Appliances such as EPCs offer a meal in one pot, or a sequential cooking

experience. Many cooks do not like to do sequential cooking, particularly if the pot has to be washed between dishes. Cooktop devices with a single hob have a small advantage in that several pots can be used, and swapped during a cooking process (ie bringing beans to temperature, taking them off the hob while frying some onions and then bring them back up to temperature before the pan of beans drops below cooking temperature).

For convenience consumers prefer two or more cooking surfaces and chambers. It is normal for people to have something in the oven while attending pots and pans being used for different dishes or sauces. A two ring hob has the advantage of being able to cook in two pots consecutively.

### 8.4.2 TEMPERATURE RANGE

Few devices specified an operating temperature range, so although temperature is indeed an important aspect of cooking practice, information is not commonly provided. The cooking temperatures needed to perform common cooking processes are shown in Table 3.5. The range of cooking processes that an eCooking appliance can perform depends, therefore, on the maximum temperature that it can achieve, as well as the functional design of the appliance (e.g. an air fryer is not designed for boiling water). Table 3.3 shows that each type of appliance is available in a range of models with different power ratings. The cooking temperatures that can be achieved will be a function of both the power rating and the size of the appliance. This makes it difficult to say what process can be carried out in which type of appliances. For example, EPCs are generally regarded as not well suited to frying, but it is perfectly possible in a high power model.

**Table 7.7:** Common cooking processes and the average temperature range needed for these processes<sup>47</sup>

COOKING PROCESSES	TEMPERATURE RANGE (°C)
Poaching	70-80
Simmering and Stewing	80-95
Boiling	95-100
Braising	135-160
Steaming	100
Shallow Frying	160-204
Deep Frying	175-190
Air frying	150-205
Baking	150-205

Cooking temperatures, and the modulation of power to adjust temperatures is closely related to control.

### 8.4.3 TEMPERATURE CONTROL (AUTOMATION)

Some devices offer tight control of the temperature within the cooking environment. Devices that have a chamber often offer to set the temperature as part of their control process. An oven can be set to say 180 degrees C. The sensing of the temperature may be through a mechanical thermostat (often based on metals that expand at different rates and can switch the heat on and off). More commonly and increasingly preferred are digital thermostats that directly switch the electronics of the heating system. Digital systems can be more precise depending on where the sensors are.

47. [https://workforce.libretexts.org/Bookshelves/Food\\_Production\\_Service\\_and\\_Culinary\\_Arts/Culinary\\_Foundations\\_\(Cheremie\\_and\\_Thibodeaux\)/11%3A\\_Appendices/11.03%3A\\_Basic\\_Cooking\\_Methods](https://workforce.libretexts.org/Bookshelves/Food_Production_Service_and_Culinary_Arts/Culinary_Foundations_(Cheremie_and_Thibodeaux)/11%3A_Appendices/11.03%3A_Basic_Cooking_Methods)

Some cooktop appliances, most self contained appliances, and even some task specific appliances are now including digital thermostats to offer more precise temperature control,. Even kettles are now being sold with an option to switch the heating of the water off before boiling, in order to maximise the flavour of some drinks (The best temperature for brewing coffee is between 85-95°C, while green tea ranges from 75°C to 80°C). A sous vide task specific device is intended to hold water at 90 degrees in a pan – for sous vide cooking (long slow cooking that retains the tenderness).

Self contained appliances such as rice cookers and EPCs variously use temperature sensors to ensure optimum cooking processes. In the case of the pressure cooker, the separation of pressure and temperature (which are related) is often bundled together. The working pressure environment pushes on a mechanical switch to switch off the heat input, but safety thermostats ensure that this has worked and that the temperatures are not exceeded.

Temperature control (or automation) benefits the cook as it can often be set at the start of the cooking process and the device switches itself on and off to reach and maintain that cooking temperature. The cook can leave the device alone and does not have to watch or control the appliance. This contrasts with cooking something in a pan where the cook has to watch until it reaches temperature, and then turn down the heat input to simmer. Most cooktop appliances require the input of the cook to match the heat input with the desired cooking temperature.

#### 8.4.4 CAPACITY

Consumers need a cooking device that can cook enough food for their family, so capacity is an important consideration. However, there is no consistent way of assessing the amount of food that can be cooked using the different types of eCooking appliances. For example, EPCs, multicookers, and air fryers, characterized by an enclosed cooking chamber, commonly provide information on the volume of the cooking vessel in litres (L). On the other hand, the amount of food that can be cooked on induction, infrared and hotplate cookers depends on the size of the pot used, as well as the power rating of the heating ring. Of course, more food can be cooked on appliances with multiple rings. Microwaves are measured according to the volume of the cooking chamber (litres), but the amount of food that can be cooked depends on the size of the cooking vessel that is placed inside the chamber.

EPCs and multicookers typically ranged from 4L to 6L capacity. Multicookers are available in smaller capacities, such as 1.2L, although they may have limited functions. Larger 8L EPCs are available for larger households (6-8 people) and still larger appliances are available for commercial and community scale cooking. A very rough rule of thumb would seem to be that each person requires 1 litre of capacity.

It should be noted that EPCs should not be filled to their capacity since the food expands and may clog up the safety release valve during the pressure phase. So a device advertised as 6 litres can actually only cook 4.7 litres of food (stew) safely.

Air fryers typically have a capacity of 6-8 L, although devices with innovative features can be larger, e.g. 12 litre model with rotisserie. Still larger models are available for commercial and institutional kitchens.

#### 8.4.5 REPAIR AND MAINTENANCE

Product manuals mostly include instructions on proper care practices and precautionary measures to safeguard the product's longevity. These mainly emphasise the importance of regularly cleaning the exterior of the cookers, exercising caution by allowing the cooktop to cool before initiating the cleaning process, and avoiding the use of abrasive materials that could potentially damage the surfaces of the cooker.

Manuals are often in multiple European languages, but cheaper devices intended for a single market (say China) may be in one language.

It is important to emphasise the significance of the availability of spare parts and technical support for repair facilities in fostering an enabling environment for eCooking. For appliance failures covered by a warranty, customers typically need to be able to visit a manufacturer's local store or distributor to get their appliance repaired or replaced.

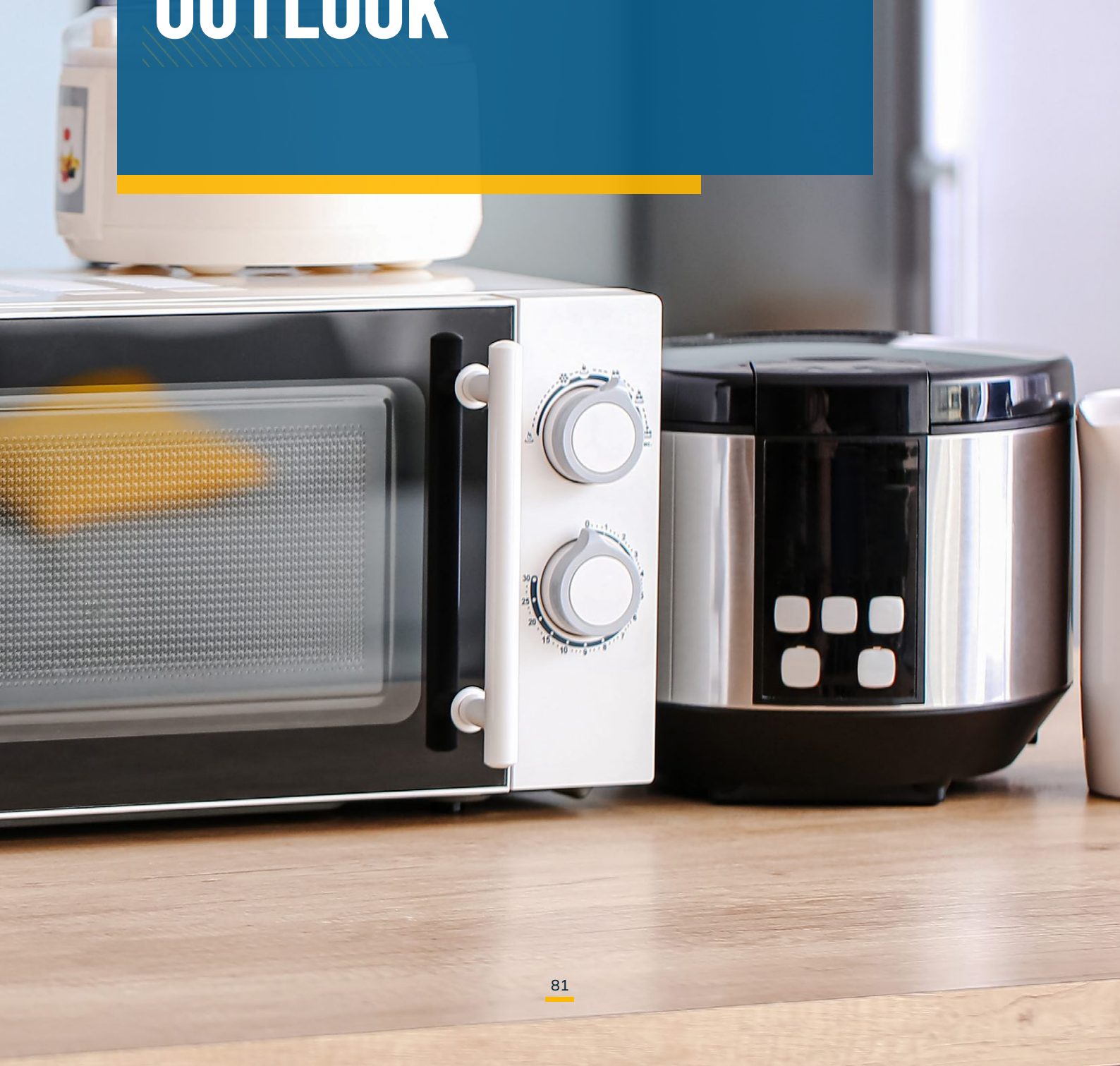
#### 8.4.6 LIFESPAN

Although an important factor in purchasing decisions, no meaningful information was available for appliances in the database. From the consumer's point of view, the longer the lifespan of an appliance generally represents better cost-effectiveness. However, this is not necessarily the case, especially in the case where a more efficient appliance comes onto the market. The advent of LED light bulbs are a good example, where money can be saved by replacing tungsten filament bulbs before the end of their life.



# 9

## SUMMARY AND OUTLOOK



## 9.1 KEY FINDINGS

The study focused on eCooking appliances to achieve a transition from biomass cookstoves, with a focus on Low and Middle Income countries as the target market. This report reviewed available eCooking appliances and their key characteristics to generate insights that could inform their uptake and user experience in the LMICs. As such, it is intended to be used by stakeholders planning an eCooking intervention to inform their procurement of eCooking appliances, although it also has insights that may be useful to a typical user choosing an appliance.

In 2024, a total of 234 eCooking appliances were reviewed, with the intention of continuing to expand to incorporate more appliances. The diverse power ratings, capacities and cooking processes observed underscore the adaptability of eCooking appliances to the varied cooking needs and household sizes across LMICs. Expansive temperature settings and the flexibility of eCooking appliances showcased the versatility of these appliances. Ongoing advancements in eCooking appliance development, including smart features and safety certifications, enhanced efficiency, convenience, and trustworthiness. These features also present opportunities for eCooking to tap into carbon finance markets as built-in monitoring and verification mechanisms.

During 2025, as the report was being finalised and it became apparent that the supply of eCooking appliances was evolving rapidly, the narrative pivoted away from creating a database of appliances, to learning and summarising the key characteristics that stakeholders in procurement should be looking for.

## 9.2 THE ECOOKING PROPOSITION

The characteristics discussed in this report are the core elements of the eCooking proposition. For analytical clarity we have treated them separately, but in real kitchens they operate as a system: performance, safety, cost and convenience interact. Procurement and programme design should therefore apply a holistic lens when selecting appliances.

Six lenses for a holistic assessment

- ▶ **Cooking outcomes and user acceptance** — speed, texture, evenness, taste, ease of use, and how well the appliance fits local cuisines and habits.
- ▶ **Energy performance in real use** — kWh per acceptable meal, temperature control/holding, standby/keep-warm, and implications for tariffs, load profiles, and reliability under voltage variation.
- ▶ **Context and infrastructure fit** — compatibility with existing cookware, kitchen space, ventilation, available power (ampere limits, sockets), and any off-grid/mini-grid constraints.
- ▶ **Safety, usability and inclusivity** — surface temperatures, protections, intuitive controls, cleaning, and accessibility for different users (e.g., elderly or low-vision).
- ▶ **Total cost of ownership and support** — purchase price, warranty, spare parts, repairability, expected lifetime, after-sales network, and financing options.
- ▶ **Sustainability and end-of-life** — durability, materials, reparability, recyclability/take-back, and verified emissions reductions where relevant.

Using these six lenses keeps the focus on **energy per acceptable meal** and long-term adoption, rather than on isolated specifications. Restating these, we find:

**User experience:** Several characteristics relate to issues that influence cooks' experience of using an eCooking appliance. In studies exploring cooks' attitudes towards eCooking appliances the most important characteristics centre on ease of use, time saved and cost. Features such as sliding touch controls, pre-

programmed temperature settings, and delay timers all make an appliance much easier to control than a traditional stove. Microprocessor control **automated** features provide another level of ease of use by liberating the cook to leave the kitchen and attend to other tasks (saving time). Cooks have a keen interest in appliances that are easy to clean, so the **materials** used are important. **Safety** in the kitchen is a priority for cooks, especially those with children. Aside from the safety features described above, certain heating appliances are inherently safer than others. For example, induction hob cooking surfaces cool down quickly when the pot is removed; the sides of EPCs are insulated so they will not cause burns.

**Cost:** Cost is a cross-cutting characteristic and covers both **cost** of ownership (capital cost), running costs, and repair costs. Although most appliances in the study were priced below USD 50, this can still constitute a barrier to many households. However, depending on the prevailing domestic tariff, eCooking can offer substantial savings in running costs compared with traditional fuels, especially when using more **energy efficient** appliances such as the EPC. There are a multitude of characteristics to be considered when deciding whether it is worth getting an appliance repaired when it fails, including how long it is expected to last.

**User behaviour:** Other characteristics relate user behaviour, influenced by their context. There are variations in cooking styles used to prepare local menus that will determine whether an appliance is appropriate for the setting. For example, the menus in many African countries rely heavily on boiling, such as beans, stews, and soups including frying. Boiling does not require particularly high cooking temperatures, so appliances such as single hob hotplates and EPCs are typically rated at 1000W, but EPCs will not reach high enough temperatures for certain cooking tasks like deep frying. Induction hobs tend to have higher **power** ratings, around 2000W, meaning that they can reach **cooking temperatures** faster and are more flexible. The family size will influence the choice of eCooking appliance. The cooking requirements of small, stable households will be suited to fixed **capacity** appliances, such as rice cookers, EPCs, and air fryers. On the other hand, large families wanting to cook larger quantities of food may find that many of the appliances currently on the market are not big enough, so heat transfer appliances such as induction offer the flexibility, they need to cook varying quantities of food. The type of dwelling can also influence the choice of eCooking appliance. Many dwellings have a dedicated kitchen, sometimes with a built-in stove. In small dwellings, where space is at a premium, it can be necessary to stow the eCooking appliance away after use, in which case the **weight** of the appliance becomes important.

**From a supply perspective:** The supplier offers another way of viewing and clustering the characteristics presented in this report. It includes the business models of manufacturing companies and how they address distribution and quality. Studies have shown that customers are concerned with the quality of eCooking appliances; they understand that cheap, poor-quality products can be more expensive in the long term; nevertheless, there remains a place in the market for low-cost products. In the absence of personal recommendations, perhaps the best characteristic of a product quality is the **warranty** period offered, if any. It is disappointing to see that just over one third of products offered any kind of warranty. However, this may be a consequence of a relatively new and untested market in LMICs, in which original manufacturers are reluctant to offer warranties, and shift the responsibility to local distributors. **Certification** of compliance with various standards should also give customers some confidence in product quality, although only a few appliances appeared to come with certification. It has been pointed out that adhering to manufacturers' **maintenance** instructions can help extend the time to failure, but even so, it is likely that electrical appliances will fail at some point. Customers may then be faced with a choice – to take the appliance back under warranty, which may require considerable expenditure and time, or to get it repaired locally. The **availability** of eCooking appliances depends on consumer access to the internet to access online shops, as was done in this study, and on the extent of local distribution infrastructure. Manufacturers of eCooking appliances are currently working on a range of commercial arrangements to bring their products to African markets. This may include local assembly, in-country representation, and partnerships with local distributors and retailers.

**Emerging appliances:** Mobile phones are an example of an appliance, developed in the global north, that was adopted rapidly in the global south with little need for adaptation. It is likely that eCooking appliances will follow a similar pathway, from north to south, but there is greater scope for innovation to meet the different market needs in the south. Whilst the majority of eCooking appliances on sale are designed for connecting to a domestic **mains supply** (almost exclusively at around 220V in sub-Saharan Africa), it is interesting that the study has captured a small number of stoves specifically designed to work in conjunction with solar photovoltaic (PV) panels, working on **DC**. Some of these appliances come packaged with **battery storage** in an integrated unit, while others are ‘free standing’ and can be manually connected to a DC power supply (battery).

**Accessibility.** One of the obvious barriers to scaling up adoption of eCooking is the capital cost of appliances. However, the digital appliance referred to under ‘**Data monitoring**’ is being used to overcome this barrier in two ways: enabling customers to pay in instalments; the IoT (Internet of Things) appliance can be used to ‘unlock’ stoves once scheduled payments are made (Pay as you go); accessing carbon finance to subsidise the cost to customers; energy use gathered through IoT appliance can be used to claim high integrity carbon credits through metered methodology projects.

## 9.3 PROJECT CONTEXTS FOR ECOOK

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The analysis of eCooking appliances encompassed a diverse array of models including EPCs, electric induction cookers, multicookers, air fryers, hotplates, but the characteristics discussed are relevant to all electric cooking appliances. The description of characteristics has highlighted how some appliances represent versatile solutions suitable for individuals or households with diverse cooking needs, while other appliances (not included in this study) are designed for a single purpose e.g. kettle for boiling water. This document is not attempting to design an integrated energy plan, but contribute to one. In this section we consider a range of project contexts that developers and implementers (the target group) are likely to be working in, how the importance of characteristics varies between contexts, and how this will affect the selection of eCooking appliances suited to different projects and applications.

**Residential grid connected households.** This covers a wide range of consumers, from well-off, middle-class households that have a good quality, metered electricity supply to informal and slum communities where households may have shared meters or illegal connections. Middle class customers will be attracted to electric cooking by its ability to save time, through automated control, innovative cooking appliances (e.g. EPC, microwave), high powered hobs, and cleanliness, which means less time spent cleaning pots. Other user experience issues such as safety and cost may be less important as they may feel more confident with modern appliance and have more disposable income. Wealthier customers are likely to be well educated, urban dwellers, so quality will be a priority for them, and warranties may well be important to them.

Adopting eCooking in informal housing can be difficult for many reasons, customers may have different priorities. With less disposable income, the cost of cooking becomes more important, so customers need to be convinced that eCooking is affordable. However, the capital cost of appliances is more of a barrier than the ongoing cost of fuel. This is an area where innovative appliance will play an important role by enabling micropayments and subsidising the cost of appliances with carbon finance. Another major issue in low-cost housing is the quality of electrical connections and domestic wiring. Poor quality wiring cannot support high power appliances, which causes safety hazards. In rented accommodation, landlords often prohibit electric cooking, usually because dwellings are on shared meters, leading to difficulties with billing tenants as well as overloading wiring. In this context, the power rating of eCooking appliances becomes critical. In locations with weak grids, all households can be subject to poor quality of power supply, such as power cuts and voltage spikes and drop, and there may be opportunities for innovative appliances incorporating battery appliance.

**Residential off-grid households.** To date, mini grids tend to be designed to supply minimal household loads, typically lighting, phone charging, TV, and refrigeration. However, low demand results in relatively high tariffs. It has long been recognised that higher capacity systems designed to meet increased loads would result in lower tariffs. There is growing interest among mini-grid developers in eCooking as a means of increasing load characteristic of existing systems, and of improving financial viability of systems in the future. This is a particularly interesting market segment, given that many countries aspire to universal access to electricity, and will rely heavily on off-grid solutions to close the connectivity gap. In this high tariff context, customers will be most concerned with running costs so appliance efficiency will be a priority, especially given that prices of traditional fuels tend to be lower in rural areas than in urban centres. Disposable income is generally lower among rural households, so emerging appliance that improves accessibility will be valuable. Rural families tend to be larger, and dwellings larger with more outdoor space, so issues of cooking capacity and portability are likely to be more important. Rural customers will not have easy access to eCooking appliances or repair shops, so any programme will need to be characteristic in special provision. Given that customers in remote locations are unlikely to be able to take advantage of warranties (time and distance to travel to authorised shops), they will be less attractive. Mini-grid operators will also be keen to deploy low power appliances to minimise loads on networks. The nature of the load profile offered by multiple appliances can affect network stability (e.g. spikes); emerging appliance that incorporates storage appliance or switching control of individual appliances may be a cost-effective means of optimising grid capacity.

**Institutional.** WFP (World Food Program) recognise the burden that procuring fuels for school feeding programmes can have on parents and families and are exploring sustainable energy alternatives to biomass fuels. They aspire to lead the way on cooking with electricity and are trialling eCooking in schools<sup>48</sup>. Other situations that provide centralised preparation of meals for large numbers of people include health facilities and prisons. Institutional settings can benefit from financial support from collaborating donors or ministries, and there can be strong knock-on effects, e.g. when a ministry adopts a clean cooking programme. Perhaps the dominant characteristic in these settings is running costs, which are dependent on efficiency and control features. Upfront costs are less likely to pose a barrier where school authorities can be convinced to invest in eCooking. School meals tend to be simple and consistent (i.e. they don't use a wide range of cooking techniques); this means that a high proportion of cooking can be done using only a single type of eCooking appliance e.g. rice cookers, or EPCs. Institutions will need large appliances, and these are beginning to appear on the market e.g. Chinese manufacturers are making appliances up to 65 litre capacity<sup>49</sup>. However, electricity supplies to school kitchens usually need upgrading to cope with high power eCooking appliances.

**Humanitarian.** This covers a range of situations that can broadly be categorised as accommodation in camps and resettlement among host communities. Each of these types can also be nuanced by duration, from short duration, temporary and emergency setting, through to mature settlements established over decades. Each has their own priorities. Many settings, both camps and settlements, lie in remote, rural areas, beyond the grid, and often beyond the reach of LPG distribution networks. In these situations, displaced people can be forced to buy or collect firewood, leading to financial hardship and possible tensions with host communities. For short term settlements, in the absence of the grid the only eCooking options will be PV and battery powered stoves, but these are relatively expensive solutions, at least in terms of upfront cost (solar energy is free)Click or tap here to enter text.. They are, therefore, only likely to be of interest to humanitarian organisations providing cooking fuel as part of emergency responses, where costs may be subordinate to meeting survival needs.

In long term, rural settlements, mini grids may provide access to electricity and eCooking opportunities described above where developers can be convinced that a viable market exists, but ability to pay is likely to be low. Host governments tend to be reluctant to provide infrastructure to displaced communities, for fear that this confers legitimacy on settlements and weakens incentives for people to return; it is

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48. [https://docs.wfp.org/api/documents/WFP-0000101538/download/?\\_ga=2.172146336.2057301437.1708007218-365608586.1708007218](https://docs.wfp.org/api/documents/WFP-0000101538/download/?_ga=2.172146336.2057301437.1708007218-365608586.1708007218)

49. <https://mecs.org.uk/wp-content/uploads/2021/06/Large-electric-pressure-cookers.pdf>

not clear whether mini grids can be regarded as infrastructure or not. Where host communities already have access to the grid, displaced households may be able to access electricity, although this is quite likely to be an informal connection, which may not readily support eCooking. Organisations are also interested in emerging appliance options as a solution in long term camps where environmental and social impact on local communities has become acute (e.g. extreme deforestation). The user experience is not a priority, but it does have to be good enough to convince users to transition from using traditional fuels. In the range of humanitarian contexts, it is unlikely that eCooking appliances can be provided through normal markets; it is more likely that institutions will support an eCooking intervention, in which case they will need to handle commercial issues such as warranties and supply chains for sourcing appliances.

10

# CONCLUSION



This report stated clearly at the start that it was not a design guide for a complete systematic programmatic approach to scaling eCooking. It was a contribution to such necessary systems wide thinking, by documenting the key characteristics of eCooking appliances for the domestic markets in Low and Middle Income countries.

Electric cooking (eCooking) technologies offer a transformative pathway for achieving clean cooking access in low- and middle-income countries, directly supporting the objectives of **SDG 7** and broader climate and health goals. This report has shown that a wide range of appliances—each with unique strengths, limitations, and contextual requirements—can be effectively deployed when carefully matched to user needs, cultural practices, and local energy realities.

Amongst the barriers is a lack of consistency to inform technological choices. The report has attempted to contribute towards filling this information gap despite limitations such as lack of consistency and uniformity in the data available for the eCooking appliances reviewed. This inconsistency was particularly evident when the same eCooking appliances were listed on multiple online market platforms, with varying sets of information provided for each listing. This in itself shows the challenges consumers would face when trying to make online purchases, and underscores the need for continuous efforts towards generation and synthesis of sector data<sup>50</sup>.

Key conclusions are:

- ▶ **Cooktops are very versatile, but require cookware that matches the desired cooking style.** For instance high temperature cooking of flat breads such as Roti require flat cookware and good heat transfer. Induction stoves require specific cookware to work, and therefore **any focus on ‘cooktops’ should also consider the cookware.**
- ▶ **Self contained appliances are often more ‘efficient’ (energy per acceptable meal) than cooktops** Many self contained appliances such as EPCs, rice cookers and airfryers consistently deliver very high efficiency, but while they can do more than their name suggests (rice cookers can cook more than rice) their use as a primary appliance depends on the cultural cooking style.
- ▶ **Task specific appliances such as kettles for boiling water are very energy efficient, but constrained in their role within the overall cooking processes.**
- ▶ **Within any category the ‘system energy efficiency’ and the ‘energy efficiency per acceptable meal’ can vary significantly.** While energy efficiency labels can be created for some products such as ovens and more recently induction stoves in India, the standardised tests address energy conversion to heat in a replicable set up. In day to day use, the ‘system’ efficiency for example, an infrared stove will depend on the cookware – is there wasted heat from uncovered surfaces. And the ‘meal’ efficiency will include human behaviour – e.g. whether the cook leaves off the lid to the pan, perhaps purposely to reduce the fluids in the stew. **Self contained appliances tend to constrain humans from wasteful behaviour more than cooktops.**
- ▶ **Cultural fit is critical** – Appliances must align with staple food preparation methods, texture preferences, and cooking traditions to be adopted at scale. This is particularly important if a programme of action is promoting one item per household.
- ▶ **Fuel and appliances stacking should be considered as part of an integrated energy plan both nationally and at a household level.** If LPG is widespread and yet too expensive for ‘long cook’ staples, self contained appliances can be, and will likely be, used alongside the LPG. This could reduce the cost of refills for the LPG and/or stop households from lighting a biomass stove to stack alongside the LPG. In a transition from other fuels to eCooking, fuel stacking should be considered as one of the planned variables of behaviour for target cooks.
- ▶ **Infrastructure compatibility drives feasibility** – Grid stability, mini-grid capacity, and off-grid energy supply determine the range of viable appliances.

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50. This statement written in 2024 has been slightly overtaken by Large Language Models often called AI, during 2025. A consumer can now ask an AI model to delve deeply into the characteristics, and synthesise across multiple platforms and websites.

- ▶ **Sustainability depends on after-sales service** – Access to spare parts, repair facilities, and warranties is essential for maintaining appliance functionality and consumer trust.

In summary, the transition to electric cooking is not a matter of technology availability alone—it is a systems challenge involving **technical performance, financing, logistics, user engagement, and policy support**. By applying the guidance in this report, programme planners can select and deploy appliances that maximise efficiency, meet cultural needs, and accelerate the shift toward universal access to modern, sustainable cooking solutions.

In terms of the wider programme

**Match appliances to cooking practices and cultural norms** – Adoption depends on meeting culinary expectations—e.g., EPCs excel with beans and stews but do not meet frying or flatbread needs without supplementary appliances.

**Align with energy access realities** – Off-grid and mini-grid systems may require low-wattage or DC-compatible devices to avoid overloading supply. Grid-connected households have broader appliance options but must still consider peak load impacts.

**Integrate procurement efficiency** – Factors like volume of packaging, stackability, and ease of distribution affect logistics costs—critical for large-scale programmes in remote or rural areas.

**Plan for financing access** – Credit models (e.g., PAYGO, microfinance) and targeted subsidies can overcome upfront cost barriers, but must be designed to avoid market distortion.

**Ensure after-sales support** – Availability of spare parts, warranty coverage, and local repair capacity is essential for sustainability and consumer trust.

**Prioritise training and user engagement** – Demonstrations, recipe adaptation, and user feedback loops improve uptake and correct usage, increasing the likelihood of long-term adoption.

# 11

## **ANNEX – OUR RAPIDLY CHANGING WORLD OF INFORMATION AND KNOWLEDGE**

This report was commissioned by SEforALL in 2024 to create a resource that might guide the design of future integrated energy planning (IEP) and universal energy access (UEA) actions and activities that would include eCooking. eCooking is becoming increasingly affordable, practical and relevant to electricity access programmes, with evidence suggesting its use ensures a predictable demand from consumers. It offers considerable opportunities with the newly connected because it potentially pivots existing expenditure on alternate cooking fuels into expenditure on electricity. This ensures a better return on infrastructure and on the investment in a new connection. Creating a link between the planning by utilities, governments and financiers for electricity access inclusive of planning for modern cooking suggested that stakeholders would need a resource to help them identify appliances that could be part of any such Integrated Energy Planning.

The starting point for this report was, as described in the introduction, a scan of online retailers offering appliances. An early draft introducing the database stated ..... *“The 19 characteristics presented in Section 2.3 provided the basis of analysis of eCooking appliances that were identified through the online search. The online search entailed a general keyword search on the internet.<sup>51</sup> The search also entailed visiting online global markets like Amazon and Alibaba that are known for their extensive product listings and diverse market representation of eCooking appliances. Further verifications were conducted to ensure that they can be shipped to countries within Sub-Saharan Africa (SSA), however, this shipping process incurs additional cost which is calculated based on the destination, weight and type of the product. Additional searches were focused on online markets serving SSA region such as Flipkart, AliExpress, Jiji (Kenya), Jumia (Ghana, Nigeria, Kenya) and Jiji (Nigeria and Ghana). An excel-based database was developed where information was extracted for each appliance identified, which was allocated a unique ID. This was followed by a data extraction exercise focusing on the 19 characteristics. For appliances that lacked such information, the characteristic was labelled as missing data for that appliance.”* Draft as at July 2024

However, since its creation the manually collected database has become out of date, and it was decided that the database should not be made public as it was not complete and the detailed information became out of date rapidly. The report pivoted to using the analysis of the specific appliances to create a schema of what to look for in appliances. Since most scaled actions will require tenders to be issued, the resulting report can give the stakeholders some parameters to frame the call for suppliers.

However, this does not leave planners blind to the details of appliance stockists and pricing. In the 18 months that this report has taken to write, the world of online searching has changed! Rather than the manual process the authors started with, the advent of Large Language Models (LLM) often called AI, has created a short cut to finding the details of what is available online (there is of course still a shortage of information about local retailers).

CoPilot, introduced by Microsoft to their package of software, is just one of several LLM AI. Our use of CoPilot in the following example does not indicate an endorsement over other AI. To illustrate the change that LLM AI has brought to this type of investigation, we used CoPilot to identify ‘Toasters’ in Kenya. Toasters are task specific and not particularly important to the transition away from biomass based cooking, and they are even more niche than eCooking in general. However, this example is used to illustrate that a simple enquiry to an AI driven search engine, now produces the sort of detail that an integrated energy plan could use when getting to the tender stage for eCooking appliances. Where the authors spent many days and weeks undertaking a systematic manual search of the internet, this can now be done in minutes.....

Query (13/08/2025): can you trawl the internet and find all the toasters that are sold in Kenya?

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51. Search terms used included, amongst others “electric cooker,” “electric pressure cooker,” “electric induction cookers,” “electric hotplates,” “electric multicooker,” and “solar eCookers.”

Answer Here's a curated list of **toasters currently sold in Kenya**, based on major online retailers:

Hotpoint Appliances Kenya

[View full catalog](#)

- ▶ **VON VSTP02MVK** – 2 Slice Toaster – KES 2,995
- ▶ **Kenwood TCM01** – 2 Slice Toaster – KES 4,495
- ▶ **Philips HD2650/31** – Black & Copper – KES 8,395
- ▶ **BLACK+DECKER ET444-B5** – 4 Slice – KES 8,395
- ▶ **Nutricook NC-T102S** – 2 Slice – KES 7,495
- ▶ **Braun HT 1510 BK** – Purshine Bread Toaster – KES 5,695
- ▶ **Nutricook NC-TS401** – 4 Slice Digital Toaster – KES 9,995
- ▶ Jumia Kenya

[Explore full range](#)

- ▶ **Sokany 2 Slice Bread Toaster** – KES 1,598
- ▶ **RAF 2 Slice Sandwich Maker** – KES 1,939
- ▶ **ElectroMate Sandwich Maker** – KES 1,734
- ▶ **VON VSTP04MVK** – 4 Slice Toaster – KES 3,589
- ▶ **Mika MTS2204** – 2 Slice Toaster – KES 3,995
- ▶ **Ramtons RM/678** – 4 Slice Pop-Up Toaster – KES 7,200
- ▶ **EDENBERG 2 Slice Pop-Up Toaster** – KES 2,820
- ▶ Avechi Kenya

[Browse selection](#)

- ▶ **Ramtons RM/195** – 4 Slice Pop-Up Toaster – KES 4,999
- ▶ **Ramtons RM/478** – 2 Slice Sandwich Maker – KES 2,949
- ▶ **Ramtons RM/448** – 2 Slice Bread Toaster – KES 2,599
- ▶ **Ramtons RM/586** – Wide Slot Stainless Steel – KES 4,599
- ▶ **Mika MTS2201 / MTS2204 / MTS2205** – 2 Slice Toasters – KES 2,499–3,999
- ▶ Observations
- ▶ **Price Range:** KES 1,500 to KES 10,000+
- ▶ **Popular Brands:** Sokany, Ramtons, Mika, VON, Nutricook, Philips, Kenwood
- ▶ Types Available:
  - ▶ Pop-up toasters (2–4 slice)
  - ▶ Sandwich makers
  - ▶ Digital and stainless steel models

Here's a detailed comparison of toasters sold in Kenya based on their energy efficiency, warranty, and suitability for clean cooking programs:

- ▶ Energy Efficiency of Toasters in Kenya

Most toasters in Kenya range between **700W and 1500W**, with **2-slice models** typically drawing less power than 4-slice models. Here's what we found:

Brand/Model	Power Rating	Energy Efficiency Notes
Sencor STS2607BK	830W	Includes defrost/reheat modes, 6 browning levels
Philips Eco Conscious	830W	Made from bio-plastics, energy-saving design

Ramtons RM/586	850W	Wide slot toaster, stainless steel body
Mika MTS2201 / MTS2204	850–950W	Basic pop-up models, no advanced energy-saving features
Nostalgia MyMini	500W	Single-slice toaster, ideal for minimal energy use

**Tip:** Toasters with **infrared heating** or **smart shut-off timers** tend to be more efficient. Lower wattage models are better suited for weak-grid or solar-powered homes.

► Warranty Coverage

Warranty policies vary by brand and retailer:

Brand	Typical Warranty	Notes
Ramtons	1 year	Covers manufacturing defects; available via official distributors
Mika	1 year	Warranty honored through authorised retailers like Avechi
Armco	1 year (strict)	Requires voltage guard; warranty void if used with unstable power
Sencor	Not specified	Warranty details not listed online; check with retailer

► Important: Always confirm warranty terms at purchase. Some brands require proof of purchase and voltage protection devices to maintain coverage.

► Suitability for Clean Cooking Programs

Toasters are **task-specific appliances** and not central to clean cooking transitions. However, they can play **a supporting role** in urban or institutional settings:

► Suitable Contexts

► **Urban households** with reliable grid access

► **Schools or offices** for breakfast/snack preparation

► **Programs promoting appliance diversity** (e.g. pairing with EPCs or induction cookers)

► Limitations

► Not suitable for main meal preparation

► High wattage models may strain **weak-grid or off-grid systems**

► Limited impact on **air pollution reduction** compared to EPCs or induction cookers

**Kenya’s National Cooking Transition Strategy (2024–2028)** emphasizes appliances that reduce emissions and support full meal preparation. Toasters are not prioritized but may be included in broader appliance bundles.

► Summary

Feature	Best Option(s)	Notes
Energy Efficiency	Philips Eco Conscious, Nostalgia MyMini	Low wattage, smart features
Warranty	Ramtons, Mika	1-year standard; check for voltage protection clauses
Clean Cooking Fit	Limited	Useful in urban programs; not core to clean cooking

AI can make mistakes, but this example is given because with a conventional search engine as used 18 months ago, it would have taken several days to go to each website, search for details on energy efficiency, warranty, etc. In this case CoPilot took 8 minutes.

The example is given for a task specific eCooking appliance for illustration of how the insights of this resource guide can be used with AI to reach the detail of appliance online availability, and then tenders with product specification and terms of reference for supply of appliances can be written accordingly.





## ABOUT SEFORALL

Sustainable Energy for All has a global mandate to accelerate progress on the energy transition in emerging and developing countries.

Hosted by UNOPS, we work at the intersection of energy, climate and development, partnering with governments and organizations worldwide to end energy poverty, double energy efficiency, significantly expand renewable energy and combat climate change.

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