

CLEAN COOKING: FINANCING APPLIANCES FOR END USERS



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REPORT 2 OF THE FINANCING CLEAN COOKING SERIES

MECS AND ENERGY 4 IMPACT
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FINANCING CLEAN COOKING APPLIANCES FOR END USERS: THE BIG PICTURE

- To achieve universal access to modern energy cooking services by 2030, about \$150 billion investment a year is needed. Over \$100 billion of this will need to come directly from household contributions for stoves and fuels.¹
- The vast majority of clean cooking appliances are still sold for cash.
- Some stove sales have been financed through local financing institutions, but lending volumes have been disappointing.
- Layaway savings schemes are likely to become increasingly important for more aspirational cooking technologies.
- Many of the poorest households cannot afford the upfront cost of modern energy cooking devices which typically cost between \$30 and \$100.
- Consumer credit is critical for these lower-income customers, especially for higher value or less aspirational appliances.
- New payment models are emerging, such as automated pay-as-you-go (PAYGO), energy-as-a-service, specialist asset financing, and potentially in the future, financing through electric utility bills.

¹ MECS and ESMAP, *The State of Access to Modern Energy Cooking Services* (2020)



PayGo Energy 2020

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THE FINANCING CLEAN COOKING SERIES

Energy 4 Impact and Loughborough University, the lead implementing partner on the UK aid-funded Modern Energy Cooking Services (MECS) programme, signed an agreement in 2020 to collaborate on research into financing for the clean cooking sector.

The **Financing Clean Cooking** series aims to facilitate the transition to clean cooking through financing and investment. The series is targeted at a diverse range of public and private stakeholders in clean cooking, including NGOs, donors, investors, and suppliers.

Clean Cooking: Financing Appliances for End Users is the second report in the series and provides a snapshot of the state of end user financing for clean cooking. It looks at the pricing of different appliances and outlines how the current market is dominated by cash sales. It explains why consumer credit is important and examines emerging financing models such as automated pay-as-you-go and utility-led financing. Finally, it calls upon donors to make interventions to scale up appliance financing for clean cooking.

The first report in this series looked at crowdfunding for clean cooking and subsequent reports will include research into clean cooking concessions for displaced people in humanitarian settings.



INTRODUCTION

Currently around four billion people in the world lack access to clean, efficient, convenient, safe, reliable and affordable cooking energy². The rate of access is particularly low in sub-Saharan Africa (SSA) with only 10% of the population having access to modern energy cooking services³.

One of the biggest challenges is financing. To achieve universal access to modern energy cooking services, it is estimated that around \$150 billion will have to be spent every year up to 2030, of which over \$100 billion would need to come directly from household contributions for stoves and fuels.

2. The statistics quoted in the first two paragraphs derive from MECS and ESMAP, *The State of Access to Modern Energy Cooking Services* (2020)

3. 'Modern energy cooking services' refers to a household context that has met the standards of Tier 4 or higher across all six measurement attributes of ESMAP's Multi-Tier Framework: convenience (fuel), availability (a proxy for reliability), safety, affordability, efficiency, and exposure (a proxy for health related to exposure to pollutants from cooking activities). Typically this includes cooking with electricity and modern fuels such as biogas, liquefied petroleum gas, and ethanol.



TO ACHIEVE UNIVERSAL ACCESS TO MODERN ENERGY COOKING SERVICES, IT IS ESTIMATED THAT AROUND **\$150 BILLION** WILL HAVE TO BE SPENT EVERY YEAR UP TO 2030

This report looks at some of the ideas being adopted to address the \$100 billion end user financing challenge. It is based on the premise that **any successful clean cooking business model depends on the price of the clean cooking hardware, the operating costs (mainly the price of fuel) and end user financing**. While some households may be able to afford the costs of a new clean cooking technology because they can transfer their existing spending on polluting cooking fuels to a cleaner alternative, many poorer customers cannot afford the upfront cost of modern cooking devices.

In this report, **we examine end user financing for different clean cooking technologies, particularly modern energy cooking services such as electric cooking (e-cooking), ethanol, liquefied petroleum gas (LPG), biomass gasifiers, and biogas**. We look at the typical prices of appliances and the opportunities and challenges around different end user financing models. We explore emerging appliance financing mechanisms such as technology-enabled PAYGO and energy-as-a-service, and the potential for on-bill financing by utilities. Finally, we call upon donors to make specific interventions in these emerging areas.

Most of the primary research in the report comes from Kenya which is the most developed market for clean cooking in SSA and the one with the widest range of appliances. However, many of the concepts are likely to be applicable to other countries as well and the report includes case studies of clean cooking companies operating in Kenya, Cambodia, Rwanda, Tanzania and Zambia. Our case studies are based on both primary and secondary research, including interviews with company management.

PRICING OF APPLIANCES

Most modern energy cooking appliances in sub-Saharan Africa are priced between \$30 and \$100 and tend to be sold on a cash basis.

One of the key factors determining the uptake of clean cooking is affordability, which is a function of the upfront costs of the hardware and fuel, the running costs of the new technology and the availability of finance.

Retail prices for different clean cooking appliances vary widely in SSA, from \$5 or less for an inefficient unbranded improved biomass stove to over \$100 for a multi-functional electric pressure cooker (EPC) or over \$500 for a biodigester. Table 1 shows the price ranges for different clean cooking appliances in SSA – the final price of an appliance package depends on the brand, the size and functionality of the appliance, and whether the package is sold on credit or not. Interestingly, many modern and aspirational cooking solutions such as LPG or ethanol have similar prices to improved biomass cookstoves, with prices in the \$30-40 range.

Table 1: Pricing of Clean Cooking

Appliance	Price range
Improved biomass stoves	\$5 to \$40
LPG solutions	\$30 to \$110 (depending on the size of LPG cylinder and accessories)
Ethanol stoves	\$25 to \$36
Electric hotplates	\$10 to \$30
Induction stoves	\$60 to over \$100
Microwaves	\$70 to over \$110
EPCs	\$60 to over \$100
Gasification stoves	\$110 to \$130
Biodigesters	\$500 to \$750
Battery-supported e-cooking appliances (e.g. solar electric systems)	\$150 to \$2000

Source: Energy 4 Impact research in Kenya and Uganda; MECS research⁴

4. MECS and ESMAP, *Cooking with electricity, a cost perspective* (2020).



PayGo Energy, 2019

Modern energy cooking companies have developed different product packages to serve different target markets, for example different income groups or cooking dishes. For some technologies such as LPG, the product can be adapted for lower-income households by charging no upfront cost for the device or providing a smaller LPG cylinder that allows households to top up small quantities of fuel that fit with their cashflows. In some cases, LPG competes with charcoal users, while in others it competes with – or is a fuel stacking option for – users of e-cooking.

Research by MECS has shown that in Kenya **electrical appliances including electric hotplates, ovens and**

microwaves are commonly available but not widely used. Newer energy efficient appliances such as EPCs are emerging and have a clear economic advantage over polluting fuels and less energy-efficient appliances. EPCs are particularly well-suited for slow cooking staple foods and dishes – such as ugali, kale, cereals such as beans, green grams and lentils, plus rice dishes and meat stews. However, **significant challenges around technology and adoption remain** with other common Kenyan foods such as chapatis, mandazi, and meats that are usually roasted on an open fire⁵. Similar trends can also be observed in other SSA markets.

5. MECS, *The Kenya eCookBook: Beans & Cereals Edition* (2019)



MODERN ENERGY COOKING COMPANIES HAVE DEVELOPED DIFFERENT PRODUCT PACKAGES TO SERVE DIFFERENT TARGET MARKETS,

END USER PAYMENT MODELS

While most appliances are still sold for cash, sales on credit are important for increasing the access of low-income groups to modern energy cooking solutions.

The **vast majority of clean cooking appliances are still sold today for cash.** Most of the sales involve improved biomass cooking devices, but they also include electric, LPG, ethanol, and other modern energy cooking devices.

The amount of consumer credit available for clean cooking appliances remains small as a proportion of sales. However, access to consumer credit and financing solutions is important to enhance **the access of low-income groups to modern energy cooking solutions. It is also essential to support market growth for the higher value products.** Most payment plans involve a small down payment, followed by monthly instalments over 6 to 36 months.

In this section, we look at **eight end user payment models** for clean cooking devices:

- Cash & carry
- Layaway savings
- Third-party financing partnerships and crowd-based micro-lending
- Automated PAYGO
- Energy-as-a-service PAYGO (currently only offered by the LPG company M-Gas in Kenya)
- Asset financing loans
- Razor and blades
- On-bill financing by utilities or mini-grids (currently unused as a financing option)

Table 2 shows the end user payment models in operation in SSA and South Asia categorised by clean cooking technology and type of appliance. The final selection of the payment model depends on factors such as the retail pricing point of the appliance, the target customer market, and other factors such as the aspirational qualities of the appliance.

Table 2: End user payment models for clean cooking appliances in SSA and South Asia

Cooking Technology	Appliance type	Cash & Carry	Layaway Savings	Credit				
				Third party financing partnerships and Kiva	PAYGO*	Asset financing	Razor and Blades	On-bill Financing
E-cooking	EPCs	✓	✓		✓	✓		?
	Induction stoves	✓	✓		✓			?
	Hot plates	✓	✓					?
Modern fuels	LPG	✓		✓	✓	✓		
	Bioethanol	✓	✓	✓				
	Biodigesters	✓		✓	✓			
Other	Biomass gasifiers	✓		✓	✓		✓	
	Improved biomass cookstoves	✓		✓				

Note:
 * PAYGO energy as a service
 ✓ actual
 (✓) planned or in pilot phase
 ? option, but not yet being piloted

Table 3 summarises the end use financing strategies of some leading clean cooking companies. It is interesting to note that

all but one are operating or testing automated PAYGO solutions.

Table 3: Consumer credit and automated PAYGO systems – position of leading clean cooking companies

COMPANY	CLEAN COOKING TECHNOLOGY	B2C OR B2B	COUNTRIES OF OPERATION	TRADITIONAL CONSUMER CREDIT	AUTOMATED PAYGO CONSUMER CREDIT	COMMENTS
ACE	Solar-Biomass hybrid	B2C	Lesotho Uganda Cambodia	Yes	Yes	Cooking products are financed through 10-month payment plan ACE One stove can connect with Android smartphone enabling PAYGO. PAYGO stoves sold in Lesotho Partnership with Kiva's micro-lending platform
A TEC	Biodigesters Induction stove	B2C	Cambodia Bangladesh	Yes	Yes	Cooking products are financed through payment plans of up to 30 months Partnership with Angaza for PAYGO-enabled biodigester Patent for PAYGO-enabled electromagnetic-induction cooker Partnership with Kiva's microlending platform
BURN Manufacturing	All	B2C B2B	Kenya Rwanda Tanzania Uganda	No (except via local financing partners)	Exploring asset financing for EPCs	Most products still sold for cash
Circle Gas M-Gas	LPG	B2C	Kenya Tanzania	No	Yes	Energy-as-a-service PAYGO. No deposit requested for LPG connection. LPG package includes home delivery of fuel, 24/7 customer service, and use of cylinder and 2-burner stove
ECS	Biomass gasifiers	B2C	Zambia	Yes	Market-ready	PAYGO technology solution based on Internet of things is ready, but not yet rolled out
Envirofit	Biomass stoves LPG	B2C	SSA Latin America Asia		Yes (for LPG)	Seeking capital to grow PAYGO LPG
KOKO Networks	Bioethanol	B2C	Kenya Uganda India	No except via local	No	Appliances nearly all sold for cash or through layaway savings
PayGo Energy	LPG	B2B	Kenya	No	Yes, but credit risk taken by gas companies	Gas companies decide payment plan for LPG connection Revenues from gas sales shared with PayGo Energy
Traditional LPG companies	LPG	B2C	Multiple	No	No	Gas companies collect deposit to cover cost of the cylinder

Note:
B2C Business to Consumer – refers to the process of selling products and services directly between a business and consumers who are the end users of their products and services
B2B Business to Business – refers to the process of selling products and services between one business and another such as a wholesaler or retailer.

This report does not consider receivables financing as it is focused on end user finance. With the exception of a few larger companies, **we do not see receivables financing as being currently relevant in the short term.** For example, the PAYGO solar home system (SHS) market has only attracted large-scale receivables financing relatively recently because it has reached

sufficient scale and maturity. The clean cooking market is probably four or five years behind the SHS market and, given the dominance of cash sales, we do not believe that receivables financing will play a major role for some time.

The remainder of this section will examine each of the major payment model in turn.



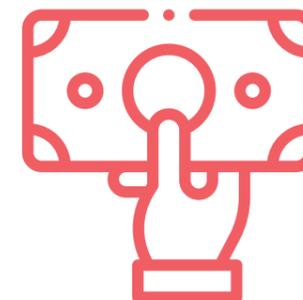
1. CASH & CARRY

In the cash & carry model, customers pay 100% of the cost of the appliance upfront. This model has been successfully scaled by companies such as BURN Manufacturing and KOKO Networks.

Cash sales are also the norm for LPG connections. The pros and cons of the cash & carry model are shown in Table 4 below.

Table 4: Cash & Carry model: Pros and Cons

✓ PROS	✗ CONS
<p>For companies:</p> <ul style="list-style-type: none"> Improves the company's cashflows and reduces their need for working capital. Saves the company time and resources assessing customer credit risk and managing financing scheme. 	<p>For companies:</p> <ul style="list-style-type: none"> Reduces size of the potential target market. May not work for high price appliances. May not work for non-aspirational products.
<p>For customers:</p> <ul style="list-style-type: none"> Lowest costs for customers as they do not pay for financing costs (interest, fees, commissions). 	<p>For customers:</p> <ul style="list-style-type: none"> Some products are not affordable for lower income customers.



IN THE CASH & CARRY MODEL, CUSTOMERS

PAY 100%

OF THE COST OF THE APPLIANCE UPFRONT.



2. LAYAWAY SAVINGS

Whilst cash payments are still the most common, some **customers prefer to reserve appliances and build up savings to pay for them**, typically over 1 to 6 months. These layaway savings schemes are generally run by the companies

themselves and are particularly well suited for more aspirational cooking devices because buyers are likely to be more disciplined in making the required savings. The pros and cons of layaway savings are shown in Table 5 below.

Table 5: Layaway Savings: Pros and Cons

✓ PROS	✗ CONS
<p>For companies:</p> <ul style="list-style-type: none"> • Opportunity to attract additional customers by marketing the layaway option. • Customers tend to be high quality with strong savings discipline. • Works particularly well with aspirational products since people are more disciplined in saving towards them. • Improves the company's cashflows – the layaway deposits are provided upfront before delivery of the items. • Relatively easy to administer – no need to assess credit rating of customer. 	<p>For companies:</p> <ul style="list-style-type: none"> • Small administrative costs for running layaway schemes – need to carry out basic checks e.g. customer identity. • May not work for some appliances, e.g. higher ticket, less aspirational products.
<p>For customers:</p> <ul style="list-style-type: none"> • Retail price for the device is the same as for cash & carry. Also there are no financing costs involved (e.g. interest, fees, commissions). • Fosters discipline to save for aspirational products. 	<p>For customers:</p> <ul style="list-style-type: none"> • Funds locked for 1-6 months until device is handed over. • Most layaway schemes require a small down payment (10-20%). • Some layaway schemes with supermarkets require customers to pay off the product within 3 months. • Most layaway schemes have a cancellation fee to lock in customers.



3. THIRD-PARTY FINANCING PARTNERSHIPS

Over the years many clean cooking companies have developed **partnerships with local financing institutions to finance the sales of stoves**. The main advantage of this approach is that the companies do not have to get involved in administering loans and are not exposed to end user credit risk. However, most companies still sell only a relatively small proportion of their stoves through this channel.

Another important source of clean cooking end user financing in Kenya is **Kiva's micro-lending crowdfunding platform**. Kiva is used by individual or institutional investors to provide small loans to end users, usually via a microfinance institution, social enterprise, or non-profit organisation that is

a field partner of the platform. The loans are provided at zero interest to the field partner, which then on-lends them to end users, usually at a subsidised interest rate. Some clean cooking companies have become Kiva field partners, while others have worked with existing MFI field partners.

Between 2014 and 2020, \$4.2 million of loans in the clean cooking sector came from micro-lending crowdfunding loans in Kenya, nearly all from Kiva. These loans remain an important source of funding for clean cooking customers, although volumes have fallen in recent years.⁶

⁶ For more information on crowdfunding and clean cooking, please see our first report in the Financing Clean Cooking Series.



4. PAYGO

One of the most exciting new areas in clean cooking is the emergence of automated PAYGO models, similar to those which have transformed the off-grid solar market in the last five years. **The PAYGO technology removes the upfront price barrier of the cooking kit, by allowing end users to pay a small deposit, or none at all, followed by affordable installments over time.**

Many leading clean cooking companies have developed PAYGO solutions, covering a wide range of appliances including EPCs, induction stoves, LPG cooking kits, biomass gasifiers, biodigesters, and solar-biomass hybrid energy systems.

Most companies use their PAYGO model for end users (the B2C model), but some offer their PAYGO solution to intermediaries (the B2B model). A good example of the latter is PayGo Energy,

which offers an LPG PAYGO solution to gas companies.

The PAYGO model has to be adapted for the specific clean cooking technology, but typically includes many of the following features:

- The distributor rents or sells consumers a clean cooking kit which could be just a stove or a stove plus related fuel dispensing equipment.
- Payments are made by customers on a daily, weekly, or monthly basis, using mobile money, cash dispensing machines, or other means.
- Customer payments are tracked. The cooking kit can be remotely enabled or disabled if a customer tops up or falls behind on their payments. The distributor usually has the right to repossess a device if a customer defaults on their payments. In practice, repossession of cheaper stoves is

CASE STUDY KOKO NETWORKS

KOKO Networks is a venture-backed technology company that delivers liquid ethanol-based cooking solutions to low-income urban households in Nairobi. In June 2021, they reached the milestone of 150,000 customers.

In KOKO's layaway savings scheme, customers pay a small deposit to KOKO upfront and pay off the balance at a time of their convenience. Apart from the deposit, there is no minimum payment amount or time limit for making the payments. Customers collect their KOKO cooker kits on completion of payment.

Historically about 35% of KOKO's customers have paid through the layaway scheme. It is well suited for their relatively low price and aspirational product package (cost of \$30 to \$40) and removes the need for them to offer credit. About 80% of KOKO's layaway customers complete full payment in under 60 days and 50% do so in under 30 days. KOKO locks in customers by charging a small penalty fee if they opt out of the scheme.

unlikely to happen due to the relatively high cost of repossession versus the cost of the appliance.

- In some cases, the cooking device can be remotely managed and fuel or electricity usage can be tracked by smart meters. For modern fuel businesses, arrangements can be made to dispatch refills to customers before they run out.
- Some PAYGO providers do not use smart meters to track fuel usage because of the high cost. Instead, they use pre-existing metered PAYGO

technologies such as solar home systems to manage payments for non-metered cooking solutions. Examples include non-metered biomass and gasifier stoves on the Angaza PAYGO platform. There are also examples of PAYGO for smaller LPG cylinders where the gas usage is not tracked.

- Customer service can be supported through the use of customer relationship management (CRM) software.

The pros and cons of the PAYGO model are shown in Table 6 below:

Table 6: PAYGO Model: Pros and Cons

✓ PROS	✗ CONS
<p>For companies:</p> <ul style="list-style-type: none"> • Increases market for clean cooking devices, especially for lower income households. • Increases scalability of business – potential economies of scale and increased access to finance. • Particularly attractive for higher ticket items. • Ability to track payments and disconnect non-paying customers. • Ability to manage remotely and track usage with smart meters, and potentially dispatch fuel refills in a timely manner. • Can support customer service with CRM software. <p>For customers:</p> <ul style="list-style-type: none"> • Increases ability to afford larger and more efficient devices by spreading payments over 6-36 months. • Improved customer service. • Fuel refills can be managed more efficiently. 	<p>For companies:</p> <ul style="list-style-type: none"> • Asset financing is very capital intensive – it will constantly require new debt and equity to scale up. • Exposes companies to customer credit risk that the cash & carry and layaway models do not. • Requires different skills to core distribution business e.g. credit assessment, credit management, portfolio monitoring. • Cost of repossessions likely to be prohibitively high for some appliances. • Smart meters can be expensive. • Some business models for PAYGO still not proven. <p>For customers:</p> <ul style="list-style-type: none"> • Higher cost versus cash payments – need to pay the cost of financing (interest, fees, commissions). • Need to be confident of meeting payment obligations. Potential to be remotely disconnected by seller or device could be repossessed.

CASE STUDY
PAYGO ENERGY

PayGo Energy is a Kenya based technology company, founded in 2015, that builds hardware and software solutions to help develop markets for LPG. PayGo Energy's patented Cylinder Smart Meter (CSM) is an Internet of things device that makes clean cooking accessible and affordable for low-income households.

The CSM is attached to the top of an LPG cylinder and measures gas consumption by the gram. This enables households to purchase gas in small amounts, using mobile money with no minimum top-up amount. The CSM tracks how much credit the customers have left. When their credit runs out, the flow of gas is automatically shut off. The CSM also allows distributors to monitor consumption in real time, enabling them to replace the cylinder before the customer runs out of gas.

PayGo Energy started as an LPG service company for end users and later pivoted and became a PAYGO technology service provider for gas companies. This was because the end user market had thin margins and was highly capital intensive, requiring significant investment in infrastructure such as refilling and distribution, and in other areas connected to the retail business and cylinder fleets.

PayGo Energy offers two different packages to gas companies:

- **Hardware package (outright sale):** The gas company buys the CSM and is charged a small monthly software service fee. In this model, the gas company is responsible for managing all aspects of the customer relationship.
- **Metering-as-a-service package (service model):** The gas company is charged a monitoring and service fee for each CSM deployed. In this model, end customers are charged a premium over the prevailing LPG retail price of the gas company which is shared between PayGo Energy and the gas company.

The metering-as-a-service model offers a number of advantages for gas companies:

- It frees up working capital by reducing the average number of cylinders required per household.
- It enables just-in-time delivery of cylinders to households by technology-enabled monitoring and operational mapping.
- It makes customer relationships stickier and introduces constant data-driven feedback loops with the customer.
- It creates new markets with lower-income households that would otherwise not be viable.

CASE STUDY

ATEC INTERNATIONAL (CAMBODIA): BIODIGESTERS

ATEC International is a vertically integrated social enterprise that designs, manufactures, distributes, and finances prefabricated biodigesters for rural farming households in Cambodia and Bangladesh. Their biodigesters are seen by customers as long-term, aspirational purchases, making them ideal for PAYGO sales.

In 2019, ATEC integrated PAYGO functionality into their biodigesters through a collaboration with Angaza, a PAYGO technology company. ATEC had previously sold the biodigesters for cash or through third-party financing channels. **The introduction of PAYGO led to a**

doubling in lead conversion rates and a significant increase in monthly sales volumes. Under the PAYGO scheme, customers who cannot afford the upfront cost of the biodigester can pay through monthly installments, which are set so they can be paid out from savings made by the customer from reduced purchases of gas and fertiliser.

In 2020, ATEC was granted a patent for a PAYGO-enabled electro-magnetic induction stove. ATEC and their distribution partners can sell the stoves in installments for as little as \$5 a month⁷.

7. Harris, L. 2021. *A Cutting Edge Solution to a Global Problem: Why PAYGO Electromagnetic Induction Stoves Will Become the Leading Clean Cooking Technology by 2030*. NextBillion



5. ENERGY-AS-A-SERVICE

Energy-as-a-service is a PAYGO business model in which end customers pay for an energy service without having to make any upfront capital investment. Currently,

the only clean cooking company adopting this model is the LPG company Circle Gas which is profiled below. The pros and cons of the model are shown in Table 7.

Table 7: The Energy-As-A-Service Model: Pros and Cons

✓ PROS	✗ CONS
<p>For companies:</p> <ul style="list-style-type: none"> Speeds up customer acquisition process, allowing tool and fuel companies to reach critical mass more quickly. Can create attractive and recurring revenue stream from monthly fuel sales over several years. Short customer feedback loops through monthly engagement can create customer loyalty and stickiness. <p>For customers:</p> <ul style="list-style-type: none"> Pay no upfront cost for equipment. 	<p>For companies:</p> <ul style="list-style-type: none"> Growth strategy relies on selling sufficient quantities of fuel at a premium. Can be highly capital-intensive. Can take several years to get payback from fuel sales. <p>For customers:</p> <ul style="list-style-type: none"> Pay a potential premium on fuel over a number of years.

CASE STUDY CIRCLE GAS

Circle Gas is a UK holding company that provides affordable LPG to low-income households. In January 2020, Circle Gas acquired KopaGas, a Tanzanian LPG distributor, and their proprietary LPG smart meter technology, in a transaction worth \$25 million, making it the largest pure private equity investment in the sector to date. Safaricom, a Kenyan telecoms company and owner of the popular M-Pesa mobile payment system, is a strategic investor in Circle Gas and a brand partner in the business.

M-Gas, Circle Gas's subsidiary in Kenya, has developed a PAYGO LPG distribution model in which customers pay nothing upfront for the LPG cooking kit, but are charged for fuel and services over time. Their product package comprises a 2-burner stove and a 13-kilo filled cylinder fitted with a smart meter, enabling PAYGO cooking and a regulator. Their target customers are informal settlements and high-rise slum households living in single-room dwellings.

The smart meter is fixed to the cylinder and is able to release cooking gas to customers until their pre-paid balance — which is tracked through an embedded digital wallet — runs

out. Customers are able to buy very small quantities of gas, topping up their balance with mobile money as needed. The smart meter also tracks usage of the gas, enabling the company to proactively dispatch refills to customers before they run out. Full LPG cylinders are delivered at no additional cost to customer homes when their cylinders run low. The price of the LPG service covers the upfront equipment and service costs, but is still less on a daily basis than cooking with charcoal, or financing a cylinder, stove and refills.

M-Gas has 20,000 household customers in Kenya, making it the largest PAYGO cooking business in East Africa. M-Gas has a depot-based distribution strategy. They have identified high population centres and established depots to serve customers, for example, in a 3 km² catchment area. Unlike traditional LPG companies, M-Gas does not use distributors or retailers. Instead, they service customers entirely through in-house teams of technical sales representatives, logistics technicians and customer care. Currently, M-Gas has three depots in Nairobi and plans to launch many more shortly. Circle Gas also plans to expand KopaGas in Tanzania.



6. ASSET FINANCING

Some specialist asset financiers such as Bidhaa Sasa in Kenya have developed successful businesses providing loans for household and productive use

equipment, including clean cooking. The pros and cons of the asset financing model for different stakeholders are shown in Table 8.

Table 8: Asset Financing Model: Pros and Cons

✓ PROS	✗ CONS
<p>For companies:</p> <p>Suppliers</p> <ul style="list-style-type: none"> Increases potential market for clean cooking devices, especially for lower income households – suppliers can sell to asset financiers that have existing customers and distribution channels. No impact on the balance sheet of the supplier if financing is provided by third-party. No end user credit risk borne by supplier if finance is provided by a third-party. Supplier is able to focus on their core business rather than financing. <p>Asset financiers</p> <ul style="list-style-type: none"> Asset financiers have existing customers, so can choose best customers based on historic purchase and payment records. Loans well suited for LPG businesses where customers have user rights for LPG cylinders, but do not own them (the ownership stays with the gas companies). <p>For customers:</p> <ul style="list-style-type: none"> Ability to afford larger and more efficient devices by spreading payments over time. Ability to buy clean cooking devices together with other household or business appliances. 	<p>For companies:</p> <p>Suppliers</p> <ul style="list-style-type: none"> Suppliers lose direct feedback loop with customers. May not work for higher ticket items. <p>Asset financiers</p> <ul style="list-style-type: none"> Standard asset financing business risks <p>For customers:</p> <ul style="list-style-type: none"> High cost versus cash payments – need to pay the cost of financing (interest, fees, commissions).

CASE STUDY BIDHAA SASA

Bidhaa Sasa is a last-mile distribution and finance company operating in rural Kenya. It was set up to serve rural women customers and make their products affordable by offering payment plans to groups of women instead of individual consumers. It has developed a successful business funding clean cooking equipment for women in rural Kenya, notably around deposits for LPG cylinders. Over the last 5 years, they have provided asset financing for 80,000 products, with all payments being done through mobile money.

Gas companies such as Total and Rubis typically ask for an upfront deposit to cover the cost of the cylinder and the gas in the cylinder. Bidhaa Sasa has financed 25,000 deposits for new LPG connections for first-time gas users. They have also started selling EPCs, initially targeting sales of 100-200 units. Their clients like the EPCs, but there are currently limited suppliers in Kenya and the price per unit is high, reflecting the small size of the market. Bidhaa Sasa sells EPCs for around \$75-90, while their clients' preferred price point for cookers is \$50-60. They have responded by offering payment plans comprising 1-month deposit and 9 monthly payments.



7. RAZOR AND BLADES

In the razor and blades model, **a product such as a clean cookstove is sold at a discounted or zero price in order to increase sales of a complementary product such as fuel for the stove.** The razor and blades model is still unproven at scale for clean cooking. It has been adopted by several biomass gasifier companies, notably Inyenyeri in Rwanda and Emerging Cooking Solutions (ECS) in Zambia, but with mixed results.

Inyenyeri announced in April 2020 that they were going bankrupt and were closing down their business. They leased stoves to customers with no upfront payment and charged them regularly for the biomass pellet fuel. They chose a relatively broad target market – namely urban, peri-urban and rural households in Rwanda – rather than just prioritising the more profitable urban market. They did not

manage to acquire enough customers to achieve financial sustainability, reaching just over 5,000 customers compared to the 100,000 threshold deemed necessary⁸.

The razor and blades model **relies on sales of fuel growing sufficiently quickly and fuel prices being high enough to recoup the low margins from the sale of stoves.** It is also important that the local currency used for sales of stoves is relatively stable against the hard currency often used for purchases of stoves. If the local currency weakens, distributors of stoves will need to periodically increase the local retail price of the stoves. If these conditions are not met, the end result will be cash flow problems. The pros and cons of the razor and blades model are shown in Table 9.

8. Clean Cooking Alliance, 2021 *Clean Industry Cooking Snapshot*.

CASE STUDY EMERGING COOKING SOLUTIONS

Emerging Cooking Solutions Zambia is a tool and fuel company that sells biomass gasifier cookstoves and biomass pellet fuel to low-income households. The stoves are imported from Mimi Moto and the pellets are manufactured in-house. The target customers of ECS are the mass market comprising 70% of the peri-urban population in Lusaka which spends between \$6 and \$16 per month on charcoal for cooking. In order to make the product offering affordable and to be competitive with the spending patterns on charcoal, the company sells the stoves on 36-month payment plans with a “cost recovery” model based on three pillars:

- Stoves are sold for little or no margin (i.e. at or just above the landed cost of goods sold plus direct costs).
- The monthly price of the pellet fuel is competitive with charcoal, their primary substitute fuel.
- Margins foregone on the sale of the stoves are made up through higher margins on pellet sales over a period of 3 to 5 years.

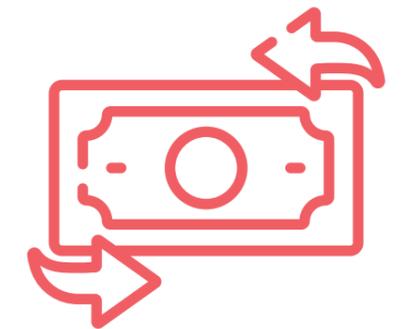
Unfortunately, it has been difficult to implement this model and ECS has had some cashflow challenges. The situation has been exacerbated by a significant depreciation in the Zambian Kwacha and lower than expected fuel consumption during the worst months of the Covid pandemic.

In order to break even on the sale of pellets, ECS needs 7,500 paying customers purchasing an average of 12 kilos of pellets per month. It has taken much longer than expected to reach this point and as a result, the company has made losses on the sale of fuel, while still making little or no margin on the sale of the stoves. On a positive note, the average purchase per customer is now more than 20 kilos per month.

Given the cash-intensive nature of the business model, ECS plans to pivot to a platform-based business model in which they offer the stove, IT software, financing, real-time impact monitoring, pellets and carbon revenues to other distributors and partners.

Table 9: The Razor & Blades Model: Pros and Cons

✓ PROS	✗ CONS
<p>For companies:</p> <ul style="list-style-type: none"> • Speeds up customer acquisition process allowing tool and fuel companies to reach critical mass more quickly. • Can create attractive and recurring revenue stream from monthly fuel sales over several years. • Short and regular customer feedback loops can create customer loyalty and stickiness. 	<p>For companies:</p> <ul style="list-style-type: none"> • High risk and unproven strategy that is dependent on selling sufficient quantities of fuel at a profit. Potentially the company risks losing money on both the stoves and the fuel. • Highly capital-intensive. Can take 24-36 months or more to make enough from fuel sales to compensate for the lack of margin on the stoves.
<p>For customers:</p> <ul style="list-style-type: none"> • Access appliances cheaply. 	<p>For customers:</p> <ul style="list-style-type: none"> • Customers pay premium for fuel to compensate for company's low margin on stove sales.



UNFORTUNATELY, IT HAS BEEN DIFFICULT TO IMPLEMENT THIS MODEL AND ECS HAS HAD SOME CASHFLOW CHALLENGES



8. UTILITY-LED FINANCING

Utility-led financing is **potentially a powerful tool for reducing the upfront cost of e-cooking devices and increasing uptake of e-cooking**. It can take different forms:

- **On-bill financing (OBF)** in which the devices are financed on the balance sheet of the utility and the repayments are collected through the utility bill.
- **On-bill repayment (OBR)** in which the devices are financed by a third party (e.g. an asset financier or clean cooking distributor) and the repayments are collected through the utility bill.
- **Co-marketing and data-sharing** in which the finance and the billing for the devices are done by a third-party, but the utility provides data and other support related to their customers for credit scoring and marketing purposes.

We are not aware of any national utility in Africa adopting an OBF or OBR model for clean cooking or other electric appliances, although several pilots are in progress or planned in Uganda⁹ and Sierra Leone.

The main benefits of utility-led financing for the utilities are increased electricity sales and other potential revenues from the appliances. Most utilities in East Africa are looking to increase demand on their grid and are therefore keen to encourage the uptake of e-cooking. The same is true of many private mini-grids, although their tariffs are generally much higher than the national grid and the costs of locally-sourced wood and charcoal are usually so low that even the most energy-efficient electric appliances struggle to be cost-competitive.

Some utilities such as Zesco in Zambia are keen to switch users to more energy-efficient appliances to reduce the load on their power systems and cut load shedding. In the case of Zesco, there is significant potential to transition to energy-efficient EPCs from hot plates and other commonly used but less energy-efficient appliances. An OBF for energy-efficient stoves could reduce consumer bills if the

9. There is a data-sharing and co-marketing arrangement for electric appliances between Umeme and EnerGrow.

on-bill payments for the new stoves were no higher than the savings made by customers through reduced consumption of electricity.

In reality, **most African utilities are cash-constrained and are likely to prefer informal partnerships over OBF and OBR**. Many are already struggling with payment collections, so will not want to increase the financial burden on their customers through on-bill payments for appliances. Other challenges include potential regulatory hurdles for disconnecting customers, potential consumer finance regulations and the likely need to upgrade billing systems.

The benefits of utility-led financing for the cooking companies include access to an existing customer base and payment system, the ability to mitigate payment risk with historic customer data, the ability to monitor ongoing stove usage and the ability to curtail energy service for non-payment (subject to local regulations).

The main benefits for end customers of OBF and OBR are increased affordability for energy-efficient devices, financial and other benefits from the use of the devices, and increased awareness of the financial savings of their investments.

Assuming the utilities can overcome the challenges described above, several elements need to be considered when implementing an OBF or OBR programme:

Programme funding – Most African utilities will struggle to fund OBF programmes without external support. Much depends on whether the utility can get donor funding or is able to easily access the debt or equity capital markets. The capital raised must be competitively priced so any financing provided to end consumers can also be competitive. In reality, most utilities will find OBR schemes more attractive since the financing is provided by third-parties. However, they may still have to offer customer credit enhancements and make certain commitments (particularly around handling non-payments and disconnections) to attract third-party funders.

Diverse programme management team – While OBF or OBR programmes can leverage the strengths of utilities, they are based on a very different business model to what utilities are accustomed to. It is therefore important that the utility has a diversified programme management team, including representatives from finance and billing, sales and marketing, product development and IT.

Customer selection – The utility will need to determine parameters for selecting customers and build an in-house customer credit scoring system. This should include data on individual customers such as monthly income, historical electricity consumption, payment history on utility bills, and existing experience cooking with electricity. It could also include other parameters, such as the strength and reliability of the regional electricity grid and support for low-income and underserved communities.

Stakeholder engagement – It is important to engage with relevant stakeholders during the design phase of the programme, including e-cooking manufacturers and distributors, financial institutions, technical and safety standard organisations, energy auditors and specialist consultants with experience in OBF programmes.

Quality control and assurance – Quality standards are a critical part of any OBF. It is important to ensure that all appliances are safe and perform to a high standard, with appropriate warranties. The appliances should be suitable for the local context and not jeopardise the stability of the local grid. Capacity-building will be needed, both at the level of the programme administrator (probably the utility), and supporting organisations, such as the local bureau of standards. There will also be a need for ongoing monitoring to ensure appliances perform as predicted and safety is not compromised.

Handling non-payment – This is a very sensitive matter for both consumers and utilities and it will be important to have a clear and documented process for handling late payment and non-payment. This can include warnings, notices of disconnection, or collection of partial payments from customers. Any disconnection must comply with local laws and regulations which may need to be updated for the programme.

Data and IT management – It is important to monitor programme performance and evaluate the data coming out of the programme. Most utilities do not have



sophisticated data analytics platforms that can track energy audit results, customer registrations, payment information, loan portfolio quality, and customer satisfaction scores. Many of the successful OBF programmes in developed countries have brought in external experts to develop tailor-made data management and tracking services and loan management platforms. This will also be needed by most African utilities.

Billing systems – Billing systems will probably need to be upgraded for OBF programmes to comply with local regulations. Utilities may not be allowed to bill customers for energy management service fees or repayments on appliance loans. Programme administrators will need to work with regulators to change the billing systems, which could involve significant investment in billing hardware and software as well as new management processes.

PRICING VERSUS ASPIRATION

The price and aspirational nature of an appliance directly impacts the end user payment model adopted

The clean cooking market incorporates multiple technologies and business models and this is reflected in the wide range of end user payment models used. But why are biomass gasifiers not sold on cash & carry? Why have bioethanol stoves been successful with the layaway model? Why have e-cooking appliances not been sold widely on credit?

The answer partly lies in the pricing and aspirational nature of the appliances, as shown in Figure 1 below. An aspirational product is a term used in consumer marketing for a product which a large segment of the market wishes to own. Our research for this report resulted in a number of important findings:

- Products that are aspirational and relatively cheap, such as bioethanol stoves, have been successful with layaway schemes.

- Products that are aspirational but relatively expensive, such as EPCs, provide an opportunity for credit providers to expand the market.
- Products that are less aspirational but cheap, such as improved biomass stoves, are primarily sold through cash & carry.
- Products that are less aspirational but expensive, such as biomass gasifiers, are in a more difficult position and may need to offer long-term credit plans to acquire customers.
- Products that are aspirational can generally be sold through cash & carry or the layaway model. Consumer credit is less likely to be needed except for the high-value products.
- Other factors influencing the end user payment strategy include local regulations, the distribution strategy, the running costs, and the level of competition.

Below we examine the end user payment models for different clean cooking technologies. While the analysis is mainly based on Kenya, many of the findings are likely to be applicable to other countries in SSA.

In **e-cooking**, the majority of appliances in Kenya are sold through major supermarkets and other retail channels, either on a cash & carry basis (the standard approach) or through 3-month layaway savings schemes due to the aspirational nature of the products. Sales on credit and PAYGO distributor schemes will become more important in the future, but are likely to remain a relatively small part of total sales to middle and high-income customers.

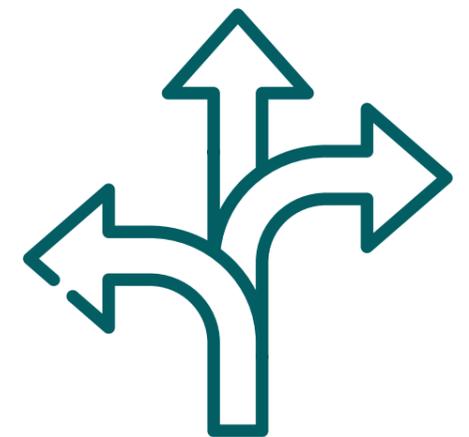
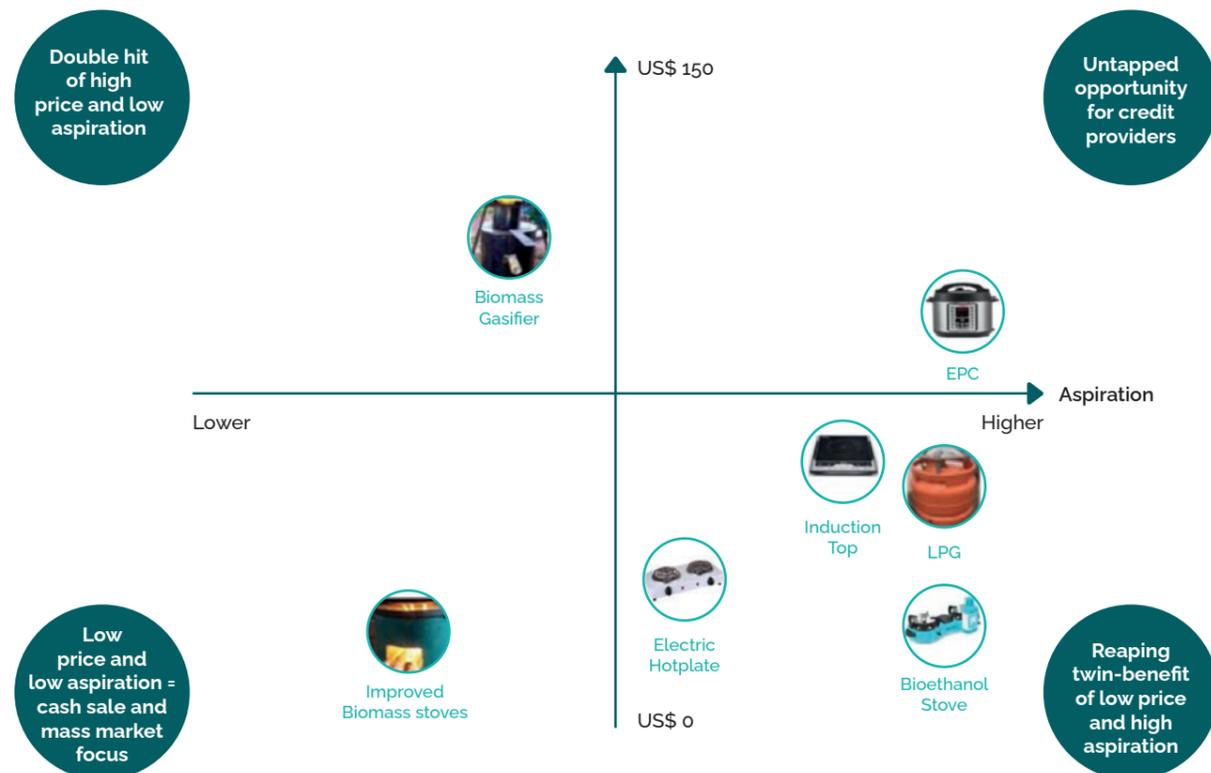
In **LPG**, the vast majority of connections are paid for by cash, mostly because the gas companies retain ownership of the cylinders which comprise a large part of the connection cost. Investment by the gas companies depends a lot on local regulations. For example, investments in Kenya have picked up in the last few years because all LPG refills are now supposed to be done using the cylinders

of a particular gas supplier (rather than the cylinders of any gas company which was the case before). While cash sales are likely to remain the norm, some gas companies are selling LPG on a PAYGO basis (see case studies of PayGo Energy and Circle Gas above), and some asset financiers such as Bidhaa Sasa have developed a scalable business offering loans for LPG cylinder deposits and connections.

In **biomass gasification**, the stoves are relatively expensive and lack the aspirational qualities of other similar or more cheaply priced cooking technologies such as LPG or ethanol. As a result, these stoves are usually sold on credit and often for little or no margin due to competition from other types of stoves. The success of this model depends on long-term, higher-margin sales of the fuel.

In **biogas**, the biodigesters are very expensive and are targeted at rural farm households, so the market for cash sales is limited. The future growth of biodigester companies is likely to depend on credit sales and the adoption of automated PAYGO systems.

Figure 1: Pricing and Aspirational Nature of Clean Cooking Appliances



THE CLEAN COOKING MARKET INCORPORATES MULTIPLE TECHNOLOGIES AND BUSINESS MODELS AND THIS IS REFLECTED IN THE WIDE RANGE OF END USER PAYMENT MODELS USED.

CALL TO ACTION

In this report, we have described new appliance financing models for clean cooking, including automated PAYGO systems and utility-based OBF solutions. In this section, we call on donors to take action to stimulate further growth in these areas:

- **Support the expansion of PAYGO solutions in the clean cooking sector.** Clean cooking companies have developed PAYGO solutions covering a wide range of appliances including EPCs, induction stoves, LPG cooking kits, ethanol stoves, biomass gasifiers, and biodigesters – see Table 3 above. Donors can play an important role in the scale-up of these solutions in the sector. Apart from facilitating payment collection, the smart meters often used for PAYGO can provide usage data that is relevant for reporting on impact metrics and for impact payments including carbon credits and other results-based financing schemes. We also encourage donors to support PAYGO pilots. Further research and testing is needed to optimise business models and develop technical solutions for different appliances.
- **Develop an e-cooking OBF programme with an African utility that has excess demand on their electricity grid.** Some utilities such as Zesco in Zambia are looking to reduce demand and load shedding by replacing inefficient e-cooking devices with more efficient ones such as EPCs. An OBF for energy efficient stoves could reduce consumer bills if the on-bill payments for the new stoves were less than the savings made by customers through reduced consumption of electricity.
- **Develop an online customer data platform with an African utility to help them improve their customer management and enable sharing of their customer data with distributors and financiers of electric appliances, including e-cooking devices.** Many power utilities in East Africa are keen to increase electricity sales, but are not ready to consider OBF programmes. Clean cooking companies are interested in growing sales and financing the most

creditworthy customers. Having access to a utility's customer records – for example, basic identification, historical consumption and payment history – would allow these companies to target better customers and de-risk their operations, while also increasing load on the utility's grid. Care would need to be taken to ensure no data protection rules were broken.

- **Set up a first loss concessionary debt facility with technical assistance (TA) to promote end user financing** in the clean cooking sector. Any organisation offering consumer credit could be eligible for the funds and TA. It will be important to collaborate and avoid replication with other clean cooking funding initiatives, notably the World Bank's Clean Cooking Fund and the Spark+ fund.
- **Set up a grant programme or first loss debt facility to help modern fuel cooking companies pilot e-cooking devices and raise awareness.** Many fuel companies see e-cooking as an attractive cross-selling opportunity for their existing customers and also an opportunity to expand impact by building a clean fuel stack. Donor funding could be used to support product development, test different business models and carry out end user surveys.
- **Extend the provision of small grants to test the business model for EPCs and other e-cooking devices with private mini-grids.** In many off-grid settings, there is a big gap between energy affordability and tariffs which needs to be addressed. It is important to consider both the perspective of the mini-grid operator which wants to increase sales of electricity and the mini-grid customer which is more driven by the ongoing cost and user-friendliness of e-cooking devices versus traditional wood and charcoal stoves. The grants could be used to test different EPC models, payment plans, and marketing campaigns, and to educate customers on efficient EPC usage and fuel stacking options.

- **Integrate clean cooking into clean energy programmes.** In the past, multilateral development banks and other large development finance institutions have tended to ignore the clean cooking sector due to the small size of the projects. Greater opportunities now exist for these organisations to integrate clean cooking into their clean energy programmes and in particular to use their lines of credit as a conduit for consumer finance to support end user appliance purchases.



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ABOUT ENERGY 4 IMPACT

Energy 4 Impact is a non-profit organisation that works to increase the quality of life for people in developing countries through access to energy, including clean cooking. We provide operational, financial and technical advice to accelerate the growth of private sector businesses that deliver energy access. For more information on our work, please refer to www.energy4impact.org.

ABOUT MECS

Modern Energy Cooking Services (MECS) is a five-year programme funded by UK aid which aims to spark a revolution through rapidly accelerating the transition from biomass to clean cooking on a global scale. By integrating modern energy cooking services into energy planning, MECS hopes to leverage investment in renewable energy (particularly in electricity access, both grid and off-grid) to address the clean cooking challenge. Modern energy cooking is tier 5 clean cooking, and therefore MECS also supports new innovations in other relevant cooking fuels such as biogas, LPG and ethanol. The intended outcome is a market-ready range of innovations (technology and business models) which lead to improved choices of affordable, reliable and sustainable modern energy cooking services for consumers. We seek to have the MECS principles adopted in the SDG 7.1 global tracking framework and hope that participating countries will incorporate modern energy cooking services in energy policies and planning.

