MECS
Modern Energy Cooking Services

“Solving the clean cooking challenge, promising business models on ecooking”

S Batchelor, MECS, Director

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Headlines and Targets

- **Global Energy Access Goals** – SDG7 AND Decarbonisation (Net Zero).
- SDG7 - ‘modern energy’, 7.1.1 electrification, 7.1.2 Clean cooking, 7.2 Renewables, 7.3 Energy efficiency.

- **Electrification** – significant gains during 2010 decade – **670m** not yet having access
- **Clean cooking** – not really keeping up with population growth – **3 billion** not yet having access to clean cooking, 4 billion not yet modern energy cooking (ESMAP, World Bank).
- However, by implication – over **2 billion** have electricity but still cook with polluting fuels. (Majority of these are in Asia)

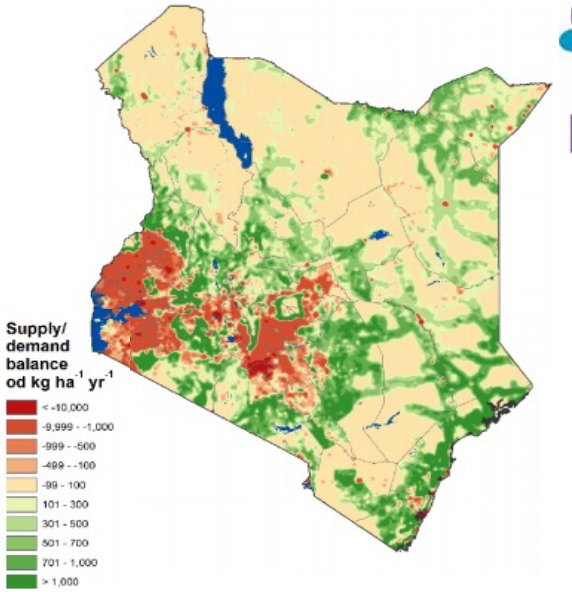
- ‘Mutual Neglect’ – clean cooking and electrification

The problem in context
(an example from Africa)

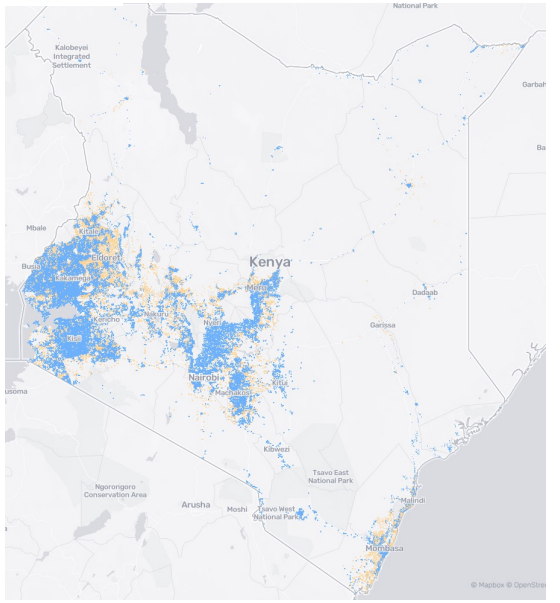
- Urbanisation – deforestation – example Kenya

- Kampala, Uganda: – 93% connected, Utility company profitable, has more than twice as much generation capacity than current peak demand, mainly renewable energy generation.
- And yet 65% households using charcoal for cooking.

- So would it be cost effective for those households?
- "*The increasing efficiency improvements in electric cooking technologies, could enable households to shift to electrical cooking at mass scale*." IPCC 2022
- Energy efficient appliances suited to cooking.

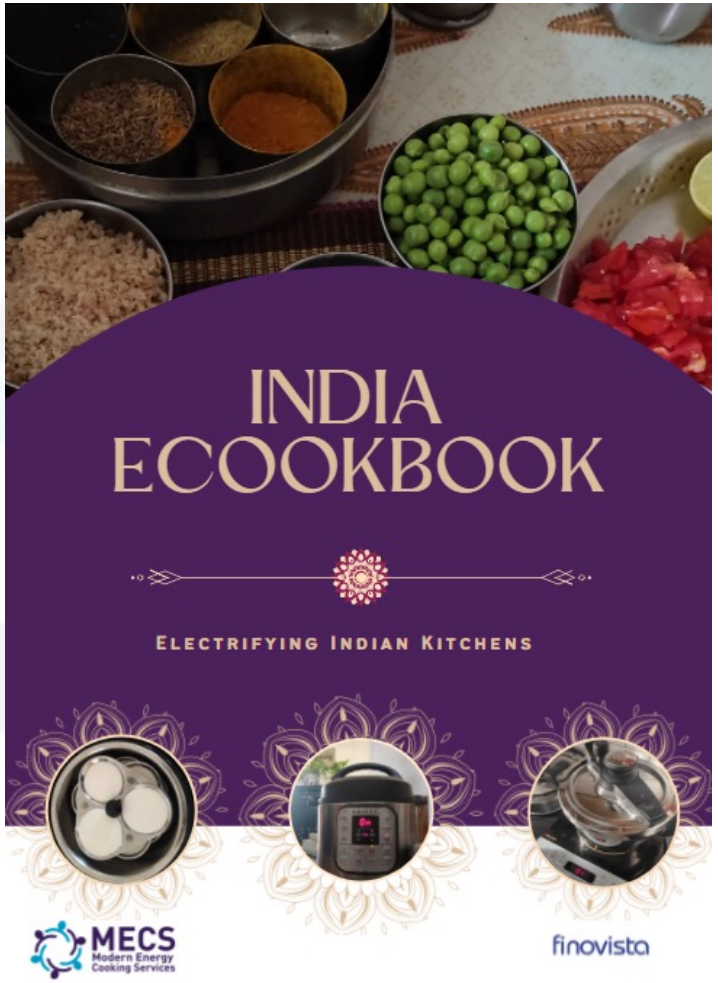


Kenya Non renewable biomass hotspots, Drigo et al 2015



Kenya Grid electrification (projected to 2025) World bank

Don’t mess with peoples food! Cooking is a daily activity



The Kitchen Laboratory experiments in this eCookBook compared Electric Pressure Cookers (EPCs) to induction with a conventional pressure cooker and showed that:

Most everyday Indian dishes can be cooked using an EPC

around **85%** of typical weekly menu can be cooked with an EPC

Indian households could make substantial cost savings

savings on pressure cooked, steamed & boiled dishes of up to:

40% vs. subsidised LPG + pressure cooker

60% vs. induction + pressure cooker

EPCs are extremely convenient allowing multi-tasking

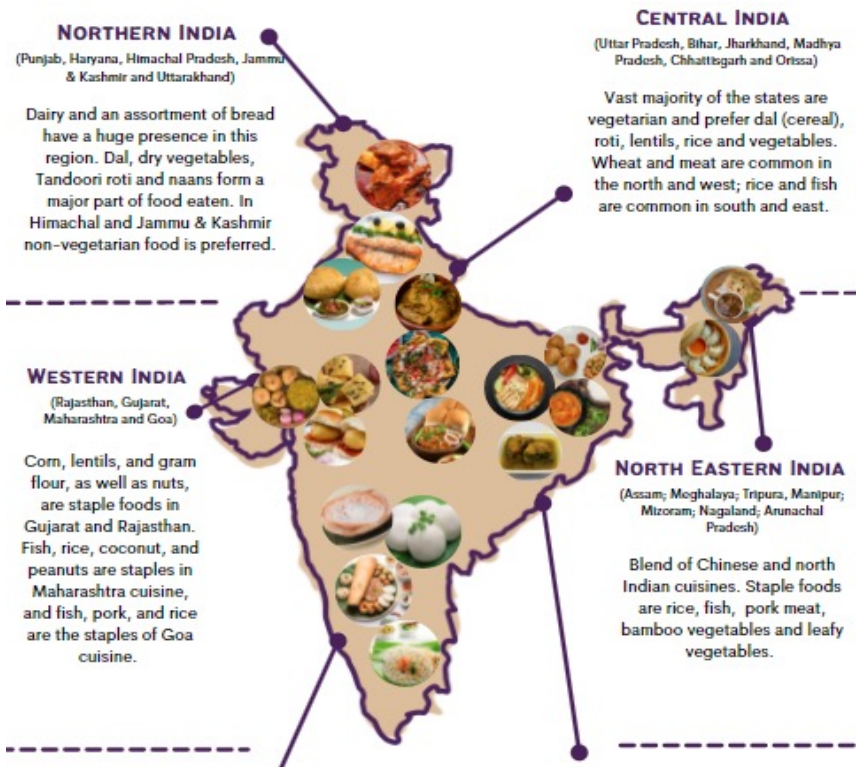
- **fully automated**
- **pre-set menus**
- **can be left unattended**

EPCs can achieve superior texture and flavour blends with dal

"Rajma Masala flavours blended well and the gravy had a thick consistent texture"

The evidence in this eCookBook shows that **an EPC can be a valuable complement to an Indian kitchen**. An EPC can very efficiently replace conventional pressure cookers, idli makers, steamers and rice cookers and other utensils partially and thus, **it is likely to be a valuable tool for the electrification of Indian kitchens.**

REGIONAL COOKING CULTURE



NORTHERN INDIA
(Punjab, Haryana, Himachal Pradesh, Jammu & Kashmir and Uttarakhand)

Dairy and an assortment of bread have a huge presence in this region. Dal, dry vegetables, Tandoori roti and naans form a major part of food eaten. In Himachal and Jammu & Kashmir non-vegetarian food is preferred.

CENTRAL INDIA
(Uttar Pradesh, Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh and Orissa)

Vast majority of the states are vegetarian and prefer dal (cereal), roti, lentils, rice and vegetables. Wheat and meat are common in the north and west; rice and fish are common in south and east.

WESTERN INDIA
(Rajasthan, Gujarat, Maharashtra and Goa)

Corn, lentils, and gram flour, as well as nuts, are staple foods in Gujarat and Rajasthan. Fish, rice, coconut, and peanuts are staples in Maharashtra cuisine, and fish, pork, and rice are the staples of Goa cuisine.

NORTH EASTERN INDIA
(Assam; Meghalaya; Tripura, Manipur; Mizoram; Nagaland; Arunachal Pradesh)

Blend of Chinese and north Indian cuisines. Staple foods are rice, fish, pork meat, bamboo vegetables and leafy vegetables.

SOUTHERN INDIA
(Andhra Pradesh, Tamil Nadu, Karnataka, Kerala)

In spite of variations across the states, the food is known for its spicy curries with rice as the major staple food. Seafood, spices and coconut products have a significant presence.

EASTERN INDIA
(West Bengal; Bihar; Jharkhand; Sikkim; Orisaa)

Contains significant amount of sweets, fish and other seafood. Use high amounts of spice. Staple foods are: rice, fish, vegetables and lentils. Various ethnic groups have their own distinct cuisines.

Affordability and energy efficiency

	Rice	Daal	Meat	Total(NPR)
LPG	3.36	6.09	4.34	13.78
Infrared	3	6.07	3.53	12.60
Induction	2.47	5.93	3.37	11.77
EPC	2.07	2.13	2.07	6.27
Firewood	3.44	4.41	5.45	13.29

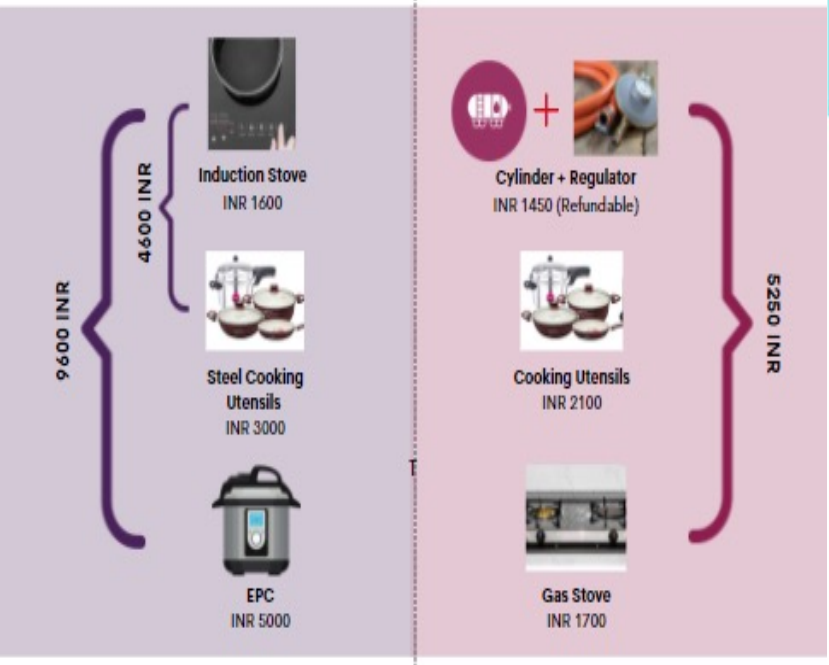
TYPICAL UPFRONT COSTS

ELECTRICITY VS. **LPG**

eCooking with induction has a **lower upfront cost** than LPG,

WHILE

the cost of induction cooking is **lower than unsubsidised LPG**, it is higher than subsidised LPG.



eCooking with Induction + EPC has a higher upfront cost than LPG,

HOWEVER

the cost of cooking with induction + EPC is **comparable to subsidised LPG.**

TYPICAL COSTS OF COOKING

ELECTRICITY VS. **LPG**

NITI Aayog: **1,022 kWh/yr** for family of 4 to cook all food with induction.[1]

@ 5 INR/kWh

Induction: **5110 INR/yr**

@ 5 INR/kWh

Induction + EPC[4]**: 3832 INR/yr**

Prices for 200-400 units[3]

NITI Aayog: **8 refills per year** for family of 4 to cook all food with LPG.

@ 899 INR/refill unsubsidised price

Unsubsidised LPG: **7192 INR/yr**

@ 450 INR/refill subsidised price

Subsidised LPG: 3600 INR/yr

Unsubsidised LPG prices are **steadily increasing**[2]

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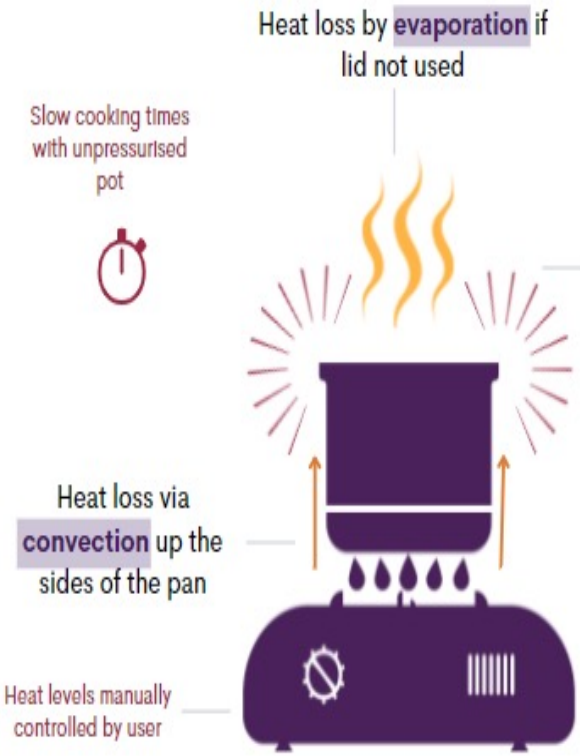
Conventional cooking techniques waste energy through a variety of mechanisms, creating opportunities for modern appliances to reduce energy consumption.

LOWER ENERGY CONSUMPTION = CHEAPER COOKING.



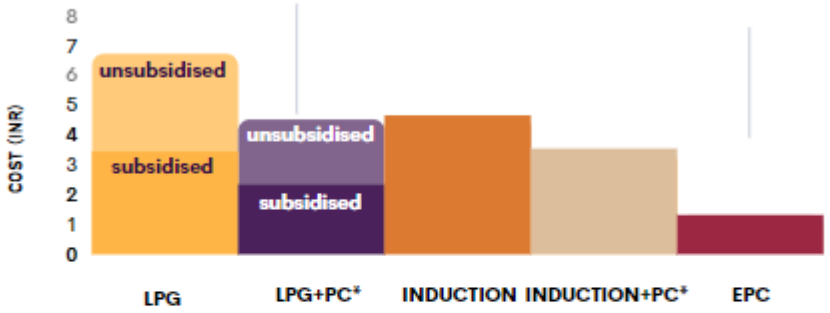
Cost & Energy - Rajma Masala

The EPC is the cheapest way to cook Rajma Masala. Unsubsidised LPG is the most expensive, however, using a pressure cooker can reduce the cost by around 25%. Induction is approximately 25% cheaper than LPG and similar savings are possible with the pressure cooker. Subsidised LPG is cheaper than induction, however, the EPC is the most energy-efficient and therefore more cost-effective because:

- the EPC is insulated so less heat escapes
- the EPC is fully automated, so it turns the heating element off as soon as it reaches pressure

40%

Cost saving with EPC vs LPG with pressure cooker



Best performer

EPC

60%

Cost saving with EPC vs induction with pressure cooker

*PC = Pressure Cooker

Rajma Masala

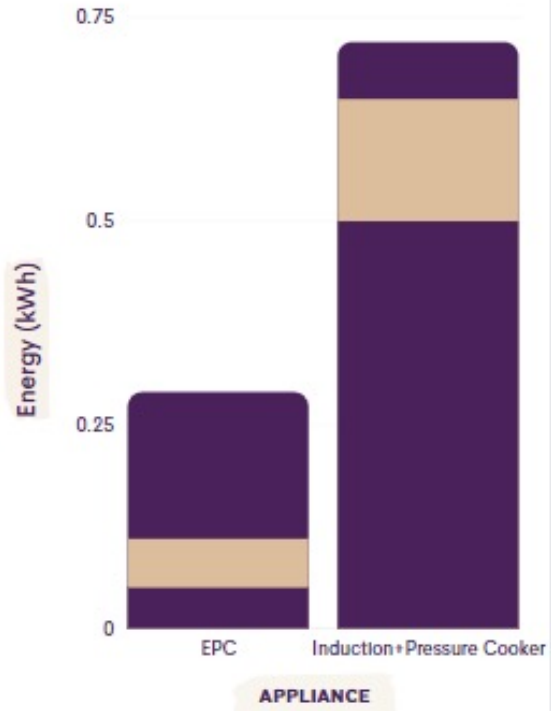
Energy Comparison

We tested cooking a Rajma Masala on an **electric pressure cooker (EPC)** and on an **induction stove with a pressure cooker**. The results showed the EPC was **more energy-efficient** and **60% cheaper** than the induction stove and pressure cooker. The induction stove, however, cooked the meal in less time than the EPC.

Device/Appliance	Time	Energy	Cost
EPC	64mins	0.29kWh	INR 1.45
Induction Stove + Pressure Cooker	55mins	0.72kWh	INR 3.60

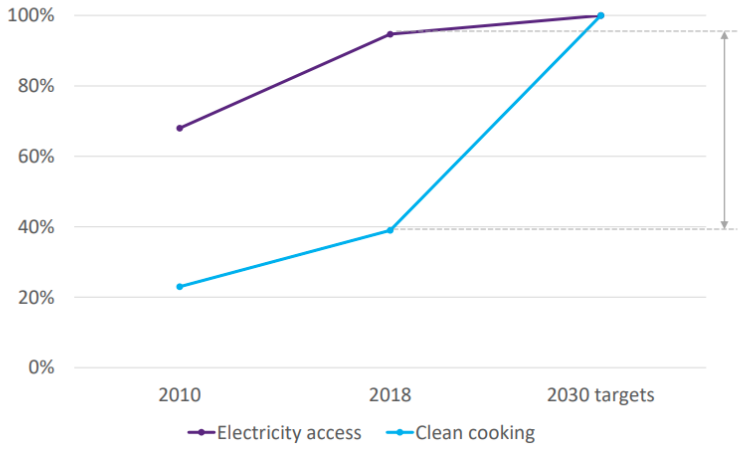
60%

cheaper using an EPC



Leveraging electricity for impact

Clean cooking and electricity access in Nepal



56% now connected to electricity, but still primarily cooking with polluting fuels

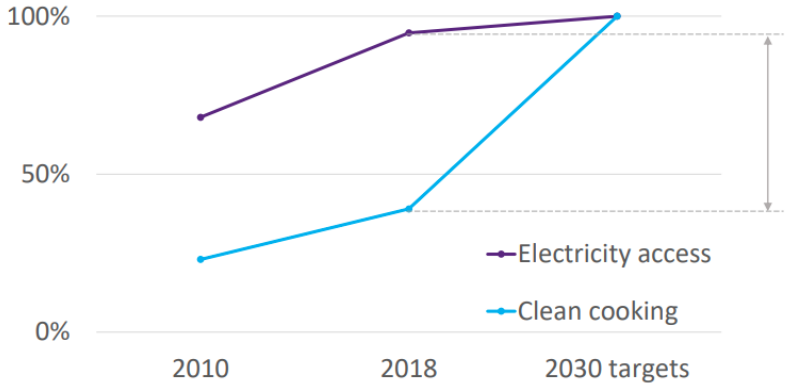
Potential impacts of scaled uptake in most viable market segment

If 40% of Nepal's grid-connected firewood users (2.7m ppl, 650,000 HHs) switched to eCooking, the WHO's BAR-HAP tool suggests that:

- 11,881 DALYs/yr avoided
- 1.8m tonnes/yr CO2eq emissions reduced
- 1m tonnes/yr reduction in unsustainable wood harvest
- 286m hrs/yr of women's time saved (438hrs/HH/yr)
- 6 months payback for eCooking appliances (80$/HH upfront cost, 165$/HH/yr savings on fuel energy costs)
- 571 GWh demand for electricity stimulated

- Health benefits include more than 700 lives saved per year.
- Some 12% of current unsustainable wood harvesting would be avoided.
- Nepal's electricity almost completely renewable, so greenhouse gas emissions from the cooking sector would reduce by >10%.
- Impacts may seem modest, but this scenario is targeting less than 10% of the total population.

Clean cooking and electricity access in Bangladesh



77% now connected to electricity, but still primarily cooking with polluting fuels

Potential impacts of scaled uptake in most viable market segment

If 40% of Bangladesh's grid-connected firewood users (25m ppl, 5m HHs) switched to eCooking, the WHO's BAR-HAP tool suggests that:

77,578 DALYs/yr avoided
12.7m tonnes/yr CO2eq emissions reduced
6m tonnes/yr reduction in unsustainable wood harvest
1,640m hrs/yr of women's time saved (329hrs/HH/yr)
12 months payback for eCooking appliances ($80/HH upfront cost, $73/HH/yr savings on fuel energy costs – assuming the firewood purchasers transition, rather than collectors)
3,277 GWh demand for electricity stimulated

- Electricity prices are low and firewood prices relatively high.
- If govt implemented, would cost $147/HH for equipment and programme costs, but would save HHs several times that in reduced energy bills over the ten years.
- 21% of current unsustainable wood harvesting would be avoided and greenhouse gas emissions from the national cooking sector would reduce by more than 22%.
- Power generation mix is almost 100% fossil fuel, but natural gas dominates and most firewood is assumed to come from unsustainable sources.

Integrated energy planning (SE4All)

Expansion opportunity for clean cooking solutions in Nigeria in 2030, No. of households

0-25 25-50 50-100 >100 Clean cooking Unpopulated

LPG

E-cooking

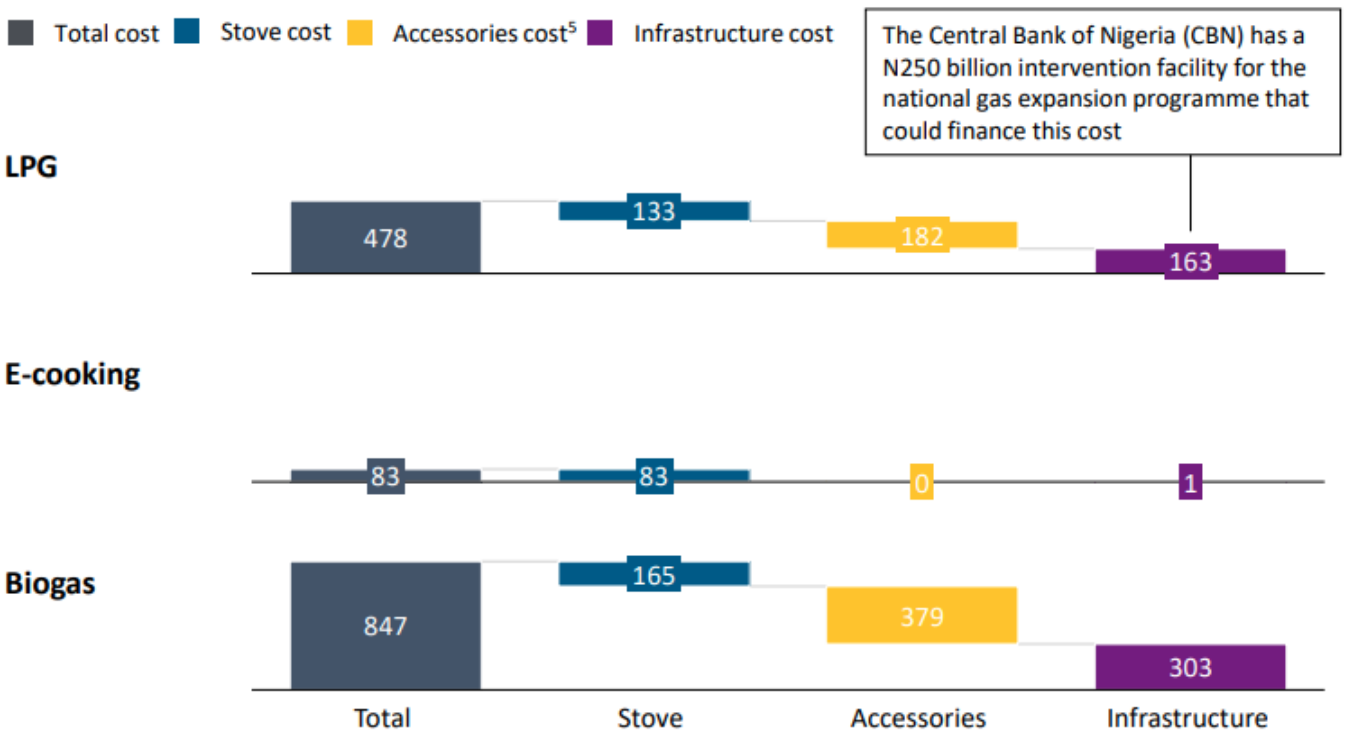
Biogas

	Rural	Urban	Total
Households access-constrained from CC[1]	23.6 Mn	13.1 Mn	36.6 Mn
Households with LPG opportunity	1.5 Mn	2.2 Mn	3.7 Mn
Households with e-cooking opportunity	1.3 Mn	2.1 Mn	3.5 Mn
Households with biogas opportunity	2.0 Mn	2.3 Mn	4.3 Mn

Investment required to realise clean cooking opportunity in Nigeria in 2030[1], USD Mn

Total cost Stove cost Accessories cost[5] Infrastructure cost

The Central Bank of Nigeria (CBN) has a N250 billion intervention facility for the national gas expansion programme that could finance this cost



Finance options - Upfront costs (Tool)

- **Credit facilities** – not yet aware, focus on productive use, yet it saves households expenditure on polluting fuels.
- **Pay as You go** – proven in solar, beginning to apply to electric based cooking
- **Utility led finance** – on bill financing, similar to Mobile Phones.

If we don't…..

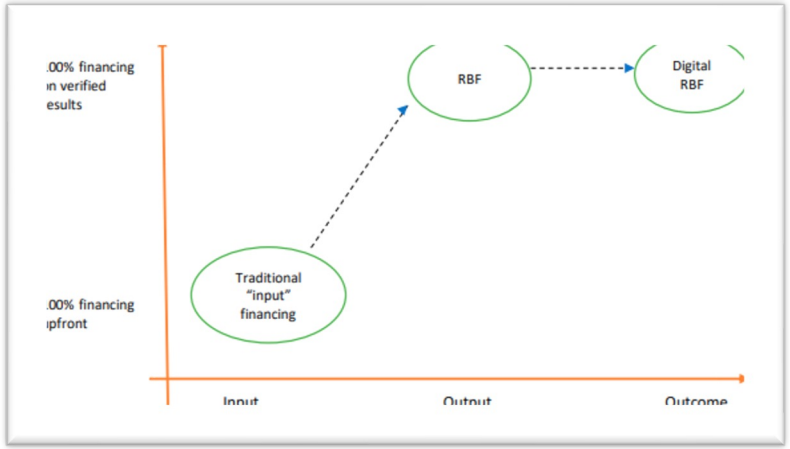
The State of Access to Modern Energy Cooking Services, ESMAP 2020

Finance options – Ongoing costs Fuel (and tool)

- **Lifeline Tariffs** – example Uganda cooking tariff
- **Carbon finance** – metered supplies, mean actual use verification
- **Results Based Finance** – co benefit verification

- More profit for the utility – more upgrading of their infrastructure

ERA ELECTRICITY REGULATORY AUTHORITY



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Solving the Clean Cooking Challenge:

Promising Business Models

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