EnDev Learning & Innovation Agenda

Cooking Energy webinar series 2022

Exploring the Market for e-cooking: Insights from sub-Saharan Africa and South Asia

15.2.2022

eCooking Market Assessments

Endev/MECS Webinar - 15th February 2022

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EnDev Country Teams
MECS Country Teams

Overview

- Introduction
  - Why eCooking?
  - Why Market Assessments?
  - Approach
    - Framework for analysis
    - Impact modelling
- National level market outlook
- Emerging trends
  - Recommendations for strategic interventions
- Key takeaways

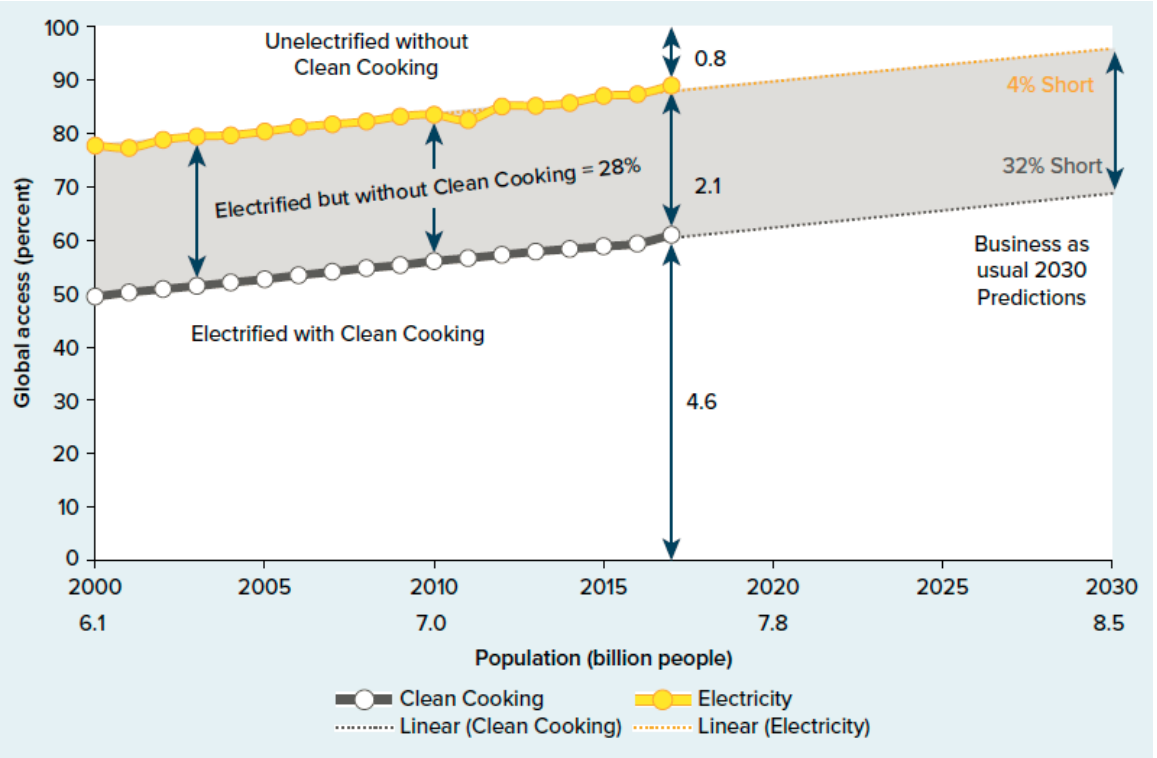
Introduction

Modern Energy Cooking Services (MECS)

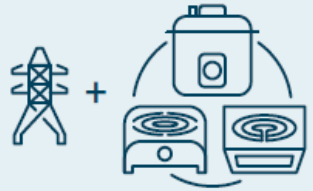
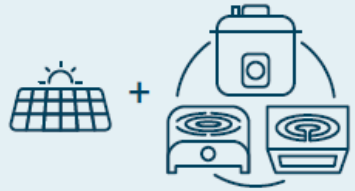
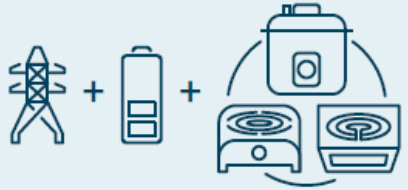
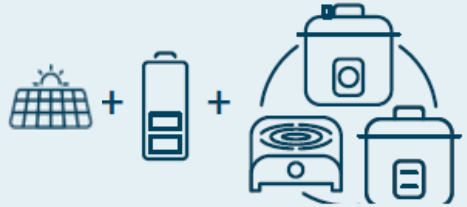
- 5 year £40m UK-govt. funded research & innovation programme
- Designed to enable the 3 billion people who still cook with biomass to transition to cooking with modern energy
- Variety of mechanisms, inc.
  - innovation challenge funds
  - country partnerships
  - WB partnership
  - thematic workstreams
- Changing the narrative in the clean cooking and electrification sectors by integrating cooking into the planning and implementation for modern energy
- Range of modern energy cooking technologies in scope (ESMAP, 2020), but big focus on eCooking

Why eCooking?

- Leverage the progress in electrification to drive forward the clean cooking agenda
  - Increasing access, reliability, high RE shares
- Broad range of energy-efficient appliances
  - Aspirational nature connects with broader trends – urbanization, modernisation



Why eCooking?

USE OF BATTERY	GRID OR MINI GRID	SOLAR HOME SYSTEM
Without battery	**Strong grid** AC grid eCooking 	**Off-grid** DC solar eCooking 
Battery-supported	**Weak grid** DC grid battery-powered eCooking 	**Off-grid** DC solar battery–powered eCooking 

- New business models & technologies that can:
  - break down the high upfront cost
  - deliver eCooking services to HHs with strong or weak grid connections or in off-grid areas

EnDev/MECS eCooking Market Assessments

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

MECS Modern Energy Cooking Services

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Approach

Framework for analysis

- Desk study collating findings from existing studies & drawing upon knowledge & expertise of local EnDev/MECS teams
- Guiding research questions
  - *What is the market potential for eCooking in this country?*
  - *What are the key opportunities & challenges for piloting or scaling up eCooking in this country?*
- 3 dimensions
  - Enabling environment – inc. integrated policy analysis
  - Consumer demand – inc. culinary compatibility analysis
  - Supply chain – inc. relative cost & import data analysis

Impact modelling

- WHO *Benefits of Action to Reduce Household Air Pollution* (BAR-HAP)
  - Scenario modelling of impacts of transitions in cooking fuels/technologies
  - Databases of demographics, population health, current cooking methods and national energy systems for LMICs, and technical assumptions for traditional & clean cooking options, inc. eCooking.
  - Impacts include costs and changes in subsidies (to the consumer, to government and to other funders etc); health benefits; climate and other environmental impacts; reduction in use of non-renewable biomass; and reductions in time spent gathering fuel.
- Identified a key target market segment in each country for biomass -> eCooking
  - modelled impacts if roughly 40% of each segment transitioned (aligned with MECS 40, 60 by 2030 goal)

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National level market outlooks

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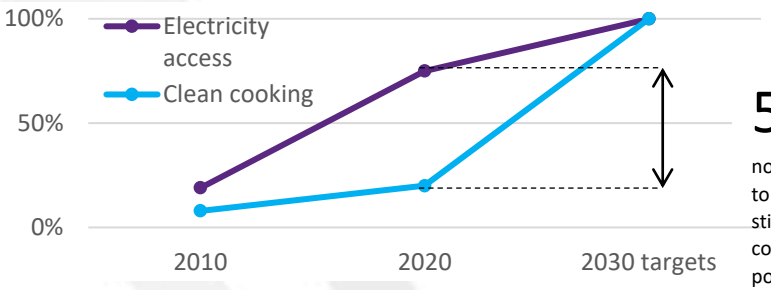
Kenya



55%

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

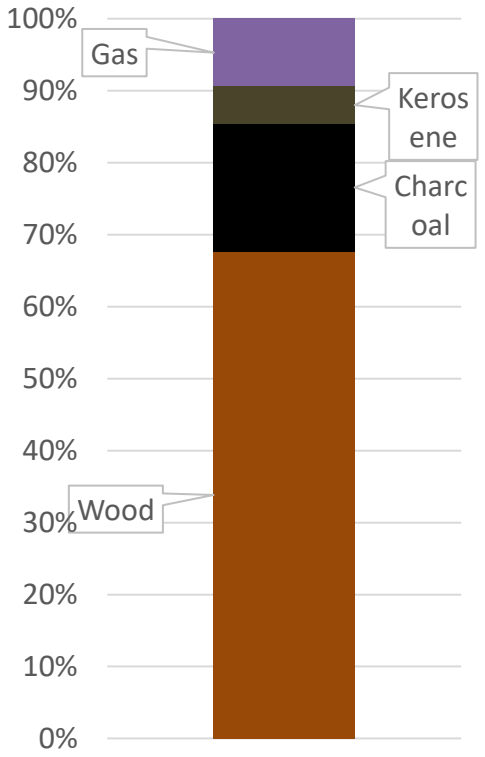
Kenya: Summary

- **Hotbed for innovation** in the development sector - **birthplace of mobile money.**
- Many **new MECS eCooking technologies & business models piloted in Kenya**
  - strong ecosystem of actors & enabling environments in converging clean cooking & electrification sectors.
- **Enormous progress on electrification -** 19% to 75% in just 10 years
  - majority of **grid electricity renewable**, mainly geothermal & hydro
- **91% still rely on polluting fuels** such as firewood, charcoal and kerosene for cooking.
- **0% use electricity as primary cooking fuel**
  - **enormous untapped potential for eCooking**
  - increasingly drawing interest from govt., consumers & private sector.

Kenya's clean cooking challenge

- Majority of the population still relies on polluting fuels GoK (2019):
  - IAP: 21,560 deaths/yr
  - Forest degradation: 8-11Mton/yr. woody biomass lost
  - Climate change: 13.6 MtCO2e/yr emitted
- Women & girls disproportionately affected:
  - greater exposure to cooking smoke
  - drudgery of collecting fuel & lighting/tending fires - missed educational/economic opportunities.
- ICS heavily promoted, but sustainable uptake challenging (GoK, 2020).
- LPG already aspirational fuel for many
- Electricity commonly perceived as 'too expensive for cooking', even though clean fuel stacks (LPG & EPC) often the most cost-effective solution (ESMAP, 2020)
- Policy makers identified need for integrated planning, but framework not yet in place

0% cook primarily with electricity



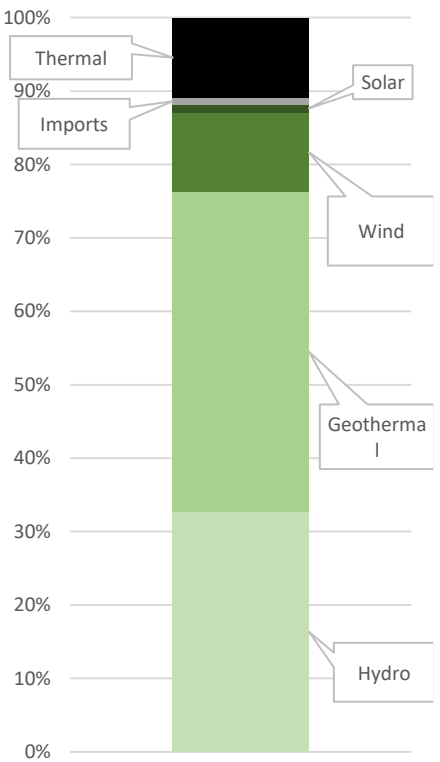
22% cook primarily with commercialized polluting fuels (charcoal & kerosene)

91% cook primarily with polluting fuels

The opportunity for eCooking in Kenya

- eCooking = transformative opportunity to break out of the ‘business as usual cycle’.
- 0% use electricity as primary cooking fuel
  - enormous untapped potential - 75% now connected, but not yet using for cooking
- EPC highly compatible with popular ‘heavy foods’
- Kenya Power stimulating demand for its almost exclusively renewable electricity
  - Last Mile Electrification Programme connected many new customers with very low demand
- Rich history of progress in the energy sector:
  - market leader for SHS sales in SSA
  - modern energy cooking technologies (e.g. LPG) already widely adopted
  - groundwork laid for goal of achieving universal energy access ahead of 2030 SDG targets, by leveraging progress in electrification to drive forward the clean cooking agenda.

89% renewable



45% surplus power generation

High reliability: 99% power availability (SAIDI*SAIFI=83hrs/yr)

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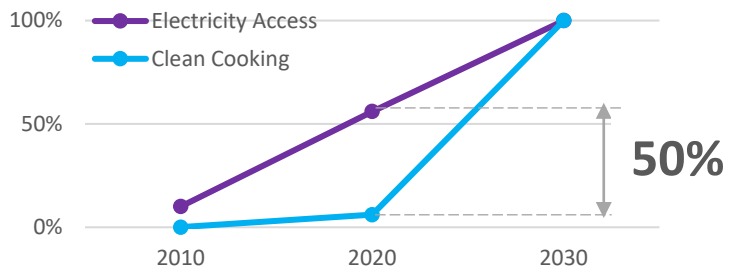
Rwanda



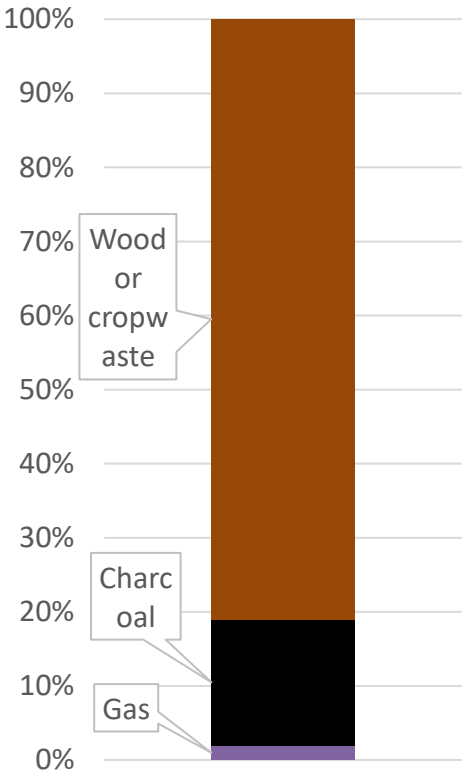
Rwanda: Summary

- **Strong economic growth** in last decade, creating favourable environment for new businesses and lifting people out of poverty.
- GoR actively driving economic development & financial/business sector reforms
  - **139 to 38 on World Bank Doing Business Report** between 2010 & 2016
- Rapid progress on **electrification: 10% in 2010 to 67% in 2021**
  - Generation capacity currently **236 MW**
  - 11% imported, 51% hydro, 43% thermal, 5% solar
- Most still rely on polluting fuels, e.g. **firewood/charcoal,** for cooking
  - 0% use electricity as primary cooking fuel
- **Rwandan cuisine compatible with energy-efficient appliances**, such as Electric Pressure Cookers (EPCs) & rice cookers
- **Interest expressed by GoR & private sector**, but currently in early stages.

The clean cooking challenge

- At **85%**, biomass energy is most important source of energy in Rwanda.
  - **Households use 91% of biomass** (industry (4%), non-energy (2%), commercial & public sectors (2%).
- **Reducing reliance on firewood** is a **priority for GoR** to improve health, increase economic opportunities by reducing time spent collecting and preserve forests.
- **Women & girls are disproportionately affected.**
- Historically ICS (for firewood, as well as pellets and briquettes) heavily promoted
  - **Sustainable uptake** of efficient cooking fuels & techs **= major challenge**
  - Currently, **LPG promoted for urban centres & ICS for rural areas**.
- LPG actively aspirational fuel for many, but recent fluctuations in prices due to international market volatility pushing many back to biomass
- Low income, particularly in rural areas (GDP per capita in 2020 estimated at $816)
- Electricity commonly perceived as 'too expensive for cooking' and changing the taste of certain foods
- Relatively high tariff (RWF255 (~$0.25) for users <100kWh per month)
- Low awareness of eCooking & low availability of efficient appliances

0% cook primarily with electricity



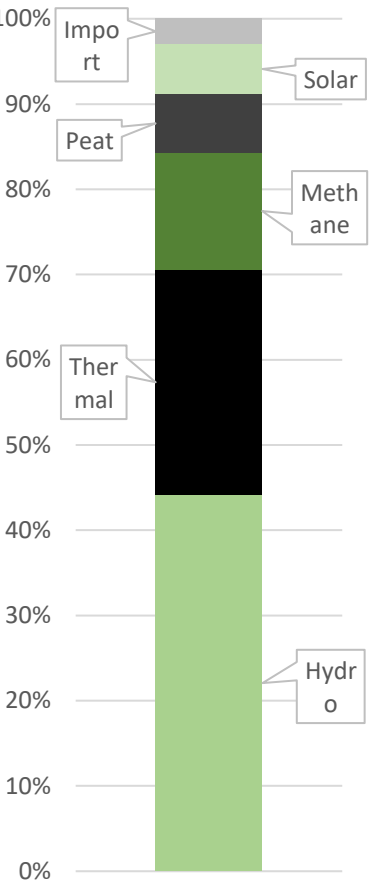
17% cook primarily with commercialized polluting fuels (charcoal)

98% cook primarily with polluting fuels

The opportunity for eCooking in Rwanda

- GoR:
  - reduce biomass use **from 83%** in 2017 **to 42% by 2024**
    - Includes LPG, biogas, **electricity** and ICS
  - universal clean cooking access by 2030
  - NDC: modern efficient cook stoves to 80% rural & 50% urban by 2030.
- **High urban access** to electricity (>90%) and reliable supply.
- **Increased private sector interest** in eCooking for both on- and off-grid contexts
  - Several eCooking pilots and studies, e.g. E4I & MECS, Electrocook & ARC Power.
- **Inclusion of eCooking** in the largest Clean Cooking RBF to date.
- EPC largely compatible with popular 'heavy foods'.
- **Strong ecosystem for innovation** and political will for change.

~57% renewable



~80MW surplus power generation

High reliability: SAIDI*SAIFI = 29hrs/year

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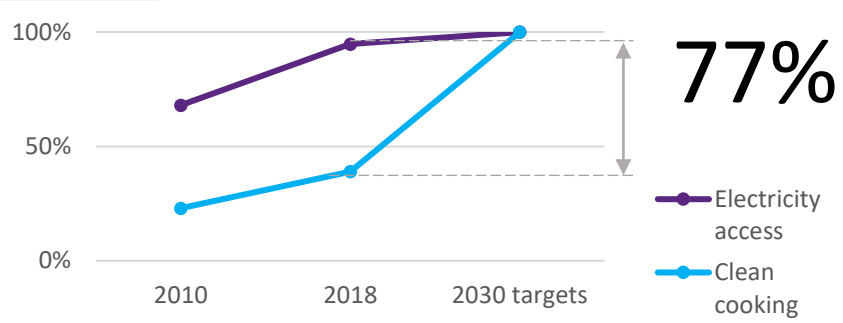
Bangladesh



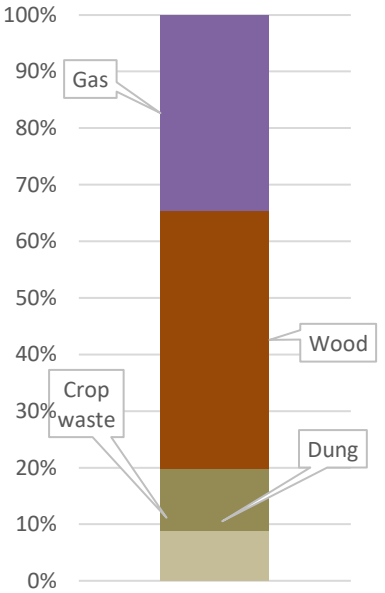
Bangladesh: Summary

- Became a lower-middle-income country in 2015
- One of the most densely populated countries in the world, with over **160 million people**.
- Rapid progress towards universal electrification - **99% now connected**.
  - **Grid electricity** very **cheap**, but still **unreliable**. Despite surplus electricity on the grid as a whole, several regions still experience load shedding
  - Only **2% renewable**
  - World leading **mini-grid & off-grid sectors**
- **77% still lack access to clean cooking, yet it is not prioritised** by the national government and doesn't connect with electrification policy.
  - **Biomass remains a popular,** especially in rural areas.
- Gas (both PNG & LPG) already widely adopted
- **eCooking gaining in popularity**, but mainly as a complimentary rather than primary cooking option.

The clean cooking challenge in Bangladesh

- Clean cooking – and eCooking specifically – not supported at policy level
  - popular opinion that eCooking would overload existing power lines and require more generation;
- Lowest access to clean cooking fuels & techs in SE Asia with around 77% of the population lacking access.
  - Bangladeshi people hesitant due to socio-cultural perceptions, lack of awareness & affordability concerns.
- Fuel stacking common with ~75% stacking firewood with other biomass fuels.
- Highly vulnerable to climate change & 50% of wood fuel harvested unsustainably.
- Low existing use and awareness of electric cooking;
  - Prevalence of low-quality eCooking appliances & lack of after sales service
  - Policy interventions needed for product standardization & labelling

0% cook primarily with electricity



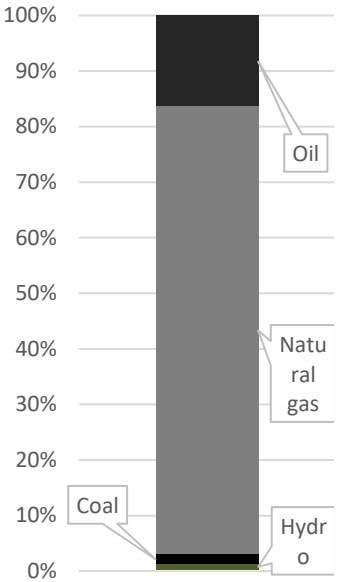
0% cook primarily with commercialized polluting fuels

66% cook primarily with polluting fuels

The opportunity for eCooking in Bangladesh

- **Sustainable and Renewable Energy Development Authority (SREDA)** currently updating **National Country Action Plan for Clean Cooking (2020-2030)**
  - **Aims to achieve 100% clean cooking** by **2030**
  - **eCooking accounts for 8%**
- Local companies committed to **addressing poor perceptions** of eCooking appliance sector by reducing prices and increasing accessibility
- MECS research by UIU found the **cost of eCooking for a family of 6 is lower** than LPG & firewood: BDT 600 (GBP 5.45) vs BDT 800 (GBP 7.27) per month.
- Additional research showed that if it is possible to implement **low-cost integration of PV in households**, monthly **costs could reduce** to BDT 350 (GBP 3.25).
- Recent expansion of national grid & generation capacity will have negative economic impact on utilities if consumption does not increase.

1.5% renewable



40-45% surplus power generation

Variable Reliability: Across 17 districts, users face load shedding between 1-8 hrs p/day

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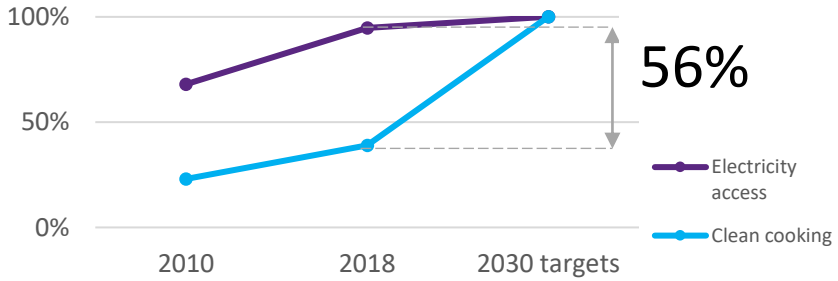
Nepal



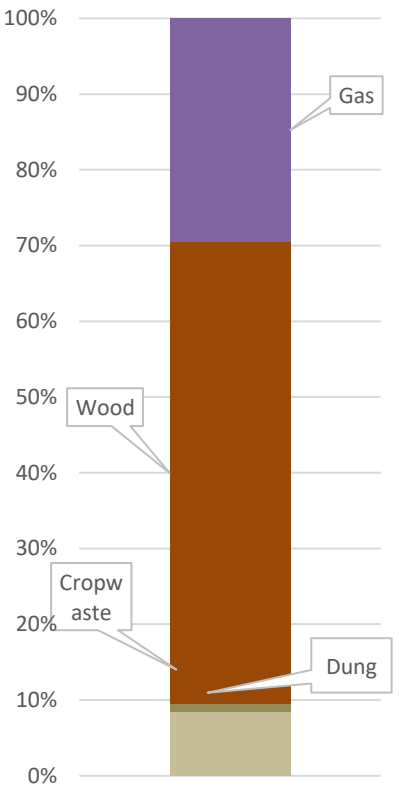
Nepal: Summary

- GoN has adopted an **integrated electrification-clean cooking approach**
  - 2020 NDC target of 25% using electricity as primary mode of cooking by 2030
  - dedicated eCooking tariff already deployed.
- Massive strides in electrification - **95%** current access
  - **72% grid-connected** & **23% off-grid**
  - GoN announced 2018-2028 as Decade of Energy & Hydropower to realize the dream of 'Prosperous Nepal, Happy Nepali' – **aimed to provide universal electricity access by 2022**.
- **52%** rely on **firewood** for cooking
- **Currently 0.4% use electricity as primary cooking fuel**
- Increasing investment in **renewable generation capacity** & expected **surplus capacity** means that **eCooking is a viable option** (& will become increasingly so), particularly for the grid-connected.
- In 2020/21, the GoN's AEPC aimed to promote eCooking in 100,000 HHs & NEA launched a dedicated eCooking tariff.

The clean cooking challenge in Nepal

- <1% primarily cook with electricity
- HHss continue to rely heavily on freely available solid biomass (firewood, cow dung, plant residue) as a cooking fuel.
- Clean energy sources such as LPG & electricity perceived as expensive
  - especially in comparison to freely available fuelwood or cheaper agricultural residue.
- Issues around the unavailability of after sales services (repair and maintenance) persist
- Despite near universal access to electricity, quality and reliability of supply remain key issues
  - Installed capacity of the grid currently insufficient to support large scale uptake

0.4% cook primarily with electricity



0% cook primarily with commercialized polluting fuels

The opportunity for eCooking in Nepal

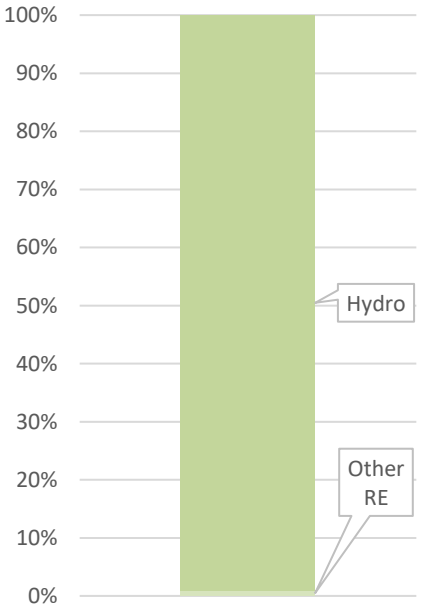
- GoN has 2020 NDC target of 25% using electricity as a primary mode of cooking by 2030.
  - Main driver = switching LPG users (33%) to eCooking.
- The GoN MoEWRI "*Current Status and the Roadmap for the Future*" White Paper, the 15th Plan Approach paper (2019/20-2023/24) and the Clean Cooking Solution for All (CCS4ALL) made provision for eCooking in the long-term vision of AEPC.
- The 15th Plan Approach is a five-year plan with the dual aim:

  (1) smokeless kitchens with suitable electricity tariffs for e-cooking;

  (2) standards and efficiency of electric cookstoves to be established prior to household dissemination.
- Recently (October 2021), the ERC reduced the tariff for HHs consuming >150 units to increase power consumption and reduce wastage by encouraging the use of electric ovens (& other eCooking appliances)
  - However, this disincentivises low-income households from adopting eCcooking
- Most mini-grid systems hydro powered - more appropriate than solar for electric cooking
- Large body of past/ongoing research

100%

renewable



200-600MW per day surplus power generation

Variable Reliability: **47.4%** hh receive almost 24 hours supply; **5%** hh have **8-16 hrs** p/day, whilst **47.7%** receive **16-23 hrs** p/day.

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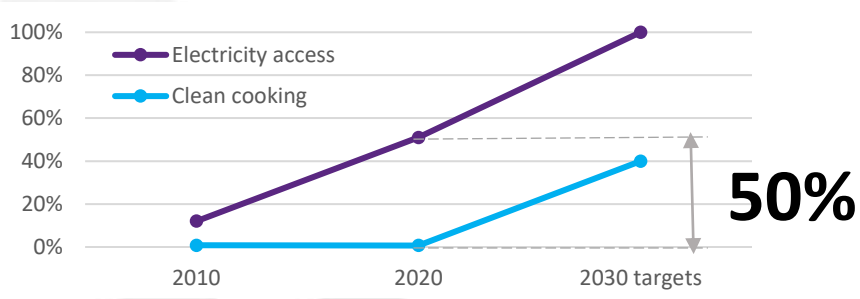
Uganda



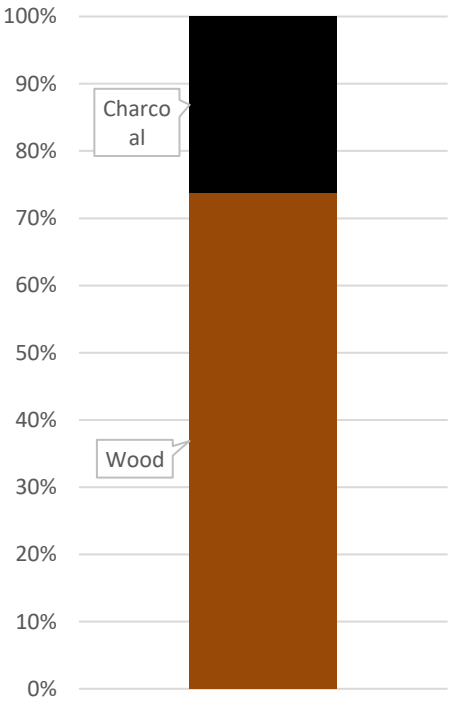
Uganda: Summary

- Despite historically **low electrification rates**, eCooking is becoming an increasingly viable & scalable option
- **24%** now have grid access & **27% off-grid access (e.g. SHS)**
- **Significant investment in generation capacity** has helped mitigate against hydropower dependency
  - significant, drought-induced load shedding and power outages in 2005
  - total installed generation capacity doubled from 600 to 1200 MW from 2010 to 2019
  - **Now surplus of almost double demand** & utilities are proactively stimulating demand for predominantly renewable (92%) electricity.
- **21% use charcoal as primary cooking fuel,** however intensive charcoal production is depleting forests & the population is set to double by 2050.
- As a result, the GoU has put in place an array of policies and **targets to facilitate the transition away from biomass**
  - incl. *Draft Energy Policy (2019)*, which made specific mention of energy-efficient eCooking appliances.

The clean cooking challenge in Uganda

- The vast majority of Ugandan households use either firewood (73%) or charcoal (21%) as primary cooking fuel (AEPL,2021).
- Intensive charcoal production is depleting forests & the population is set to double by 2050.
- Currently only 1.4% use electricity and alternative non-biomass fuels such as LPG as their primary cooking fuel.
  - In urban areas, 4% use electricity as primary cooking fuel (6% in Kampala), yet 74% of have access to electricity (Uganda Bureau of Statistics, 2021)
- Military, state and business elite involvement in charcoal production creates a disincentive for top-down strategies for clean fuel adoption.
- There is a perception that electricity is too expensive for cooking that is deeply embedded in society
  - Limited lifeline allowance cause affordability issues for some consumers

0% cook primarily with electricity



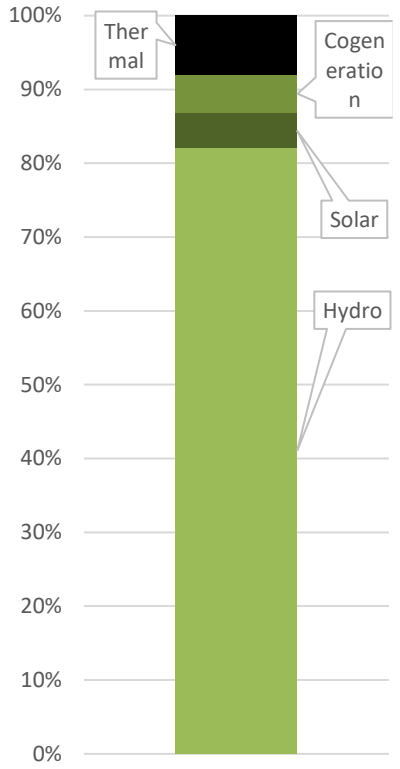
26% cook primarily with **commercialized** polluting fuels (charcoal)

100% cook primarily with polluting fuels (charcoal & firewood)

The opportunity for eCooking in Uganda

- Electrification & generation capacity continue to accelerate rapidly
  - Total installed generation capacity doubled from 600 MW to 1200 MW between 2010 and 2019.
  - electricity mainly from large hydropower (68%) and mini-hydro (16%) - thermal, cogeneration, and grid-connected solar now account for the rest (ERA, 2020)
  - significant investment in generation capacity to mitigate dependency on hydropower
  - in 2005 electricity demand was double supply, but today Uganda produces an electricity surplus of almost double current demand of 680MW (AEPL, 2020)
  - the major electric utility, Umeme, is proactively seeking ways to boost household demand, inc. eCooking
- Sizeable and well-financed SHS sector which may lay the foundations for a future profitable business model for off-grid eCooking solutions.
- Energy efficient appliances are highly compatible with Ugandan cuisine, in particular the EPC, which can drastically reduce energy consumption for the most energy intensive dishes (heavy foods).
- Policy environment starting to integrate clean cooking and electricity access, e.g. in the NDPIII.

92% renewable



76% (520MW) surplus power generation

Increasing reliability: 65%

power availability (SAIDI*SAIFI=3,072hrs/yr)

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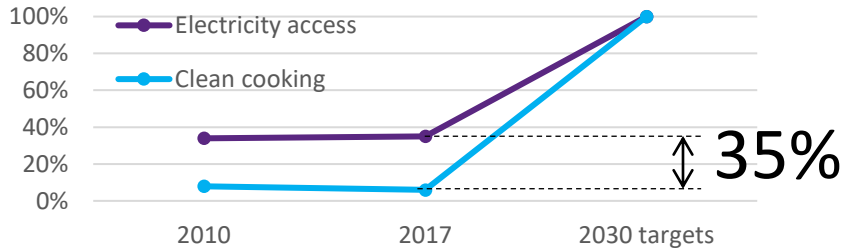
Benin



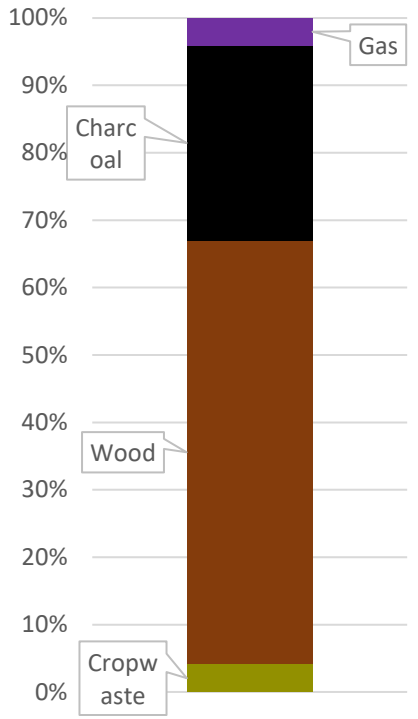
Benin: Summary

- 41% electrified & 6% clean cooking access, meaning that **35% now have access to electricity, but are still cooking with polluting fuels**
- Clean cooking addressed by some **programmes**, but **focused on ICS**
- **Significant potential for the uptake of e-cooking** among **urban, middle-class households**
- Beninese **consumers seem very interested** in modern energy cooking, inc. eCooking
  - Beninese cuisine seems broadly compatible with energy-efficient appliances, such as EPCs
- **Comparatively high price of electricity per kWh** versus price of charcoal
- Frequent power outages
- **eCooking supply-chain** at **nascent stage**
  - support for local supply-chain management & business-model development for SMEs & consumer awareness campaigns could accelerate the uptake of eCooking in urban areas

The clean cooking challenge in Benin

- Vast majority (94%) still rely on polluting fuels such as firewood and charcoal
  - ~5,000 deaths/yr caused by IAP annually
  - case rate of around 156 per 100,000 people - one of the highest in the world*
- Woodfuel consumption of 3,085 kton/yr leading to high rates of deforestation:
  - forest cover dropped drastically by over 20% between 2005 & 2015
  - deforestation continues to be very high at 2.2% annually**
  - ~12 Mio tCO2e/yr emitted
- Women and girls disproportionately affected
- Historically, ICS have been promoted in Benin
- Limited availability of modern energy cooking fuels and appliances, inc. an underdeveloped supply-chain and business models
- Moderate electricity tariffs (0.24 USD/kWh) and cheap charcoal
- Low access to electricity (40% overall; 17% rural; 65% urban)
- Voltage variations & power-cuts are frequent
- Most grid electricity is imported fossil fuels (75-95%)

0% cook primarily with electricity



95% cook primarily with polluting fuels

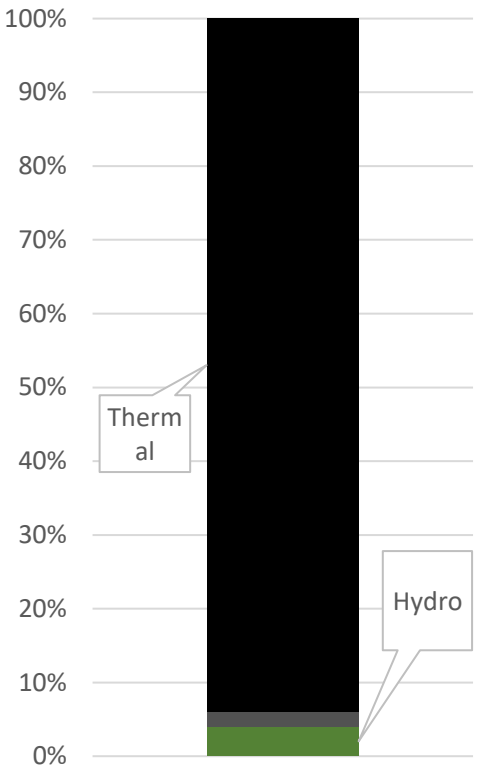
26% cook primarily with commercialised polluting fuels (charcoal)

*https://ourworldindata.org/indoor-air-pollution
**https://blogs.worldbank.org/nasikiliza/hidden-value-benins-forests

The opportunity for eCooking in Benin

- Rising charcoal prices & limited supply of firewood, especially in urban areas;
  - Forest-Protection efforts by GoB supported by WB to increase sustainable charcoal & firewood supply
- Infrastructure investment has reduced power cuts, especially in urban areas
- Cuisine includes many boiled foods, which are highly compatible with energy-efficient eCooking appliances
- Consumer priorities for selecting cooking devices align with modern eCooking appliance characteristics: cooking speed (32%), affordability (18%), no indoor pollution (13%)
- Annual GDP growth rates (5-6% annually) above SSA average
- Rising awareness amongst companies on consumer needs and awareness; some companies have started campaigning for e-cooking
- Established PAYGO models in the off-grid/SHS sector

94% fossil fuels; over 90% is imported



0% surplus power generation

Low reliability: avg. 28 blackouts/month

MECS
Modern Energy
Cooking Services

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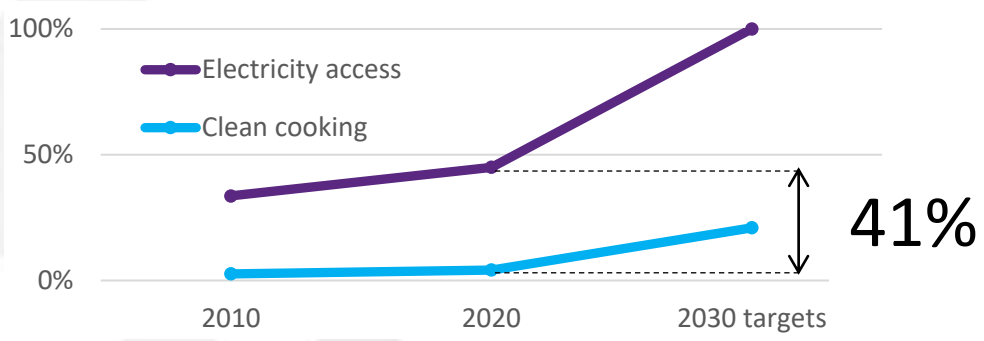
Ethiopia



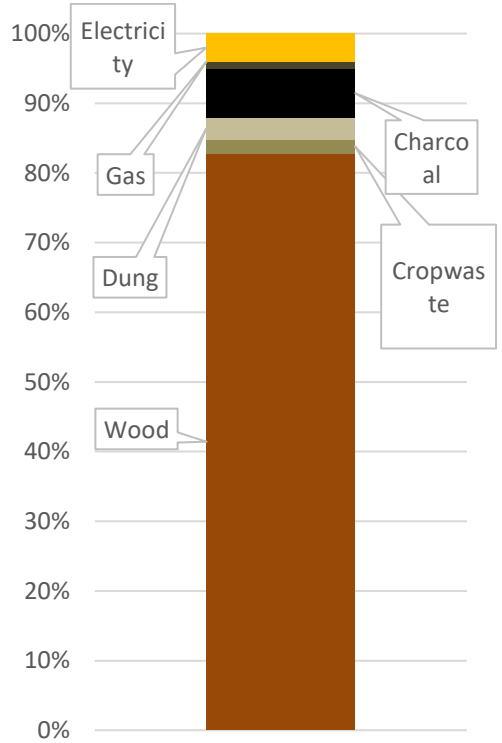
Ethiopia: Summary

- eCooking has been a feature of Ethiopian cooking practices since the 1970s when govt programmes promoted eCooking appliances (particularly electric injera stoves)
  - Motivations: create demand for surplus power & reduce environmental impacts of biomass consumption.
- The majority (96%) still rely on polluting fuels for cooking, with firewood most used (82%).
- Rapid increase in eCooking in urban areas over the last decade
  - very low Ethiopian electricity prices
  - ongoing support from government programmes for eCooking
  - 4.1% use electricity as their primary cooking fuel.
- Ambitious plans to increase electricity access from 45% to 100% by 2025 offer further opportunities for eCooking
- To increase uptake & unlock the potential for eCooking in Ethiopia, measures are required to:
  - address electricity coverage and reliability issues
  - policy needs to better integrate electrification and clean cooking
  - Improved access to finance/payment plans could increase the affordability of eCooking appliances

The clean cooking challenge in Ethiopia

- Majority (96%) still rely on polluting fuels for cooking
  - firewood predominant as primary cooking fuel for 82%
  - 63,000 deaths/yr from HAP
  - impacts disproportionately affect women and girls.
  - deforestation & environmental degradation also major issues
- Declining availability and increasing price of biomass and LPG
- Despite the low electricity tariff, the affordability of eCooking appliances is a challenge & firewood is freely available in most rural areas.
- Unreliable grid electricity service and lack of coverage in many areas

4% cook primarily with electricity



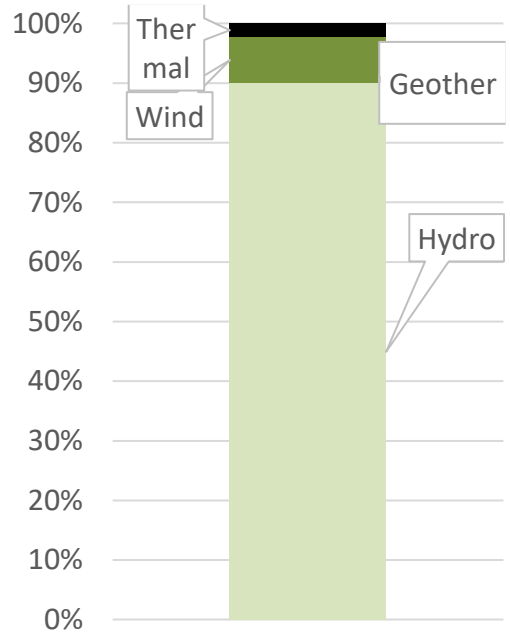
8% cook primarily with commercialized polluting fuels (charcoal)

95% cook primarily with polluting fuels

The opportunity for eCooking

- 4.1% use eCooking (half exclusively)
  - electricity second most used cooking fuel in urban areas
  - 65% of HHs in Addis Ababa own electric appliances [2] and 63% use it as their primary cooking stove [7].
- Opportunities greater in urban areas, where existing usage is much higher (15.3%) compared to rural households (0.9%) due largely to greater access to grid electricity (urban: 96.2%, rural: 12.2%) [3].
- Fuel stacking a major coping practice in response to fuel price fluctuation & availability of cooking fuels
  - significant increase in eCooking in the last decade which has led to reduced firewood usage.
- Electricity access stands at 45%, the unit cost of grid electricity amongst the lowest in SSA, significant increases in grid generation capacity are projected, so there is clear untapped potential to increase uptake of eCooking.
  - 41% appear to have an electricity connection, but not use it for the majority of their cooking needs
  - 6-15% of the population have tier 1 connections (e.g. solar lantern or small SHS), which cannot support electric cooking (ESMAP (2020)/discussions with GIZ Ethiopia).
- Significant local manufacturing base for supply and maintenance of eCooking appliances

98% renewable



27% surplus power generation but major deficits (**up to a 44% shortfall**) when hydropower water levels are low

Reliability issues:

81% power availability (SAIDI*SAIFI= 1634 hrs/yr)

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Cooking Services

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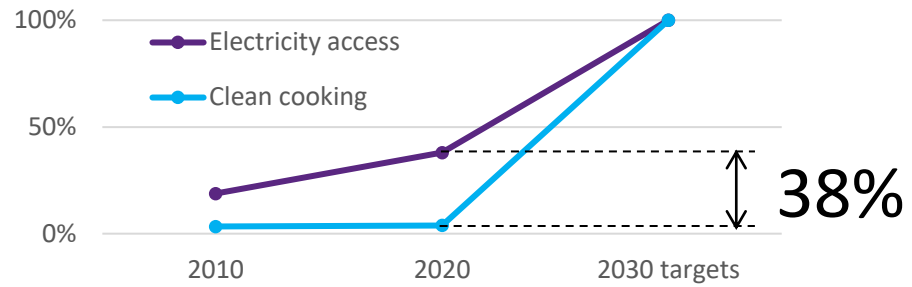
Mozambique



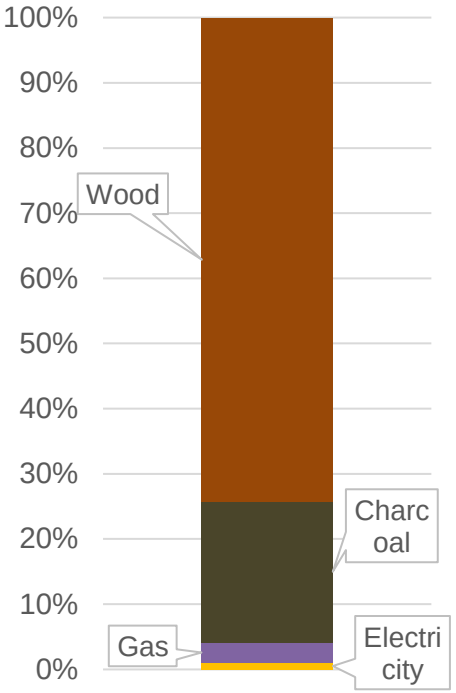
Mozambique: Summary

- The market potential for eCooking growing rapidly given growth in electricity access, which has doubled, from 17% in 2009 to over 40% in 2020 (ALER, 2021).
- Emerging eCooking sector, with 1.4% already cooking primarily with electricity (WHO, 2020).
- Access to electricity & eCooking concentrated in urban areas, with 73% of the urban population now connected & UNDP (2020) reporting that 17% of the urban population already cook with electricity.
- Low electricity tariff ($0.10/kWh) means that eCooking already most affordable option, even without considering the generous lifeline tariff ($0.02/kWh < 100kWh/month).
- Reliability & access, in particular in rural areas, hinder greater uptake, creating an opportunity to pilot battery-supported and solar-eCooking.
- Further study of the existing eCooking market in urban areas involving primary research is needed to inform potential future interventions by gaining a deeper understanding of the key actors in the eCooking value chain & the key market segments that have already adopted eCooking.

The clean cooking challenge in Mozambique

- Heavily reliance on biomass (71.2%) [WHO, 2019), with firewood the most predominant (64%).
  - 22% use charcoal as their primary cooking fuel.
  - Mocumbi et al (2019) estimate:
    - HAP: 17,154 deaths/yr
    - Climate: 62.7Mt/yr released was a result of tree cover loss between 2001 and 2020.
  - Women and girls disproportionately affected
- Only a small portion of the population has access to cleaner fuels:
  - 1.4% primarily use electricity for cooking
  - 3% primarily use LPG (WHO, 2019).
- Historically ICS heavily promoted in Mozambique
  - Adoption rates have high in areas where ICS have been promoted by EnDev ~ 90-95%. However, recent evidence shows that the health benefits of ICS are much more limited than previously thought (WHO, 2016)
- Low consumer awareness of eCooking and low availability of eCooking appliances outside of the Provinces of Maputo and Manica

1.4% cook primarily with electricity



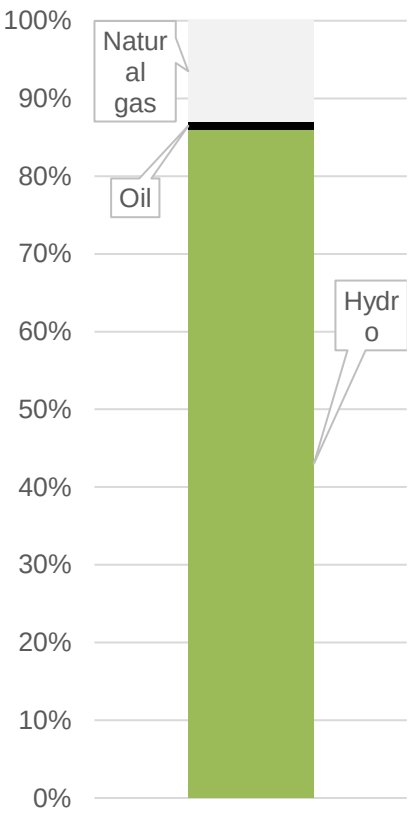
22% cook primarily with commercialized polluting fuels (charcoal)

95% cook primarily with polluting fuels

The opportunity for eCooking

- Currently, only 1.4% of Mozambican's use electricity as their primary cooking fuel – 0.1% rural & 3.9% urban
- eCooking pilot has recently kicked off with Burn Manufacturing to pilot EPCs in urban & peri-urban Maputo.
- Electricity access has doubled in the past decade (2009 – 2019), testament to GoM's commitment to accelerate electricity access
  - Enormous untapped potential: ~40% now connected but doesn't yet use it for most of their cooking needs (IEA, 2019).
- Low tariff: $0.10/kWh regular & $0.02/kWh lifeline tariff (1st 100 kWh/month).
  - eCooking is already the cheapest way to cook.
- Largest hydropower potential in Southern Africa: 187GW
- Existing eCooking sector & proximity to other countries (e.g. South Africa, Zimbabwe, Zambia) where uptake of eCooking is already much higher can potentially yield positive spill-over effects in Mozambique
- Rapid growth in off grid energy markets

86% renewable



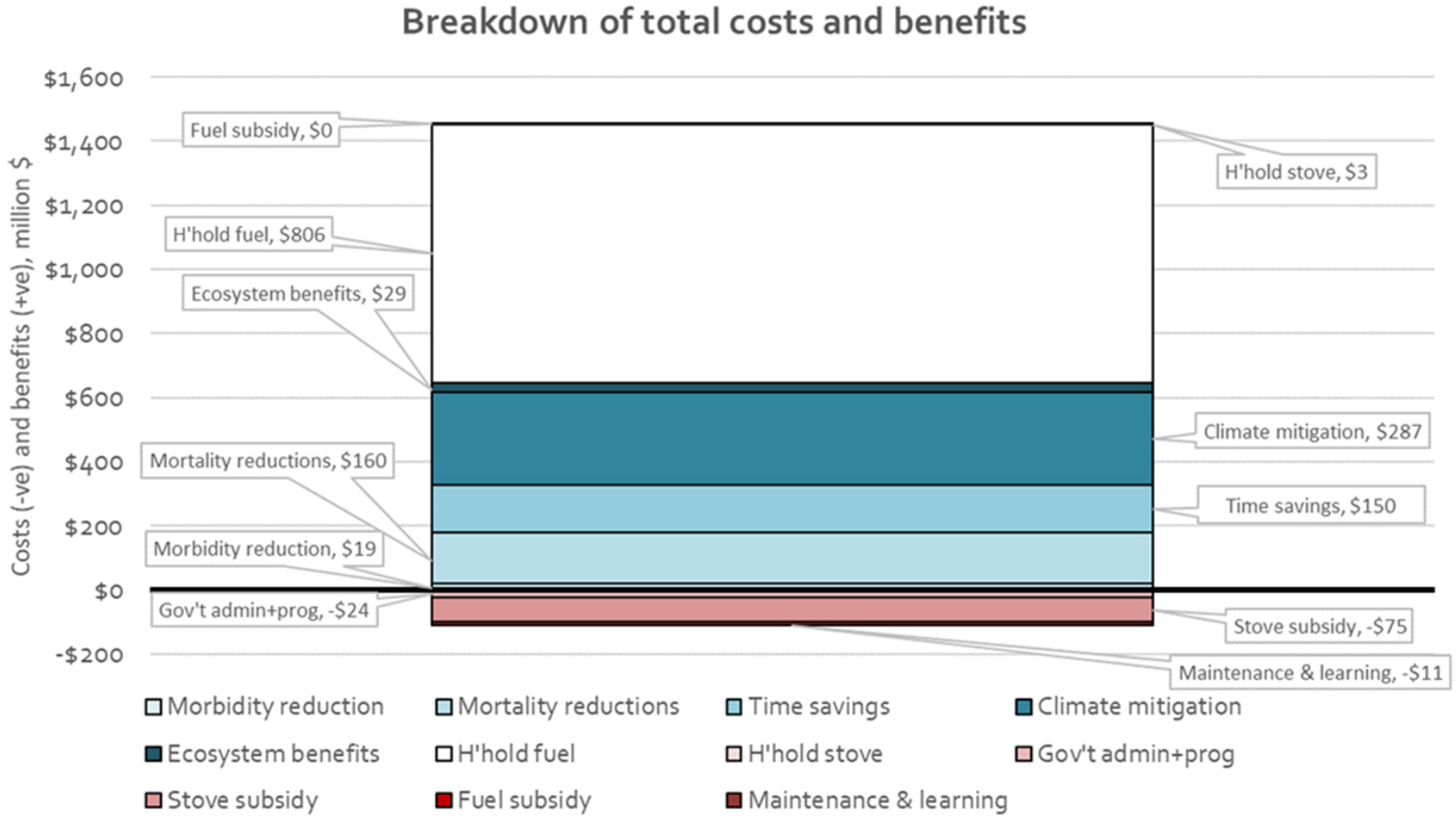
Surplus power generation – exporting regionally

Moderate reliability: 73% power availability (SAIDI*SAIFI=2,400hrs/year)

Emerging trends

Potential impacts of scaled uptake: e.g. Kenya

If 40% of Kenya's grid-connected charcoal users (0.7m HHs) switched to eCooking:



Potential impacts of scaled uptake

	Market segment	KE Grid-connected charcoal	BD Grid-connected firewood	BE Grid-connected charcoal	UG Grid-connected charcoal	RW Grid-connected charcoal	NP Grid-connected firewood	MZ Grid-connected charcoal	ET Grid-connected charcoal
	40% of segment (millions HHs)	0.7	5	1.04	1.7	0.7	0.65	0.4	0.9
per million HHs	**Health** (DALYs/yr avoided)	1719	15516	747	3597	956	18278	3530	1003
	Emissions (million tonnes CO2eq/yr reduction)	2.7	2.5	-1.7	5.5	0.8	2.8	1.3	2.4
	Deforestation (million tonnes/yr reduction in unsustainable wood harvest)	0.6	1.2	0.0	1.0	0.3	1.5	0.2	0.4
	Women's time (millions hrs saved /yr)	273	328	66	612	161	440	260	147
	Payback period for energy-efficient appliances (months)	9	12	n/a	11	14	6	5	14
	Demand stimulation (GWh/yr)	603	655	227	892	337	878		574

Impact stories

- Uganda, Rwanda, Kenya, Ethiopia, Mozambique:
  - charcoal -> electricity
  - high usage of unsustainably sourced & inefficiently burned charcoal + renewable electricity generation + moderate/low electricity tariffs
    - high potential impacts across the board
- Nepal & Bangladesh
  - firewood -> electricity
  - high usage of unsustainably sourced & inefficiently burned firewood moderate/low electricity tariffs
  - Electricity generation: Nepal = hydro, Bangladesh = gas
    - high potential impacts across the board
    - Displacing firewood leads to very high health benefits

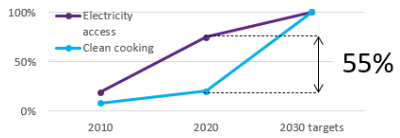
Impact stories

- Benin:
  - charcoal -> electricity
  - Most charcoal sustainably sourced, but inefficiently burned + imported fossil electricity generation + moderate electricity tariff
    - negative carbon impacts
    - no payback on appliances
    - minimal impact on deforestation
    - moderate savings on women's time & health impacts

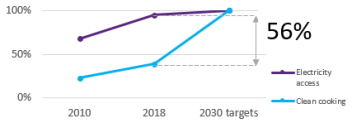
Clean cooking & electricity access

Majority now electrified, but still cooking primarily with polluting fuels

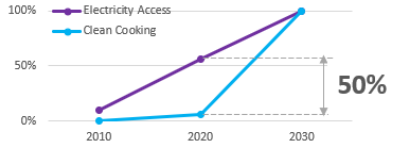
Kenya



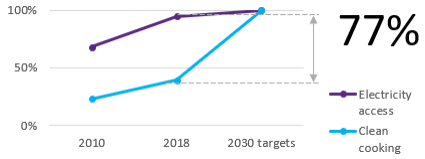
Nepal



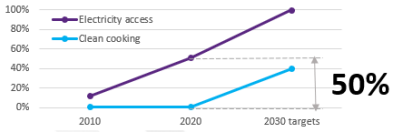
Rwanda



Bangladesh

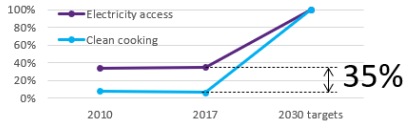


Uganda

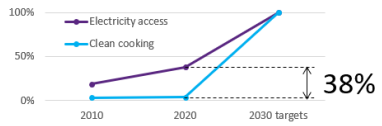


Minority electrified, majority still lacking access to clean cooking

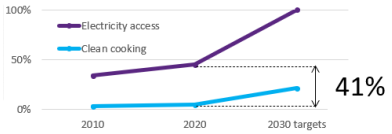
Benin



Mozambique



Ethiopia



RECOMMENDATION

- Develop consumer awareness, supply chains & enabling environment for eCooking

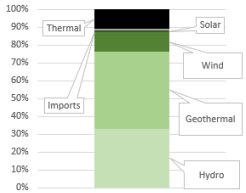
RECOMMENDATION

- focus on urban areas where electricity access is much higher
- Pilot off-grid eCooking

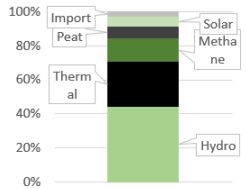
Electricity generation

Diversified renewable generation with surplus reliable electricity

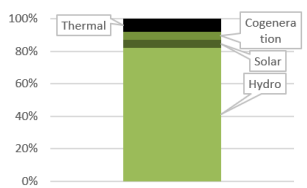
Kenya



Rwanda



Uganda

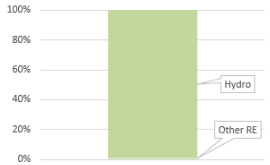


RECOMMENDATION

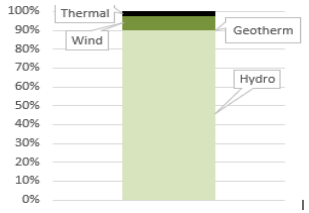
- support utility to develop eCooking demand stimulation programme
- leverage carbon finance to mitigate upfront cost of energy-efficient appliances

Hydro generation with seasonal/regional supply deficits

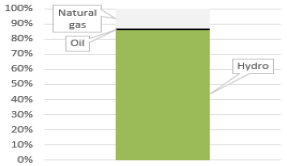
Nepal



Ethiopia



Mozambique

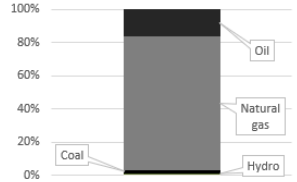


RECOMMENDATION

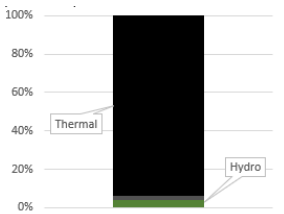
- pilot battery-supported eCooking to mitigate unreliability

Fossil-based generation with seasonal/regional supply deficits

Bangladesh



Benin



RECOMMENDATION

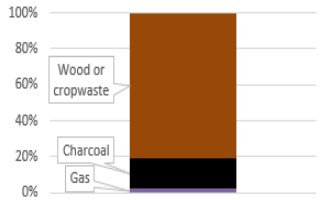
- pair eCooking interventions with decarbonization of the grid
- Pilot off-grid eCooking

Commercialised polluting fuels

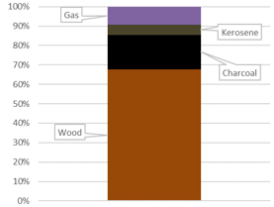
Widespread use of polluting fuels that may or may not be purchased, e.g. wood, crop waste, dung

Substantial use of purchased polluting fuels, e.g. charcoal, kerosene

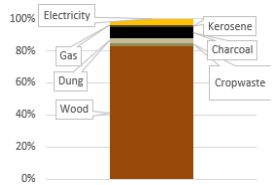
Rwanda



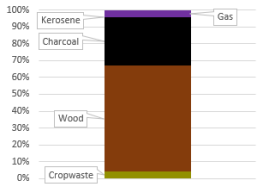
Kenya



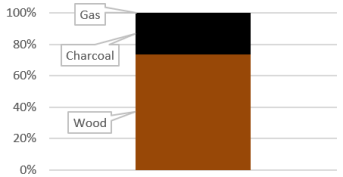
Ethiopia



Benin



Uganda



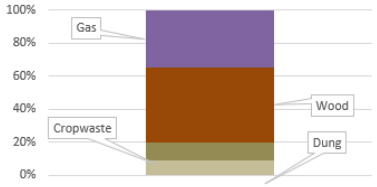
Mozambique

RECOMMENDATION

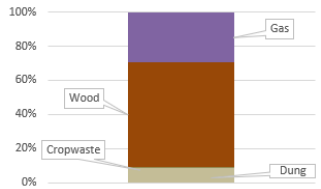
- Carry out market research to understand how much & how frequently people are paying for these fuels and design appliance financing schemes accordingly

Low use of polluting fuels that are always purchased, e.g. charcoal, kerosene

Bangladesh



Nepal

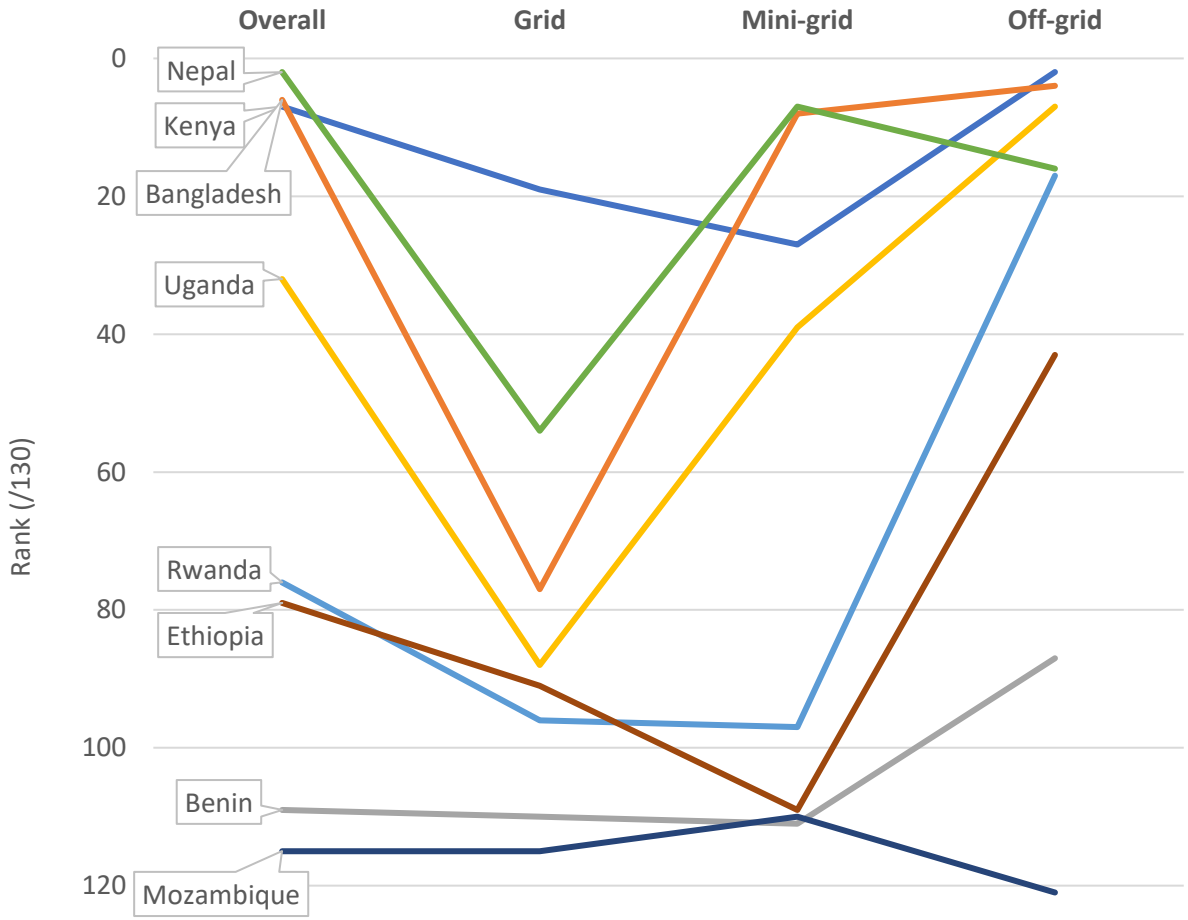


RECOMMENDATION

- carry out further research to identify who is paying for these fuels & target these individuals
- promote eCooking as part of a holistic intervention that can create new income streams

MECS eCooking GMA viability scores/rankings

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



Policy environment

Integrated policy framework

Strong integrated framework already in place: Nepal

Starting to connect clean cooking & electricity access: Kenya, Uganda, Ethiopia

RECOMMENDATION

- Support the ongoing development of integrated policy & feed in learnings from pilots

Clean cooking & electricity access treated as 2 separate problems

Rwanda, Bangladesh, Mozambique, Benin

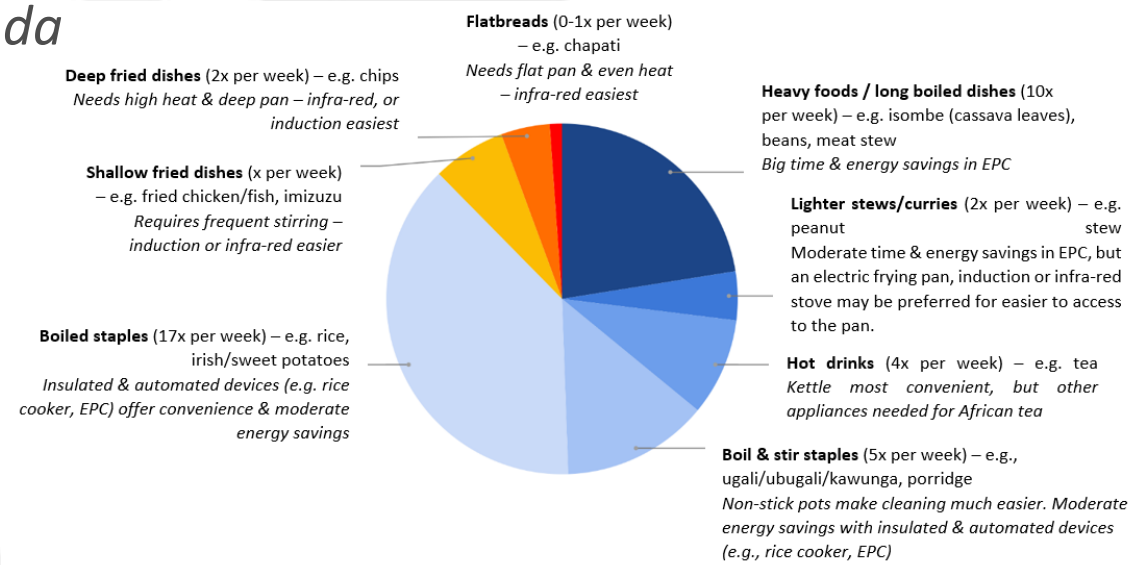
RECOMMENDATION

- Facilitate dialogue between clean cooking & electrification sectors, encourage policy makers to see opportunities for integrated planning

Consumer demand

High prevalence of stews & ‘heavy foods’ (long boil)

Rwanda



+Uganda, Kenya, Ethiopia

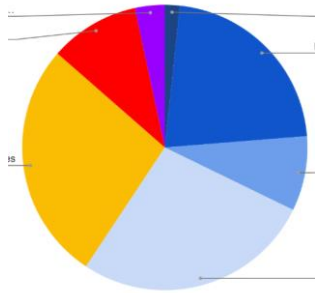
RECOMMENDATION

- Promote EPCs as part of a clean fuel/appliance stack

Rice is major staple

Bangladesh

+Nepal



Boiled staples (16x per week) – e.g. rice, hodgepodge, polao
Insulated & automated devices (e.g. rice cooker, EPC) offer convenience & moderate energy savings

RECOMMENDATION

- Promote rice cookers as part of a clean fuel/appliance stack

Supply chain

eCooking already widely adopted as primary cooking fuel

Ethiopia

RECOMMENDATION

- Support domestic manufacturers to develop energy-efficient appliances (e.g. with innovation challenge fund)

eCooking already widely adopted as secondary cooking fuel

Rice cookers in Nepal & Bangladesh, urban Mozambique

RECOMMENDATION

- Support network of importers/distributors already supplying eCooking appliances to target low income households by piloting innovative consumer financing models (e.g. targeted RBF)

Emerging eCooking market

Kenya, Uganda, Rwanda, Benin

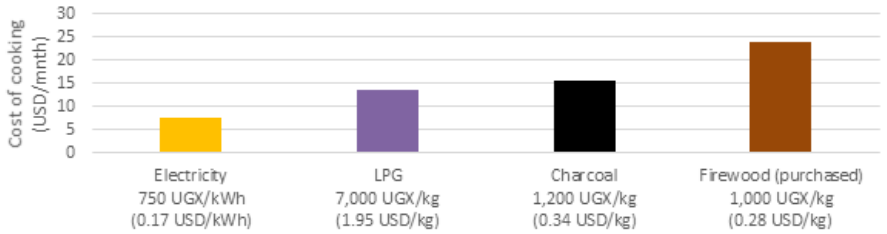
RECOMMENDATION

- Support existing network of importers/distributors to add eCooking appliances to their product range (e.g. with RBF)

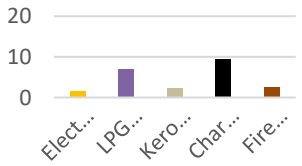
Relative costs of cooking

Cooking all your food with electricity is already the cheapest way to cook (except collected fuels)

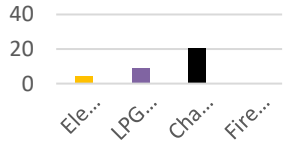
Uganda



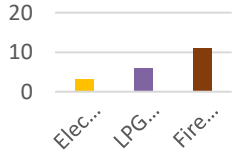
Ethiopia



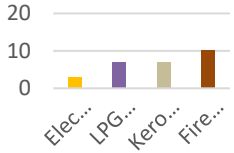
Mozambique



Nepal



Bangladesh

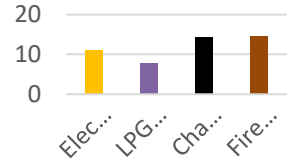


RECOMMENDATION

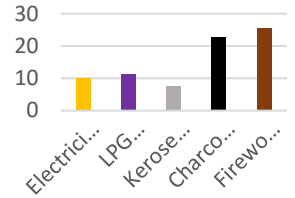
- Support consumer awareness campaigns to challenge the false perception that electricity is 'too expensive for cooking'
- Develop consumer financing mechanisms to break down the high upfront cost of energy-efficient appliances

Cooking all your food with electricity is cheaper than purchased biomass, but more expensive than LPG

Rwanda



Kenya



RECOMMENDATION

- Promote the most energy-efficient eCooking appliances as part of a clean fuel stack

Cooking all your food with electricity is more expensive than purchased biomass

Benin

endev

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Conclusion

Key takeaways

- The clean cooking challenge, the state of electricity sector and therefore the opportunity for eCooking is different in each context
  - However, there are similarities and therefore similar interventions can be effective in countries with similar characteristics
- There are opportunities for eCooking in all the countries studied, however:
  - Nepal, Rwanda, Kenya, Uganda and Ethiopia stand out as contexts where a rapid transition at scale could occur
  - This could make a substantial contribution to SDG 7 by leveraging progress in electrification to drive forward the clean cooking agenda

Thank you for listening!

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

- The full set of 8 eCooking Market Assessments
- Cross-country comparison
- Impact modelling methodology
- Guiding framework
- Blog

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