COOKING WITH ELECTRICITY

5TH MINI GRID ACTION LEARNING EVENT AND SUMMIT

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ESMAP
Energy Sector Management Assistance Program

MECS
Modern Energy Cooking Services

Outline

Ed Brown - An Introduction to the Modern Energy Cooking Services (MECS) programme

Besnik Hyseni – Electric Cooking on Mini-Grids

MECS
Modern Energy
Cooking Services

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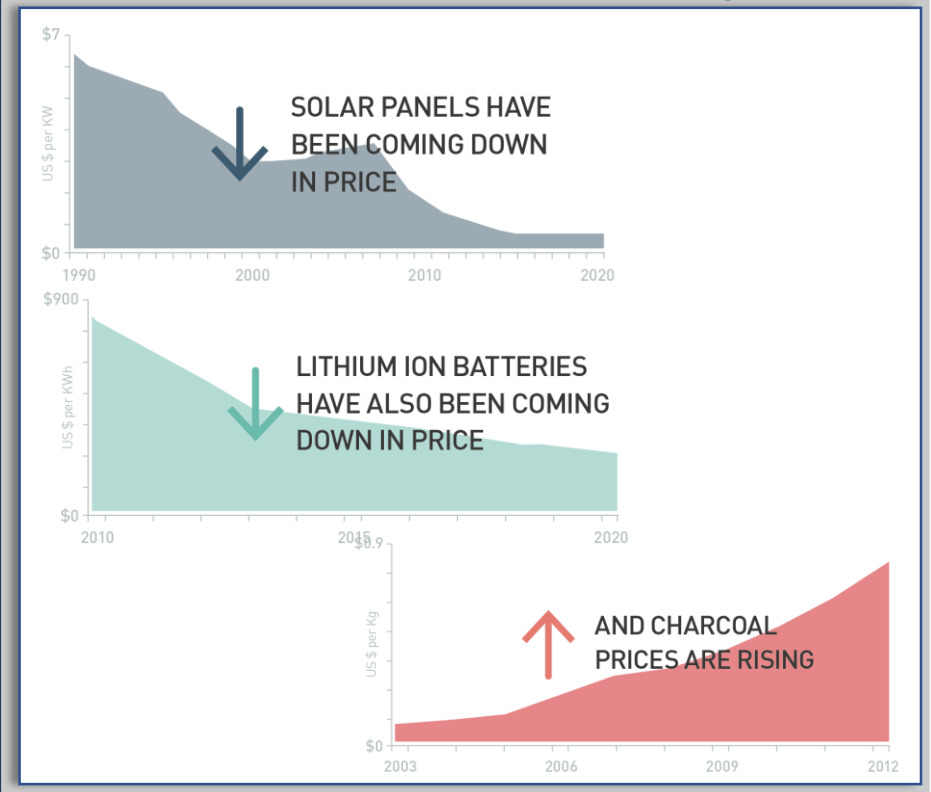
2013 – we noticed something



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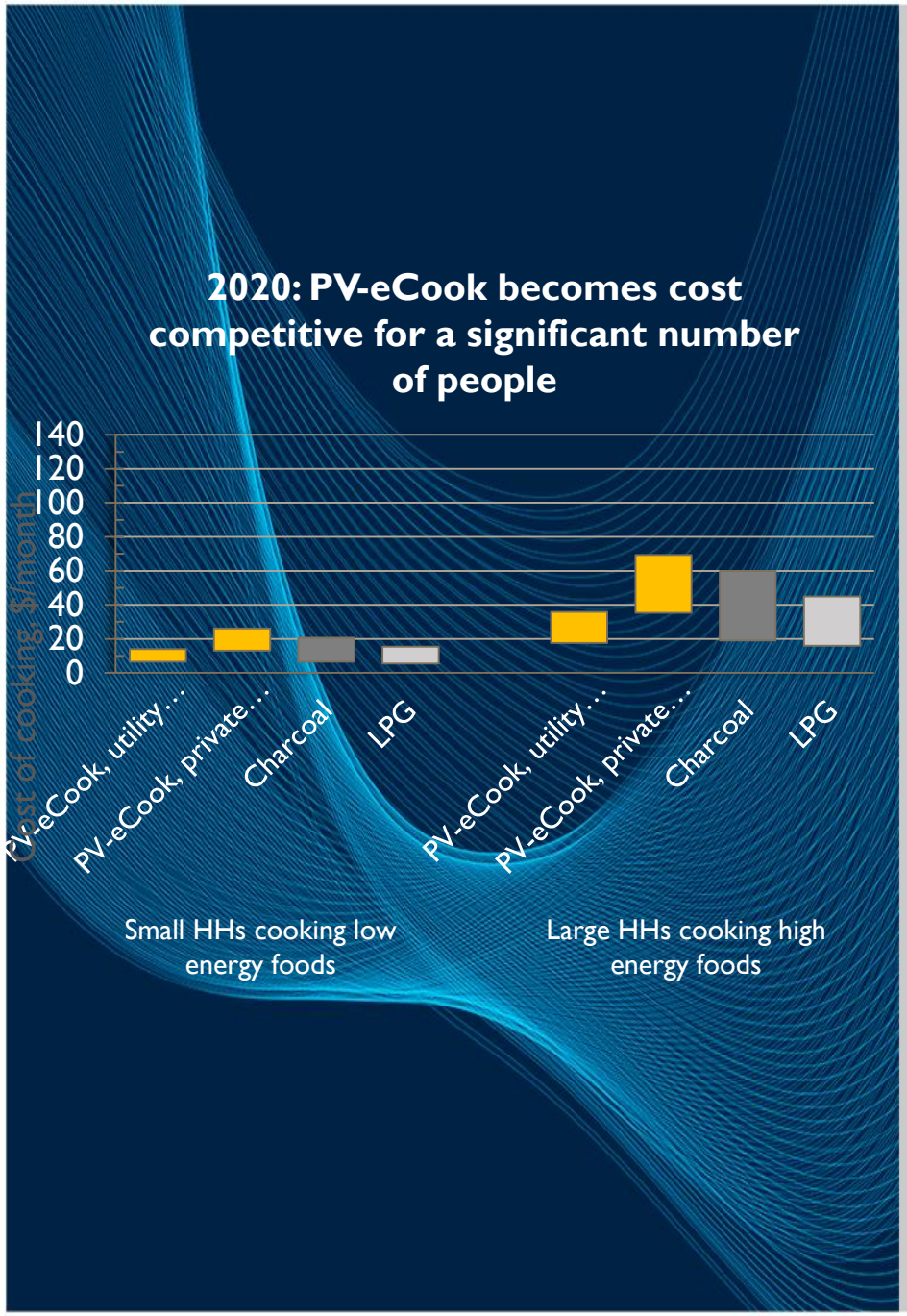

Converting existing expenditure

"Much of the evidence available to date shows that electricity can be a key driver of economic and human development. However, in order to achieve this, it must go "beyond connections." Quality, reliability and affordability matter"
"Increased electrification levels provide opportunity to reduce indoor air pollution – one of the most prevalent causes of premature deaths. Energy efficient electric cooking solutions are on the horizon, following a path of other super-efficient appliances."

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Cooking is deeply cultural

- In 2013, the eCook concept suggested that by 2020 it would be cost effective to cook with a Solar PV Battery combination.
- Since 2013, research on eCook has generated evidence that the concept is sound, created concept prototypes, undertook a global market assessment, **undertaken trials and evidence gathering on behaviour in Zambia, Myanmar, Kenya and Tanzania** and consulted policy actors about the concept.
- The concept has been expanded to include variants that draw energy from different sources (Solar, Hydro, Wind), at various scales (Home systems, off-grids, and National grid) and utilise existing technology in new configurations as well as developing new technologies.

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THE PROBLEM

The problem of cooking with electricity can be:-

NO ACCESS OR INSUFFICIENT ACCESS - rural households don't have it or the supply is very weak!

BURNT OUT WIRING - drawing high power for cooking through small wires overloads and burns the wiring

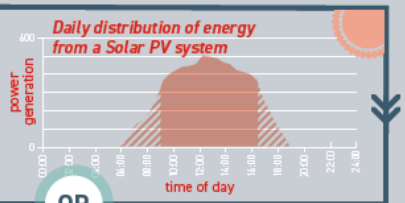
BLACK OUTS - load shedding either planned or unplanned means the household cannot cook when it wants.

LOW VOLTAGE - we have measured as low as 40V on a national grid that was meant to be 220V, meaning that cooking equipment doesn't work

THE SOLUTION

Solve these problems by trickle charging a battery, cook when you want, charge whenever power is available

TRICKLE CHARGE the battery from Solar PV during the day when the sun shines



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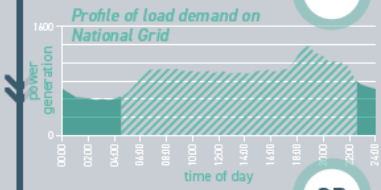

TRICKLE CHARGE from national grid during the night when there is spare capacity

OR

TRICKLE CHARGE from other sources during the day & night

Hydro grids
surplus energy particularly at night

Wind Power
energy available when the wind blows

Any micro or mini grid

For utilities and IPPs, this can mean more revenue and a more effectively used power system.

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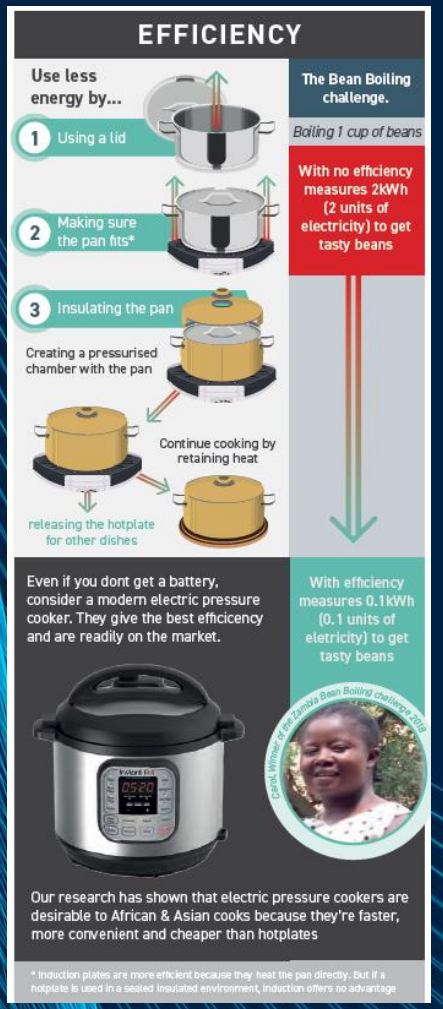
- To date researchers have tended to advocate induction hobs as a more efficient device than a hotplate. Evidence suggests this is only part of the picture.
- Recent eCook data suggests that a well insulated (electrical) 'multi-cooker' is an even more efficient device. Able to cook the majority of foods, it is desirable for its cleanliness and ease of use.



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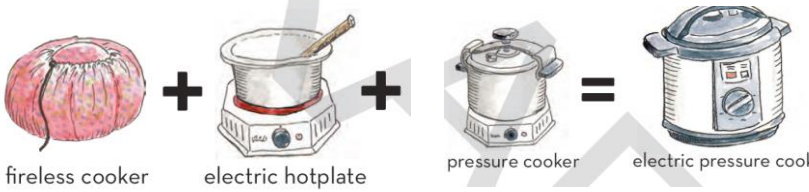
CHRISTINE'S

NJAHI BEANS

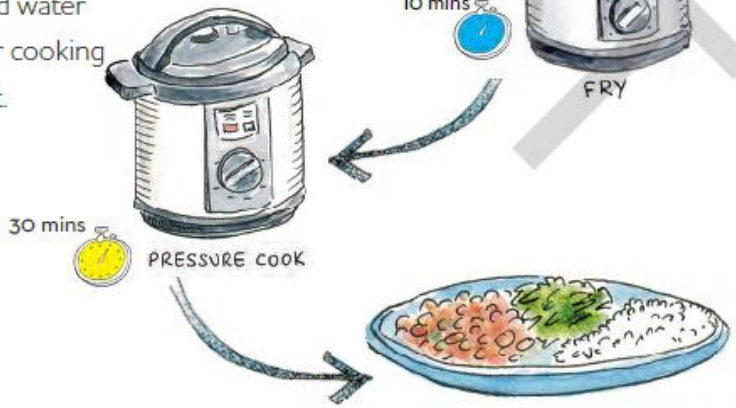
WITH COCONUT MILK

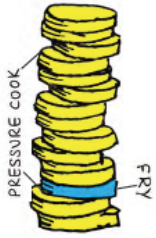


method

1 onion *(sliced)*
2 tbsp vegetable oil
1 tsp salt
1/2cm ginger *(crushed to a paste)*
2 cloves garlic *(crushed to a paste)*
1 tin coconut cream

If you have left over hot water (e.g. from making tea), use in place of cold water to give your cooking a head start.





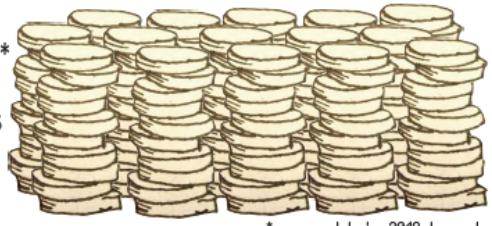
where is the money going?

14 Ksh
2hrs 10mins
0.6 units

Smaller beans are generally faster and therefore cheaper to cook than bigger ones. Njahi are one of the biggest and therefore slowest and most expensive. Smaller beans (e.g. yellow, wairimu, baazi and nyayo beans) cook 20-40% faster and tiny cereals like kamande or ndengu cook over 60% quicker.

when using charcoal...

150 Ksh*
3+ hours
1 tin



*measured during 2018 charcoal ban, 60 to 80 Ksh before ban

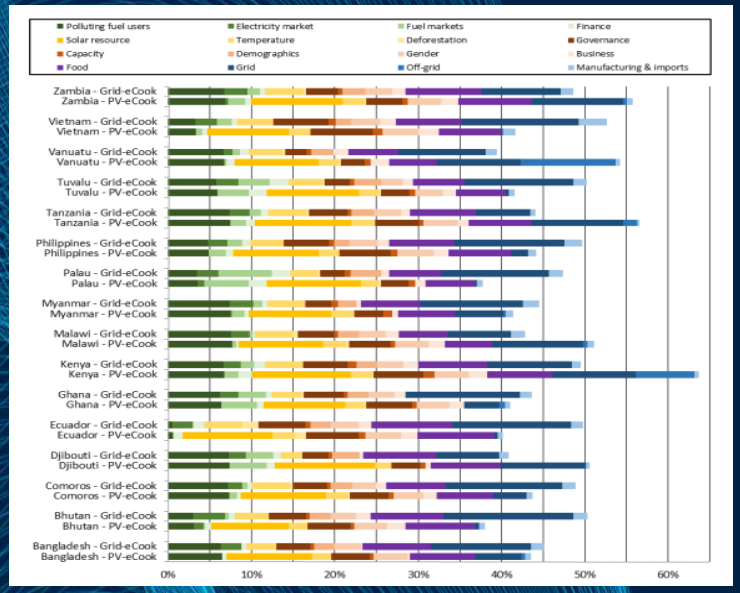
where is the money going?

7 Ksh
1hrs 10mins
0.3 units

Frying makes food tastier, but pressure cooking is the wiser choice for softening beans. It cost Karen the same to fry for 10 mins as pressure cook for 60. To save even more, she could fry less, or even not at all!

when using electric hotplate...

50 Ksh
2 hrs
2.2 units



MECS
Modern Energy Cooking Services

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So we end with….

- We have conducted a multi decision criteria scan of the world to identify potential markets for transition.
- We have just begun a more coherent integrated multi-year research programme on **Modern Energy Cooking Services**.
- MECS is broader than electric cooking and also includes work on new approaches to other fuels such as biogas, ethanol and LPG.
- The programme is funded by UK Aid, and while it begun its work a few months ago, its official launch was in early April (also East Africa launch in Kenya next week), so public exposure of the programme is light at the moment.
- All the piecemeal research to date can be found at www.pv-ecook.org

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Modern energy cooking services MECS

- This MECS programme aims to **break out of the "business-as-usual"** cycle of developments on cooking by investigating how to rapidly accelerate a transition from biomass to genuinely 'clean' cooking (i.e. with electric or gas).

……MECS will deliver

- **Evidence, research and insights** into the drivers and pathways for economies to transition to modern energy cooking services (households, institutions, businesses).
- **New technologies** that make using electricity and gas more efficient, more practical, more desirable and affordable for poor households.
- **Innovations** in business models, financing and private sector delivery of modern energy cooking services.
- SDG **global tracking** that includes modern energy cooking services.
- Inclusion of modern energy cooking services in **World Bank International Development Assistance** programming and lending (and other MDBs, social investment funds etc.).
- A **changed narrative on cooking** for those involved in wider energy access policy and programming.
- **UK leadership** in a new approach to clean cooking.

MECS Challenge Fund Themes

Energy storage for cooking

Grid and infrastructure adaptability

Alternative fuels

Gender, Accessibility and inclusion in MECS

- Two funding rounds completed.
- Latest round funded projects up to GBP 30,000 each (first larger projects run with LEIA)
- Open to all companies/organizations, any size.
- Novel and innovative MECS solutions that use science, engineering or technology focussed on DFID's priorities;

Later this year: Global Leap Award on Pressure Cookers

GLOBAL LEAP AWARDS

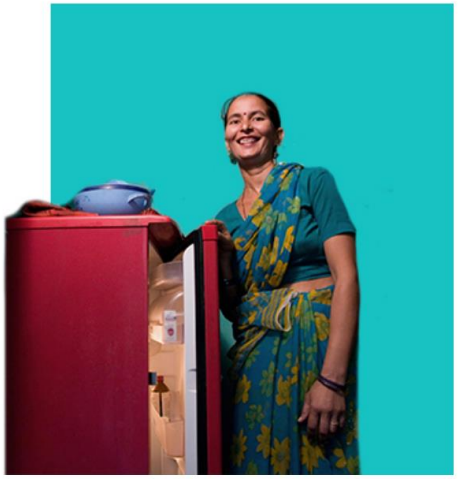
Current Awards

SOLAR WATER PUMP COMPETITION

November 2018 – January 2019

Learn about the competition & nominate a product.

LEARN MORE



OFF-GRID REFRIGERATOR COMPETITION

November 2018 – January 2019

Learn about the competition & nominate a product.

LEARN MORE

SOLAR E-WASTE CHALLENGE

March 2018 – September 2020

Learn about the competition & submit an application.

LEARN MORE

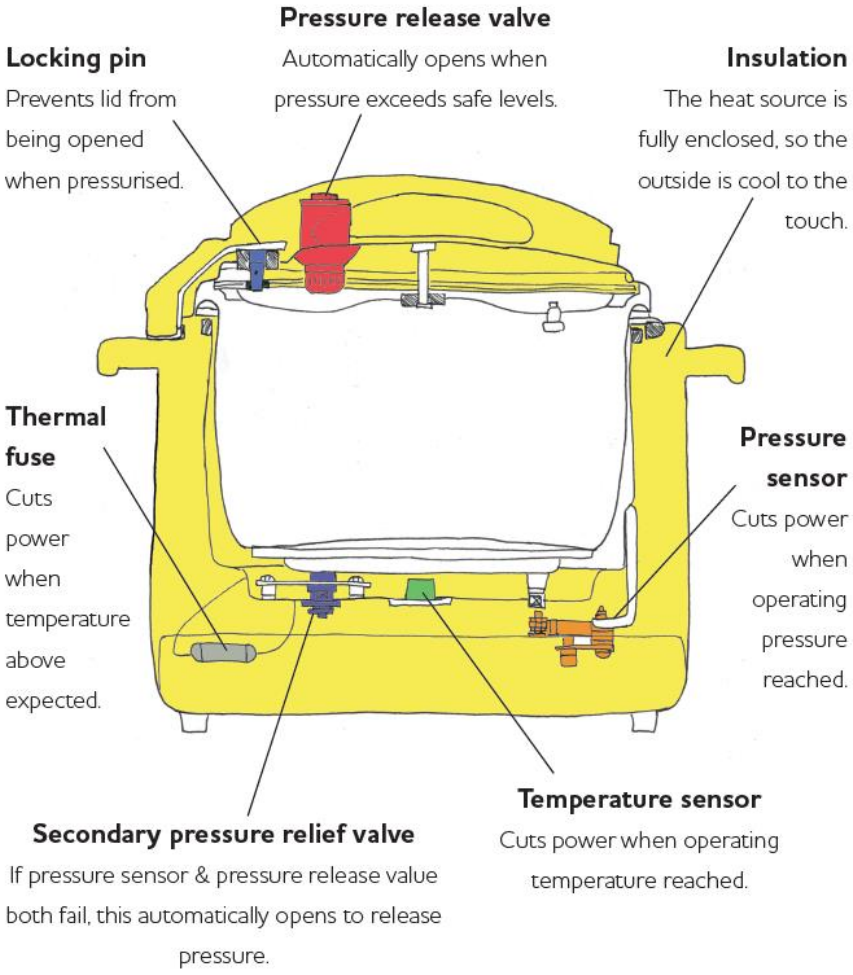
Why would HH choose electric cooking?

Disruptive and transformational value proposition for HH:

- ✓ **Cooks faster and carefree (free up valuable time)**
- ✓ **Automated heat control settings (doesn't burn food)**
- ✓ **Safer (no burning incidents)**
- ✓ **Cleaner (no toxic emissions, cleaner kitchen and pots)**
- ✓ **In many instances cheaper than baseline fuels (e.g. charcoal)**
- ✓ **Behavioral implications for switching can be significant but are attainable**

What is an Electric Pressure Cooker and why do people like it?

What are they



+ PROS

- **Fast** – a pressure cooker raises the temperature above boiling point.
- **Cheap** – it is energy efficient. There is insulation around the pot so that the heat stays in there.
- **Convenient** – the whole cooking process is automated. Once you set the time, the temperature is controlled by the EPC, so that you can go off and do other things
- Can **fry, boil, steam** and even **bake** a cake**!**
- **Safer** than ordinary sufarias – locks shut when pressurised.
- **Less stirring and water** needed – completely sealed during pressure cooking, so food cannot dry out
- **Lid can be taken on and off freely** when frying, boiling, steaming or baking.

– CONS

- Not ideal for certain dishes such as mandazis (deep frying) or chapatis, where you need to manually control heat or use a shallow pan.
- Not yet available in most Kenyan stores.
- The appliance costs about twice as much as an electric hotplate.
- Looks complicated at first, but once you get used to it, cooking becomes much easier
- Inconvenient to check on the food during pressure cooking stage.

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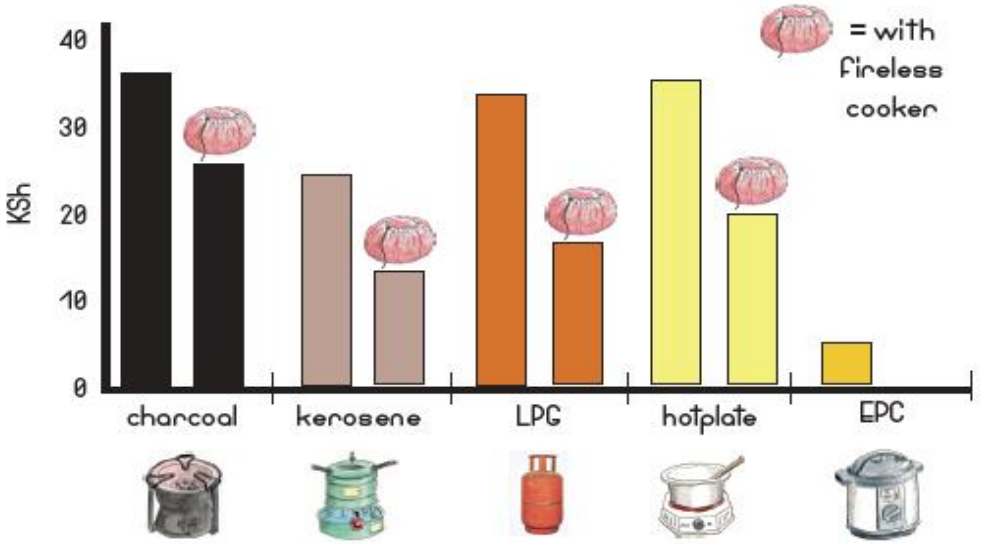
Electric Pressure Cookers are the low hanging fruit

- EPCs, slow cookers, and rice cookers already being piloted in a number of countries (KE, TZ, ZM, MM) as HH are able to cook half or more of their meals (beans, rice, stews, etc.)

Cooking diaries Kenya →



- **Studies now show that even if greater capex are needed for adequate MG peak load sizing LCOE remains similar due to parallel increase in demand (Lombardi et al. 2019)**
- **In cases where existing MG productive loads are available and load factor increases from daytime usage LCOE may decrease (direct cooking or battery cooking possible)**
- **Bottom line: increasing energy demand would increase revenue for mini grids (price signaling and other demand side interventions possible)**

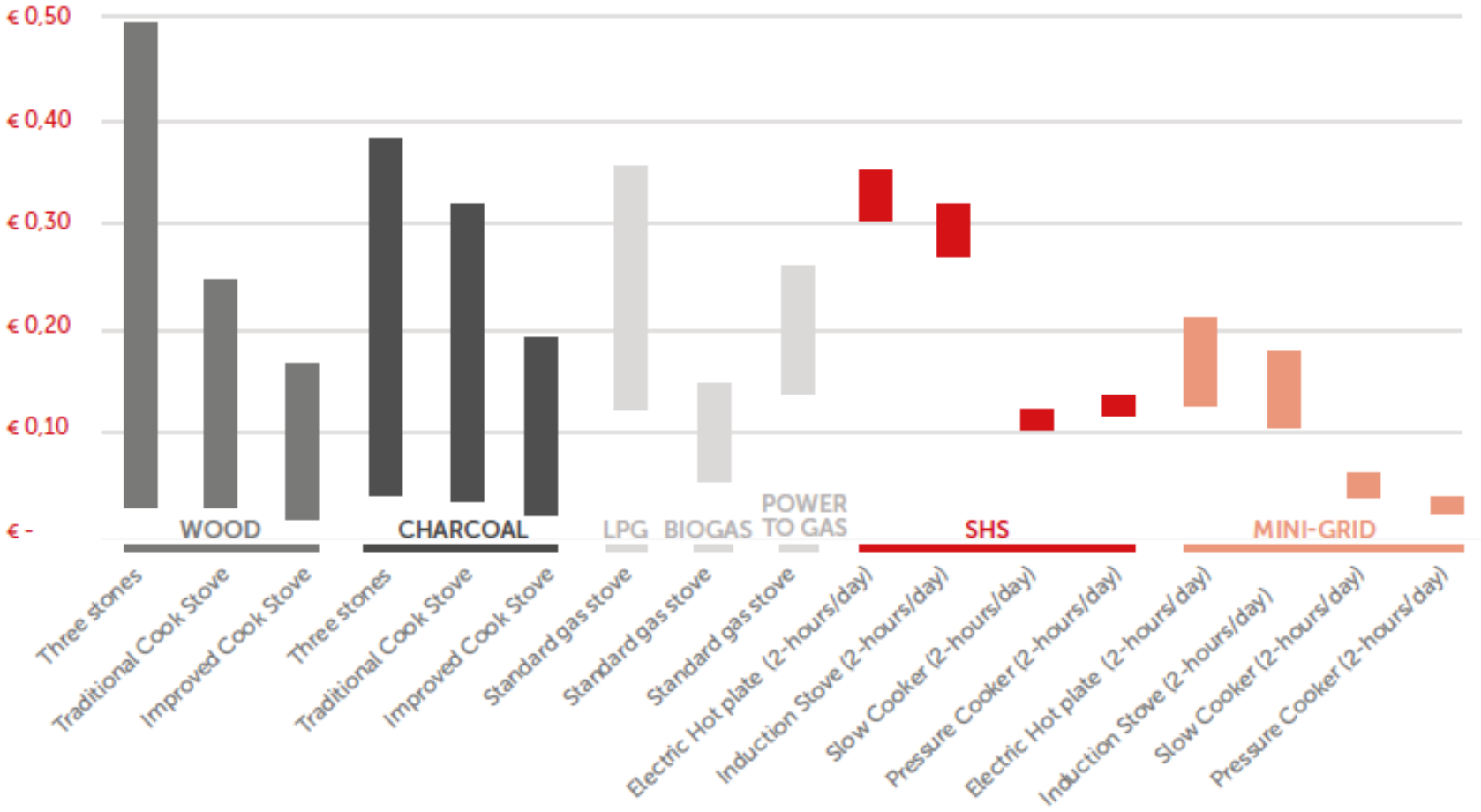
Beyond Fire report (by HIVOS) – costing of electric cooking

TABLE 13: ACTUAL COOKING ENERGY DEMAND AND COSTS FOR MINI-GRIDS USING DIFFERENT APPLIANCE TYPES

Cooking Appliance (actual wattage assumed)	Actual Wattage Modelled	Low Electric Cooking Household (kWh per day)	Average Electric Cooking Household (kWh per day)	High Electric Cooking Household (kWh per day)	Approximate Cost Range per person per year (EUR)*
Hours of Cooking		**1 Hour/day**	**2 Hours/day**	**4 Hours/day**	**Assuming 2 hours per day on average**
Electric Hot Plate	**2000W**	0.6kWh	1.2kWh	2.4kWh	**46 – 77**
Induction Hot Plate	**1500W**	0.5kWh	1kWh	2kWh	**39 – 64**
Slow Cooker	**190W**	0.178kWh	0.355kWh	0.710kWh	**14 – 23**
Pressure Cooker	**700W**	0.164kWh	0.221kWh	0.334kWh	**9 – 14**
Mini-Grid Cost per kWh[22]	**EUR 0.53 – 0.88/kWh**				

Source: Beyond Fire - How to achieve electric cooking; Hivos 2019.

Beyond Fire report - cost of electric cooking in mini grids



Source: Beyond Fire - How to achieve electric cooking; Hivos 2019.

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What do the Beyond Fire report results mean?

- **Beyond Fire report makes a very strong case for the transformative potential of electric cooking (solar home systems, mini grids)**

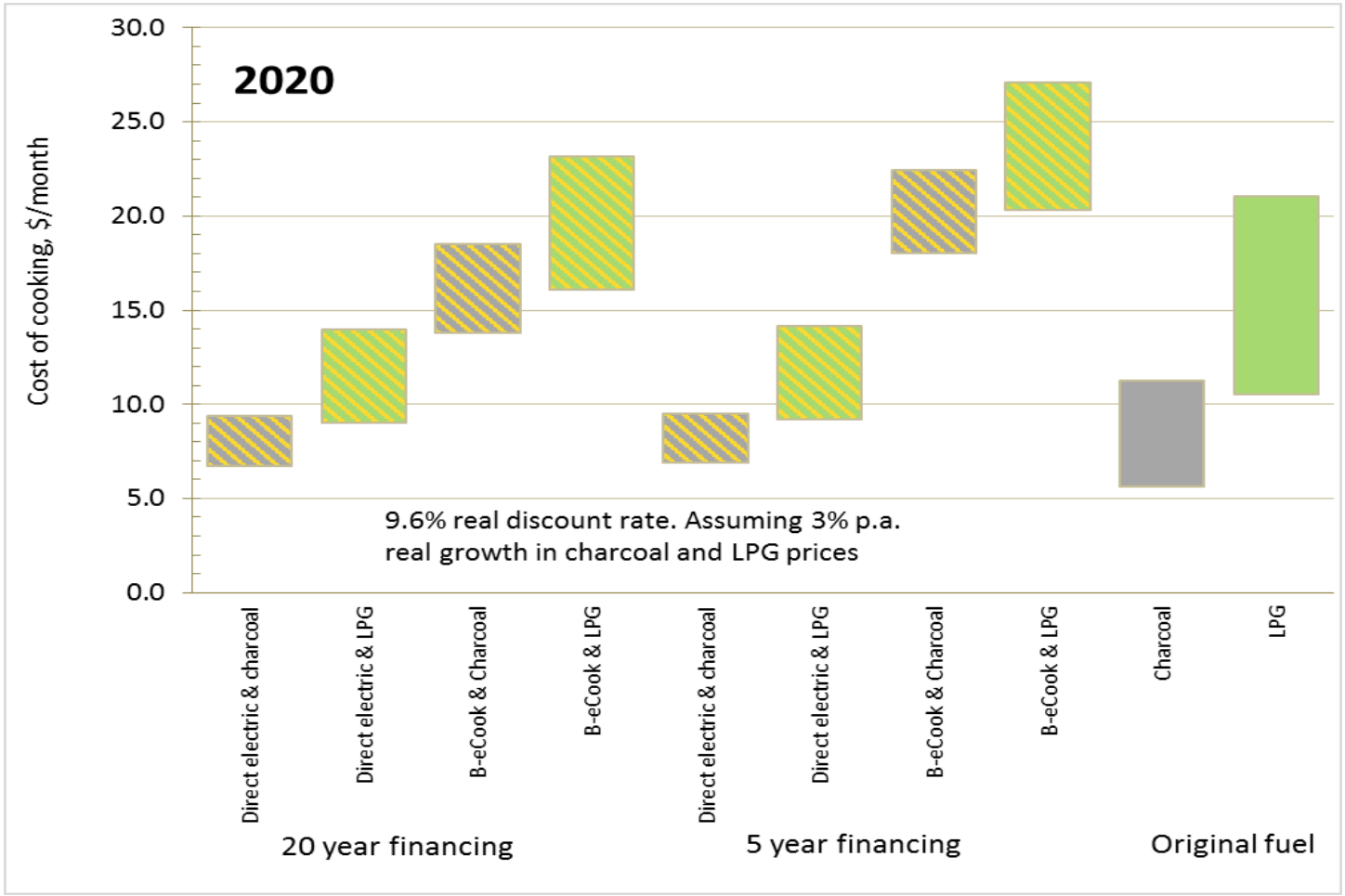
However, while Beyond Fire report results are encouraging they are still hypothetical and further assessments are needed:

- **Assumption that EPCs and slow cookers are cooking all the foods is not a realistic scenario.**
- **EPCs, hotplates and slow cookers cook at different speeds, so would be used for different amounts of time each day.**
- **The EPC energy consumption figures are a bit optimistic - in spite of it operating wattage level being lower they are used open e.g. for frying, which uses up more power.**

MECS/ESMAP electric cooking report underway…

- **Exploring technological and cost-based viability of electric cooking (grid, mini grid, standalone) – reviewing experiences and potential for each scenario**
- **Tweaking assumptions to incorporate fuel stacking and realistic cooking practices based on actual CCTs carried out in trials**
- **Make policy recommendations to the development community for informing investment operations and technical assistance**

Electric Pressure cookers may be the low hanging fruit



Source: MECS team calculations

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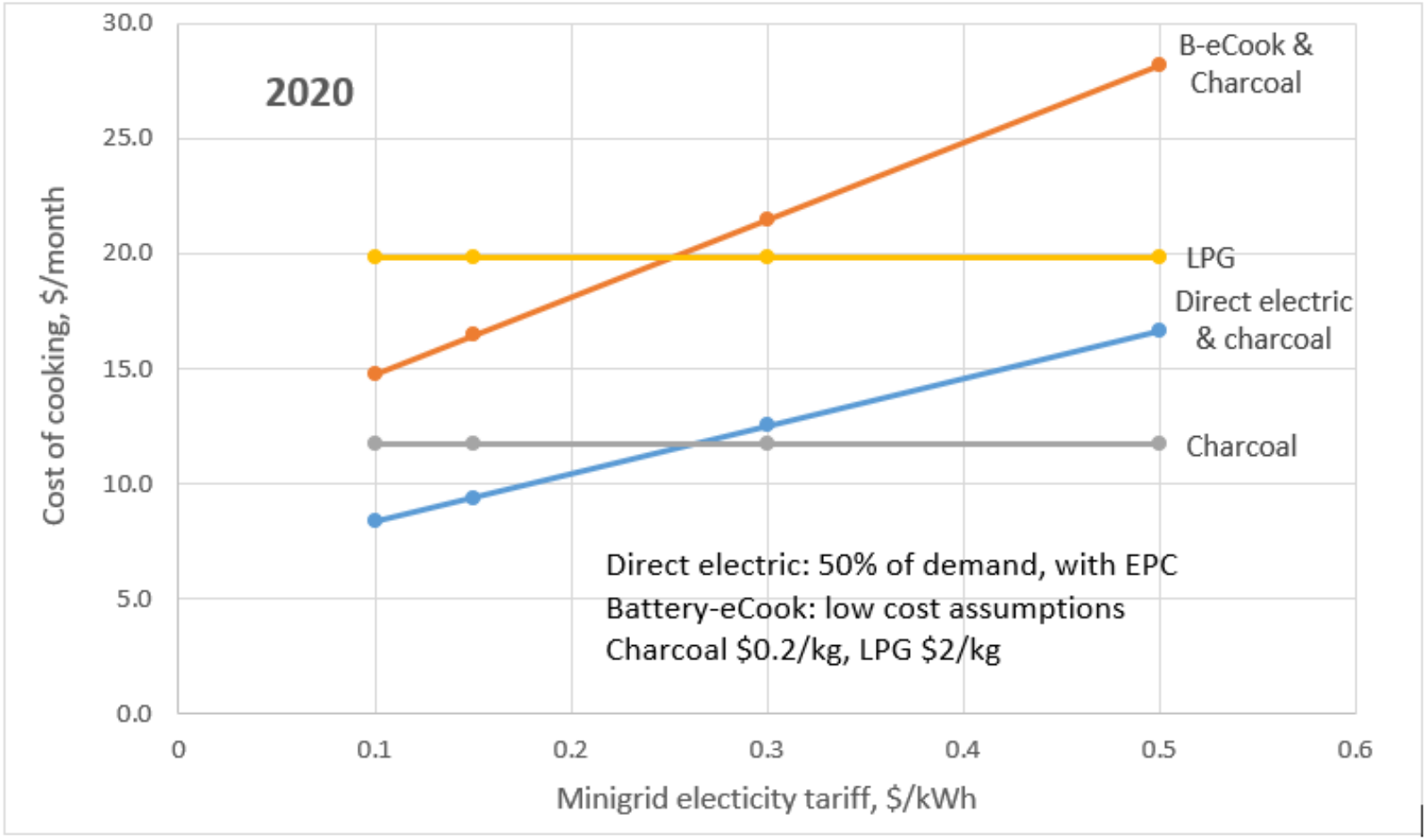
Electric Pressure cookers may be the low hanging fruit



Source: MECS team calculations

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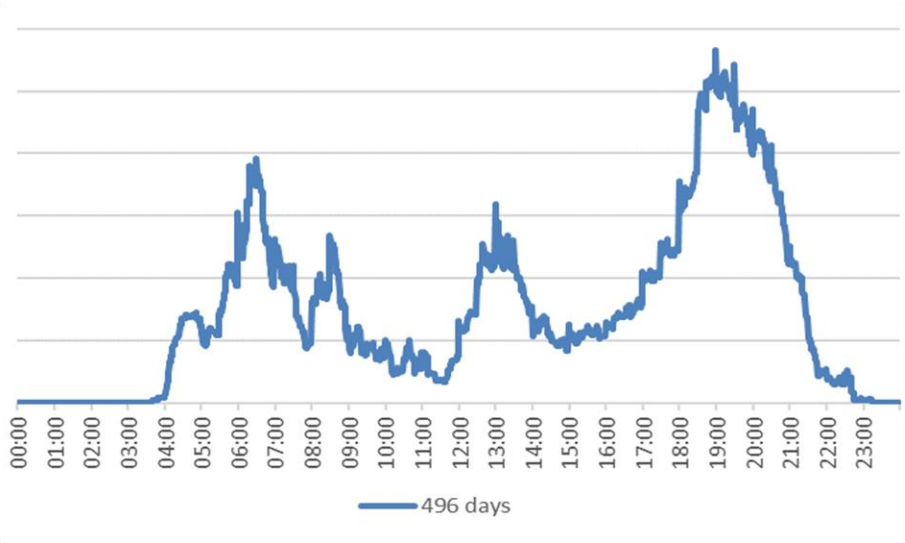
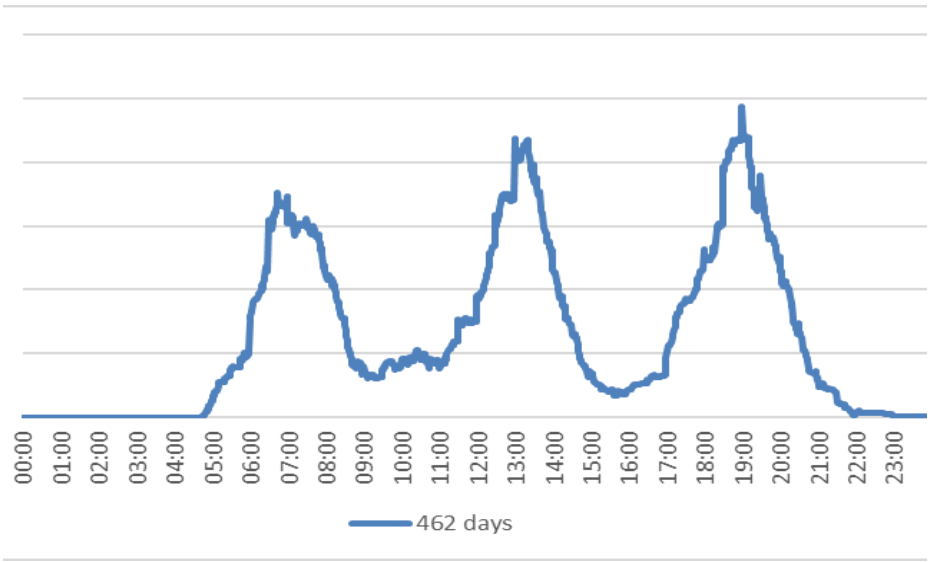
24 hour aggregated cooking load profiles

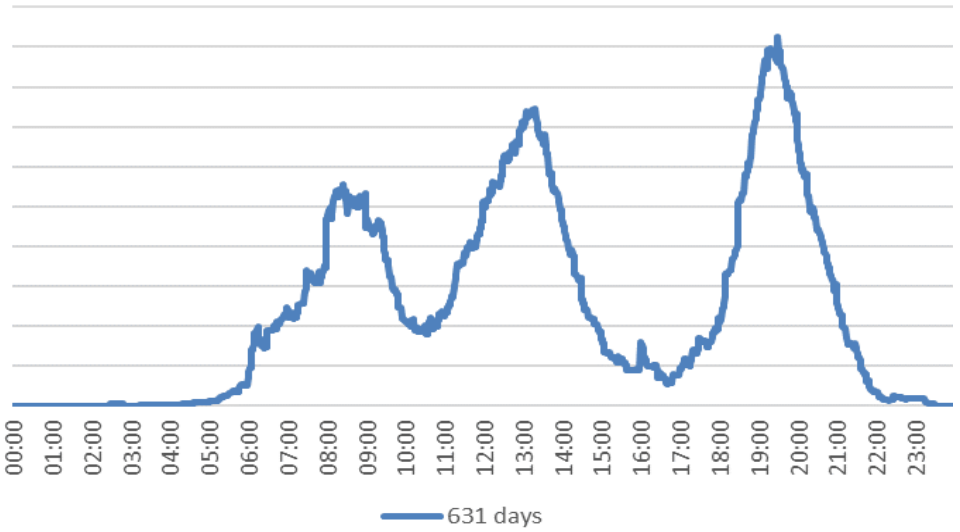
Kenya



Tanzania



Zambia



Source: MECS team calculations

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Could EPCs become the LED of solar electric cooking…

We are especially interested in knowing who in the MG community would like to trial electric cooking in their projects!

To get in touch & for more information:

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