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Design Challenges for Modernising Energy Cooking Services

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Introduction

Sustainable Development Goal 7 targets access to modern energy services for all by 2030. Despite advances in electrification, 3 billion people still cook with wood or charcoal. Developments in improved cookstoves have only marginally improved the situation. Increasing population numbers increases deforestation and exposes women and children to smoke whereby the World Health Organisation estimate 4 million people die each year from the effects. To counter this there have been recent developments in the use of cleaner fuels such as LPG in developing countries[1]. Furthermore, the potential to cook using renewable electricity has shown promise[2,3]. Recent funding by UK Department for International Development is enabling researchers to examine the technical and non-technical challenges to the successful deployment of electrical cooking systems.

Selected Issues

Social data on cooking practices needed: when do people cook, how often and what do they cook?

How will user experiences influence the design?

How much energy is required to cook a tasty meal using different appliances? Should other services be provided (lights, phone charging).

How will be the energy be generated for grid and off-grid situations? Is storage needed?

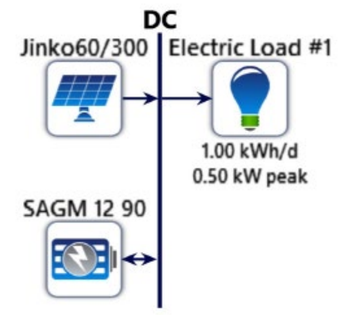
Outcomes

Based on the research, designs will be piloted in TWO contexts.

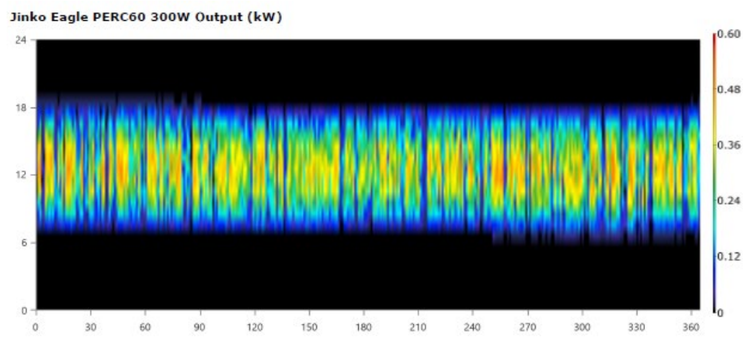
1) Rural off-grid using photovoltaics, battery and appliances
2) Urban weak-grid using battery and appliances

Design Challenge Example:

Effect of cooking for 2 or 3 meals on system model and battery State-of-Charge, Lilawe, Tanzania

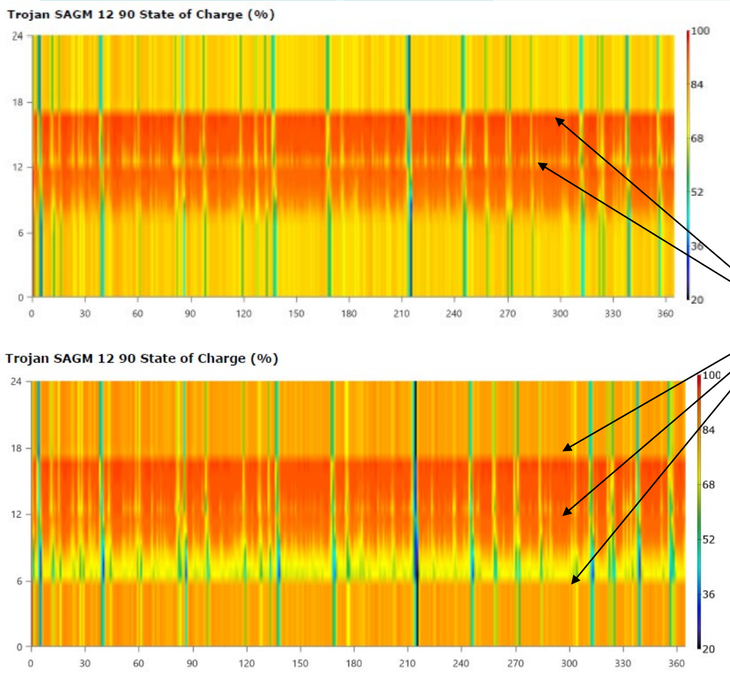


DC off-grid design



Solar resource at Lilawe

System Requirements	2 meals per day	3 meals per day
Cooking load 0.5kWh per meal	1.0kWh	1.5kWh
Rated photovoltaic demand (300W module)	0.574kW (2 modules)	0.762kW (3 modules)
Number of 90Ah 12V lead acid batteries	2	3
Battery life	5.10yrs	4.56yrs
Cost of electricity	$0.444kWh	$0.455kWh



HOMER Pro

Modelled cooking times

Long periods in state of discharge and greater Depth-of-Discharge for 3 meal design choice.

State-of-Charge of system batteries if 2 or 3 meals cooked per day.

MECS Modern Energy Cooking Services

UKaid from the British people

ESMAP Energy Sector Management Assistance Program

References
1) J. K. Parikh, et. Al. 2016. Providing clean cooking fuel in India: Challenges and solutions. IISD.
2) C Solanki. 2018. The Dawn of PV Cooking. https://www.linkedin.com/pulse/dawn-solar-pv-cooking-chetan-singh-solanki/
3) S Batchelor et. Al. 2018. Solar cooking in Africa: Where will the transition happen first? Energy Research and Social Science, 40, 257-272.

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INDIA-UK CENTRE FOR EDUCATION AND RESEARCH IN CLEAN ENERGY
JUICE Joint UK-India Clean Energy Centre
Newton-Bhabha Fund