

Team 2020-22 - Design and Build a Solar Battery Cooking for Use in SSA

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Theme – Cooking

Proposal

The proposed design is to use detailed modelling to identify suitable existing direct current (DC) appliances, then design and build an integrated prototype solution for a solar e-cooking system.

Project summary

Through detailed modelling, it has been identified that an electric cooking system with current DC appliances, powered by solar panels and a lithium iron phosphate battery, can be cost competitive. A prototype solution for an integrated unit has been designed to demonstrate this.

Key design highlights

A sample meal plan was used to estimate energy requirements in a way that was as representative as possible. Appliance testing was then carried out to further improve the model by identifying the combination of components that provided the minimum possible lifetime cost for a system. A prototype for an integrated unit was then designed (and is currently being assembled). A prototype water tank has also been designed and tested to explore alternative energy storage as a way of reducing system cost. Cooking experiments were conducted with the appliances to validate the model and identify where further work would add the most value.

Cost

The funding received as part of the challenge went towards prototyping. The most significant expenses were £150 GBP (\$212.9 USD) for thermocouples and £46.26 GBP (\$ 65.7 USD) for a thermometer to test the appliances and water tank.

How does your design help to work towards the Sustainable Development Goals (SDGs)?

This design works to address the following SDG targets:

- **SDG 3 (Good Health and Well-being) target 3.9:** 4 million premature deaths each year are estimated to be caused by household air pollution linked to cooking with traditional stoves.
- **SDG 5 (Gender Equality) target 5.b:** Solar electric cooking could help remove the need for travelling to buy or collecting traditional fuels, which would empower women by freeing their time.
- **SDG 7 (Affordable and Clean Energy) target 7.1:** Solar electric cooking could provide reliable, safe cooking at a price that is competitive with traditional fuels.

Social, environmental and economic considerations

Based on an estimation that the cost of cooking with charcoal is \$14.84 USD per month, the 890 million people (estimated to be 218.1 million households) in Sub-Saharan Africa who are currently without access to clean cooking solutions could represent a potential market of \$3.24 billion USD a year if they were to transfer to electric cooking.

Life cycle assessment has not been conducted, however avoiding the burning of solid fuels for cooking would avoid 2% of global CO₂ emissions and 58% of global black carbon emissions. Using a water tank as energy storage is also expected to reduce environmental impacts as it significantly reduces the size of battery required (therefore reducing all the environmental impacts associated with battery manufacturing).

[Link to the Full Report](#)

[Video Submission](#)