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## Energy Monitoring and Management System

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# The Energy Monitoring and Management System

Zachery Holsinger, Benjamin Weaver, David Williams

## Our Project

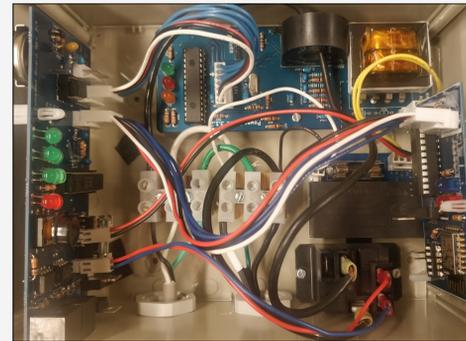
Many areas of the world do not have reliable access to electricity. Some worry about rationing limited solar resources and others strive to minimize usage on a local electrical grid due to cost. There are few viable options for energy management available.

The Energy Monitoring and Management System project is developing a meter to help automate the regulation of energy usage. The meter will be able to measure energy usage and set limits for rationing.



## Working Principle

Our solution consists of a meter which allocates a configurable daily energy limit and includes a display that provides feedback to the user. This display includes information about how much energy remains in a day and how much power is being used at any time. Through the interface, the limits can be set, notification alarms can be managed, and information about lifetime energy usage can be seen.



Inside the EMMS Meter! The meter is organized into modules so future improvements can be added without replacing the rest.

By connecting to the power source in parallel and by running the main line through a transformer, the meter is able to measure the voltage and current drawn by the system, and from there can calculate energy and power. Once the energy usage has reached a specified level, a relay cuts the power supply for the rest of the day. Then, every day at a user-specified time, the energy allotment is restored.

## Meter Installation at TCZ

In May of 2019, we installed 25 EMMS meters in Zimbabwe. These meters have working hardware, but the code made the meters nonfunctional for more than a few minutes at a time. Knowing code changes were coming, we left equipment at TCZ so that they can update the meters when the code is running.



Bennett Andrews installing an EMMS meter in Zimbabwe

Installing a meter requires splicing an incoming power line (120VAC or 240VAC) and using the provided cable junction and labels housed in the meter enclosure to wire positive, negative, and ground through the box. The spliced wires are held by screws and housed inside the enclosure to prevent exposed wires and prevent the connections from weathering.

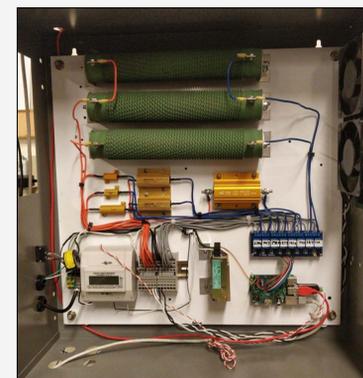
## Clients

- Ray Motsi; Theological College of Zimbabwe (TCZ)
- Matt Walsh; on behalf of IMS in Burkina Faso
- IEEE Smart Village



## Current Status

During the 2019-2020 year, the team has primarily been focusing on several code issues that prevented the meter from functioning properly in Zimbabwe. The code that handles the communication between parts of our meter has been overhauled, and several other bugs have been successfully fixed. Currently, we are tackling what we think are the last of the code issues and completing some more rigorous testing of the code before reaching out to our client to update the code remotely. We have also worked to improve the design of our enclosure based on notes taken during the site-team trip.



Our new variable load system for calibration!

## Looking Forward

As a project, our first priority is to finalize the current version of the meter with thorough testing. Once we are able to update TCZ, we have a number of goals and dreams for the future of the meter. These include, but are not limited to surface mount boards, a payment system for energy usage, and potential RF or cell-type connections for meters.



## Acknowledgements

We would like to thank our Project Review panelists for their advising and guidance. We would also like to thank Tom Austin, project manager, for his continuing support and leadership.

