

BACKGROUND

In areas where the electrical grid is not available, mobile microgrids could become an adaptable and scalable solution for those in need.

Photovoltaic (PV) panels in combination with batteries can be used to produce and store power where needed. Unfortunately, modern electronics needlessly convert Direct Current (DC) power to alternating current (AC) and back again with a loss of approximately 30 percent of all power produced.

Mobile power stations have the capability to increase usable electricity while remaining lightweight, mobile, and safe around the world.

This project has the potential to help provide power to those in underserved, transient, and those suffering natural disasters.



Residential Use of DC Power

Providing remote power to individuals and communities without direct access to the electrical grid system.



DC vs AC Testing

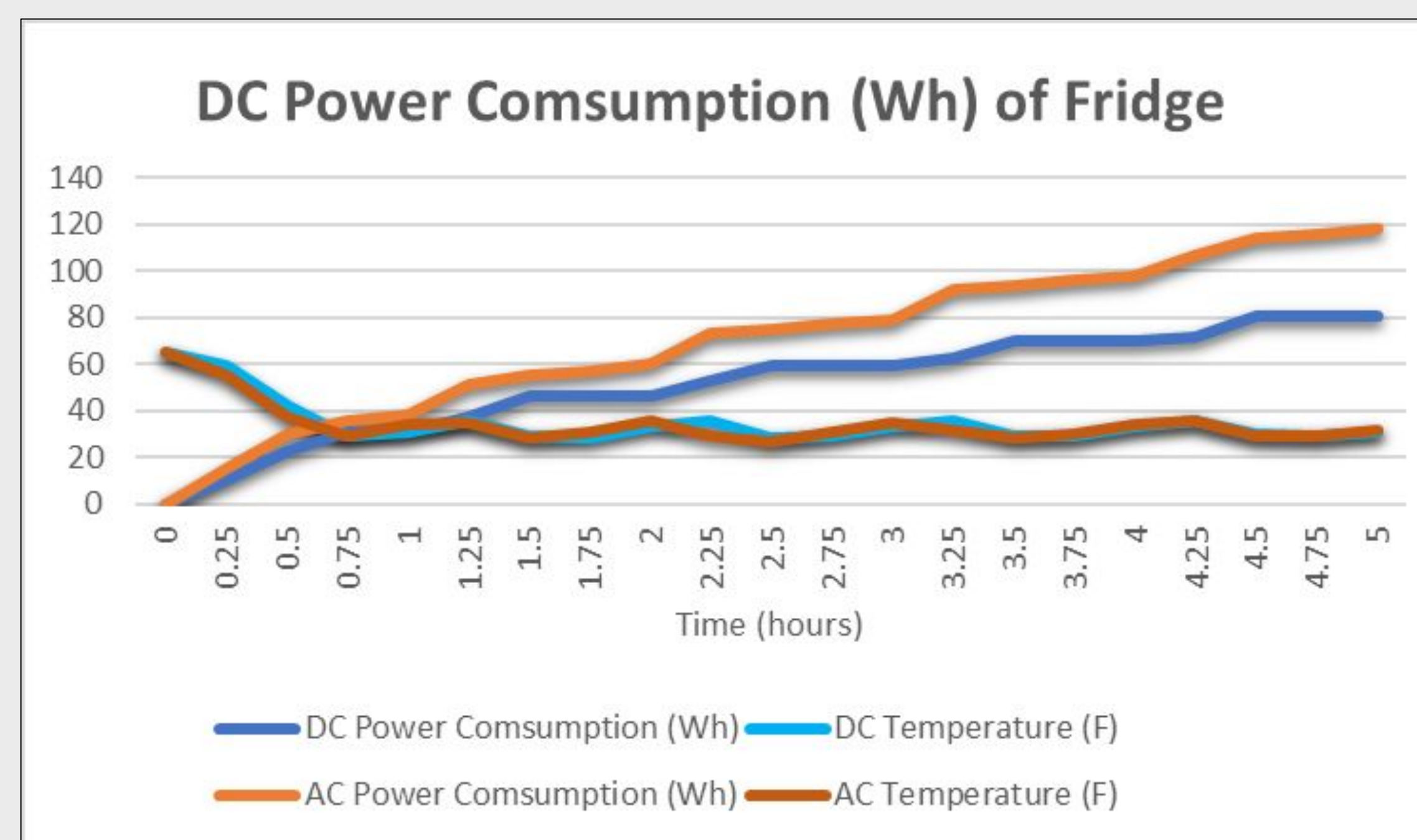


Figure 1. TV power test

The Direct to DC Power system was compared to an equivalent AC converted system with a mobile fridge, Television, Lighting, and phone charging. Results show that the DC power system operated at an efficiency of **30 percent above** the equivalent AC system.

Power Station



Figure 2. Central Module

Figure 3. Basic Needs Module

The Central Module houses a power meter, fuse box, and room to store two expansion modules. The product includes waterproof extension cables capable of attaching a 12V car battery and providing power to two, four port expansion modules that can be attached directly to DC accessories.

A basics needs module pictured in figure 3 is capable of handling lights, TV, and basic electronics charging up to 12 amps of current

The Kitchen Module handles heavier electrical loads such as hot plates and fridges. The module handles loads of up to 30 amps.

Need for DC

According to a 2016 study on energy services for refugees and displaced people found that a displaced person requires a combined 1720 KW of power to safely cook and heat for themselves in a safe manner.

By using a 100 percent DC power module a displaced person can save \$60 to \$500 when compared to AC grid power depending on cost per KWh

DC saves 30 percent of the total energy used which can expand a displaced persons ability to power their accessories for 16 hours a day to 24 hours per day

DC systems can be set up remotely, safely, and without prior training. With the addition of a PV system that can match power needs, the system could potentially run indefinitely without the need to maintain the system or protect it from the elements.

Current Prototype

The current prototype utilizes a 12V RV battery to power two power distribution modules for use by the consumer. Off-the-shelf waterproof cases and electrical connectors were used to increase the weatherability to IP67 standards

Future Vision

The product was created as a scalable model for future Capstone teams to continue testing and build upon. Future iterations will:

- Integrate power management for accessory prioritization
- Integrate PV power battery management
- Field and lab testing
- Larger capacity battery for long term power needs

Project Team

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