

# High Capacity Wood-Fired Oven with Phulano Baking Group & D2D Chilumba, Malawi Noelle Jacobs

## Abstract

Three engineering students were sent to Malawi, Africa through the ETHOS program to work with the non-profit, Determined to Develop (D2D), started by Matt Maroon a University of Dayton graduate. The non-profit focuses on four different areas of development in Malawi: Health and Nutrition, Environment, Education, and Women's Empowerment. One way the non-profit works to empower women is by supporting various small businesses run by women. One ETHOS student was tasked with designing and building a higher efficiency and higher capacity oven with the Women's Empowerment Phulano Baking group. This oven would hopefully help grow the baking business.



Figure 1. ETHOS student with the Phulano Women's Baking Group

## Introduction

- Deforestation is a big problem in Africa
- Main form of cooking, both inside and outside, is through fire burning
- Higher efficiency ovens/stoves are needed in order to reduce wood use
- The Phulano baking group is the most successful Women's group that D2D supports
- Good candidate for a way to grow their business through a higher capacity oven that is also higher efficiency

## Project Description

### RESEARCH

- Looked for information on high efficiency ovens and stoves, both indoor and outdoor
- Sought out designs in various rural communities for a display of similar materials available

### DESIGN

- Inspiration taken from American design of a backyard oil drum oven
- Consists of five oil drums in pyramid shape, a chimney to create draw and smoke ventilation, counters and shelves for preparation and cooling, steps to reach higher drums, and two fire chambers at back to allow for adaptability to smaller batches

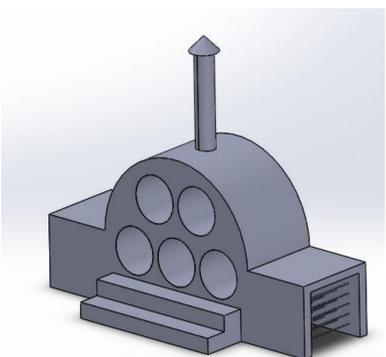


Figure 2. Isometric view of new oven design

## Project Description

### CONSTRUCTION

- Foundation was dug out and poured
- Bricks were laid to begin the structure
- Drums were taken to local welder to transform them into chambers with two racks for pans
- Clay was applied to outside of oven to provide insulation in addition to the brick
- A roof was built for protection from the elements



Figure 3. Construction



Figure 4. Construction

## Results & Discussion

### RESULTS

- Capacity was increased by five times while wood use only increased by two times
- Same oven pre-heating time and same bake time
- A ton of buns

Table 1. Results of the first bake

Time to heat	Amount of wood	Time to bake	Number of pans
~1.5 hours	~3 bundle of small, 6 large logs	~20 minutes per pan	~10 (per bake)



Figure 5. Some of the first buns!



Figure 6. Ribbon cutting

### DISCUSSION

- Easy to use with lifting fire chamber doors and hooks
- Counters and racks provided a place for preparation
- The doors of the chambers sealed and didn't allow too much heat out
- The chimney provided sufficient ventilation for smoke
- The buns were delicious!

## Recommendations

- Not starting the fire as early as they do because it isn't necessary
- Perhaps starting to buy more dough so they can make as many buns as possible every time
- Better trenches to prepare for rainy season (we ran out of time)

## Acknowledgements

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