

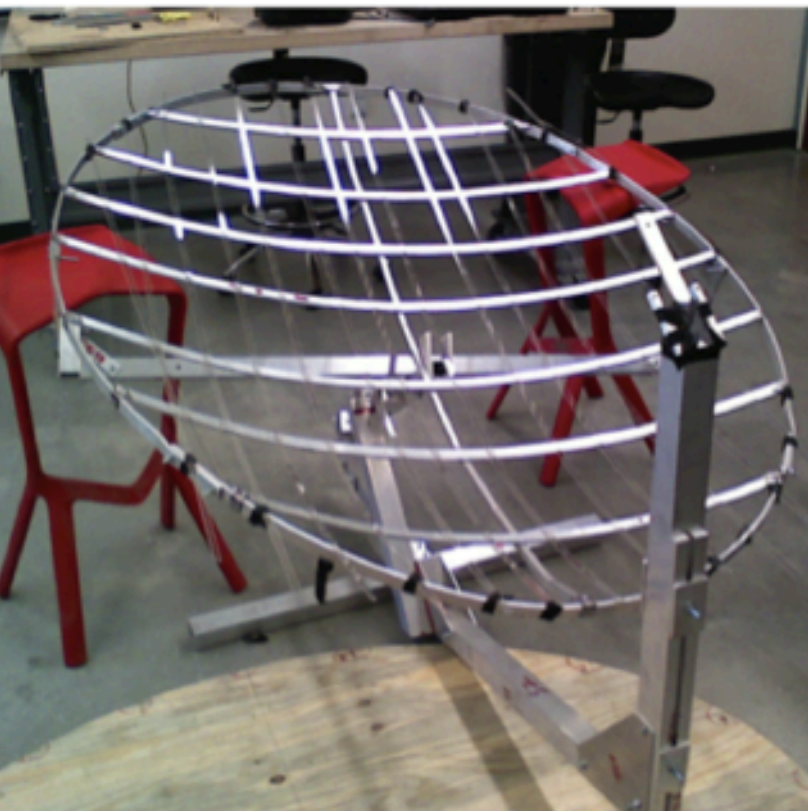
# Insulated Solar-Electric Cooking in Uganda

## and Preliminary Implementation of Prototypes

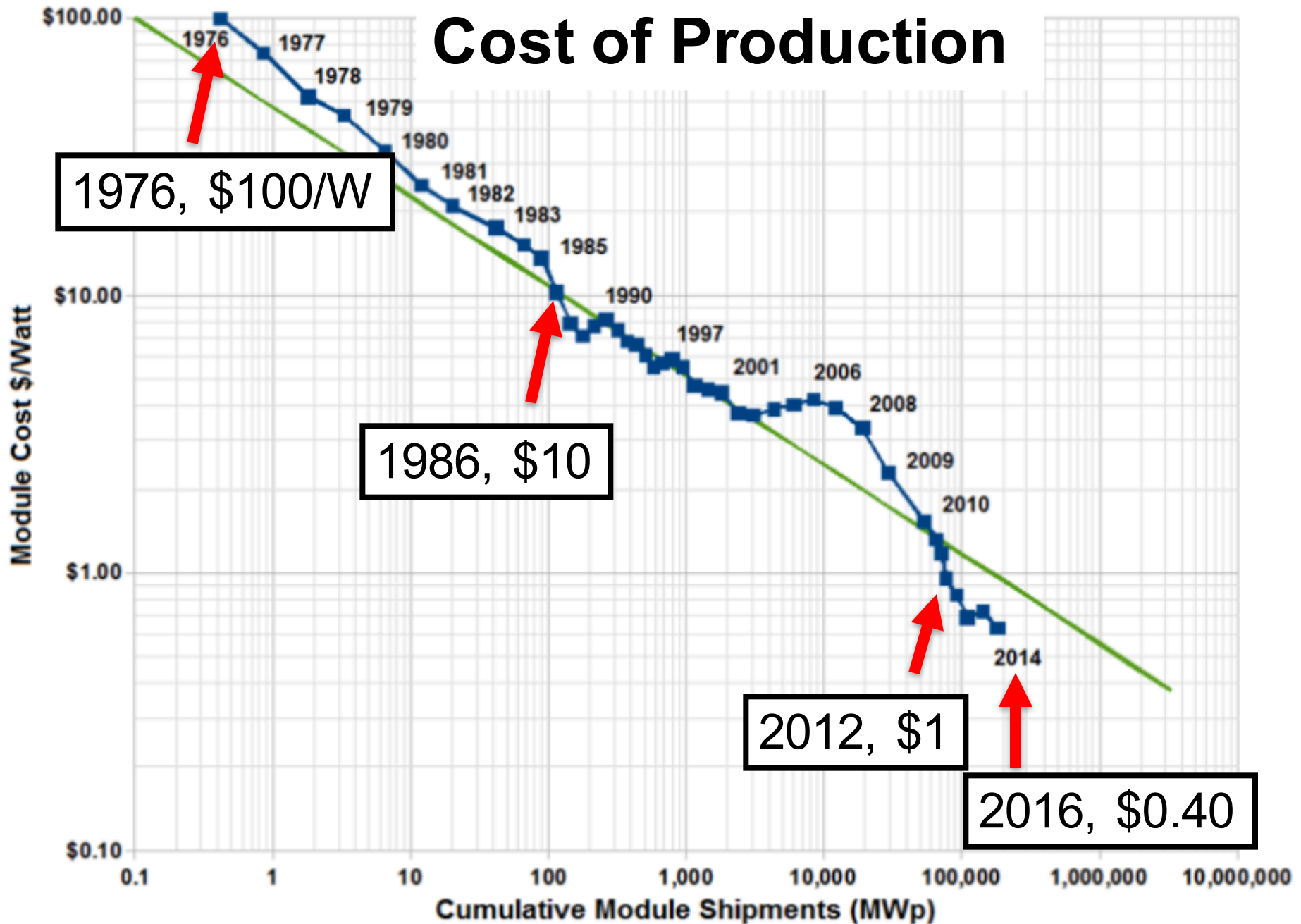




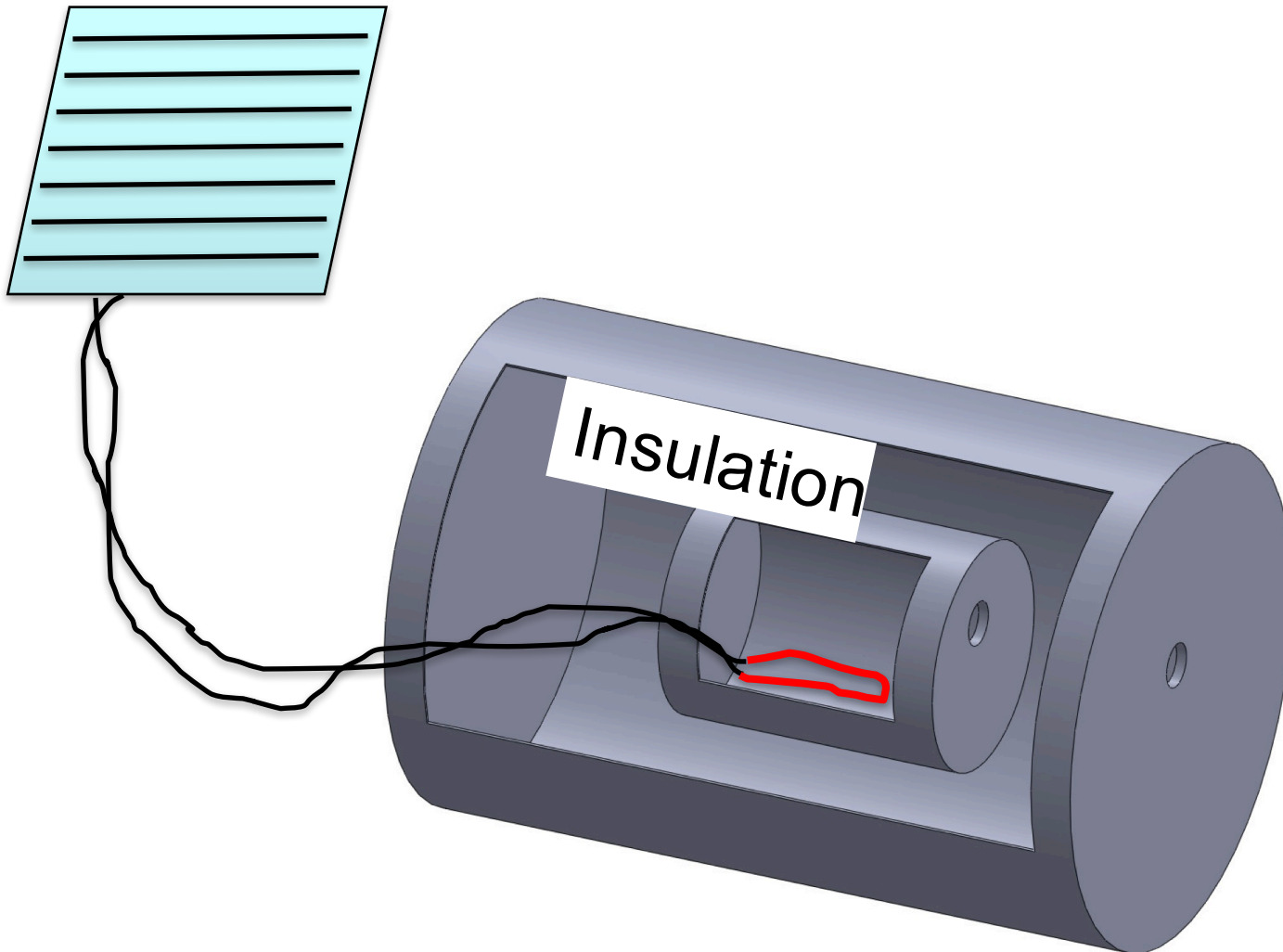
After 5 years of trying to make powerful concentrators cheaper and more reliable than Scheffler, the future of PV became apparent.



# PV Learning Curve, Cost of Production



# Solar Panel, Heater, No Electronics

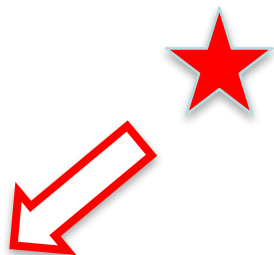
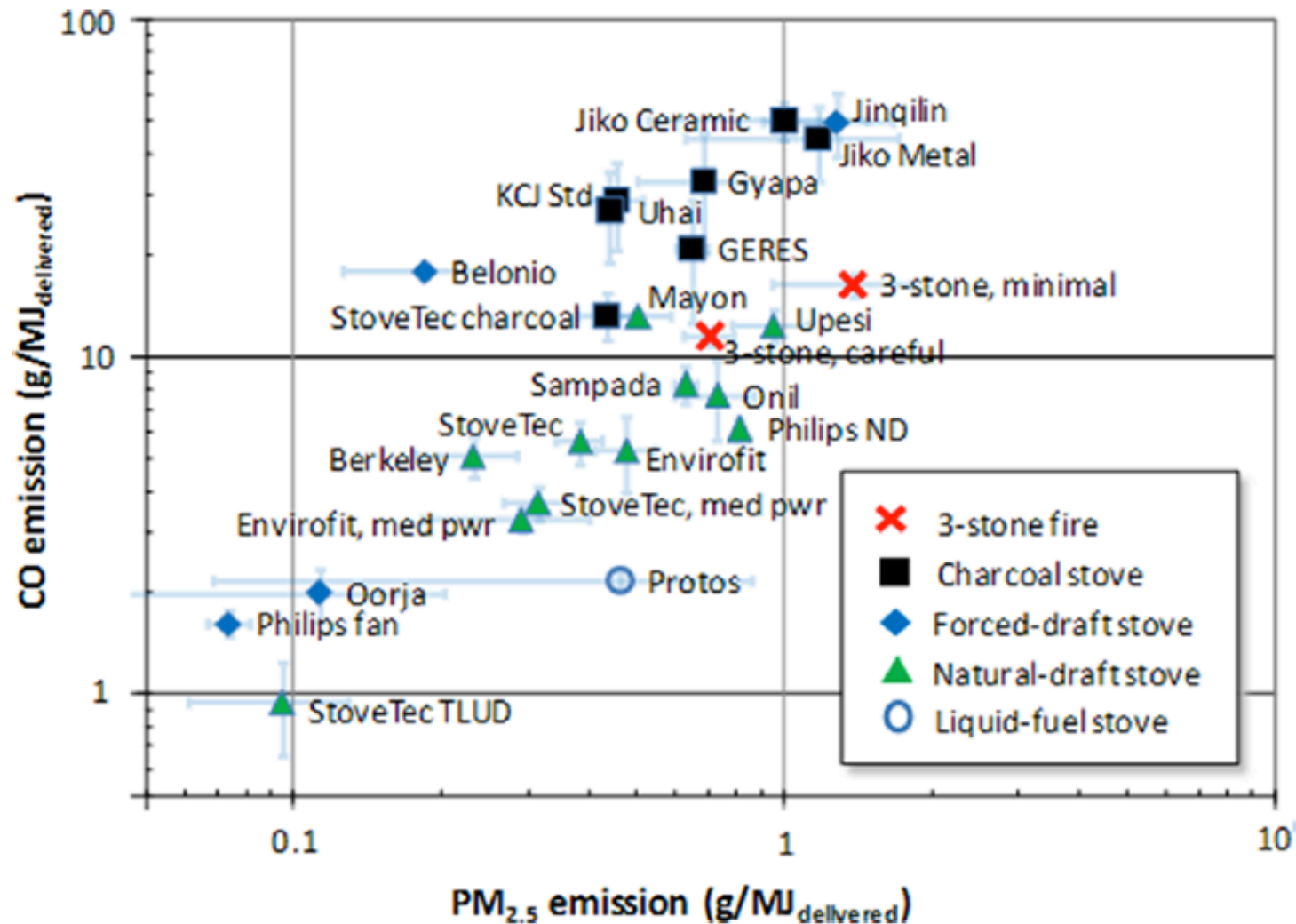




100 W:

- \$75 (PV) + \$2 (heater)
- 1 liter of water boils after 1 hour
- 1 day ~ 6 kg of food

Tier 4  
and  
beyond



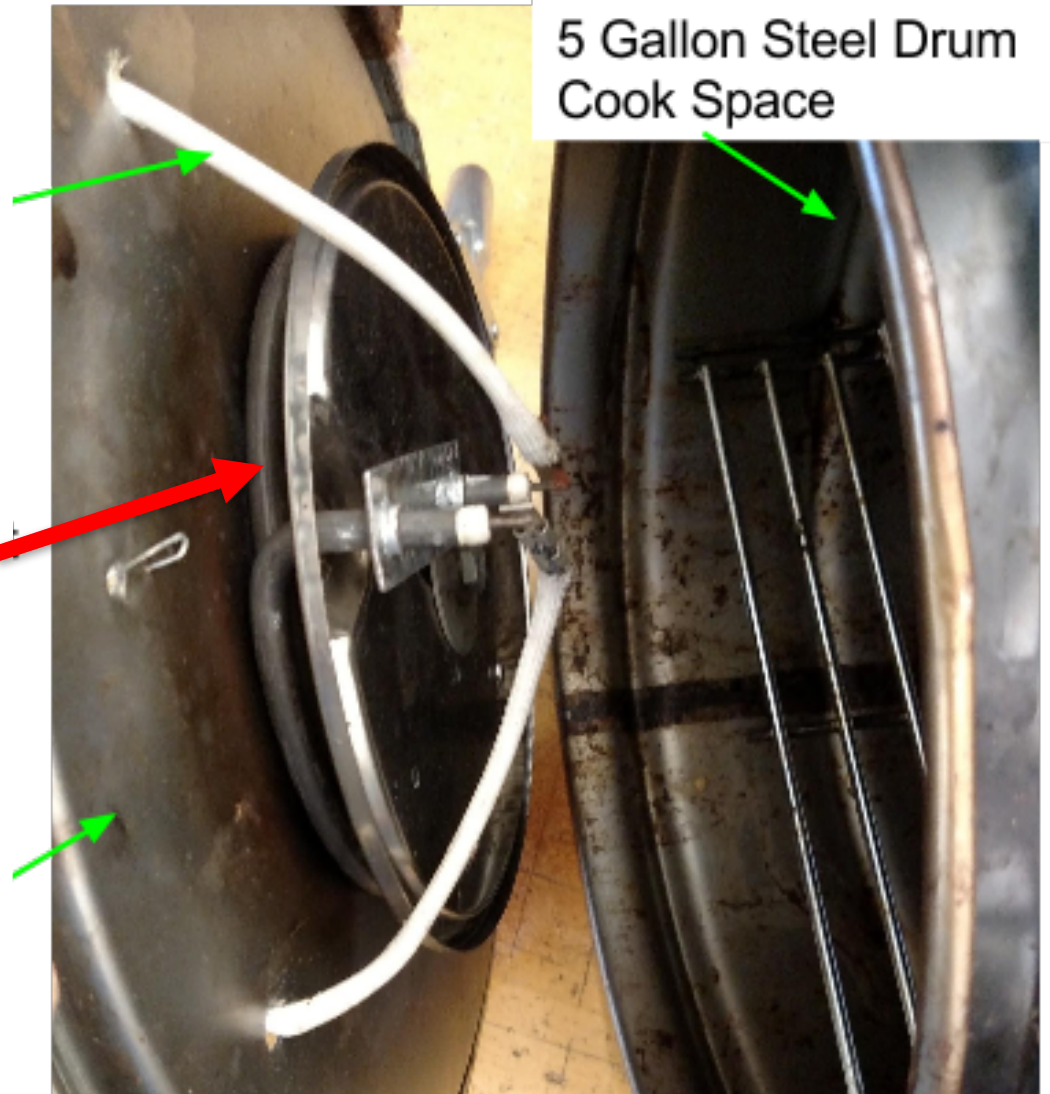


# Prototype #1: Barbeque



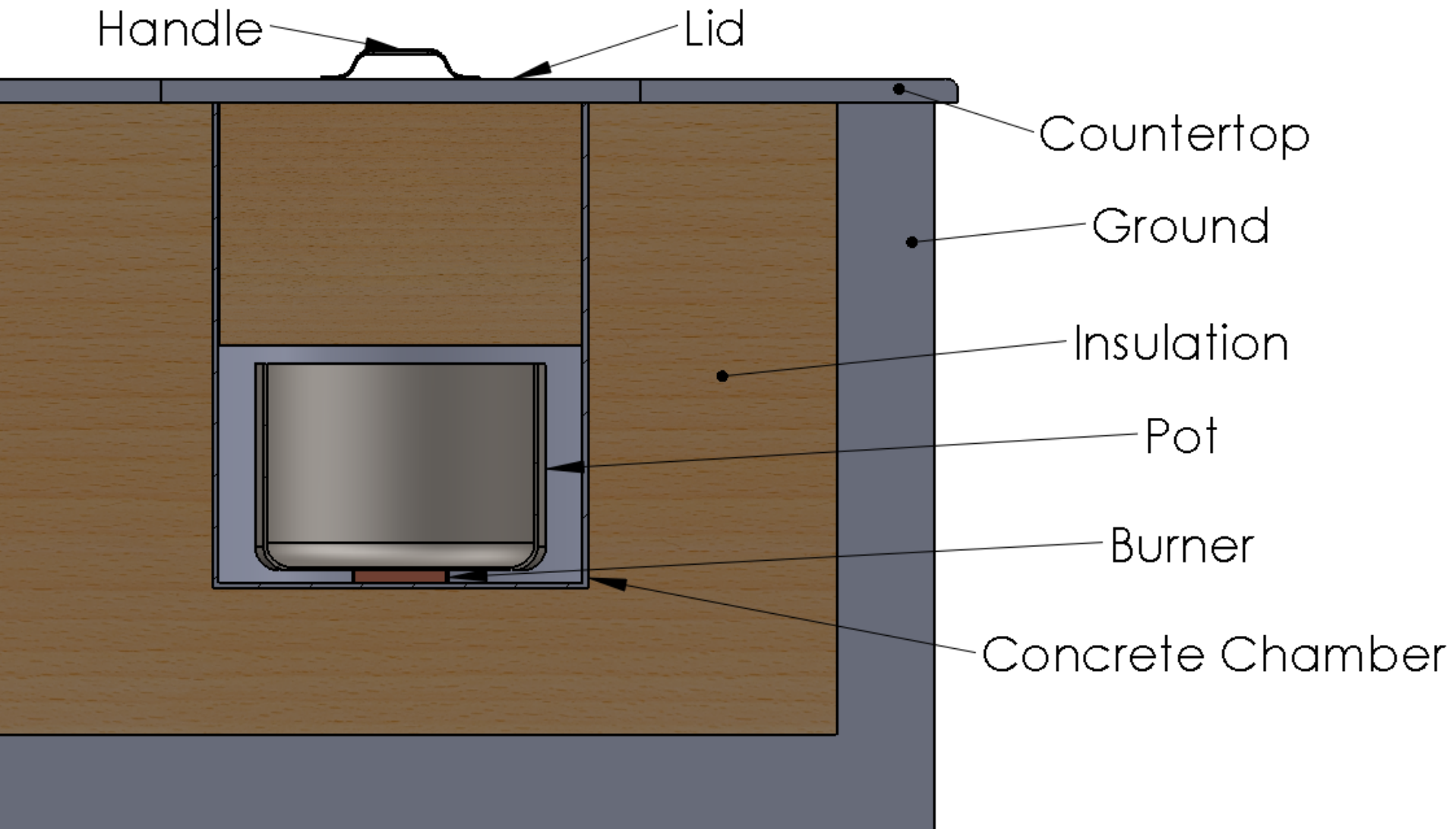
Electric Range  
Heating Element

5 Gallon Steel Drum  
Cook Space

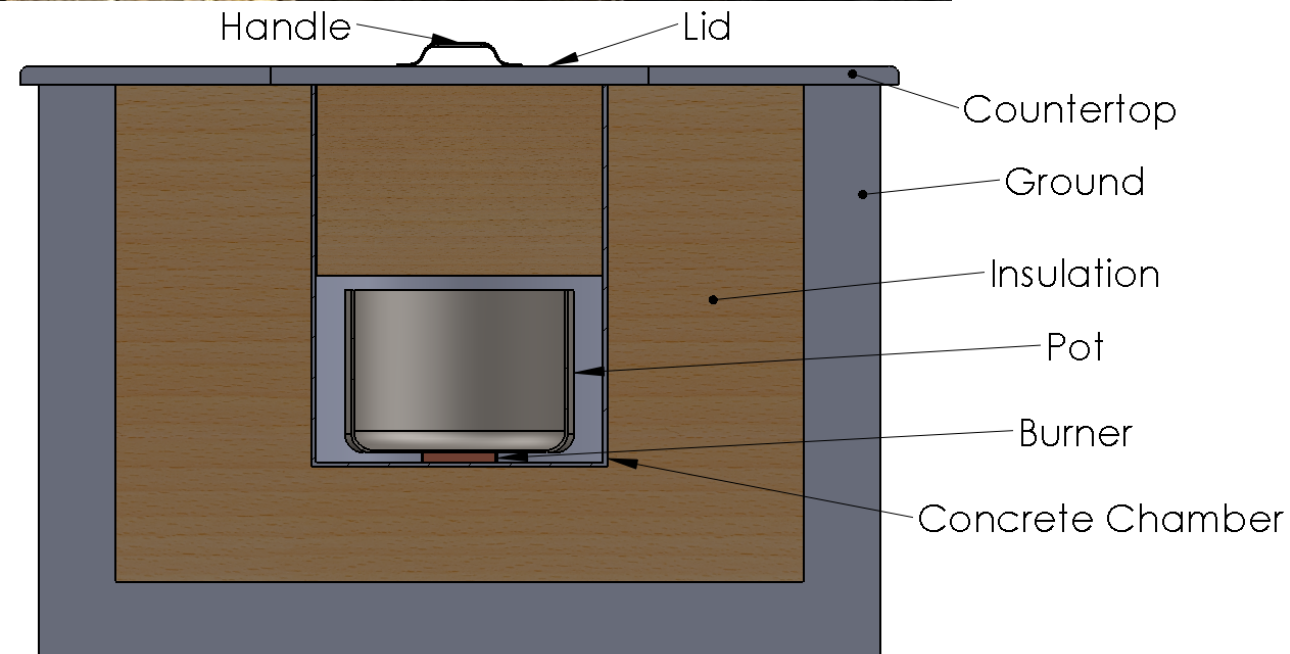




# Prototype #2: Boil and Simmer



# Earth Housing, Straw Insulation





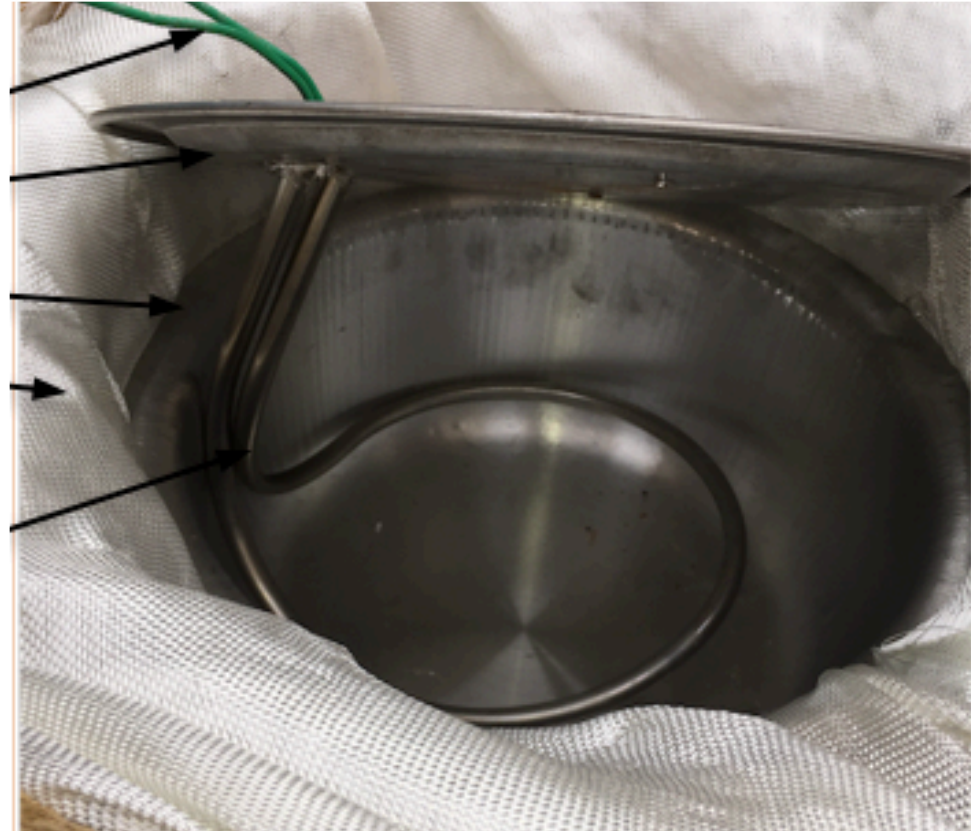


## Nickel-Chromium Wire and Concrete:

- Tailor Resistance
- Tailor Shape and Size

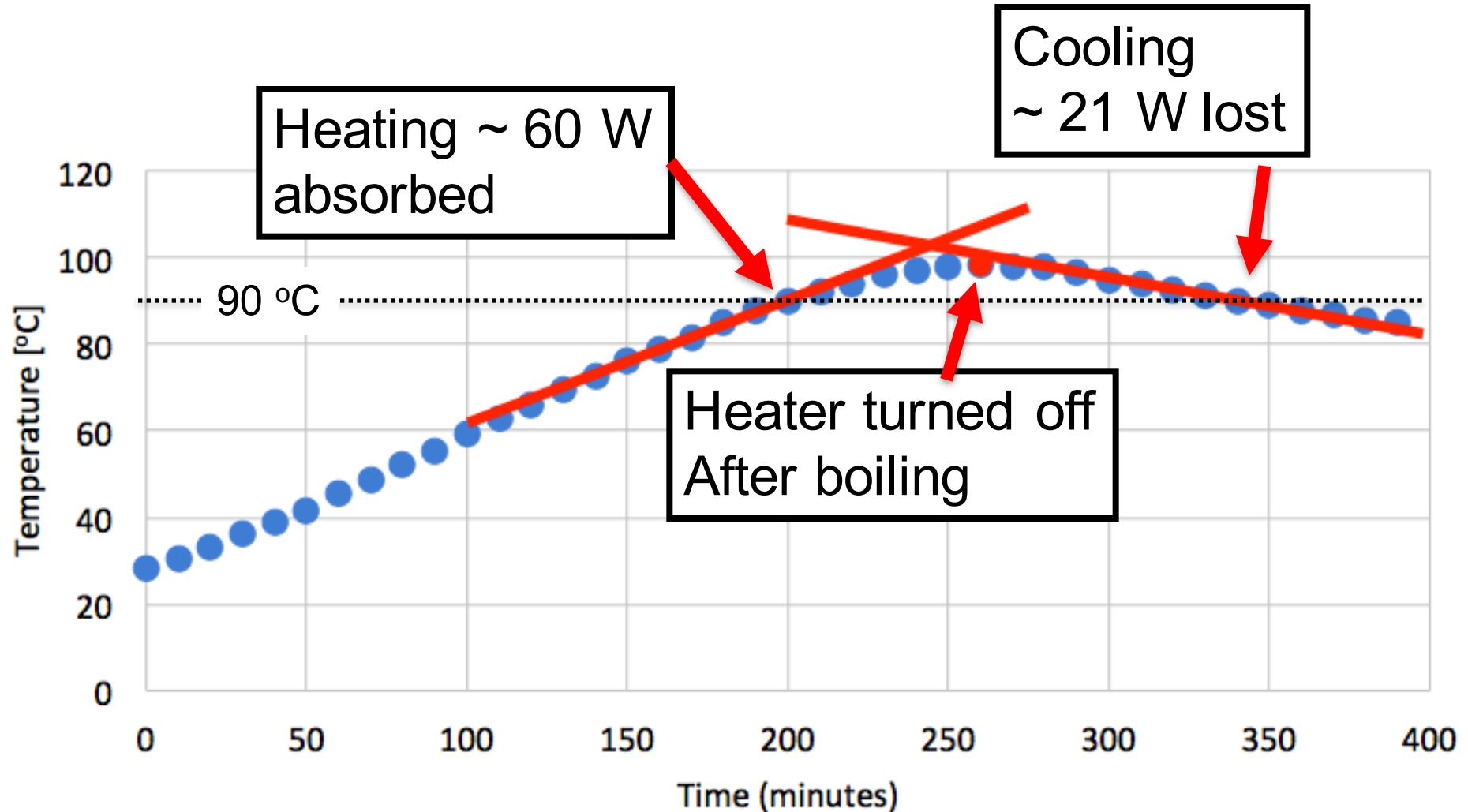
# Prototype #3: With Immersion Heater:

- Eliminates need for shell between heater and insulation
- Insulation stays below boiling point
- Stainless steel
- Heater costs \$2



# 2.7 kg of stew

## 4 hours to boil with 80 Watts





# Heating Efficiency at 81W, 90°C:

$$\zeta = \frac{P_{absorbed}}{P_{in}} = \frac{60 \text{ W}}{81 \text{ W}} = 74\%$$

Increases with:

- Increased power
- Improved insulation
- Decreased pot size (surface area)

Ok, it works great, but will it be used?  
We need implementation studies!

# Off to Uganda with Aid Africa





# Four Students, one Month





# Collaborative Design with Users

## Aid Africa: Build your own stove

### Prototype: ugly and too low





Reed is better



They built two stoves, are they used?





# Development Engineering, January, 2017

## “Insulated Solar Electric Cooking – Tomorrow’s Healthy Affordable Stoves?”

Pete Schwartz, *Cal Poly Physics*

Peter Keller, *Aid Africa, Uganda*



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10 Student Authors

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**Original Barbeque Prototype, 2015**



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Boil and Simmer Prototype, 2016

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Uganda Implementation, July 2016

Yes, they use the two stoves...

...to heat bath water?





Stoves are used daily for cooking all kinds of food, but increasingly for bath water.

- For \$100?
- Not displacing biofuels?
- Carbon market funding?

# Plan:

a) 50-100 stoves single community to see if ideas are shared.

b) Provide solar water heating to encourage cooking.



40L 100  
Shower  
from tomt

Features:4  
environme

[See more c](#)

**\$6.63**

tomtop.com

ol.

Users express desire for more available power (just like we would):

c) Cal Poly team developing thermal storage for more available power

d) Hybridization is easy: just heat on a fire first.

e) Hybridization reduces use of high emission, low power fires.

# Insulated Solar-Electric Cooking in Uganda

- Any Ideas?
- Want to try it?
- Work with us?

Thanks!

