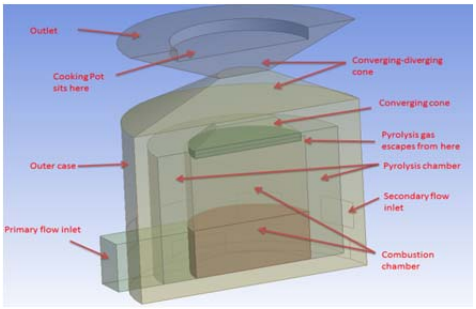
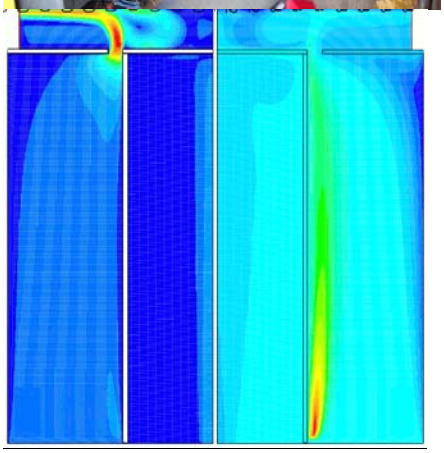
# Sustainable Energy Cookstove Producing Biochar: Modeling, Testing, and Design




I am looking for 1-3 students to join work on the modeling, design, and testing of cookstoves that use biomass fuel to produce both biochar and heat for cooking. In recent years, there has been much interest in designing improved cookstoves for use in developing countries. Improvements have focused on reducing harmful emissions and improving efficiency. We are working on a different type of cookstove, which produces both heat and biochar. Biochar is a carbon-rich residue of combustion, similar to charcoal, that has beneficial effects on soil fertility. Biochar in the soil also sequesters carbon, potentially serving as a net sink for CO2. We use numerical modeling to improve the heat transfer and fluid flow in the stove. We also consider factors that make the stove convenient to use, safe, and economical. For instance: How easy is it to load fuel? Can the heat output be varied for different cooking tasks? Can we guard against dangerous products? How can the stove be manufactured in Kenya?

The project is part of a large project based in Soil and Crop Sciences and involving collaborators at other universities and abroad. Our prototype stove was tested in 30 households in Kenya in 2013, and our collaborators from UC Irvine are currently processing data from measurements of air pollutant levels in those households. For AY 13-14, we plan several complementary activities: 1) adapting our current design drawings so that they can be fabricated more easily and more inexpensively. 2) improving numerical models of the complex heat transfer, chemical reactions, and fluid flow in the stove for further improvements in performance 3) validating current numerical models and learning more about pollutant emissions through laboratory measurements on a cookstove.

Students with an interest in numerical modeling with commercial software can contribute, as can people who are interesting in designing, instrumenting, and testing a prototype cookstove. **I have a preference for students wishing to start a 2-semester project for Fall 2014 and Spring 2015.** Work on the cookstove project can be used for M. Eng. or senior design credit, or can be taken as independent study (MAE 4900).

DESIRED QUALIFICATIONS: familiarity with heat transfer, fluid mechanics, thermodynamics, and basic chemistry. Desirable, but not necessary: experience with FLUENT, CFX, or COMSOL software, hands-on lab work, coursework in combustion or numerical modeling, fabrication skills, knowledge of Labview and Matlab.

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