1649: Parameterisation of TLUD Cookstoves to Reduce Emissions

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BACKGROUND
- 3 billion people use biomass fuels in primitive cookstoves
- 4 million people die each year from indoor air pollution
- Little scientific data on the operation of improved cookstoves

AIM
Goals:
- Investigate the effect that TLUD stove parameters have on stove performance
- Provide design recommendations based on analysis of data

Parameters under investigation:
- Primary Airflow Rate
- Secondary Airflow Rate
- Fuel Size
- Fuel Stack Location
- Depth of Fuel Stack

WHAT IS A TLUD
Top-Lit Up-Draft Cookstove (TLUD):
- An improved cookstove
- Separation of volatile gases from the solid fuel mass
- Volatile gases mix with air at a secondary air inlet
- Better mixing between gas and air leads to more complete combustion
- Reduces hazardous emissions

METHODOLOGY
Data Collection:
- Emissions (CO, CO₂, O₂, NOx, H₂)
- Cookstove internal temperature
- Cookstove chimney temperature
- Water boiling test

Approach:
- Benchmarking of natural buoyancy driven conditions
- Iterative forced air tests to determine an airflow range

RESULTS
The primary airflow rate results for carbon monoxide (CO) during the steady-state phase are seen below.
- Red dashed line is from natural buoyancy testing

- Natural buoyancy airflow around 90 - 120 L/min
- Airflow rates greater than 120 L/min do not yield noticeable improvements in CO reduction

CONCLUSION
Goals completed:
- Forcing primary air beyond natural conditions is not effective at improving combustion efficiency
- Forcing secondary air reduces harmful emissions
- Larger surface area to volume ratio of fuel results in lower hazardous emissions
- Fuel stack close to the secondary inlet reduces CO peak in initial phase
PROMOTING STOVE RESEARCH

CHANNEL 11 SCOPE

The current project will be featured on a science show, called Scope, to be broadcast on network television. During filming the importance of improved cookstoves was emphasised, as well as the benefits associated with TLUD stoves.

WORLD VISION

On the 14th of July 2014, the CEO of World Vision Australia, Tim Costello, visited the Thebarton Research Laboratory, where members of the group gave an overview of the current project. Preliminary discussions are currently underway which may see World Vision Australia contributing towards an ARC linkage grant for future improved cookstove research at the University of Adelaide.