

Emissions reduction in a household cook stove with a simple modification



G. Archan, M. Blehrmühlhuber, J. Gregorc, P. García-Ramos, N. Muhumuza, C. Rakos, P. Anderson, R. Scharler, A. Anca-Couce

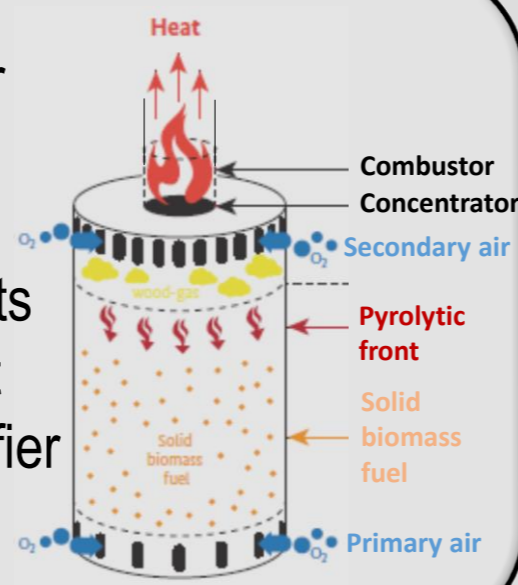
MOTIVATION

Problem

- 2700 million people cook with biomass in substandard traditional stoves.
- **3.8 millions deaths** due to **household air pollution** in 2016 in low- and middle-income countries.

Solution

Re-engineer devices and methods, with concepts as the top-lit updraft gasifier (TLUD).



Target of this work

To further optimize cook stoves in order to reduce its emissions.

Application in **Awamu Gasifier Stove**, a TLUD-based cook stove employed in Uganda.



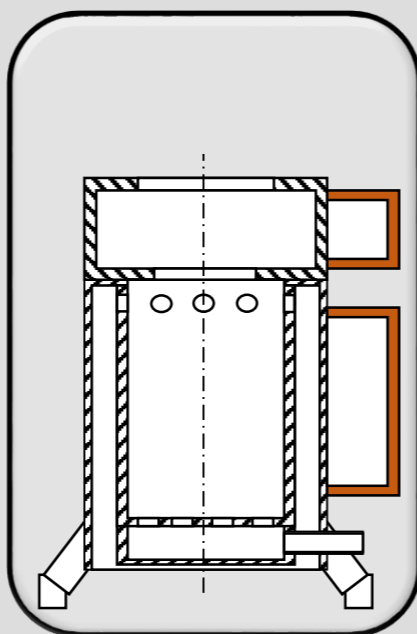
COOKSTOVE MODIFICATION

Introduction of **extra combustor** with insulation on top of original one:

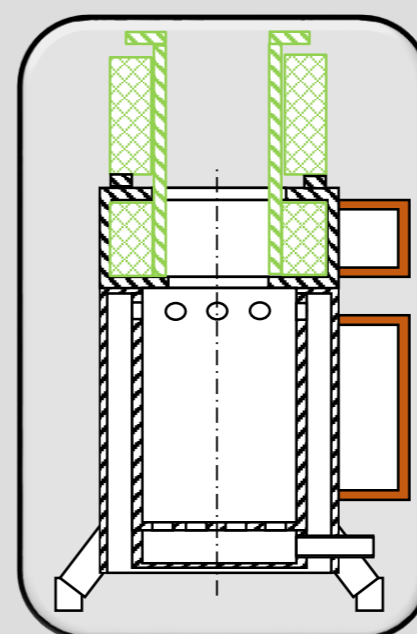
- Increase of residence time, draft and temperature for combustion.
- Simple and with reduced costs.



Novel combustor with and without insulation



Original Awamu cook stove



Modified Awamu cookstove with novel combustor in green



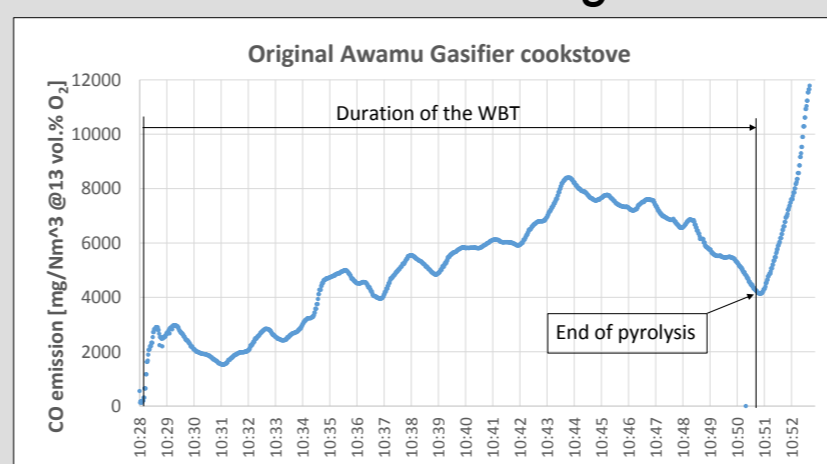
Pot
Modified combustor
Fuel bed

RESULTS AND DISCUSSION

Water boiling test (WBT)

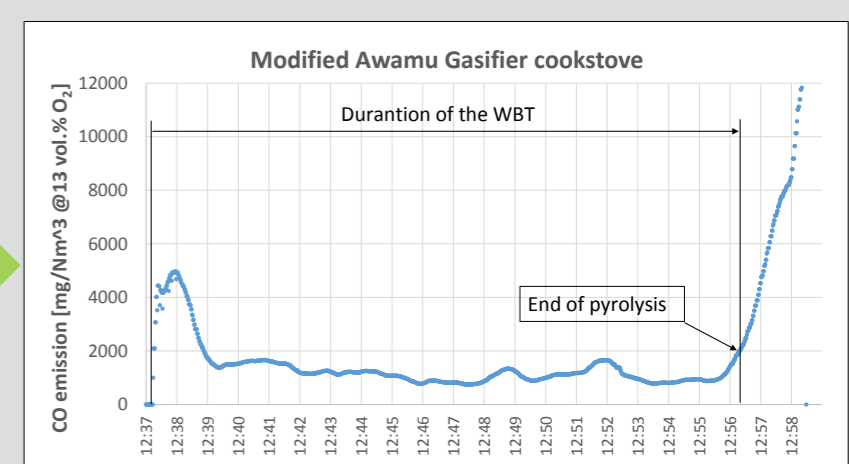
	Original cook stove	Modified cook stove
Time to boil [min]	22.3 ± 2.1	19.7 ± 2.1
Firepower [kW]	3.94 ± 0.36	4.65 ± 0.51
Efficiency [%]	28 ± 1	27 ± 2

CO emissions original



5.3 g CO / Nm³ (13% O₂)
8.5 g CO / MJ_{del}

CO emissions modified



1.3 g CO / Nm³ (13% O₂)
2.15 g CO / MJ_{del}

↓ 75%

Influence of modification:

- Similar efficiency, in a typical range for this kind of devices.
- Increased firepower due to higher natural draft.
- **75% reduction in CO emissions.**

- ✓ CO emissions in traditional biomass cook stoves can be reduced with simple methods.
- ✓ These cheap solutions can lead to significant health benefits when they are implemented.



Contact:

Dr. Andrés Anca-Couce
anca-couce@tugraz.at
+43 316 873 4203

Group Bioenergy clean and sustainable systems
Institute of Thermal Engineering
Graz University of Technology
Inffeldgasse 25 B, A 8010 Graz, Austria
www.iwt.tugraz.at