

# Comparison Testing of Haitian Cookstoves

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Please visit: <http://gadgilab.berkeley.edu> for more information.

## Background



Haitian woman selling charcoal <sup>1</sup>

85% of Haitians use biomass for fuel, mainly charcoal,<sup>1</sup> even though Haiti is over 96% deforested.<sup>2</sup>

Since the earthquake, charcoal now costs up to 40% of a family's income.<sup>3</sup>



Border of Haiti and the Dominican Republic <sup>2</sup>



Stove trial of several charcoal stoves in Haiti <sup>2</sup>

Many cookstoves were already available for dissemination in Haiti.

Gadgil Lab - Stoves provided an unbiased, independent assessment instead of designing a new stove.



Stove testing facility <sup>3</sup>



Haitian woman with *diri kole ak pwa* (rice with red beans and vegetables) <sup>1</sup>

## Tests

### Pros

- International standard
- Can be used for cross-comparisons of stoves (different countries or types)
- Repeatable
- Incorporates culture-specific cooking practices
- More representative of stove behavior in the field

### Cons

- Not necessarily representative of stove performance in the field
- Does not consider cultural needs
- Regional specific - shouldn't compare stoves internationally
- More variables to control than WBT

## Controlled Cooking Test (CCT)

Lab-reproducible surrogate of local cooking practice

In the case of Haiti, this meant preparing *diri kole ak pwa*, a combination of beans, vegetables (simulated by boiling water), and rice.



Five charcoal stoves tested for the CCT <sup>3</sup>

## Water Boiling Test (WBT)

Lab test based on the energy needed to bring water to a boil and keep it simmering.

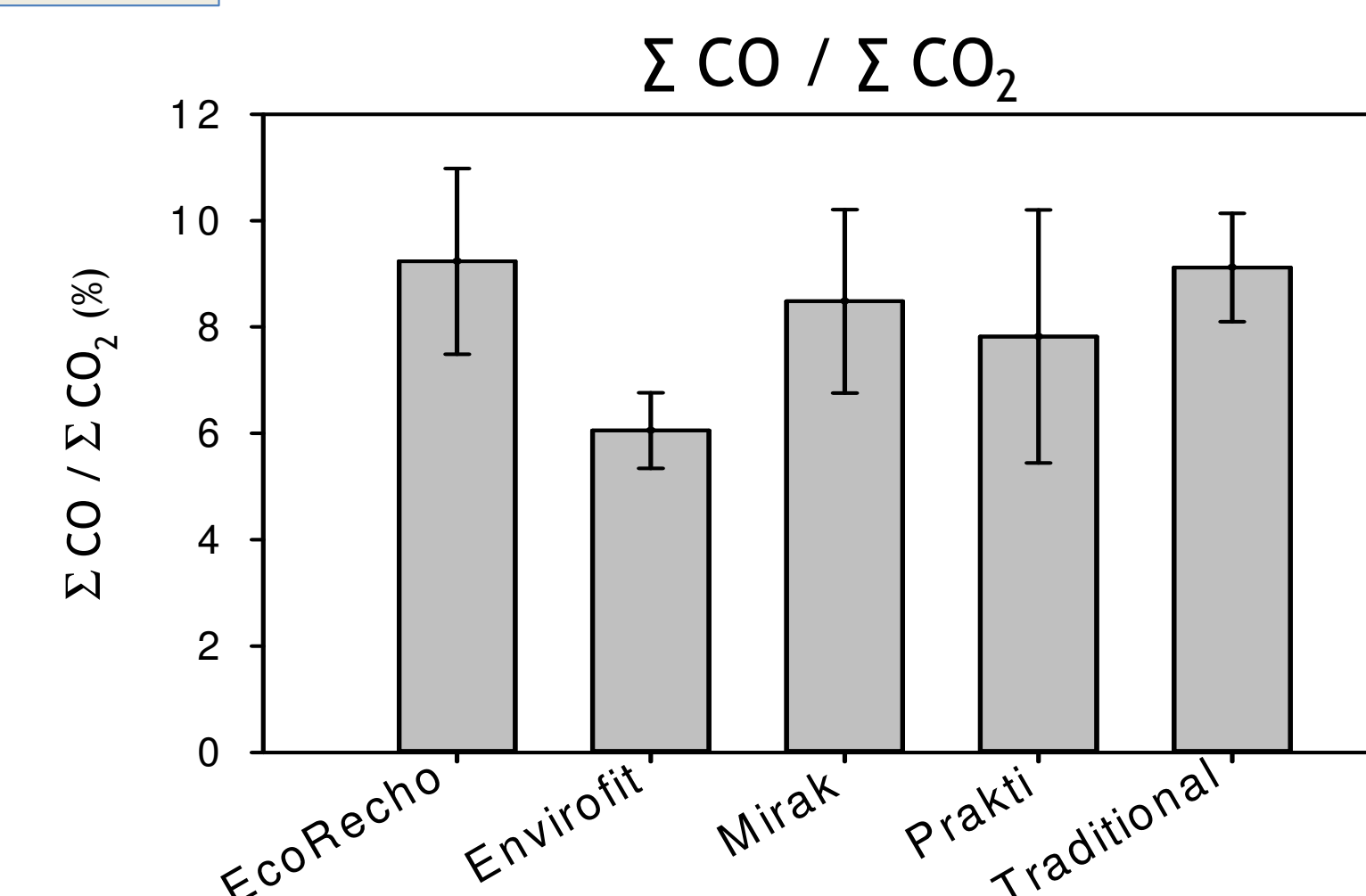
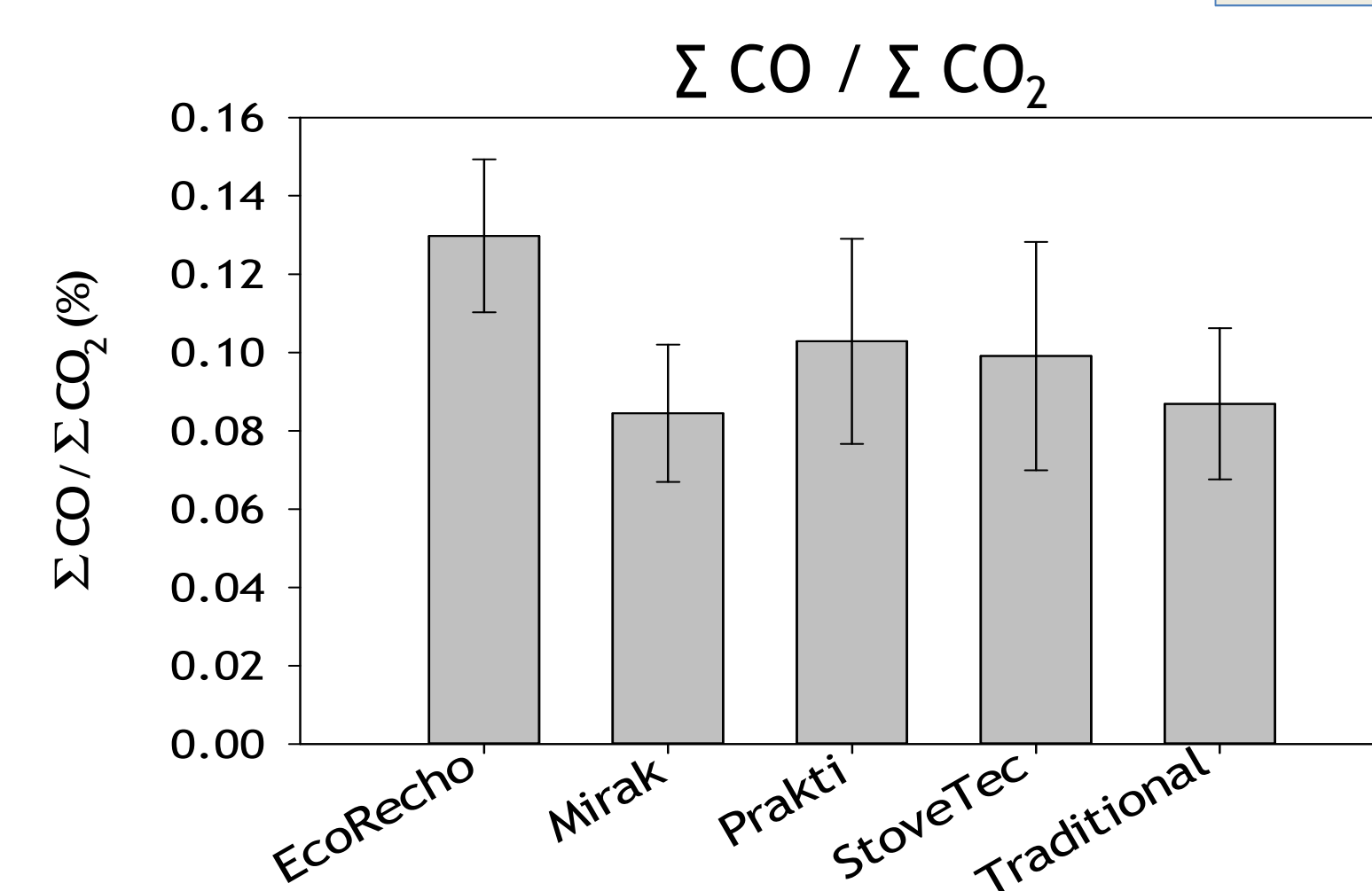
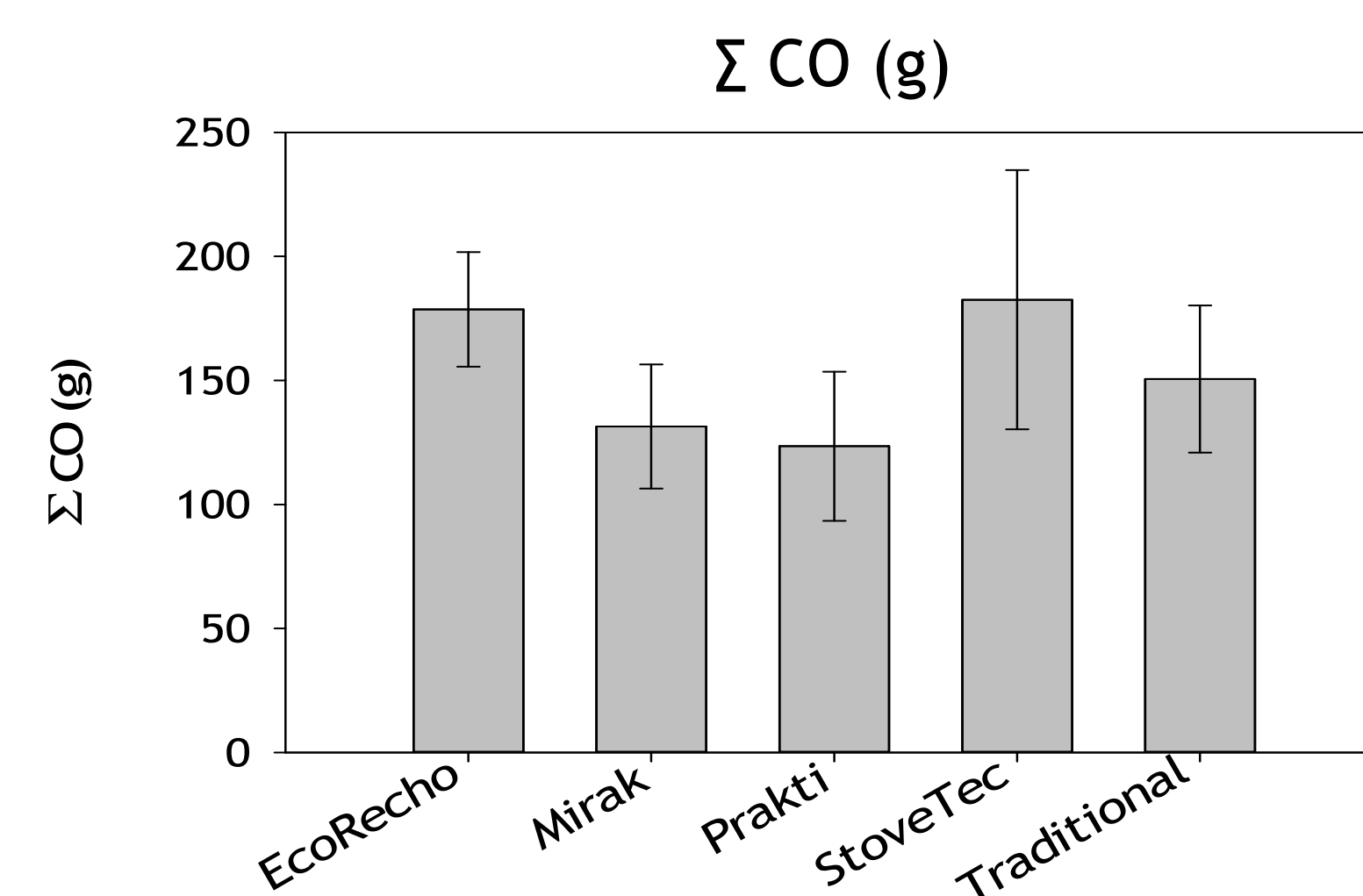
Three phases: Cold Start, Hot Start, Simmer



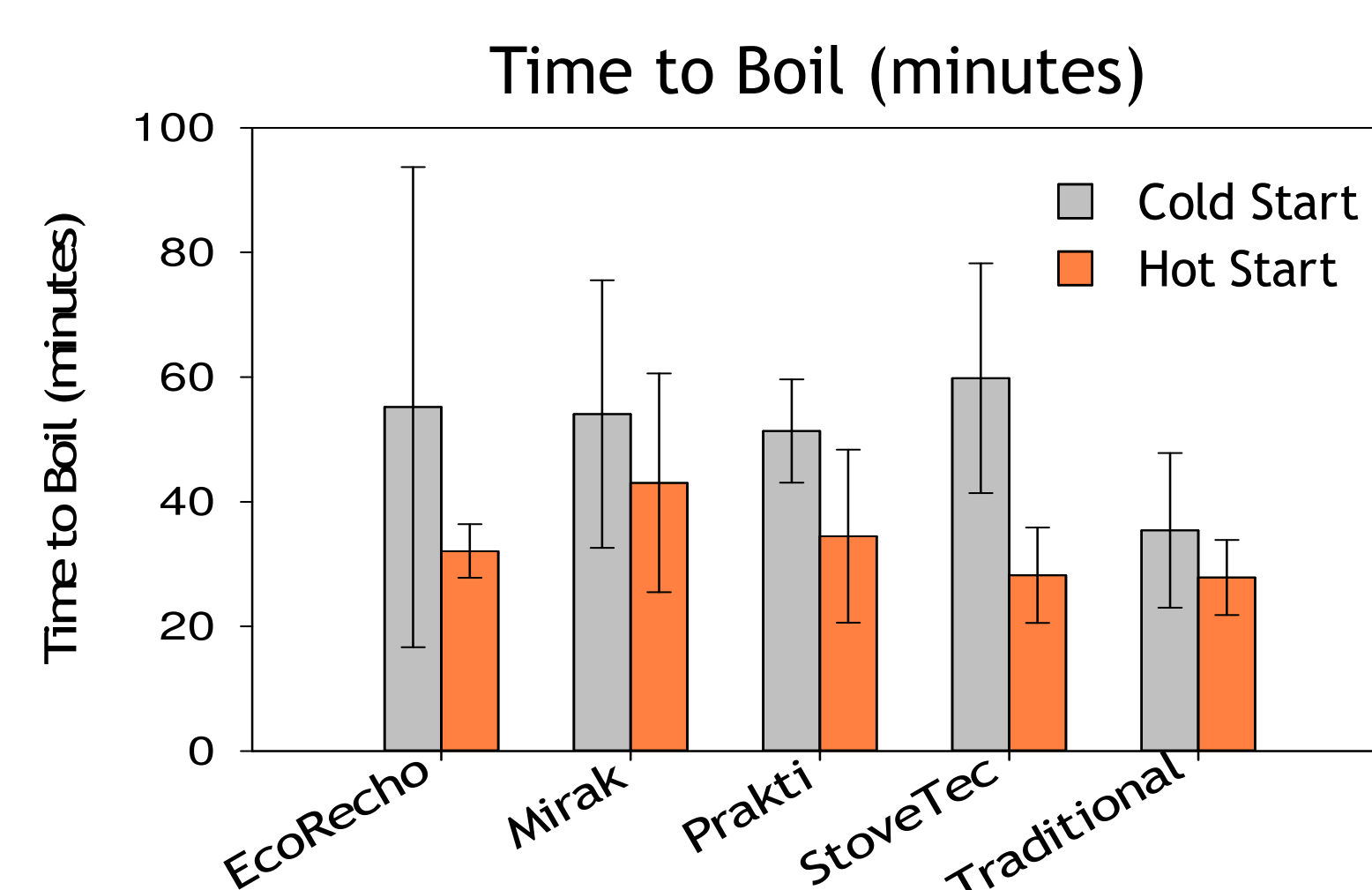
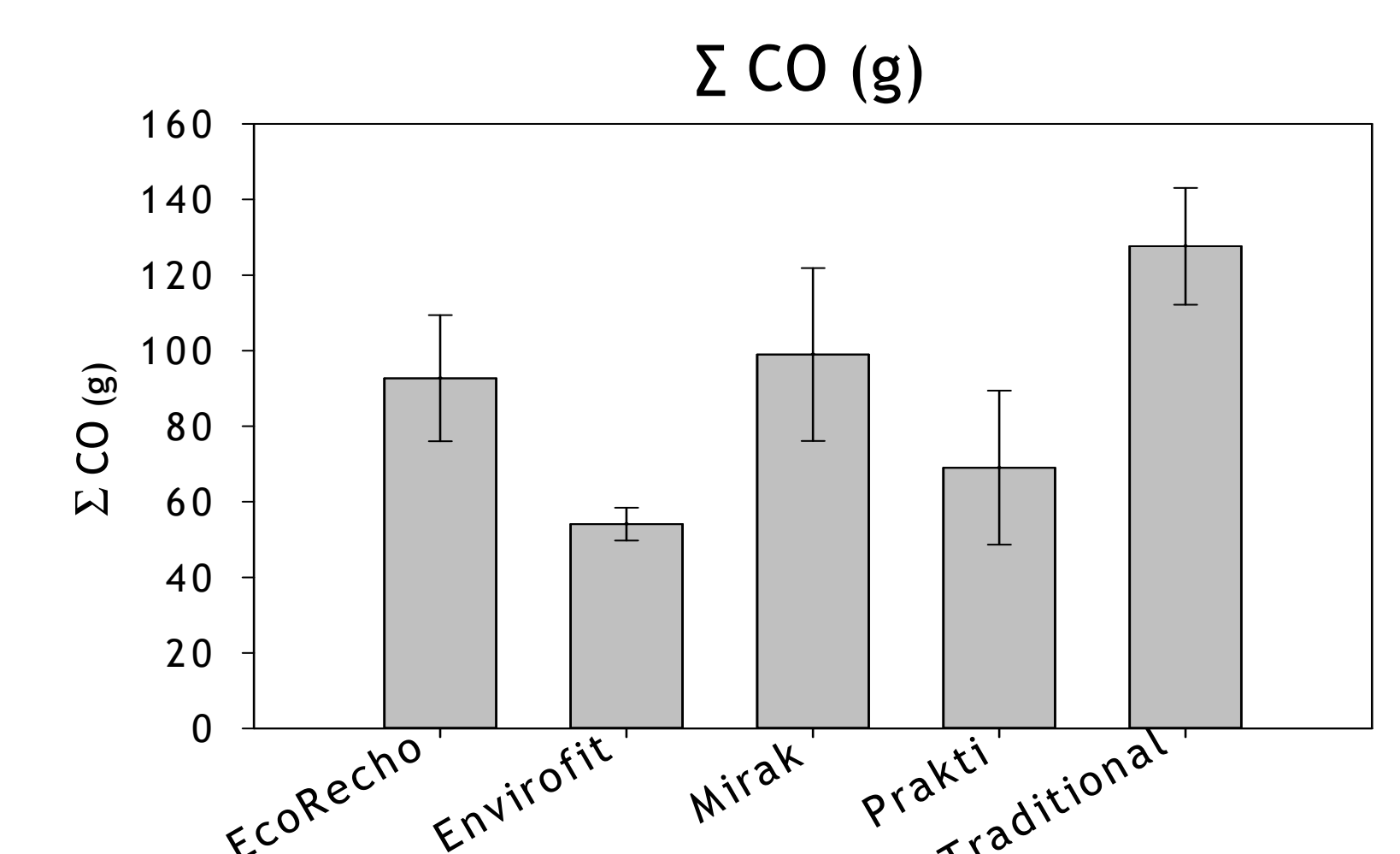
Five charcoal stoves tested for the WBT <sup>4</sup>

## Results

All WBT data is averaged over all three phases (cold start, hot start, and simmer).



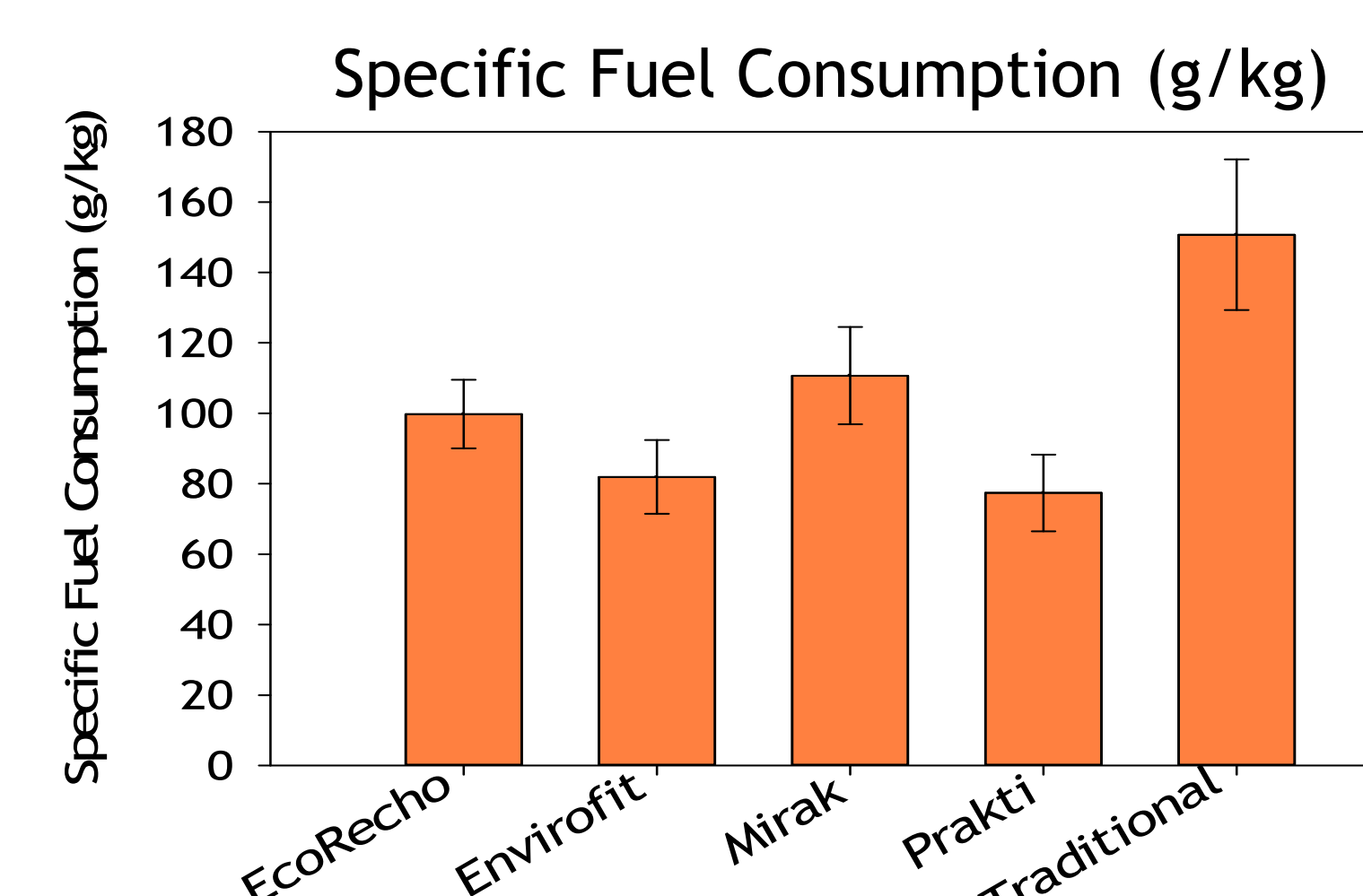
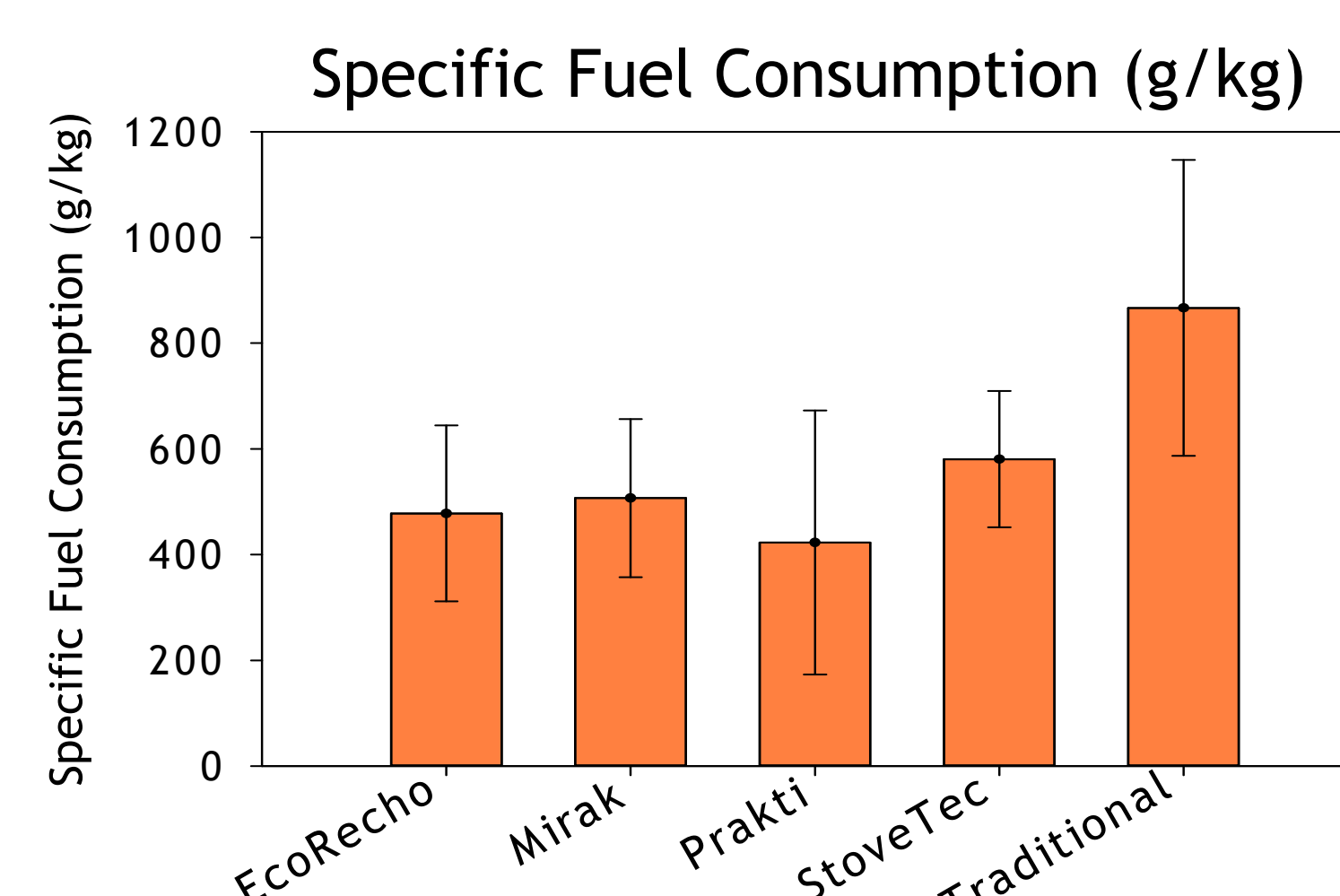
All graphs show 95% confidence intervals for error bars (both WBT and CCT).



More thermally massive stoves (EcoRecho, Prakti, StoveTec) have larger differences between cold and hot starts.

The traditional stove is still the fastest to light on average.

Emissions data varied between the WBT and CCT.  
ΣCO: The relative ranking of the Mirak and traditional varied greatly between the two tests. Prakti consistently had low emissions of CO. EcoRecho consistently had high emissions of CO.  
ΣCO / ΣCO<sub>2</sub> : EcoRecho and Prakti had higher percentages (more incomplete combustion) for the WBTs than the CCTs, while the Mirak and traditional stayed constant.



For both WBT and CCT, all improved stoves save charcoal compared to the traditional stove.

### Conclusions and Future Considerations:

- More tests need to be conducted to reduce sampling error.
- Smaller error (from more tests) would allow a rigorous comparison of CCT and WBT data to determine the key differences obtained from conducting each test.
- Research needed into what determines the difference in emissions between WBT and CCT
  - Differences in flow rates, possibly due to different pot sizes?
  - Differences in power cycles of tests?

Photo Credits:  
[1] Robert Cheng  
[2] James P. Blair/National Geographic/Getty Images  
[3] Kathleen Lask  
[4] Cristina Ceballos  
[1] Centre de Formation et d'Encadrement Technique, 1997, Diagnostic des communautes vivant au sein et dans le voisinage de la Forêt des Pins, Assistance Technique pour la Protection des Parcs et Forêts (ATPPF)/Ministère de l'Environnement (MDE), Port-au-Prince, Haiti.  
[2] FAO, 2009, State of the World's Forests, FAO, Rome, p13, Annex 2.  
[3] Women's Refugee Commission & World Food Programme, 2010, Cooking Fuel Needs in Haiti: A Rapid Assessment, pp. 10-11