Experimental Interventions to Facilitate Clean Cookstove Adoption, Promote Clean Indoor Air, and Mitigate Climate Change

USEPA Cookstove Research Meeting

Research Triangle Park, NC

Building C, Classroom C111

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From the RFP…

- How would **a feasible set of interventions** for residential cooking, heating, or lighting in a developing part of the world impact air quality and climate?
- What is **the realistic range and timeframe** of foreseeable benefits to air quality and climate of various interventions in cooking, heating, or lighting practices in a developing part of the world…

From: http://www.epa.gov/ncer/rfa/2012/2012_star_cook_heat_light.html

Past/current interventions…

- Low adoption rates
- Lower than expected benefits

Why?

- Misperception of health risk?
- Low “willingness to pay” (WTP)?
- Risk aversion?
- Inappropriate/poorly designed stoves?
- Norms and preferences?

Study design

- Risk perception
- Norms
- Inappropriate technology
- Low WTP
- Risk aversion

Included in survey instruments
Potential independent variables
Ethnographic work

Participants choose from among a wide range of stove types (including aspirational technologies)
Long-term monitoring (sub-sample)

Liquidity constraints

½ free stoves ½ pay (subsidized)

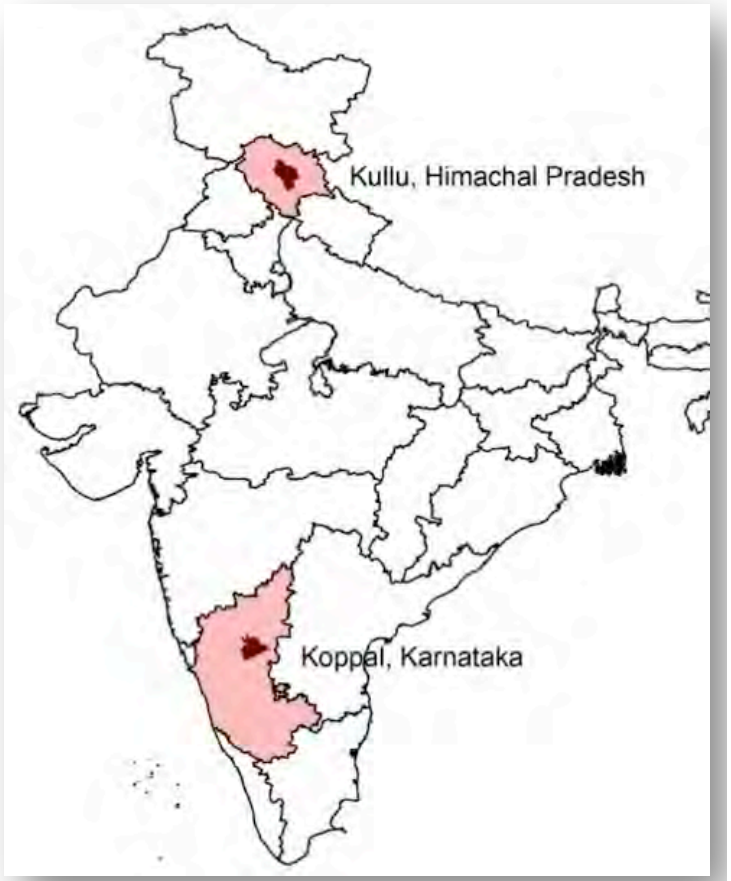
Adoption risk

½ quarterly switch-outs* ½ single choice

* Switch-outs occur at stove "bazaars" where participants can share experience and discuss pros and cons of each model

Study design

- RCT in 2 Indian States
  - with local NGO co-Pis
- 4 villages each
- 480 HHs total
  - Factorial design



Study design

(replicated in two states)

Data collection

Socioeconomics & social networks

(full sample)

KPTs

(20% sub-sample)

Emissions/SUMS

(10% sub-sample)

Exposures

(full sample)

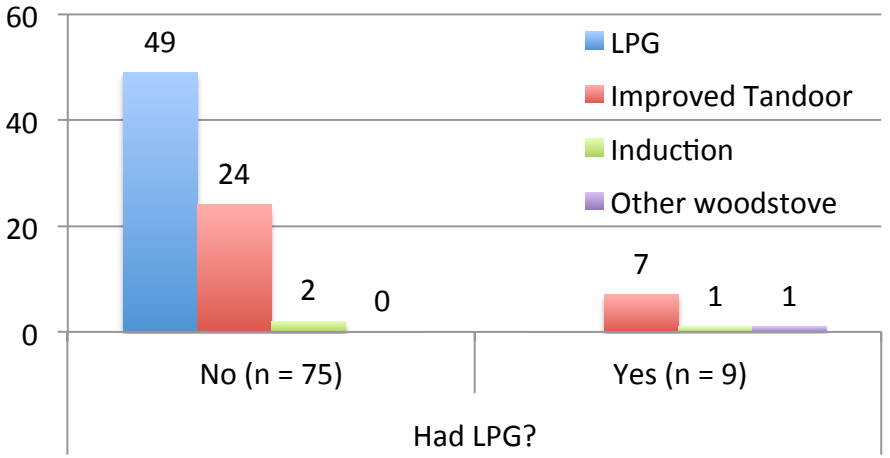
Pre-treatment, after each bazaar, and post-treatment

Stoves

- 1-pot, no chimney (Envirofit, Chulika, Greenway, Samuchit)
- 2-pot, chimney (Prakti, TIDE, Envirofit)
- Forced draft: TERI, Eco-chulha
- TLUD (Serval)
- Improved tandoor (HP only)
- Induction
- LPG

Preliminary activities

- CCTs and trial sales events
  - 3 villages in HP (84 HHs)
  - Gauge response to unfamiliar stoves
  - Measure WTP



Tangent: LPG in India

- National subsidy scheme
  - HHs get up to nine 14.2 kg cylinders/yr
- Phasing in Aadhaar-based system linked to bank accounts

"world's largest direct benefit transfer scheme"

ET Bureau Nov 15, 2014

Socio-economics & social networks

(full sample)

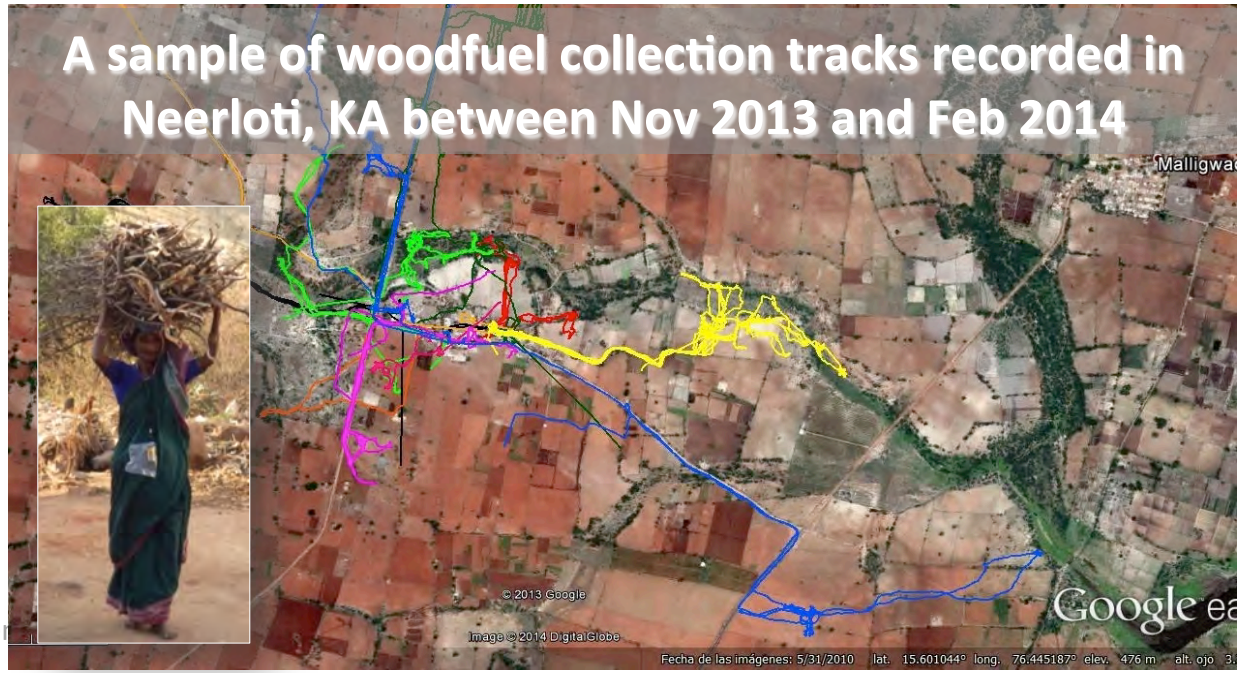
Co-led by Bailis, Zerreffi, and Dwivedi

- Demographics
- Wealth
- Gender
- Energy use
- Soc. networks
  - Information sharing between HHs
  - Role in adoption/rejection

KPTs

(~20% sub-sample)

- Fuel consumption
- Species preference
- Extraction patterns

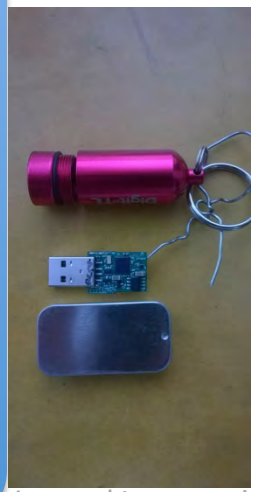


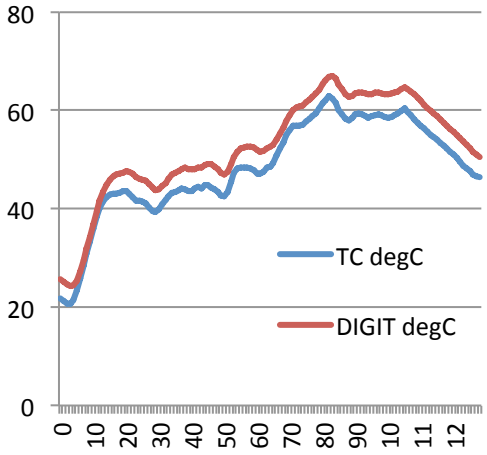
Emissions/ SUMS

(10% sub-sample)

Led by Grieshop

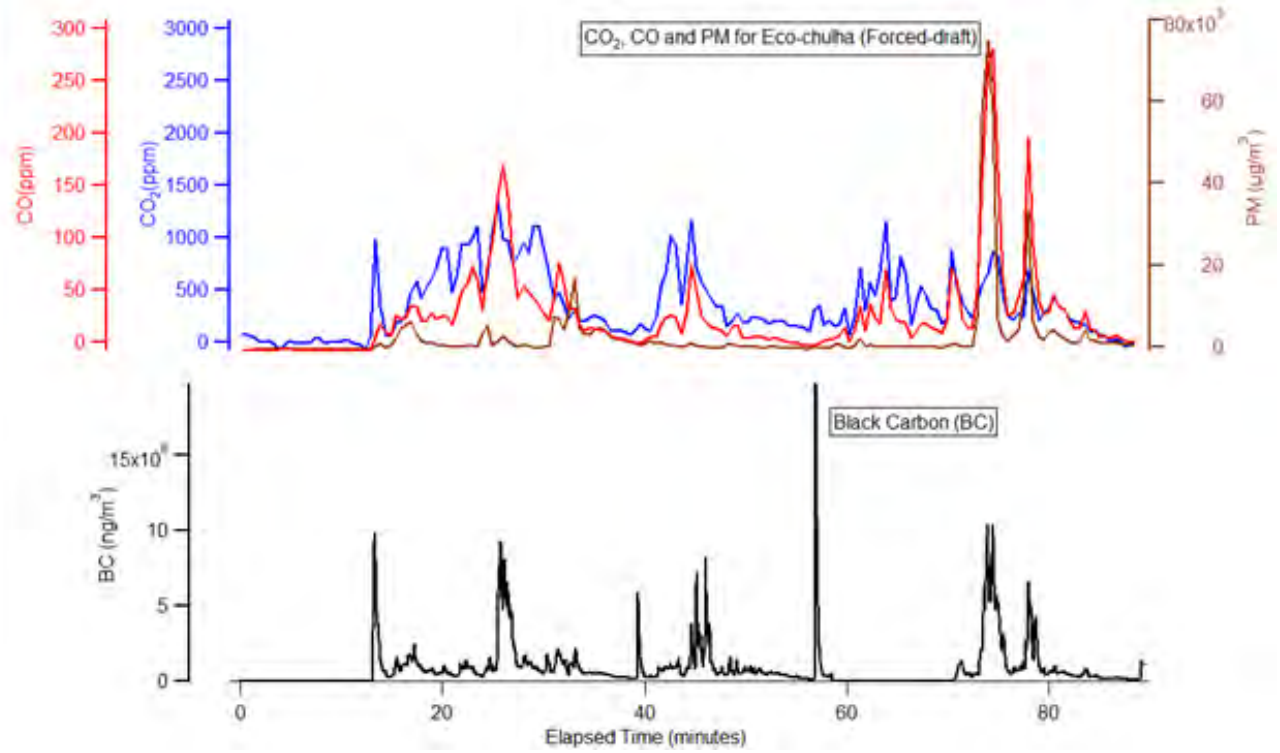
- STEMS
  - Real time CO_2, CO, PM and BC
  - Gravimetric $PM_{2.5}$
- SUMS





Emissions/ SUMS

(10% sub-sample)

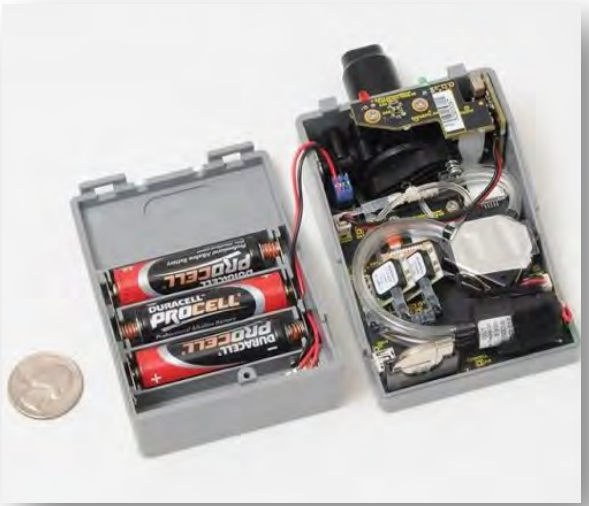


Exposures

(full sample)

Led by Julian Marshall

- 24-hour HAP concentrations
- Using µPEM
- Real-time & gravimetric $PM_{2.5}$



Progress to date

Summer-Fall 2014

- Community selections
- Equipment trials
- Pilot surveys/sales events

Winter 2014/15 - HP

- Baseline surveys HAP and emissions
- Bazaars
- Stoves given to HHs

Spring 2015 - shift to Karnataka

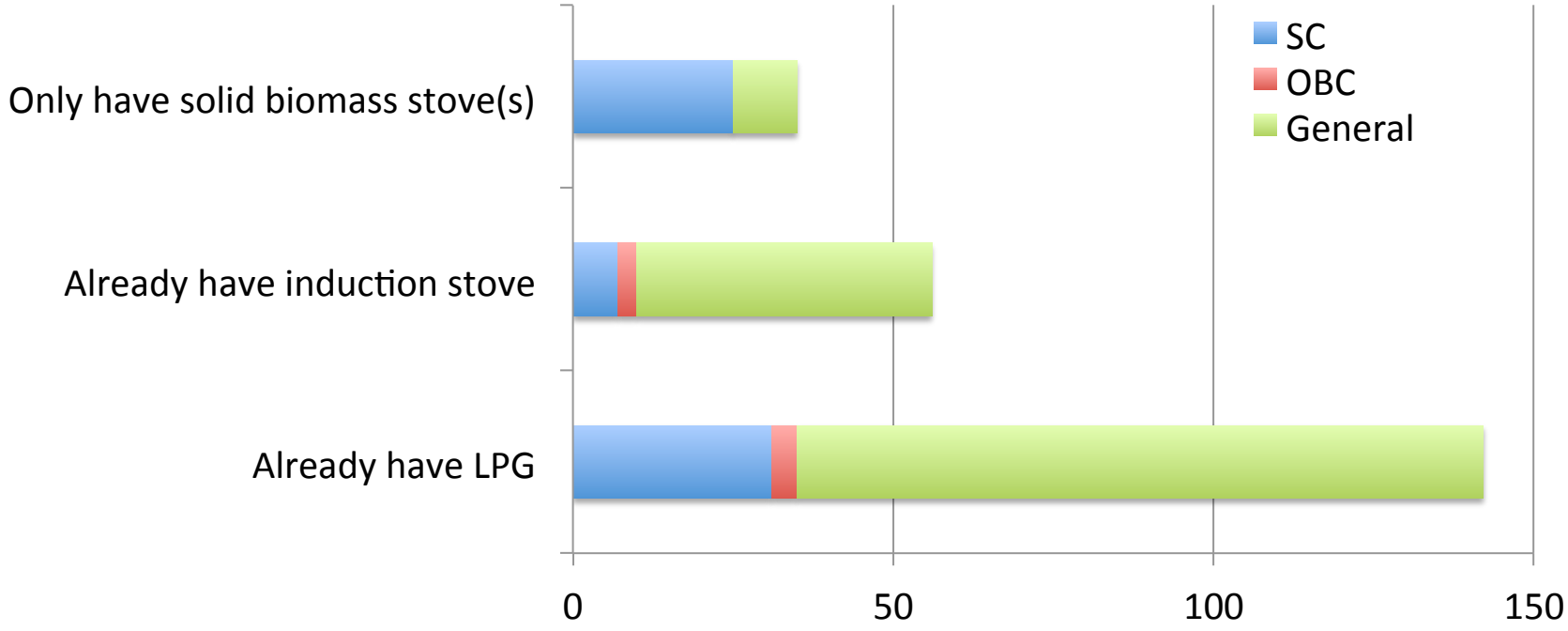
Insights from equipment trials

- "Improved" stoves not suitable for staple dishes
- In HP, a tandoor is essential

  1-pot "rocket" not popular
- In KA, 1-pot models were popular
- Forced-draft stoves got mixed reviews

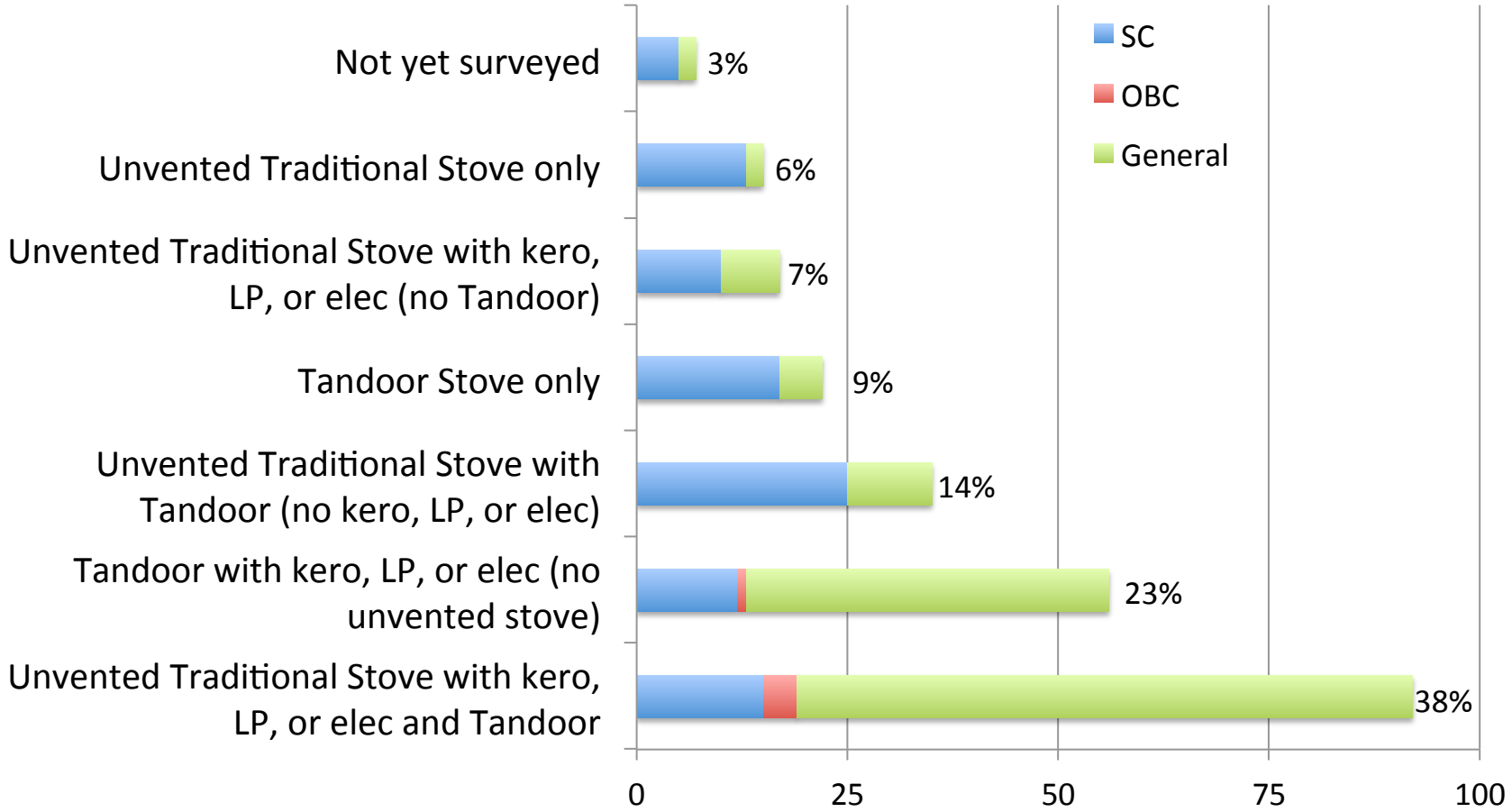
Insights from baseline surveys

- 60% of HHs already have LPG
- 23% have an induction stove



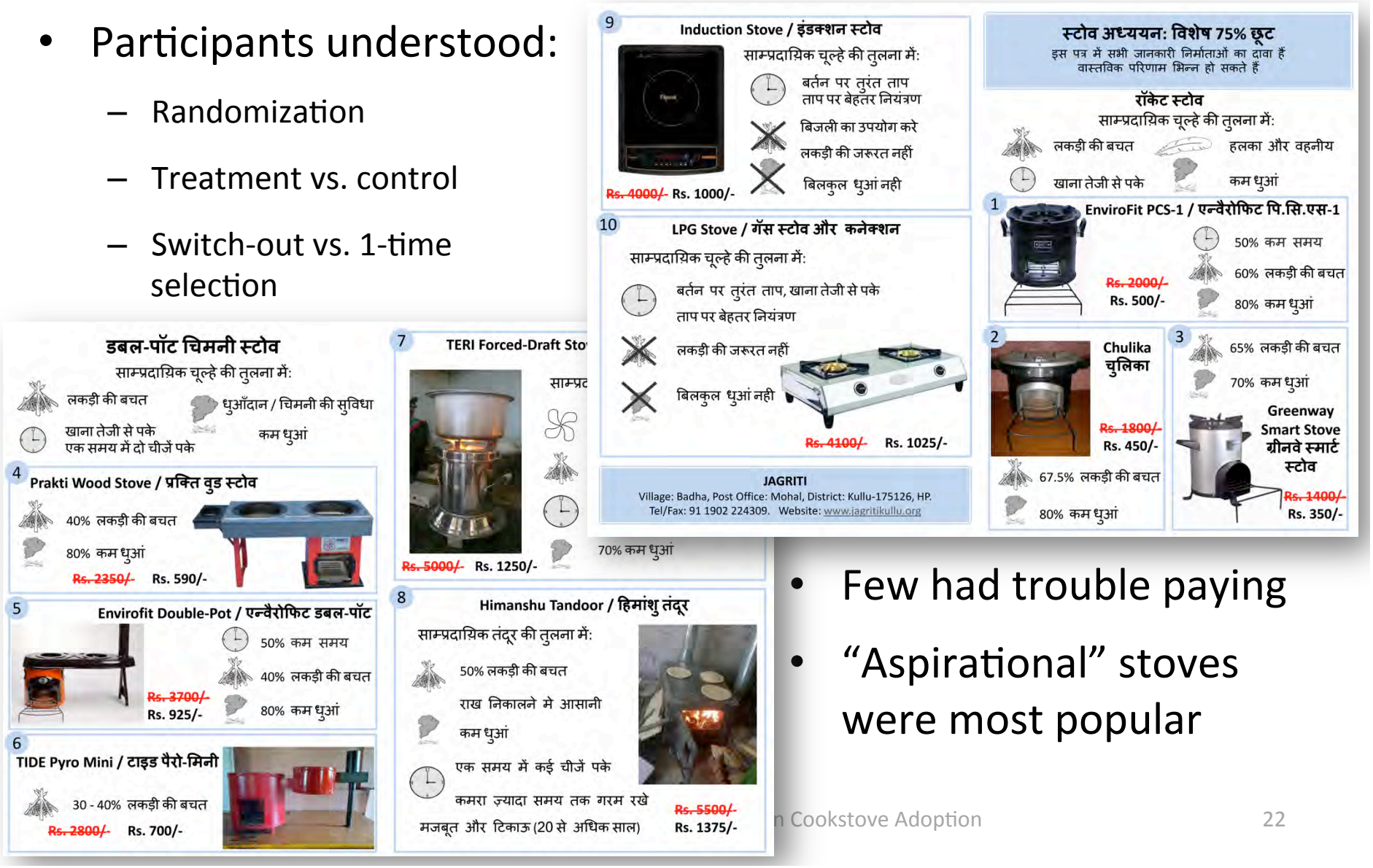
Insights from baseline surveys

- A lot of stacking



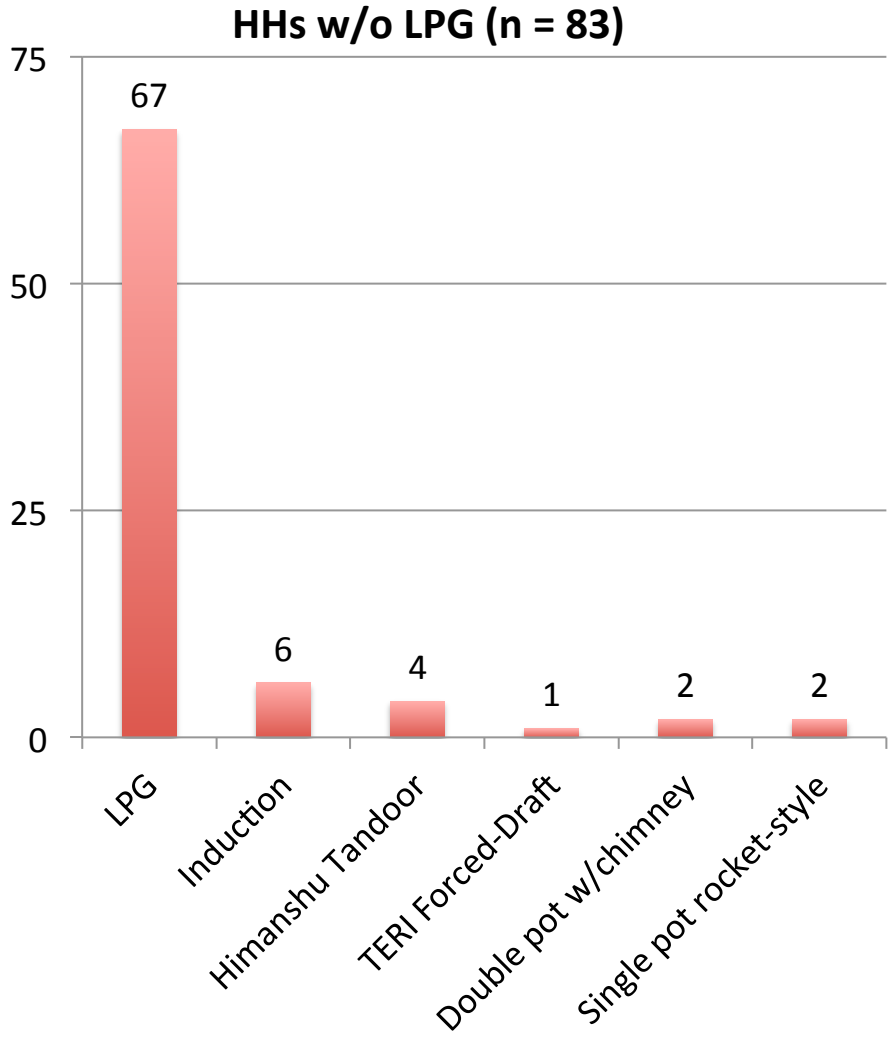
Insights from stove bazaars

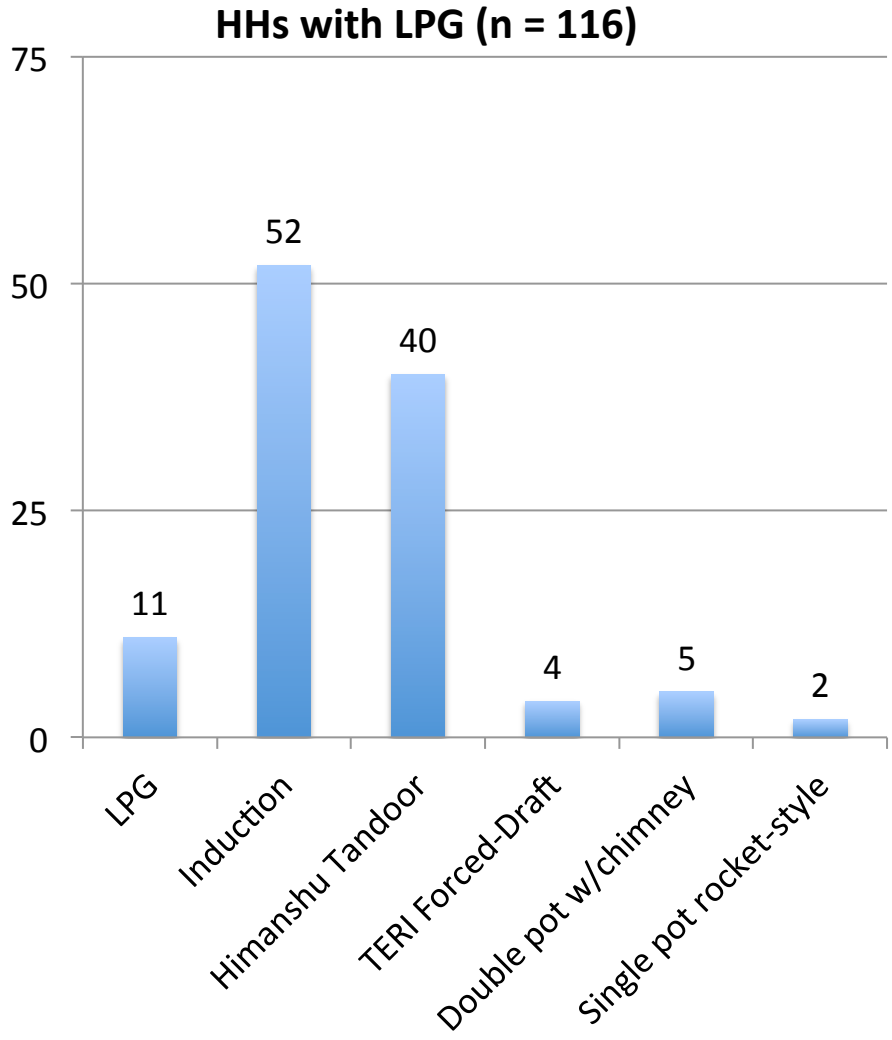
- Participants understood:
  - Randomization
  - Treatment vs. control
  - Switch-out vs. 1-time selection



- Few had trouble paying
- "Aspirational" stoves were most popular

HH choices at initial stove bazaars





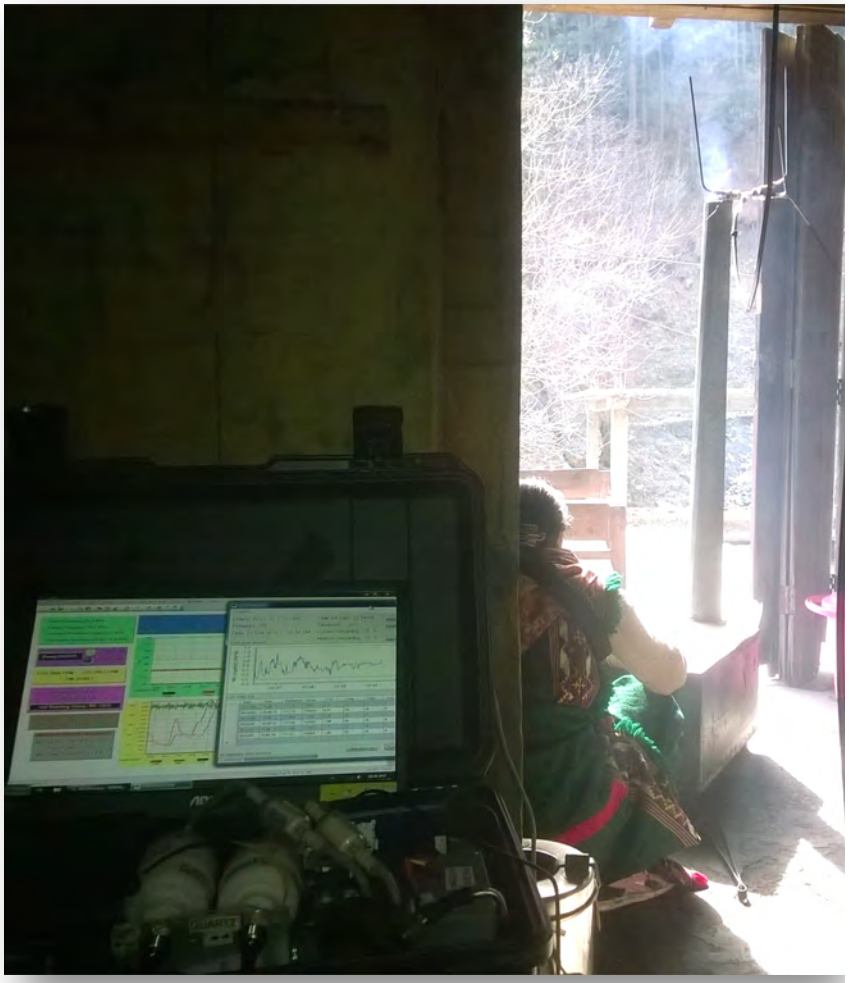
Next steps

Wrap up phase-1 in HP:

- Baseline emissions and exposure measurements
- SUMS and KPTs
- Stove handouts

Shift to Karnataka and repeat…

Start climate modeling (Unger)



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- RAs: Adam Walters and Ryan Repoff (NCSU); Carlos Gould (Yale)


HP 02K 0266


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POPULAR

Insights from equipment trials

This was not posed!! I'm fixing TERI's forced-draft stove. At $80, the stove is the most expensive model in our trial. It arrived at our test center with no fuse and 3 separate wiring faults.