Black Carbon: 
When the Rubber Hits the Road

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From Knowledge to Action: Metrics for providing climate credits to rural women in India

Wireless sensors linked to climate financing for globally affordable clean cooking

Tara Ramanathan¹, Nithya Ramanathan¹*, Jeevan Mohanty², Ibrahim H. Rehman², Eric Graham¹ and Veerabhadran Ramanathan³
• Provided climate credits individually to 4038 homes in N. India
• Installed wireless sensors in 456 homes
• Women took loans to buy the stoves and used climate credits to pay off the loan

The “Smart” Stove
Determination of cooking time with the thermal sensor

Total cooking: 3.83 hr, Total Fuel 2.03 kg, Total Events: 2
Duration: 130 min  Fuel: 1.11 kg (Start: 06:30)
Duration: 100 min  Fuel: 0.92 kg (Start: 17:00)
Self reported cooking time had no correlation with actual cooking time reported by the sensors.
Climate Financing To Individuals Incentivizes Adaptation
The sensor determined mitigation was four times less than the potential (projected) mitigation.

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<th>Projected</th>
<th>Actual</th>
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<td>ICS_FD cooking duration (h)</td>
<td>380,250 h</td>
<td>92,289 h</td>
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<td>SLCP mitigation (tCO$_2$e)</td>
<td>739 tCO$_2$e</td>
<td>182 tCO$_2$e</td>
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<tr>
<td>CO$_2$ mitigation (tCO$_2$)</td>
<td>380 tCO$_2$</td>
<td>90 tCO$_2$</td>
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<td>Total mitigation (tCO$_2$e)</td>
<td>1,119 tCO$_2$e</td>
<td>272 tCO$_2$e</td>
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Ramanathan et al, 2016
Rate of non-renewable wood consumption:
Mud Stove : 1.06 kg hr$^{-1}$ ; Smart Stove: = 0.47 kg hr$^{-1}$

100% use of Smart Stove Can:

- Save 1.8 tonnes of non-renewable woody biomass annually.
- Mitigate 2.3 (30%) kg of BC yr$^{-1}$

India-Specific 40 Year GWP(BC; OC; CO) is 1500 (700 to 2100).
Uses Streets, Shindell and IPCC-AR5 forcing values.

BC/OC/CO climate mitigation: 3.5 (1.5 to 5.9) tCO2e yr-1.

Climate Credit : $6/ton of CO$_2$ equivalent

If a woman used the smart stove for all her needs, would have received $35/year (about half the cost of the stove).

See Supplements of Ramanathan et al for details
Lessons learned

Rewarding individuals for behavioral change is important.

For climate protection, monitoring the use of clean technologies on an individual basis is critical.

Adequate supply chain to distribute and maintain technologies can significantly improve adaptation.