FUEL, USAGE AND EMISSIONS LOGGER
An integrated sensor platform to monitor cookstove performance

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Monitoring & Evaluation Metrics

- Adoption & Usage
- Stove Stacking
- Time
- Fuel Consumption
- Emissions
Derived Impact Metrics

Emissions

\[ GW_{Ci} = AFU_i \left( f_{N RB} EF_{CO2} + \sum_k GWP_k EF_{k,i} \right) \]

\[ ER = N_{stoves} Use (1 - f_{dis})(GW_{C_{pre}} - GW_{C_{post}}) \]

Health Impacts

\[ aDALY = B \ Use SFU_{frac}(PAF_{pre} - PAF_{post}) \]
FUEL: Fuel, Usage and Emissions Logger
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- Fuel Consumption
- Adoption & Usage
- Stove Stacking
- Time
- Emissions
- Adalys
- Carbon Credits
# Field Testing

<table>
<thead>
<tr>
<th>Timeframe</th>
<th>Purpose</th>
<th>Location</th>
<th>N Households</th>
<th>N Sensors</th>
<th>t (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 2017</td>
<td>Proof of concept</td>
<td>El Eden, Honduras</td>
<td>4</td>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>Aug 2017</td>
<td>Pilot</td>
<td>Apac, Uganda</td>
<td>85</td>
<td>100</td>
<td>30</td>
</tr>
<tr>
<td>July 2018</td>
<td>Pilot</td>
<td>Apac, Uganda</td>
<td>44</td>
<td>68</td>
<td>45</td>
</tr>
</tbody>
</table>

**FUEL Installation**

- Rural Wood Stove (RWS) (Improved)
- Three Stone Fire (TSF) (Traditional)
- Locally Mudded Stove (LMS) (Traditional)
Usability Assessment

Community Training Session

Usability Survey

Focal Follow
Sensor-Based Assessment

Temperature and weight vs time over 24 hours
Practical Evaluation

- Protects from rain, keeps dry
- Stores wood, more floor space
- Away from termites
- Proximity to stove
- Keeps safe
- Keep track of firewood use
- Just wood
- Wood and food or dishware
- Nothing

Reported benefits, baseline. Apac, Uganda, 2017

Observed Holder Storage Content after 8 months. Apac, Uganda, 2018
Technical Evaluation

Sensor Performance, Apac, Uganda, 2018
Technical Evaluation: Single Household

Fuel use (kg) per day for a single, stove stacking household

Daily variation of fuel consumption and cooking duration
Technical Evaluation: Aggregated

- Firepower
- Global Warming Commitment (per household)
Findings

• FUEL captures stove stacking patterns that contribute to higher fuel consumption and GWC – balance with usability
• FUEL captures variation in fuel and cookstove use over time
• Ethnographic data can be used to triangulate sensor-based data and avoid biases

Submitted/working papers:


(2019). Integrating rapid ethnographic techniques into design for development: a case study for design of a cookstove monitoring system. *Design Studies (in review).*
Ongoing Work

- Comparison to KPT
- Multiple fuel types, tensile and compressive scales
- Development of wireless system with Climate Solutions
- Conduct a baseline and follow-up study to calculate project impact
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Thank you for your time.

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