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Designing Healthier Houses in Guatemala

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Designing Healthier Households in Guatemala

Mary Prescott (EVE), Jonathan Ross (ME), Alessandra Torres (ME/HUA), Meghan Trahan (EVE)
Advisors: Geoffrey Pfeifer (HUA), Derren Rosbach (CEE)

Abstract
This project aims to address the problems of indoor air pollution (IAP) in Guatemala due to inefficient cooking methods. Currently, citizens use open fire as their main cooking method which can be hazardous to the households. We used background research on IAP and Guatemala to develop a stove design that decreases the levels of IAP yet is affordable and adaptable to the individual families we hope to help.

Background

<table>
<thead>
<tr>
<th>Guatemala</th>
<th>Growth Rate</th>
<th>Infant Mortality (per 1000 births)</th>
<th>Povery Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.86%</td>
<td>23.51</td>
<td>54%</td>
</tr>
</tbody>
</table>

Particulate matter levels in this region reach more than 100 times accepted levels (Von Ritter Figueres, 2010). The inhalation of these harmful emissions leads to high disease rates in rural areas.

Problem Statement
Each year, thousands of children and adults in Guatemala suffer or die from respiratory diseases due to the inhalation of indoor air pollution from biomass burning. Families in this area are unaware of the harmful impacts of open fire cook stoves, and are unable to afford a safer option.

Studies
- We found many case studies that focused on the relation between indoor air pollution and:
  - Loss of life years
  - Rate of disease
  - Breathing problems
  - Infant birth weight
  - Death rates
- We also found pilot studies for modified stove implementation.

Process
We shaped our solution based on current stove designs in such a way that it is adaptable to a wide range of households. We then decided to build a prototype of the stove to find any flaws or difficulties in our design, which led to some modifications and improvements.

The 4-Step Stove - La Estufa de Cuatro Pasos
- Efficient wood-burning
- Elevation
- Ventilation
- Table/workspace
- Optional modifications
  - Fire bricks for warmth
  - Easy to build/repair
  - Build-on/upgradable approach (levels)
- Price increases with level

<table>
<thead>
<tr>
<th>Level</th>
<th>Provides</th>
<th>Total Price (Quetzals)</th>
<th>Total Price (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Efficient Wood Burning</td>
<td>Q 177.80</td>
<td>$22.99</td>
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<tr>
<td>2</td>
<td>Elevation</td>
<td>Q 188.51</td>
<td>$24.37</td>
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<td>3</td>
<td>Ventilation</td>
<td>Q 265.91</td>
<td>$34.37</td>
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<td>4</td>
<td>Table/Workspace</td>
<td>Q 381.62</td>
<td>$49.33</td>
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</tbody>
</table>

Acknowledgments
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References