Cookstove Manufacturing in Guatemala

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• **Introduction**
• Objectives
• Initial Testing
• Field Work
• Product Improvements
• Process Refinement
• Summary
Introduction

• Working with HELPS International organization in the Latin American Region (Guatemala)

• Modifying design and production method of the HELPS ONIL Cookstove Model for production ramp up

• End goal of production ramp up to approximately 1.3 million stoves over the next ten years
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Objectives

• Ramp up overall production of ONIL stove to 1.3 million in ten years (15,000/month)

• Maintain Emissions standards of current ONIL stove design

• Increase Production Rate for stove body from 50 units a day per mold to 100 units a day per mold

• Reduce stove weight by 40 pounds

• Reduce upfront stove cost by $15
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Initial Testing

• Testing was performed at the CSU Advanced Stoves Laboratory
  – Temperature Trends
  – Efficiency
  – Emissions

• Four Combustion Chamber materials were selected for testing.
  – Steel
  – Baldosa Tile
  – Low Fire Clay
  – High Refractory Brick

• Temperature measurements determined stove efficiency and heating ability

• High refractory brick yielded best overall results
Plancha Surface Temp vs. Time

Temperature Versus Time for Combustion Chambers

- Low Fire Clay
- Steel
- High Refractory Brick
- Baldosa Tile

Temperature (deg C)

Time (hr:min)
Temperature Data

Maximum Inside Wall Temperature of Combustion Chamber

Baldosa Tile, High Refractory Brick, Steel, Low Fire Clay

Maximum Outside Wall Temperature of Combustion Chamber

Baldosa Tile, High Refractory Brick, Steel, Low Fire Clay

Maximum Temperature in Flue Cavity Between Chamber and Chimney

Baldosa Tile, High Refractory Brick, Steel, Low Fire Clay

Maximum Temperature at Base of Chimney

Baldosa Tile, High Refractory Brick, Steel, Low Fire Clay
• Computational Fluid Dynamic analysis was performed on an improved cookstove

• The results show potential chimney problem areas
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Guatemala Field Work

ONIL Stove Assembly
Stove Installation
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PLANCHA

• Angle iron simplification
  – Reduces # of cuts from 22 to 6 per plancha
  – Reduces # of welds from 28 to 16 per plancha
  – Use uneven angle iron to lower weight of steel
    • Currently using 1.25” x 1.25”
    • Change to 1.25” x .75”
    • Reduce weight and cost by 20%

• Reduce Plancha Thickness
  – Currently being field tested
  – Reduce from 3/16 in. to 1/8 in.
  – Lower weight by 1/3 which reduces material cost by 1/3
Shelf redesign

• Eliminate cutting off scrap piece

• Reduce thickness of steel shelf to 1/16”
  – Allow piece to be bent into shape instead of cut and welded
  • Eliminates 2 cuts and 6 welds
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Process Refinement

• Current Process
  – Time consuming heating process, wastes Acetylene welding gas
  – Hammering the dimple
    • Misalignments cause tearing
    • Warps metal disc

• New Process
  – Pneumatic die press to stamp dimple in square stock, before rings are stamped
• Room for improvement in process to facilitate better efficiency and higher production volume
  – Kilns
  – Molding technology
  – Automation

• Ramp up is still feasible at this point due to large availability of similar production sites.
Stove Body

- **Types of Casting:**
  - Wet Casting produces 2 stoves per day per mold
  - Dry Tamp produces approx. 50 stoves per day per mold

- **Curing Process**
  - Wet pour: 14 days
  - Dry Tamp: 11 days
Stove Body

• Current Dry Tamp Process
  – Fiberglass Molds
  – Pneumatic Handheld Tamper
  – Climate Controlled Curing Areas

• Areas for Improvement
  – Metal Molds
  – Concrete Additives
  – Weight Reduction
  – Automated Compression, via two part molding

• Other Areas of Focus
  – Storage
  – Shipping
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Summary

• Objectives
  – Production ramp up
  – Emissions
  – Weight
  – Cost

• Product Improvement
  – Plancha
  – Shelf

• Process Refinement
  – Stove Body
  – Plancha Dimple
Questions?

Working Together to Make a Difference