Dorothy Collins - Materials Science and Engineering
Lindsay Drabek - Biology
Jeffrey Hallenbeck - Architecture
Young Jung - Architecture
Mark Kimball - Mechanical and Civil Engineering
William Lange - Architecture
Al Maranon - Aerospace and Materials Science Engineering
Yong Jae Park - Architecture
Nikki Parks - Chemical Engineering

IPRO 325

Affordable and Sustainable Quality of Life Improvements for World's Poor

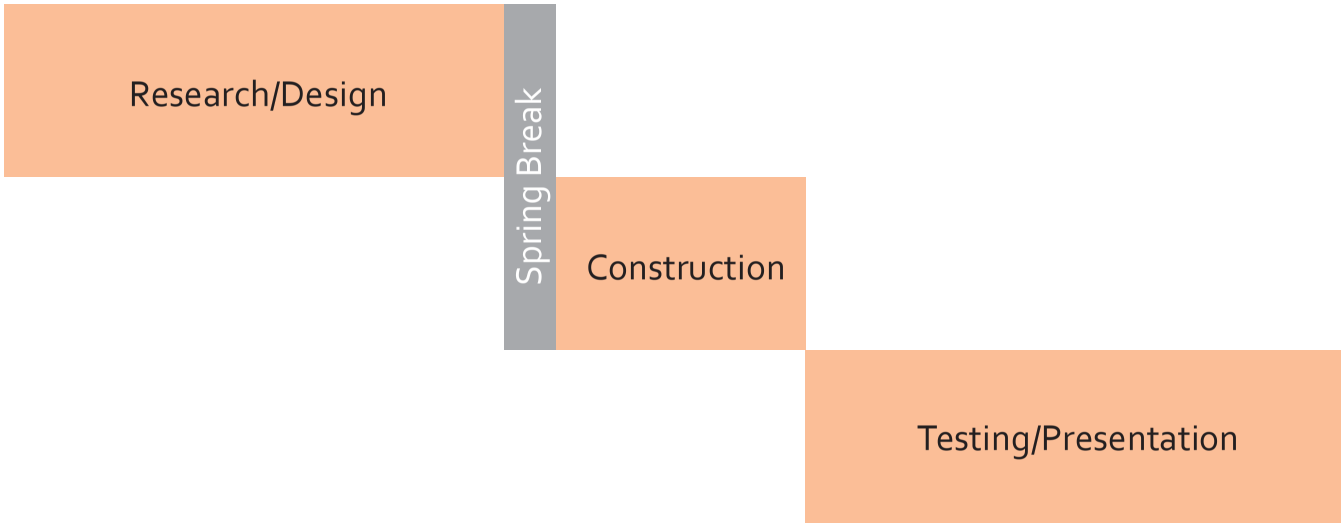
Professors:
Margaret Huyck
Ken Schug

Timeline

Phase 1
(February 9 - March 4)

Phase 2
(March 16 - March 30)

Phase 3
(March 30 - April 23)



Work Structure

Phase 1

Design

Dorothy Collins
Jeffrey Hallenbeck
William Lange
Young Park
Nikki Parks

Research

Lindsey Drabek
Mark Kimball
Al Maranon
Yong Jae Park

Phase 2

Construction

Dorothy Collins
Lindsey Drabek
Jeffrey Hallenbeck
Young Jung
Mark Kimball
William Lange
Al Maranon
Yong Jae Park
Nikki Parks

Phase 3

Presentation

Jeffrey Hallenbeck
Young Jung
William Lange

Testing

Dorothy Collins
Lindsey Drabek
Mark Kimball
Al Maranon
Yong Jae Park
Nikki Parks

Huancavelica, Peru

Climate

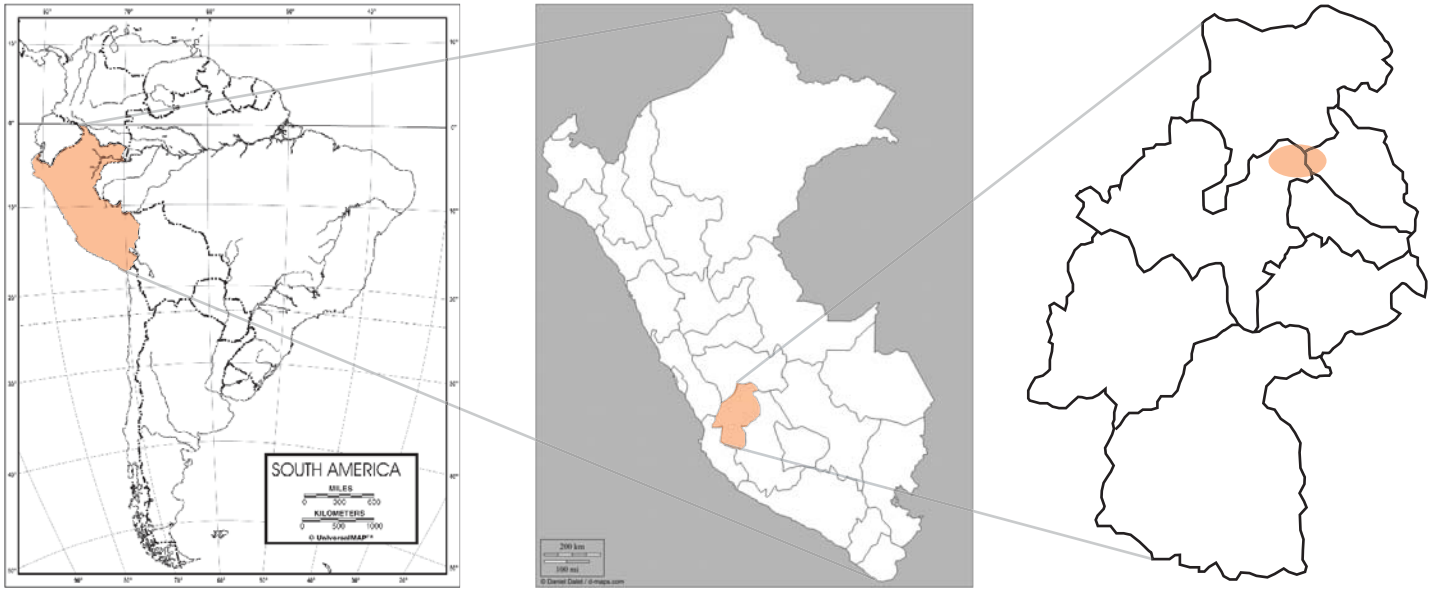
Oceanic currents create very unstable conditions.

Health

Poisoning from the wood burning stoves is common.

Poverty

80% of Huancavelica is considered in poverty.



Goals

Heating

Provide heat to promote general health.

Knowledge

Teach native Peruvians why this is important (manual).

Cost

Due to extreme poverty low cost and local materials are a must.

Low Emmisions

Decreasing mortality rate from poisonous fumes.

Heating Efficiency

Decrease need for fuel to slow deforestation.

Precedents

Ondol

Korean wood burning stove used to heat house.

Wood Burning Stoves

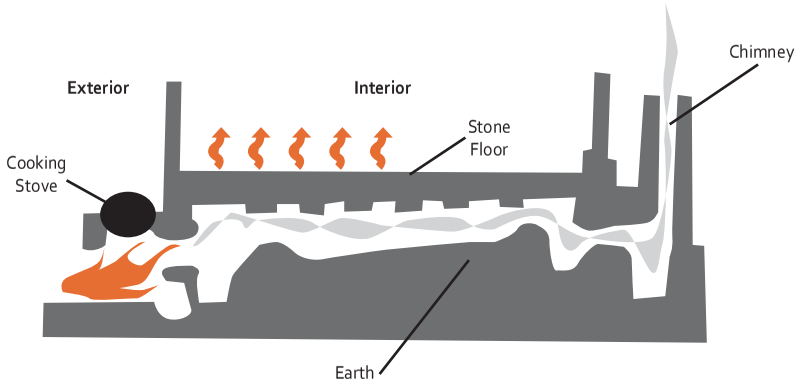
German, Russian, and Chinese designs.

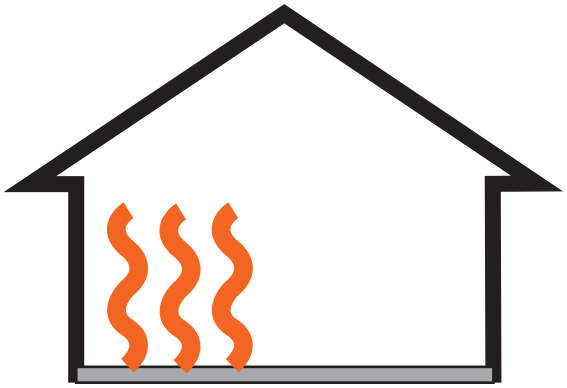
Radiant Heating

Hot water running through pipes to heat a space.

Previous IPRO 325 Groups

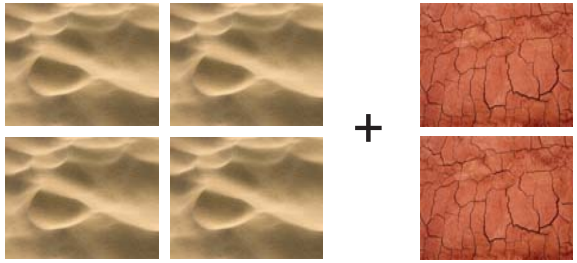
Structural development, roof design, and some research into heating.





Adobe Composition

Team's Adobe Composition =



4 Parts Sand

+

2 Parts Clay

+

1 Part Water

+

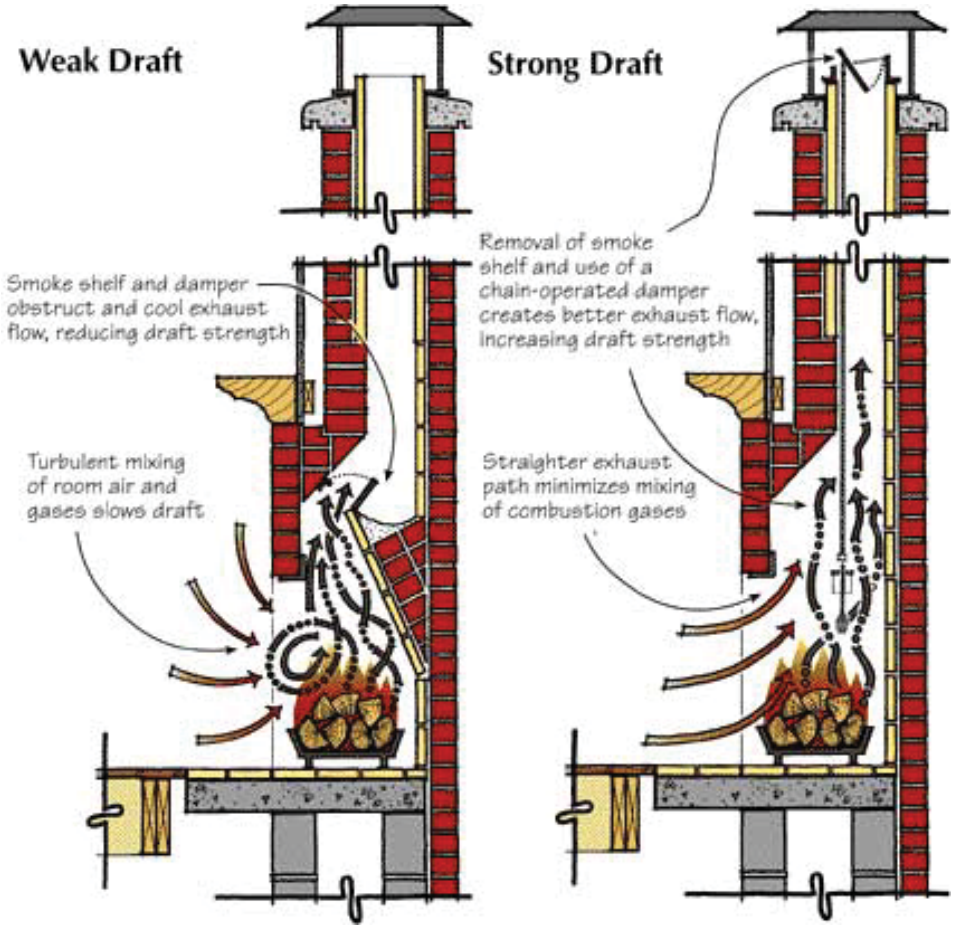
1/2 Part Straw

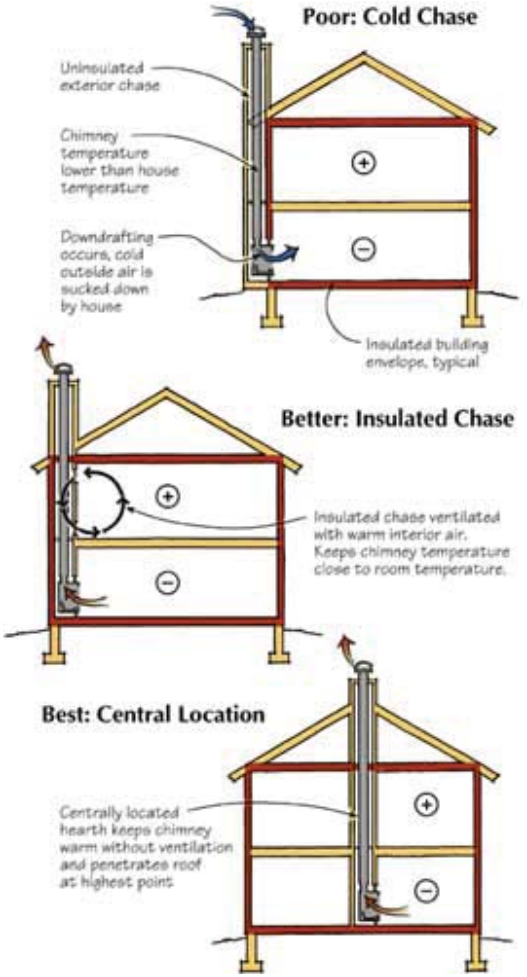
+

1/2 Part Soil

Adobe Bricks

Design Intent

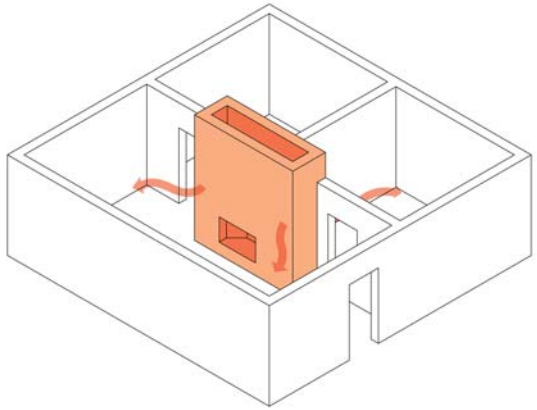




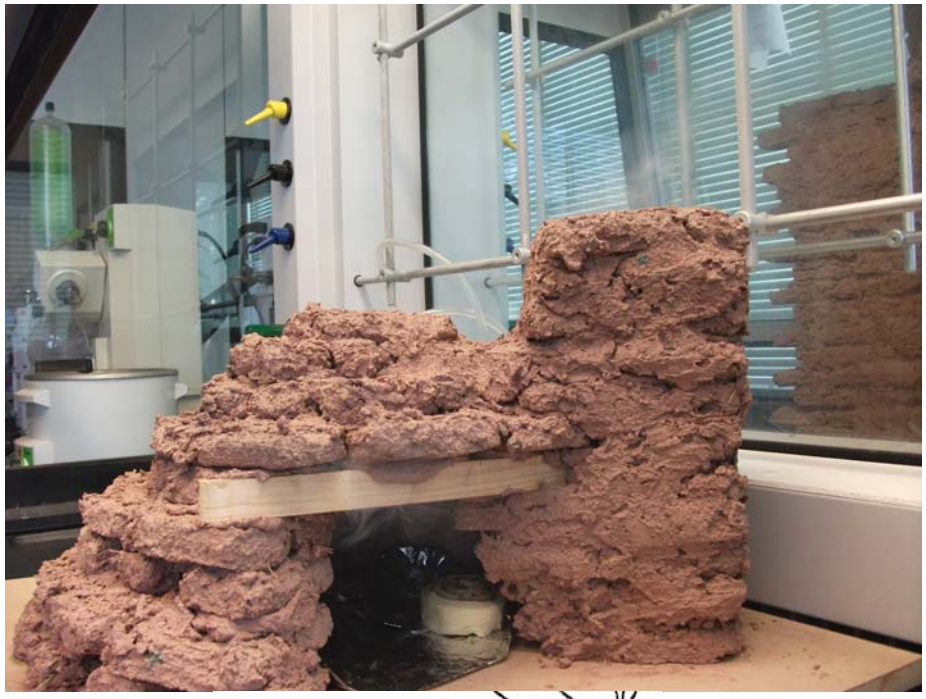
Design Basis

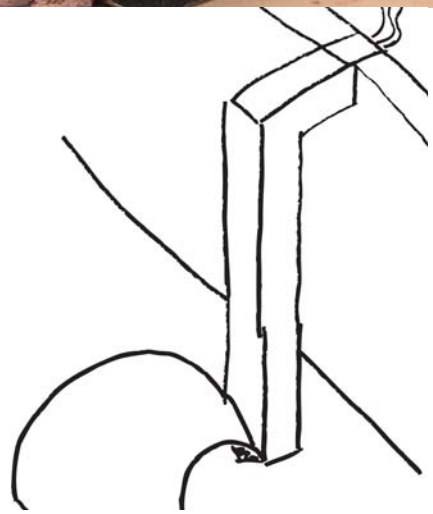
Designs

1



2





Testing Objectives

Analysis of stoves was mainly based on

Efficiency

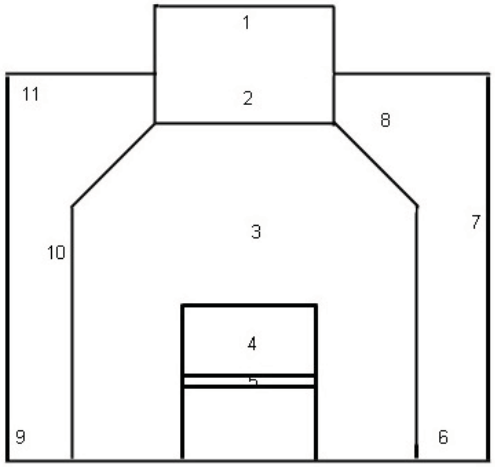
The amount of time it took to boil water

Heat retention

Based on frequently measuring the temperature of various points on the stove during and after burning

Effectiveness of smoke exhaust

Results

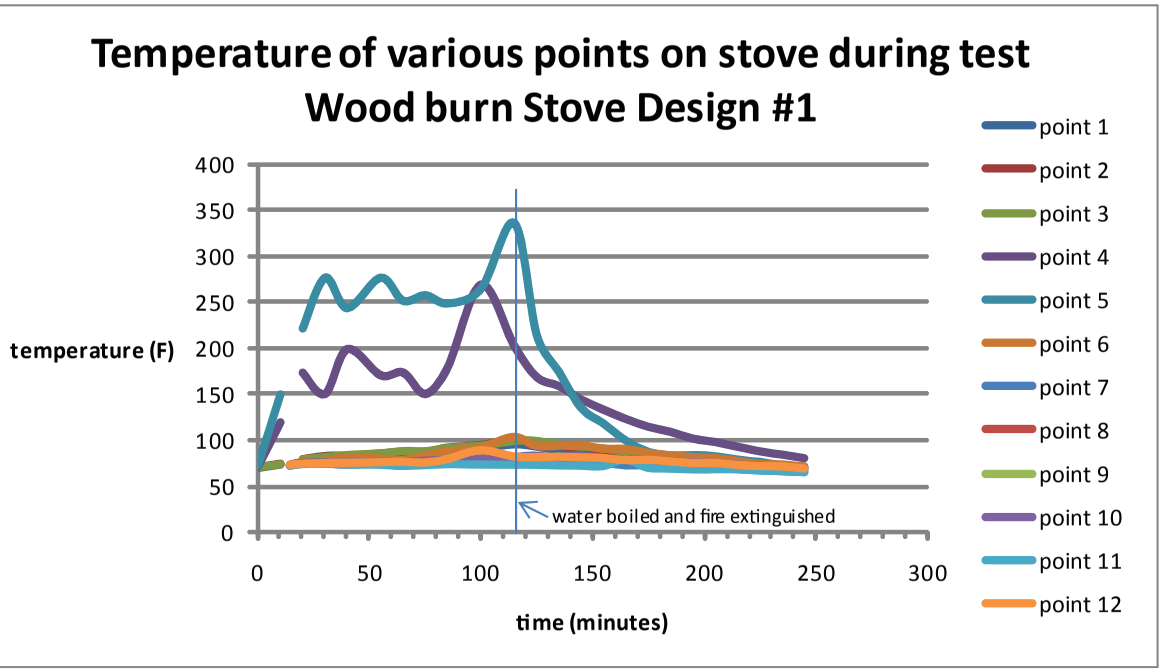


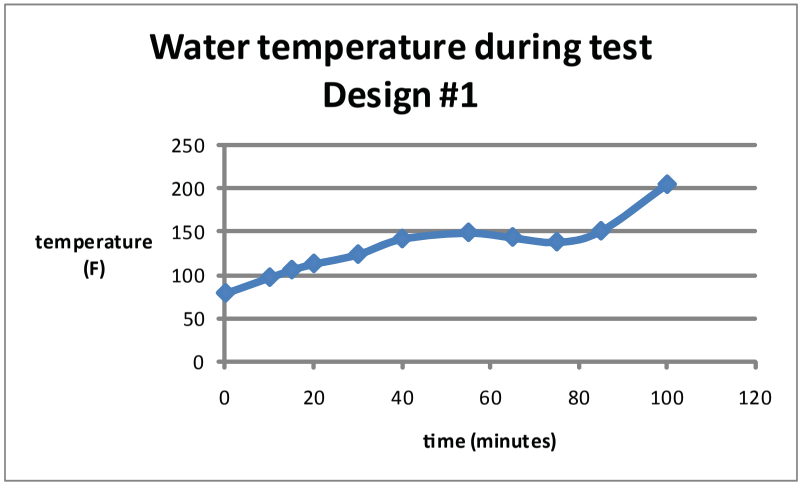
Design # 1

Showed no problems exhausting smoke, boiled water in 50 minutes, and retained significant heat for over 90 minutes.

Design # 2

Showed significant problems correctly exhausting smoke such that the experiment had to be ended prematurely.





Problems

Scale

Testing at 1/4 scale vs. performance at full scale

Design #1

Must be built into a new structure.

Design #2

Drafting problems cause excessive smoke.

Team Restructuring

First two weeks lost from lack of organization

Ethics

Cost

People are in extreme poverty.

Local Materials

Adobe is a commonly used material for current construction.

Integrity

Honest testing and representation of results.

Team Contributions

Work was equally divided amongst group members.

Contacts

Provided cultural information about the region.

Summary

Implementation

Resources are readily available to accomplish designs.

Health

Improved IAQ to help prevent illnesses.

Advantage

Combining stove and heating element.

Knowledge

Manual will teach Peruvians how to properly exhaust fumes.

Next Step

Rigorous use to determine long-term durability.

Covering the front opening to improve efficiency.

Adjusting the height of the fire to determine optimal height.

Test outside of a laboratory for a less controlled situation.

Full-scale testing to provide more accurate information.

Provide a damper for a more control over the draft.

Improve efficiency for heating, cooking, or both.

Questions?