

I PRO 325

Spring 2010

Final Report Rough Draft

1. Abstract

Homes in mountainous Peru lack sufficient heating infrastructure, which leads to many deaths each year. The object of this I PRO was to design a stove that would continue heating the home long after a fire stopped burning. The stove design utilizes the high heat capacity and availability of adobe bricks to create a hearth that will keep the home warm for many hours.

2. Background and Objective

I PRO 325 has a history of focusing projects on Peru. This team decided to follow in previous teams footsteps, mainly due to the amount of geographical and cultural information available from former projects. The region of Huancavelica, Peru is stricken by extreme poverty. The temperature lows here are around 34°F, but the “Fria je”, a phenomenon, of extreme cold never before experienced in this area, has sent temperatures as low as -31°F in 2003. This simply adds to the problems posed by extreme poverty, such as childhood fatalities, malnutrition and disease. In addition, indoor smoke inhalation due to unventilated cooking fires increase the occurrence of disease and fatality.

In an attempt to help decrease these issues, this team of I PRO 325 has focused on heating solutions that also function as food cookers for the homes in this impoverished area of Peru. By looking at both heating systems such as the Korean ondol and the German kachelofen, the team has decided to make a system that utilizes a wood burning fire to heat a thermal mass, while ventilating the smoke through a chimney. The key idea is that the thermal mass absorbs the heat

and stores it, giving it off to the environment over a certain amount of time. This does away with having to constantly maintaining a fire as a source of heat.

Adobe was chosen as a material, since, due to the extreme poverty of the region, it is vital for materials to be chosen locally. It is the main building material of the area, can be easily and cheaply made, and the communities have experience with it. In addition, it happens to act as a thermal mass, which suits the project perfectly.

In order to implement the final product, contacts were made around the area. First and foremost, it needed to be known if such a project was feasible, whether or not the locals would even accept the system, whether this would be seen as an infringement on the culture. From the responses and research, it definitely seems like a welcome and necessary idea. As for bringing the actual finished product to the region, it was decided to make simple, easy to understand manuals that give instructions for building, using and maintaining the stove.

3. Organization and Approach

The IPRO 325 team was originally split into two groups, designed to have a variety of majors on both teams, and the two teams were to work on two separate projects. It was quickly realized that the group as a whole would work better as two teams working on different aspects of the same project, and therefore reorganized into a Design Team and a Research Team. The research team found information about the project and reported it to the design team, who created a specific design. It was found, though, that since these steps are not simultaneous, the two teams mostly disintegrated and the team as a whole worked on all aspects of the project.

The team first researched what previous IPRO 325 groups had found, and drew knowledge from their experiences. None of the groups had focused on exactly the same project, but they went through largely the same process of design. Researching the location and culture

there were also very important in order to take into consideration what the people there needed and would accept. After the research team acquired all that information, the design team created a sketch, which was then constructed to scale and tested for heat retention and ability to function as a stove. This was done by monitoring the temperature of the stove after a fire had burned for some time, to test how well it retained heat and continued to disperse it throughout the home. Also, a fire would burn in the stove to heat a (scale) pot of water to test how long it takes to boil water on the team stove design. If the stove cannot boil water in a reasonable amount of time, it would be useless.

During this time the team also intended to create a manual that would detail the construction of the team's stove design clearly enough that it could be constructed without any members of the team being present. The most important consideration for the team during the design process was the people the stove was intended to be used by. The region the team decided upon is one of the poorest in Peru, so the design had to be as economical as possible, or else it would be insulting to them. The design also had to be as similar as possible to what the people are accustomed to, or they won't use it.

4. Analysis and Findings

The team has not completed testing yet, so there is nothing to report at this time.

5. Conclusions and Recommendations

For subsequent IPRO 325 groups, the team recommends testing their design more extensively than this team did. Also, they should begin testing procedures earlier in the semester, as this process takes longer than predicted (this seems to be a common trend amongst other IPRO 325 groups as well).

6. Appendix

Budget:

\$75 on clay for adobe

\$25 on wood for construction of bricks

\$30 on sand, tubs for mixing, and soil for adobe

\$5 stones for cooking surface in stove

Team Members:

Reinmar Maranon, rmaranon@iit.edu

Mark Kimball, mkimball@iit.edu

Young Jung, yjung8@iit.edu

Lindsay Drabek, ldrabek@iit.edu

Nicole Parks, nparks@iit.edu

Yong Park, parkyon2@iit.edu

William Lange, wlange@iit.edu

Jeffrey Hallenbeck, jhallenb@iit.edu

Dorothy Collins, dcollin8@iit.edu

Contact List:

- Herbert Roncal, President of KunturNetPeru.org, a non-profit organization promoting biodiversity, sustainable tourism, and nature.
- Marcial Blondet, Professor of Civil Engineering, Catholic University of Peru
- Percy Gomez Merino, President of non-profit organization Aprobe Peru