Small Solar Oven Project Proposal

Description of Problem

We are looking to design an oven that is smaller, more portable, and less cumbersome than the conventional design. The large ovens currently built are about 43"x21". This design is quite heavy and usually requires more than one person to carry. This semester, we will design smaller ovens that can be easily carried by one person and are able to fit through a door. The current oven design is intended for use in tropical areas, where the sun is nearly overhead throughout the year. Due to the drastically different angle and amount of incident solar radiation, we cannot use the same design at Cornell. We will design our smaller ovens with a capture angle more appropriate for the Ithaca climate, and hope to promote and raise awareness of solar oven technology in our part of the world with smaller ovens that will work in Ithaca. These ovens can successfully be used for demonstration any sunny day of the year.

Tasks for Semester

1. Research possible proposed ideas for tilted and scaled down versions of solar ovens.

- Professor Vanek has a small solar oven that is built to be used at the Ithaca solar elevation. We will be basing our design off of his oven: dimensions will be similar and like materials will be used. We will consult Professor Vanek to see if he would like to see any changes made to the current design, and will additionally come up with new ideas to make the oven easier to construct and use.

2. Decide on the design for the oven that will be used in Ithaca.

- We will measure the dimensions of the base of Professor Vanek's oven and use these measurements for our base. We will then decide on the optimal angle for the glass panel. The height of the front wall will be dependent on the height of pots used in the oven, and the height of the back wall will depend on the angle and front wall height.

3. Obtain the required materials.

- Most of the materials will be available in the Winter Lab. We will use 2x4's for the frame and plywood for the outside. Screws, other attachments and insulation material (fiberglass most likely) will most likely be available in the lab. Anything that is not available can be ordered online.

4. Construct the new oven.

5. Test the new oven's performance.

- Since the oven should be able to perform well regardless of the time of year, we can take it outside on any sunny day and measure the temperature reached inside the oven, as well as, the time it takes to achieve this temperature.

6. Make changes accordingly based on tests and then reevaluate.

- If the oven tests successfully, we will leave the design unchanged

7. Demonstrate

- Since the purpose of constructing this oven is for demonstration, we want to showcase the oven at a sustainability event on campus. It would need to be a sunny day, and we would set up the oven and reflector panels outside to show the temperature in the oven, and possibly even cook something.

Criteria

Technical:

For the small oven project, our team has a few clearly defined technical criteria for the construction of the new ovens. The ovens will be smaller than the current ones built for Nicaragua, so we would like to ensure that despite the smaller size, the ovens still reach high enough temperatures and perform adequately for cooking. In the past, the solar ovens have been designed for solar elevations typical in Nicaragua. We would like the new oven design to accommodate for the lower solar elevation in Ithaca, so the ovens can still be used outdoors. Last, despite the changes in design, the ovens will be built from mostly the same materials (other than the insulation, which is being investigated by another subteam) the previous ovens have been built from, as they use materials that will be the cheapest, and easiest to find in Ithaca.

Social:

The social characteristics of the small oven project closely follow those of the previous solar ovens. The ovens will be constructed such that the design (not including the changes due to lower solar elevation) can be reproduced by the group in Nicaragua using them. The changes in design from the previous ovens are being made so the team at Cornell University can have working ovens that can be used outdoors in our current location. This will allow us to demonstrate cooking outside and give us the opportunity to raise awareness of the effectiveness of the ovens.

Economic:

In the construction of the small ovens, we will focus on keeping the cost of materials as low as possible, but will not limit ourselves to using materials only found in Nicaragua. We will allow ourselves to purchase the materials we think will allow the cooker to perform better in Ithaca conditions. An appropriate budget will be decided on by the group and the project supervisor, which we will use for the semester.

Environmental:

The primary focus of the solar oven project has been to minimize energy consumption. By using the suns energy to cook food, we are directly reducing the amount of nonrenewable energy normally used to cook, such as burning wood, or gas. Another environmental criterion of ours concerns durability. We would like the ovens to have a robust design, but we do not want to over-design and have them made from costly materials that may go to waste after.

Items Specifically Outside of Scope

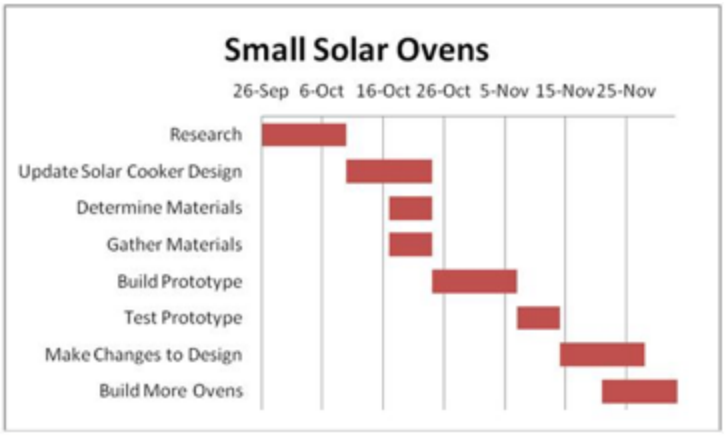
There are several tasks that fall outside the scope of the small solar oven project. Our main objective this semester is to redesign the solar ovens currently used in Nicaragua for demonstration purposes in Ithaca. We will change the angle to reflect the different solar elevation and scale the oven down so it is easier to transport. We will not be investigating fundamental changes to the oven design. Also, we will not be investigating any issues that the ovens are currently experiencing, such as the glass breaking. We currently have a design that works reasonably well for our purposes, and we would like to avoid drastically changing that design. Rather, we would like to focus our time and efforts more towards making small changes so that the oven can be used outside in Ithaca for outreach purposes. We feel that the team's time would be best spent on this more focused path. Attempting to redesign the oven would result in our efforts being spread too thin, which would limit what we accomplish over the course of this semester.

Anticipated Critical Theory Issues and Challenges

The major challenge we intend to face with the construction of the small ovens is the reflector assembly. Since, the ovens are smaller, a reflector assembly must be constructed and be able to be placed on the oven to collect more light to produce higher temperatures. This reflector assembly is unlike the ones currently used on the larger ovens and will be slightly more complex. Other foreseeable challenges could be adjusting the design for solar elevation, as well as, various material challenges.

The purpose of this project is not only to build a small solar oven designed for Ithaca's solar elevation, but also to be able to use it for demonstration purposes. We will need to be able to find a venue to share our project/cause with the public. Though the oven does work year round, this may be difficult in December or other colder months because people may not want to stand outside while the oven is heating up and cooking. As soon as the oven is constructed, our main challenge will be to come up with effective ways to promote it and get people to become interested in this technology.

Gantt Chart Timeline



Financial Requirements

1. Small sheets of glass: $20
2. Wood/fiberboard: $20
3. Sheet metal and paint: $10
4. Rice hulls/wood shavings: free
5. Mineral wool: up to $10
6. Hinges, screws/bolts: available at lab