Designed and Fabricated by Joshua B. Guinto, Specialist, Appropriate Technology
With Arnold Catacutan, Metal Worker
For the Culinary Education Foundation
Katipunan Avenue, Quezon City
Philippines
March – April 2016

The Solar Food Dehydrator

The Solar Food Dehydrator

- **Introduction**
  - Spoilage of farm products is high thus drives most farmers to low market prices of their harvests.
  - Dehydration of fruits and vegetables is an option. However, available technologies prescribe xpensive electric dehydrators or gas fired models thus making the technology inaccessible to micro enterprises.
  - This model hopes to inspire other farmers and home entrepreneurs to cross over this difficulty beginning with the practice of the Culinary Education Foundation.

The Solar Food Dehydrator

- Introduction
  - In an interview with Mrs. Luzviminda Castillo in April 2016, the person in charge in dehydrating the banana supply from the farm; she uses two models of dehydrator at the Cravings Restaurant:
    - An electric powered dehydrator that runs for three hours for every batch. *(what is the capacity? Electric power consumption?) 8 tray ; 14 saging ; 1 – 3 oras; 1.5 manibalang*
    - A solar food dehydrator built with a combination of wood and metal and then fitted with an electric stove. This model is now unusable. Because of old age, the wood panels are too brittle and the tray metals are completely rusted. Without the electric stove, the banana chips would also spoil with fungus in the following morning. (*capacity? Age?electricity consumption ?) 8 tray; 14 saging per tray ; no electric stove all amag*

The Solar Food Dehydrator

- The Design
  - The challenges faced by this project are as follows
    - It will not use electricity
    - It will have a back-up heat supply at night time or whenever there is less sunlight.
    - It has twice the capacity of the old dehydrators.
    - It will be built with recycled materials at low cost.
    - Easy to operate
    - Durable

The Solar Food Dehydrator

- The Designs Features
  - It will be built with old glass doors from the Lising Materials Depot
  - There will be four layers of shelves measuring _____
  - It will sit over a concrete floor with an additional layer of gravel and stones to serve as heat bank.
  - A back up heat supply will provided by a stove that will be fed with biomass fuel from waste agricultural materials.
  - A heat exchanger will be installed in between the shelves. It will produce hot air that will rise through the shelves.
  - The smoke from the stove will not come in contact with the food products.

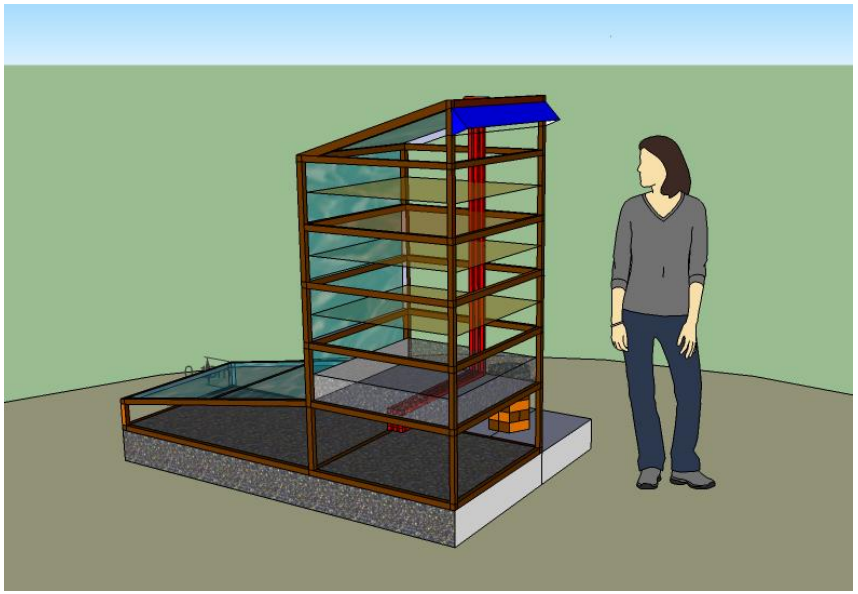
The Solar Food Dehydrator

THE SOLAR DRYER

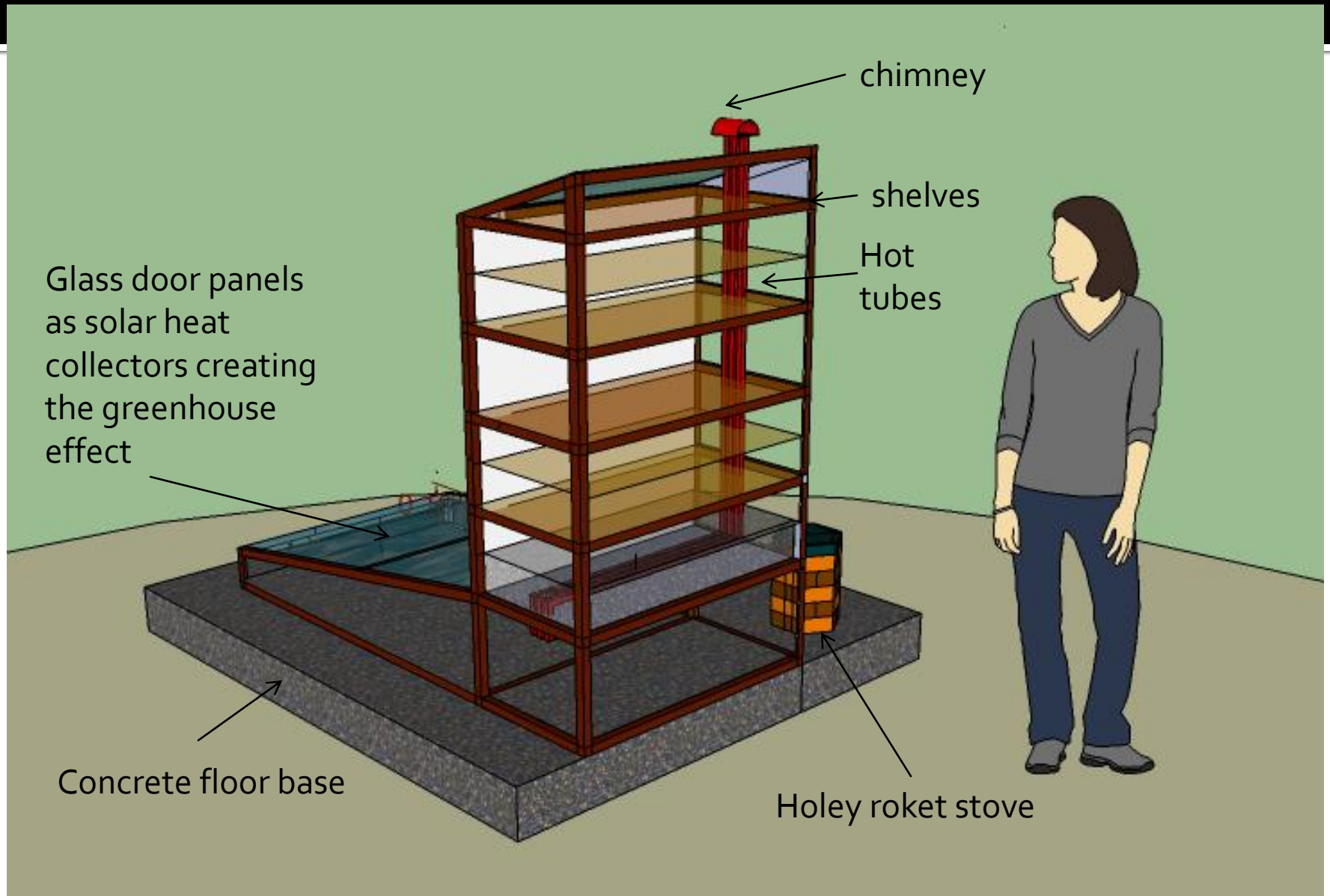
- Direct Sunlight
- Fast

THE DEHYDRATOR

- **Indirect sunlight**
- **slow**



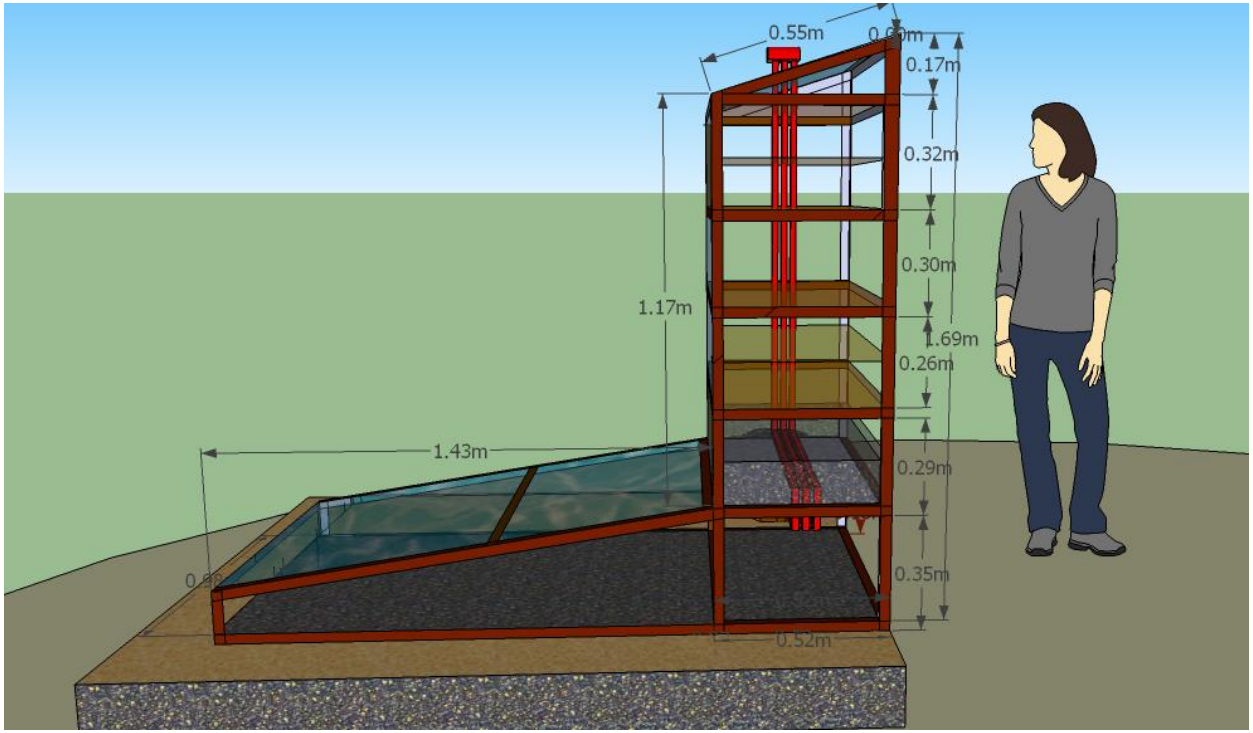
The Solar Food Dehydrator



The Solar Food Dehydrator

The Design :

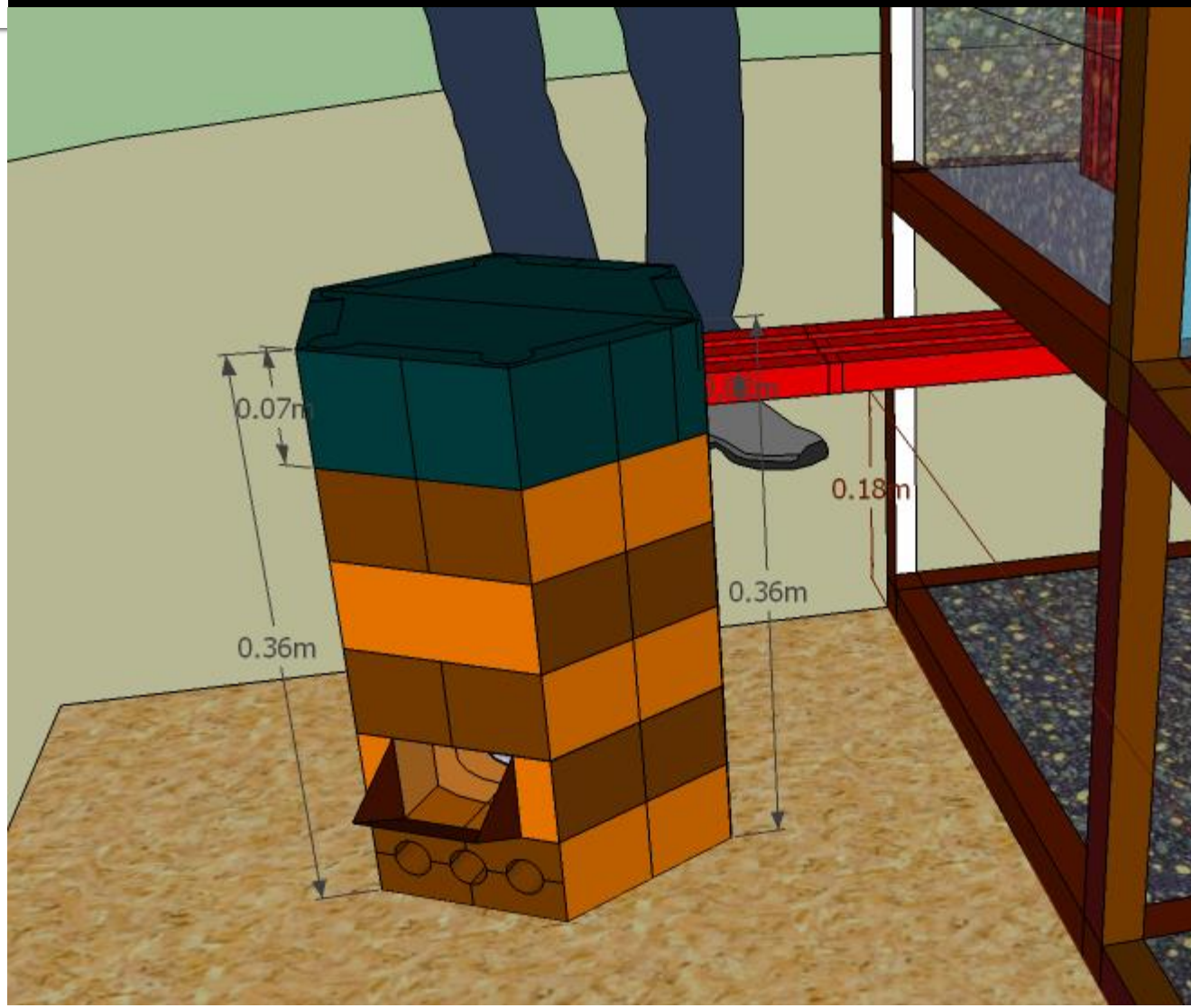
Dimensions



The Solar Food Dehydrator

The Stove

It is a brick stove made from a customized recipe of fire clay.



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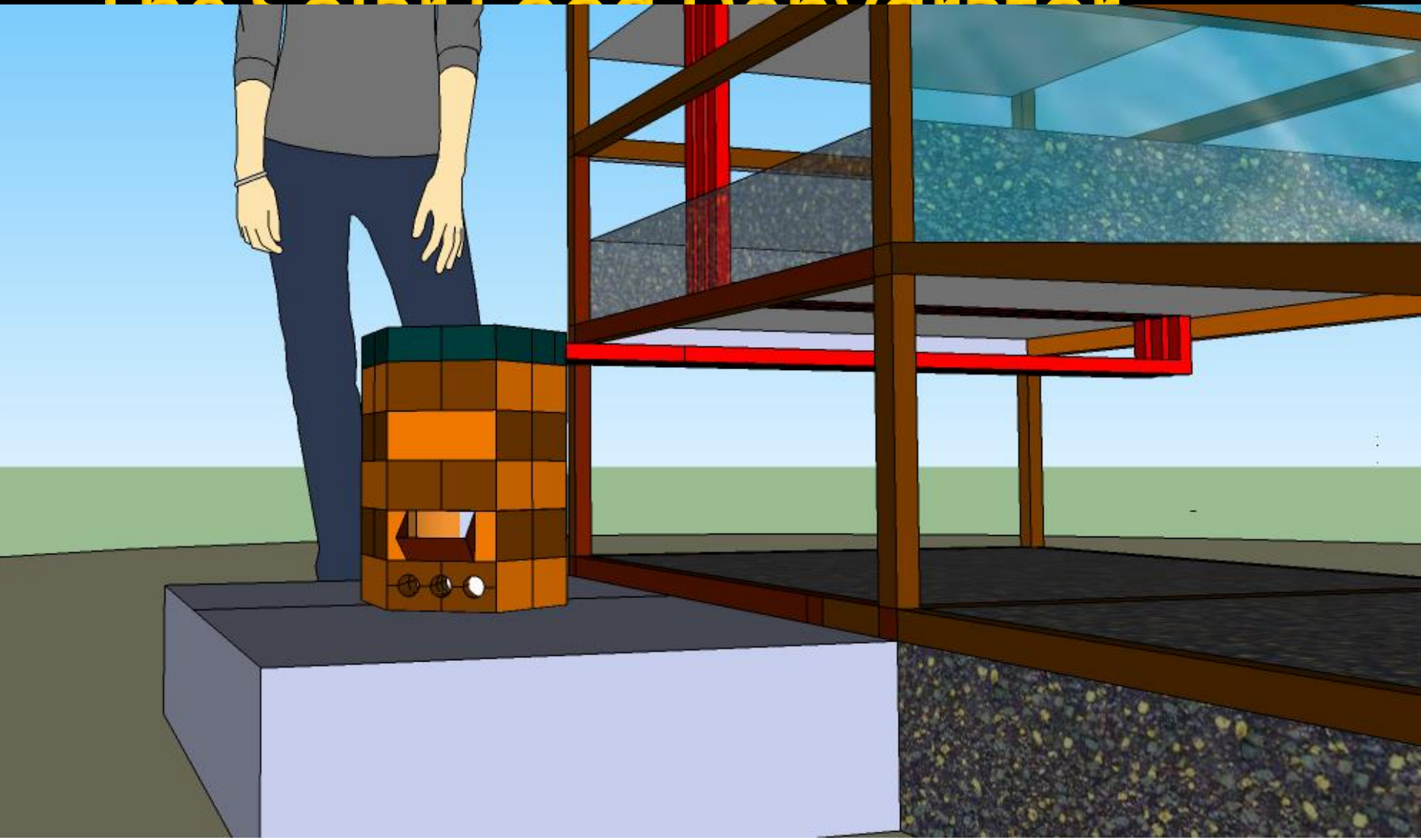
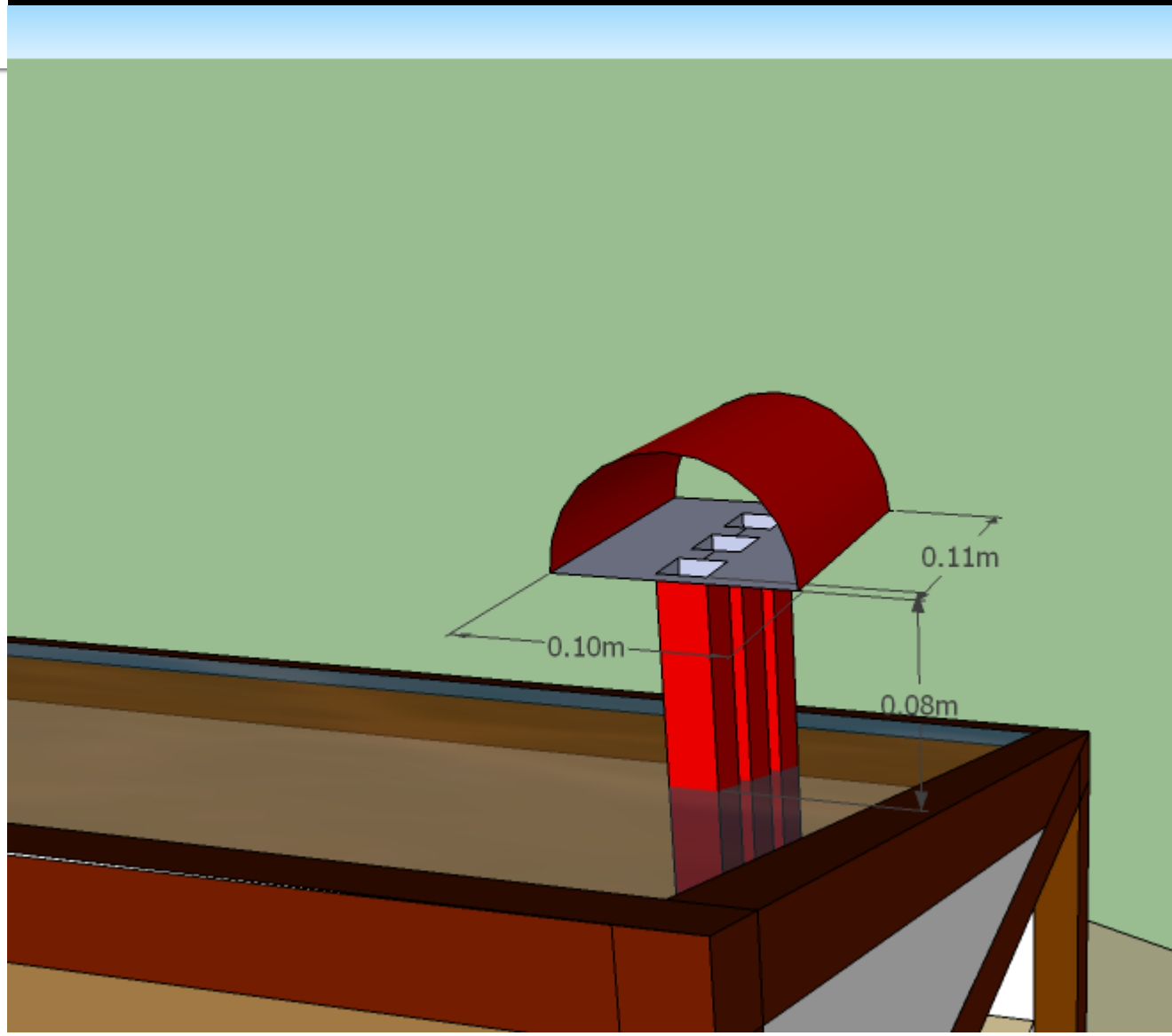


The Solar Food Dehydrator

The Design

The chimney connects to the three hot tubes that runs inside the shelves all the way to the hot plate at the top of the stove.



The Solar Food Dehydrator

The Design Concept As Constructed


SOLAR FOOD DEHYDRATOR

The Solar Food Dehydrator

- The Design Concept As Constructed

Beneath the glass panel is a layer of gravel and broken boulders which serve as heat banks.

The Solar Food Dehydrator

The Solar Food Dehydrator

The Design Concept As Constructed

The dehydrator receives sunlight from 7 am to 3 pm, which is the maximum exposure it can get within the Lising compound.

To test the air flows and leakages, smoke was made to flow inside the dehydrator. Heat leakages were then sealed.

The Solar Food Dehydrator

The Design Concept As Constructed

To test the heat exchanger, the stove was lit with dried buko shells which is a product of another installation, the solar dryer.

The Solar Food Dehydrator

The Design Concept As Constructed

The hot tubes consists of stainless metal tubes that was cut from old table frames. Additional flat bars were installed to capture more heat from the stove.

The Solar Food Dehydrator

The Design Concept As Constructed

Smoke coming out from the chimney indicates the heat flow inside the tubes. The flat bars and the tubes got hot soon after to about 45degrees centigrade.

The Solar Food Dehydrator

The Design Concept As Constructed

The hot plate that was installed at the top of the stove got very hot as indicated by the boiling water. It also indicates that there is still a lot of heat that may be collected from this hot plate which can be driven inside the drying compartment.

It also shows that this hot plate can also serve as a cooking plate. The hot plate came from an old table top.

The Solar Food Dehydrator

- The Design Concept as Constructed

The Solar Food Dehydrator

Results of Tests

The shelves can accommodate ___ pieces or about __ kilograms of ripe banana.

Over ripe bananas takes longer to dry because each chip will have to be cut thicker.

Most of the trays were built from metal scraps from refrigerator doors.


D DEHYDRATOR

The Solar Food Dehydrator

Results of Tests

The dehydrator registered a maximum temperature of 54.44 degrees Celsius (130 degrees Farenheit) between 12 noon and 1 pm.
However it is difficult to read the thermometer which was installed inside the drying compartment. Instead, the thermometer had to be fixed by the door of the compartment for ease in reading From then on it registers a maximum temperature of 48.88 degrees Celsius (120 degrees Farenheit) during the same time of the day.
This also indicates that there are hot and cold zones inside the drying chamber.

The Solar Food Dehydrator

Results of Tests

At one point, the author had to open the doors completely late in the afternoon because the door handles and the lock had to be installed.

The following morning, about 3 % of the banana chips caught fungus and had to be discarded.

It indicates a huge heat loss from the previous day.

The Solar Food Dehydrator

Results of Tests

Still, Ate Luz was very satisfied with results. According to her, on the old wooden dryer and with the same incidence, the entire batch of the banana chips would have already caught fungus.

- Fabrication Stage

The Solar Food Dehydrator

Results of Tests

Mrs. Luzviminda Castillo and the author happily presents the output from the early tests.

The Solar Food Dehydrator

- More Notes, Lessons and Recommendations
  - This dehydrator will have to be tested and observed during days of less sunlight.
  - If the fruits would still catch fungus in the following morning, then,
    - more metal pieces will have to be added to allow more heat transfer from the hot plate on top of the stove.
    - More boulders will have to be added on the floor.

The Solar Food Dehydrator

- More Notes, Lessons and Recommendations
  - This model is probably the first of its kind in the Philippines and possibly in the world. For purposes of scientific researcher, it is recommended that technical data be collected to asses the over all technical performance of this model.
  - To test the adaptability of this model to other food products, more fruit varieties may be tested as well as herbs and vegetables.
  - To improve it overall aesthetic looks, artists may be invited to create art work over the dehydrator, but being careful not to compromise its capacity to collect heat.

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- More Notes, Lessons and Recommendations
  - This model is probably the first of its kind in the Philippines and possibly in the world. For purposes of scientific researcher, it is recommended that technical data be collected to asses the over all technical performance of this model.
  - To determine the savings from the electric consumption, a sub meter may be installed at the electric dehydrator to isolate its power consumption.
  - To test the adaptability of this model to other food products, more fruit varieties may be tested as well as herbs and vegetables.
  - To improve it overall aesthetic looks, artists may be invited to create a art work over the dehydrator, but being careful not to compromise its capacity to collect heat.

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Acknowledgements:

The Fabrication Team consisting of Mr. Arnold Catacutan and the author.

With the participation of Mrs. Luzviminda Castillo

For the Culinary Education Foundation headed by Mrs. Susana P. Guerrero.

April 2016
Quezon City

- 165; 4 oras
- Satabado salang umiitim pag matagal