



Solar-Energy Education: Making a Miniature Solar Oven

Yukimasa Tsubota, J. F. Oberlin University in Tokyo, Japan

1. Objectives of our research

- to develop lesson plans for solar energy education;
- to utilize solar ovens as science-teaching materials;
- to evaluate a miniature solar oven that is proposed by our research;
- to list science concepts that should be taught using a miniature solar ovens.

2. Solar Oven in Education

Many kinds of solar ovens are available at affordable prices for educational use in Japan. Solar ovens are used to introduce the benefits of solar energy within Japan's environmental dissemination activities, albeit they are affected by the weather. Solar ovens are not used in school science-curriculum in Japan. We propose lesson plans using a miniature solar oven that has many possibilities to enhance school science-curriculum.

3. Science of Solar Oven

•Solar Energy

- Solar constant and energy density 1370 W/m^2
- Annual and diurnal change
- Renewal energy source

•Principles of Heat Transfer

- Conduction, Convection and Radiation
- Insulation Materials
- Absorption and reflection of energy

•Radiation Balance

- Heat gain = Heat loss

•Greenhouse Effect: Box type solar oven

•Reflection Law of light

- Plane, spherical and parabolic mirrors

4. Advanced Topic in Solar Energy

A solar cell is a popular teaching material for solar-energy education in school science-curriculum. In our lesson plan, we suggest comparing the performance of a solar cell to the same-size solar oven using the electric lamp within a laboratory. The heat & light energies are studied for their advantages & disadvantages. For example, solar oven's energy conversion rate is much higher than a solar cell. It is not easy to store heat energy as compared with electric energy.

5. Extended Activity

We may ask students to design their own solar oven based on their scientific knowledge. Although a student's design and building of a solar oven using cardboard are already being implemented in many countries, our proposal starts from making a miniature solar oven and testing solar oven performance in a laboratory. Eventually we expect to have a practical and efficient model of a solar oven.

6. Outcomes of lessons

- Pupils will learn solar energy as a natural energy source.
- Pupils will learn about renewal energy technology and its application.
- Pupils will foster their science literacy.
- Pupils will develop their basic modeling skills such as cutting and gluing.
- Using solar ovens for cooking are entertaining to pupils.

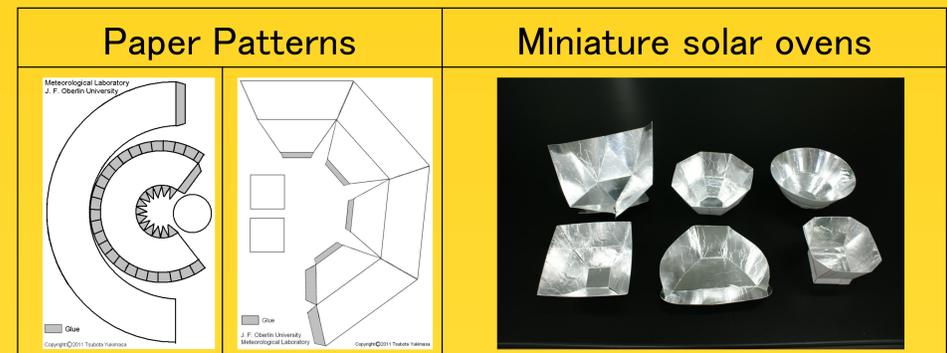
7. References

Solar Cookers International, Solar Cooking Basics
<http://www.solarcookers.org/basics/basics.html>

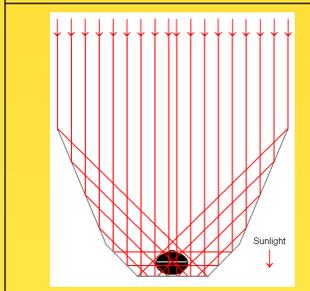
Corresponding address:

Yukimasa Tsubota, J. F. Oberlin University
 3758 Tokiwamachi, Machida-shi, Tokyo 194-0294, Japan
 e-mail: tsubota@obirin.ac.jp

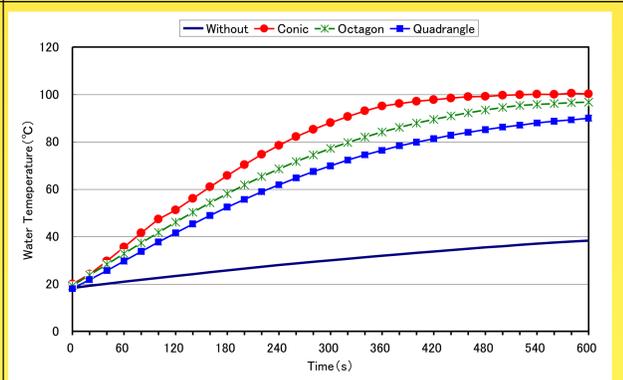
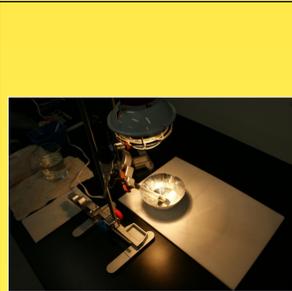
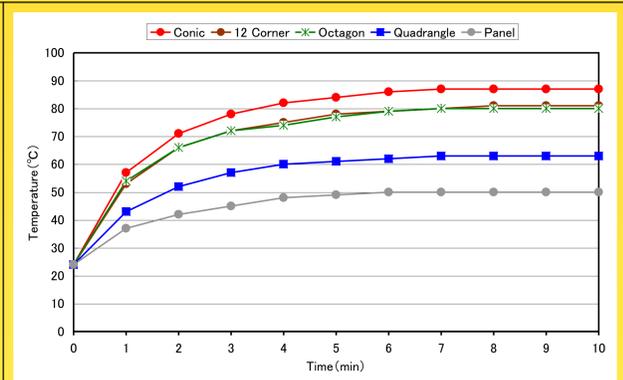
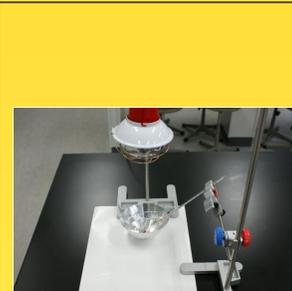
Solar Oven Classification			
Concentrator Type		Box Type	
Panel Type	Parabolic Type	Without Mirror	With Mirror
			



Cross Section



Proposed Experiments



Making a miniature solar oven.



Testing a miniature solar oven.



Advanced Experiment

