Understanding Solar Cooking, Its History, and Application for Today's World

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Presented by

The Solar Education Project

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&
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Part 1
Solar Cookers

Part 2
A Brief History

Part 3
Application

Solar Cookers

- Basics of cooking with the sun
- Variety of solar thermal oven styles
- Best materials - available & affordable

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We DARE you to Solar Cook!

Principles: Solar cookers work on basic principles: sunlight is converted to heat energy that is retained for cooking.
The Fuel is Sunlight You need a sunny outdoor spot protected from strong wind where food will be safe.

Remember the basics of solar cooking. We DARE you to try it!

Direct extra sunlight

- One or more shiny surfaces reflect extra sunlight onto the pot, increasing its heat potential.

Absorb light and convert to heat

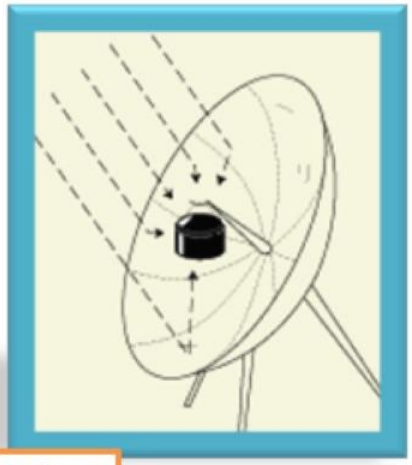
- Dark surfaces get very hot in sunlight, whereas light surfaces don't. Food cooks best in dark, shallow, thin metal pots with dark, tight-fitting lids to hold in heat and moisture.

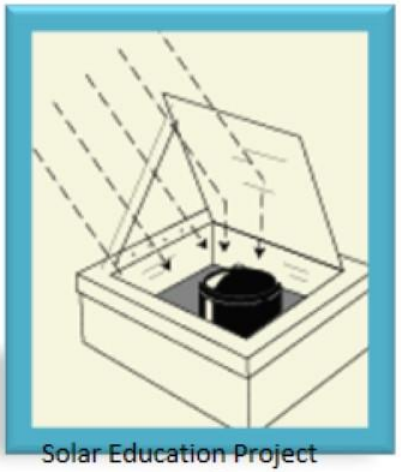
Retain heat

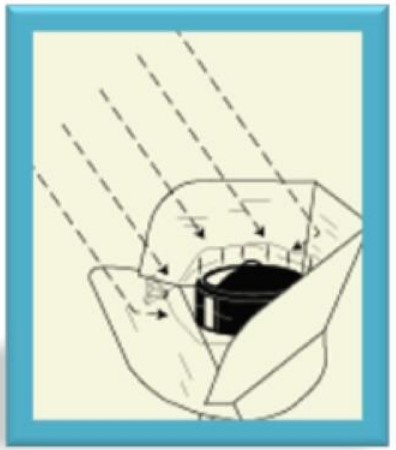
- A transparent heat trap around the dark pot lets in sunlight, but keeps in the heat. This is a clear, heat-resistant plastic bag or large inverted glass bowl (in panel cookers) or an insulated box with a glass or plastic window (in box cookers). Curved concentrator cookers may not require a heat trap.

Eat, Enjoy, Educate, Extend, Enrich…

- Eat delicious food cooked in the sun. Share solar cooking and solar cooked food with others. *EACH ONE REACH ONE!*







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Types of Solar Thermal Cookers

Panel

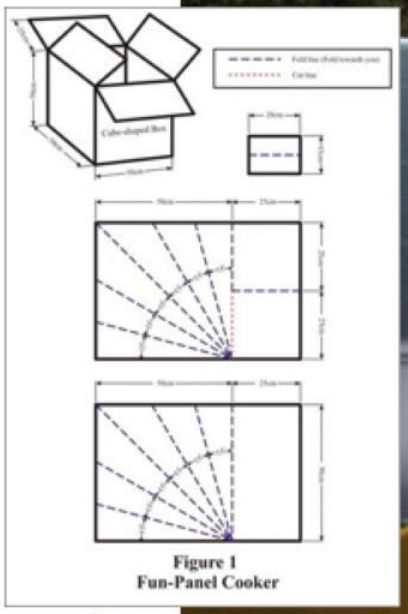

Figure 1
Fun-Panel Cooker

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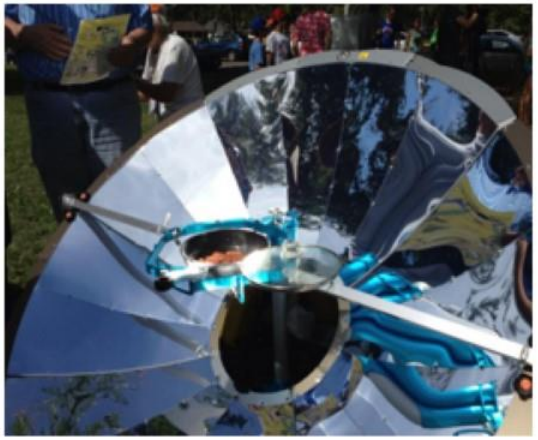
Photo credit: Mary Buchenic @ Sacramento Solar Cooking Festival

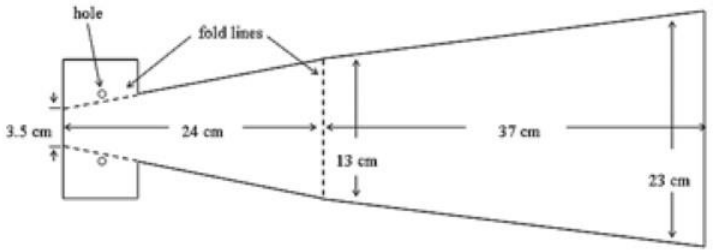
Types of Solar Thermal Cookers
Panel and Cone

Sharon Clausson of California
The Copenhagen

Muhammad Yasin Khan
Chichawatni, Pakistan
Backpack Solar Cooker

Types of Solar Thermal Cookers
Parabolic and Cone





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Elly Emmett's
Wheelbarrow Solar Oven

Photo Credit: Torsten Kremser @ Korando Educational Institute in Kisumu, Kenya The Sol Source

Types of Solar Thermal Cookers

Box

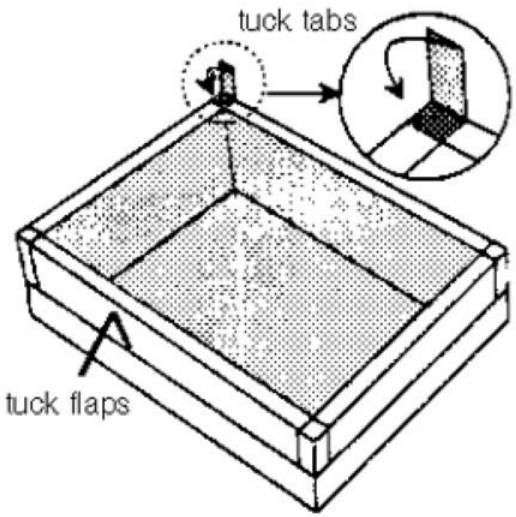

Figure 6

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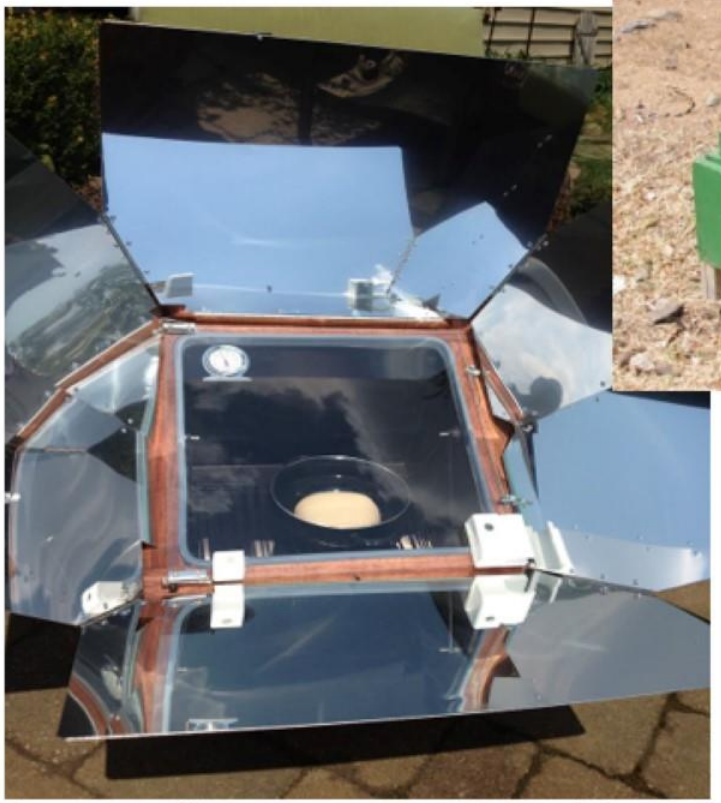


Photo Credit: Mary Buchenic @ Ohio, USA
The All American Sun Oven

Home made by Sharon Cousins of Idaho, USA

Types of Solar Thermal Cookers
Box & Metal Tube

Photo Credit: Ivan Yaholnitsky @ Permaculture Lesotho

Types of Solar Thermal Cookers
Evacuated Tube

Photo Credit: Bernhard Mueller @ Eschborn, Germany using Alex Kee's SK-TF.

Photo Credit: Mary Buchenic @ Ojai, California using large evacuated tube.

Types of Solar Thermal Cookers
Jar in Jar

Photo Credit: Mary Buchenic @ SCI Convention
Berhnard Muller's Jar in Jar

Types of Solar Thermal Cookers
Fresnel Lens

Matteo Muccioli of Italy with his Fresnel Cooker

Photo Credit: Mary Buchenic @ Sacramento Solar Cooking Festival

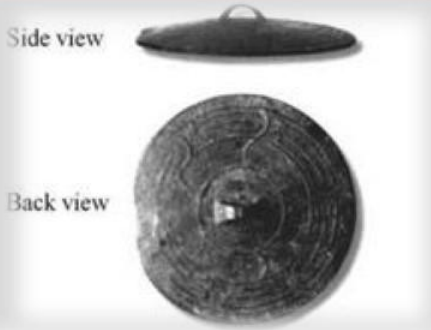
Types of Solar Thermal Cookers
Bowl with Panel

Photo Credit: Mary Buchenic @ Sacramento Solar Cooking Festival with Sharon Cousins of Student Solar Cooking Science Projects.

Photo Credit: Camily Wedende Family @ Student Solar Cooking Science Project, Eldoret, Kenya.

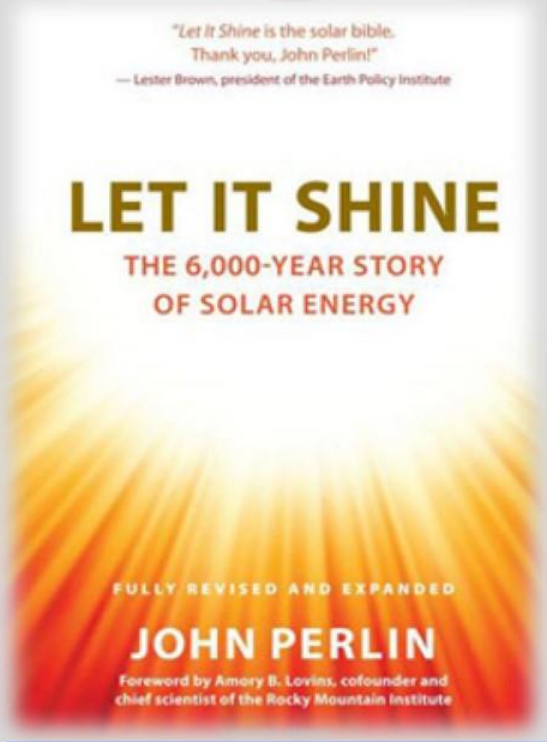
History

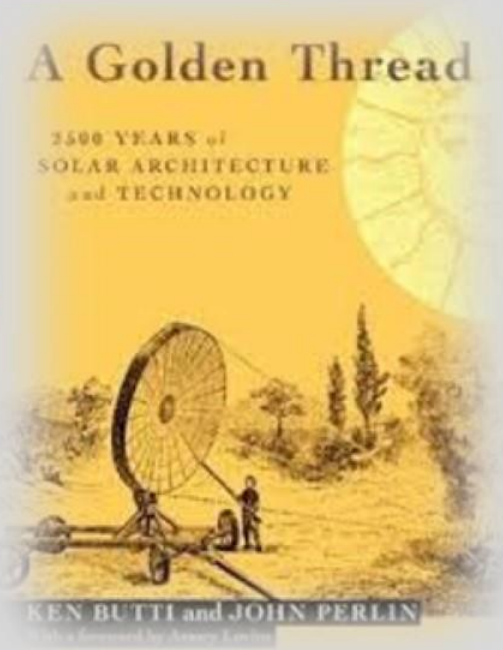
- Ancient civilizations' use of passive solar energy
- Solar cooking technology - 18th Century to today.
- Effect of location on adoption



A bronze solar igniter from the ZhOu Dynasty dated 1000BC (Physics of Solar Energy, C Julian Chen)

Ancient cultures used solar orientation of their homes to take advantage of the sun's energy.





Solar devices from ancient times can be recreated for modern uses.

The sun heated houses in many Greek cities 2,500 years ago.

Leonardo da Vinci (1452 – 1519) thought of building mirrors a mile in diameter to heat water for the Florentine woolen industry.

As wood became a scarce fuel source, ancient Roman architects planned entire communities with solar orientation.

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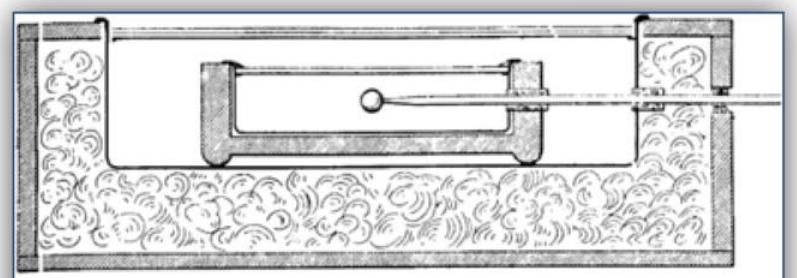
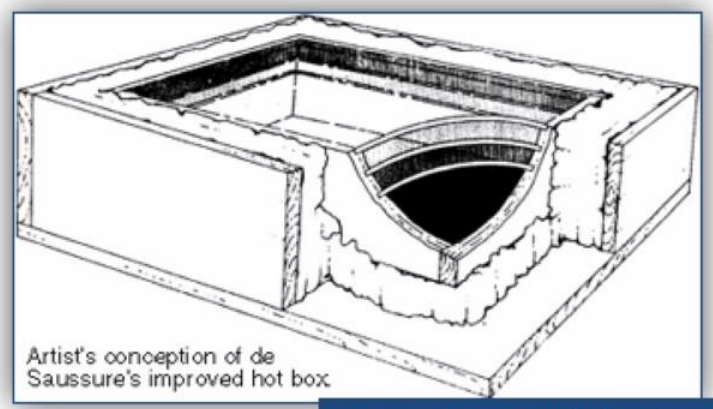
Sample of Early Solar Ovens



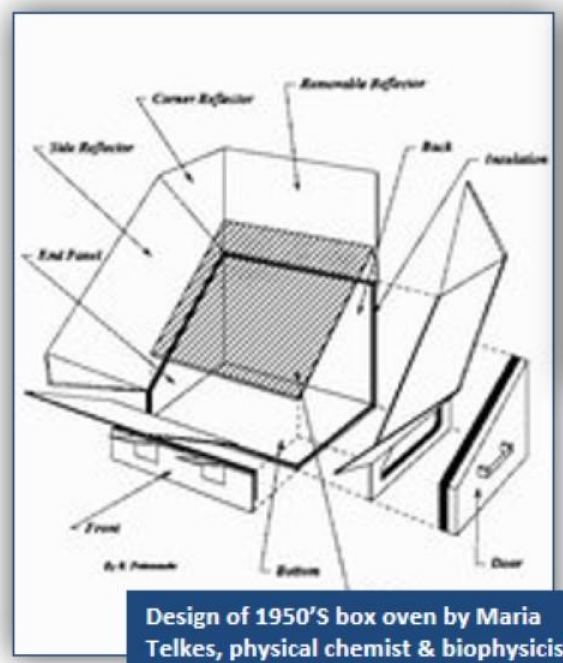
Cross-section of Langley's hot box, which was similar to de Saussure's later models. A thermomether penetrating the walls at right was used to measure the air temperature inside the inner box.

Samuel Langley 1884

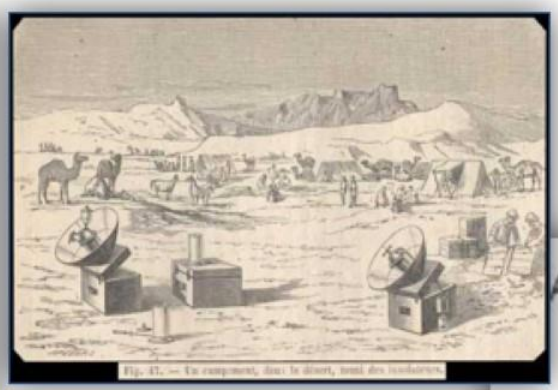


Artist's conception of de Saussure's improved hot box

Horace de Saussure's hot box - 1767



Design of 1950'S box oven by Maria Telkes, physical chemist & biophysicist. Source: Arizona State University



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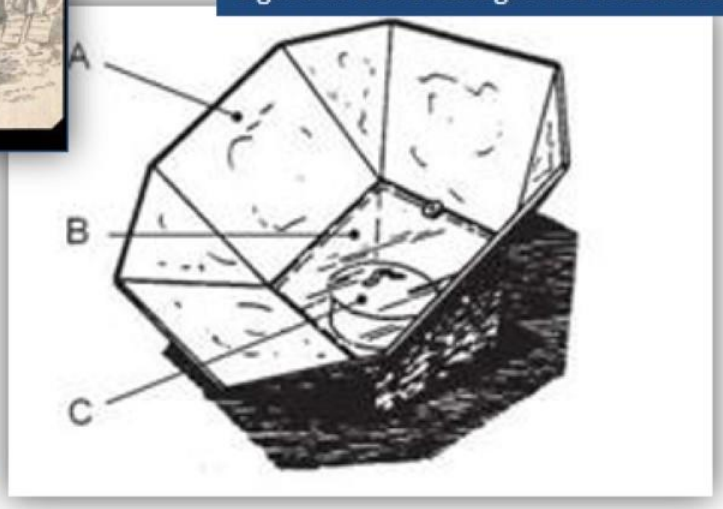
EnergyProfessionalSymposium.com

W Adams 1878 Bombay, India
Eight mirrors reflect light into wooden box.



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Original evacuated tube was designed for insulating already heated liquid. Modern evacuated tube was introduced as solar cooker and water pasteurizer in 2006 by Alex Kee of Malaysia.

Sir James Dewar's evacuated tube 1892
http://www.rigb.org/

Thermos ad early 1900s

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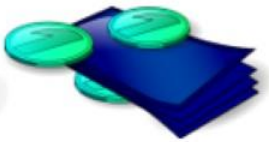
Adolph Weinhold's vacuum flask
1881

Application

- Replace cooking fires when possible. (Part of integrated cooking)
- Reduce costs and time spent gathering wood
- Alleviate medical conditions and pasteurize water
- Address environmental concerns
- Use when other fuels not available
- Teaching tool for STEM and more



Application

Friends of the Old (FOTO) works in Western Kenya in area with 60% poverty.

FOTO works to provide the elderly with means to **safe drinking water**, minus the **burden of gathering firewood** and the **dangerous exposure of women and children to cooking smoke**.

FOTO Director: Dinah Chienjo
Source:solarcookingwikia.com

What health issues can be dramatically reduced by solar cooking?

Those related to open fire cooking:

- **Pneumonia**
- **COPD**
- **Asthma**
- **Eye damage**
- **Burns**

Solar Cookers can pasteurize water and milk, destroying the **micro- organisms that cause disease.**

WAPI (Water Pasteurization Indicator) is a tool that indicates when water or milk is safe to drink.

The WAPI can be safely used with solar cookers.

Source:solarcooking.org

Application

Workshops and Training for Water Testing, Solar Pasteurization, and Solar Cooking

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Application

Use when other fuels are not available.

In 2010, following the devastating earthquake in Haiti, Friends of Haiti Organization sent two large Villager Sun Ovens, 160 Global Sun Ovens, 200 CooKits, and 2,000 WAPIs.

Snowstorm knocked out your power? Cook with the sun instead.

Example of compact oven for camping.

Photo Sources: Sunoven.com, Sunflair.net and SunshineOnMyShoulder.com

Application

Use as a way to reduce dependence on charcoal and wood and combat deforestation

Fuel in the form of wood or charcoal remains the dominate energy source for over two billion people worldwide. To stem the rate of deforestation and erosion, alternate integrated cooking methods can be adopted that include solar.

Application

Use as a basis for economic empowerment.

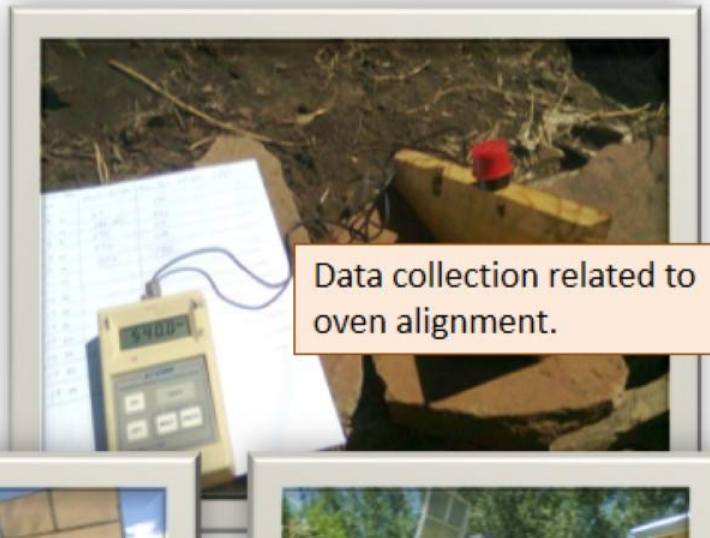
- Box ovens for sale in Eldoret, Kenya.
- Retained heat baskets for sale in Nairobi, Kenya.
- Restaurant in Villaseca, Chile cooks with the sun.
- Home bakery in Lesotho sells baked goods made in a solar tube.

Application

Use as a basis for economic empowerment.

Bethel Business and Community Development Centre in Lesotho, Africa.
The school's primary mission is to provide skills and knowledge to young men and women for well-being and self-reliance through experiential learning.

Solar Cooking is part of daily life at this off-the-grid educational facility.



Data collection related to oven alignment.

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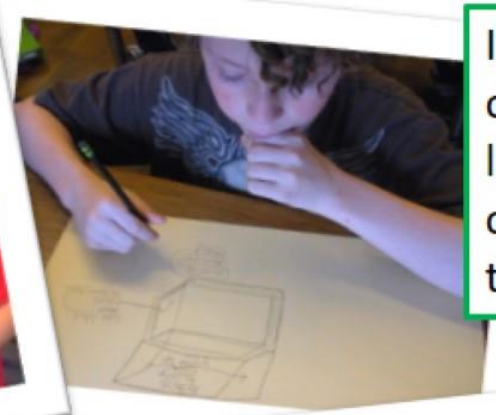
Application

Use as a tool for education in science, math and other subjects.

In 1996, Mary Buchenic developed cross-curricular, project-based lessons using solar cookers. Solar cookers are impactful tools for teaching.



Application

Use as a tool for education in science, math and other subjects.

Teachers around the world share solar cooking with their students. We depend on our youth to help this technology develop and improve.

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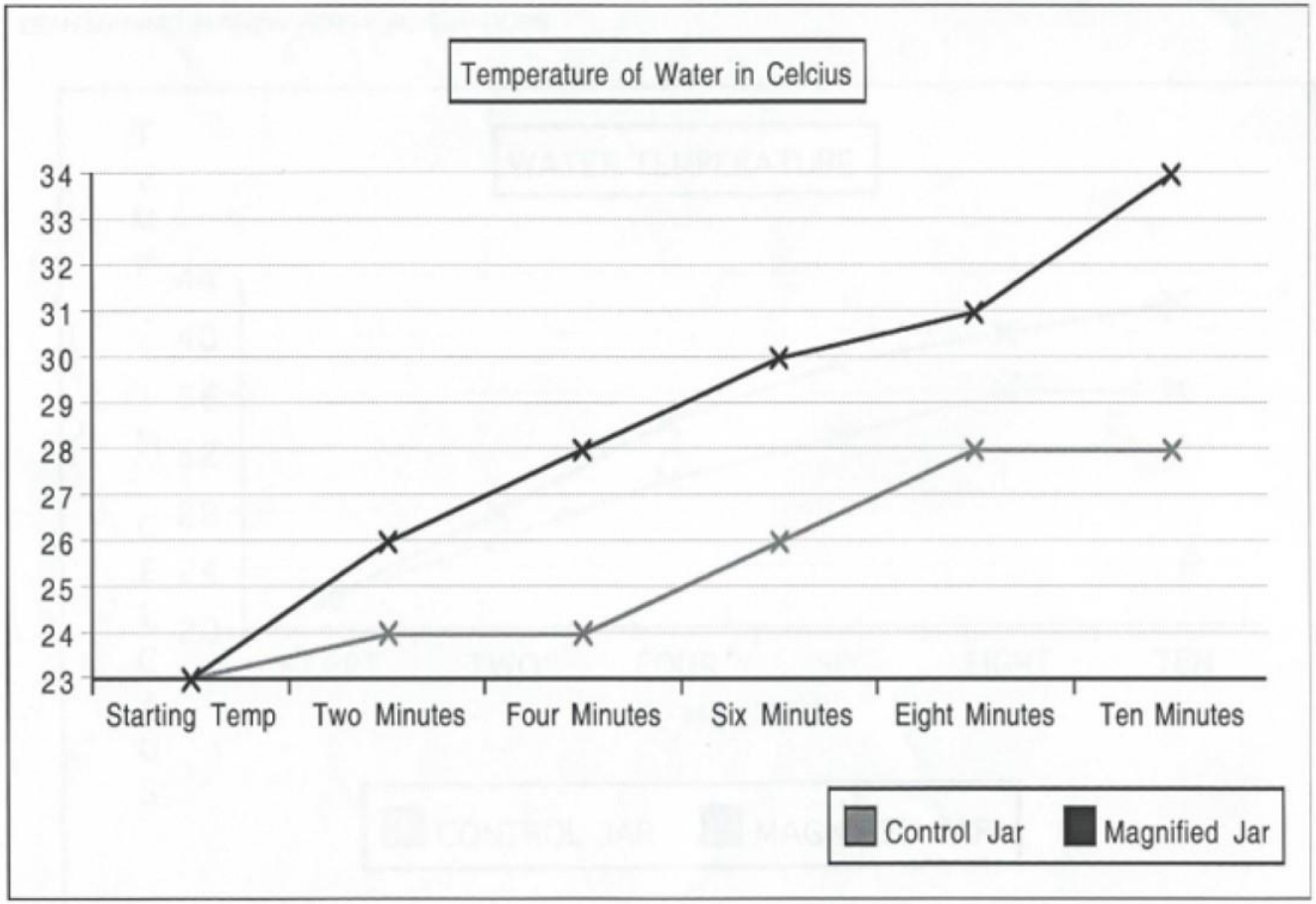
Students conduct introductory experiment to test effect of directing light onto a penny in a jar of water. (Concepts support planning and design of ovens.)



COPPER PENNY, TRANSPARENT JARS W WATER, THERMOMETER, TIMER, MAGNIFIER.

Solar Thermal Cooking Technology

Science Next Generation Science Standards	Math Common Core Math Standards	Language Arts Common Core ELA Standards	Social Studies Ohio Academic Content Standards for Social Studies	Other
NGSS.MS-PS3-3. NGSS.MS-PS3-4 NGSS.MS-PS3-5 NGSS.MS-PS4-2 NGSS.MS-ESS3-3 NGSS.MS-ESS3-4 NGSS.MS-ETS1-1 NGSS.MS-ETS1-2 NGSS.MS-ETS1-3	CCSS.MATH.CONTENT. 6.EE.C.9 CCSS.MATH.CONTENT. 6.G.A.1 CCSS.MATH.CONTENT. 6.G.A.3 CCSS.MATH.CONTENT. 6.G.A.4	CCSS.ELA-LITERACY. RST.6-8.1 CCSS.ELA-LITERACY. RST.6-8.2 CCSS.ELA-LITERACY. RST.6-8.3 CCSS.ELA-LITERACY. RST.6-8.4 CCSS.ELA-LITERACY. RST.6-8.5 CCSS.ELA-LITERACY. RST.6-8.6 CCSS.ELA-LITERACY. RST.6-8.7 CCSS.ELA-LITERACY. RST.6-8.8 CCSS.ELA-LITERACY. RST.6-8.9 CCSS.ELA-LITERACY. RST.6-8.10	HIS.68.1a HIS.68.2a GEO.68.1a GEO.68.2a ECON.68.1a ECON.68.2a ECON.68.3a ECON.68.5a ECON.68.6a	

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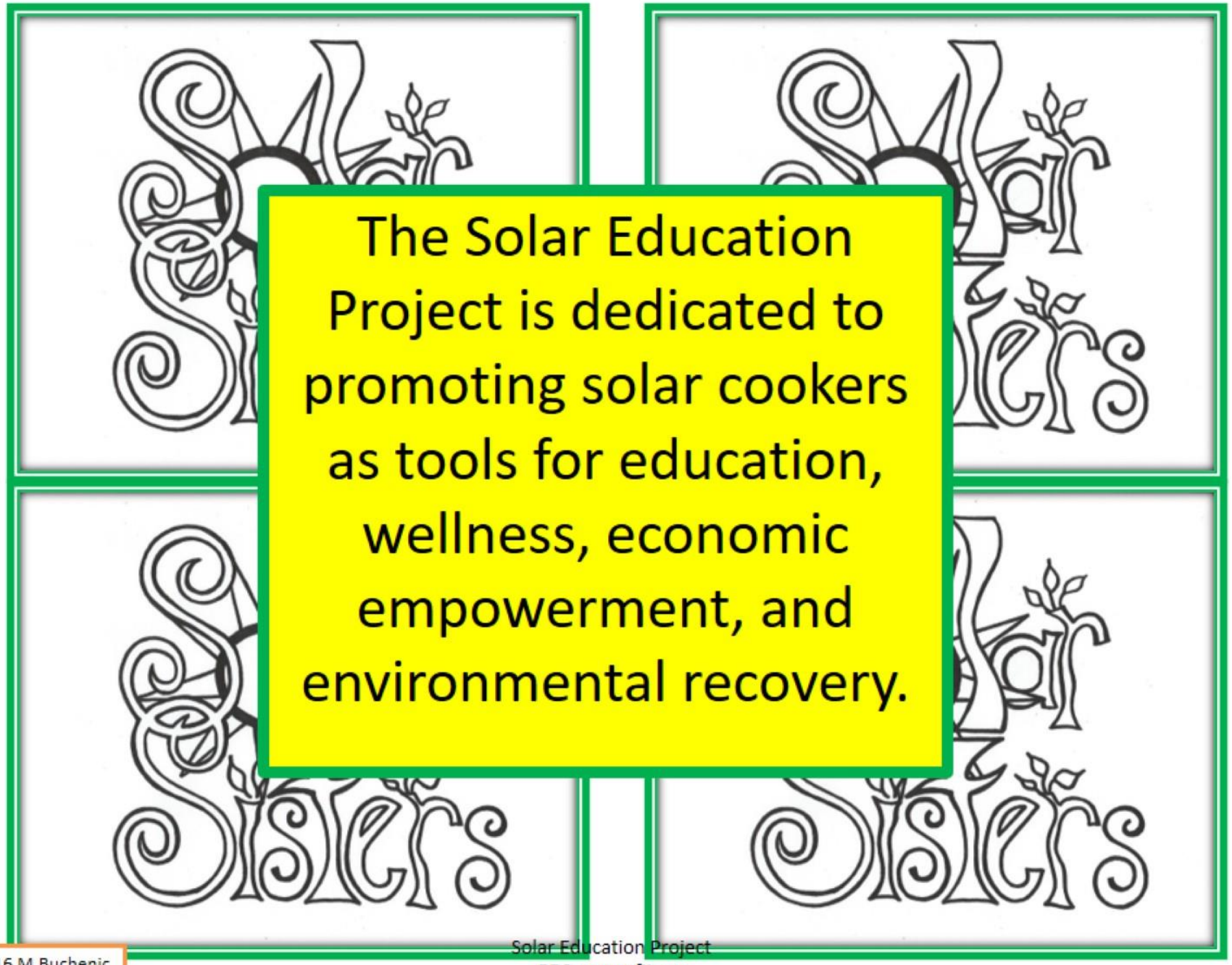

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Thank You All!

Now, let's get cooking!