SOLAR MADE CRAYONS!

This activity was designed and made by Joveline Alvarez, KCSC Intern and member of the KCSC Industry Partnership Program in collaboration with Kauai Island Utility Cooperative, KIUC, The Sciencenter in Ithaca, NY and STEAM Truck in Atlanta, Georgia. One of the goals of this program is to develop STEAM content related to the industry partner's business, in this case, the KIUC West Kauai Energy Project, WKEP. You can learn more about the program here, https://kauaicsc.org/kcsc-industry-partnership

THE BIG IDEA

Solar energy is a big component of the West Kauai Energy Project. Build your very own solar oven and learn about solar power to make crayons with this creative sunny weather science experiment!

KEYWORDS

Solar Energy, Solar Oven, Renewable Energy, Reflection, Absorption.

MATERIALS

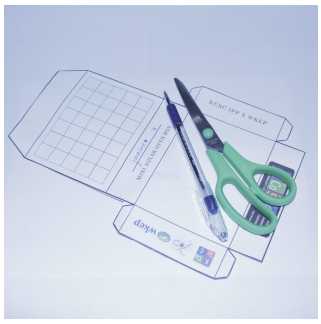
- Foil Lined Box Template
- Chopped Up Crayons
- Cookie Cutter, 3D printed by KCSC
- Black Paper
- Clear Sheet of Plastic
- Toothpick
- Tape
- Glue Dots
- Solar Oven Stand (popsicle sticks)

Other materials you will need:

- Scissors
- The Sun!

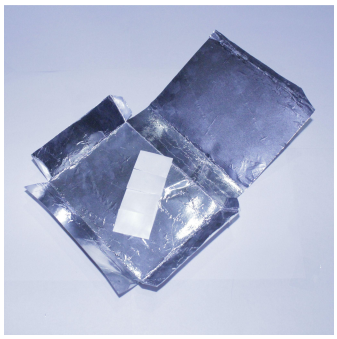
Use your mobile device to scan the QR code and watch steps 1 - 7 in an instructional video if needed.

METHODS/DIRECTIONS:

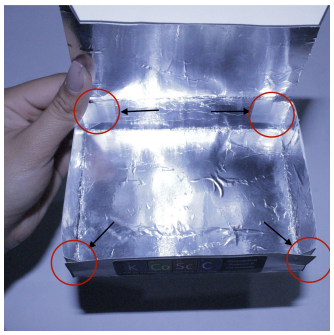


1. With scissors, carefully cut along the bolded lines with scissors.

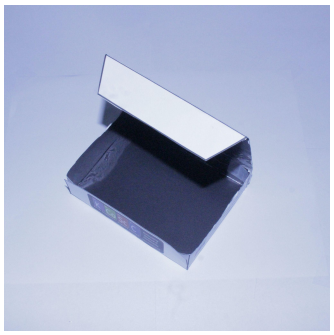
(Don't forget to write your name!)



2. Fold and crease the thinner back lines until the box starts to take form.



3. Use the tape provided to tape the flaps down. Use the diagram as a guide.



4. Place the black cardstock inside the base of your box.

This helps your solar oven absorb and retain heat by conduction.

Optional:
Elevate one side of your oven by gluing the popsicle sticks to the bottom side of the box using the provided glue dots (left)

OR

If the cover of your solar oven is too floppy and closes on itself, use the popsicle sticks and glue dots to keep the flap up right. (right).

5. Next, pour out your crayon bits from its pouch to the cookie cutter, and evenly distribute it.

TIP: Use the toothpick to level out the crayon bits.

6. Add the clear plastic sheet over your cookie cutter and crayons.

This plastic “window” allows sunlight to pass into your oven while also retaining heat.

7. Place your solar oven box outside in direct sunlight for about 1-2 hours (+ more if needed).
TIP: Keep it in an area where the wind and/or pets will not be able to disturb it!

This oven uses solar energy- light and heat emitted from the sun, to melt the crayons!

8. Once all crayon pieces fully melt, let it cool and harden. (Approx. 5 - 10 minutes)

9. Then, peel the blue tape off and use the toothpicks to help assist the release of the crayon from the cookie cutter.

10. Your solar made crayons are now ready to use!

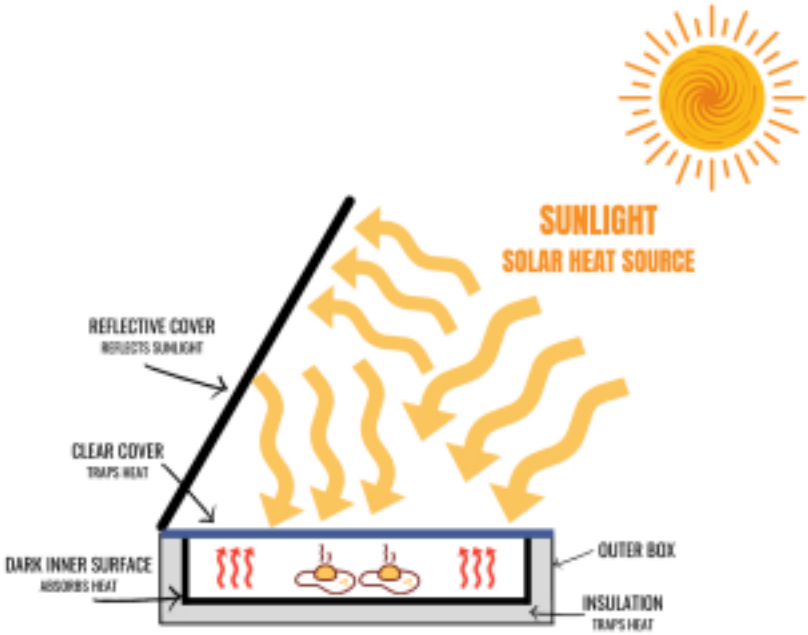
Please share pictures of your creations and tag us on Instagram & Facebook, @kauaicsc. Check out the KCSC Linktree to keep up with KCSC events & activities. https://linktr.ee/kauaicommunitysciencecenter

DISCUSSION

Solar cookers are essentially what they sound like, solar-powered contraptions for cooking food. Solar cookers are one of the earliest attempts by humans to harness solar energy for practical purposes. There is a lot of variation between designs of solar cookers, in general they all fall under three categories: **box**, **parabolic**, and **panel**. The **box style** is the most prolific, due to its decent efficiency, ease of use, and price. The parabolic style tends to be more effective, reaching higher temperatures and faster cook times, but is expensive and requires frequent adjustments. The panel style cooker can be very cheap and easy to build, but often are not as effective as the other models. The “Solar Oven Crayon” activity uses a modified **BOX STYLE** solar cooker.

BOX STYLE SOLAR COOKERS, are the first known solar box cooker, and are also the most commonly used style. In general, they are boxes, usually insulated, that have a transparent top and a reflective lid. Box-style cookers take advantage of three basic ideas.

• When light hits shiny or reflective surfaces, the light bounces off the surface at particular angles, which can be used to direct sunlight.
• When sunlight hits a dark surface, it is partially transformed into infrared radiation, or heat.
• Finally, transparent materials allow sunlight to pass, but traps heat. [3] Thus box cookers are generally a box with internal dark surfaces, reflective pieces to direct sunlight into the cooker, and a transparent lid that allows light in, but traps the heat in the box.



Today, these box cookers often reach temperatures of about 200 to 300 degrees Fahrenheit. One focus of technological improvements are materials, specifically the materials used for the inner box, the insulation layer, and the transparent layer in an attempt to increase the heat absorbed, minimize heat loss, and increase light transparency and heat trapping. For more complete details and references visit this site, http://large.stanford.edu/courses/2012/ph240/nii1/.

KCSC CLIMATE CONNECT: The Sun powers life on Earth; it helps keep the planet warm enough for us to survive. It also influences Earth's climate: We know subtle changes in Earth's orbit around the Sun are responsible for the comings and goings of the past ice ages. But the warming we've seen over the last few decades is too rapid to be linked to changes in Earth's orbit, and too large to be caused by solar activity.

Warming from increased levels of human-produced greenhouse gasses is actually many times stronger than any effects due to recent variations in solar activity. For more than 40 years, satellites have observed the Sun's energy output, which has gone up or down by less than 0.1 percent during that period. Since 1750, the warming driven by greenhouse gasses coming from the human burning of fossil fuels is over 50 times greater than the slight extra warming coming from the Sun itself over that same time interval. Learn more about the sun's impact to climate change here, https://climate.nasa.gov/ask-nasa-climate/2910/what-is-the-suns-role-in-climate-change/

On Kauai we are fortunate that our utility cooperative, Kauai Island Utility Cooperative, KIUC is dramatically reducing the amount of fossil fuels used to power Kauai by moving to renewable energy including power from the sun or solar energy production. Do you know that KIUC, is a leader in renewable energy production in the country and around the world! KIUC uses solar power, hydropower and biomass for renewable energy production methods. During the daylight hours of most sunny days, Kauai is powered 100% by renewable energy production. The majority of the day-time renewable energy production on Kauai comes from solar power. You can also take steps to reduce fossil fuel use by driving less, taking the bus, riding a bike or driving a fuel efficient or electric vehicle. You can make a difference for Kauai and Earth by CONNECTING TO MAKE A DIFFERENCE EVERYDAY!

KCSC INDUSTRY PARTNERSHIP PROGRAM

A collaboration between Kaua'i students, Kaua'i Industry professionals and STEAM* professionals from the mainland to co-develop fun, relevant, hands-on STEAM content.
** Science, Technology, Engineering, Art & Culture and Math*

Kauai Community Science Center was awarded a County of Kauai Innovation Grant 2021-2022 to support STEAM learning and 21st century skills development.Learn more about the program here, [https://kauaicsc.org/kcsc-industry-partnership.](https://kauaicsc.org/kcsc-industry-partnership)

KCSC Student Interns and staff along with a team of professionals from Kauai Island Utility Cooperative, KIUC, The Sciencenter in Ithaca, NY and STEAM Truck in Atlanta, Georgia will meet over the course of the school year to co-develop STEAM content (activities, exhibits and events) directly related to KIUC's West Kauai Energy Project, WKEP, the first ever Solar + Pumped Storage Hydro Project to move Kaua'i beyond 80% renewable energy generation and meet more than 25% of its electricity needs.

TIMELINE OF PROGRAM

May 2021 – Kick-Off meeting with all collaborators –

- Introduction of team members and KIUC presents about West Kauai Energy Project, WKEP and their goals for the project.
- **June – August** – Students work over the summer to learn about WKEP, build a prototype model, create a presentation, and develop a list of STEAM content Ideas for KIUC.

August 2021 – First Quarterly Meeting -

- Students provide an update, present results of their WKEP presentation and list of STEAM content ideas for KIUC.
- **August – October** – Students prioritize STEAM Content ideas, define the subject area focuses on energy, water and resources and develop the first activity, “So Much Potential” activity.

October 2021 – Second Quarterly Meeting –

- Students present results of prioritization and defining areas of focus and present “So Much Potential” activity.
- **October – January -** Students work on developing more ideas for STEAM content demos and activities related to solar power, pump hydro, penstocks and reservoirs.

KCSC INDUSTRY PARTNERSHIP STUDENT INTERN TEAM

Standing L-R: Jo Ann Canty, Benjamin Uri, Joveline Joseph Sams and Halia Moriguchi
Sitting L-R: Joveline Alvarez, Lilinoe Lo, Kaori Koerte
Not pictured: Areck Yamamoto