

SUSTAINABILITY WORKSHOPS

for Middle School & High School Teachers

Solar Panel Kinetic Mobile Activity

Argonne's Sustainability Workshops for Middle School and High School Teachers were conceived, designed and implemented as part of the Laboratory's educational outreach. The goals of these workshops include knowledge and awareness of alternative energy technologies, their advantages and limitations; the key issues and impacts of technologies related to climate change; to extend the resources of sustainability; and to encourage energy literacy. Participating teachers are asked to synthesize their experiences and knowledge gained into a useable lesson plan. The plans presented in this unit are a compilation of those lessons.

Background Information

Solar energy is most often used for practical purposes such as home lighting or recharging a car's battery. However, there are artistic uses for solar energy. One example is General Electric's (GE's) Carousolar, a carousel powered by one hundred 80-watt thin film GE solar panels. As solar panels become less expensive to manufacture, more flexible, and of lighter weight, we can look forward to seeing even more unusual uses.

Grade Level

Middle School

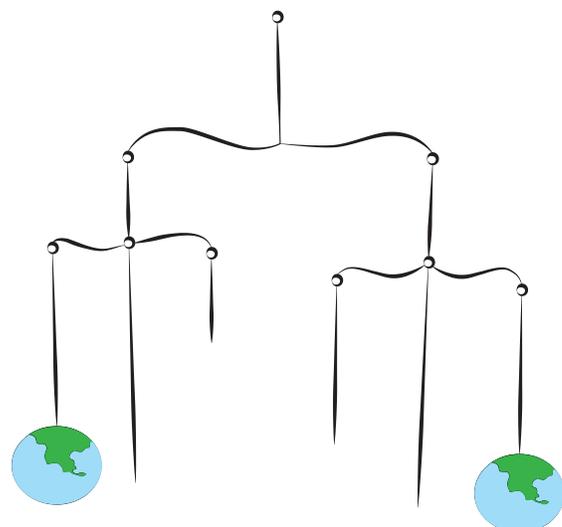
Goals and Objectives

Students will

- Explore their creativity while solving an artistic engineering design challenge
- Apply their knowledge of solar panels to an artistic engineering design challenge
- Create a model, construct, and test their design

Activity Description

Students watch a video and read an article about a 13-year-old student who imagined, designed, and constructed a better use of solar panels, in a tree array. The teacher leads a discussion about the design cycle and presents the students with their creative engineering design challenge: to build a mobile which moves using solar energy. Students work in teams to design and build their mobiles. Students then demonstrate their mobiles to the class. Classmates will critique each other's mobiles.



Materials

- [GE Website slide show](#) of *Top 10 Coolest Uses of Photovoltaics*
- [MYP Design cycle description](#)
- [YouTube video](#) of student talking about his solar panel tree design
- [CNN article](#) about student's new solar panel configuration
- Several solar panels per group (see Resources for purchasing panels)
- One small motor per group
- Electrical wire
- Wire clipper/strippers
- Art supplies (scissors, colored paper, string, yarn, coat hangers, markers, modeling clay, tag board, magazines, glue, glue guns, foil, sharpies, plastic containers and lids, straws, paper plates, plastic cups, etc.)

Time Needed

3-6 class sessions

Strategies and Methodology

- Whole group discussion
- Small group discussion and activity
- Designing
- Guided inquiry
- Measuring
- Experimental testing
- Data collection and analysis
- Comparing
- Re-designing
- Re-testing
- Diagramming
- Communicating
- Descriptive and scientific writing

PROCEDURE

Introduction of Lesson

(20 minutes)

1. Walk students through an explanation of the Design Cycle if they haven't used it in other activities before such as the one on the [Mesa Middle School website](#).
2. Show the [video](#) of a 13-year-old who experimented and improved on the way solar panels catch sunlight.

3. Discuss this teenager's inspiration for his idea (copying or trying to mimic nature, called biomimicry), and how he went about testing it. You might also want to read the [CNN article](#) about student's new solar panel configuration with the students for more information as well as an opportunity to use reading for content in science.
4. Ask the students to brainstorm and come up with a list of ideas on how one might use a solar panel. After they have run out of ideas, you can share the following websites, which have photos and descriptions of unusual or creative uses of solar panels:
 - [GE Website slide show](#) of *Top 10 Coolest Uses of Photovoltaics* which also has short videos on the sun, and a solar powered carousel
 - Steph Hick's (writer and environmental attorney) [blog pages](#), *Creative Uses for Solar Energy*

Design, Build, and Test Mobiles

(1 - 2 class sessions)

1. Introduce the creative engineering design challenge to the students: they will build a kinetic mobile, which is capable of moving using solar energy. It should creatively illustrate an aspect of solar energy for the viewer. Remind the students of the Design Cycle, and encourage them to refer to it as their team designs their mobile.
2. Require the students to carefully draw out their design as they create the kinetic mobile. On their diagram page, have the students also describe how their mobile moves, and identify how it illustrates an aspect of solar energy. (See Resources for instructions on how to connect and use solar panels.)
3. When teams have finished designing and building their mobiles, have each share and demonstrate how they work. Students can critique each other's designs, and turn in their own team design document with their model and descriptions.
4. Find a sunny location to best display all of your students' kinetic mobiles.

Assessment

Use a teacher-created rubric as a summary assessment of the students' design:

- Did it move using solar energy?
- Is it a mobile?
- Is it creative and in some way illustrates an aspect of solar energy for the viewer?
- Involvement in discussions
- Cooperative teamwork
- Safety behavior
- Careful diagram of the mobile
- Explanations for how it works
- Creatively illustrates some aspect of solar energy

The assessment information can inform teacher instruction for the following school year.

Resources

- [YouTube video](#) of student talking about his solar panel tree design
- [CNN article](#) about student's new solar panel configuration
- [GE Website slide show](#) of *Top 10 Coolest Uses of Photovoltaics*
- Steph Hick's (writer and environmental attorney) [blog pages](#): Creative Uses for Solar Energy
- Buy solar panels: [Alibaba.com](#) sells a large variety of small solar panels used in toys
- Buy solar panels: [Edmund Scientifics](#) sells a variety of solar panels, kits, and toys with solar panels
- Buy solar panels and use instructions: The [Solar Energy Panel Shop](#) has a wealth of information on solar panel items to buy and make, as well as instructional pages teaching how to select and use solar panels, how solar panels work, and more
- [NESEA Solar Kit Lessons](#), instructions and lessons on using solar panels. Free download PDF curriculum unit on solar panels and testing. Includes instructions for selecting, testing, and installing small solar panels on toys.
- [Instructional YouTube video](#) on building a solar powered car; of interest are the instructions on how to connect the small panel to the leads
- [Instructional video](#) with plenty of photos on connecting a child's ride-on toy to solar panels for energy

Need more information or help with this lesson?

Contact Argonne National Laboratory by e-mailing SustainabilityEd@anl.gov.

Find out more about Argonne's Sustainability Program at blogs.anl.gov.