# Bay Area Scientists in Schools Presentation Plan

**Lesson Name** How to Get Renewable Energy from the Sun
**Presenter(s)** Anthony Fu, Anna Goldstein, and Stephen Silveira
**Grade Level** 3rd
**Standards Connection(s)** Physical Science: Energy comes from the Sun to the Earth in the form of light. Energy can be stored in many forms.

**Abstract:** Students will learn about the important concepts of renewable resources and solar energy through two fun activities! First, a mini-water mill to demonstrate how water can be reused. And then (weather allowing), we will help them assemble a solar-powered car. We want to emphasize the benefits of energy from the sun versus energy from fossil fuels, and get students talking and thinking about energy in new ways.

**Vocabulary/Definitions:** *3 – 6 important (new) words*

Energy source
Fossil fuels
Renewable
Solar Cell

**Materials:**

*What will you bring with you?*

- 3 solar kids
- 3 water mills
- 6 paper cups
- 25 worksheets

*What should students have ready (pencils, paper, scissors)?*

None

**Classroom Set-up:** *Student grouping, Power/Water, A/V, Light/Dark, set-up/clean-up time needed*

Need water from the faucet.
Students should be divided into 3 groups for activities.
Chalk/whiteboard for writing student responses.

## Classroom Visit

**1. Personal Introduction:** 5 **Minutes**

Stephen: I am a mechanical engineering student studying at Berkeley. I love engineering because I get to learn about how stuff works and how to build things. One of my greatest interests is energy efficiency which means as we get smarter, we can do more things while using less energy.

Anna: I am a student at UC Berkeley studying Chemistry. I do science because I want to invent things that make people's lives better. The world needs energy from a source that won't cause pollution and global warming, so I'm trying to find new ways to get energy from the sun.

**Topic Introduction:** ___7___ **Minutes**

I. Before Exercise #1:

- Does anyone know what energy is?
- Energy gives us the ability to perform work. Humans need energy to move.
- What gives you energy to move? Our energy comes from food.
- How about cars, lights, TVs, ipods? We give energy to machines by burning fuels like coal or oil or gasoline. These are called energy sources.
- Where does gasoline come from? Plants decomposed 300 million years ago under the surface of the earth.
- What are fossil fuels? Fossil fuels are non-renewable fuels, because they come from things decomposing over millions of years. If we use them all, we would have to wait millions of years before we get more.
- What do think renewable energy is? What is an example of renewable energy?

II. Between Exercises #1 and #2:

- Energy from the sun is one of the best ways we have of replacing fossil fuels. Is energy from the sun renewable? How to you know?
- Have you ever heard of solar cells?
- What do they do?
- How much energy do you think it takes to move a car? We measure energy use in units called Watts. How many Watts do your lightbulbs take? Lightbulbs are about 100 W. Driving a car takes about 100,000 W.
- How much energy do we get from the sun? Guess how many cars could be powered by the sun if we could capture all of its energy? The answer is 1 X 10^11, 100 billion cars.
- How can we get all that energy from light into something we can use? That's where solar cells come in.

**2. Learning Experience(s):** _15,20___ **Minutes**

- Exercise #1: "Using water as a Renewable Resource"
  - Each group will get a water mill and two cups. Someone in the group will go fill one of the sups with water (ask for a volunteer).
  - One student will pour water over the mill (off center) and make it turn while another student holds the empty cup underneath to collect the water. (Maybe have the mill turn a fan?)
  - They can repeat this process several times and each student can have a turn.
  - The group presenter/leader can show them how to make it a little more efficient by pouring the water in an ideal spot.

- Exercise #2: "Getting Energy from Sunlight"

- Solar car kits (one per group) will already be partially assembled. These do not work indoors, so we will need to come up with a backup activity or a very strong lamp/flashlight for cloudy days.
- The leader asks students to identify the different parts of the car: body, wheels, motor, solar cell.
- Point out that the energy from the solar cell has to travel through a wire to get to the motor – ask for a volunteer to connect the alligator clips.
- Students will see the motor start to turn, then brainstorm ideas about how to bring that energy to the wheels – ask for a volunteer to connect the rubber band.
- Have students play with the angle of the front axle to make the car turn in different directions.

**3. Wrap-up: Sharing Experiences** ____5____ **Minutes**

- What did we learn about? Write points on the board.
- What are the problems with fossil fuels? It takes too long to get it back from fossils. When you poured the water through the water mill, you collected the water back at the end, and you get to use it again. Do you get the gasoline back after your car uses it? Pollution from fossil fuels harms the environment and harms our health.
- What is good about solar energy?

**4. Connections & Close:** ____3____ **Minutes**

- Try to think about energy source throughout your day. Anytime you see something moving or producing heat and light, ask yourself where does it come from? How do we get the energy to cook our food? Or to turn on a flashlight? There are many sources of energy, and only some of them are renewable.
- Think about how important energy is to your life. Can you think of anything you do that doesn't require energy? What would your life be like if we didn't have any sources of energy?

**Total 50 – 60 Minutes**

# Follow-up – After Presentation

*Suggest students write a letter explaining "How we learned about renewable energy?"*

Students can make a list of energy sources and their pros and cons.
This website has fun activities about energy efficiency and renewable energy sources: http://www.eere.energy.gov/kids/. They also have a list of energy related lesson plans for teachers. Students can write a letter to their parents or to the governor's office about why it's important to use renewable energy.

**Reading Connections:**

- Fossil Fuel Power by Josepha Sherman - Introduces the history, uses, production, advantages and disadvantages, and future of fossil fuel energy as a power resource. http://books.google.com/books/about/Fossil_Fuel_Power.html?id=IZH-qAlDtFAC

- Global Warming by Seymour Simon - In the brilliant Seymour Simon format, this book provides a photo essay examining global warming and the devastating facts regarding this enormous world issue. This NSTA/CBC Outstanding Science Trade Book for 2011 presents the facts in a clear text within the range of most readers from middle elementary to secondary level. http://www.nsta.org/recommends/ViewProduct.aspx?ProductID=20612

- How We Know What We Know about Our Changing Climate: Scientists and Kids Explore Global Warming by Lynne Cherry and Gary Braasch http://www.amazon.com/Know-What-About-Changing-Climate/dp/1584691034

- 365 Ways to Live Green for Kids: Saving the Environment at Home, School, or at Play – Every Day! By Sheri Amsel http://www.amazon.com/365-Ways-Live-Green-Kids/dp/1605506346

- The Everything Kids' Environment Book: Learn how you can help save the environment – by getting involved at school, at home, or at play by Sheri Amsel http://www.amazon.com/Everything-Kids-Environment-Book-environment/dp/159869670X/ref=pd_sim_b_2

- The New 50 Simple Things Kids Can Do to Save the Earth by Sophie Javna http://www.amazon.com/Simple-Things-Kids-Save-Earth/dp/B003F76HOS/ref=pd_bxgy_b_img_b

**Build a Reflective Solar Marshmallow Cooker** - In this activity, learners use the Sun's energy to cook marshmallows. Learners construct the solar oven out of simple everyday materials. They experiment to see how the color of the marshmallow (vanilla or chocolate) and height of the straws affect cooking time. Use this activity to introduce learners to solar energy and reflection. Note: this activity requires adult supervision. http://stardate.org/teachers/activities/cooker

**Activity Directions**: http://stardate.org/sites/default/files/ReflectiveSolarCooker.pdf

This reflective solar cooker uses the Sun's energy to cook marshmallows. The target cooking area is the space where the light concentration is greatest. Never look directly at the Sun! It could damage your eyes. Don't allow the cooker to reflect sunlight into your eyes. This activity requires adult supervision.

**Materials**

- shoebox
- aluminum foil
- string
- tape
- straws
- manila folder
- marshmallows (white and chocolate, or other color)

**Preparation**

1. Cut slots of equal length down the short sides of the shoebox opposite each other. Draw a scale, beginning with zero at the top, along each slot. Then cut diagonal slits at the corners of the box for the string.

2. Cut a manila folder in half along the fold. Place one half inside the shoebox, so that the folder bows into a curved, half-pipe shape resting on the bottom of the box. Fasten with tape in this shape to the box.

3. Lay a sheet of aluminum foil, shiny-side up, along the curved folder. Tape it to the box, fitting it to the folder shape.

4. Cut two 20-inch lengths of string. Knot each at one end. Floss the knotted ends into slits A and B. Drape the string inside the box, and insert the other end into slits C and D.

**Experiment**

1. Place one white marshmallow onto a straw near the end, and a colored marshmallow (or more, if you have several colors) on a second straw.

2. Snip a slit at one end of the second straw and join the slit end to the other straw. Space the two marshmallows an inch or two apart from each other.

3. Lay the straw into the slot so that the marshmallows are near the center of the box. The straws should rest on the string at both ends.

4. Pull on both strings to bring the straw to the first level from the bottom.

5. Direct the box toward the Sun; prop it up. Allow the marshmallows to cook for a specified time.

6. Repeat with another set of marshmallows at a different height for the same length of time.

**Analysis**

1. Why is the shiny surface curved? Would this work if it were straight?

2. Did the color of the marshmallow make a difference? Why?

3. Did the height of the straws make a difference? Why?

**Answers**

1. It is curved to focus the sunlight. A straight surface will reflect but not focus light.

2. The darker marshmallows should cook faster, since white reflects rather than absorbs energy. (This is the reason you are cooler when you wear white clothes in the sunlight than when you wear dark colors.)

3. When the straws bring the marshmallows where the Sun's energy is most concentrated, the marshmallows will cook fastest. Imagine that the reflecting surface is part of a circular pipe (depending on the shape of your box, it may not be perfectly circular). The focus is one half of the radius of this pipe.