



Solar Powered Fan & Light Kit Manual

Laboratory Experience



OBJECTIVES

This kit is designed for elementary students to learn about solar energy and electricity. The set-up and tasks are simple in nature and should be attempted by the students directly, but adult supervision is necessary to avoid potential injuries (e.g. finger caught in the fan).

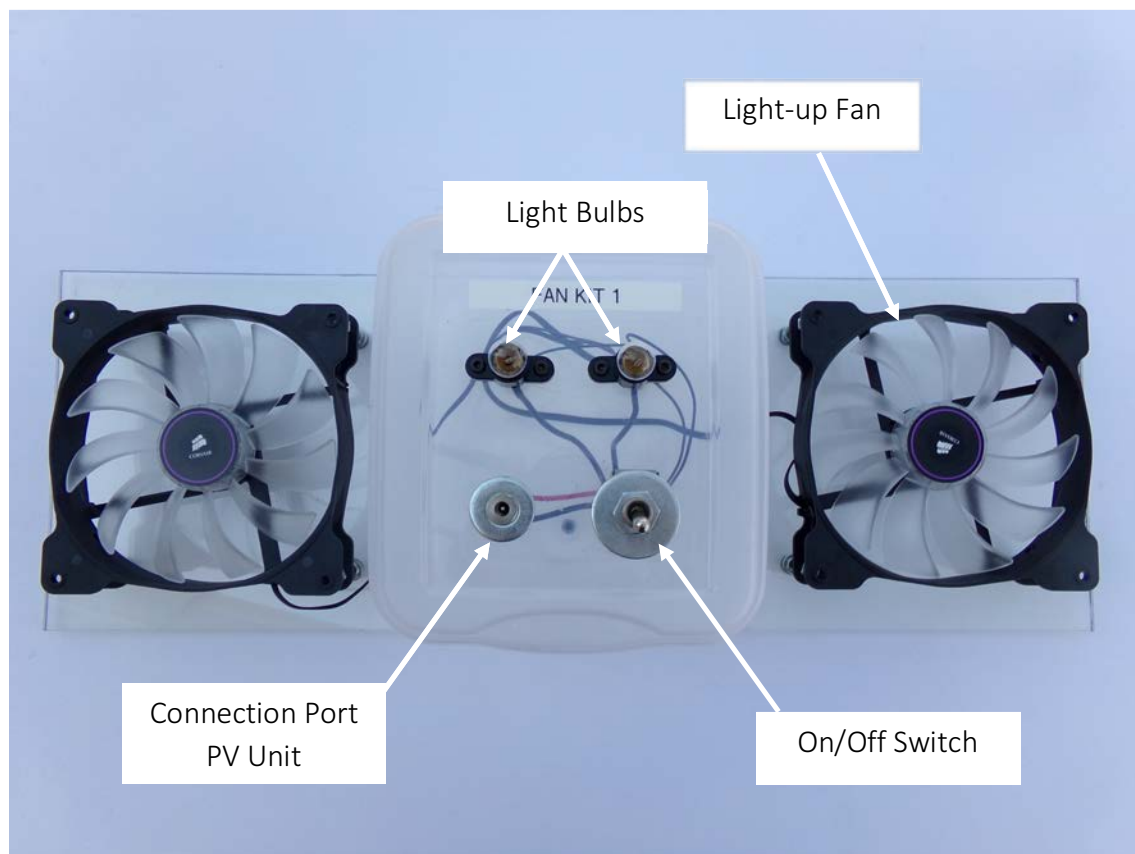
Key concepts covered in the activities include:

- conversion of energy forms
- conservation of energy
- limits of solar energy

DIAGRAM and SET-UP

The kit is composed of a photovoltaic panel (PV unit), two computer fans, two light bulbs, and electrical connections housed in a clear plastic container. Except for the PV unit, all of the components are mounted on a clear plexiglass base.

To begin, place the plexiglass base on a flat surface and place the PV unit face-down next to the plexiglass base. The PV unit should not be plugged into the connection port and the switch should be in the off (down) position. Check that the light bulbs are screwed in completely.



SAFETY CONCERNS

Adult supervision is necessary to prevent student injuries or damage to the kit. When the kit is in use, take the following precautions:

- Do not touch the light bulbs because they can get very hot after being turned on for a while.
- Do not stick fingers or other objects in the fans. Doing so could damage the fans.
- Do not open the plastic container where the electronics are housed. Only view the items through the container.
- Do not put any objects other than the plug from the PV unit into the connection port. Doing so could damage the connection port and cause the kit not to work.
- Avoid touching the dark surface of the PV unit. The surface can become hot after being in the sun for a while.

Take time now, before you start the activities, to go over these safety measures with the students.

ACTIVITIES

Activity 1: Energy Conversion

Have students consider the following question: What is the source of energy for life on Earth?

Guide students in understanding that energy comes from the sun and converted to different forms.

Facilitator notes: Our energy source is the sun. The sun provides energy as light and radiation. Plants need light to grow and animals eat the plants as food, which gives the animals energy. Also, animals need radiation to stay warm. Wind is due to temperature differences caused by the sun heating the Earth. The sun's energy also gets stored as coal, petroleum, and natural gas. All of these many energy forms are traced back to the sun. Energy changes forms, like when plants convert light and carbon dioxide to sugar through photosynthesis. Or when you burn gasoline in a car and convert it to mechanical energy or motion to move the car.

A photovoltaic panel takes the sun's energy and changes it to electricity. We use electricity all the time. Electricity runs motors, makes objects spin, and turns on lightbulbs. Energy is converted twice in order for the fans and lightbulbs in this kit to work.

Actions:

- 1) Place the photovoltaic panel face down on the table or surface.
- 2) Connect the photovoltaic panel to the port on the electrical switch.
- 3) Place the photovoltaic panel face up on the table or surface, pointing at the sun.

Reflect:

- Record your observations. What happened to the fans and lights when you turned over the photovoltaic panel?
- What happened to the sun's energy?
- Can you identify how the energy changed forms?

Activity 2: Conservation of Energy

Have the students think about the position of the sun during the day and the temperature. Is it constant or does it change? *Guide students in understanding that the angle of the sun relates to how much direct sunlight we receive and, therefore, how much energy we receive.*

Facilitator notes: Earth rotates on an axis. The rotation causes us to have day and night. It is daytime when your location on Earth is facing the sun and it is nighttime when your location on Earth is facing away from the sun. At midday, the sun's light is direct and very strong. In the morning and at night, the sun's light is indirect and not as strong. So we receive sunlight at different angles and that affects how much energy we obtain from the sun.

Actions:

- 4) Place the photovoltaic panel at an angle to the ground.
- 5) Change the angle to allow less sunlight to hit the photovoltaic panel.

Reflect:

- Record your observations. What happened to the fans and lights as you changed the angle of the photovoltaic panel?
- Can you produce the same amount of electricity with less sunlight?
- What would happen to the fans and lights if you were closer to the sun and received more energy from the sun?

Activity 3: Limits to Solar Energy

Have the students think about how a cloudy day would affect solar energy production. Do you generate the same amount of energy on a cloudy day as compared to a clear day?

Actions:

- 6) Place the photovoltaic panel face up on the table or surface, pointing at the sun.
- 7) Using a hand or another item, cover up part of the photovoltaic panel. (Don't touch the panel. Just block the sun with your hand or the object.)

Reflect:

- Record your observations. What happened to the fans and lights when you partially covered the photovoltaic panel?
- Are there any limits to using solar power as an energy source?

CLEAN UP

When finished, disconnect the PV unit by removing the plug from the connection port. Allow the parts to cool down by moving them out of the sun. When the parts are cool, carefully return the materials to the storage box.

INFORMATION SOURCES

Content for this manual came from the following sources. Visit these websites for more information.

- Fun with the Sun. Teacher's Activity Guide for Elementary Grades K-2. National Renewable Energy Laboratory Education Programs. Obtained September 2016 from <http://www.nrel.gov/docs/gen/fy01/30928.pdf>.
- Getting Energized! Teacher's Activity Guide for Elementary Grades 3-6. National Renewable Energy Laboratory Education Programs. Obtained September 2016 from http://www.nrel.gov/education/pdfs/getting_energized_elementary.pdf.
- Exploring Solar Energy Student Guide, Grades 5-8. NEED Project. U.S. Department of Energy. Obtained September 2016 from http://www1.eere.energy.gov/education/pdfs/solar_exploringsolarenergystudent.pdf.
- The Sun and Its Energy Teach Guide, Primary Grades. U.S. Department of Energy. Obtained September 2016 from <http://www.need.org/files/curriculum/guides/The%20Sun%20and%20its%20Energy.pdf>