6. Solar Energy

OBJECTIVES: After completing this lesson, a student should be able to:

* Explain how the sun heats the earth
* Illustrate how the SUN'S ANGLE affects seasonal changes
* Illustrate the SOLAR ENERGY BUDGET (Grades 4-8)

TEACHER BACKGROUND: *(Grades 1-8)*

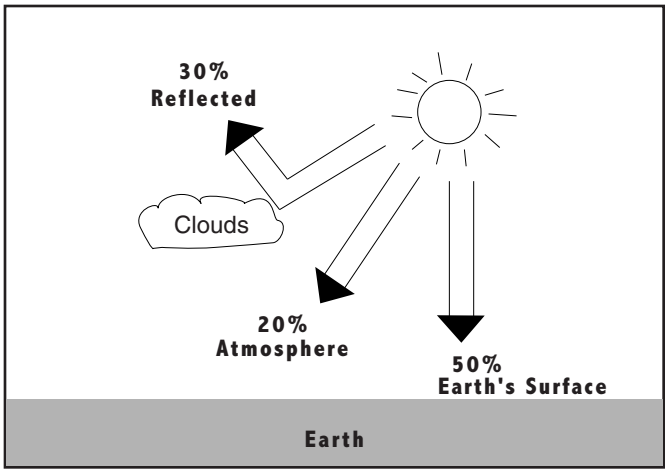
Recall a time when you have gotten into a car that had its windows up on a sunny afternoon. The warmth you felt inside the car was caused by sunlight coming through the glass and changing to heat. SOLAR ENERGY is the radiation of the sun that bombards and heats the earth and its atmosphere. The angle of the incoming solar energy has an effect on how warm an object will get. Since the sun is higher in the sky during the summer and lower in the sky during the winter, the angle of the incoming solar energy plays a major role in changing our seasonal temperatures. In July, the sun's location in the sky provides a concentration of direct solar radiation and warmth to the United States. Summer sunshine strikes the earth with a greater concentration than winter sunshine.

Another important factor in warming the Northern Hemisphere during the summer is more hours of sunshine. Summer days are longer than winter days. There is, however, a slight delay between the period of the concentrated sunshine and the greatest warming. Although the greatest concentration of sunshine for the Northern Hemisphere occurs in July, the peak warmth follows in late July and August. This is because the earth is gaining more heat than it is losing during the summer months.

Additional notes for grades 4-8:

Regardless of what season it is, incoming solar energy is "divided up" as it nears the earth. Much like an automobile engine divides the fuel it intakes for use in different parts of the engine, the atmosphere divides the incoming solar fuel for use in different parts of the earth. (See figure below.)

Clouds are very good "mirrors" which reflect a significant portion of the incoming solar energy. About 30% of all of the sun's energy is reflected back into space. Only about twenty percent of the



energy is used by the earth's atmosphere. That means that the remaining portion, or about half of the sun's energy, goes into the surface of the earth. Together, the clouds, the atmosphere and the surface of the earth are factors in the SOLAR ENERGY BUDGET, the distribution of the sun's energy as it passes through the atmosphere. Without this unique balance of solar energy distribution, the earth's weather pattern would be much different.

Solar Activity

** **WARNING** ** **Instruct your students never to look directly into the sun.**

GRADES 1-3

INTRODUCTORY: ***SUN SHADOWS***

On a sunny day, take the students and a piece of chalk outside on a cement surface. Have each student make a chalk line to mark their shadow on the cement. Later that day, return to the same location to make a second chalk line to mark their shadow. Did the shadows change? Why? How often do shadows change?

ADVANCED: ***FLASHLIGHT SUNLIGHT***

Point a flashlight at a sheet of paper or the chalkboard and make an outline of the light pattern. Tilt the flashlight on an angle and make a second outline. Compare. Which beam was "spread out" and weaker? (angled beam) Compare these patterns to the sun's seasonal angles. (Sunlight in the U.S. is angled in winter but direct and more intense in summer.)

GRADES 4-8

INTRODUCTORY: ***SUN GRAPH Part I***

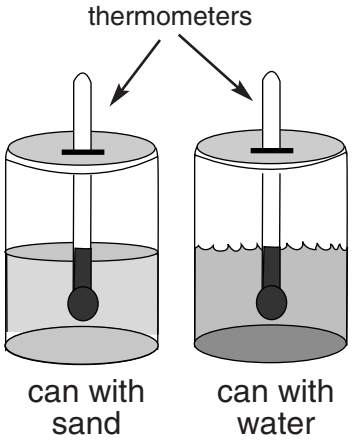
Divide the class into two groups for Parts I and II. Outside, group I measures and records the shadow length of a fixed object such as a flag pole. Visit the site at the same time daily, keeping a record of shadow lengths. (A compass may be used to determine directions.) Students may graph the lengths. Does the length change with time?

ADVANCED: ***SUN GRAPH Part II***

Group II obtains the length of each day in hours and minutes from the weather section of the newspaper. (If not given, use sunrise and sunset times to calculate length.) On graph paper, write days of the month on the bottom and length of days on the left. Use a dot to graph the length of each day. Connect the dots weekly. Does the length change? How? Compare with measurements in Part I.

CAPTURE SOME SUN (Time: 30-45 minutes) GRADES 4-8

Materials:	**2 identical coffee or juice cans with lids, 2 outdoor thermometers, sand (or dirt) and water**
Preparation:	**Fill one can with the sand and the other can with water. Cut slits in the lids and place each thermometer through the lids so that they don't touch the cans' bottoms or sides.**
Procedure:	**Place cans in the sun and read both thermometers every minute for 15 minutes. Record temperatures on a chart.**
Evaluation:	**What does the temperature chart indicate? How does this experiment give us an insight to the earth's heating?**
Excursions:	**Out of the sun, measure the rate that the cans cool for 15 minutes. Grades 4-8 students can graph the readings, then compare the warm-up graph with the cool-down graph.**



WEATHERSCHOOL QUESTION:
Which is the sunniest state? A. Arizona B. Florida C. California
Obtain the answer tonight on your Weatherschool television channel!