Renew-A-Bean

This activity introduces students to the difference between renewable and nonrenewable resources. It shows students that nonrenewable sources will be exhausted over time. Moreover, it shows that conservation measures—ways of using less energy—along with increased use of renewables can slow the depletion of fossil fuels. Through the activity, students will gain an increased understanding of:

- the eventual depletion of fossil fuel resources
- the effect of changing rates of energy use on the future
- the need to conserve as well as the need to develop renewable resources

This activity will also give students an opportunity to practice charting and graphing skills, and working with percentages.

Note: The numbers used in this game are approximate and do not reflect actual depletion rates. The actual figures are difficult to estimate. The intent is only to simulate depletion of nonrenewable resources.

GRADES: 7–12

Note: The difficulty of this activity can be adjusted for different grade levels. Junior high teachers may want to end the activity with step 6, or continue subsequent rounds with each group using the same variation.

SUBJECTS: math, science, social studies

TIME: one to two 45-minute class periods

MATERIALS: Divide students into groups of five. Each group will need:

- a paper bag containing 100 beans (or poker chips, or different colored pieces of paper): 94 of one color, six of another color
- extra beans of both colors: 10 of first color, 40 of second color
- five copies of the student handout
- extra graph paper

PREPARATION: Fill each bag with 94 beans of one color, six beans of another. This represents the ratio of nonrenewable to renewable energy use in the United States today. Mix the beans well.

PROCEDURE:

1. If you have not done the "What Is Renewable Energy?" activity, review with students the difference between renewable and nonrenewable resources and what those resources are. Ask them how much of each type of resource they think we are using in the United States today. Do they think the world will use more or less energy in coming years?

2. Discuss rates of energy use. Ask students whether they use the same amount of energy all day, or if the amount of energy they use varies at different times. Does energy use vary with the season? Do today's students use more or less energy than their parents did when they were in school? Explain how increases and decreases in energy use each year can be expressed in percentages.

3. Tell the students that they will participate in a game called "Renew-A-Bean." Explain that the beans in the paper bag represent nonrenewable and renewable resources. They will draw beans from the paper bag in order to simulate energy use over time. The class will play the game twice.

4. Divide the class into groups of five. In the games, students in each group will take turns drawing a given number of beans from the bag. When they pick a "nonrenewable" bean, they should set it aside—it is "used up." When they pick a "renewable" bean, they should return it to the bag. Each drawing represents one decade.

5. Distribute bags. In the first game, have students in each group take turns drawing 10 beans per decade out of the bag. Have them record the number of renewable and nonrenewable beans they drew on their student data sheet. Groups should stop picking beans when all the nonrenewable beans are "used up."

6. Ask groups how many decades it took to "run out" of nonrenewable energy. When the nonrenewable energy ran out, was there enough energy to meet the next decade's energy needs (10 beans)? Graph energy use over time. (Sample graph provided on pg. 14.) Ask students how they could make the energy supply last longer. They should come up with two answers—use less energy (conservation) and use more renewables.

7. In the next game, give each group a different variation to simulate. You can use the variations and charts on the teacher information sheet (pg. 14) to tell students how many beans to pick each year, or you can have students make up variations and calculate the numbers on their own. Some groups should increase the rate of energy use, some should conserve energy, and others should increase the percentage of renewable beans in their mix. Have each group chart and graph their results.

8. At the end of the second game, list the different variations on the blackboard. Ask the class to guess which variation produced the longest-lasting energy supply. Then, have one student from each group copy its chart of results on the board.

FOLLOW-UP:

1. When did each group run out of energy? How did this relate to how quickly they used energy? Which groups ran out of energy first?

2. Have students look at their graphs. During which decade did each group start using more renewables than nonrenewables? How is this represented on the graph? Which kind of energy will people probably use more of in the future?

3. Introduce the concept of "sustainable use." A sustainable rate of energy use ensures that there will always be enough energy for the next year's needs. Ask groups when, if ever, their energy use was sustainable during the game. (For

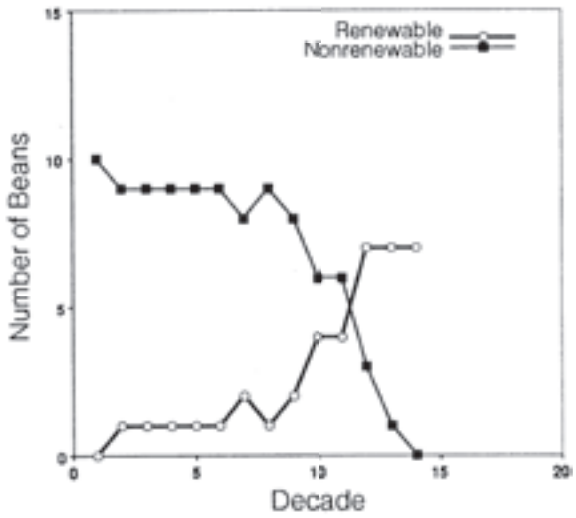
the purpose of the game, energy use is sustainable when the number of "renewable" beans in the mix is equal to a constant consumption rate, or is growing at the same rate as or faster than a growing energy consumption rate.)

4. Ask students if they think energy use can keep increasing indefinitely. Why or why not? If students answer that the rate of energy use can keep increasing because renewable energy will never run out, discuss limits on the growth of renewable sources of energy (e.g., available land for biomass crops and wind turbines, water sources for hydro).

5. Ask students what they think the ratio of renewable to nonrenewable energy use in the United States is in the current year (see "What Is Renewable Energy?" activity for 2001 figures). Ask how they think the rate at which we use energy changes each year. Is our current use of energy sustainable? What do we need to do to make it sustainable?

This activity was adapted from *Conserve and Renew: An Energy Education Package for Grades 4–6,* Sonoma State University, 1990.

Game 1: Draw 10 beans per decade until there are no "nonrenewable" beans left. Pool data, take average, and draw graph.

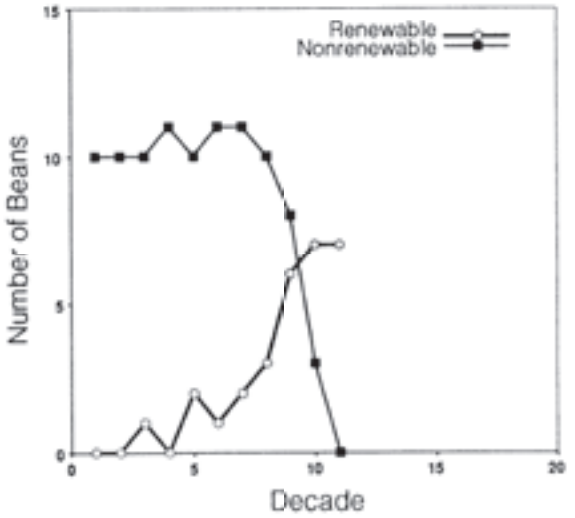


Game 2:

Variation 1: Energy consumption increases by four percent per decade. Compute number of beans to draw each decade (round to the nearest whole number), or use chart below. Graph results.

Decade	1	2	3	4	5	6	7	8	9	10
# of Beans to Draw	10	10	11	11	12	12	13	13	14	14

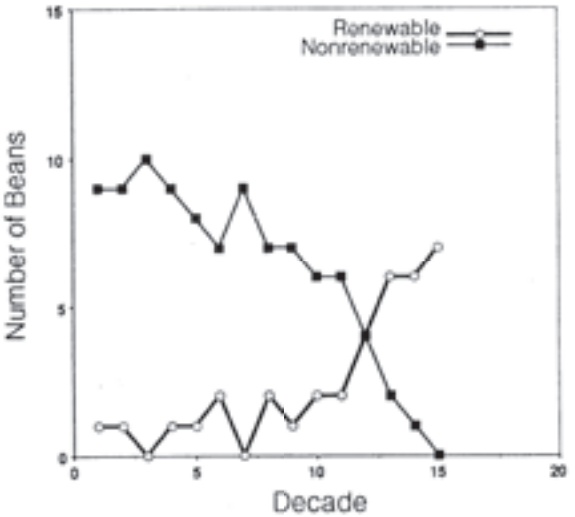
Decade	11	12
# of Beans to Draw	15	16



Variation 2: Energy consumption decreases by two percent per decade. Compute number of beans to draw each decade (round to the nearest whole number), or use chart below. Graph results.

Decade	1	2	3	4	5	6	7	8	9	10
# of Beans to Draw	10	10	10	10	9	9	9	9	9	8

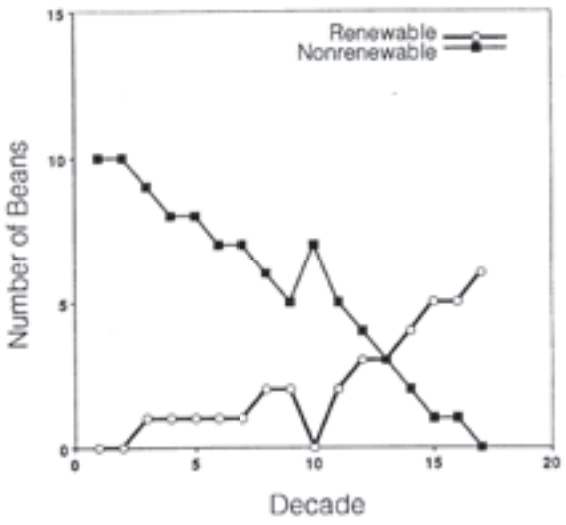
Decade	11	12	13	14
# of Beans to Draw	8	8	8	8



Variation 3: Energy consumption decreases by four percent per decade. Compute number beans to draw (round to the nearest whole number), or use chart below. Graph results.

Decade	1	2	3	4	5	6	7	8	9	10
# of Beans to Draw	10	10	10	9	9	8	8	8	7	7

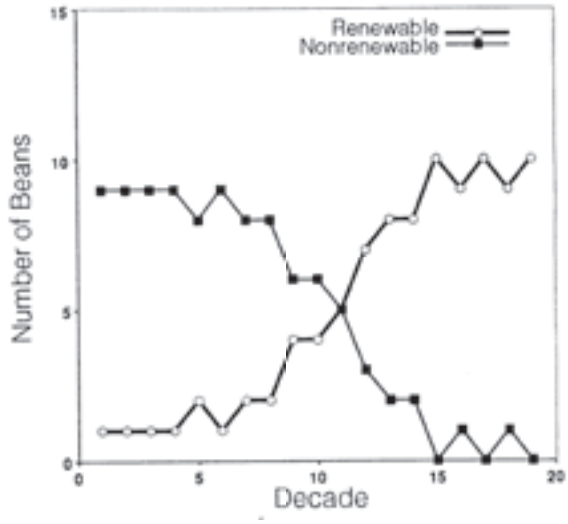
Decade	11	12	13	14	15	16	17
# of Beans to Draw	7	7	6	6	6	6	6



Variation 4: Renewables increase by six percent per decade; energy use remains constant. Compute the number of renewables to add per decade (round to nearest whole number), or use chart below. Graph results.

Decade	1	2	3	4	5	6	7	8	9	10
# of Beans to Add	0	0	1	0	1	0	1	1	0	1

Decade	11	12	13	14	15	16	17	18	19
# of Beans to Add	1	1	0	1	1	1	1	1	1

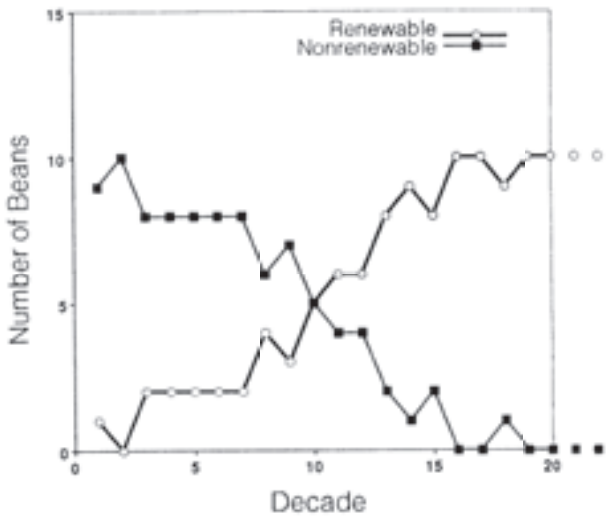


Variation 5: Renewables increase by 10 percent per decade; energy use remains constant. Compute the number of renewables to add per decade, or use the chart below. Graph results.

Decade	1	2	3	4	5	6	7	8	9	10
# of Beans to Add	0	1	0	1	1	1	1	2	1	1

Decade	11	12	13	14	15	16	17	18	19	20
# of Beans to Add	2	2	2	2	3	2	3	3	4	4

Decade	21	22
# of Beans to Add	4	5



Renew-A-Bean

STUDENT HANDOUT

Take turns drawing beans from your group's bag at the rate assigned by your teacher. Each drawing represents one decade of energy use. If you draw a "nonrenewable" bean, set it aside (but do not throw it out). If you draw a "renewable" bean, return it to the bag *after* you have completed your drawing for the decade. Record how many renewable and nonrenewable beans you draw each decade on the chart below, then graph your results.

DECADE	NUMBER OF BEANS DRAWN			
	Round 1		Round 2	
	renewable	nonrenewable	renewable	nonrenewable
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
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