Looking at the Advantages of Renewable Energy

RENEWABLE ENERGY
THE INFINITE POWER OF TEXAS

FOR USE WITH FACT SHEET NO. 2: THE ADVANTAGES OF RENEWABLE ENERGY

TEXAS ESSENTIAL KNOWLEDGE AND SKILLS

TEKS utilized: **SCI.** 4.1(B) make wise choices in conservation of resources; 4.2(B) collect information through observation and measuring; 4.3(A) analyze, review and critique scientific explanations; 4.6 recognize change creates recognizable patterns; 4.11(C) identify the sun as the major source of energy for the earth and understands its role in plant growth, in the creation of winds and the water cycle.

OVERVIEW

This lesson continues the study of renewable energy as a means of becoming energy independent and healing the planet's atmosphere, damaged by the use of fossil fuels. The lesson specifically focuses on sunshine and wind as major non-polluting sources of renewable energy in Texas. Students will engage in a class discussion, read and discuss a recommended text, create a word wall and work in groups and gather information about specified topics in renewable energy. Students will present a topic using written explanation, graphics or other visual aids.

TEACHER PREPARATION

Materials:

- resource list on back page of Fact Sheet 2
- list of vocabulary words on large sheet of paper, to be displayed in the classroom throughout the unit of study
- five large sheets of paper with one of the following topic headings on four of the sheets (save fifth for outlining the book summary):
    1. Sunshine and wind are renewable energy
    2. Renewable energy doesn't pollute
    3. Texas has plenty of renewable energy
    4. Renewable energy is free
- a poster size Beaufort Scale (included in Lesson Plan) for students to copy in their science notebook
- old magazines to cut out pictures for a culminating collage (National Geographic magazines are recommended as they have great photos, and students learn about the world while searching.)
- bulletin board size sheet of butcher paper
- markers and/or paint and brushes
- *Old Turtle* by Douglas Wood, Pfeifer-Hamilton Publisher, 1992
- distributable form of assessment questions (posted on chalkboard, transparency, handouts)

Possible Answers to Assessment Questions:

1. Renewable energy is different from non-renewable energy in that renewable sources are derived and replenish quickly from nature and usually do not pollute our environment when used to generate electricity.
2. Wind and sun are renewable because they are derived and replenish quickly. A fresh supply is created in a very short time.
3. Some of the non-renewable fossil fuels used in Texas are oil, coal and natural gas.
4. The effects of using non-renewable sources for electricity production include: smog formation, radioactive waste accumulation, smoke production, consumption of millions of gallons of water, and chemical emissions that pollute the air and water.
5. Sun and wind are Texas' major sources of renewable energy. Other renewable resources include biomass, geothermal and hydropower.
6. The environment is kept clean of pollutants when sun and wind are used as sources of electricity generation. Other natural resources, such as water, are conserved.

7. Texas has plenty of bright sunshine and steady winds to fill all our energy needs.
8. Some examples of people using energy directly include burning gasoline in their cars, turning on a light switch and cooking dinner in their ovens.
9. People use energy indirectly by purchasing products that require energy during manufacturing.
10. People can reduce the amount of energy they use by purchasing locally made products, which would reduce transportation costs, and by conserving their daily energy usage.

KEY VOCABULARY:
abundant – to have enough of something; plentiful
carbon dioxide – a colorless, odorless, non-combustible gas formed during respiration, combustion, and organic decomposition
efficient – acting or producing effectively with a minimum of waste, expense, or unnecessary effort
emit – to give or send out matter or energy
kilowatt – a unit of power equal to 1,000 watts
potential – something that can develop or become actual
refined – free of impurities; purified
renewable energy – forms of energy that derive and quickly replenish from the natural movements and mechanisms of the environment, such as sunshine, wind, movement of the seas and the heat of the earth
therm – a unit of heat equal to 1,000 large calories

CLASSROOM ACTIVITIES

1. Assess Current Level of Knowledge

If graphic information-organizers, such as webs, were used to display the main ideas of study in Fact Sheet 1, *Renewable Energy and Sustainability*, display them and recount the main ideas generated from this introductory lesson. If Fact Sheet 1 was not used, you can create a way of visually organizing information to display what students already know about sources of energy production and their accompanying environmental pollutants. To assess what students know, prompt a class discussion with questions such as: How is renewable energy different from non-renewable sources of energy? What are the major types of renewable energy in Texas? How do these affect the environment? What types of non-renewable forms of energy are used in Texas? How do these affect our environment? Why are wind and sun renewable forms of energy? What are some of the good reasons to depend upon renewable energy sources? Are there enough renewable forms of energy to provide all our energy needs? How much pollution do you and your family make in a month?

2. Literature Link

a. Read *Old Turtle* by Douglas Wood, either by reading it aloud to the class or by having various students take turns reading. Have the students verbally summarize the story. Use this discussion as an opportunity to model the development of an outline, using main ideas and supporting story details on the chart paper. This skill will be practiced later in the lesson using the Fact Sheet's information.
b. Next, have the students summarize the story in writing, practicing the TAAS skill of summarization using main ideas and supporting details. Consider the message that Old Turtle gives to the human species.

3. Language Arts

a. Create a "word wall" by displaying the Key Vocabulary list.
b. Working in groups, have students write down the vocabulary words in their science notebooks and find the definitions in the dictionary or from reading the Fact Sheet. Authentically evaluate understanding by having the students either create meaningful sentences with the words or create a story using the words.

4. Cooperative Group Work

a. Before proceeding with this lesson, make sure the class understands what it looks and sounds like for a group to be working well together, sharing the responsibility for their knowledge. Discussion should include the development of group roles and proper interactions among group members, resulting in clear expectations. This needs to include respectful communication in order for all students to feel safe to participate and be respected for what they know and think about.
b. Explain to the class that each group will be giving a class presentation on one of the four Advantages of Renewable Energy topics. Let the students know that each group must be able to: 1) summarize in clear and concise language, using vocabulary from the Fact Sheet, the information within its topic; 2) support its summary with details; and 3) present some type of visual aide, different from any found in the Fact Sheet, to help explain and teach its topic. A written explanation should accompany the visual

aide. As a class, create clear expectations for presentations by writing down what the students and teacher agree upon to be a quality presentation and what are effective behaviors by listeners during presentations. This could lead into developing a rubric, or system of standards, for grading purposes if the teacher desires.

c. Display the four pieces of paper with the topic headings. (These will also be used later in the lesson to assist students in developing an outline of the Fact Sheet's material.) Divide the class into groups of three or four and assign roles. Suggested roles include: recorder, discussion leader, researcher, and graphics person. Rotate these roles to allow the students to learn to be effective in all roles. Assign or allow groups to choose the topic for which they will be responsible.

d. Allow groups adequate time for this part of the assignment. If using only the information in the Fact Sheet, 45 minutes should be adequate. If additional research is done through the Internet and reference sources, more time may be needed according to the class' abilities.

e. Have each group present its topic with the mandatory elements. The listeners should be encouraged to generate questions in order to broaden their scope of understanding. After each presentation, the class as a whole should generate an outline of the information on the large sheet of paper for that topic. If time allows, students can copy the outline into their science notebooks. After each group presents, new information can also be added to the graphic information-organizer that was created at the beginning of the lesson.

5. Additional Activities (Optional)

a. Wind Observations

Have the students copy the table of the Beaufort Scale into their science notebook for a long-term assignment. If possible as a class, go outside to practice wind observations around the schoolyard. The students should then make observations about wind characteristics on their Beaufort Scale for five days, answering the questions at the bottom of the table. Instruct students that their observations should be made at the same location and close to the same time every day.

b. Utility Bill Averaging

Have the students bring in copies of their household's utility bills. Using these bills, calculate the average monthly energy use for each person in the class and come up with a class average. (You can also use the figures that are provided in the Fact Sheet). Extend this by getting similar information for the school's energy use and determining a school wide average. Estimate the number of households in your city in order for students to see the magnitude of this ecological situation.

c. Energy Debate

Divide the class into two sides and let them debate the advantages and disadvantages of energy production by use of nuclear and fossil fuel and production using renewable sources.

Beaufort Scale	Description	Observations
0	calm (0-1mph)	smoke rises vertically
1	light air (2-3 mph)	smoke drifts slowly
2	slight breeze (4-7 mph)	leaves rustle, wind vane moves
3	gentle breeze (8-12 mph)	twigs move, flags extend
4	moderate breeze (13-18 mph)	branches move, dust & paper rise
5	fresh breeze (19-24 mph)	small trees sway
6	strong breeze (25-31 mph)	large branches sway, wires whistle
7	moderate gale (32-38 mph)	trees in motion, walking difficult
8	fresh gale (39-46 mph)	twigs break off trees
9	strong gale (47-54 mph)	branches break, roofs damaged
10	whole gale (55-63 mph)	trees snap, damage evident
11	storm (64-72 mph)	widespread damage
12	hurricane (73-82 mph)	extreme damage!

Keep a record of the following information:

1. What are the wind speeds in the: a) morning_____
   b) afternoon_____c) evening_____
2. What time of day do the fastest winds occur? _____
3. From what direction are the winds coming? (Get out the compass)
4. Would a wind turbine work well in your area? Why?

NOTE *A minimum average wind speed of 13 mph is needed to produce electricity economically throughout the year.*

6. Culminating Activity

As a class, create a bulletin board collage. Divide the board space in half vertically and write "Renewable" on one half and "Non-renewable' on the other. Have students look through old magazines and cut out photos illustrating possible environmental outcomes of using renewable and non-renewable energy sources. Arrange photos and glue down. Overlapping is great in collages. Adding captions adds to this activity. Paint or use markers to add the titles to the board. This also could be an individual homework assignment.

ASSESSMENT

Have the students answer the questions below in complete sentences, reflecting the question in their answers. Alternatively, the class can answer the questions as a group discussion either instead of a written assignment or as a review before giving it to them as a test.

1. How are renewable energy resources different from non-renewable sources of energy?
2. Why are wind and sun renewable sources of energy?
3. What types of non-renewable fossil fuels are used in Texas to meet our state's energy needs?
4. What are the effects on the environment of producing energy from non-renewable sources?
5. What are the major types of renewable energy in Texas?
6. How is the environment affected by using renewable energy sources?
7. Identify two renewable energy resources that could meet half of Texas' energy needs by 2010.
8. How do individuals use energy directly?
9. How do individuals use energy indirectly?
10. How can people reduce the amount of energy they use?

Advantages and Disadvantages of Renewable Energy

Another way to authentically assess student's knowledge is to assign a paper in which students classify the pros and cons of renewable energy production. A language arts grade could be taken from this science assignment. TAAS classificatory writing strategies should be used to fully develop both sides of the theme. Three main ideas are identified for both sides of the argument and supported by three details from the information learned during this study.

Advantages	Disadvantages
1._____	1._____
a._____	a._____
b._____	b._____
c._____	c._____
2._____	2._____
a._____	a._____
b._____	b._____
c._____	c._____
3._____	3._____
a._____	a._____
b._____	b._____
c._____	c._____

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