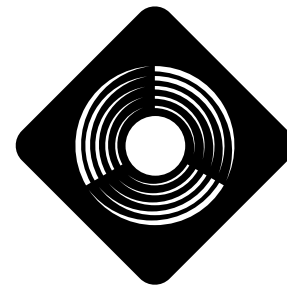


Exploring Alternative-Fuel Vehicles



RENEWABLE ENERGY
THE INFINITE POWER
OF TEXAS

FOR USE WITH FACT SHEET NO. 7: SOLAR AND ELECTRIC CARS

TEXAS ESSENTIAL KNOWLEDGE AND SKILLS

TEKS utilized: SCI. 4.1(B) make wise choices in the use and conservation of resources and the disposal or recycling of materials; 4.2(C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence; 4.2(D) communicate valid conclusions; 4.2(E) construct simple graphs, tables, maps and charts to organize, examine, and evaluate information; 4.3(A) analyze, review, and critique scientific explanations; 4.11(C) identify the sun as the major source of energy for the earth and understand its role in the growth of plants, in the creation of winds, and in the water cycle.

OVERVIEW

Students will learn about using vehicles for transportation that are powered by renewable forms of energy. Students will engage in a class discussion, 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:

- resources on back page of Fact Sheet 7
- list of vocabulary words on large sheet of paper, to be displayed in the classroom throughout the unit of study
- computers with Internet access
- large sheets of butcher paper or bulletin board size paper
- markers or tempera paint
- grid paper
- four large sheets of paper to be used to model outlining skills. Write one of the following topic headings on each sheet:
 1. Model solar cars
 2. Solar car races
 3. Electric cars
 4. Gasoline, cars and smog
- distributable form of assessment questions (posted on chalkboard, transparency, handouts)

Materials for Additional Activity 4.c

- Model solar car kits - 1 kit for every 3 students
(Kits generally include a small solar panel and electric motor. Some kits also contain materials for wheels, axles, gearboxes, and car bodies. All of these materials can be purchased independently from local hobby stores, and many materials can be adapted for use – such as using CDs for wheels. Prices for complete kits range from \$27 to \$50. More information about building a model solar car and procuring parts can be found at www.txses.org/tjss/. Local electric utility companies often agree to sponsor purchase of kits for use in classrooms.)

Possible Answers to Assessment Questions:

1. Biomass is all living matter. In terms of energy sources, biomass comes from plants, like corn or quick grass, and from garbage.
2. Corn is biomass, and it can be used to produce ethanol, a renewable biofuel.
3. Wind generators can produce “green” electricity to supply energy or power for electric cars.
4. We cannot depend on fossil fuels because their supply is limited, and they pollute our atmosphere.

5. Two alternative forms of transportation are solar and electric cars.
6. Electric cars plug into an electric outlet for energy while a solar car uses a solar panel. However the panel could be separately built. Electric cars don't have to carry fragile solar panels so they can be larger and carry more people.
7. Both solar and electric cars don't burn gasoline, so the motor does not produce air pollution. However electricity to charge-up the vehicle may be from coal, oil or gas power plants.
8. Gas-powered cars are less efficient than electric.
9. A model solar car gets its power from a solar panel that converts light from the sun into electrical power. It is then transmitted by a wire to the motor, causing the drive shaft to turn, which causes the wheels to spin and moves the car.
10. An SUV takes a great deal more energy to run.

CLASSROOM ACTIVITY

1. Assess Current Level of Knowledge

If graphic information-organizers, such as webs, were used to display 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 the students already know about renewable forms of energy production. To assess what students know, prompt a class discussion with questions such as: What is the difference between renewable and non-renewable energy? What types of non-renewable forms of fossil fuels are

used in Texas? Why has coal, oil and natural gas been used in the 20th century to produce electricity? How do these affect our environment? What are the major types of renewable energy in Texas? Why are wind and sun renewable forms of energy? How do these affect the environment? How is wind energy used in Texas to produce electricity? What are some of the good reasons to depend upon renewable energy sources? Are there enough renewable forms of energy to provide all our needs?

2. Language Arts

- a. Create a "word wall" by displaying the Key Vocabulary words.
- 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.

3. 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.
- b. Explain to the class that each group will be giving a class presentation on one of the four Solar and Electric Cars topics. Let the students know that each group must be able to: 1) summarize in clear and concise language the information within its topic; 2) support its

KEY VOCABULARY:

alternative – other or substitute

biomass – organic matter, such as plants or garbage, that can be used as an energy source

ethanol – a clean-burning alternative fuel that can be made from corn or other crops

fossil fuel – a hydrocarbon deposit, such as oil, coal or natural gas, created from previous living matter

green electricity – electric power produced from energy resources that emit little or no pollution

kilocalorie – unit of heat required to raise the temperature of 1 kilogram of water by 1C

pollution – a material that is harmful to living things

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

solar – relating to the sun

sustainable – able to supply necessities today without sacrificing future generation's needs

SUV – sport utility vehicle, a large passenger car that holds many passengers and gear

- 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 four or five. Assign or allow groups to choose the topic for which they will be responsible.
 - d. Instruct the model solar cars group to use grid paper and design a schematic of a model solar car using information from this Internet site: www.nrel.ov/business/education/SprintWeb and the Fact Sheet. Have them answer the question: How does a model solar car get its power to move?
 - e. Have the solar race cars group research this Internet site: solarcar.arizona.edu. Have them answer the following questions: What is the racecourse and about how long does it take the winning car to complete it? What do engineers have to keep in mind, when designing their cars, to allow them to run at optimum potential?
 - f. The electric cars group can research other forms of electric transportation at this site: www.electricbikes.com/. Have them

answer the following questions:
How does an electric car work?
How is it different from a solar car?

- g. 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 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.

4. Additional Activities (Optional)

a. Class Discussion

Introduce the following scenario to the class and prompt discussion: The year is 2010 and fossil fuel reserves, especially oil, have drastically declined because of increased use and population growth. Oil prices have soared so high most people are not able to purchase gasoline for their vehicles. As a community, use the information you have discovered and develop a plan for becoming sustainable. As the students begin to brainstorm ideas, use graphic-organizers, such as webs, to display their concepts.

b. Narrative Writing

Have the students write a narrative story from the class discussion. Students need to develop the setting with "who, when and where" statements and develop a story line leading to a climax and a conclusion.

c. Building Model Solar Cars

If model solar car kits are available,

divide the class into groups of three and have them follow the instructions for building a solar car. With help from outside mentors, this takes about 4 hours of class time.

The best approach to conduct this activity is to first build a car yourself. Once you have built a car, you can determine the best way to use this activity in your classroom: either strictly following the kit instructions or allowing the students to be flexible in their design and construction; or you may simplify or expand on the instructions yourself and distribute them to the class. The following are guidelines to instruct students on the activity that can be posted:

1. Examine and test all your parts: Make sure you have all the parts and test them.
2. Design and draw your solar car: Use your imagination and creativity as a team to design your car. Think about the important features of the car. Should it be lightweight? Low to the ground? Motor in the front or rear? What gear ratio?
3. Construct the body of the car: Using your design, construct the body of the car.
4. Install the motor, wheels and solar panel: With the assistance of a mentor or teacher, install the final parts. Soldering the wires to your motor and alligator clips make a better electrical connection.
5. Test the car and make final adjustments: Take the car out into the sun and do a test run!
6. Race your car with others!

6. Culminating Activity

Comparing Energy Used Bulletin Board

Create a classroom or hallway bulletin board depicting the concept of “doughnut energy” from the Fact Sheet to compare transportation energy used. Encourage students to be creative in how they want to transfer the information onto the bulletin board. Suggest they choose an object other than doughnuts for comparison.

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. Explain what biomass is and give three examples.
2. How can biomass help produce fuels to power our automobiles?
3. Wind is another form of renewable energy. How can wind be used to help with our transportation needs?
4. What are the disadvantages of depending on fossil fuels for our transportation needs? List two.
5. What are two alternative types of transportation that don't use fossil fuels?
6. List two ways electric cars are different from solar cars.
7. How are solar and electric cars alike?
8. Are gasoline-powered cars more efficient or less efficient than electric cars?
9. How does a model solar car get its power to move?
10. Which uses more energy: an SUV or an electric car?

InfinitePower.org

Financial Acknowledgement This publication was developed as part of the Renewable Energy Demonstration Program and was funded 100% with oil overcharge funds from the Exxon settlement as provided by the Texas State Energy Conservation Office and the U.S. Department of Energy. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.



RENEWABLE ENERGY
THE INFINITE POWER
OF TEXAS