

Using Alternative Energy In the Home



Target Grade Levels

Third - Fifth

Time

Three hours

Materials

- 8 large sheets of paper with one of the following topic headings on each:
 - Heating Your Home
 - Cooling Your Home
 - Clothes Drying Without Using Gas or Electricity
 - Heating Water
 - Cooking With Renewable Energy
 - Electricity Generation, The Renewable Way
 - Water pumping
 - Playing/Working the Clean Way
- 1 shoebox
- construction paper
- 16 oz. plastic soda bottle with cap
- thermometer
- aluminum foil

Knowledge and Skills (TEKS)

- Science:
 - Students make wise choices in the use of natural resources and the recycling of materials;
 - Observe and measure;
 - Analyze, review and critique scientific explanations;
 - Draw inferences based on promotional;
 - Collect and analyze using tools; and
 - Identify the sun as the major source of energy.
- Language Arts:
 - Construct explanations; and
 - Communicate conclusions.
- Math:
 - Construct graphics, tables maps and charts using tools.

Overview

This lesson focuses on using natural and simple renewable energy sources to heat and cool homes without giving up comfort. Students will learn that by using nature to cook our foods, dry our clothes, work and play, we can save money, reduce dependence on fossil fuels and help clean up our environment.

Students will engage in a class discussion, read and discuss a recommended text, create a word wall and work in groups to gather information about specified topics in renewable energy. Students will present a topic using written explanation with visual aids.

Background Information

You can make use of earth-friendly, renewable energy sources in your home. Renewable energy comes from sources that we cannot use up, such as the sun and wind. It almost always causes less pollution than our more typical sources of energy, such as oil, coal, natural gas and nuclear.

Renewable energy is sustainable, so it can provide for your energy needs now and in the future without doing great harm to the environment and human health. This kind of energy can also save you money.

Procedure

1) Vocabulary

- | | |
|--------------|------------------------|
| a) convert | f) overhangs |
| b) demolish | g) photovoltaic system |
| c) eliminate | h) sanitize |
| d) hornos | i) sustainable |
| e) minimize | j) transport |

2) Activities

a) Assess Current Level of Knowledge

Create a way of visually organizing information to display what the students already know about conservation and efficiency. To assess what students know, prompt a class discussion with questions such as:

- i) What does sustainable mean?
- ii) Can a community be sustainable?
- iii) How does our community get most of its electricity?
- iv) What are alternative ways of generating electricity without the use of fossil fuels?
- v) How can we reduce the amount of energy used from the burning of fossil fuels?

b) Cooperative Group Work

i) Explain to the class that each group will give a class presentation on one of the eight Renewable Energy for the Home topics. Let the students know that each group must be able to:

(1) summarize in clear and concise language the information within its topic, including the definitions of the vocabulary found in their 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.

ii) 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, if the teacher desires.

iii) Display the eight 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. Assign or allow groups to choose the topic for which they will be responsible.

iv) Allow groups adequate time for this part of the assignment. If using only the information in the fact sheet, 30 minutes should be adequate. If additional research is done through the Internet and reference sources, more time will be needed.

v) 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.

c) Additional Activity—Making a Solar Water Heater

i) Post the following instructions on a large sheet of paper:

(1) Gather materials for each group:

- (a) shoebox
- (b) construction paper
- (c) 16 oz. plastic soda bottle with cap
- (d) thermometer
- (e) aluminum foil

(2) Line the inside of a shoebox with a sheet of aluminum foil to make solar oven.

(3) Wrap the plastic bottle with a sheet of construction paper. (Each group will be given a specified color.)

(4) Fill bottle with tap water.

(5) Place bottle in your oven and locate oven in direct sunlight. Adjust placement to reflect as much light as possible onto the bottle. Start your water temperature measurements. Record the measurements in a table in your science notebook.

ii) Have the students create a table in their science notebooks for recording their water temperature measurements in 15- or 30-minute intervals. (Regulate the length of data collection to fit your schedule.)

iii) Divide the class into groups. Have groups gather their materials according to the instructions. Give each group a different color of construction paper (color will be the variable) and compare results later. Make sure groups measure the beginning water temperature, before the heater is placed in the sun. Have the class draw conclusions about the qualities of the different colors as they pertain to heat absorption.

3) Review

- a) Groups can quiz their fellow students on the contents of their presentation.
- b) Discuss the community's current power generation portfolio. Ask the class if this is acceptable and, if not, how the community could diversify.
- c) Discuss the concepts made evident in the activities and who these are applied to actual, residential situations.

4) Evaluation

- a) One way to authentically assess student 's knowledge is to assign a TAAS process writing practice. A language arts grade could then be taken from this science assignment. Have the students write a "How To" paper on making their solar water heater. Students should write down the chronological steps used to make their water heater. They need to use transitional words such as first, next, then, after that, etc. Make sure they include all of their steps.

- b) 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 in place of a written assignment or to review before giving the questions as a test.
- i) If you want to heat your home in the winter, where (direction) would be a good place to put large windows and why?
 - ii) Explain how roof overhangs can help keep heat out of your house in the summer. You may use a diagram.
 - iii) If you were gathering wood for a wood stove or fireplace, recommend what type of wood you would choose and why.
 - iv) Explain how a thermal chimney works to help cool your house in the summer.
 - v) If you wanted to use thermal mass to help make your home more comfortable, what kind of flooring would you install in your house?
 - vi) When considering efficiency, why is drying your clothes on a line outside a good choice? Include at least three reasons.
 - vii) Create a diagram that explains how a solar water heater works. Be sure to label your diagram!
 - viii) How does a solar cooker work to cook food without the use of gas or electricity?
 - ix) If you wanted to generate electricity using a renewable resource, what renewable energy sources would you use and why?
 - x) What is hydropower? What are the advantages and disadvantages of using this renewable resource to generate electricity?
- c) Possible Answers to Assessment Questions:
- i) If you want to heat your house in the winter, it would be a good idea to have large, south-facing windows to allow sunshine to enter and warm your house.
 - ii) In the summer, when the sun is higher in the sky, an overhang shades the window and keeps out the hot sun.
 - iii) Most people will first try to find dying or diseased trees to burn; however, even fallen stumps or dead branches lying on the ground, have their place in the ecological web, too. A better choice for wood to burn might be compressed logs made from the sawdust scrap of wood mills. This way, people are re-using something that otherwise would have gone to the landfill. If people are instead gathering in a situation where compressed logs aren't available, dying or diseased trees is good. Ultimately, green wood (fresh-cut) doesn't burn well and taking it will not do the Earth any good, either.
 - iv) Thermal chimneys use the principle that warm air rises to the top of tall spaces and is replaced by cooler air from below. In a two story house, opening the first floor windows and a window at the top of the stairs will allow hot air to escape at the top and draw in cooler air from below.

- v) Floors made of tile, concrete, stone or earth can make a house feel much cooler in the summer.
- vi) Hanging your clothes on the line saves the energy cost of using a dryer, keeps your clothes newer looking, and sanitizes your clothes, eliminating the need for harsh chemicals such as bleach. Plus you get to hear the birds singing!
- vii) Accept your student's drawings of their water heaters. Make sure that they have labeled their diagrams.
- viii) A solar cooker works by concentrating the heat-producing rays of the sun through one or two layers of glass or other see-through material like plastic.
- ix) Wind and solar generated electricity are both good choices in Texas because they are both plentiful. I would also build my house in a way that would help keep me cool in the summer and warm in the winter.
- x) Hydropower is using the energy in falling water to produce electricity. It is an inexpensive way to generate energy and it produces no air pollution. One of the disadvantages of using hydropower is that dam construction can hurt aquatic life and reduce water quality.

5) Extension

- a) Wind is a significant power source in Texas. Students can examine wind power by building miniature sailboats and having races with wind or using their own wind power by blowing in the boats' sails.
- b) Students can research wind power – how the power of the wind helps reduce pollution by reducing the need to burn fossil fuels for energy.
- c) Students can research storms and tornadoes and how wind moves, carries pollution, and destroys things, and then present their findings in a report.
- d) Students can make conceptual drawings of wind or write creative pieces pretending that they are wind's diary, discussing what they have carried, seen, or done in a day.
- e) Students can find out how their own home is powered, surveying all of the major appliances, the heat and cooling, and water heating, and see how diversified their home energy portfolio is. They can also research residential applications of alternate energy, such as solar water heaters.

RENEWABLE ENERGY FOR THE HOME

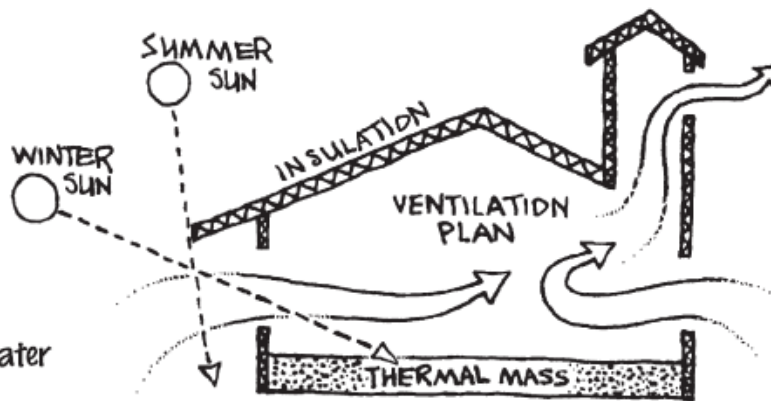


RENEWABLE ENERGY
THE INFINITE POWER
OF TEXAS

FACT SHEET 4 A RESOURCE FOR CLASSROOMS AND TEACHERS

Highlights

- ◆ Heating and cooling your home
- ◆ Drying clothes without gas or electricity
- ◆ Cooking with renewables
- ◆ Using renewables to pump water
- ◆ Playing and working the clean way



NATURAL HEATING & COOLING

OF THE HOME Low winter sun through south-facing windows helps heat the home in the winter. Overhangs keep the high summer sun out, while windows allow cooling breezes through.

Earth-Friendly Energy

You can make use of earth-friendly, renewable energy sources in your home. Renewable energy comes from sources that we cannot use up, such as the sun and wind. It almost always causes less pollution than our more typical sources of energy, such as oil, coal, natural gas and nuclear.

Renewable energy is sustainable, so it can provide for your energy needs now and in the future without doing great harm to the environment and human health. This kind of energy can also save you money.

Using Renewable Energy for your Home

HEATING YOUR HOME

■ PASSIVE SOLAR ENERGY

Have you ever felt how hot it gets in a car on a sunny, winter day? The sun's rays can also be used to heat your home. South-facing windows allow sunshine in when the sun is low in the

winter sky. A proper roof overhang above these windows can keep out the hot sun in the summer when it is high in the sky.

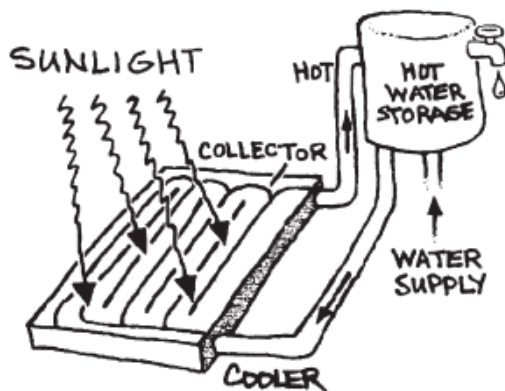
■ WOOD STOVES AND FIREPLACES

Under certain circumstances, burning wood can be an earth-friendly, renewable source of heat. But the wood should come from dying or diseased trees, or trees that had to be cut down for other reasons. And well-designed stoves and fireplaces can limit the amount of smoke these fires produce, minimizing air pollution.

COOLING YOUR HOME

■ NATURAL BREEZES

Natural breezes offer free cooling in the fall, spring and summer. Open the windows on the side of the house facing the breeze and also on the opposite side of the house. This allows the breeze to flow easily through your home.



SOLAR WATER HEATING Renewable energy from the sun can be used to heat water for household use.

■ THERMAL CHIMNEY

This uses the principle that warm air rises to the top of tall spaces and is replaced below by cooler air. In a two-story house, open the first floor windows and a window at the top of the stairs.

■ THERMAL MASS

Have you noticed how cool a well-shaded concrete sidewalk feels even when the summer air is hot? Floors made of tile, concrete, stone or earth can make a house feel much cooler in the summer. This can help minimize or eliminate the need for air conditioning.

CLOTHES DRYING WITHOUT GAS OR ELECTRICITY

■ CLOTHESLINE IN THE WIND

Hang the wash on a clothesline instead of throwing it into an energy-guzzling dryer. You will be using free energy from the wind and sun. The sun helps whiten and sanitize the wash, eliminating the need for harsh chemicals, such as bleach, in the washer.

HEATING WATER

■ SOLAR WATER HEATERS

Water easily absorbs heat from the sun. A passive solar water heater uses a solar collector, usually on the roof, to heat water. Then the natural movement of the heated water, a process called convection, transports it into the water tank in your home. A passive solar water heating system can supply 50 percent or more of your household's hot water needs.



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COOKING WITH RENEWABLES

■ SOLAR COOKERS

A solar cooker works by concentrating the heat-producing rays of the sun through one or two layers of glass onto food that is placed in an insulated box. A dark-colored cooking pot with a glass lid also will work.

■ HORNOS

Hornos are outdoor, wood-fired brick or earthen ovens that cook food using radiant heat. Heat the oven with a wood fire for three or four hours. Then remove the embers. The oven remains hot, and several hours of baking can begin.

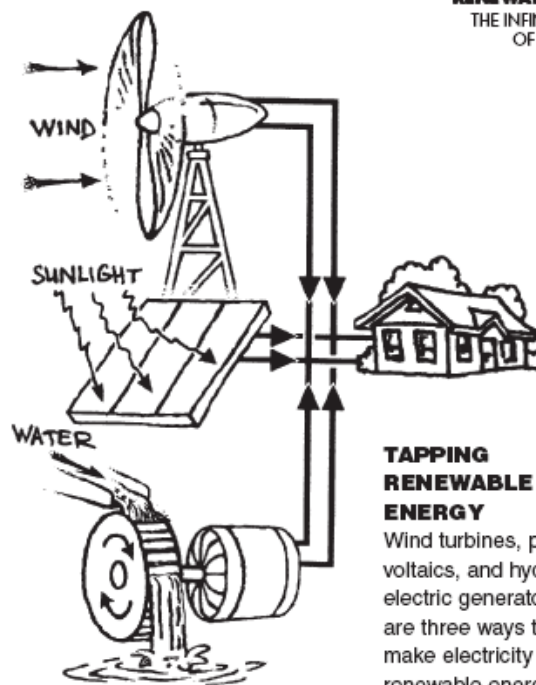
HORNOS Bake food without using gas or electricity



ELECTRICITY GENERATION THE RENEWABLE WAY

■ PHOTOVOLTAICS

Photovoltaic, or PV, systems convert sunlight, the world's most abundant source of energy, into electricity. This power can be used in rural places where an electrical connection isn't available, or they can provide power for a house in the city.



TAPPING RENEWABLE ENERGY

Wind turbines, photovoltaics, and hydroelectric generators are three ways to make electricity from renewable energy.

■ WIND

The power of wind can be seen in a hurricane or tornado when trees are uprooted and buildings demolished. Wind energy can be harnessed for useful purposes with wind turbines throughout Texas. The mountains of west Texas and the plains of the Panhandle, which are very windy areas, are especially good places for this.

■ WATER

Hydropower, or water power, has historically been used for grinding grains in grist mills. Today it is one of the cheapest ways to produce electricity. While hydropower creates no air pollution, dam construction can hurt aquatic life and reduce water quality.

WATER PUMPING

■ *WINDMILLS*

There are about 80,000 windmills operating in Texas. Most of these pump water for livestock, but windmills can be used to pump water for people as well.

PLAYING & WORKING THE CLEAN WAY

■ *ENERGY SAVING TOYS*

Many toys require batteries or electricity to make them operate. Look for solar powered toys such as race cars and speedboats. Or choose manual toys for which you supply the power. Battery operated toys can be powered by reusable batteries re-energized in a solar recharger.

■ *ENERGY SAVING TOOLS*

Mowing the lawn is more fun, and better for the environment, with a manual push mower instead of a gasoline powered one. Manual mowers, trimmers and rakes use renewable human power and cost less to buy, operate and maintain. Solar rechargeable flashlights and lanterns, portable solar showers and water purifiers are also good choices.