

Fun with Renewable Energy

Subject: Science

Grade Level: Middle school (6-8)

Rational or Purpose:

Students will expand their knowledge of renewable energy by exploring a particular technology in detail.

Materials:

- Copies of “Renewable Energy Sources from Texas” reading passage
- Copies of the student data sheet
- Copies of the assessment questions
- Access to the internet
- Computers with PowerPoint capability

Lesson Duration: Four 40-minute periods

TEKS Objectives:

§112.22. Science, Grade 6

(9) (A-C)

§112.23. Science, Grade 7

(14) (C)

Background Information:

Renewable energy provides a means to supply energy by utilizing natural resources that are abundant on Earth. Some examples of renewable energy include solar energy, geothermal energy and wind energy. These energy resources provide enormous advantages in that they cause less pollution into the atmosphere, can be found anywhere, and cannot be used up; they provide more than enough energy to meet our needs unlike fossil fuels.

Activity:

This lesson will allow students to explore different forms of renewable energy through the use of an internet research activity. Students will be assigned a renewable energy technology and responsible for researching their topic in order to give a presentation to the class.

Procedure:

Day one:

1. To grab your students' attention, display several solar-powered devices in the classroom. Talk about each item.
2. Introduce the lesson by informing students that they will be learning about renewable energy and the resources available in Texas. Initiate a classroom discussion about what they already know about renewable energy. Create a K-W-L chart on the board to organize this information visually.
3. After this discussion, pass out the reading passage handouts. This will help students to familiarize themselves with renewable energy and aid them in understanding the vocabulary used in the lab activity instructions.
4. Collect and grade students' work. Return next class period.
5. Handout the lab activity handouts and ask the students to read it over for the next class period.

Day Two/Three:

6. Ask students to summarize what they will be doing in their internet research activity based on the lab activity handout and ask questions about the research guidelines to make sure students read the instructions.
7. Go over rules for using the internet and discuss some good search engines to use. (Students should not be accessing sites irrelevant to the research activity.)
8. Divide students into groups of 2-4 and assign each group one of the following types of renewable energy:
 - a. Solar electricity (photovoltaics)
 - b. Solar thermal (i.e. water/space heating, solar cooking)
 - c. Passive solar energy
 - d. Wind energy
 - e. Biomass energy
 - f. Geothermal energy (i.e. heat pumps)
 - g. Hydroelectric energy
 - h. Tidal/wave energy
9. Instruct all groups to research their assigned topic. Be sure to provide methods for saving information.

10. Remind all groups that they will compile their information and organize it into a 10 to 15 minute presentation based on the guidelines given to them. Inform all groups each student will be responsible for the presentation and therefore each group member will present a part of their topic. In addition, groups must create a 5 question quiz for the class in order to hold the class responsible for all the renewable energy resources that were researched in this lesson. Groups will decide how this quiz should be administered.

Day Four:

11. Each group will now present their topic.
12. After all groups have presented, summarize the findings and complete the "L" part of the K-W-L chart on the board.

Resources:

- "The Infinite Power of Texas." Renewable Energy: The Infinite Power of Texas. Texas State Conservation Office. <<http://www.infinitepower.org/index.htm>>.

Renewable Energy Resources for Texas



RENEWABLE ENERGY
THE INFINITE POWER
OF TEXAS

HIGHLIGHTS

- Texas has more renewable energy potential than any other state
- Every Texas community can use clean, renewable energy affordably
- Developing Texas' renewable resources will help the State's economy

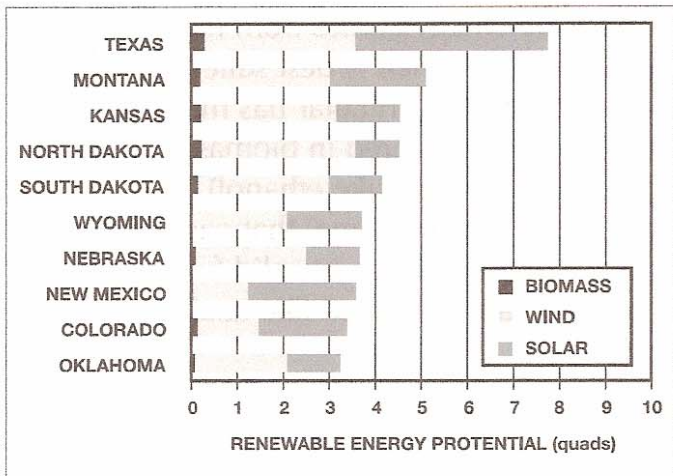
SUMMARY

Due to its size and diverse climate, Texas has tremendous potential to use clean, renewable energy resources such as wind, solar and biomass. These resources are plentiful, large enough in fact to meet all of our State's energy needs. These technologies do not create pollution and are available as large systems (power plants) and as smaller systems (for home use). Thanks to rules established by the Texas government, our State must have 2,000 Megawatts of electricity that comes from renewable resources by the year 2009. Not only does renewable energy help our environment, but it also means good business and creates jobs for our local communities.

WHAT IS RENEWABLE ENERGY?

Renewable energy is energy that comes from sources that are always available in the natural world and cannot be used up. Following are examples of renewable energy and their resources:

- Solar energy – energy that is produced from the sun whether it is in the form of sunlight particles that can create electricity (solar electricity or photovoltaics) or in the form of heat to warm water or air space
- Wind energy – energy that is produced from the natural movement of the wind; also considered a form of solar energy because wind is created by differences in the amount of heat that the sun sends to different parts of the earth
- Biomass energy – energy that comes from materials that were once living like plants or some types of garbage
- Geothermal energy – energy that comes from heat generated deep inside the Earth from items like hot rocks, hot water and steam
- Hydroelectric energy – energy that is produced from moving or falling water
- Tidal/wave energy – energy that is produced when ocean tides or waves change or move across the ocean or sea



TEXAS IS #1 IN RENEWABLE POTENTIAL This figure, based on a study done for the United Nations, shows that Texas can develop more clean, renewable energy than any other state.

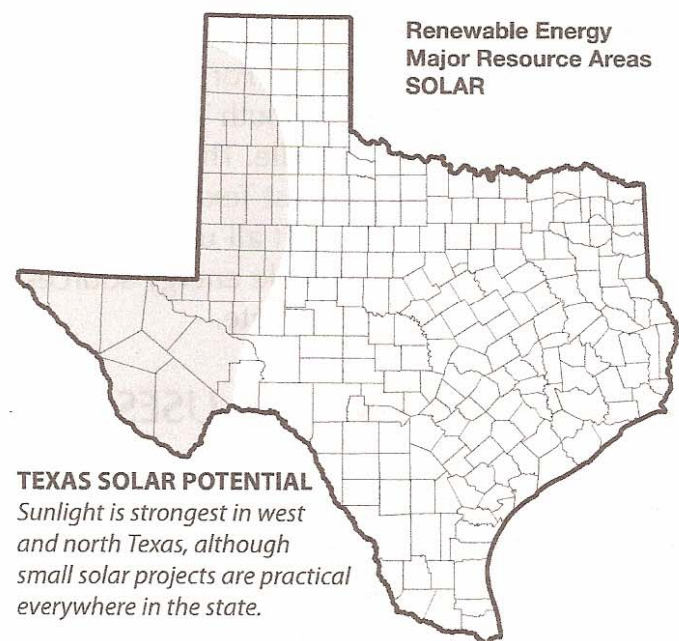
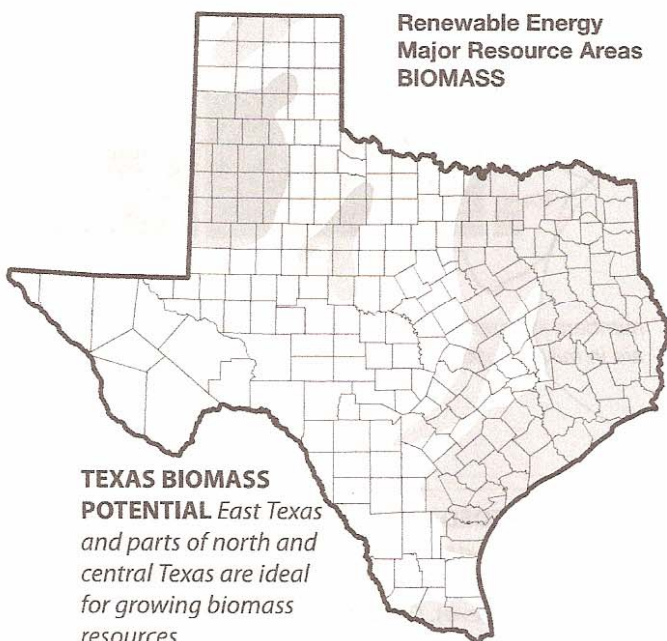
All of these forms of energy are made directly from the sun (solar), indirectly from the sun (wind, hydropower and biomass) or from other movements of our natural world (geothermal and tidal/wave energy). The most common types of renewable energy in Texas are solar, wind, and biomass.

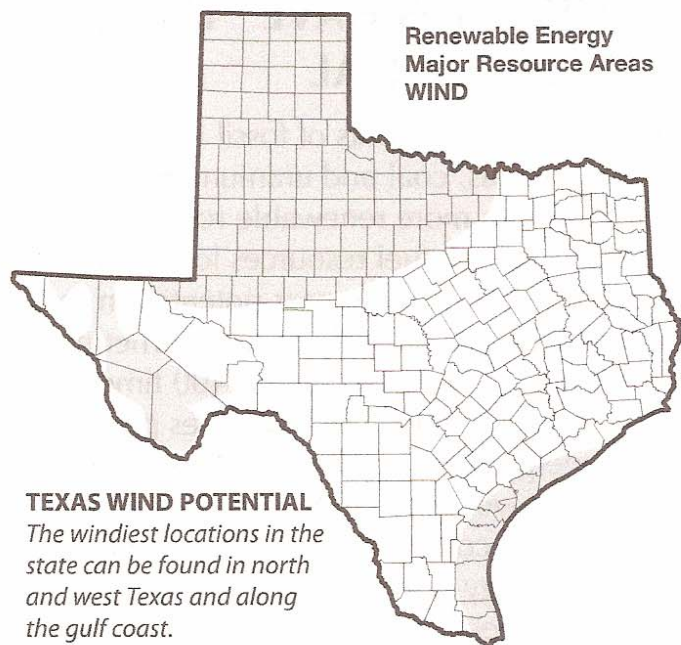
RENEWABLES HAVE "TEXAS SIZE" POTENTIAL

Texas has large amounts of fossil fuel resources such as oil, gas, coal and uranium. But the State has even more renewable resources that make those fossil fuel resources look small. The wind, solar and biomass potential in Texas is equal to 4,330 quadrillion British Thermal Units (BTUs) per year, or about 400 times the amount of energy our State uses per year. Wind energy alone could provide eight times as much power as all of the State's electric power plants combined. And our potential for solar energy is even greater than wind! In order to meet our energy needs in Texas, we only need to use a small fraction of the renewable energy resources that are available.

WHERE ARE THE RESOURCES LOCATED?

No matter where you are in Texas, renewable energy resources are, more than likely, all around you. Some forms of renewable





energy such as solar heating, photovoltaics, solar water heaters and geothermal (in the form of heat pumps) can be used just about everywhere in Texas. Other technologies, such as biomass energy plants and water pumping windmills, can be used in many communities across the State.

However, for large power projects that use wind and solar energy, the best locations in the State should be found. For wind and solar, the best areas are in south Texas, west Texas and the Panhandle. The best biomass resources are in east Texas and the Panhandle. When you add it all up, Texas can benefit from clean, renewable energy sources in every community in the State.

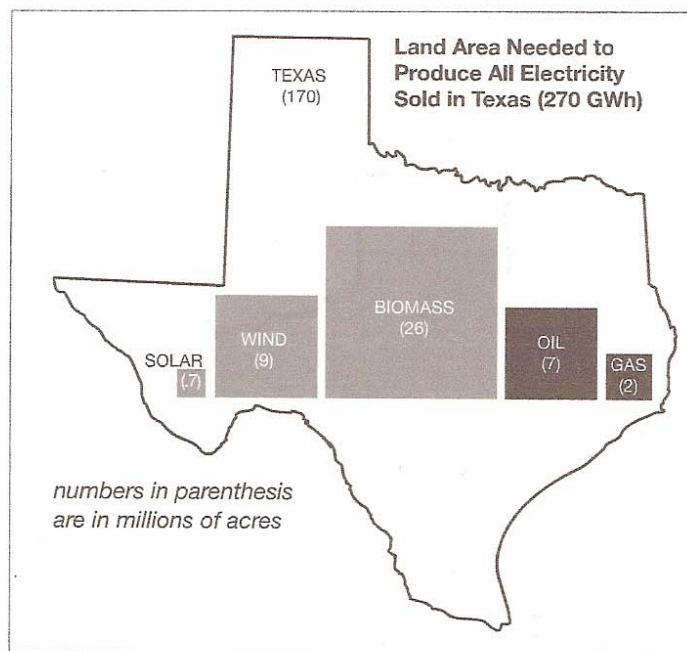
RENEWABLE ENERGY USES

Renewable energy resources can fulfill our energy needs that we often get from fossil fuels. These needs include generating electricity, providing heat, powering mechanical equipment and powering vehicles.

Renewable energy comes from nature in many forms, each of which is best suited for certain uses. Biomass in particular has many uses. The solar energy stored in biomass can make liquid fuels for cars (like ethanol), fuels in the form of gas (like methane) that can be burned in place of natural gas, or solid fuels like wood chips that can be burned like coal.

LAND USE

Some people think that renewable energy uses too much land to be practical. This is not true. Renewable energy uses as much land as that used by fossil fuels such as oil and gas. Harnessing renewable energy can be done along side other traditional land uses. For instance, cattle can graze around windmills, and solar equipment can be placed on the roofs of factories, shopping centers and individual houses, over parking lots and along roadways.



LAND AREA NEEDED FOR VARIOUS TEXAS ENERGY SOURCES Each square shows the land area needed by different energy resources to produce enough electricity for the entire state of Texas. Oil wells and wind turbines produce about the same amount of energy per unit of land area.

Understanding the Reading Passage

1. What is renewable energy? _____

2. Briefly describe the following types of renewable energy in your own words:
 - solar energy _____
 - wind energy _____
 - biomass energy _____
 - geothermal energy _____
 - hydroelectric energy _____
 - tidal/wave energy _____
3. Can renewable energy be used for our current energy needs? Why or why not? _____

4. Does renewable energy use too much land to be considered? Why or why not? _____

Vocabulary

Based on the Reading Passage, write down your understanding of these words or word pairs and verify your definitions in a dictionary, on the Internet if available or with your teacher:

biomass energy _____

British Thermal Unit (BTU) _____

fossil fuels _____

geothermal energy _____

heat pump _____

hydroelectric energy _____

quadrillion _____

potential _____

renewable energy _____

resources _____

solar energy _____

tidal/wave energy _____

wind energy _____

Internet Research Guidelines

Researching Renewable Energy Resources

Introduction

The purpose of this activity is to expand your understanding of renewable energy resources by researching a specific technology as directed by your teacher.

Before You Start

Review the vocabulary words from the Reading Passage. Ask your teacher if you are unsure of any of the meanings. Divide up all the steps in the Lab Activity first, so that everyone has a clear job to do.

Research Guidelines

1. Receive your renewable energy technology assignment from your teacher.
2. Your teacher will provide guidelines for using search engines on the Internet. Based on your assigned topic, use the Internet to research the following aspects of your technology:
 - description of the technology and the renewable resource that powers it—include how the resource and technology work and typical equipment components if applicable;
 - end uses or applications of the technology—include users;
 - where, if at all, the resource can be found in the state of Texas;
 - at least 1 sample project in Texas; and
 - conclusion stating whether the assigned resource is practical, worthwhile and can be successfully used in Texas.
3. The research you compile should consist of the following components at a minimum:
 - written electronic text in your own words that addresses each aspect listed in #2 above;
 - electronic graphics, such as photos, tables or diagrams, supporting the information gathered; and
 - a list of resources with website links for more information.
4. Save any information you gather from the Internet on disk or the computer's hard drive, according to your teacher's directions (text, photos, diagrams, resource links, etc.).

Presentation Guidelines

1. Your presentation will be made using computer software that is available to your class (such as Microsoft PowerPoint).
2. Organize your information so that when it is presented, it follows a clear and logical flow such as: introduction, main information, conclusion and where to get more information.
3. Your presentation should include all the components listed in #3 above.
4. Choose text colors, style, font size and background colors that can be easily viewed by the class.
5. The last part of your presentation will be a quiz for your classmates to answer. This will make sure they pay attention to your presentation! Prepare 5 questions about your assigned topic. You can present the questions as the last slide of your presentation, read them aloud or write them on the board. You can make the quiz for the whole class to answer aloud or have students write the answers in their notebooks and check each other's work.