



Renewable Energy Sources


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Renewable Energy Sources
Table of Contents

Introduction	1
Grade Level	1
Discipline	1
TEKS	1
National Education for Sustainability Learning Standards	1
Objective	2
Keywords	2
Description of Activities	2
Activities	3
Activity 1: What is Renewable Energy	3
Introduction	3
Materials	3
Products	3
Process	3
Activity 2: Energy Use at Home	6
Introduction	6
Materials	6
Products	6
Process	6
Activity 3: Solar Box Cooker	8
Introduction	8
Materials	8
Products	8
Process	8
Additional Resources	10
Online Resources	10
Educational Videos.....	10
Handouts	
“Renewable Energy Resources”	
“How to Build a Solar Box Cooker”	
“Solar Box Cooker: Guidelines for Cooking Food”	

Introduction

Grade Level

These activities are intended for an eighth grade classroom.

Discipline

These activities have a science and social studies focus.

TEKS

Content:

Organisms and environments. In studies of living systems, students explore the interdependence between these systems. Interactions between organisms in ecosystems, including producer/consumer, predator/prey, and parasite/host relationships, are investigated in aquatic and terrestrial systems. Students describe how biotic and abiotic factors affect the number of organisms and populations present in an ecosystem. In addition, students explore how organisms and their populations respond to short- and long-term environmental changes, including those caused by human activities. TEKS §112.20. Science, Grade 8. (a)(4)(E)

Throughout social studies in Kindergarten-Grade 12, students build a foundation in history; geography; economics; government; citizenship; culture; science, technology, and society; and social studies skills. The content, as appropriate for the grade level or course, enables students to understand the importance of patriotism, function in a free enterprise society, and appreciate the basic democratic values of our state and nation as referenced in the Texas Education Code (TEC), §28.002(h). TEKS §113.20. Social Studies, Grade 8. (a)(5)

Skills:

The student knows that interdependence occurs among living systems and the environment and that human activities can affect these systems. TEKS §112.20. Science, Grade 8. (b)(11)(A)(B)(C)(D)

The student understands the physical characteristics of North America and how humans adapted to and modified the environment through the mid-19th century. TEKS §113.20. Social Studies, Grade 8. (b)(11)(A)(B)(C)

The student understands the relationships between and among people from various groups, including racial, ethnic, and religious groups, during the 17th, 18th, and 19th centuries. TEKS §113.20. Social Studies, Grade 8. (b)(23)(A)(B)(C)(D)(E)

National Education for Sustainability K-12 Student Learning Standards

2.2 ~ Ecological Systems ~ Natural Resources

2.3 ~ Economic Systems ~ Food Systems

2.4 ~ Social and Cultural Systems ~ Multiple Perspectives

3.2 ~ Collective Action ~ Designing a Sustainable System

Objective

Students will use Internet resources to investigate renewable sources of energy. They will learn about misconceptions commonly associated with energy. They will examine controversial issues associated with renewable energy sources from multiple perspectives; by exploring benefits, drawbacks, and social ramifications, students will develop a deeper appreciation for these complex issues.

Key Words

Renewable resources

Alternative energy

Geothermal

Biomass

Hydropower

Description of Activities

The following activities have been compiled to address the topic of “Studying Food” in eighth grade classrooms. The activities meet the state and national education standards for eighth grade, and are intended to supplement pre-existing curricula, with a focus on integrating sustainability topics. The activities can be used in conjunction or alone.

Activities

Activity 1: What is Renewable Energy?

Introduction

In this activity, students will investigate a variety of renewable energy resources, as well as the benefits and drawbacks of each. They will present their findings and work to determine which is most practical and/or mostly easily implemented.

Materials

Computers

Handout

Products

Vote

Mock city council meeting

Presentations

Summaries

“Community news article”

Process

1. Ask the following questions in order to review basic ideas and find out what students already know about renewable and nonrenewable energy sources. Be sure to determine if students hold any misconceptions and to let students know that they will focus on renewable/alternative energy sources in this lesson.
 - Is there more than one source of energy?
 - What are some sources of energy?
 - What is meant by a renewable energy source? What are some examples?
 - What is meant by a nonrenewable energy source? What are some examples?
 - What are major differences between nonrenewable and renewable/alternative energy sources?
 - Do you know of any places where renewable/alternative energy sources are regularly being used?
2. Have students go to the California and Renewables: FAQs site (<http://www.repp.org/>) and read these two articles:
 - What are the environmental benefits of renewable energy?
 - How much would it cost a household to do renewable energy?
3. After students have read these sections, ask them questions such as:

- Why do these reports suggest that communities should begin to look at alternative energy resources?
 - There were seven sources of energy described on this site. What are they?
 - What are the benefits of using renewable energy technologies?
 - Why aren't some renewable resources widely accepted today?
 - Which energy resource is cheaper in the short run? In the long run?
 - What is meant by the terms "environmental costs" and "social costs"? What are some examples of each?
4. Divide students into teams of four or five. Each team will be responsible for researching one of the following: Solar; Wind; Geothermal; Biomass; or Hydropower systems.
 5. Distribute the Renewable Energy Resources student handout and explain the entire scope of the lesson to students. Explain the final product (the vote), as well as all steps leading up to that. Be sure that the due dates are clear and recorded on the student sheets. If they aren't known yet, be sure to remind students to record them as they are determined.
 6. In their research, students could use any of the following online resources, as well as any others you find appropriate. They also could use print resources available in the classroom or library.
 - Renewable Energy, part of Energy Kid's Page from the Department of Energy, offers a basic introduction to each energy resource (http://www.eia.gov/kids/energy.cfm?page=renewable_home-basics).
 - Renewable Energy Basics (http://www.nrel.gov/learning/re_basics.html) provides more in-depth information.
 - Energy Story (<http://www.energyquest.ca.gov/story/index.html>) has a chapter devoted to each type of renewable energy.
 - The U.S. Department of Energy's Frequently Asked Questions page (<http://www.eia.gov/tools/faqs/index.cfm>) allows students with specific questions to contact specialists from the Energy Information Administration by using a tool found on the right side of the page near the middle (students will have to scroll down the page).
 7. As outlined on the student handout, after students have finished their research and one-page summaries, they should present their findings to the class. They could use PowerPoint, Excel, or other creative presentation formats.
 8. At appropriate times during the presentations, lead discussions to help the rest of the class process the information and compare the benefits and the drawbacks of each type of resource. Ask questions such as:
 - What are the potential impacts of the different types of energy?
 - What are the benefits of each?
 - What are the drawbacks of each?
 - Are there any environmental impacts from the different types of energy?
 - Are there economic impacts from the different types of energy?
 - What sort of social issues impact the use of alternative sources of energy?

- In what forms could individuals use this resource in their homes, if at all?
 - What is the greatest factor that has kept alternative energy sources from being universally accepted/adopted?
 - What is a possible solution to these challenges?
9. After listening to all class presentations, students will write a “community news article” in which they choose the type of alternative energy they feel would be the easiest to implement in wide spread use. They will use persuasive writing, for they will ultimately be trying to persuade other members of the community to adopt this alternative energy source. They should defend their choices using research.
10. Students will then participate in a mock town-hall meeting in which they will be advocates for particular energy sources. They will discuss and debate the various alternative energy sources, and at the end, participate in a class vote to determine what type of alternative energy the “town” will adopt.

Activity 2: Energy Use at Home

Introduction

Students they are going to participate in an activity to discover where and how they get the energy they use.

Materials

Computers

Products

Chart/list

Process

Day 1

1. Ask students to list all the ways they use energy in their homes. You can either do this as a class, in small groups, or with each student writing out his or her own list. Make the lists as comprehensive as possible. You should probably restrict the list to students' direct use of energy (e.g., to power their televisions, school buses), rather than including such indirect uses as providing energy for the factory that manufactures the jeans they wear.
2. Group the lists by energy source used (e.g., wood for wood stoves, sunlight for calculators, natural gas for home heating, oil/gasoline for cars). For those energy uses that run on electricity, place them in a category titled "electricity."
3. Ask the students if they can trace any of the other materials used for energy back to their original sources. Write the answers on a chart. For example, if students have wood stoves, how do they get the wood and where does it come from? Where do they get the gasoline for their cars? They should trace the energy as far back toward its origin as they can: Where does the gas station get its gasoline? Where does the school get its electricity?
4. When students are unable to trace a particular energy use back to its source, place a question mark on the chart. So, if they do not know where the gas station gets its gasoline, your chart would look as follows: Car ← gas ← gas station ← ?
5. Then assign individual students or groups of students to find answers to replace the question marks. Tell them that their job is to trace the energy back to its source and that they will be asked to report back to the full class. Several students should work together on the subject of electricity. They should find out what energy sources their local utility uses to supply electricity, where the power plants are located, and how much electricity comes from each energy source.
6. Inform students that electric appliances have a label or plate that lists how much power they require (usually in watts or amps). Have students go through their houses and record all electric appliance

power requirements for homework. Then help the students rank their uses of power from their largest use of electricity to their smallest (e.g., refrigerators use more electricity than televisions). How much power would they need to run all the appliances in their houses simultaneously for an hour? How much would it cost to do this?

Day 2

1. After students have had time to complete their homework assignments, have them report back to the class.
2. How much energy do the students use at home? How much of it comes from renewable energy sources?
3. As the students present their information, add to the chart that traces the various energy uses back to their sources.

Activity 3: Solar Box Cooker

Introduction

Students will build a solar box cooker in order to demonstrate their functionality in a developing country.

Materials

Two large corrugated cardboard boxes with flaps—one fitting inside the other with about 5 cm between them on all sides and bottom (inner box should be at least 46 x 56 cm)

A flat piece of cardboard about 20 cm longer and wider than the larger box

A light piece of glass or Plexiglas about 50 x 60 cm

A thin metal tray, painted black, about 42 x 52 cm

Dark cooking pots

Aluminum foil

Water-based glue

Lots of newspaper for insulation

String (one foot long)

A stick (approximately one foot long)

Handouts

Products

Solar box cooker

Process

1. Ask students to discuss renewable energy use in developing countries. Can renewable resources be harvested/used without advanced technology?
2. Identify particular developing countries on a map and discuss what people in those countries use for energy.
3. Show students the following video (or videos, the second one can be shown if time allows):
 - <http://www.youtube.com/watch?v=arD374MFk4w>
 - https://www.ted.com/talks/william_kamkwamba_on_building_a_windmill
4. Discuss firewood depletion in developing countries. Help students understand that the developed countries aren't the only ones experiencing resource scarcity. Ask students: what are some practical ways renewable resources can be used in developing countries?
5. Discuss solar cookers, what they are, and why they are useful. Direct students to the following websites placing particular emphasis on discussing the "Why Solar Cook?" page. Inform students that you will build a solar cooker in order to demonstrate their functionality in a developing country:
 - <http://www.solarcookers.org/basics/how.html>
 - <http://www.solarcookers.org/basics/why.html>

6. Ask students how energy gets from the sun to Earth. Ask about the difference between light and heat. Review the basics of solar energy collection, such as the storage, reflection, insulation, and heat absorption of materials with different colors and densities. You may want to have students experiment with different insulation materials and investigate the absorptive capacities of different colors before you build your cooker.
7. Build the solar box cooker, using the directions on the student handout **Note: Do not use Styrofoam for insulation. The heat could cause it to melt and emit toxic fumes.**
8. Ask students the following questions:
 - How does the solar box cooker work?
 - In what parts of the world would solar cookers work the best? the worst?
 - Are solar cookers difficult or expensive to make? Are there disadvantages to solar cookers? How do these disadvantages compare with the advantages of solar cookers, especially in less developed countries?
 - How would your life be different if your family relied on a solar box cooker to cook your food?
9. Have students research other solar cooker designs and design (and possibly build) a model of their own. Students should use their research and scientific knowledge to propose improvements to the model built in class. They should be able to explain why their model/modifications are superior and how it could positively affect someone who might rely on a solar cooker to cook all of their food.
4. Try using the cooker at different times during the school year. When does it take the longest time for food to cook? The shortest time? Why? You may want to schedule a special “solar lunch” after the cooker is built. Food can be put in the cooker one to eight hours before the lunch (Read Teacher Information Sheet).

Additional Resources

Online Resources

Primary Source

<http://sciencenetlinks.com/lessons/renewable-energy-sources/>

Reference Resources

http://www.ucsusa.org/assets/documents/clean_energy/renewablesready_fullreport.pdf

<http://www.repp.org/>

http://www.eia.gov/kids/energy.cfm?page=renewable_home-basics

http://www.nrel.gov/learning/re_basics.html

<http://www.energyquest.ca.gov/story/index.html>

<http://www.eia.gov/tools/faqs/index.cfm>

<http://www.solarcookers.org/basics/how.html>

<http://www.solarcookers.org/basics/why.html>

Educational Videos

<http://www.youtube.com/watch?v=tDB3zP9MEZc>

https://www.ted.com/talks/william_kamkwamba_on_building_a_windmill

Renewable Energy Resources

INTRODUCTION

In this lesson, you will investigate various alternative energy sources and in the end, vote on a new type of energy to be adopted by the “town.” There will be several steps, with the following guidelines and due dates.

Guidelines

1. You will be placed into a group of 4 or 5 members to research one of the following energy sources, as assigned: Solar; Wind; Geothermal; Biomass; or Hydropower. As a group, you will write a one-page summary of the energy source and prepare a presentation for the class.

The following ideas should be included in your summaries/presentations:

- How does this technology work?
- How could this energy source be used?
- What are some examples of its current use?
- What are apparent environmental impacts associated with this?
- Are there hidden environmental and social costs?
- Is this technology widely accepted today? Why or why not?
- Do the costs of this technology make it prohibitive for common use? Why or why not?

The due date for the summary is _____, and the due date for the class presentation is _____.

2. After listening to all class presentations, you will write a “community news article” in which you choose the type of alternative energy you feel would be the easiest to implement in wide spread use. You will use persuasive writing, for you will ultimately be trying to persuade other members of the community to adopt this alternative energy source. You should defend your choice using information learned in this lesson.

The due date for the article is _____.

3. Then you will participate in a mock town-hall meeting in which students will be advocates for particular energy sources. You will discuss and debate the various alternative energy sources, and at the end, participate in a class vote to determine what type of alternative energy the “town” will adopt.

The town-hall meeting and vote will be held on _____.

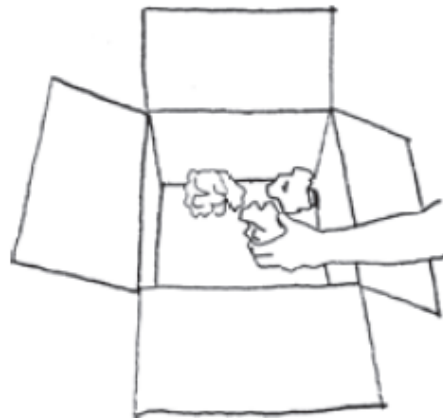
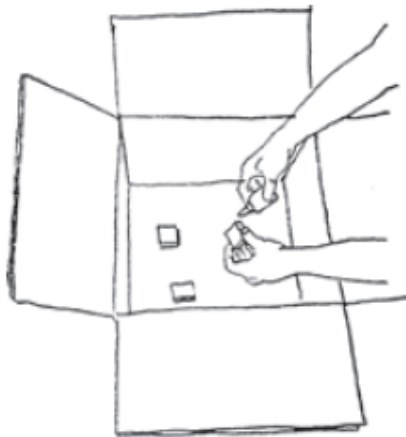
How to Build a Solar Box Cooker

STUDENT HANDOUT

1. **Glue foil on the cardboard.** Dilute the water-based glue in a bowl, so that it will last a long time and you can brush-apply it. Glue foil completely over: (a) the inside *and* outside of the smaller box (cut off the flaps), (b) the inside of the larger box, (c) the inside *and* outside of the larger box's flaps, and (d) one side of the flat cardboard piece.



2. **Add bottom supports and insulation.** Cut out 4 cm squares from the discarded smaller box flaps. Glue them on top of each other to form eight pillars 2–3 cm high. Glue these pillars inside the bottom of the bigger box to support the inner box. Tear up newspaper sheets in fourths and crumple each piece into a lemon-sized ball. Cover the bottom of the bigger box with these balls.



How to Build a Solar Box Cooker

STUDENT HANDOUT

3. **Add inner box and side insulation.** Place smaller box inside the larger box. Stuff more newspaper balls between sides of boxes.



4. **Cut the flaps of the outer box so that they fit in the inner box.** Cut them so that they can be folded over, covering the top space between the boxes as well as the inner wall of the inner box (see diagram). Fold the flaps over and glue them.



5. **Put the black tray in the box.** Paint it black if it isn't already. Use nontoxic paint.



6. **Make the lid.** Take the flat cardboard piece and center it, foil facing down, on top of the box. Fold down what sticks over the edges of the large box. You need to make four cuts in the cardboard to do this. Then, glue the folded edges of the lid together (not to the box). Make sure the lid fits snugly on the box.



7. **Glue the glass to the lid.** Cut 3 sides of a rectangle in the lid. This rectangle should be slightly smaller than the glass. Turn the lid over and glue the glass, around its edges, to the inside of the lid. Press it flat until the glue dries. If you use plastic wrap, stretch it out around the rectangular opening and tape in around the sides.



8. **Make a prop.** Bend up the cut-out rectangle in the lid so that it can reflect sunlight into the cooker. Attach a stick with string to the corner of the reflector and the side of the lid. If it is windy, you may want a prop on both sides.



You are now finished with your solar box cooker and are ready to cook!

Solar Box Cooker: Guidelines for Cooking Food

TEACHER INFORMATION

1. Put your food in covered black pots in the solar box cooker with the lid on.
2. Aim the box so the shiny side of the lid reflector faces where the sun will be in late morning (lunch) or early afternoon (supper). Tie the prop to hold the lid reflector where it shines the most sunlight into the box.

Warning: Temperatures inside the cooker can reach 275 degrees Fahrenheit. Do not leave cooker unattended in a place where it could be disturbed by other students.

3. Food cooks better:
 - on a warm, sunny day in late spring, summer, or early fall
 - if you put it toward the back of the box
 - if you adjust the cooker often so that its shadow lies directly behind it
 - if you divide the food up into small pots
4. You need not stir the food while it is cooking. If you open the box during cooking, be careful of the high temperatures inside.
5. Most importantly, put the food in early, and don't worry about overcooking—solar cookers seldom overcook. Cooking times for recommended foods are:
 - one to two hours for rice, fruit, above-ground vegetables, pretzels
 - three to four hours for potatoes, root vegetables, some beans (including lentils), most bread
 - five to eight hours for most dried beans



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