Energy Revolution

A Closer Look at Energy Sources

Due to global warming and other issues, concern for the environment grows daily. Scientists' research on alternative energy sources, such as biomass and solar energy, is often reported in the news. Consequently, students are curious about such technological advances. *The Energy Revolution* Teacher Guide serves to fuel further exploration of alternative energy. By using this guide, you have an opportunity to tap into high student interest while exposing students to broader social issues.

Participation in these lessons will lead students to make global connections and understand higher-level concepts, such as renewable energy sources and conservation principles. Students will become aware of some of the issues involved in using alternative sources of energy. They will realize that they can make a positive difference through their actions.

The lesson plans in this guide are tailored for grades 4–6 and address various subjects, such as science, language arts, economics, mathematics, and social studies. Each lesson plan is designed to stand alone. As such, they do not need to be presented in sequential order. Helpful reproducible worksheets and rubrics appear at the end of the guide. The book titles referenced in this guide include:

Biomass: Fueling Change

Generating Wind Power

Harnessing Power from the Sun

Hydrogen: Running on Water

As students investigate the topics addressed in the guide and become more aware of energy and the environment, they will sharpen their critical thinking skills to work towards creative solutions to worldwide problems. We invite you to jump in and ask questions with your class as you have fun learning more about alternative energy sources.

Developmental services by Shakespeare Squared
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National Standards Correlation

Lesson Plan Title	Correlation to National Standards
Fossil Fuel Exploration	**Science** Students should develop understanding of organisms and environments. Students should develop an understanding of properties of earth materials. Students should develop understanding of types of resources. Students should develop understanding of changes in environments. **Math** Students should represent data using tables and graphs such as line plots, bar graphs, and line graphs.
Calling All Citizens	**Social Studies** The learner can recognize the responsibility of all citizens to address societal needs, setting directions for public policies, and working to support the common good. The learner can think more deeply about how we can manage technology so that we control it other than the other way around. The learner can evaluate the impact of energy production, distribution and consumption.
Siting Your School	**Science** Students should develop the abilities necessary to do scientific inquiry. Students should develop understandings about scientific inquiry. Students should develop understanding of types of resources.
See Which Way the Wind Is Blowing	**Science** Students should develop abilities necessary to do scientific inquiry. Students should develop an understanding of transfer of energy. Students should develop understandings about science and technology.
My Friend the Photon	**Science** Students should develop understanding of types of resources. Students should develop an understanding of transfer of energy.
Find Your Place in the Sun	**Science** Students should develop abilities necessary to do scientific inquiry. Students should develop understanding of science and technology in society. Students should develop abilities of technological design. **Math** Students should represent data using tables and graphs such as line plots, bar graphs, and line graphs.

Lesson Plan Title	Correlation to National Standards
One Person's Trash Is Another Person's Energy	**Science** Students should develop understandings about scientific inquiry. Students should develop an understanding of transfer of energy. Students should develop understandings about science and technology.
Classroom Conservation Crew	**Science** Students should develop understanding about science and technology. Students should develop understanding of science and technology in society.
Stop the Press!	**Science** Students should develop understanding of organisms and environments. Students should develop understanding of types of resources. **Language Arts** Students conduct research on issues and interests. They gather, evaluate, and synthesize data from a variety of sources (e.g., print and non-print texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.

For state specific educational standards, please visit http://www.crabtreebooks.com/.

Overview and Scope of Lesson Plan Activities

Lesson Plan Title	Subject Areas	Major Concepts
Fossil Fuel Exploration	Economics Mathematics Science	• conservation • fossil fuels • renewable vs. nonrenewable resources
Calling All Citizens	Performing Arts Science Social Studies	• author's purpose and main ideas • benefits of hydrogen as an energy source • conservation tips • public service announcements • societal and environmental needs
Siting Your School	Mathematics Science	• measuring wind speed • scientific inquiry • wind energy • wind turbines
See Which Way the Wind Is Blowing	Language Arts Science	• evaluating the generation of wind power • persuasive speaking
My Friend the Photon	Science Writing	• solar energy • solar devices • writing process
Find Your Place in the Sun	Mathematics Science	• collecting and analyzing data • drawbacks of solar energy • solar collectors
One Person's Trash Is Another Person's Energy	Science Social Studies Writing	• evaluating biomass as a form of energy • forms of biomass • persuasive writing • political activism
Classroom Conservation Crew	Art Science	• author's purpose • conservation • producing and transporting energy • renewable vs. nonrenewable resources
Stop the Press!	Language Arts Science Social Studies	• conservation • renewable vs. nonrenewable resources • conducting a survey

Pacing Chart and Vocabulary

One class period is approximately 40 minutes.

Lesson Plan Title	Pacing	Vocabulary	Assessment
Fossil Fuel Exploration	1 class period	conservation fossil fuels nonrenewable resource renewable resource	Review students' graphs and answers on the reproducible.
Calling All Citizens	1 class period	fossil fuels hydrogen economy public service announcement	Evaluate student performances for accuracy of information and persuasiveness.
Siting Your School	3 partial class periods	furling horizontal axis wind turbine prevailing wind siting vertical axis wind turbine	Check data tables and questions.
See Which Way the Wind Is Blowing	1 class period	energy wind turbines	Assess presentations for accuracy, understanding of content, creativity, and persuasiveness.
My Friend the Photon	1 class period	photon solar energy	Use the reproducible to evaluate student work.
Find Your Place in the Sun	1–2 class periods	solar cooker solar hot box	Check reproducible for student comprehension of main concepts.
One Person's Trash Is Another Person's Energy	1–2 class periods	biomass persuasive letter	Check letters for appropriate focus and voice, use of language, and use of supporting evidence.
Classroom Conservation Crew	1 class period	nonrenewable resource renewable resource	Use the reproducible to evaluate student work.
Stop the Press!	1–2 class periods	conservation nonrenewable resource renewable resource	Review student surveys and evaluate student participation for accuracy of information.

Fossil Fuel Exploration

A Lesson Introducing Renewable and Nonrenewable Energy

Content

Students will strengthen their graphing abilities while learning about renewable and nonrenewable energy sources such as fossil fuels.

National Standards

The following standards will be addressed in the lesson:

Science

Students should develop understanding of organisms and environments.

Students should develop an understanding of properties of earth materials.

Students should develop understanding of types of resources.

Students should develop understanding of changes in environments.

Math

Students should represent data using tables and graphs such as line plots, bar graphs, and line graphs.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:

- Linguistic
- Logical-Mathematical
- Spatial
- Interpersonal
- Naturalist

Prerequisites

Students should read books in the *Energy Revolution* series to familiarize themselves with the concepts of renewable and nonrenewable resources as well as conservation efforts. Students should also review how to create a bar graph.

Materials

- 200 pennies
- a piece of coal
- toy pinwheel
- *Fossil Fuel Exploration* reproducible
- 4 three-ounce plastic cups per pair of students
- markers

Instructional Procedure

Anticipatory Set

Before class begins, hide 200 pennies around the room. Make sure to hide some of them in obscure places.

To begin the lesson, show students a piece of coal and ask: *Can anyone identify what I am holding? What is it used for?* (Coal. It can be burned for energy.) Then, hold up the toy pinwheel. Blow on it to start the wheel in motion. Ask: *What made the pinwheel move?* If students say "you," lead them to understand that the real force was "wind" or "air." Ask students whether they believe the supply of coal or wind is more likely to run out.

Class Discussion

Write *renewable energy*, *nonrenewable energy*, and *conservation* on the board. Ask the following questions:

What do you think renewable *means?* (It describes a source of energy that will not run out; that is, it can be renewed.)

What do you think nonrenewable *means?* (It describes a source of energy that will run out. Nonrenewable resources are permanently destroyed as we use them.)

What is an example of a renewable energy source? (wind energy, solar energy, water energy)

What is an example of a nonrenewable energy source? (coal, gas, oil, wood)

What does the word conservation *mean?* (If students have trouble answering, shorten the word to *conserve*. Ask if they can define this word alone.)

Objectives

The student will be able to…

- recognize the difference between renewable and nonrenewable energy sources
- define *fossil fuels* and *conservation*
- understand that something with a limited supply (such as nonrenewable energy sources) becomes harder to obtain over time
- create a bar graph

Activity

Place students in pairs and distribute the *Fossil Fuel Exploration* reproducible, plastic cups (four per pair), and markers. Have them label the cups 1 through 4. Tell students that they are going to be searching for a nonrenewable source of energy. Show them a penny. Explain that the penny represents a quantity of nonrenewable energy (for example, one penny = one coal deposit), and that this nonrenewable energy is hidden throughout the room.

Give students four 30-second time periods to search the room for pennies. After each search, have pairs count their pennies and record the information on the reproducible. Then, have students deposit the pennies into the cup labeled for that search. When the fourth search has ended, have each pair count their pennies and create a bar graph with the information. Have students answer the questions on the reproducible about their findings.

Have students share their results with the class. Discuss any trends you see. Point out that each search produced smaller amounts of "coal" because there was a limited supply to begin with, just like nonrenewable energy sources.

Accommodations and Extensions

Encourage students to work with a small group rather than just one other student.

As an extension, have students draw a world resource map that shows the locations of oil fields and other nonrenewable resources.

Closure

Make sure students understand the connection between the pennies and nonrenewable energy sources. Inform students that through their exploration, they discovered one of the main problems of using nonrenewable energy sources (sources are harder to find the more they are used).

Assessment

Check graphs and answers on the reproducible for accuracy.

Calling All Citizens

A Lesson on Identifying Societal and Environmental Needs

Content

Students will identify the main environmental and social issues discussed in *Hydrogen: Running On Water*. They will then synthesize the information they learned to create public service announcements to inform fellow citizens of the energy challenges our country is facing.

National Standards

The following standards will be addressed in the lesson:

Social Studies

The learner can recognize the responsibility of all citizens to address societal needs, setting directions for public policies, and working to support the common good.

The learner can think more deeply about how we can manage technology so that we control it other than the other way around.

The learner can evaluate the impact of energy production, distribution and consumption.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:

- Linguistic
- Spatial
- Bodily-Kinesthetic
- Interpersonal
- Interpersonal

Prerequisites

Students should read the book *Hydrogen: Running on Water* before proceeding with the lesson. Also, review with students the term *author's purpose* and how to identify it. Remind students that the three main purposes are to inform, persuade, and entertain.

Materials

- *Hydrogen: Running on Water* books
- *Calling All Citizens* reproducible
- paper
- pencils

Instructional Procedure

Anticipatory Set

Ask students to identify the main points in *Hydrogen: Running on Water*. Give the class time to scan through the book. Ask students what they think the author wants them to know or do as a result of having read the book.

Class Discussion

Ask students how they determined the most important ideas. Students should use examples from the book to justify their responses. Have students speculate as to what the author's purpose is in writing the book. Students should reply that the purpose is both to inform and to persuade. Point out sections of the book that signify an informative purpose. Point out other sections of the book that lead readers to believe that the purpose is to persuade the audience. Students should mention the conservation tips and also the section on page 28 where the author encourages everyone to get involved in helping the environment. Ask: *What is it that the author wants you to do?* Students should mention practical things that they can do to conserve energy.

Objectives

The student will be able to…

- identify main ideas from the text
- infer author's purpose
- work with a group to create an informative public service announcement

Activity

Divide students into small groups. Students will plan, write, practice, and perform a public service announcement that covers the following information: why fossil fuels are no longer a good choice as an energy source, the benefits of using hydrogen, the challenges we will face restructuring our economy to run on hydrogen, and what people can do to get involved. Distribute copies of the *Calling All Citizens* reproducible. Have students complete the reproducible to help them gather and organize their information. The commercial should be engaging and include a slogan. Have students perform their commercials for the class.

Accommodations and Extensions

Students can use the Internet to research the cost and availability of products that run on hydrogen fuel cells to gather supportive data for the public service announcements.

As an extension, have students write letters to state representatives asking what their state is doing to address the energy crisis.

Closure

Ask students if they would be willing to buy hydrogen powered products even if they were more expensive than the other options.

Assessment

Evaluate student performances for accuracy of information and persuasiveness.

Siting Your School

A Lesson on Wind Energy

Content

Students will practice scientific inquiry while learning about siting and wind energy.

National Standards

The following standards will be addressed in the lesson:

Science

Students should develop the abilities necessary to do scientific inquiry.

Students should develop understandings about scientific inquiry.

Students should develop understanding of types of resources.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:

- Logical-Mathematical
- Interpersonal
- Bodily-Kinesthetic
- Naturalist

Prerequisites

Students should read the book *Generating Wind Power* before proceeding with the lesson. Review with students how wind can be used as a renewable energy source.

Materials

- *Generating Wind Power* books
- sewing needle (1 per group)
- 30 cm heavyweight thread (1 per group)
- table-tennis balls (1 per group)
- protractor (1 per group)
- masking tape
- pencils and paper
- *Siting Your School* reproducible

Instructional Procedure

Anticipatory Set

Write the word siting on the board. Explain its definition. Read the case study about Spirit Lake Elementary School from *Generating Wind Power. Ask: Is it possible for something like this to work at our school?*

Class Discussion

Review important terms from *Generating Wind Power*, such as *horizontal axis wind turbine, vertical axis wind turbine, furling,* and *prevailing wind*.

Have students brainstorm a list of possible places to build a wind turbine at your school. Tell students that wind turbines are useful in places where the wind blows steadily at 13 kilometers per hour. Discuss students' ideas aloud and create a list of possible locations. Tell students they are going to be measuring the wind speed over the course of the next three days at two of the locations. They are going to be siting the school, trying to determine which location would be best suited for a turbine. You should choose the two most appropriate locations from the list.

Objectives

The student will be able to…

- define important terms that deal with wind energy
- measure wind speed at various locations around school
- determine the best location for a wind turbine near school
- evaluate the use of wind as an energy source

Activity

Students will build a device to measure wind speed. Distribute the sewing needles, thread segments, table-tennis balls, protractors, and tape. Have students follow these directions to make the device:

1. Tie a large knot in one end of the thread and use the needle to pull the thread through the table-tennis ball.
2. Tape the opposite end of the thread to the center mark on the protractor.

Take students to the first location you decided upon to measure the wind speed. Have students place their backs to the wind and hold the protractor so the curved edge is facing the ground. Ask students to read the angle where the thread crosses the protractor's curved edge as the wind blows. They should record the data on the *Siting Your School* reproducible. Have students use the table on the reproducible to convert this angle into a speed measurement. Repeat the procedure at the second location. Have students take wind measurements over the next two days. Once students have recorded all measurements, ask them to complete the follow-up questions on the reproducible.

Accommodations and Extensions

Place students in mixed-ability groups.

As an extension, ask students to research the locations of wind turbine plants around the country.

Closure

Compare and contrast student data in a class discussion. Decide on the location for a wind turbine. Mention to students that this is the process scientists would follow, only scientists would use more precise instruments and work on a much larger scale.

Assessment

Check reproducibles for accuracy.

See Which Way the Wind Is Blowing

A Lesson on the Advantages and Disadvantages of Generating Wind Power

Content

Students will appraise the generation of wind power as they develop their persuasive speaking abilities.

National Standards

The following standards will be addressed in the lesson:

Science

Students should develop abilities necessary to do scientific inquiry.

Students should develop an understanding of transfer of energy.

Students should develop understandings about science and technology.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:

- Interpersonal
- Linguistic
- Logical-Mathematical
- Spatial

Prerequisites

Have students read *Generating Wind Power* before proceeding with the lesson. Particular attention should be paid to "Energy at Work," "Wind Turbines," "Wind at Work," and "The Drawbacks," which explain energy, the generation of wind power, and the disadvantages of said generation.

Materials

- *Generating Wind Power* books
- *See Which Way the Wind Is Blowing* reproducible
- poster board and/or construction paper
- scissors
- glue
- markers

Instructional Procedure

Anticipatory Set

Ask: *What is energy?* Solicit responses from students and then define energy as the capacity to work or make something happen.

Class Discussion

Ask: *What sources of energy exist in the world?* Answers may include wind, solar, biomass, water, and sun. Ask: *Why do some people care about conserving energy?* Hold a general discussion in which you invite students to share their thoughts and knowledge with the class.

Objectives

The student will be able to…

- evaluate the generation of wind power
- work collaboratively in small groups to formulate an argument for or against the generation of wind power
- design and illustrate a visual aide
- present an argument persuasively to the class

Activity

Have students use their copies of *Generating Wind Power* to complete the *See Which Way the Wind is Blowing* reproducible. Explain to students that they will use the reproducible to help them understand arguments for and against generating wind power. They will need to know these arguments well in order to try to persuade their peers to vote for or against using wind power.

Divide students into small groups. Assign groups a position *for* or *against* wind power. Tell students to argue for the option they were assigned. Allow small groups to brainstorm arguments and ideas. Distribute poster board and markers for them to illustrate their arguments. After students have prepared their visual, have each group defend their position to the class.

Accommodations and Extensions

Place students in mixed-ability groups. Encourage students with reading difficulties to take a leading role in designing the visual aide for the group.

As an extension, combine the small groups to form two larger groups (one *for* and one *against* wind energy). Arrange a debate on the subject. Invite students from other classes to watch the debate and decide which side is more convincing.

Closure

Once each group has presented, ask students to think about the arguments they have heard and vote *for* or *against* generating wind power. After the students vote, stress that each form of energy has its advantages and disadvantages and that it is the job of scientists to continue to develop and improve sources of energy.

Assessment

Assess each small group's presentation for accuracy, understanding of content, creativity, and ability to persuade.

My Friend the Photon

A Lesson on Solar Energy

Content

Students will write creatively and express ideas through illustrations while learning about the generation of solar power.

National Standards

The following standards will be addressed in the lesson:

Science

Students should develop understanding of types of resources.

Students should develop an understanding of transfer of energy.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:

- Verbal-Linguistic
- Spatial
- Naturalist

Prerequisites

Have students read *Harnessing Power from the Sun* before proceeding with this lesson. Review with students how we can create energy from the sun.

Materials

- *Harnessing Power from the Sun* books
- a children's picture book
- pencils and paper
- *My Friend the Photon* reproducible

Instructional Procedure

Anticipatory Set

Read a children's picture book to the class. Explain to students that children's books have few sentences because they allow the pictures to tell the story. Announce to students that they are going to create a picture book. The book will detail the journey of a photon from the sun to the point where humans can use it as energy.

Class Discussion

For students to understand solar power and what they are going to write about, discuss the following questions:

How does the sun produce energy?

What types of devices collect solar energy?

How does the energy get from the collector to the location where it will be used?

What can we use solar energy for?

Objectives

The student will be able to…

- define *photon*
- identify the different types of solar collectors
- track the journey of a photon from the sun to usable energy

Activity

Have students use *Harnessing Power from the Sun* as a reference while writing. Encourage students to make the photon the main character of the story and give it a name. Students should also provide colorful illustrations and use proper grammar, punctuation, and spelling. Have students share their stories when completed.

Accommodations and Extensions

Encourage English language learners to work with a partner while writing their stories.

As an extension, have students create similar picture books for other alternative methods of energy production.

Closure

Stress the importance of knowing about and using alternative sources of energy. Remind students that they should share what they have learned with members of their family and community.

Assessment

Use the *My Friend the Photon* reproducible to evaluate student work for accuracy and creativity.

Find Your Place in the Sun

A Lesson on Simple Solar Devices and Solar Collectors

Content

Students will participate in scientific inquiry and create solar hot boxes. Students will also collect and analyze their data as well as the data.

National Standards

The following standards will be addressed in the lesson:

Science

Students should develop the abilities necessary to do scientific inquiry.

Students should develop understanding of science and technology in society.

Students should develop abilities of technological design.

Math

Students should represent data using tables and graphs such as line plots, bar graphs, and line graphs.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:

- Interpersonal
- Naturalist
- Logical-Mathematical
- Verbal-Linguistic

Prerequisites

Have students read *Harnessing Power from the Sun* before proceeding with the lesson. Review main concepts concerning solar energy.

Materials

- *Harnessing Power from the Sun* books
- *Find Your Place in the Sun* reproducible
- shoe boxes without lids (students may bring to class)
- construction paper (a variety of different colors)
- clear cellophane
- aluminum foil
- thermometers
- masking tape
- scissors

Instructional Procedure

Anticipatory Set

Have students read pages 12 and 13 of *Harnessing Power from the Sun*. Have each student write a one-sentence summary for the following sections: "Solar Heated Water," "Solar Space Heating," and "Solar Cookers."

Class Discussion

Have volunteers share their summaries aloud. Write the term *solar hot box* on the board. Explain that a solar hot box is a simple device that collects and uses the sun's energy to heat items placed inside it. A solar hot box is very similar to a solar cooker. Discuss the difference between solar cookers and hot boxes and flat-plate collectors. Explain that solar cookers and hot boxes do not transfer the heat with pipes or fans. They only heat something placed inside them.

Objectives

The student will be able to…

- define types of solar collectors and differentiate between them
- construct a simple solar collector
- collect and analyze data to determine best materials/colors for solar heat
- identify drawbacks of solar energy

Activity

Challenge students to create a solar hot box that will collect the most solar energy, or will be the hottest. Each student should bring a shoe box to class. Distribute sheets of construction paper and aluminum foil to students. Tell students that they should choose one type of material, colored paper or foil, to cover the inside of the box and another to cover the outside. Have students tape the materials they've chosen to the box. Ask them to cut a small hole in the box. This is where they will insert a thermometer later on. Then, instruct students to cover the opening of the box with cellophane. You may want to construct your own solar hot box with aluminum foil on the inside and black paper on the outside beforehand. Later, students will be able to compare their data to yours.

On a sunny day, have students bring the solar hot boxes outside to take heat measurements. Distribute the *Find Your Place in the Sun* reproducible. Using the thermometers, students should measure the temperature inside the boxes every minute, for ten minutes. Take your own measurements as well. Make sure students record their temperature readings on the reproducible.

Back in the classroom, instruct students to generate line graphs and answer the follow-up questions on the reproducible. Ask students to share their data. Discuss which materials or colors seemed to work best. If no students have results similar to yours, share your data with the class. Make sure you lead students to find that aluminum foil inside the box and black paper on the outside were the best materials to use.

Accommodations and Extensions

Have students take measurements every two minutes so they only have to plot five temperature readings. They will still be able to see the temperature trend by doing this.

As an extension, have students create a chart that lists the best material combinations to the worst for conducting heat energy.

Closure

Ask students to brainstorm conditions outside that could help or hinder solar energy usage. Briefly review the different types of solar collectors.

Assessment

Check reproducible for student comprehension of main concepts.

One Person's Trash Is Another Person's Energy

A Lesson on Evaluating and Explaining Biomass

Content

Students will assemble information about biomass and articulate their thoughts on using alternative sources of energy in a persuasive letter to a senator.

National Standards

The following standards will be addressed in the lesson:

Science

Students should develop understandings about scientific inquiry.

Students should develop an understanding of transfer of energy.

Students should develop understandings about science and technology.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:

Linguistic

Logical-Mathematical

Prerequisites

Have students read *Biomass: Fueling Change* before proceeding with the lesson. If possible, students should have access to computers with a word processing program.

Materials

- *Biomass: Fueling Change* books
- *One Person's Trash Is Another Person's Energy* reproducible
- computers with printing capabilities or pen and paper
- envelopes
- stamps

Instructional Procedure

Anticipatory Set

Ask: *What can people who care about the environment do to get others to change their habits?* Solicit responses from students. If no student mentions writing to Congress, then mention it as another way people can be catalysts for change.

Class Discussion

Ask: *Why do people write to their senators?* Solicit responses from students. Answers may include: to express displeasure, to express concern, and to bring about change. Tell students that they will be writing a letter to a senator about biomass as a form of energy.

Objectives

The student will be able to…

- identify and explain the world's energy problems and the forms of biomass available
- evaluate biomass as a form of energy
- write a persuasive letter to a senator recommending an energy plan for the state or the United States as a whole

Activity

Distribute and have students complete the *One Person's Trash Is Another Person's Energy* reproducible. They should use *Biomass: Fueling Change* as a reference as they write a persuasive letter about biomass to a senator.

Tell students that the body of the letter should include the following:

- their name, age, and school
- the reason why they are writing (because they are learning about biomass in science class)
- some facts about biomass
- a suggested plan of action for the state or the United States
- a thank you for reading the letter

If possible, students should type the letter on a computer. Students should turn the first draft in for feedback before mailing the letter.

Accommodations and Extensions

Provide extra assistance with the writing of the letter to students with developmental delays and English language learners. Allow such students to work with a partner to draft the letter.

As an extension, have students research another source of energy from the Energy Revolution series and include that information in the letter.

Closure

Mail student letters. Explain that you hope the letters will help make a difference. Encourage students to report back if they receive a response.

Assessment

Check letters for appropriate focus and voice, use of language, and use of supporting evidence.

Classroom Conservation Crew

A Lesson on the Importance of Energy Conservation

Content

Students will gain a better understanding of the energy required to produce the materials they use on a daily basis at school. Students will then apply conservation principals to create persuasive posters to place in appropriate areas of the school.

National Standards

The following standards will be addressed in the lesson:

Science

Students should develop understanding about science and technology.

Students should develop understanding of science and technology in society.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:

- Linguistic
- Logical-Mathematical
- Spatial
- Interpersonal
- Naturalist

Prerequisites

Have students read any of the books in the *Energy Revolution* series before proceeding with the lesson. Particular attention should be focused on the conservation tip boxes.

Materials

- books from the *Energy Revolution* series
- chart paper
- poster board
- markers
- rulers
- *Classroom Conservation Crew* reproducible

Instructional Procedure

Anticipatory Set

Ask students to think about the products, such as paper, or resources, such as water, that they use each day at school. They should think about the things that they use for class as well as the supplies they use throughout the building. List these products or resources on the board. Have students think about where these things come from.

Classroom Discussion

Create a flow chart showing the steps required to manufacture and transport a widely-used product in schools—paper.

grow trees
⇩
cut trees
⇩
truck transports wood to a mill
⇩
the mill produces woodchips from the wood
⇩
woodchips are then transported by train to paper factory
⇩
paper factory creates paper
⇩
paper trucked to warehouse
⇩
paper trucked from warehouse to school

Discuss the type of energy used throughout the process. Ask students to classify the type of energy as *renewable* or *nonrenewable*.

Objectives

The student will be able to…

- define *renewable* and *nonrenewable* resources
- identify the energy required to produce and transport the materials used on a daily basis at school
- work in a group to create conservation posters to display in the school building

Activity

Place students into small groups. Assign each group a product or resource that is used at school. The group will design a conservation poster. The poster should name the item being used, explain why it's important to conserve it, and offer some practical suggestions for how students can use the item wisely. Posters should be appealing. Be sure to go over expectations for the project by presenting the information on the *Classroom Conservation Crew* reproducible. Each group should begin by assigning tasks (who will work on what). Each member of the group will produce a plan for their part of the project. Each group will then reconvene to decide on the layout of the poster. Provide students with art materials to create their poster. Display posters around the school building.

Accommodations and Extensions

English language learners may benefit from a short lesson on word parts. Divide the terms *renewable* and *nonrenewable* by prefix, base word, and suffix.

As an extension, have students investigate their school's recycling program. How could they improve it?

Closure

Ask students how they will decide whether their conservation campaign has had an impact on the school. Accept all responses. Put one of their suggestions into action.

Assessment

Use the *Classroom Conservation Crew* rubric to check student posters for accuracy and creativity.

Stop the Press!

A Lesson on Alternative Energy Sources and Conservation

Content

Students will practice their interviewing skills while learning about conservation, renewable energy, and nonrenewable energy. They will learn actions that they and their families can take to help conserve.

National Standards

The following standards will be addressed in the lesson:

Science

Students should develop understanding of organisms and environments.

Students should develop understanding of types of resources.

Language Arts

Students conduct research on issues and interests. They gather, evaluate, and synthesize data from a variety of sources (e.g., print and non-print texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.

Multiple Intelligences

The following intelligences will be activated throughout the lesson:

- Verbal-Linguistic
- Interpersonal
- Naturalist

Prerequisites

Have students read books from the *Energy Revolution* series. Review the difference between renewable and nonrenewable energy sources and the positive effects conservation has on the environment.

Materials

- *Energy Revolution* books
- *Stop the Press!* reproducible (5 per student)
- pencils

Instructional Procedure

Anticipatory Set

Discuss student answers to the following questions:

What kind of energy sources do you use in your home?

Do you prefer one source to another?

Class Discussion

Have students brainstorm ways people can conserve energy in their homes. List student suggestions on the board.

Objectives

The student will be able to…

- recognize a variety of ways to conserve energy
- gather information about energy and conservation by surveying adults
- organize results of a survey and discuss them with the class

Activity

Tell students that they are going to gather information from the community. They will interview five adults, using a survey you provide, about energy usage and conservation. Remind students that the adults should be people they know and trust, such as family members, neighbors, or other teachers.

Distribute copies of the *Stop the Press!* reproducible. Check for student understanding of the questions listed on the survey. Remind students that they may learn new ideas from the adults they interview, or they may be able to provide the adults with some helpful conservation tips. Remind them that the purpose of a survey is to collect information, so they need to take careful, accurate notes. Give students several days to complete their surveys. Have students give short news reports of their findings once the interviews have been completed.

Accommodations and Extensions

Students can work with a partner to conduct their interviews.

As an extension, have students turn their findings into a newspaper article. If several students write articles, the class can compile a one- or two-page newspaper (using desktop publishing software, if available).

Closure

Discuss survey results with the class. Ask students if they learned any new ideas for conservation and write them on the board. Tell students that they have learned the importance of conservation and its effects on the environment, and that even the smallest of efforts can make a difference.

Assessment

Each student should interview at least five people. Review student surveys and evaluate student participation for accuracy of information. Students' notes should be thorough and reliable.

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Name _____ Date _____

Fossil Fuel Exploration

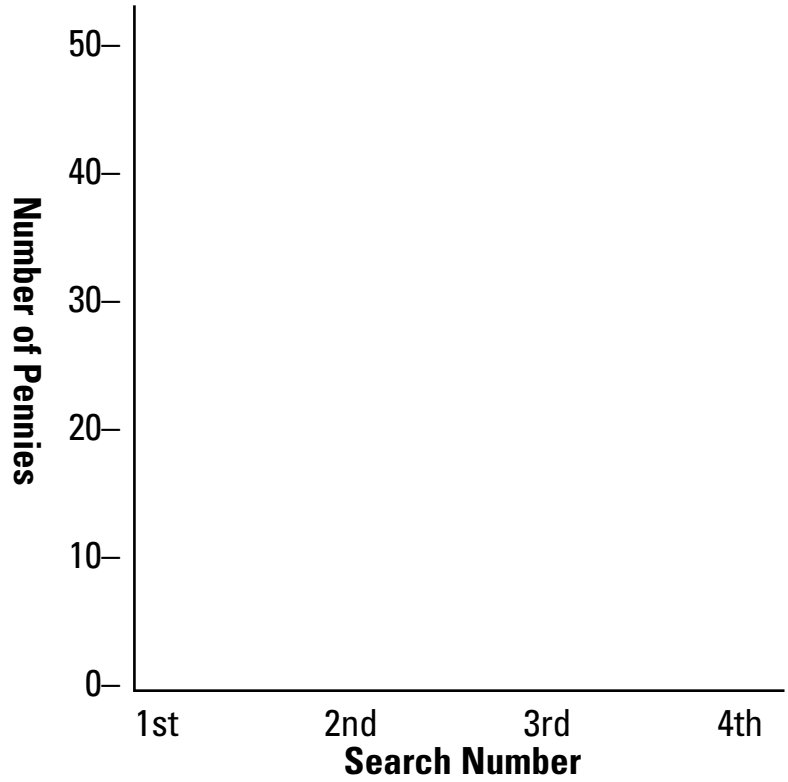
Directions: In this activity, you will search for coal deposits (in the form of pennies). After each 30-second search, count the pennies, record the total below, and deposit the pennies into the correctly numbered cup. After the fourth search make a bar graph to show the number of pennies you found during each search.

First search: _____

Second search: _____

Third search: _____

Fourth search:_____



Follow-up Questions

1. Look at your graph. In which search did you find the most pennies?

2. What is the difference between the number of pennies you found in your most productive search and your least productive search?

3. Why do you think it became harder to find pennies?

4. What does your graph tell you about the future of coal and other nonrenewable resources?

Name _____ Date _____

Calling All Citizens
Public Service Announcement

Directions: Answer the following questions to help you prepare your announcement.

1. What is the purpose of your public service announcement?
   What are you trying to tell people?

2. What are the reasons that fossil fuels are no longer a good energy source?

3. What are the benefits of using hydrogen fuel cells?

4. What challenges will our society face in switching to a hydrogen economy?

5. What can the American people do to get involved?

6. What slogan are you going to use?

Name _____ Date _____

Siting Your School

Directions: Use the charts below to record your angle and wind speed measurements for each day. Then answer the follow-up questions at the bottom.

Day 1

Location	Angle	Speed
1.		
2.		

Day 2

Location	Angle	Speed
1.		
2.		

Day 3

Location	Angle	Speed
1.		
2.		

Angle	Wind Speed (km/h)
90°	0
85°	6
80°	8
75°	10
70°	12
65°	13
60°	15
55°	16
50°	18
45°	20
40°	21
35°	23
30°	26
25°	29
20°	33

Follow-up Questions

1. Find the average wind speed for each location.

Location 1: _____km/h Location 2: _____km/h

2. Which location had the highest average wind speed?

3. Which location had the lowest average wind speed?

4. Are either of the locations suited for building a wind turbine? Why or why not?

Name _____ Date _____

See Which Way the Wind Is Blowing

Directions: Write three reasons that support the idea of generating wind power and three that do not support it. Use your book to help you.

Three reasons in support of wind power:

1. _____

_____

2. _____

_____

3. _____

_____

Three reasons against wind power:

1. _____

_____

2. _____

_____

3. _____

_____

Name _____ Date _____

My Friend the Photon Rubric

Category	Score 4=Exemplary 3=At Standard 2=In Progress 1=Emerging
Accuracy of Journey • Includes all steps of process • Each step is accurately depicted • Steps are in proper order	
Story Details • Characters are developed • Language for children • Not too much writing per page	
Grammar, Punctuation, and Spelling	
Illustrations • Focus of page • Bright and colorful • Neat	

Total: _____ / 16

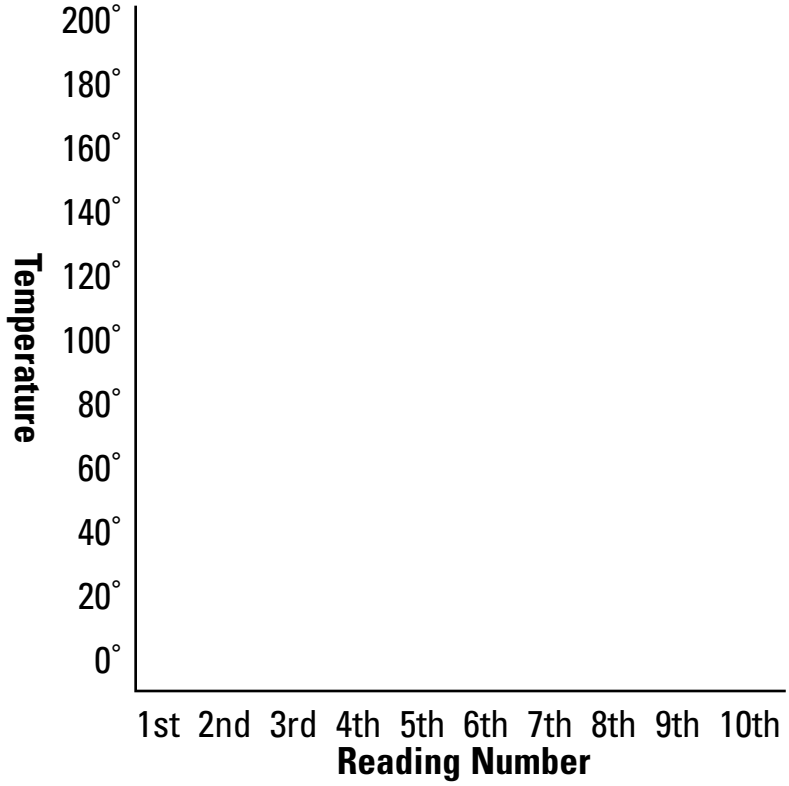
Name _____ Date _____

Find Your Place in the Sun

Directions: Place your thermometer in the box and take heat measurements every minute for ten minutes. Record your measurements below, and then create a line graph on the bottom of the page. When you are finished with your graph, answer the follow-up questions.

Temperature Measurements

1._____	**6.** _____
2._____	**7.** _____
3._____	**8.** _____
4._____	**9.** _____
5._____	**10.** _____



Follow-up Questions

1. What is a solar hot box?

2. What was the highest temperature your box reached?

3. How many minutes did it take to reach this temperature?

Answer the following question after the class discussion:

4. Which color/material best attracted the sun's energy? What was the highest temperature it reached?

Name _____ Date _____

One Person's Trash Is Another Person's Energy

Directions: Write a rough draft of your persuasive letter on the lines below. Use the following questions to guide your thinking:

- What is biomass?
- What are some energy problems we face today?
- What is plant power?
- What happens when people burn garbage?
- What is biogas?
- What is biofuel?
- What are the drawbacks to using biomass?
- How can we make a change?

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Name _____ Date _____

Classroom Conservation Crew Rubric

	Below Expectation	Met Expectation	Above Expectation
resource named			
why it's important to conserve			
suggestions for conservation			
spelling			
grammar			
punctuation			
visually appealing			
worked well in a group			

Name _____ Date _____

Stop the Press!

Directions: Before you begin asking questions, politely introduce yourself and say that you are conducting a survey on energy and conservation. Then, ask the person if he or she would mind answering a few questions about energy usage.
Always close the interview by thanking the person for his or her time!

Questions

1. What kind of energy is used in your house, natural gas or electricity? Do you use any other such as solar?

2. Do you use the lowest heat setting when cooking with your stove?

3. Do you put on a sweater or cover up with a blanket when you get chilly, or do you turn up your thermostat?

4. Do you keep your refrigerator at its coldest setting?

5. Do you use cold water instead of warm or hot water to wash your clothes?

6. Do you hang your clothes outside to dry, or do you use a dryer?

7. Do you use new compact fluorescent light bulbs?

8. Do you use the microwave instead of the oven whenever possible?

9. Do you use both sides of a piece of paper whenever possible?

10. Do you always make sure the dishwasher is full before running it?

11. Do you always turn off the TV, DVD player, and computer after using them?

12. Do you turn off lights when you leave a room?