

ENERGY RESOURCES

Grade Level or Special Area: 6th grade

Written by: Sally Ferrelle, Oglethorpe Charter School, Savannah, GA

Length of Unit: 6 lessons (12 days)

I. ABSTRACT

This unit on Energy Resources studies the forms of energy and the ways in which energy is used in our society. Students work in cooperative groups to explore the issues of fossil fuels and nuclear wastes that are current in today's society. A variety of teaching strategies are used, including whole group, small group, and individual work, as well as cooperative groups. At the end of the unit, students are asked to recycle items and create an art object illustrating what they have learned during the course of the unit.

II. OVERVIEW

A. Concept Objectives

1. Describes how energy and work are related.
2. Recognizes the major energy sources people use today to meet their energy needs.
3. Recognizes the use of alternate energy sources.
4. Recognizes the effects human beings have on pollution and the environment.

B. Content from the *Core Knowledge Sequence*

1. Energy, p. 164
 - a. Six forms of energy: mechanical, heat, electrical, wave, chemical, nuclear.
 - b. The many forms of energy are interchangeable, for example, gasoline in a car, windmills, hydroelectric plants.
 - c. Sources of energy: for example, heat, mechanical motion.
 - d. Fossil fuels: a finite source. Carbon, coal, oil natural gas. Environmental impact of fossil fuels: carbon dioxide and global warming theory, greenhouse effect, oil spills, acid rain.
 - e. Nuclear energy: Uranium, fission, nuclear reactor, radioactive waste. Nuclear power plants: safety and accidents.

C. Skill Objectives

1. Explain how fuels provide energy.
2. List the three major fossil fuels.
3. Explain why fossil fuels are considered nonrenewable resources.
4. Identify and describe various sources of energy not dependent on fossil fuels.
5. Describes different forms of energy.
6. Compare and contrast nuclear fission and nuclear fusion reactions.
7. Identify the parts of a nuclear power plant.
8. Defines and investigates energy sources such as solar, wind, geothermal heat, nuclear, fossil fuels, and hydroelectric power.
9. Identify things that individuals can do to conserve energy.
10. Distinguish between kinetic and potential energy.
11. List and describe the categories of hazardous wastes.

III. BACKGROUND KNOWLEDGE

A. For Teachers

1. *Science Explorer-Environmental Science*, Prentice Hall.
2. E. D. Hirsch, Jr. *What Every 6th Grader Needs to Know*.

B. For Students

1. Water cycle, grade 2
2. Ecology, grade 3

3. Electricity, grade 4

IV. RESOURCES

- A. *Windows on Science- Energy Resources, vol. 2*
- B. *Energy and Safety: Science Activities for Elementary Students*
- C. *Energy, Creative Teaching Press*
- D. *Energy: How does it impact our lives?*
- E. Alternative energy kit
- F. Laser disc player
- G. Overhead projector

V. LESSONS

Lesson One: Fossils Fuels (2 days)

- A. *Daily Objectives*
 1. Concept Objective(s)
 - a. Recognizes the major energy sources people use today to meet their needs.
 2. Lesson Content
 - a. Types of fossil fuels
 3. Skill Objective(s)
 - a. Explain how fuels provide energy.
 - b. List the three major fossil fuels.
 - c. Explain why fossil fuels are considered nonrenewable resources.
- B. *Materials*
 1. Different kinds of chocolate chip cookies
 2. Toothpicks
 3. Paper clips
 4. Fossil fuel extraction worksheet (Appendix B)
 5. *Science Explorer-Environmental Science*, Prentice Hall.
 6. *Silent Spring*, Rachel Carson
 7. KWL chart (Appendix A)
- C. *Key Vocabulary*
 1. Fossil fuels – Coal, petroleum, and natural gas.
 2. Hydrocarbons – Chemical compounds whose main feature is a long chain of carbon atoms bonded to hydrocarbon atoms.
 3. Combustion – Burning; a chemical reaction that involves the rapid combination of a fuel with oxygen.
 4. Petrochemical – Any material made from substances found in oil or natural gas.
- D. *Procedures/Activities*
 1. Read the first chapter aloud to the students from *Silent Spring*, by Rachel Carson. Have the students close their eyes while reading this selection so they can visualize the scene. Have a class discussion about what they think the reading is about.
 2. Use the KWL chart to introduce the unit to the students. The students will record responses on their chart to keep in their notebook.
 3. Read and discuss pp. 164-170 on Fossil fuels in textbook. Students work on answering section questions at the end of the lesson.
 4. Fossil fuel extraction activity – students work in cooperative groups to complete activity, using materials supplied by teacher. The teacher will have cookies, toothpicks, paper clips, and the handout for the groups to use while working on

the assignment. Students will show understanding of the topic as they answer the questions on the worksheet.

- E. *Assessment/Evaluation*
1. The students will complete a worksheet on energy to show understanding of topic covered in class.
 2. Teacher observation during fossil fuel extraction activity.

Lesson Two: Renewable Sources of Energy (water, solar, hydroelectric) 2 days

- A. *Daily Objectives*
1. Concept Objectives
 - a. Recognizes the use of alternate energy sources.
 - b. Describes how energy and work are related.
 2. Lesson Content
 - a. Sources of energy
 3. Skill Objectives
 - a. Identify and describe various sources of energy not dependent on fossil-fuels.
 - b. Describes different forms of energy.
 - c. Defines and investigates energy sources such as solar, water, hydroelectric power.
 - d. Distinguishes between kinetic and potential energy.
- B. *Materials*
1. *Science Explorer-Environmental Science*, Prentice Hall
 2. Paper cups
 3. Dowels
 4. Straws
 5. Soup cans
 6. *Windows on Science-Energy Resources*, vol. 2.
 7. Energize handout (*Windows on Science*)
 8. Water wheel handout (*Energy and Safety: Science Activities for Elementary Students, Level III*)
 9. Overhead projector
 10. Clear transparency sheets
 11. Jigsaw lesson (Appendix C)
- C. *Key Vocabulary*
1. Potential energy – the energy an object has because of its position, rather than its motion.
 2. Solar energy – The energy the Earth receives from the sun, primarily as visible light and other forms of electromagnetic radiation.
 3. Renewable resource – Any resource, such as wood or solar energy, that can or will be replenished naturally in the course of time.
 4. Kinetic energy – The energy an object has because of its motion.
- D. *Procedures/Activities*
1. The teacher will begin a class discussion by asking the students to summarize what they studied in class the day before and cover the questions answered on the fossil fuel extraction activity.
 2. Jigsaw lesson on pp. 171-180 in the textbook. Students are placed in five different groups and given instructions on a section to read in the lesson. They fill out the handout and use the transparency sheets to illustrate their notes. The groups share

their information with the rest of the class using the overhead projector. After all groups have shared their notes; the handout should be filled in with the most important information.

3. Pass out Energize handout. As students watch the Windows on Science lesson on T.V., they will highlight vocabulary words and energy types on handout.
4. Use materials supplied by the teacher to make a water wheel in cooperative groups. The teacher will supply paper cups, dowels, soup cans, scissors straws, and the handout to the groups to complete the activity.
5. Students will write a ½ page paragraph about how the water wheel works and why it is used as a source of energy.
6. Students will look in newspapers/magazines for articles on energy and bring in one to share with the class.

E. *Assessment/Evaluation*

1. Teacher observation of student participation during construction of water wheel.
2. Teacher uses rubric to grade groups on their presentation during the jigsaw lesson.

Lesson Three: Renewable Sources of Energy (wind, geothermal, biomass) 2 days

A. *Daily Objectives*

1. Concept Objectives
 - a. Recognizes the use of alternate energy sources.
 - b. Describes how energy and work are related.
2. Lesson content
 - a. Sources of energy
3. Skill Objectives
 - a. Identify and describe various sources of energy not dependent on fossil fuels.
 - b. Describes different forms of energy.
 - c. Defines and investigates energy sources such as wind, geothermal heat, and biomass fuels.

B. *Materials*

1. *Windows on Science- Energy Resources, vol. 2*
2. Windmills worksheet (*Discover Science, Teacher's Resource Book*)
3. Pencils
4. Colored paper cut into 4 squares
5. Pushpins
6. Scissors

C. *Key Vocabulary*

1. Geothermal energy – energy obtained by tapping underground reservoirs of heat, usually near volcanoes or other hot spots on the surface of the earth.
2. Biomass – Material in growing or dead plants.
3. Gasohol – A mixture of gasoline with alcohol derived from plants.

D. *Procedures/Activities*

1. Students share articles on energy with the rest of the class.
2. Windows on Science lesson – watch together in class, have students take notes and fill in chart on sources of energy.
3. Windmills activity – pass out scissors, colored paper cut in squares, pushpins. Students cut paper squares into 2 triangles and arrange them on the pencil eraser. They use the push pin to attach them and then blow on the paper to make it spin around. Afterwards they fill in the questions on the worksheet about windmills.

4. Review with the students the forms and sources of energy studied so far to prepare them for a short quiz the next day.
- E. *Assessment/Evaluation*
1. Teacher observation during windmill activity.
 2. Teacher checks charts for accuracy and completion.

Lesson Four: Nuclear Energy (2 days)

- A. *Daily Objectives*
1. Concept Objectives
 - a. Recognizes the major energy sources people use today to meet their energy needs.
 2. Lesson Content
 - a. Types of nuclear energy
 3. Skill Objectives
 - a. Compare and contrast nuclear fission and nuclear fusion reactions.
 - b. Identify the parts of a nuclear power plant.
 - c. Defines and investigates energy sources such as solar, wind, geothermal heat, nuclear, fossil fuels, and hydroelectric power.
- B. *Materials*
1. Teacher-made quiz (Appendix D)
 2. *Science Explorer-Environmental Science*, Prentice Hall
 3. Dominos
 4. Ruler
 5. Marie Curie video
 6. Chain reaction handout (*Windows on Science*)
- C. *Key Vocabulary*
1. Nuclear fission – A nuclear reaction in which a single large nucleus splits into two or smaller nuclei.
 2. Nuclear fusion – The combining of two small atomic nuclei to form a larger nucleus, sometimes with the release of energy.
 3. Nuclear reaction – A reaction that changes the number of protons or neutrons in the nucleus of an atom.
 4. Chernobyl – A place in Ukraine where a nuclear power plant – a generator powered by a nuclear reactor – underwent a meltdown in 1986.
- D. *Procedures/Activities*
1. Pass out student quiz on forms and sources of energy for students to complete in class.
 2. Read pp. 181-185 in textbook on Nuclear Energy, students answer questions and define words from lesson. Students will also draw a model of a nuclear fission and nuclear fusion reaction to compare how they work.
 3. Domino activity – students work in cooperative groups to complete activity about nuclear chain reactions. They use the materials supplied by the teacher to model chain reactions.
 4. Students will watch a video on Marie Curie and take notes. They will write a ½ page summary about the movie to turn in for a grade.
- E. *Assessment/Evaluation*
1. Teacher observation during completion of the domino activity.
 2. Grade given for the quiz on forms and sources of energy.
 3. Students will read their summary about the video on Marie Curie.

Lesson Five: Hazardous symbols (2 days)

- A. *Daily Objectives*
1. Concept Objectives
 - a. Recognizes the effects human beings have on pollution and the environment.
 - b. Recognizes the major energy sources people use today to meet their energy needs.
 2. Lesson Content
 - a. Types of hazardous symbols
 3. Skill Objectives
 - a. List and describe the categories of hazardous wastes.
- B. *Materials*
1. *Windows on Science-Energy Resources, vol.2*
 2. Paper bag filled with different plastic items
 3. Handout to complete with plastic activity
 4. Toxic Wastes handout (*Windows on Science*)
 5. *Science Explorer-Environmental Science*, Prentice Hall
 6. Plastics handout (*Waste in Place*)
- C. *Key Vocabulary*
1. Toxic waste – A general term used to refer to chemical compounds produced by industry which, if they are ingested or breathed in by humans, can cause physiological damage.
 2. Radioactive waste – Radioactive materials that may be left after a commercial or laboratory process has been carried out.
 3. Three Mile Island – The location of an accident in 1979 in a nuclear power plant
–
an electrical generator powered by a nuclear reactor – in Pennsylvania.
- D. *Procedures/Activities*
1. Read pp. 130-134 on Hazardous Wastes in textbook orally in class, students define words and answer questions.
 2. Students draw hazardous symbols to put in binder to study.
 3. Plastics activity – pass out paper bags to each cooperative group. Each group classifies the items and logs them onto a worksheet. Students complete math percents to see if their bag had the percentage shown on the chart for each category. Class discussion about their findings after the activity has ended.
 4. Color the Toxic Wastes worksheet according to the directions and complete questions to show understanding of the lesson.
- E. *Assessment/Evaluation*
1. Teacher observation during plastics activity.
 2. Grade given for Toxic Wastes worksheet.

Lesson Six: Energy Conservation (2 days)

- A. *Daily Objectives*
1. Concept Objectives
 - a. Recognizes the effects human beings have on pollution and the environment.
 2. Lesson Content
 - a. Ways to conserve our energy sources
 3. Skill Objectives
 - a. Identify things that individuals can do to conserve energy.
- B. *Materials*

1. *Science Explorer-Environmental Science*, Prentice Hall
 2. Magazines with lots of ads and pictures.
 3. Flip book pages (*Energy and Safety: Science Activities for Elementary Students, Level III*)
 4. Scissors
 5. Glue
 6. Markers/colored pencils
 7. Envelope pattern
- C. *Key Vocabulary*
1. Solar cells – Devices, usually made of semiconductors, that convert sunlight directly into electric current.
 2. Insulator – A material that does not easily transmit energy, such as electric current or heat.
- D. *Procedures/Activities*
1. Read orally pp. 187-190 on Energy Conservation in textbook, students answer questions and define any words.
 2. Pass out pages on Generating energy – students cut out pictures and paste them onto the correct squares. Color and staple pages together to make a flip book about sources of energy.
 3. Pass out envelope pattern for students to cut out. Have a stack of magazines for each group to look through to find a picture to use for their envelope. Students cut out an envelope using scissors and fold together.
 4. Review with students for assessment test on energy resources.
- E. *Assessment/Evaluation*
1. Teacher observation when making flip book and recyclable envelope.
 2. Students fill in last column on KWL chart to turn in to teacher.

VI. CULMINATING ACTIVITY (Optional)

- A. Students will take a trip to the water treatment plant or a recycling center in town to observe ways the water is being recycled. They will then write a ½ page summary/reflection about their trip upon return to school and share it with the class.
- B. Students will be given a handout with various activities on it. They choose one of the activities on recycling to complete and bring it in to share with the class. Teacher uses a rubric to grade these activities (Appendix E).
- C. Teacher-made test on Energy Resources. After finishing the test, the students will circle items on pollution scene picture that show pollution and then color the picture.

VII. HANDOUTS/WORKSHEETS

- A. KWL chart on Energy Resources
- B. Fossil fuel extraction activity
- C. Jigsaw lesson on Renewable resources
- D. Energy Resources Quiz #1
- E. Energy & Resources final product

VIII. BIBLIOGRAPHY

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Appendix A

KWL Chart on Energy Resources

What I know	What I want to Learn	What I Learned

Appendix B

Name _____ Class _____ Date _____

Fossil Fuel Extraction: Instructions and Data

Your teacher will provide you with a cookie. This cookie represents a land area that may contain deposits of coal (represented by raisins), oil (represented by pieces of nuts), and/or natural gas (represented by chocolate pieces). You will also be provided with a toothpick, which represents the mining and drilling equipment used in obtaining the coal, oil, and natural gas.

Your job is to try to remove as much of the coal, oil, and natural gas as possible with as little damage to the environment as possible.

Imagine that the top surface of the original cookie is an area of land on which various kinds of plants and animals live.

In the space below, sketch the cookie surface before and after” mining.”

Also, record the amounts of the various resources that you were able to obtain and the amount of “waste” generated. (**Estimate:** about _____ % of the original cookie.)

Before Mining

After Mining

--	--

Resources recovered (as % of the original cookie):

_____ % coal (raisins)

_____ % natural gas (chocolate)

_____ % oil (nut pieces)

_____ % waste (crumbs and pieces)

Name _____ Class _____ Date _____

Fossil Fuel Extraction: Questions

1. What are some problems associated with obtaining and using coal?

2. What can be done to reduce or avoid these problems?

3. What are some problems associated with obtaining and using oil?

4. What can be done to reduce or avoid these problems?

5. How can saving electricity help reduce the need for mining and shipping coal?

6. List some ways that you could reduce your electricity use.

7. How can reducing gasoline consumption reduce the need for mining, shipping, and refining oil?

8. List some ways that you could reduce the need for oil?

9. What are some advantages and disadvantages of natural gas as an energy source?

Appendix C
Jigsaw Lesson on Renewable Sources of Energy

Each group reads their assigned section. They then decide on the most important points (definitions, pictures, words in bold print). These points are written down on this sheet and on a blank transparency. Using the overhead projector, each group shares with the rest of the class what they have determined to be the most important points of their selection. The rest of the class members write down the notes until all the sections are completed.

Group 1. Pages 171-173 Energy from the Sun -

Solar Technologies –

Group 2. Pages 174-175 Capturing the Wind –

The power of flowing water –

Group 3. Pages 175-176 Tidal Energy –

Biomass Fuels –

Group 4. Pages 177-178 Tapping Earth's energy –

Hydrogen Power –

Group 5. Pages 180 Hydroelectric Dams -

Appendix D

Energy Resources Quiz #1

Name _____

Match the following words to their definition:

- | | |
|----------------------------|------------------------|
| 1. Combustion _____ | 2. Reserves _____ |
| 3. Petrochemicals _____ | 4. Refinery _____ |
| 5. Hydrocarbons _____ | 6. Petroleum _____ |
| 7. Fossil fuels _____ | 8. Water cycle _____ |
| 9. Geothermal energy _____ | 10. Biomass fuel _____ |

- a. Liquid fossil fuel, oil.
- b. Known deposits of fuels.
- c. Fuel made from living things.
- d. A repeating process, by which water on earth's surface evaporates, condenses, and falls back to earth, then repeats.
- e. The burning of a fuel.
- f. An energy-rich substance formed from the remains of organisms.
- g. A factory where crude oil is separated into fuels and other products.
- h. Heat from the earth's interior.
- i. A compound that contains hydrogen and carbon atoms.
- j. Compound made from oil.

Complete the following questions:

11. The three major fossil fuels are _____, _____,
and _____.

12. Because fossil fuels take hundreds of millions of years to form, they are
considered _____.

13. Explain how fuels provide energy.

Appendix D cont.

14. Name two ways that you can reduce the need for fossil fuels.

a.

b.

15. What did you learn about the problems of fossil fuel extraction in the class activity?

16. Name three examples of biomass fuels.

a.

b.

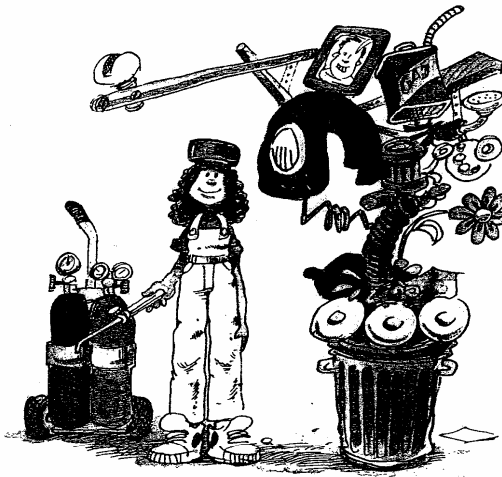
c.

Bonus : 5 points

Pioneer and Indian children used what as firewood?

Appendix E

Pick one activity to complete. A poster should be colored and labeled neatly. Follow all instructions completely for the activity you choose.

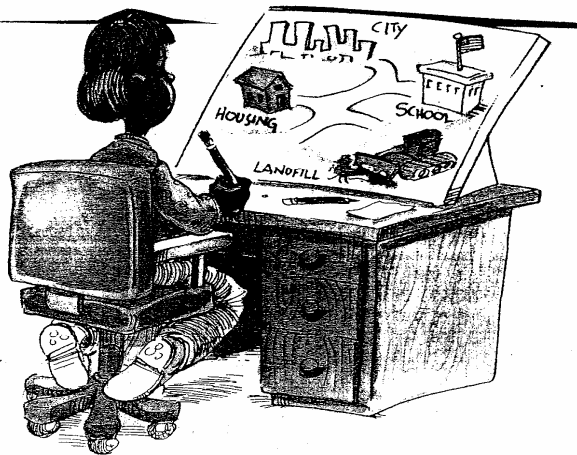


Trash Artist Make a sculpture, a musical instrument, or a toy out of trash. Use only recyclable items, no food that can spoil.



Poster Artist Design a poster that makes people realize that they can save energy by recycling.

City Planner Many people don't want to live near a landfill. Design a city with all the necessary structures: schools, houses, a water treatment plant, roads, landfill, and anything else you think is necessary. Will your city need an incinerator? Use posterboard to draw your city on or Make a model.



Appendix E cont.

<p>Building a Structure: Energy Resources</p> <p>Teacher Name: <u>Mrs. Ferrelle</u></p> <p>Student Name: _____</p>

Category	4	3	2	1
1. Construction-Materials	Appropriate materials were selected and creatively modified in ways that made them even better.	Appropriate materials were selected and there was an attempt at creative modification to make them even better.	Appropriate materials were selected.	Inappropriate materials were selected and contributed to a product that performed poorly.
2. Construction - Care Taken	Great care taken in construction process so that the structure is neat, attractive and follows plans accurately.	Construction was careful and accurate for the most part, but 1-2 details could have been refined for a more attractive product.	Construction accurately followed the plans, but 3-4 details could have been refined for a more attractive product.	Construction appears careless or haphazard. Many details need refinement for a strong or attractive product.
3. Plan	Plan is neat with clear measurement and labeling for all components.	Plan is neat with clear measurements and labeling for most components.	Plan provides clear measurements and labeling for most components.	Plan does not show measurements clearly or is otherwise inadequately labeled.