

Helping Our Planet's Environment
Investigating Energy: An Interdisciplinary Unit
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SUV's, the Internet, digital TV, space shuttles, Mir.....the new and exciting developments of the millennium, all promising to improve the standards of living and all using some form of energy. Every living creature needs energy to survive. It invades every sector of our lives. Energy sources come in many different forms. Though we can not see energy, we can measure its effects. We can not destroy it we can only waste it.

About twenty years ago several countries decided to temporarily stop selling oil to the United States. Months later we became painfully aware of how much we depend on having an abundant and constant supply of oil. The long lines at the gas stations were only one result for the oil embargo. Gasoline and oil prices caused the cost of many other items to increase. This was the first stage of the energy crunch. It is vital that everyone learns the importance of energy and the necessity of conservation of energy. If society is to conserve energy, we must start with our youngest users. They are our "**HOPE**" for tomorrow. They can learn to " Help Our Planet's Environment".

Introduction

The purpose of this unit to develop an understanding of how consumption of energy will affect the school the community, the environment, as well as to develop an understanding of the importance and value of energy so that our children can also Help Our Planet's Environment.

This unit was designed to fit the needs of all elementary children. Many times when one thinks of science they have a vision of vigorous high level activities. Well, this unit will not only challenges the highest level student but even bring success to the lowest level student. Integrated in this unit are all the disciplines of education. It especially focuses on Language Arts and Technology.

With the dawn of the new millennium comes the Science Math and Communications standards. The students will incorporate the above standards through four thematic units. Each unit will last for one to two days. The last unit will result in a culminating activity for Earth Week.

The unit will incorporate the following standards:

Science

- Explaining how scientific principles of chemical, physical and biological phenomena have developed and relate them to real world situations.

- Developing and applying skills of observation, data collection, analysis, pattern recognition, prediction and scientific reasoning in designing and conducting experiment and solving technological problem.
- Evaluating the impact on current and future life of the development and use of varied energy forms.

Communications

- Writing for a variety of purposes, including to narrate and persuade.
- Exchanging information orally, including understand and giving spoken instructions, asking and answering questions appropriately and promoting effective group communication.

Mathematics

- Evaluating, inferring and drawing conclusions from charts, tables and graphs, showing the relationships between data and real-world situations.

What is Energy?

Energy is the capacity for action, to do work or produce heat. It exists in two forms: kinetic and potential energy. Suppose you have a book in your hand and you slowly raise and lower the book. A force pulls the book down. This force is the weight of the book caused by gravity. Instead of gravity pulling on the book, a spring holds the book to the floor. As the book is raised the spring will stretch. A spring that is pulled out of its normal shape has energy stored in it. This energy cannot be seen but we know it is there because the stretched spring applies force over a distance to another object as it returns to its normal shape. Energy that is stored in an object as a result of a change of position is called potential energy. A spring gains potential energy when it is stretched.

When relaxed, a stretched spring releases potential energy stored in it. A book held above a floor releases its potential energy if it is allowed to fall. The potential energy stored in the book held above ground is changed into energy of motion as it falls. Energy that an object has as a result of its motion is called kinetic energy. An object that is moving in any direction has kinetic energy.

Energy can be classified in various forms including: mechanical, thermal, chemical, electrical, radiant and atomic. All forms are interconvertible. In the process of transformation either kinetic or potential energy may be gained or lost, but the sum total of the two always remains the same.

Thematic unit #1 understanding energy through literature

Objective

Listen to The Lorax and make comparison between the environment of the Lorax and the real world's environment.

Call the students to the meeting area. Begin to recite The Lorax by Dr. Seuss to the

children. Afterwards have the children make a comparison between The Lorax and the world's environment. Give them a few minutes to talk about it with their group. Have the recorder of the group write down the comparisons and later present their list.

Objective

The children will define energy.

Ask the students what they think the Oncler (from The Lorax) used to run his factory and/or what do they think caused the pollution that occurred in The Lorax? Once the children have come up with the correct response, have the students discuss what they believe energy to be. In groups of three or four, the children will create a list of items in their house and in the school that use energy. The reporter will share the group's ideas. After the discussion the teacher will give the scientific definition of energy.

Objective

Differentiate between potential and kinetic energy.

Review the definition of energy emphasizing potential and kinetic energy. Blow up a balloon and ask the children at what point are you creating potential energy according to the definition. Then ask at what points would kinetic energy occur. Arrange the children in groups of three or four. The students will receive paper cut into four equal sections, two unsharpened pencils, four, small paper plates, 8 stick on erasers that have been cut in half, thick cardboard, balloon string and tape. To assemble see inserts

After testing the vehicle suggest wind as one way to move it. Ask can you think of other types of energy that could make the vehicle go. Have the children list the ways.

Types of Energy

Thermal energy is related to the concepts of temperature. It is associated with random molecular motion within any medium. Increases of heat energy contained in any substance results in a temperature increase.

Electrical energy is the physical phenomena resulting from the existence of charge and from the interaction of charges.

Radiant energy is the process of transmitting energy through space. It consists from waves or particles. Radiant energy includes such forms as visible light, radio waves, radar waves, infrared, ultra violet and x-rays.

Atomic energy or Nuclear energy occurs during the splitting or fusing of atomic nuclei.

Chemical energy is the energy stored in certain chemicals and released by a chemical reaction, often combustion. Wood, coal, natural gas or oil when burned

releases chemically stored energy in the form of heat energy. Chemical energy in the United States is the energy of choice.

Thematic unit #2 types of energy

Objectives

The student will explore various types of energy through classroom stations.

Ask the children to name as many types of energy they know. Once the children brainstorm as a group, create the list of energy types (cues might be necessary). The list should include chemical, atomic, thermal, radiant, mechanical and electrical. Set up the energy stations with an example of each type of energy present. As the children go to each station they will complete a journal page answering the questions in full sentences.

◆ Station 1 Chemical Energy

Take the temperature of vinegar and record the information. Mix baking soda with the vinegar and take the temperature again. Record the information and answer questions in the journal.

◆ Station 2 Atomic Energy (simulated activity)

Take a half a teaspoon of sugar. Take one crystal and try to cut the crystal in half. Complete a journal page.

◆ Station 3 Thermal Energy

Take a plastic, foam and a glass cup filled with luke-warm water. Take the temperature of each cup every minute for five minutes. Record and complete a journal page.

◆ Station 4 Radiant Energy

Take a box wrapped in white paper and a box wrapped in black paper put a hole in the side of each box. Put a thermometer in each hole. Place them under a light. Take the temperature every minute for five minutes. Record and complete the journal page.

◆ Station 5 Mechanical Energy

Pull a nail out of a piece of wood. Feel the nail and record. Feel A whistle before and after it is blown. Record.

◆ Station 6 Electrical Energy

Create a simple flash light using two wires, a battery, and a small bulb. Complete a journal page.

Objective

The student will create a word bank.

In the children's journal they should create a word bank that contains all of the new vocabulary they have learned (energy, potential, kinetic, chemical, atomic, thermal, radiant, mechanical, electrical). Throughout this unit the students should continue keeping a word bank.

The Fuel Eras

(Before 1885)

Wood was the first and major source of energy. Extensive forests grew in many parts of the world so wood was readily available. By the 1860's, however, wood was becoming scarce. The forests close to homes had been cut down and wood had to be brought from great distances. Because it had to be transported, wood became costly.

(1865 -1950)

The fuel situation changed from wood to charcoal during the Middle Ages to reduce ore in metals. During the onset of the Industrial Revolution charcoal was replaced by coke from coal. People slowly found that coal produces three times as much energy than wood at half the cost. This caused rapid growth of the coal industry.

(1950 - Present)

The petroleum era began when a commercial well was brought into production in Pennsylvania in 1859, although petroleum had been used for centuries as medicine and for buildings. American oil industries expanded rapidly to make oil products from crude oil. Their principle product was kerosene, which was traded all over the world. The invention of the internal combustion engine and the automobile created another gasoline and yet another heating oil replaced coal in many energy markets, hence the beginning of the depletion of fossil fuels.

Fossil Fuels

Millions of years ago, the remains of plants and animals were buried under rock, mud and water. These remains were slowly changed into the three fossil fuels: coal, oil and natural gas.

Out of the three, coal is the most abundant fossil fuel. It is 80% recoverable. Coal recovery begins with mining. Large machines dig it out of the ground then load the coal onto small railroad car or conveyor belts that bring it out of the mines. Over half of all electrical power plants are powered by coal.

The second most abundant fossil fuel, Natural Gas, is also found underground. It can be located with or without crude oil. Natural gas has no odor. Because of it's lack of smell, once piped out of the ground an odor is added before it is sent to homes and buildings. Its primary use is to provide warmth in homes and buildings, and to furnish heat for use in industry.

Oil, the least abundant of the fossil fuels, is found beneath the earth trapped in holes or cracks. Power drills move the earth to reach the oil then it is pumped out of the ground. About 1 /3 of the oil is pumped out easily, the rest is more difficult and costly to remove. Primary uses of oil include gasoline and other fuels for transportation. It is also made into many chemicals used to produce products such as plastics, fabrics and medicine.

Thematic unit #3 fossil fuels

Objective

Discover where fossil fuels are found.

Call the children to the meeting place. Begin the session by asking the children to define a fossil fuel. After listening to several answers begin to tell the story of fossil fuels. Millions of years ago plants and animals lived on our planet earth. When those plants and animals died, they were covered by water, rock and mud. Over the years pressure from the substances turned the plants and animals into fossil fuels - oil, coal and natural gas. Begin to draw a picture of where the three fossil fuels are located in the ground and have the children reproduce a three dimensional picture as a group. Use sand and/ or potting soil to represent the dirt, aluminum to represent oil, cotton to represent natural gas and charcoal bricks to represent coal.

Objective

Find methods for recovering the greatest amount of oil.

Explain to the children that of the three forms of energy oil is the hardest to recover, yet it is the most widely used fossil fuel. The children will then be placed in groups of three to four. Each group will receive a large bottle, oil, 36 cm tube, tub and water. Have the children create a way to recover as much oil as possible without tipping the bottle over. After the activity, call the children to the meeting area. Have a discussion of the way they extracted the oil. Solicit answers to the question do you think the earth will ever run out of oil. Using an overhead, show the children a time line of when oil will be exhausted. Prepare them for the next unit, conservation.

Renewable and Nonrenewable Energy Sources

In dealing with energy resources and energy use, it is often necessary to distinguish between renewable and nonrenewable resources. The Nonrenewable resources are those that could be exhausted within a relatively short period of time as a result of our exploiting them. Some examples of nonrenewable resources are all the fossil fuels and some types of geothermal energy. Renewable resources can never be consumed to completion. Examples of renewable resources are solar, geothermal and tidal energy.

Conservation

In the past energy seemed very plentiful. Energy was cheap and people did not worry about their wasteful use of energy. Americans had big houses and big cars. We became so dependent on oil that we began buying energy from other countries.

Today 90% of energy resources used in the world come from fossil fuels. At this present rate of use fossil fuels, except for coal, may not last much longer than the life times of people living now. It is said that at this rate of consumption oil and natural gas will be depleted by the year 2060.

With the United States in a persistent pattern of consuming more energy than we are producing, we will soon revisit another energy crisis. In this period there will be a major turn towards cars with greater fuel efficiency, improved standards for building insulation and various energy conservation measures in industry.

Thematic unit #4 conservation activities

Objective

Devise a take home checklist of electrical appliances with times used, and graph the recorded information.

Begin by reviewing information about fossil fuels. Ask the children how many times a day they think we use energy. Explain to the children that energy is used constantly in our homes. To demonstrate the constant use of energy have the children take home the check list, reminding the children that they should bring it back in the next day. The next day should begin with a discussion of how many items in the home actually use energy. Then the children are to take the results of their checklist and graph their own data. At the end of this lesson have the children write in their journals their reactions to this experiment.

Objective

Categorize list necessity versus pleasurable.

Review the last lesson. Conduct the following surveys: number of TVs the children have at home, the number of hours that the TVs are in use and the necessity of the TV. Define necessity and give examples of things that are a necessity. Using a Venn Diagram the groups will take their list and categorize the items into things that are considered to be pleasurable and things that are considered to be a necessity. The reporter should then present their list and decide if the items are in the correct categories.

Objective

Create a list of ways humans waste energy.

The children will be given one list containing a mixture of everyday wasteful activities and everyday conservative activities. Individually they will review the lists deciding which is conserving energy and which is wasting energy. Call the students to

the meeting area asking them to bring their paper. Begin a discussion of their answers. Ask the children are there are any other ways in which people waste energy and create a list. As a follow up, have the children pay close attention to their usage of energy.

Objective

Solve problems that show the impact of energy waste.

Review energy usage. In groups of two, have the students solve problems using actual data from a graph or a chart. See insert.

Objective

Interview five people and find out how they save energy.

As a follow up activity, have the children interview five adults on ways they save energy. Prior to interviewing, have the children make up at least five questions they will ask while conducting the interview. Give the students about two to three days to return the homework then have the student present their findings.

Thematic unit #5 letter writing

Objective

Write a letter to the Department of Energy to ask for more information.

Explain to the children that there are programs in the country that regulate energy usage. Ask the children if they know of any programs. Once the children have exhausted their answers give them some examples. Explain to the children that these programs develop various ways energy is conserved. The students will write one of the programs to ask for suggestions for additional ways to conserve energy. Assign the children different programs to write to. They can do this activity in groups of two or individually. If the children have access to the Internet the teacher may even want to research some programs and then have the children write the programs via e-mail.

Objective

Write a letter to parents explaining their purpose and requesting assistance in conserving energy at home.

To involve the parents have the children write a letter to inform parents about project H.O.P.E. and their efforts in conserving energy. The children should then ask their parents if they can help them with this effort. The student will include in the letter a list of energy conservation ideas to be used at home.

Environmental Issues

Energy resources are crucial to modern society and allows us to enjoy many conveniences today. We must understand that we are a part of the larger picture and that our well-being is dependent upon the well-being of the planet. It was only in the 1960's that "ecology" or the study of interrelationships between organisms and the environment,

became popular as society became aware of the role and responsibility we had to our environment.

Energy use and power production can have significant environmental effects. For instance, air pollution results from increased energy consumption. Air pollution is a concern to almost everyone, especially if you happen to live in the metropolitan area. People and plant are affected by air pollution far from its source. Gases, small particles of solids called particulates, or small droplets of liquid suspended in a gas called aerosols, are found as pollutants in the air. Carbon monoxide, sulfur oxides, particulate matter, hydrocarbons and nitrogen oxides are emitted in the greatest quantities by our human activities.

This abundance of pollution has caused a serious break down of the ozone layer in our atmosphere. The true culprit, chlorofluorocarbons (CFC's), has increased each year since the 1970's. Scientist predict that if we do not find ways to reduce these chemicals then the hole in the ozone layer will continue to increase in size.

Thematic Unit #6 Environmental Issues

Objective

Determine the types of particulate matter in the air and compare the particulate matter collected from different locations.

Introduce environmental issues with simple facts. Ask children if there is a ways that we can see how much the air is polluted. Once children have come up with answers begin the experiment. Take 6 - 8 Petri dishes and spread vegetable oil or Vaseline on each dish. Set each dish in various places in and around the building of your school. After two - three days collect the dishes and examine. Discuss how the particles collected are related to vegetation, industry, or other factors at each location. Remind students that the evidence of air pollution collected is particulate matter. Discuss harmful effects of the material collected.

Alternative Energy Resources

With such great dependence on nonrenewable resources, *we* can make our present resources last longer by using only what we need. Energy for future generations can be assured if we will begin now to make use of alternative energy sources.

Oil shale is a rock that was formed millions of years ago. Containing the remains of plants and animals, it was partly formed into oil. When shale is extracted out of the ground, crushed and heated, it is turned into a liquid oil. The United State has large quantities of shale and companies are desperately working on ways to produce oil from shale at lower cost.

Geothermal energy is the heat that comes from the inside of the earth. Hot rock underneath the earth's surface causes water to steam above it. Companies use this steam heat to power the geothermal plant. However, geothermal plants can only be built in certain places on earth.

Solar energy or sun power can be used to make electricity. This type of energy plant uses large mirrors to catch the heat from the sun. It is then generated into electricity. Again, these plants can be very costly.

Wind power has been a source energy production for thousands of years. Ships have sailed the seas using wind power. We too can use the power of the wind. By using something as simple as a windmill, we can generate enough electricity to power an entire city. However, this type of power can only be produced where wind blows at a consistent rate.

Tidal power is another source of energy. As the tide moves in to shore and out to sea the power of water can be used to produce energy. Unfortunately, tidal power plants can only be built where there is a great difference between high and low tide. There are very few such places in the world.

The energy source generally thought to be the leading energy source of the future is called nuclear fusion. In fusion, two atoms of hydrogen are joined together to produce heat. Hydrogen atoms used in fusion are plentiful. There are enough of them to supply the world with electricity for thousands of years, but it is very difficult to produce electricity from nuclear fusion.

A more futuristic type of energy would be bioconversion. This means changing matter from living things into energy. The matter can be plants or even things such as paper and food that were once in living form. These things can be changed into liquid and gas fuels to power things like automobiles.

Thematic unit #7 alternative methods

Objective

Discover and explore alternative energy.

Begin this session by asking “if fossil fuels are exhausted what other sources of energy can be used?” Once all answers are depleted then introduce the alternative methods of energy (geothermal, solar, wind, tidal, nuclear fusion and bioconversion). Use visual aids to show the children how each one works. Then guide the children through an activity demonstrating each type of energy. As the children go through each activity they will be asked to complete a journal page which they must answer in complete sentences.

- ◆ Geothermal - Watch a documentary on Old Faithful
- ◆ Solar-the making of sun tea.
Prior to the lesson the teacher should put all materials on the table (jar, water, tea bags and timer). Simulate sunlight using a grow lamp. Have the children add the water and the tea bags to the jar. Observe and illustrate. Then have them place their jars under the grow lamp. Every fifteen minutes they should observe and write their observations. While the children are waiting to make their next observation, have the children answer questions in their journal about the pros and cons of solar cooking.
- ◆ Wind- measure the effects of wind power.
In groups of three or four the children will construct a simplistic boat using soap, a 10 cm thin stick and cloth or paper that has been cut into triangles. Fill a large sink or water table with water. Place the boats in the water towards the end of the table and using a fan to simulate wind, the children will record the distance the boat moved. Do this three times and come up with the average distance. Discuss way that the children can design the boat so that it is more effective. As an extension to the lesson the student can redesign the boat.
- ◆ Tidal power -observe energy released by tidal power.
This session will occur as a demonstration lab. The teacher should construct a simulated ocean (see insert). Call the children to the meeting area. Display the simulated ocean. Introduce the activity. Explain to the children that they will be observing tidal energy. Demonstrate the activity by tipping the bottle then laying it flat on the table and counting the number of times the boat moves back and forth. The children should record the number of times the boat moves back and forth and complete the journal page.
- ◆ Nuclear fusion- Read a pamphlet on Three Mile Island
- ◆ Bioconversion - Measure the temperature of a compost
In this session begin by defining bioconversion. Ask the children what are some items they ate for lunch that could be put in this compost. Have some of those things and pull them out as they answer. Once they have exhausted all answers begin placing the lunch items in a container and cover using plastic wrap. Close the lesson. The next day have the children observe and take the temperature again. Discuss the results. Discuss what use this type of energy may have. Close session.

Thematic Unit #8 planning

Objective

Create a conservation classroom plan.

Remind the children about the interviewing activity. Corporations also have an action plan for conserving energy. Explain that schools are similar to corporations and

they too must have a plan. As a whole brain storm some ideas to conserve energy in the school. List four to five ways that the class can put the plan into action.

Objective

Create a personal mission to develop a conservation plan.

At the conclusion of this unit have the students generate their own personal conservation plan. Prepare the children for the next unit by explaining to them that their personal unit will be the first step in understanding and celebrating Earth Day.

Thematic Unit #9 Earth Week Activities

Objective

Understand the importance of the earth.

Mural - Design an energy mural entitled "Help Our Planet's Environment"

Use a roll of paper approximately 4-6 feet long (depending upon space). To alleviate repetition, assign each class to design a concept of one type of energy. Students will first draw their concepts then paint them.

Energy Encyclopedia - Design an energy encyclopedia (used as an assessment)

Students will be given a list of words from A to Z. The students will write an energy concept for each word and illustrate that concept.

Conservation Quilt - Create a conservation quilt

Using their portfolios, the students in groups of four, will be assigned an energy conservation concept. Using index cards, they will be asked to design the conservation concept. Each group will put their patches (index cards) together and the teacher will group each patch to make a class quilt. To make the quilt fancy you may want to use border or strips of construction paper. Each class quilt will be connected to make a very large quilt.

Sun Print - Create a sun print

Using various colors of construction paper, the students will place objects (pennies) on the paper and place them in a sunny area. If a sunny area is not available, use a grow light. The students will remove the object daily and record their observations.

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