Energy Revved Up

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The Background information, student activities, and resource information of this unit is the result of participating in the following programs. The Pittsburgh Teacher Institute seminar, *Energy and the Environment*, at Carnegie Mellon University, facilitated by Dr. Richard Holman, and the July Intensive Yale-New Haven Teacher Institute seminar, *Human-Environment Relations: International Perspectives from History, Science, Politics, and Ethics*, facilitated by Dr. John Wargo. Visitors are welcome to use the content and ideas of the unit as a springboard to helping primary age children become *Energy Wise and Environmentally Aware.*

Introduction

Energy is: *What we get from eating food. When you play ball. Running, jumping, and. playing. What you use to turn the TV on. Riding a bike. Power. When you use your muscles to do something hard.*

The previous statements are typical answers that were repeatedly given by many of my third grade students when ask; What is Energy? Although their answers are fundamentally correct, for students at this age and grade level a much better well-rounded knowledge about the concept of energy should be developed. The importance of this subject is realized at all levels of government as well as all levels of educational institutions. Nevertheless, there is very little is being done to provide an adequate *Energy* and *Environmental* curriculum for use in our classrooms. As a result of this lack, often activities pertaining to this subject are done during Earth Week celebrations or in recognition of Arbor Day. These types of activities should not be allowed to take the place of providing our children with an *Environmental Education* any longer. Why? Because while we take for granted the ease of turning on a television, using a microwave, playing electronic games, ironing our clothes, running hot water for a bath, or just turning on the light, none of these activities would be possible without the availability of *Energy*. Children need to know and understand that human existence depends on the availability of *Energy*. Also, that the source from which most of our energy is produced, Fossil Fuels, is a finite commodity. Therefore, we should employ ways of conserving it. The subject of conservation leads to the topic of the second part of this unit, *The Environment.*

As educators if we were to ask our youngest student the simple question: What do people need to live? They would almost without thought tick off the answers, air food, water, and shelter. An accurate answer and a great segue to the question: Do the people of the world have a right to clean air, clean water, a food supply free from harming chemicals, and shelter reasonably maintained to provide safety and not hidden dangers? The answer is YES! There are many laws to make sure that our rights are not infringed upon and that we do indeed reside in a safe environment. However, for as many laws there are, there is as much/probably more evidence to support the fact that our environment has many ills

that effect the physical and neurological well being of many people.

Young students should know that while the water they drink, the air they breath, and the food they eat may look good, it's not necessarily so. They should be aware that all people play a role in bringing to light environmental concerns and issues in order to bring about change. They may begin to examine as young citizens actions they may take to assure a clean and safe environment.

While it is not the intent to frighten young children it is intended that the activities of this unit be the cog between knowledge and understanding that will assist them in being aware of their responsibility as Caretakers of the Earth. As educators, we must realize that the children in our classrooms today, will be the responsible productive citizens of the future that develops the means by which, alternative energy will be made available for consumption and the World's environment will truly sustain life free of agents that affect our well being.

We can agree that *Energy and the Environment* is an enormous and encyclopedic subject and to attempt to thoroughly study it would be overwhelming at any stage of learning. **ENERGY REVVED UP** is an Energy and Environment unit that offers developmentally appropriate information enhanced with hands-on activities to intensify children's understanding of basic energy theory. Energy topics that will be investigated are: 1) What is Energy, 2) Energy sources, 3) How is energy supplied, 4) How is energy used, 5) Energy safety, and 6) Energy checklist. In the second part of the unit, **THE ENVIRONMENT: Who's Responsibility Is It?** Topics will focus on environmental issues and concerns that will allow young students to be consciously aware of their immediate environment. Student will consider such topics as 1) Conservation, 2) Hidden environmental risk, 3) Changes in the environment, and 4) environmental advocacy.

Goal

The entire unit activities are geared to help primary age children develop an appreciation for the gift of *Energy* and awareness of *environmental* concerns and issues. Newly acquired knowledge will hopefully result in students formulating an action plan on how they can be Energy Wise and Environmentally Aware. It is also a goal of this unit to provide educators adequate background information that can be utilized as basic foundational information for facilitating the activities young learners will engage in as they investigate basic topics about *Energy and the Environment*.

UNIT OBJECTIVES

Part 1

Students will:

1. Develop a basic definition for **Energy**
2. Identify various places energy is being used
3. Identify and list various forms of energy
4. Name the Fossil Fuels
5. Describe how energy is transformed from one form to another
6. Determine the safe use of energy
7. Evaluate their personal use of energy

Part 2

Students will:

1. Demonstrate an awareness of environmental risk
2. List ways energy is wasted
3. Develop an action plan for conserving natural resources
4. Identify unfriendly acts toward the environment
5. Describe how community changes affects the environment

Overall Objective: Implement an informational event to help other people become *Environmentally Aware and Energy Wise.*

Key Terms For Student

advocate, change, clean, coal, coal mining conserve, disease, electricity, electric power plant, energy, energy forms, environment, environment friendly, environmental caretaker, fossil fuels, gas, generator, geothermal energy, global warming, greenhouse effect, heat, kinetic energy, light, liquids, matter, natural gas, motion, non-renewable energy, nuclear energy, sun, oil, oil pump, pesticide, pipeline, pipes, potential energy, renewable energy, solids, transform, work,

What is Energy: Background

Energy is derived from the Greek word *energeia,* which means' *"force in action"*. When a source (matter) initiates some kind of force and transfer that force to another source (matter), energy is used to carry out that chain of action. Simply stated, energy is the ability to do work. The fact is energy is earth's most precious commodity, one that we take for granted. As we go about our daily activities, whether it's preparing for a day at school, a day at work, or a day of play, everything we do requires the use of energy either directly or indirectly. However, because we do not consciously think about the energy it takes to function daily, little concern is given to how it is used or misused. This ignorance is probably the foremost reason for the variety of energy and environmental problems that face the world today.

Sources of Energy

A source of energy is a material that can do work on matter. Our world's **Energy** is supplied from various sources such as the **Sun, Fossil Fuels, Nuclear, and Geothermal,** to name a few. These sources can be divided into the two categories of **non-renewable and renewable.**

Looking at the category of non-renewable energy source, we will find the fossil fuels of *oil, gas, and coal.* The fossil fuels are considered the source from which a vast amount of the world's energy comes from today. They are the fastest and easiest way of supplying sizable amounts of energy.

Fossil fuels were formed through a complex decaying process of phytoplankton in which oil and natural gas was formed. This small ocean life form would use the Sun to photosynthesis and store energy. When these animals died, they sank to the ocean floor where they were gradually buried after mixing with mud and other substances. Over long periods of time as they become more and more buried the substance in which they were buried became harden changing into rock. The Earth's heat and the pressure of the surrounding rock changed the energy containing substance in the plants into *hydrocarbon liquids and gases*. Reservoirs of hydrocarbon liquids and gases became trapped beneath the Earth's crust. From these reservoirs the world's oil companies extract the crude oil and gas which is eventually refined and supplied to the public as a source of energy in the form of oil and gas.

The fossil fuel *coal* also began as a living plant. Through *metamorphic* process carbon rich plants were slowly changed into *coal*. Like *oil* and *gas, coal* is also extracted from inside the Earth using another process. Of all the fossil fuel *coal* is the most plentiful and the most polluting. It is important that our student knows that we can use the energy from *oil, gas, and coal* in the form it is supplied, but often we must convert it into another form such as *electricity* to use it.

As students move through the activities of this unit the focus will be on the fossil fuels. However, for informational purposes of extending student knowledge, student should be made aware of what renewable energy sources are, and the role they play today and in the future in providing energy.

ACTIVITY 1: Energy Source/Fossil Fuels

Part 1

Where Is Energy

Begin the lesson by asking students to share: **What they know about Energy.** Be sure to list all response with the initial of the person giving the response. This will be the beginning of a KWL chart that will be used throughout the unit. Once all students have been given an opportunity to response, tell the students that they will be learning about Energy. Solicit ideas from the student about, what they may want to know about **Energy**. These responses should be listed in the next section of the KWL chart. Provide them with a basic working definition for Energy i.e. **Energy is the ability (power) to do work.** Continue by reading them Energy and its Sources to reinforce their thinking about the subject of Energy. After reading the book, tell the students that they are going to go on an Energy Scavenger Hunt. Their task is to find and list all the places that they find energy. Instruct them that they can look at school, home, outside, etc. Tell them that this

list will be used throughout the unit.

Part 2

Energy Source; Fossil Fuels

Before class meeting set up display of coal samples, small propane tank and burner, and campers oil lamp. Call student to the meeting area and begin meeting with students sharing their list of places they found energy. Tell students to keep list in their folders for future use. Continue the meeting by having students recall the three states of matter solids, liquids and gases. Ask the student, what do they think matter has to do with energy. Solicit a few responses, after a few minutes; show the students the display. Tell them that the items represent the source from which we get most of our energy today, Fossil Fuels. Let students examine the pieces of coal, ask them what kind of matter it is? Challenge students to discuss how it is used and what has to happen for it to do its' work i.e. burn. Finally when it's doing its' work what does it give of – *HEAT* – which is a form of energy. Follow the same procedure with each of the other item, however for safety purposes **DO NOT** let students handle propane tank or oil lamp when it is lit.

Once all of the items have been discussed place a large letter E (for energy) followed by an equal sign on a piece of large chart paper and display. Have students recall the three fossil fuels discussed, placing the name of each one next to the equal sign as they are identified along with what kind of matter it is. Solicit from the students a response to the prompt, Coal, Oil, and Gas represent what? MATTER. Display all responses on the chart as follow:

E = COAL OIL GAS

SOLID LIQUID GAS

\ /

MATTER

Now that the students have some knowledge about what the Fossil Fuels are, ask them to think about some of the things they listed as places they found or saw energy. Ask them if they can now think of some other places to add to their list.

Assign student the task of finding out who Albert Einstein was and what his famous formula is.

How Energy Is Supplied/Background

In order for people to use the fossil fuels to supply energy, it must first be retrieved from its natural place of deposit. Once coal, oil, and gas is supplied to companies in its' natural state it is generally transformed into another energy form that is supplied to consumers via wires, pipes, trucks, and pumps, for daily use.

Energy supplied for American use by the fossil fuels is approximately 43% from oil, 26% from natural gas, and 22% from coal. Other forms supply the remaining 9%.

Coal

Of the three fossil fuels, *coal* is the most plentiful. There are two ways to get coal, by underground mining or surface mining.

Underground mining requires digging a hole or shaft all the way down to the coal. This process is much like digging a well the difference being that once coal is reached tunnels are then formed. Most underground mining today is done by big machinery. The technique used is call *longwall.* "It uses a rotating shearing blade on a mining machine that moves back and forth across the coal, cutting it from the seams and transporting it away in an automatic conveyor. This type of mining produces more coal in less time than any other underground mining method."

Surface mining is used to retrieve coal when the coal is close to the surface. Usually it is found at about 200 feet or less from the surface. When surface mining, digging a hole is not required. Instead heavy equipment is used to clear the land. Topsoil is then remove and stored in another area to be used later in reclamation; a process in which the land is returning to the condition it was prior to the mining. In order to get the coal, holes are dug above the coal location and loaded with explosives. The explosives are set off to shatter the rock. These shattered rocks are cleared away until a large area of coal is exposed. This coal is removed and loaded onto trucks. This method is friendlier to the environment but the work is more dangerous.

In both cases coal is supplied to coal preparation plants to be made ready for transporting to energy producing plants.

Oil & Natural Gas

Unlike coal the fossil fuels oil and gas are not as easily retrieve. As far as its' availability is concerned, it is not how much oil there is, but how much we can get to. It is predicted that we will run out of oil that we can get to by the year 2060. However oil will still be there for the taking. Much of the fossil fuels oil and gas production now comes from underneath the sea bed, but there are some onshore deposits that can be tapped. Using conventional methods gets only about 15% of the oil. A method that uses waters or steams to push the oil up is how oil is retrieved. This tertiary method only gets about 45% of the oil; this is including Saudi Arabia. There are methods by which synthetic oils can be produced, but the use of synthetic oil is not feasible nor cost effective. However, it may be a time when synthetic oil will be all there is.

After natural oil and gas deposits are tapped of their rich holdings, they are prepared for public use. Natural gas is stored underground wells and dispersed through steel pipes to areas where it will be supplied for use by million of consumers. Natural gas can also be stored in above ground tanks. In this case the natural gas is cooled to very low

temperatures so that it becomes liquid, known as "liquefied natural gas' (LNG). Oil is retrieved through fractionating columns. At different levels of the column different oil is found with the lightest at the top. Oil is shipped and stored in tanks for use as heating oil as well as gasoline and automotive oil.

Activity 2: How We Get Fossil Fuels

Part 1

Cookie Strip Mining: This version of this activity was taken from *Pennsylvania Elementary Energy and Environment Activities*, volume 5.

Prior to class meeting, prepare the following materials for each student. 1 chocolate chip cookie, napkin or paper towels, toothpick, and straws. Also have pieces of coal samples for student observation.

Begin the class by recalling the names of the fossil fuels as learned in the previous lessons. Recalling the fact that coal is an energy source. Discuss how coal is formed (peat bog, packing rain, sunshine, dinosaurs ferns, and other plants and animal decay over millions of years). Tell students that the U.S. gets about 22% of its energy from coal. Use visuals to show how mining is used to get coal from the earth. Explain that the activity will demonstrate a method called strip mining that is also used to get coal. A method that does not harm the environment as much, but the work is more dangerous. Give each student a napkin and a cookie. Explain that the cookie represents the Earth. Instruct students to observe the surface (top) of the cookie with their fingertips. They should consider the chips in the cookies as coal deposits that are on or near the Earth's surface. Have the students compare the possibility of mining the coal on the surface with the coal that cannot be seen (chips within the cookie) under the Earth's surface. Do they think it will be more or less and why? Record some of their responses. Next have them count the number of visible chips. Record these numbers on paper with student's initials. Next pass out a toothpick to each student. Tell students to pick out all of the chips from the cookie. Instruct them that they are to place their coal deposits in one pile and land mass (cookies crumbs) in another pile. Have students count the chips they extracted from the cookie. Place this number from each student next to the number given for surface chips. Have students compare the numbers and decide which method produces the most coal. Challenge students to put the cookie back as it was before the chips were removed.

Assign students the task to create a picture showing what prehistoric times, animals, plants, and weather conditions may have been like.

Part 2

The Weight of Oil: This activity is adapted from density activities from the *GEMS* resource book *Liquids.*

Before students arrive color four liquids (cooking oil, glycerin, water, and salt water) different colors. Place each liquid in a bottle marked with an identifying letter or number for facilitator use only. Cut enough clear straws to about 10cm in length for each group of 4 students to have 2 or 3 pieces. Slice potatoes in 1-inch slices and store in cold water. These potatoes will be used as stands to hold the straws. Have enough small vial marked to coincide with labeled liquid bottles, available for each group to have a sample of each of the liquids previously prepared.

Explain to the students that the activity will demonstrate to them how when oil is pump up in a fractionating column, that oils of different weights are found at different levels, with the lightest at the top. Show them the four bottles of colored liquids. Tell them that the liquids in the bottles represent oils of different weights. Their task is to layer the liquids in the straws so that they do not mix. Once they experience success they are to record what they think the liquids are. Tell them to be sure to record all of their variations as they work, this will help them keep track what layered and what didn't.

In closing, discuss how oils of different weights are used for different sources of energy. Brainstorm ways oil is used for an energy source. Finally identify the liquids that were used for the activity.

How Energy Is Used/ Background

Fossil Fuels once retrieved from their natural resources are processed at preparation plants prior to being shipped to plants of various manufacturing industries. At these plants, energy sources are further processed and transformed to another energy source that billions of consumers can use. Some of these transformed energy sources are electricity, natural gas, heating oil and gasoline. Once transformed these sources are use by consumers in myriad ways.

What all consumers of energy from fossil fuels should and need to understand is that fossil fuels are non-renewable sources of energy. Although advance technology in locating and getting to fossil fuels has lengthening the prognosis on how long they will be available, they will still eventually be depleted. Therefore, we should be mindful that there is enough energy to use wisely, but there is none to waste.

Activity 3: Using Energy: The following activities are adapted from lessons found in the *Energy Source Energy Education Program: Brightland*

Part 1

Let's talk about Energy users.

Before students arrive have filmstrip set up and ready to run. Also have ready individual student booklet, chart display pre-labeled with the names of energy forms, Electricity, Natural Gas, Heating Oil, and Gasoline heading four columns, and enough blank index

cards for each student to have four cards.

Tell the students that they are going to view a filmstrip about a kingdom called Brightland. Explain to them briefly what the problem is. Encourage them to watch closely because the solving of the problem will assist them as they investigate energy users. Generate a class discussion following the viewing of the filmstrip. Give each student a Brightland booklet. Introduce the booklet as a resource that they will use throughout the unit, and that they will keep once the study is over. Finally, to close the lesson, read and discuss captions of each picture on pages 2 & 3 for reinforcement.

Part 2

Classifying Energy users

Call the class to the meeting area. Tell them that since they now have an idea about what some energy users are, that thier task is to identify more energy users. Flash energy user picture cards for students to identify. After a few minutes of identifying, begin a discussion that recalls events of the filmstrip shown in the previous lesson. Guide questions toward students identifying the forms of energies that were supplied by the "wizard" in the filmstrip. Introduce the pre-labeled chart once again naming the types of energies. Have student get list generated in activity 1 part 1 from their folders. Tell students to review their list and that they are allow to add to the list if they wish. After a few moments instruct the students to choose four energy user or places that they saw energy being used from their list. Once their selections are made, they are to write each one of their choices on index cards. Be sure only to write one on a card. After students have had a sufficient period of time to do this task, tell them that their cards will be placed on the chart under the correct heading that tell what type of energy is necessary for the energy user to work. Call each table group of students to the chart to place their cards. Once all cards are placed review the chart identifying the energy users placed under each heading.

Part 3

Heat, Light, and Motion

In this lesson adapted from Energy Source's, Brightland, the concept that heat, light, and motion are present when energy is being used is introduced. Begin the lesson by reading and discussing the short story *"Antonio's First Day of Work"*.

Tell the student that they will be using the energy user flashcards in a game. Explain to them that the objective of the game is to identify what energy use produce when they are doing work. Before the start of the game, examine energy user around the classroom discussing whether they produce heat, light, or motion. After a few minutes divide the class into teams for the game. Take turns showing each team an energy user flashcard for identifying what it produces. Give a tally to the teams for each correct response. Continue until all of the cards have been shown. Count each team tallies to decide the

winning team.
Assign heat, light, and motion activity in their booklets to reinforce the concept of this lesson.

Career Connection: Assign students the task of creating a chart that shows jobs or careers in their community that are directly related to energy. Tell them that the chart should show what the job is, what the person is called that does the job, and the type of energy that the job is related to.

Activity 4: Energy Safety & Checklist

It is a fact that we use energy all the time without a thought. However, all forms of energy have an element of danger connected to it if not used properly.

The following activities adapted from the Energy Source Energy Education Program will help students become aware of some of the dangers connected with the daily use of energy.

Part 1

Have students get their Brightland booklets from their folders. Tell the students that now that they know how we get and use energy, that it is important that they are aware of the dos and don'ts of how to use energy. Instruct them to turn to page 9 in their booklets. Read and discuss each of the safety rules and pictures.

After the discussion pass out large poster paper and markers, crayons, etc. to each cooperative group. Instruct each group to design an Energy Safety poster to be displayed throughout the school.

Part 2

Home Connection: Assign each student a Home Energy Checklist. Instruct them to complete the checklist in their homes and bring it back to class to share some of the results.

ENERGY REVVED UP
Part Two
The Environment: Who's Responsibility Is It?

Background

What's the big deal? Why teach about the environment to my students? The environment seems to be doing well. It's enough to celebrate the environment once a year, do some recycling, plant a tree, or adopt a tree. Why worry about clean air, clean water, and contaminated food? After all we have the government taking care of that, making sure everything is safe. There's the Clean Air Act, Clean Water Act, and a ban against the use of dangerous pesticides on food.

These claims about the safety of our environment are correct to a certain extent however, if we were to take off our rose colored glasses so to speak, we would see that things aren't as they should be. There are many instances of large numbers of people being exposed to toxic air and contaminated drinking water. There is the issue of use of pesticides on foods. While it is true that the wide use of the pesticide such as DDT was banned in the U.S. over 25 years ago, it is still heavily and widely used in low economic countries that export food to the United States. Even if foods were not imported, should we not be concern about the health and well being of those people? There is also the issue of hundreds of active pesticide ingredients permitted on hundreds of foods here in our country. True, the use of these pesticides have been proven to be safe when individually used on food and/or at low levels of use, little is being done about knowing the effect of these pesticides due to build-up or the interaction between pesticides mixing

Living in America has lulled its' citizens into a somewhat false sense of environmental safety. The research data and findings on environment concerns and issues that threaten the well being of people globally are vast. As educators of children in the classrooms across the USA we should have a concern for environmentally unsafe practices that take place in our schools everyday. Utilization of the information and activities in this unit are but a microscopic tip of the iceberg. It is highly recommended to thoroughly research literature on the topic beginning with that reference in the bibliography, as well as investigating public records as time permits when preparing to study this topic in the classroom.

Once again it is stressed that when approaching this subject with young children it is not meant to instill fear, but it is meant to motivate an awareness that there are reasons to be concerned about the environment in which we live. Let this unit serve as the springboard for ideas for ways that young students for whom learning is facilitated can play a responsible role in environmental protection.

Activity 1: Caution: This Is Your Environment

This activity is designed to bring to light that there are still approximately 325 pesticides legally permitted to use on 675 foods we eat daily. Student will realize that just because

something as simple as a piece of fruit may look good, it may possibly harbor harmful residues at low levels. This is also the opportunity to introduce the fact that many of our fruits and vegetables are imported from other countries that are not held to the same guidelines of this country. Students are made aware through this activity about the importance of washing foods before eating and the importance of being an educated consumer.

Part 1

Looks Can Be Deceiving

Prior to class have available hand microscopes, assorted fruit smelly stickers, large chart paper, pieces of fruit, paper, and crayons.

Begin the class by asking the question: “What did you have for breakfast (or lunch)”? List their responses on chart paper. Follow up this question by asking them: ‘Where do you think the food you ate came from?” The answer the grocery store may be accepted but guide them to the response that many of the foods come from the farm. Have student generate a list of foods that comes from a farm. Discuss the process of growing foods and what is necessary to get a good crop. Show and discuss pieces of fruit then ask the students their opinion about the fruit and if it looks acceptable to eat. Introduce the smell stickers of a variety of fruits. Tell the student that they are to pretend the stickers are real pieces of fruit. Instruct the students that they are not permitted to scratch the stickers until instructed to do so (this is the hardest part of this lesson). Tell the students that they have a few minutes to draw what they see on their stickers on their piece of paper. Observe what the students are drawing. At time have students put down their pencil and solicit volunteers to tell about their drawings. Question what was seen, how it looked etc. Instruct students to take their microscopes when told, and look at the stickers again and once again draw what they see. At time ask volunteers to share what they saw this time. Students should respond that they saw bumps, dots, or bubbles. These are correct answers. At this point explain to the students that when they looked at the stickers with their naked eye that the sticker looked fine. However, when looked at under a microscope they saw that there were little bumps all over the surface.
it is inside those bubbles that contain the scents that smells when the stickers are scratched (microencapsulation). Explain that although real fruits look good, that they are exposed to other thing in the environment such as pesticides, that may become part of it and they should take precautions by at least washing fruits and vegetables before eating. Conclude the lesson by letting the students scratch and use the fan and wave method for smelling.

Part 2

Rain, Rain, Please Go Away

This is a lesson about Acid Rain and the effect it has on crops for consumer use. As a basis for this lesson students first demonstrate for students the *Acid and Base* testing experiment in order for them to have some understanding chemicals reaction. Students will then set up an experience with plants. In this experiment two identical plants will be observed over a period of time.

One plant will be watered with regular tap water, while the other will be water with water treated with a mixture of vinegar and lemon juice. Two item that have already been proven to be acidic in the demonstration. Over the period of time student will observe and record the effect of the acid treated water on the plant. This process will simulate the affect acid rain has on living organisms on our Earth.

Activity 2: It All Adds-Up Conserving Energy

By conserving electricity we can possibly lengthen the availability of this form of energy that is produced from the non-renewable source of coal. More importantly we are protecting air quality and ozone longer.

The thing to consider is that electricity is produced at power plants that burn huge amounts of coal to operate generators. Burning coal releases sulfur high into the air affecting the ozone layer. By using less electrical energy, less coal is burned.

Part 1

A Little Becomes A Lot

Begin the class by having the students recall the names of the fossil fuels and the type of energy they produce.

Call the class to the meeting area. Introduce the story that will be read to them, *Switch On Switch Off*. Instruct them that they are to do two things while the story is being read. They are to listen and as they listen think about every thing they did prior to coming to science class that used electricity. Read the story. Immediately following the story have students return to their seats and when instructed to start, they will have approximately 3 minutes to list the ways that they used electricity. After time has expired have students report back the numbers of items on their list. Record their number responses on a piece of large graph paper posted prior to class. After reporting discuss and compare graph. Most likely level of use will be close in numbers with individual use. Discuss that as an individual the amount of coal burned to produce enough energy may not be much. Next have table team members add their numbers together and plot theses numbers. Discuss the difference. Continue along this mode comparing whole class, extending it to having them take a survey of their home usage returning the results to the classroom to be

charted. The idea of this activity is to help students visualize that what started out as a small amount of coal burning to produced electric energy has now turned into a large amount, resulting in larger amounts of coal being burned, causing more toxins being released into the air. Brainstorm ideas for conserving electricity and post for future reference.

Part 2

Oh How It Hurts

Prior to class have ready student journals and pencils for recording observation. Prepare the class to take a neighborhood walk. Inform students that they are to take note of events observed that hurts the environment. Give examples of things they might look for. Prior to walk make arrangements to stop at the gas station and a community beauty salon. These are excellent places to observe activities affecting air quality. Upon returning to the classroom discuss student recordings of observations. Be sure to bring into the discussion specific observation at the gas station, such as the way people were pumping their gas and/or gas spill or leaks. Also discuss uses of chemical observed in the beauty salon this may be the opportunity to introduce the term CFC'S. Assign students teams the task of designing, Oh How It Hurts The Environmental Posters for display in the school and community businesses.

Home Extension

This activity is adapted from the Project Learning Tree Environmental Education Activity Guide.

After a discussion about what pollutants are and where they can be found, have students brainstorm a list of possible air quality hazards that might be found indoors (old garbage, dust, tobacco smoke, and clogged air filters). Design a checklist to look for hazards in their homes, noting ones that they feel should have immediate action. When returned to class, discuss list and ways of taking action. Where possible actually make appropriate contacts to carry out a plan of action.

Activity 3: Changes In Our Environment

Students in this activity will study change in their community environment. The fact that our environment changes day to day is hardly noticed. However, other changes happen over a period of time that has a direct affect on our quality of living. Due to the gradual nature of some of these changes, we are hardly aware of those changes. In this way gradual change is as much the same as sudden everyday change. In this activity students are asked to brainstorm about how they and their community have gone through change over both a short and long period of time.

Part 1

Just Yester-Year

This activity is adapted from two sources, Project Learning Tree Environmental Education Activity Guide and Green Teacher Education for Planet Earth summer 1999 issue.

Students will work in teams to create a "Green Map" of their neighborhood. The outcome of the map will assist students in discovering ways of preserving and sustaining good environmental conditions in their communities.

For an accurate description of implementing this activity, educators are urged to refer to the two sources previously identified, which are listed in the teacher's bibliography.

Activity 4: Imagine – Standing Up For The Environment

As a group develop an action plan of events that can be implemented in the home, school, and community to advocate environmental awareness. Plan weekly and monthly events that goes beyond recycling and tree planting. Devise ways of disseminating information about concerns and issues that affect health and well being.

Pedagogy

The pedagogical approach to this unit is entrenched in the *Constructivist Approach* to learning. This approach utilizes a *Piagetian* type *learning cycle*. The constructivist theory is that the learner needs to construct his or her own understanding of the concept being presented. Based on this premise, the teacher no longer performs the traditional tasks associated with teaching but becomes a facilitator of learning creating child centered learning situations which promote the learners acquisition of applicable knowledge. Throughout the unit the four steps of the learning cycle will be the common threads that will make each activity a rich learning experience. The four steps are 1. **Focus;** assess prior knowledge, and give students a reason to explore. 2. **Explore;** engage students in meaningful activities relevant to the content of the lesson. 3. **Reflect;** make the criterion public; connect the content to the experience. 4. **Apply;** apply the ideas to a new situation.

Assessment/Evaluation

It is the intent of this two-part unit is to provide opportunities for young students to organize previous knowledge about Energy and the Environment, and acquire new knowledge that will allow them to have a more rich and well-rounded understanding of the topic.

Assessment of student learning and the way that it is handled are a personal preference. I strongly believe that assessment should be inclusive with the overall activities of the unit, not something totally separate. Hopefully you will find that, imbedded throughout the

unit are opportunities for the learning facilitator to observe student participation and performance in the unit tasks, collect the student's recorded data from activities, and review assigned writing task. These are all ways of authentically assessing students understanding of the unit's subject matter in a non-threatening way. Also, extension activities taken from several of the teacher resource books listed in the bibliography could be utilized as additional evaluative data of student understanding.

Standards

The activities of this unit are in alignment with *National*, *State* and *Local*, **Environmental** and **Ecology Standards.** More specifically the following standards directly relate to the subject of this unit.

National

Content Standard B: As a result of the activities in grades K-4, all students should develop an understanding of; 1) Properties of objects and materials. 2) Position and motion of objects. 3) Light, heat, electricity, and magnetism.

State & Local

Science & Technology

Content Standard 2: All students demonstrate knowledge of basic concepts and principles of physical, chemical, biological, and earth science.

Content Standard 6: All students develop and apply skills of observation, data collection, analysis, pattern recognition, prediction, and scientific reasoning in designing and conducting experiments, and solving technological problems.

Content Standard 8: All students evaluate the impact on current and future life of development and use of varied energy forms, natural and synthetic materials, and production and processing of food and other agricultural products.

Environment & Ecology

Content Standard 3: All students think critically and generate potential solutions to environmental issues.

Content Standard 4: All students evaluate the implications of finite natural resources and the need for conservation, sustainable development, and stewardship of the environment.

Content Standard 5: All students demonstrate an understanding of the local, national, and international implications of environmental and ecological issues.

In addition to content specific performance activities, the activities may address content standards across other disciplines of education. Included in the appendix, is a copy of the *62 Content Standards* of the Pittsburgh School District, as a reference to be utilized during the implementation of this curriculum unit.

Glossary Of Unit Terms

Advocate – One who defends or supports a cause publicly.

Change – To make different; alter in condition or appearance.

Clean – Free from foreign or extraneous matter.

Coal – A fossil fuel; a black rock composed mostly of carbon, formed under the earth's surface over millions of years from the remains of plants**.** It is used as a fuel because it burns easily. However, coal causes air pollution when burned. It is a non-renewable energy source.

Coal mining – The method by which coal is extracted from deep within the earth's surface. Coal can be mined by digging deep holes and making tunnels along the seams, or by the process of surface mining. Surface mining involves removing topsoil, shattering rocks by using explosives. The exposed coal is then removed and the earth is put back the way it originally was. Surface mining is a much more dangerous process.

Conserve – To utilize a method in which available resources are wisely used.

Disease – A morbid condition of some organ or part; illness; sickness; ailment. A similar disorder in plants.

Electricity – A form of energy that can produce light, heat, motion, and magnetic force. Electricity is a flow of electrons that can be produce by generators, friction, or chemical change.

Energy – The power to do work.

Energy forms - The results of transforming energy sources such as oil, gas and coal into a source that can produce heat, light or motion.

Environment – The physical surroundings and conditions affecting people's lives. Conditions or circumstances of living.

Environment Friendly – Not being harmful to the environment.

Environmental Caretakers – Taking on the role of an environmentalist. A person who is concerned with the protection of the environment.

Electric Power Plant – A place that produces electricity. Depending on the source of energy used, the plant may be hydraulic (using falling water) or thermal (using coal, oil, gas, or nuclear fuel).

Fossil fuels – Non-renewable energy sources (coal, oil, and natural gas) that must be mined or pumped from the ground and then burned to release their energy. Most of the energy we use comes from fossil fuels. However, mining and burning them cause pollution and damage the earth's surface.

Gas – One of the three states of matter. Gas has no shape of it's own, and can be collected and contained.

Generator - A machine that changes mechanical energy into electrical energy. It consist of a magnet and a coil of wire.

Geothermal energy – Power from magma inside the earth that can result in volcanoes and geysers. This form of energy can be tapped and controlled for consumer use.

Global Warming – The observed increase in the average temperature of the Earth's innermost atmosphere, which is believed to be a result of the **Greenhouse Effect.**

Greenhouse Effect – The trapping of heat by gases such as Chlorofluorocarbons and carbon dioxide, in the Earth's atmosphere.

Heat – A form of energy given off when matter is made to do work.

Kinetic energy – The result of matter that is no longer at rest. Energy from matter at work.

Light – A form of energy that is produced from an energy user at work. Animals use it to see, and plants use it to make food. Light when absorbed by matter can roduce heat.

Liquids – One of the three states of matter. Liquid has no shape of it's own, but takes on the shape of the container that it is in.

Matter – Any substance that has mass and occupies space. Molecules in the form of a solid, liquid or gas.

Natural gas – A fossil fuel; a colorless gas containing methane that formed over millions of years from remains of plants and animals. It must be pumped from the earth and is used as a heat fuel because it burns easily and cleanly. Natural gas is a non-renewable energy source.

Motion – Movement from one place to another.

Non-renewable Energy – A source of energy that is limited in supply. Once a non-renewable energy source runs out it would take millions of years to replace. Oil, coal, natural gas, and uranium are examples of non-renewable Energy sources.

Nuclear energy – The kind of energy produced by a nuclear reaction such as fission.

Sun – A medium star around which the earth and other planets revolve. The sun supplies the planets with light and heat. The sun is a renewable source of energy since it can be tapped to supply solar energy.

Oil – A fossil fuel; a thick, black liquid that is lighter than water, burns easily, and was formed millions of years ago from the remains of plants and animals. It must be pumped from the earth and separated into products such as gasoline, kerosene, lubricants, plastics, etc. Oil causes air pollution when burned, and is a non-renewable Energy source.

Oil pump – The machinery used to extract oil from deep within the earth.

Pesticide – An agent used to control undesirable organisms. This can be an insecticide for insect control, an herbicide for weed control, a fungicide for control of fungal plants disease, or a rodenticide for killing rats and mice. Some pesticides can contaminate water, air, or soil, or accumulate in the tissue of living organisms, and should therefore be used carefully. (PLT definition)

Pipeline – A line of connected pipes used for carrying liquids or natural gas.

Pipes – Tubular shape structures used to transport liquids or natural gas.

Potential energy – Matter at rest.

Renewable Energy – Source of energy that can be replenished in a short time, that are never really used up. Examples of renewable energy sources are sun, wind, falling water, growing plant. The problem with some renewable energy sources is that they are unpredictable, making it difficult to use consistently.

Solids – One of the three states of matter. Solids take up space and hold it's shape

Transform – Changing from one form to another.

Work – The result of the force of energy that causes something to be moved.

Energy Revved Up

Bibliographies

Teacher Books and Resources

The following bibliography contains a variety of literature, pamphlets, articles, and educator resource activity books that are appropriate for facilitators of student learning to use throughout this Energy Revved Up unit of study. Much of the material listed will also be appropriate for use with a supplemental unit that will investigate environmental issues and concerns of our society, and human responsibility for taking care of the environment. Information found in these references will establish a basic foundation to begin the investigation. Included in many of the books referenced is additional list of books that educators as well as students may use for many hours of research, enjoyable reading and ideas for hands-on activities.

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World Resources Institute (1996-97). *World Resources A Guide to the Global Environment: The Urban Environment.* New York: Oxford University Press.

Student Books and Resources

The following bibliography contains a variety of literature, pamphlets, articles, and children activity books that are appropriate for student use throughout this unit of study, Energy Revved Up as well as the anticipated unit that will investigate human responsibility for the environment. Included in many of the books referenced are additional list of books that students may use for many hours of enjoyable reading and hands-on activities.

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Web Sites

This is just the tip of the Iceberg. The following Web Sites have many links that will assist one in every aspect of their investigation of Energy and the Environment.

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www.doe.gov/educate/edusp.html
www.wlibrary.com
www.epa.gov
www.getwise.org/conserve.html
www.oneworld.org/energy/whatis.html
www.zebu.uoregon.edu/energy.html