A Quest for Homemade Energy: Earth Friendly Ideas to Produce a Global Effect

by Glenda S. Winborne, 20l3 CTI Fellow
Bain Elementary School

This curriculum unit is recommended for:
Science/ (K-2)

Keywords: Types of Energy, renewable, non-renewable, potential, kinetic

Teaching Standards: See Appendix 1 for teaching standards addressed in this unit.

Synopsis: The unit, A Quest for Homemade Energy: Earth friendly ideas to produce a global effect is designed to engage first grade students in the need for renewable resources, to concern them with the future of our planet and encourage them to consider and expand upon their ideas for a better future for all. Our first grade curriculum is limited to reduce, recycle, and reuse for our students. With this unit, the goal is to encourage students to question the types of energy and motivate them toward solutions through thought, play and reasoning. The unit, A Quest for Homemade Energy: Earth friendly ideas to produce a global effect is designed to bring about fresh, young ideas to a perplexing and frustrating need for renewable resources that are also economical for all people. This module will encourage students to investigate both the positive and negative effects for each source. Students will collaborate with classmates on a given problem and will work to research and develop a solution. Students will work in groups to develop a miniature town that models the type of energy chosen by the group. The culminating activity will produce a model town complete with hydro, solar and wind energies.

I plan to teach this unit during the 2013/2014 school year with students in my first grade class.

A Quest for Homemade Energy: Earth Friendly Ideas to Produce a Global Effect

Glenda Winborne

Introduction

Charlotte-Mecklenburg Schools is located in the Charlotte, North Carolina region and provides academic instruction, rigor and support each school day to more than 141,100 students in kindergarten through 12th grade in 159 schools throughout the cities and towns of Mecklenburg County. CMS believes setting high standards for all students creates a greater opportunity for future success – in our communities, within the region and across our diverse and global society. Each day, CMS students are prepared to be leaders in a technologically savvy and globally competitive world. CMS is proud of its diverse mix of students who represent 160 different countries and various cultural and ethnic backgrounds. CMS offers an extensive range of magnet programs in 40 of its schools to nurture the talents of students who have interest and ability in specific areas. CMS also educates supports and meets the needs of students with learning and physical disabilities.

Bain Elementary School has a long and distinguished history. John Bain, who donated both the land and money to build the school, originally founded it as Bain Academy in 1889. It was deeded to Philadelphia Presbyterian Church in 1924, and then donated to Mecklenburg County for public use. Throughout its existence, the school has been organized as a 1-12, a 1-9, a 1-6, a K-6, and is currently a K-5 facility. Today, Bain has just opened a new, "state of the art" facility that houses our 1-5 grade students. Due to our large student population, all kindergarteners are housed in our existing building, which is now referred to as our "Early Learning Academy". The staff includes three administrators, three secretaries, one academic facilitator, two EC resource teachers, one counselor, one psychologist, twelve instructional assistants, one speech clinician, one media specialist, four and one-half licensed special area teachers, and forty-one regular classroom teachers who provide instruction for over 900 students. 33.8% of teachers have a master's degree or beyond, and 20% are certified by the National Board for Professional Teaching Standards. In addition, our music teacher is Orff certified. The Common Core Standards, North Carolina Essential Standards and formal and informal assessment data drive regular classroom instruction.

My first grade classroom consists of 22 students, 12 boys and 10 girls. Academically, 59% of my students are on or above grade level in reading with 10% of my students functioning at a beginning kindergarten level. Classroom ethnicity is 95.2 % non-

Hispanic. Race is ½% African American, ½% American Indian, and 1% more than one race. One student is identified as speech/language impaired.

Rationale

It is the goal of this unit to further engage K-2 students in the need for renewable resources, to concern them with the future of our planet and to encourage them to consider and expand upon their ideas for a better future for all. The first grade curriculum focuses on reduce, recycle, reuse for our students. With this unit, it is my hope to inspire my students to ask questions and motivate them toward solutions through thought, play and reasoning. This unit is intended to provide an interactive understanding of energy and its sources for younger students and encourage young minds to investigate the need for further research into affordable methods of renewable resources of energy. K-2 students have limited understanding of energy. Most students will refer to energy as an energy drink or the energy they need to play on the playground. While both are true sources of energy both being chemical or potential energy, students do not understand that energy is defined as the ability to do work. With that definition, it applies to everything from the human body to a train moving down the tracks. Therefore, it is the teaching objective of this unit to help students categorize and apply other sources of energy, specifically, solar, wind and hydro power. This unit includes three types of renewable sources: solar, wind and hydro and the two types of energy kinetic and potential.

Content Objectives

The unit, A Quest for Homemade Energy: Earth friendly ideas to produce a global effect is designed to bring about fresh ideas to a perplexing and frustrating need for renewable resources that are also economical for all people. This unit is intended to provide an interactive understanding of energy and its sources for younger students and encourage young minds to investigate the need for further research into affordable methods of renewable resources of energy.

This module will provide knowledge of energy, renewable and non-renewable to K-2 students. Students will develop an understanding of energy, its sources, and the pros and cons for each source. Students will collaborate with classmates about a given problem and will work to research and develop a solution. Students will be immersed into research with the following questions:

- What is energy?
- What is renewable energy?
- Why is it important to find other options for energy sources beyond fossil fuels?
- Could we live without energy?
- What other energy options are available?
- How does the use of fossil fuels/non-renewables affect us?
- Are these alternative or traditional sources reliable for a long period of time?

- Can we afford to switch to renewables or stick with nonrenewable?

This unit will address standards in literacy, math and science.

Literacy Common Core Standards: Evidence of these standards will be evident through reading a variety of informational texts and students will know and use various text features (e.g., headings, tables of contents, glossaries, electronic menus, icons) (RI.1.5) to locate key facts or information in a text, and will distinguish between information provided by pictures or other illustrations and information provided by the words in a text. discussions with teacher and classmates and through explanation of models presented during this unit.

Through discussions with teacher and classmates students will ask and answer questions about key details in a text, (RI.1.1), Identify the main topic and retell key details of a text, (RI.1.2), describe the connection between two individuals, events, ideas, or pieces of information in a text, (RI.1.3), ask and answer questions to help determine or clarify the meaning of words and phrases in a text, (RI.1.4)

Math Common Core Standards: Students will meet the following objectives through completion of the Potential and Kinetic Data Sheet, student journal entries, reading and recording data, organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another (1.MD.C.4).

North Carolina Essential Standards K-2 Science: Students will provide a rationale for the types of energy and the environmental impact on the Earth and animals through journal entries.1.L.1.3 Summarize ways that humans protect their environment and/or improve conditions for the growth of the plants and animals that live there (e.g., reuse or recycle products to avoid littering).

Time Frame for Teaching this Unit

The time frame is calculated at one checkpoint a week and the unit will conclude in approximately 4 weeks. The activities are described in detail in the Classroom Activities section and all vocabulary words are defined in the Vocabulary section.

Checkpoint #1:

Energy: What is it? Definition of energy: the ability to do work. Including mechanical, chemical, geothermal, hydro-electric, solar, wave, and wind energy.

Complete a flip-book explaining the types of energy. Vocabulary: energy, renewable resource, geothermal, hydro-electric, wave, wind, solar and human.

Application: Picture of a home. Circle everything that requires energy. Choose one activity to represent with drawings, models, etc. that could be completed without the use of energy.

Checkpoint #2

Present form of energy: coal based. What's wrong with the way things are now? Why do we need new ways? How does coal get in our house and cars if it's a rock?

Present a Venn diagram of pros/cons for coal and your renewable resource

Checkpoint #3

Renewable Energy: Is this important to you? How does it affect a 6 year old? Are there other options for energy sources besides coal and oil?

Present an opinion writing piece based on why you recommend the type of renewable resource you chose to complete your project.

Checkpoint #4

Culminating project. Design a town that includes one renewable resource in the town (solar, geothermal, wind, wave, hydro). Students will research each type of renewable resource to find the pros and cons for each type. Based on their research, students will choose a group to combine their efforts toward building a model town. Groups will be limited to 3-5 members.

Teaching Strategies

Teaching modalities used in this unit include the *internet, videos, hands-on activities, research, project based learning*

The mode of delivery will be a project based learning model (Edutopia- Project Based Learning n.d.). The students will be presented with a problem and given the time and opportunity to collaborate and develop a solution to the problem. Each lesson will include a description of the lesson, research topic, hands-on activities and an independent/group activity. The goal is to encourage and develop research skills and further the student understands of energy.

This unit is designed to educate K-2 students in the area of Energy with a focus on renewable and non-renewable sources and why it is important to them. The project based learning module will provide a knowledge base, vocabulary development, problem solving scenarios and hands-on application of the module.

Vocabulary for Teachers and Students

Energy- is the ability to do work. All energy can be classified in two groups, potential and kinetic.

Kinetic energy- is energy through movement.

Potential energy- is energy that can be stored and used at a later time. This energy has the potential to do work at a later time.

Renewable energy- a source of energy that has unlimited availability. For example, solar energy is renewed daily. Other renewable sources include: wind, hydro, thermal and biomass.

Non-renewable energy- energy source that is only available once and when sources diminish the source cannot be made again. Nonrenewable energy sources include oil and petroleum, coal, natural gas and nuclear (uranium).

Fossil fuels- is energy developed from many years of decayed plants and animals.

Refine- to bring to a fine or a pure state; free from impurities.

Solar energy-: is energy from the sun. This is a type of renewable energy. By using solar panels the solar panel just converts light energy to electricity. It does not store the energy. Solar panels are usually affixed to the top of the roof. The sun's energy can be converted into electricity, to power hot water heaters and other appliances in the home or business.

Hydro energy- is energy collected from moving water, that is used to turn a turbine to produce electricity.

Wind energy- is energy collected from the wind that is used to turn a turbine to produce electricity.

Scientific Background for Teachers

Energy is the ability to do work. Energy is needed to do anything from rolling out of bed in the morning to building a skyscraper. Although there are many types of energy, all energy fits within two groups, kinetic or potential energy.

Potential energy is energy that can be stored, for example, the human body stores energy within its cells to use at a later time, batteries store energy for the car to start. Potential energy includes mechanical, chemical, nuclear (uranium) and gravitational forms of energy. (2) For the purpose of this unit we will focus on the chemical energy contained in coal and natural gas.

Kinetic energy is provided through movement and can be used as it is delivered. Kinetic energy includes radiant, thermal, motion, sound and electrical. For the purpose of this unit we will focus on solar, hydro, wind and electrical forms of kinetic energy.

It is important for students to know the difference between the two forms of energy potential and kinetic, so they develop an understanding of the need for sustained forms of energy and why we can no longer be content with fossil fuels.

Energy can be classified into two categories, renewable and nonrenewable. Nonrenewable energy is the present form used by the majority of the world (1). However, this form of energy is again nonrenewable and unable to continue to be the dominating source of energy. The nonrenewable sources of natural gas and coal rest upon the fossil fuels of decaying plants and animals of many years ago. It is inevitable that these fossil fuels will eventually run out.

Energy in the renewable forms is a constant source of energy. Solar, wind and hydro sources of energy are a constant. As long as the sun shines, and the wind blows and the water moves, these sources will renew daily.

Classroom Activities

The objectives for the following lessons is to encourage students to define, discuss, investigate and model solar, wind and hydro energies through independent and group work with a culminating activity to include a model community using all three types of renewable sources previously stated.

K-2 students have limited understanding of energy. Most students will refer to energy as an energy drink, energy from food or the energy they need to play on the playground. While these are true sources of chemical or potential energy, first grade students do not understand that energy is defined as the ability to work whether the work is being done by human or machine. With that definition, it applies to everything from the human body to a train moving down the tracks. Therefore, it is the teaching objective of this unit to help students understand, categorize and apply other forms of energy, specifically, solar, wind and hydro sources.

Each lesson includes a description of the lesson, research topic, hands-on activities and an independent/group activity. The goal is to encourage and develop research skills and further the student's understanding of energy.

<u>Lesson 1: What is Energy</u>?

Instruction time: 2 class periods

Simply stated, energy is the ability to work. Anything that moves must have some type of energy at work. All energy can be classified in two groups, *potential* and *kinetic*.

Potential energy is energy that can be stored and used at a later time. This energy has the potential to provide energy. Kinetic energy is energy that does not need storage but is developed through movement.

Activity #1- Research topic: What is Energy?

Materials: Internet access, pencils, crayons, science journal

View and discuss this student website about energy. http://www.eia.gov/kids/energy.cfm?page=about_forms_of_energy-basics

In science journals, students will describe in1-2 sentences what they learned from the website.

Activity #2

Materials: Internet access, Paper, scissors, pencils, crayons, magazines to cut, copies of worksheet (see Appendix 2), Potential or Kinetic, science journal

After viewing previous website, students will draw or cut from magazine pictures (magazines provided by teacher) of different types of energy, group students into groups of four. Students can be assigned to work on either kinetic or potential energy, or students can explore both types of energy. On the worksheet provided, students will be required to sort through their pictures and categorize the pictures by potential or kinetic forms of energy, During this activity, encourage students to use energy talk with questions such as;

Which form of energy is made through movement?

Which form of energy is stored for later use?

What is happening in that picture?

Is movement causing the energy or is the energy happening because of something else?

After sufficient time is given (30 minutes), bring students together to discuss their findings on the two types of energy. *More time can be given for this activity, teacher discretion.* Clarify any misunderstandings and encourage the students to continually ask themselves is this potential or kinetic energy I am doing at this time.

Activity #3

Independent activity: In science journal, students will write about their findings and understandings of Potential and Kinetic Energy.

Extension Activity: Students will make a potential and kinetic spool racer (UNC Tv Learning Media- Spool Racer n.d.). On this website, students can build a potential and kinetic spool racer for further investigation of energy.

Discussion: Make an Anchor Chart (a list of facts about energy provided by students in

Lesson 2: What are Fossil Fuels?

Instruction Time: 2 class periods

Fossil Fuel is energy developed from many years of decayed plants and animals. It is extracted from the Earth through drilling, digging, extracting and most recently, *fracking* (EIA Energy Kids- Fracking n.d.). Fossil Fuel comes in many forms such as, coal, oil, petroleum, natural gas, and nuclear (uranium). Fossil Fuels are the leading source for much of the world's energy consumption. The United States gets 90% of its energy from fossil fuels. (Energy Basics n.d.)

So what's wrong with the way things are now? Fossil fuels are running out. It is more difficult to locate new sources of coal, oil, petroleum, etc. and the cost of mining and refining the fossil fuels makes it more difficult to afford this type of energy. It is imperative that we find other ways to supply our energy needs.

Activity #1: Research Topic- What are fossil fuels?

Materials: Internet access, science journals, pencils, crayons

View this website about renewable and non-renewable energy sources. http://www.eia.gov/kids/energy.cfm?page=2

View this website for how Fossil fuels are formed. Fossil Fuels (Discovery Education-Fossil Fuels n.d.)

Discuss the information from the websites. In a science journal, using 1-2 sentences describe what you learned from the website about fossil fuels.

Activity #2

Materials: clay, (multi colors) enough for each student to have a small ball of clay

Students will create layers of fossil fuels using multiple colors of play-dough or clay.

Group students according to colors of clay available, assign a layer name to each color of clay. Yellow= animals, Green = plants, Blue= swamp, Brown= rocks and sand, Purple= ground cover. When each color is distributed, have a member of each color group make a new group. For example, each group will have one member with red, green, yellow, blue, brown and purple clay represented. Starting in order: swamp, animals, plants, rocks, groundcover, each member will layer their clay in the correct order. Each student will have the opportunity to apply force to their layer, not by squeezing and mixing but by

pressing down and compact the clay on top of each previous layer. The layers should be visible just tightly squeezed together. Students should note the amount of pressure and the collection of materials needed to make their fossil fuels. Students may use a straw to drill into the fossil fuels and pull out a piece of each layer. Be careful not to allow them just to poke holes but encourage them to drill into the earth's surface to extract the necessary materials from the fossil fuels.

Activity #3

Materials-flip books (complete folded books before lesson, see Appendix 3 for directions), crayons, pencils, scissors, glue or tape magazines to cut, straw for each student

This activity will help students to illustrate the origin of fossil fuels and gather a better understanding of how fossil fuels are formed and the need to find better fuels before the fossil fuels" dry up". Students will construct a flip book. Students will then draw or collect magazine pictures of the items that make up fossil fuels. These pictures will be glued to the correct section of the flip book. Start on the bottom space, Swamp, glue or draw a picture of a watery/swampy area. Students may write their ideas or thoughts on each section tab, (teacher discretion) next, add animals, dinosaurs, fish, etc. to the animal section and continue until all sections are completed.

Discussion: Make an Anchor Chart of the Pros and Cons of Fossil Fuels.

Extension Activity: Experiment with "Fracking"

Materials: small kiddie swimming pool, sand, water hose (with holes poked along the sides), water access

Students will experience an example of how "fracking" works beneath the surface of the earth. Gather students outdoors, Poke holes in the hose prior to experiment, place sand inside the pool, lay hose along the top of the sand. Turn water on (experiment with water pressure, slow at first and then turn the water pressure higher) students will observe the water pressure pushing the sand and "cracking" the sand, to show fractures. Discuss the experiment with students. Why does the water cause "cracks" in the sand? Does the water pressure make a change in the cracks? What happens to the soil on the top of the earth's crust? What are the pros and cons of "fracking"? In science journals, students write 1-2 sentences about what they observed.

Lesson 3: Renewable and Non Renewable Energy Sources

Instruction Time: 2 class periods

Definition: Renewable and Nonrenewable energy sources are defined as follows, Renewable – a source of energy that has unlimited availability. For example, water, sun, wind energy renewed daily. Nonrenewable- energy source that is only available once and when sources diminish the source cannot be made again. Nonrenewable energy sources include: oil and petroleum, coal, natural gas and nuclear (uranium). Renewable sources include: wind, solar, hydro, thermal, biomass. Focus will be on wind, solar, and hydro.

Activity #1

Materials: Internet

View and discuss the following website about renewable and nonrenewable energy sources. In science journals, students should write 1-2 sentences about what they learned from the video.

Activity #2:

Materials: Energy picture (See Appendix 4), science journal and pencil

Form groups of 4 students. Students will view and organize the types of energy found in the picture of a farm. Give each student the energy picture (EIA Energy Kids n.d.). (Or display on overhead projector) Have students discuss in their groups the energy picture. Discuss the different types of energy and categorize the types of energy by renewable or nonrenewable by using a "T" chart in their science journal. Ex:

Renewable	Nonrenewable

Activity # 3

Materials: diagram of coal burning plant (see Appendix 5), journal and pencil

Independent Activity

View How Nonrenewable energy source "coal" (UNC TV Learning Media Coal Burning Plant n.d.) is turned into electricity for our homes.

Display the diagram (Coal-fired Power Plant n.d.) of a coal burning plant for students to see while writing. In science journal, ask students to explain how coal is turned into electricity.

Discussion: Pros and Cons of Renewable and nonrenewable sources? Write student responses on an Anchor Chart titled, Renewable and Nonrenewable Sources.

Lesson 4: Renewable Energy

Instruction Time: 5 class periods

Renewable Energy is available in many forms, wind, solar, hydro, ocean, biomass, geothermal, and more. For the purpose of this lesson we will focus on solar, wind, and hydro. Solar energy is energy from the sun. This is a type of renewable energy. By using solar panels usually affixed to the top of the roof, the sun's energy can be converted into electricity to power hot water heaters and other appliances in the home or business. Wind energy is energy collected from the wind to turn a turbine to produce electricity. Hydro energy is energy collected from moving water that is used to turn a turbine to produce electricity.

Activity #1:

View the websites below and discuss the information. Each blue topic is a link to a website of information on that topic.

View this website about renewable sources of energy. Renewable Energy sources (PBS UNC Learning Media- A Never Ending Supply-Renewable Energy n.d.)

Help students understand the basics of Solar Energy. (EIA Energy Kids- Solar Energy n.d.)

This website discusses the basics of wind and the daily wind cycle. Wind En (EIA Kids- Wind Basics n.d.)ergy

View an example of a wind farm. See a Wind Farm (PBS UNC Learning Media- Wind Farm n.d.)

Basic facts and information on Hydro Energy (EIA Energy Kids- Hydropower Basics n.d.)

Observe how a hydro electric plant works. Diagram of a Hydro electric plant (Green Mountain- Hydro Power n.d.)

Activity #2: Cooking with Solar Energy

Solar Oven (Monahan 2005)(see Appendix 6 for directions)

You don't need four burners and a gas line to make some great-tasting trail food. All you need is plenty of sunlight. Make your own solar oven and feed the whole group. Solar ovens work by bouncing sunlight off a reflective surface into a pot. The hotter the pot, the faster your food will cook. It's easy to make—and cheap. Solar cooking takes a little practice. Try this recipe first:

Solar Oven S'mores:

Ingredients: Graham crackers, Milk chocolate bars, Marshmallows

Place graham crackers next to each other on the bottom of a black cast-iron pot. Black pots are best because they absorb and retain the sun's heat better than light-colored pans. Top each cracker with a piece of chocolate and a marshmallow. Put a glass lid over the pot and place the pot in the center of your solar oven. When the marshmallow is gooey, take out the crackers and add the second layer of graham crackers on top to complete it.

Activity #3: Make a pinwheel

Students will make a pinwheel. Students will try different ways to make their pinwheel move faster or slower, forward or backward. (Click on Make a Pinwheel for instructions) Make a Pinwheel (PBS.Org n.d.).

Discussion questions: Did your pinwheel spin? Did it spin backwards? Did it spin fast? Slow? What was needed to make the pinwheel spin fast? Any ideas on how to make the pinwheel work more effectively?

Activity # 4 Make a water wheel (see Appendix 7 for directions)

View the website and see how a hydro power plant works. See the Hoover Dam and Hydroelectricity (EIA Energy Kids- Hydroelectric power n.d.)

Discussion: Were you able to spin the turbine shaft? What problems did you have? Can you think of a better design? See if you can make changes to your design to make a more efficient water-powered turbine!

Make an Anchor Chart of the pros and cons of solar, wind, and hydro energies. (Make a chart for each type of energy)

Capstone Project: Tying it all together.

Over the past few weeks we have discussed many ways to produce energy. We have discussed the types of energy, potential and kinetic, the forms of energy, renewable and nonrenewable energy and several ways energy is produced both in the United States and Worldwide. Now it is time to put your knowledge to the test. A rubric for the project is provided in Appendix 8.

Build a Community: Students should be grouped according to interest and number (3-4) in the group. Form an interest group for Coal, Wind, Solar, and Hydropower and community design. Community design group is responsible for setting up the community with houses, streets, stores, river, lakes, etc. using Legos, K-Nex, cereal boxes or building

blocks of some type. Coal group will be responsible for building a coal generator (not an actual working model but at least the shell of a coal powered generator). Wind group will develop a wind turbine field near the community. Solar group will develop solar panels for the community to attach to the roofs of the businesses and homes. Solar ovens could be created for use as well. Hydro power group will develop a way to harness the water from a nearby river to power the community.

Goal of community build is to acknowledge and model each of the forms of energy and how they fit into a community development. The community should include, houses, businesses, fields, roads, rivers, lakes, oceans (if nearby) wind farm, hydroelectric dam on river or ocean, solar panels on homes and businesses or in the fields. Discuss with each group what is expected to be modeled in the community build. Encourage and guide groups toward end results of a functioning community with all areas of reviewed energy sources represented. Label each model for easy recognition of models.

Note: Because of the age of the students K-2, it is not expected that any of the models actually work but merely an understanding of how the systems work.

Discussion: Provide time for students from each group to explain their reasoning and location of their model on the community model. Discuss Pros and Cons of wind, solar and hydro forms of energy?

Writing Prompt: After studying about Energy, What do you think would be the most important source to develop wind, hydro, or solar energy? Why

Appendix 1

Implementing Common Core Standards

Literacy

Throughout this unit with the use of science journals, discussions and media presentations, students will engage in each of the following standards: CCSS.ELA-Literacy.RI.1.1 Ask and answer questions about key details in a text, CCSS.ELA-Literacy.RI.1.2 Identify the main topic and retell key details of a text, CCSS.ELA-Literacy.RI.1.3 Describe the connection between two individuals, events, ideas, or pieces of information in a text, CCSS.ELA-Literacy.RI.1.4 Ask and answer questions to help determine or clarify the meaning of words and phrases in a text, CCSS.ELA-Literacy.RI.1.5 Know and use various text features (e.g., headings, tables of contents, glossaries, electronic menus, icons) to locate key facts or information in a text, CCSS.ELA-Literacy.RI.1.6 Distinguish between information provided by pictures or other illustrations and information provided by the words in a text.

Evidence of these standards will be recorded through journal entries, discussions with teacher and classmates and through explanation of models presented during this unit.

Science

Through the many hands-on activities and the discussions of the advantages and disadvantages of each of the types of energy, the students will discuss and model the following science standard, 1.L.1.3 Summarize ways that humans protect their environment and/or improve conditions for the growth of the plants and animals that live there (e.g., reuse or recycle products to avoid littering).

Math

Through continually viewing and representation in their science journals, students will discuss and represent the following math standard, CCSS.Math.Content.1.MD.C.4 Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

Appendix 2

Picture Sort for Potential and Kinetic Energy

Lesson 1 Activity #2

Name: _____Date:_____

Directions: Sort pictures by Potential or Kinetic energy. Glue pictures under the correct heading.

Potential	Kinetic

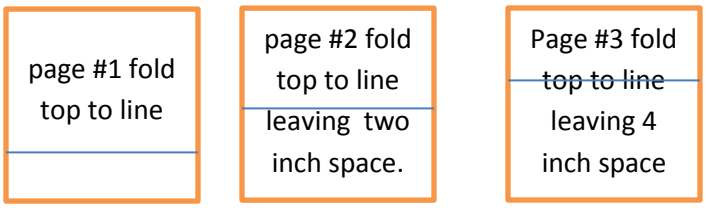
Appendix 3

Direction on How to make a Flip Book

HOW TO MAKE FOSSIL FUELS
Ground cover, grass, surface of the Earth *Glue straw to this section only.*
Glue Rocks, sand
Plants, drawings or pictures
Dinosaurs, Animals, Fish, etc. pictures or drawings
Swampy Water pictures or drawings

How to make flipbook: 3 pages of paper (any color or multi colors)

Fold paper so that each section has a 1-inch space.



Appendix 4

Energy Activity: Energy Picture

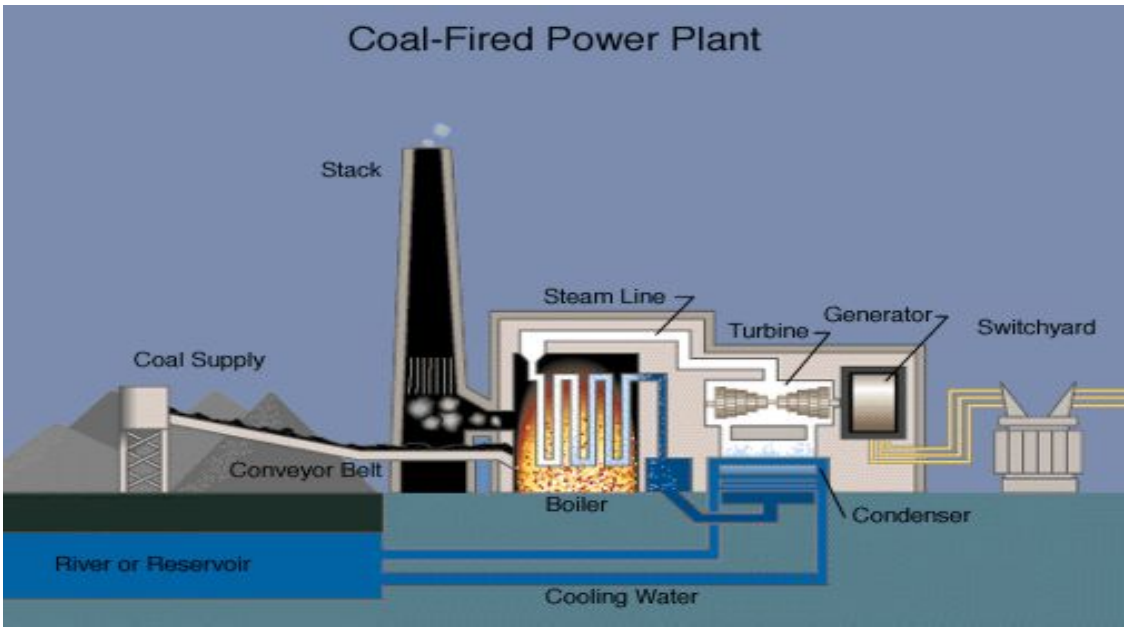
Primary

Divide the students in groups. Give each group a copy of the energy picture above. Have the students find all the ways that energy is being used. Discuss as a class. Have students collect pictures showing energy consumption from magazines and create a collage.

Elementary

After finding all the ways energy is being used in the picture above, have the students write plays, songs, commercials or skits about the energy sources used. Allow time for each group to present to the class. Discuss as a class the differences between rural and urban energy use.

Appendix 5


Coal-Fired Power Plant
Stack
Steam Line
Turbine
Generator
Switchyard
Coal Supply
Conveyor Belt
Boiler
Condenser
River or Reservoir
Cooling Water

Appendix 6

Directions for making a Solar Oven

Materials: A pizza box, Black construction paper, Aluminum foil, Plastic window covering, Permanent marker, Glue, Tape, Scissors, Ruler, String

STEP 1: Line the inside bottom of the box with foil.

STEP 2: Cover foil with black paper and tape in place.

STEP 3: Set the plastic under the box and trace the outline of the box.

STEP 4: Remove the box and draw another outline 1⁄4-inch inside the first outline and cut along inside line.

STEP 5: Close the box cover, and draw another line 1 inch from each side.

STEP 6: Cut along the lines on the front and sides—not the back.

STEP 7: Open the cover and line the inside with foil.

STEP 8: Glue foil in place.

Appendix 7

Directions for making a Water-Powered Turbine (11)

Using items from around the house see if you can harness the power of water to spin a turbine!

Materials: 2 small paper plates, Empty egg carton, Stapler or tape, Pencil, Scissors

Hydro power works the same way as your turbine, but the shaft would be connected to a generator to make electricity!

Step 1: punch a hole in the middle of each plate. Note: It's important that the hole be in the middle so that your wheel turns evenly when you finish! You may want to ask for help doing this.

Step 2: Cut out five individual cups from the egg carton (Again, get help if you need it).

Step 3: Carefully staple (or tape, if that's easier) these evenly around the edge of one plate so that each cup faces the back of the one in front of it Note: Think about the best way to position the cups so that the water fills each one, causing the wheel to turn. Once you have all the cups attached to the first plate, carefully sandwich them between the two plates by stapling the second plate to the other side of each cup.

Step 4: Now put the pencil through the center holes. Tape the plates to the pencil so that the wheel makes the pencil spin.

Step 5: It's time to test your water wheel! Have a friend hold the ends of the pencil loosely so that it can turn while you pour water over the cups. Stand over a sink or

Appendix 8

Rubric for End Product

Name: _____ Date: _____

	Labels on Model	Model	Vocabulary Use	Journal Entries	Group Activity
1	No labels on model	No model provided for community model	No scientific vocabulary used	1 Journal entry	Did not work with others
2	Some labels	Model created but lacks real life pattern	Some 2-3 vocabulary words used	2 journal entries	Worked in group but needed several redirections
3	Labels provided	Model provided patterned after a real life model, i.e. Hoover dam	4-8 vocabulary terms used	3 journal entries	Worked with group to obtain goal
4	Labels and description	Model provided with extreme details to real life model.	All representations and explanations include vocabulary terms used during the unit.	4 journal entries	Lead (not bossy) the group to reach goal .

Total points = _____/20

Appendix 9

List of materials for Classroom Use

1 wooden spool, 1 flat toothpick, 1 rubber band, tape, 1 large metal washer , 1 small metal washer, 1 unsharpened pencil

Legos, K-nex, toothpicks, craft sticks, cereal boxes or other building materials for model of community

Floor mat to contain the community model

Internet access, Paper, scissors, pencils, crayons, magazines to cut, copies of worksheet, Potential or Kinetic, science journal

clay, (multi colors) enough for each student to have a small ball of clay

flip books (complete folded books before lesson), crayons, pencils, scissors, glue or tape

Resources

Bibliography for Teachers

Cameron, Schyrlet and Carolyn Craig. "Alternative Energy Experiments." In *Alternative Energy Experiments*, by Schyrlet and Carolyn Craig Cameron. Greensboro: Mark Twain Media, 2010. cameron, Schyrlet, and Carolyn Craig. "a." n.d A list of science lesson plans including experiments. This book is designed for grades 5- 8 but the information was adapted for younger students.

Charlotte Mecklenburg Schools. n.d. www.cms.k12.nc.us (accessed October 17, 2013). The CMS website provides valuable information and data for the district.

"Coal-fired Power Plant." TVA Kids. *Coal-fired Power Plant.* n.d. A website that includes drawings and videos on the use of coal as a power source.

Discovery Education- Fossil Fuels. n.d. http://app.discoveryeducation.com/search?Ntt=fossil+fuels#selItemsPerPage=20&intCurrentPage=0&No=0&N=18340%252B18341&Ne=18339&Ntt=fossil%2Bfuels&Ns=&Nr=&browseFilter=&indexVersion=&Ntk=All&Ntx=mode%252Bmatchallpartial (accessed Sept. 25, 2013). A website that provides a student understanding of how fossil fuels are formed and used as a power source.

DTE Energy- Hydro Power. n.d. http://www.dteenergy.com/pdfs/hydroKids.pdf (accessed Sept. 25, 2013). A website that provides pictures and videos of hydropower as a fuel source.

Edutopia- Project Based Learning. n.d. http://www.edutopia.org/project-based-learning (accessed October 18, 2013). A website that provides information on the teaching strategy of project based learning. It provides multi-leveled project ideas.

EIA Energy Kids. n.d. http://www.eia.gov/kids/resources/teachers/pdfs/Activitybook_web.pdf (accessed Sept. 25, 2013). This website provides an activity book that can be downloaded for students learning about the sources of energy.

EIA Energy Kids- Fracking. n.d. http://www.eia.gov/kids/energy.cfm?page=natural_gas_home-basics (accessed October 18, 2013). This website provides a student explanation of the process of 'fracking"

EIA Energy Kids- Hydroelectric power. n.d. http://www.eia.gov/kids/energy.cfm?page=hydropower_home-basics (accessed Sept. 25, 2013). A website for kids that focuses on the basics of energy, including hydroelectric.

EIA Energy Kids- Hydropower Basics. n.d. http://www.eia.gov/kids/energy.cfm?page=hydropower_home-basics (accessed Sept. 25, 2013). A website for kids that focuses on the basics of energy, including hydropower.

EIA Energy Kids- Solar Energy. n.d. http://www.eia.gov/kids/energy.cfm?page=solar_home-basics (accessed eEpt. 25, 2013). A website that provides a general knowledge of solar energy basics.

EIA Kids- Wind Basics. n.d. http://www.eia.gov/kids/energy.cfm?page=wind_home-basics (accessed Sept. 25, 2013). A website that provides a general knowledge of the wind and the it's use as a energy source.

"Energy Basics." *EIA Energy Kids.* n.d. http://www.eia.gov/kids/energy.cfm?page=about_forms_of_energy-basics (accessed Sept 25, 2013) A website for children that provides a basic knowledge of energy.

energy.gov. n.d. http://energy.gov/maps/renewable-energy-production-state (accessed Sept. 25, 2013). A website that shows the US consumption and production of green energy.

"Forms of Energy." *EIA Energy Kids.* n.d. http://www.eia.gov/kids/energy.cfm?page=about_forms_of_energy-basics (accessed Sept 25, 2013). A website for children that provides a basic knowledge of energy.

Green Mountain- Hydro Power. n.d. http://www.greenmountain.com/resources/enviro-kids/renewable-energy-101/hydro-energy (accessed Sept. 25, 2013). A website that provides information on hydropower.

Monahan, Julie. *Boys LIfe- Solar Powered Oven.* August 2005. http://boyslife.org/hobbies-projects/projects/975/solar-powered-cooking/ (accessed Sept. 25, 2013). Directions for constructing a solar powered oven.

"Nonrenewable Energy." *eschool today.* n.d. http://www.eschooltoday.com/energy/non-renewable-energy/what-is-non-renewable-energy.html (accessed Sept 25, 2013). A website with student friendly information on non renewable sources of energy.

PBS UNC learning Media. n.d. http://unctv.pbslearningmedia.org/resource/ket09.sci.phys.energy.coal/making-electricity-at-a-coal-burning-plant/ (accessed Sept. 25, 2013). An in depth look at a coal powered plant.

PBS UNC Learning Media- A Never Ending Supply-Renewable Energy. n.d. http://unctv.pbslearningmedia.org/resource/nvel.sci.tech.supply/a-never-ending-supply/ (accessed Sept. 25, 2013). An in depth look at renewable forms of energy.

PBS UNC Learning Media- Wind Farm. n.d. http://unctv.pbslearningmedia.org/resource/e3bfa345-1281-4bcd-94f7-b53800c4d96f/e3bfa345-1281-4bcd-94f7-b53800c4d96f/ (accessed Sept. 25, 2013). A resource for providing information to students about wind energy.

PBS.Org. n.d. http://www.pbs.org/parents/curiousgeorge/activities/pdf/cc_pinwheel_bw.pdf (accessed Sept. 25, 2013). Step-by-step instructions for creating a pinwheel.

The Children's University of Manchester. n.d. http://www.childrensuniversity.manchester.ac.uk/interactives/science/energy/renewable/ (accessed Sept 25, 2013). An excellent student friendly resource for renewable energy.

UNC Tv Learning Media- Spool Racer. n.d. http://unctv.pbslearningmedia.org/resource/phy03.sci.phys.mfe.zsplcar/potential-and-kinetic-energy-spool-racer/ (accessed Sept. 25, 2013). A step-by- step instruction on how to create a kinectic and potential energy car made from rubber bands and an empty spool of thread.

Bibliography for Children

In *OIl , Gas, and Coal*, by Tea Benduhn. Pleasantville: Weekly Reader, 2009. This book focuses on the fossil fuels of oil, gas and coal.

In *Solar Power*, by Tea Benduhn. Pleasantville: Weekly Reader, 2009. This book focuses on the use of solar energy.

In *Water Power*, by Tea Benduhn. Pleasantivlle: Weekly Reader, 2009. This book focuses on the use of water power.

In *Wind Power*, by Tea Benduhn. Pleasantville: Weekly Reader, 2009. This book focuses on the use of wind power

In *Water Power*, by Tea Benduhn. Pleasantvile: Weekly Reader, 2009. This book focuses on the use of water power.

Benduhn, Tea. "Energy for Today: Ethanol and Other New Fuels." In *Energy for Today: Ethanol and Other New Fuels*, by Tea Benduhn. Pleasantville: Weekly Reader, 2009. This author has written several books on clean energy. This book focuses on the types of new fuels that can be used in place of oil and petroleum.

In *Catch the Wind, Harness the Sun*, by Michael J Caduto. North Adams: Storey, 2011. This how-to book provides 22 activities for children to try at home using wind and solar energy.

In *A Clean Planet: The Solar Energy Story*, by Robyn C., Judith Love Cohen and Lee Rathbone Friend. Marina Del Rey: Cascade, 2009. This book gives ways of collecting and using the sun's rays for a cleaner planet.

In *Done in the Sun: Solar Projects for Children*, by Anne and Mina Yamashita Hillerman. Sant Fe: Sunstone, 1983. This is a how-to book on solar energy. It gives several activities that children can do at home to experience the power of the sun.

In *Our Earth: Clean Energy*, by Peggy Hock. New York: Children's, 2009. This book is about using clean energy sucah as solar energy and the many uses such as heating a swimming pool witht eh sun's rays. The author contriutes to clean energy by driving a hybrid car ran on gasoline and electricity.

In *A Refreshing Look at Renewable Energy with Max Axiom*, by Cynthia Martin and Barbara Schulz Katherine E. Mankato: Capstone, 2010. This is a high interest graphic book about renewable sources of energy. Good science content with a lower reading level.

In *Green Power Solar and Wind Power*, by Peter, and Michael Kline Lerangis. Pleasantville: Reader's Digest, 2009. This book focuses on wind andsolar power. It includes a solar powered car to build.

In *The Kids' Solar Energy Book Even Grownups Can Understand*, by Tilly, and Malcolm Wells. Spetgang. Morganville: Imagine , 2009. Written for children this book gives clear and understandable explanations on how solar energy works and ways that it can be used. It is intriguing for adults with real life explanations of how solare energy can work today.

In *Harnessing Power from the Sun*, by Niki Walker. New York: Crabtree, 2007. This bok discusses how to collect power from the wind and the advantages and disadvantages of wind power.

In *Generating Wind Power*, by Niki. Walker. St. Catharines: Crabtree, 2007. This nonfiction book discusses the ways to collect the energy from the sun. It discusses the pros and cons of solar energy.