Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
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Energy All Around: Energy in Our Lives

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Introduction

One of the key goals of Two Way Immersion programs is that of children acquiring content area in a second language as they develop bilingualism and biliteracy skills in a multilingual and multicultural learning environment. One of the limitations teachers and students face in this type of programs is the lack of materials there are to ensure that children have access to a high quality curriculum. As the Spanish component teacher in a Dual Language or Two Way Immersion Program, I often have to create my own materials so my students can meet district goals and objectives within the guiding principles of Dual Language education. This curricular unit is a first step in creating some new materials to use with second language learners in mind.

As part of this program, the students receive all instruction in their second language 50% of the time. Thus two teachers, each with a separate class, are in charged of teaching the corresponding mathematics, science, and social studies curriculum. As the Spanish component teacher, my task is to ensure the students acquire content subject matter through their second language. This creates a few challenges other than making sure I have materials in Spanish, the most poignant being, to create lessons that are comprehensible to the students in their second language. For such a purpose, I make use of instructional strategies that enhance the development of bilingualism, biliteracy, and academic achievement. Many of the strategies used come directly from theory on Sheltered Instruction. I am constantly adjusting my rate of speech, I make use of real objects and/or pictures that represent what we are discussing, which becomes the scaffold upon which students can begin to build. I use short and simple sentences, repetition, restatements, and the same grammatical structures being targeted over and over again. I give instructions in simple sequential steps and pair L1 (native language) and L2 (non-native language) speakers so they can translate or help as needed. These strategies among others, hand-in-hand with cooperative learning techniques that provide students with opportunities to use language in real life and learning situations, describe my classroom environment.

When the word energy is mentioned, the first thought in many people’s minds relates to liveliness or capacity to do work. Therefore, we speak of having no energy, as if we were so tired that we cannot perform a task and are in need of food and nourishment. Also we tend to associate it directly with the “juice” needed for a home appliance to function. Although, these uses of the word energy are indeed appropriate to what energy is, there is much more involved and essential to our lives in the definition and make up of all its elements.

This unit will dispel some of the myths and generalizations as we discover and uncover what energy is, how it affects our lives, why it plays such an integral part of who we are and what we do. Consequently, this unit will serve as a primer and will touch upon many of key issues, that individuals and developing as well as industrial societies face in order to make their economies viable.

As an elementary school teacher, I attempt to explore in this unit the role energy plays in our lives. My objective is to bring to my students' attention the importance that energy has in a technological society and to encourage students to explore their lives looking for ways they are affected both positively and negatively by energy.

Goals and Objectives

Throughout this unit I present a series of lessons that meet the New Haven Public Schools' curricular framework, and specifically performance standards on science, language arts, social studies, social development, and mathematics. These lessons incorporate a wide range of the strategies and techniques implemented in a constructivist classroom and sheltered instruction, as the students make sense and integrate their previous knowledge into the new content. Students create meaning from their interaction with other class members, adults in the home, the classroom, the school setting, and the community that surrounds the student. Thus, I view learning not as a passive knowledge acquisition process, but as an active process where the teacher provides students with opportunities to explore the topic at hand, and values each of the students' experiential reality.

The classroom will become our laboratory where the concepts covered in this unit will be introduced and are concretely linked to the student's experiences. The concepts of energy, and their uses is presented within the context of day-to-day life experiences and the effect of their usage, production and acquisition will be later explored. In another sense this unit will attempt to ignite the students' wondering curiosity as the central force that directs and guides their study of many of the objects and things that use and produce energy around us.

For such a purpose, this unit studies everyday objects from the perspective of the energy concepts involved in their creation or the use of energy they make when we use them. By this, I mean that the day-to-day objects are studied as units of analysis and mainly interested in explaining and making students understand how energy is used/produced/wasted. Initially, a "historical" perspective is offered in order to contextualize the reasons and importance of energy in our lives. Thus, questions such as, "What is energy? What is the importance of energy? Why do we need energy? Is it possible to live without using energy? Which are the most important types of energy we depend upon? Which are the principles related to energy that are involved in the function, use, design of the given "object?," become the beginning steps in our journey in our study.

Once the previous questions have been explored, I continue looking at some more complex questions reflective of the overall goals and objectives of the unit. Why does energy play such an important role in local, national and international policy? What are the basic principles of the relationship between energy and environment that any citizen should be aware? What are the direct and indirect environmental impacts of energy acquisition, transport, production and use?

The topic at hand would allow for many activities related to the changes that take place in the conversion of

energy into motion that are above and beyond the capacity for such young students to begin to understand. However, students would be able to see the relation there is between fuel, energy, and work, even if they do not grasp all the factors and elements involved in the conversion. As part of the first and second grade curriculum, students begin to explore both non-standard and standard units of measurement. Thus students begin to use units of measurement such as the inch, foot, yard, and centimeters. They also begin to explore instruments to measure weight, temperature, and distance. Within this context, the common units of energy of calorie and BTU (British Thermal Unit) will be introduced. However, formulas, and the internal processes play in the conversion of fuel as energy into work or heat, will not be part of the lesson objectives.

Through different activities we will study and explore different forms of energy, their environmental factors, the production and use of energy in different cultures, and compare and study how energy use, production, transport and environmental impact is alike and different around the world.

Background

Given the fact that this unit will be implemented at the elementary level with second language learners in mind, it is a challenge to make this topic as concrete as possible so that students can relate to it in their own lives. For such a purpose, a series of basic lessons are set up so that the children have the background knowledge needed to explore the less contextualized concepts that attempt to be addressed as an answer to the above questions.

Energy in Our lives

As the price of fossil fuels reaches its highest level since the energy crises in the 1970's our dependence on fossil fuels is ever increasing and more indispensable to the well being of our economies and society. The higher demand for fossils is due mainly to energy-dependent economies. Without energy most developing and industrial societies would be unable to maintain their economic growth and subsistence. Without the use of an energy source, our societies would crumble. It is therefore of vital importance that we begin educating our students on how our reliance on different sources of energy affects our daily lives, the role it plays in our day-to-day activities, and the way that the acquisition, transport and production of energy affects us all.

Almost everything we see around us, the cloths we wear, the food we eat, the houses we live in, the paper we write on, the vehicles we drive, all need energy to be created or transformed from some natural resource to the final product. Without some form of energy, the "raw" materials cannot be transformed so that they can be utilized for their intended use.

At the same time, without some type of source of energy, many of the machinery used during the production and manufacturing could not operate. Therefore, we can begin looking at energy from two different perspectives: 1) everything we consume makes usage of energy in the production and manufacturing process; and 2), energy is needed to run machinery, cars, light up homes, computers, etc.

Where does energy come from?

There are both renewable and nonrenewable forms of energy. According to the Encarta World English Dictionary (1999), renewable energies are those that are "able to be sustained or renewed indefinitely, either

because of inexhaustible supplies or because of new growth." This is the case of solar, hydraulic, and wind sources of energy. Nonrenewable forms of energy originate in fossil fuels, that is, from the breakdown of organic matter through millions of years into coal, oil, and natural gas. One of the main problems with fossil fuels is that there is a limit to the amount there is, and that in the process of combustion, they release pollutants into the atmosphere. The majority of fossil fuels are used to create electricity.

In all these processes some forms of energy is used to produce other forms of energy. But before we take a closer look at these two sources of energy, we must begin with a simple and general definition of what energy is.

What is energy?

Energy is the capacity of a system to do work. Without energy our society would be unable to perform. For example, the "heating value" of a fuel is used to measure energy. The most common units of energy are the calorie and the BTU (British Thermal Unit).

Why is energy so important in our lives?

Life on earth makes uses and depends, in one way or another, on some sort of energy. Without energy our human body would be unable to perform respiratory, circulatory, or digestive functions to name a few. Plants would be unable to complete the chlorophyll process of converting the light from the sun's rays into chemical energy. Motors would be unable to perform without the use of a source of electric energy.

Energy plays an integral part in the progress of human kind. Since the beginning of mankind, we have made use of wood, water, and fossil fuels as a means of heating and making machines work.

California's energy crisis in the past years has brought to everyone's attention the limitations of an energy dependent society gone awry because of the politics of energy. In contrast, over 180,000 independent systems in the United States produce the majority of energy they consume via passive-solar energy and wind, power cells and other alternative renewable sources of energy. In these systems efficiency is a key component decreases the dependency on other non-renewable sources of energy such as coal and other fossil fuels.

In today's society, the cost of energy from fossil fuels is increasingly higher in terms of production costs, and in the amount of pollution that it emits. Car and power plants could benefit from new technologies that would increase the efficiency of the engines and power plants, decrease the pollutants they emit, and make those machines last a much longer time.

The top consumers as well as producers of energy are the United States, Russia and China. In terms of other energy producing countries, we encounter Saudi Arabia, Canada, United Kingdom, Iran, Norway, Australia, and Mexico. These countries are rich in nonrenewable energy sources. The top energy consumers reflect highly industrialized societies, in the case of China, India, and Brazil, also some of the most populous countries. Behind the United States, China and Russia we have Japan, Germany, India, Canada, France, United Kingdom, and Brazil.

History of energy

Since the beginning of history, people have looked for ways of making work easier. At first they domesticated animals in order to perform hard labor. With simple inventions such as the wheel, the lever, and the ramp, they made it possible to move their civilizations forward and accomplish great projects. They also made use of

wood and coal to heat up their homes, in addition to water to mill wood and ground grain.

It is through the use of fire and water that the first steam engine came to be. Hero of Alexandria has been credited with the invention of the first steam engine sometime between 150 BC and AD 150. Yet, it is through the study of some of the pioneers such as James Watt (1736-1819) with his improvements to the steam engine of Thomas Newcomen (1663-1729) and some of his successors, that we begin to observe how these discoveries caused significant changes in the history of civilization.

Some of the most noteworthy pioneers of the history of humankind in relation to energy are: George Simon Ohm (1787-1854) who was able to define the relationship between voltage, currents, and resistance (Ohm's Law) of great consequence to the field of electricity; Michael Faraday (1791-1867) known as the father of the electric motor, electric generator (dynamo), electric transformer and electrolysis. James Prescott Joule (1818-1889) shared in the discovery of the conservation of energy (1st Law of Thermodynamics). Thomas Edison (1847-1931) invented the light bulb, incandescent electric lamp. Rudolph Diesel (1858-1913) patented the internal combustion engine, which changed manufacturing and transportation. It is in 1876 that German engineer Nikolaus Otto, based on Alphonse Beau de Rochas proposed four-stoke cycle, builds and patents the gasoline powered auto-cycle engine, otherwise known as the four-stroke Otto cycle.

Types of energy

There are many types of energy that support and enhance life on earth. The most important type of energy is the one that originates in fossil fuels (oil, natural gas, coal). Fossil fuels are the remnants of millions of years of sediments of organic matter and represent the highest percentage of all the sources of energy. In the Unites States alone 39% of the sources of energy is from oil, 24% from natural gas and 23% from coal. That leaves only 14% of the energy consumed from other sources such as nuclear, hydropower, solar, etc.

How is the energy produced? What different types of energies are used around the world? Is there any pattern of usage of energy across the country and the world? What are the most important factors that affect energy production, consumption, and waste?

Forms of Energy

Energy comes in many different forms. Based on the 1st law of thermodynamic that states that energy cannot be destroyed, but only transformed, many of the forms of energy can be transformed to other types of energy. The most important forms are:

- Mechanical energy includes potential and kinetic. Potential energy is the energy that is stored in a system while the kinetic is the one created from the movement of matter.
- Solar or radiant energy is generated by the sun's light and heat.
- Thermal energy relates to the heat of an object.
- Chemical energy is the one stored in the chemical bonds of molecules.
- Electrical energy is the energy produced through the movement of electrons.
- Electromagnetic energy is the energy associated with waves.
- Nuclear energy refers to the one used in the nuclear atom's structure.

Lessons

The following lessons represent a sample of the different elements that are part of this unit and with the main goal of having second language students understand and interact with the content regarding engines, motors, and the environment through a second language in a cross cultural environment. The main goal of these lessons is to develop second language academic proficiency. For such a purpose, close attention is placed upon key concepts, outcomes, assessments, appropriateness of language, lessons developed with the L2 learner in mind, and selected vocabulary.

As part of the concept development strategy, three types of lessons are demonstrated: 1) concept comprehension (presented in L1), 2) integrated group lesson, and 3) second language development.

Concept Comprehension: L1

This part of the unit will be introduced in linguistically homogeneous groups during the Language Arts block. This block of time is scheduled daily with the purpose of working on literacy on the dominant or L1 language. The reason to introduce this unit during this block of time is to provide students with the main concepts of energy, motors and the environment in the language they can best understand. This lesson will activate prior knowledge, and provide the student with some of the content concepts and vocabulary. Most importantly, because instruction is in their dominant language, the focus is placed on higher order thinking.

Integrated Group Lessons

Most of the unit will be implemented in mixed heterogeneous groups. The make up of each of the two separate groups (English and Spanish components), is of 50% L1 dominant and 50% L2 dominant students. Each of these groups will work through the rest of the lessons. Half of the integrated class in each of the classes will receive instruction during that week using L2. During one week, each of these groups receives all the lessons in one language (Spanish) while the other group is receiving instruction in the other language (Spanish).

Because the concept comprehension lesson was introduced in their first language, and then the groups were mixed 50/50, the students now have some prior knowledge activated and will be able to relate their new knowledge, some of the vocabulary, and more importantly, some foundation of the concepts to be explored throughout the unit.

Second Language Development

This component of each of the lessons is the most important one, given the type of a program in which it will be implemented. In order to ensure that all students acquire content area in their second language as they develop bilingualism and biliteracy skills, emphasis is placed on the linguistic goals to be met throughout the unit. This means that close attention is placed on listening, speaking, reading, and writing. Therefore, these lessons not only provide some key vocabulary, but also have explicit grammatical structures, and linguistic elements that are based upon district Language Arts standards. Those standards targeted as part of this unit can be found in Appendix A.

Key Concepts

- Energy plays a key role in all facets of our lives. It plays an integral part of who we are and what we do.
- Energy cannot be created from nothing and cannot be destroyed.
- There are two types of energy: renewable and non-renewable.
- A society cannot maintain economic growth and subsist without energy.
- Societies are dependent on energy production and use. Without energy we cannot enjoy the advances of a technological society.
- Without some form of energy, “raw” materials cannot be transformed and be utilized for their intended usage.
- Everything we consume makes usage of energy in the production and manufacturing process.
- Energy is needed to run machinery, to produce work or make more energy.

Introduction

In order to activate students’ prior knowledge of what energy is and the importance that it has in our lives, the unit will begin with the two poems I wrote and that are listed in Appendix C. These poems and the key concepts targeted in each lesson will be revisited throughout the unit and written on the blackboard. The key concepts will anchor the activities that follow and children will be able to explain in their own words the statements.

Having read the poem a couple of times, the teachers begins by finding out through questions what students know about energy, engines, and their importance. Some of the guiding questions could be:

What would happen if there were not light? What do cars and buses need in order to run? What happens when we turn on the switch? What does a light bulb (computer, television, elevator, etc.) need to work? What would happen if electricity did not exist?

As children freely respond, the teacher writes down the comments and makes a list of what the children know, and talk about. This will be repeated at the completion of the unit to evaluate how much information the students have gathered.

Next, the teacher will show the students three of the key concepts that will direct the discussion prior to a hands-on activity that will follow the whole class mini-lesson on renewable vs. non-renewable forms of energy:

- Everything we consume makes usage of energy in the production and manufacturing process.
- Energy cannot be created from nothing and cannot be destroyed.
- There are two forms of energy: renewable energy and non-renewable energy.

The energy magnifying glass

Some traditional books, such as *Little Red Hen* can be read through an "energy magnifying glass", focusing on the different types of energy that are either used by the characters, the different seasons when the story takes place, and the machines that are used throughout the story. This can serve as an additional way of bringing key concepts to life through story telling.

At the beginning of the story the Little Red Hen finds some grains of wheat. Because none of her friends help, she plants the grains and takes care of them through the spring and summer seasons all by herself. This is the perfect place to begin looking at the importance that the sun plays in the growth cycle, the seasons, the wind patterns. How the wheat converts the sunlight into the food allowing it to germinate, grow, and produce seeds, which will be the crop that once milled will allow her to make the bread she needs to feed herself so she can do her work. Here, the children will begin to understand that the energy is transferred from the sun to the plant, to the animal, to the person. That energy is not destroyed but transformed.

In this story we also have two forms of renewable energies being used, the sun as the plants chemically convert light, and the water mill where Little Red Hen brings the wheat to be turned into flour. Additionally, we can observe her working using different tools such as a hoe and a wheelbarrow, converting it into kinetic energy. When she bakes the cake, we can assume she is using wood, coal, or electricity. Thus, a simple story such as this can be used as the springboard to bring the children's attention to the different types of energy that there are and how important they are in our lives.

Concept Comprehension L1

Title: Renewal versus non-renewable types of energy

Students classify different types of energy as either renewable or non-renewable, as we look at how the objects make use of the energy, and why it is important. This lesson will be taught in the students' dominant language first, as a whole class, followed by an activity where students will work in small groups.

To begin students will be offered a set of pictures including everyday objects (i.e. plant, car, giraffe, light bulb, internal combustion engine, campfire, wind turbine, snowcap mountain) and discuss how each of the objects makes use of either a renewable or a non-renewable source of energy. At the completion of this lesson, the students will come up with two groups of cards, one for renewable and another for non-renewable energies. This lesson can be later repeated by adding different cards. Once the students have a clear understanding of the difference between both forms of energy, each of them can be subdivided based on different sources of energy.

Performance Task I- Sources of Energy

The lesson plans have been further broken down into tasks and have been written with the student in mind.

The descriptions give the student a clear understanding of what they are expected to do, how they have to do it, and how they are going to be assessed. The students will receive copies of the assessment by which they will evaluate their own work.

The performance tasks are to be given to the students prior to the beginning of the task. It is the road map that the student, will use to be able to perform what we are asking them to do. As part of the process the students will also be able to preview the assessment tool by which they will be evaluated. Please look at Appendix B for a sample of the rubrics.

Background: 86% of the energy consumed in the United States comes from nonrenewable sources of energy (i.e. fossil fuels) while only 14% comes from renewable sources. Energy produced from fossil fuels creates problems because of pollution and because there is only a limited amount in nature.

Task: You will work with your group in drawing, and writing a list of all the animals, machines, and objects you can think of. Afterwards, you will use the computer to access the World Wide Web to list the major sources of renewable and non-renewable energy. Finally, you will classify them according to what type of energy they make use of.

Purpose: To list the major sources of renewable and non-renewable energies and sort all the animals, machines and objects in your list into categories according to the type of energy they use.

Procedure: Access http://www.eia.doe.gov/kids/whatsenergy.html

- Read about the types of energy.
- Create a list of the major sources of non-renewable energy
- Create a list of the major sources of renewable energy
- Brainstorm and write a list of as many machines and objects as you can.
- Classify those machines and objects according to the type of energy they consume

Audience: Classmates and teacher

Assessment: Please see Performance Task Listing/Categorizing - Appendix B

Extension: Classify the machines and objects according to the source of energy they use (i.e. by oil, coal, natural gas, sun, etc.)

Home-School Connection: Students make a list of all the objects in their homes that make use of energy.

Integrated Lesson

Title: From mechanical to electric energy

Students will be able to demonstrate how mechanical energy is transformed into electric energy through the use of a dynamo. This lesson will be a demonstration lesson taught with a mixed group of students.

First, we will begin reading the poem *La energía es fundamental* . Next, we will read the following key concepts and look at ways in our lives that we use energy.

- Energy plays a key role in all facets of our lives. It plays an integral part of who we are and what we do.

- Societies are dependent on energy production and use. Without energy we cannot enjoy the advances of a technological society.

Energy cannot be created from nothing and cannot be destroyed.

We will follow by talking about how mechanical energy can be potential and kinetic. This will be modeled through the traditional game of a spinning top and the string used to make it turn. As a class, we will write a simple definition and look at how mechanical energy can be turned into electricity. Some examples of this can be a crank radio and a bicycle dynamo. A good technical drawing of all the components can be found at http://bwc.hkcampus.net/~bwc-ch/bicycle_dynamo.htm.

This is an important lesson in that a dynamo or electric generator is a key component of all the machines and the foundation of a technological society. This is in fact due to Michael Faraday's discovery of the dynamo in 1831. Its function is that of converting one form of energy into continuous electricity.

Because of the availability of many kits to build a dynamo, we will follow Faraday's lead and as a class we will build our own using one of the kits. We will also experiment with a dynamo bicycle light and a flashlight that makes use of a crank to light up a bulb.

We will finish the lesson by doing a shared writing activity where we will write down as a class some of our observations and what we learned. We will also look for machines that make use of a generator.

Second language development

Title: From wind to electricity

Students will be able to name the parts of a wind turbine, demonstrate how it works and how the wind power is transformed into electric energy through the use of the turbine. This lesson will be taught in the student's second language.

First, we will begin with a shared reading activity of *El Viento* (Solano, 1986) and create an experiential chart about the wind. At the completion, we will be reading the key concepts of the unit.

- Societies are dependent on energy production and use. Without energy we cannot enjoy the advances of a technological society.

- Energy cannot be created from nothing and cannot be destroyed.

- Energy is needed to run machinery, to produce work or make more energy.

Next, we will take a tour of the multilingual Danish Wind Industry Association World Wide Web site pages related to *Wind with Miller* . Here we will be able to see an overview of the many interactive activities

designed for children that explain the construction, elements needed to create a wind turbine and how they work. One of the most important advantages of this site is it can be accessed by the teacher in four different languages. Thus, the English component teacher can have all the students going over the activities in English, while the Spanish component teacher and students can access the activities in Spanish.

Performance Task II-Wind energy

Background: Our society depends on energy. Energy produced from fossil fuels creates problems because of pollution and because there is only a limited amount in nature.

Task: You will work with your group to create a schematic diagram of a wind turbine.

Purpose: To name the major components of a wind turbine, explain what is the purpose of each of the components in the production of energy and how a wind turbine works.

Procedure: Access http://www.windpower.org/es/kids/index.htm

- Click on “curso acelerado”.

- Create a list of the major components of a wind turbine

- Make a drawing of the wind turbine – aerogenerador and write the labels of each of the components.

Audience: Classmates and teacher

Assessment: Please see Performance Task Schematic Diagram- Appendix B

Extension: Create a schematic diagram for each of the components and label its components with a small description of their function.

Home-School Connection: Students make a list of all the objects in their homes that make use of energy.

Related L2 vocabulary: dibuja - draw, escribe - write, partes - parts, componentes – components

Core vocabulary: aerogenerador - wind turbine, torre - tower, gondola - nacelle , transformador – transformer, rotor, cimentación - foundation

Extended vocabulary: caja de engranajes (multiplicadora) – gearbox, veleta – wind vane, anemómetro - anemometer, motor de orientación – yaw motor, eje principal – main shaft, generador – generator

Specific language structures addressed (scaffold oral expression): ¿Cuáles son los components de…..? Los components de ……son…..¿Para qué sirve el/la……? La/El …… sirve para……

And then there were more

The following would be the sequence of the follow up lessons that would continue our exploration of different types of energy in our lives. Most of them do focus on renewable forms of energy, even though they account for a minimal amount of energy production to satisfy the need that out society has. However, it is an important part of this unit to explore the effects that our fossil fuel dependency has on the environment. One way of demonstrating this through the lessons is to focus on how much cleaner is the use of renewable

sources of energy as compared to fossil fuels and other forms of non-renewable energies.

The following lessons will share the same structure as the previous ones and are here listed as extensions. All of them will begin with a poem or a book, followed by the key concepts to be discussed. Then, we will discuss what we learnt in the previous lessons and will relate what we are about to learn to our lives. When we begin to discuss the sun as a source of energy, we will be able to relate it to our own experiences. For example, how hot the water in a bottle gets when we leave it in the sun, just the same way as when we heat it on the stove.

There are great web sources that not only discuss the concepts, but also integrate graphics and sounds in an interactive way that make learning that much more exciting and fun. Please refer to the electronic resources listed on the back of this unit.

From Solar to Electrical

The sun is the cleanest and the most abundant source of energy. If we were to exploit the amount of energy that the sun produces in one minute, we would be able to meet the world's energy needs for one year.

Students will follow Task I or Task II above using solar energy as the concept to explore. Students will explore Environmental Education Exchange site on solar, thermal, chemical, and photovoltaic energy http://www.eeexchange.org/solar/frameset.htm Later, students will experiment with a photovoltaic cell to make a light bulb work.

Energy Consumption Around the World

Students locate on a map the top five energy-producing countries.

Students locate on a map the top five energy-consuming countries

Graphing Energy Consumption Around the World

Students read a graph showing the amount of total energy consumed by each of those countries.

Students read a graph depicting the sources of energy consumption for each of those countries.

Last Word

Because of the lack of materials in Spanish, I suggest the teacher make tapes of non-fiction books in order to provide the student with many opportunities to listen to the principles involved. These could be used at the listening center after they have been introduced to the class. The following is a list of suggested strategies to meet the goals and objectives of this unit.

Language arts: Introduce the story as a read-aloud, focusing on listening skills, doing a shared-reading lesson, whole class, in guided-reading with smaller groups of students (make a copy of any of the stories in book format). As a listening center, taping a story. As a written prompt, consider re-writing a story like Little Red Hen bringing it up to the new millennium and have her using all non-renewable sources or only renewable sources of energy.

Art: Making new gadgets that use some of the components of wind turbines, photovoltaic panels, generators, etc.

Science: Comparing the temperature of rooms at school that face South or North. Make a prediction. Collect data. What is the difference? Why? Conclusions.

Social Studies: Timeline of inventions related to energy, maps, find places of birth of key inventors listed on this unit.

Games: Make a set of cards with the name of the scientist and the major invention or accomplishment they are known for. Create a series of bingo cards with different types of energy. Match games with sources of energy and different types within that source.

Appendix A: Standards

New Haven Public School Curricular Standards

Social studies performance standards

Use a computer to access information

Compare traits found in family and neighborhoods from another time or place with those of the students

Language arts performance standards for grades K-4

Read at least 4 books on the topic of energy, engines, the environment

Make a special project requiring both oral and written presentation through the use of the writing process (first draft, conference, revision, edit, and final draft)

Participate in technology for reading and writing

Social development performance standards for grades K-4

Learn to define and look ahead at consequences.

Practice good decision-making skills

Science

Identify different properties that can be used for classification.

1.1a Students will ask questions about objects, organisms and events in the environment.
2.3c Students will explore the ways in which heat can be produced.
5.1e Students will make a proposal to build something or make something work better and communicate their ideas verbally and in writing.
6.3c Students will investigate and discuss the limited availability of many natural resources and how their availability can be extended through recycling, reuse, and diminished use.

Mathematics

4.1 Students will collect and organize data to answer a question or test a hypothesis by comparing sets of data.
1. Students will display data in graphs, tables, and charts.
4.2 Students will make statements and draw simple conclusions based on data.
a. Students will read for information data in tables, charts, and graphs.
b. Students will compare data in order to make true statements.
c. Students will identify and use the mode necessary for making true statements, e.g. “most people chose red”.

Library Media and Technology

Create a product related to the material heard, viewed and/or read

Use a self-assessment tool prepared by the teacher/student

Appendix B

CLASSROOM ASSESSMENT LIST

Listing / Categorizing - ELEMENTARY SCHOOL

1. Sources of energy
T: I have written the name of all the sources of energy.
O: I have written the name of some of the sources of energy.
N: I haven’t written the names of any sources of energy.
2. Listing
T: I have made a list of many different machines and objects.
O: I have made a list with some machines and objects.
N: I have not made a list of machines and objects
3. Classification
T: I have classified all the machines and objects by their energy source.
O: I have classified some of the machines and objects by their energy source.
N: I have not classified any of the machines and objects by their energy source.

Did I do my best work?

Terrific OK Needs Work

CLASSROOM ASSESSMENT LIST

Schematic Diagram - ELEMENTARY SCHOOL

1. Diagram
   T: I have drawn a picture of the object with many details.
   O: I have drawn a picture of the object with some details.
   N: I have drawn a picture of the object with very few details.
2. Labels
   T: I have written the labels of all the important components.
   O: I have written some of the labels of the important components.
   N: I have written only a few of the labels of the important components.
3. Oral presentation
   T: I know the role of each of the components in the object.
   O: I know the role of some of the components in the object.
   N: I know the role of only a few of the components in the object.

Did I do my best work?

Terrific OK Needs Work

Students Resources

Challoner, J. (1993). *Energy* . London ; New York, Dorling Kindersley.

Surveys various sources of energy and the ways in which they have been harnessed.

Diener, C. S. (1981). *Energy, a curriculum unit for three, four, and five year olds* . Atlanta, Ga., Humanics Ltd.

Helps young children understand the concept of energy and its sources, uses, and conservation through firsthand experience by manipulating materials, discussion, modeling, and play.

Hewitt, S. (1998). *Full of energy* . New York, Children’s Press.

An interactive approach introducing the concept of energy as found in food, sun, wind, water, and other sources and as used for nutrition, warmth, and motion.

Higgins, J. H. (1979). *Energy a multimedia guide for children and young adults.* Santa Barbara, CA., American Bibliographical Center--Clio Press..

Macaulay, D. and N. Ardley (1998). *The new way things work* . Boston, Houghton Mifflin Co.

Text and numerous detailed illustrations introduce and explain the scientific principles and workings of hundreds of machines. Includes new material about digital technology.

Macaulay, D. and Dorling Kindersley Multimedia (Firm) (1998). *The new way things work* . New York, NY, DK Interactive Learning,.

Helps children 8 and older to understand scientific principles, materials and properties. Features “digital age” technologies, machines, inventions, and twenty-two basic principles of science. Includes videos, animations, and illustrations.

McKinney, B. S. and C. Wallace (1999). *Pass the energy, please!* Nevada City, CA, Dawn Publications.

Rhyming text and illustrations present nature’s food chains, from a simple seed to a top predator, demonstrating their natural links.

Schulz, C. M. (1982). *Charlie Brown’s encyclopedia of energy : based on the Charles M. Schulz characters : where we’ve been, where we’re going, and how we’re getting there* . New York, Random House.

Alphabetically arranged entries dealing with aspects of energy including fuels, famous people, and types of energy.

Solano Flores, G. and N. J. Pati–o Domínguez (1986). *El viento* . Mexico, Editorial Trillas.

Describes the wind in simple terms that children can relate to. The big book edition allows for shared reading experiences. Includes colorful photographs.

White, L. B. and L. Hamilton (1995). *Energy: simple experiments for young scientists* . Brookfield, Conn., Millbrook Press.

Teachers Resources

Fay, J. A. and D. Golomb (2002). *Energy and the environment* . New York, Oxford University Press.

Everything you wanted to know about energy, the environment and more. Very thorough, technical, and with many references.

Fenn, J. B. (1982). *Engines, energy, and entropy: a thermodynamics primer* . San Francisco, W.H. Freeman.

This is an excellent resource for the mathematics and physics teacher, yet is easy enough to read. The many tables, technical illustrations, and methodical explanations make it a great reference book.

Macaulay, D. and N. Ardley (1998). *The new way things work* . Boston, Houghton Mifflin Co.

Text and numerous detailed illustrations introduce and explain the scientific principles and workings of hundreds of machines. Includes new material about digital technology.

Electronic Resources

(2004). Clean Energy Basics, National Renewable Energy Laboratory. 2004 http://www.nrel.gov/clean_energy/.

This is a magnificent up-to-date source of renewable energy and energy efficiency information primer. It includes many links to additional resources.

(2004). Ecokids, Earth Day Canada. 2004 http://www.ecokidsonline.com/pub/eco_info/books_n_links/eco_books/e_books.cfm

Has a great number of resources geared towards children and young adults. It also includes a list of teachers and parents resources, links, games, and great graphics.

(2004). EduGreen, The Energy and Resources Institute http://edugreen.teri.res.in/index.asp.

This site is geared towards older students. However it has to offer many great resources, including stories, poems and multimedia projects. Because it originates in India, this site offers a multicultural perspective.

(2004). Energy Quest, California Energy Commission http://www.energyquest.ca.gov/.

A very comprehensive site with all types of resources from science fair projects to colorful graphics, biographies, games, and many links.

(2004). Moliner y el Viento. 2004 http://www.windpower.org/es/kids/index.htm.

A highly recommended site for anything having to do with wind energy. This is possibly the only multilingual site that includes multiple activities geared towards students, teachers and parents. A must site for anyone interested on wind energy!

(2004). Solar Energy Education, Environmental Education Exchange. 2004 http://www.eeexchange.org/solar/frameset.htm.

What I like about this site is the simplicity of the site, yet the thoroughness of the information. Highly recommended for the primary level.

(2004). What is Energy?, Energy Information Administration http://www.eia.doe.gov/kids/whatsenergy.html.

An excellent site for young students. Has great graphics with a comprehensive look at sources of energy and many links.

@1H:Appendix C: Poem

La Energía Es Fundamental

La energia y yo

la uso cada dia

Por la ma–ana hasta la noche

Desde la medianoche al mediodia

En el invierno y el verano

La primavera y el oto–o

En la escuela, en el teatro,

En la tienda y en el ba–o

El carro, la bicicleta

El barco y el motor,

Sin energia no hay

Ni viento

Ni movimiento

La energia y yo,

Somos una. No dos

Si se mueve

Si usa o no usa un motor

La energia es

Para todo esencial.

Viene en dos estados

Una es la energia potencial

Y de la kinescética

no te puedes olvidar

Pues la energia

Para todo es fundamental.

Para crecer y jugar,

Para correr y calentar

Para mover y poder funcionar

Sin energía nada, ni nadie

Puede trabajar.

Energy All Around

Energy, energy all around

Energy, energy up and down

From the clothes we wear

To the foods we eat

From the cars we ride

To the music we hear

There is energy

Even though it can’t be seen

I know it when it moves

I know it when I grow

From consumption

To production

From the water, the air

The sun and the sea

Energy, energy all around

Energy, energy up and down