You, Me, and Energy Makes Three!

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This curriculum unit is recommended for:
Science/English Language Arts/Grade 3

Keywords: energy, kinetic energy, potential energy, wind energy, solar energy, hydroelectric power, renewable energy, nonrenewable energy, energy conservation

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

Synopsis: Energy is all around us! This curriculum unit provides students with the understanding that energy cannot be destroyed, but changed from one form to another. The students will not only explore how energy can be transferred from one object to another, they will also study and participate in activities bringing about a closer look into solar, wind, and hydropower energy as renewable energy sources. Given these sources offer many advantages for their optimal use, society has discovered some controversial disadvantages that still beg the question of whether or not investment of financial and capital resources should be placed into the alternatives for certain areas of the country. As the students explore these ideas surrounding the topic of energy, they will be able to get a bird's eye view of what all this means in their own lives as they build their own solar oven, discover how wind farms provide the means for electricity, and use a model of a water wheel to simulate the power of powerful, rushing water transforming itself into electricity via a hydroelectric power plant built near a river. The students and their families will prepare some of their hands-on projects at home for subsequent display and oral presentations. Additionally, the students will prepare a Power Point presentation about the different sources of energy and present their presentations in class for their peers and parents whom we will invite to our classroom.

I plan to teach this unit during this school year to 30 students in Science/Literacy for Grade 3.

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Introduction

Oaklawn Language Academy is a full magnet Spanish Language Immersion Program school serving students in grades K-8. The vision statement of the school concentrates on "Empowering Globally Minded Leaders in a Multicultural World". The vision encompasses the promotion of bilingualism, bi-literal, and multicultural education through a global and diverse learning environment that requires rigor, relevance, and engagement. The school is located in a historical section of the West End community of Charlotte, and many students enrolled in our school are actually present due to their parents having applied through the magnet school lottery to attend our school. For the first time since our school's existence since 2004, the school has qualified as a Title I School. We have 76% of our students qualifying for free and/or reduced lunch. Racially diverse, our school's racial composition consists of the following: 57% African-American, 38% Hispanic, 23% American Indian, 13% Multi-racial, 7% Caucasian, and 1% Asian, Pacific Islander or East Indian. We have a very active PTSA and wonderful parental support throughout our school. I am a new educator within the Charlotte-Mecklenburg School System, but I am an experienced teacher from the state of Georgia. This year will be my sixteenth year of teaching elementary students, and I am teaching two classes of third grade students in the areas of literacy and science. I am looking forward to teaching this specific grade level as third grade students are still curious about their world in the most innocent of ways and learn as quickly as a sponge soaks up water.

My classes are comprised of a substantially larger number of female students than male students. Female students tend to shy away from delving into science concepts wholeheartedly; I want to make this curriculum unit very student-oriented and fun for all. I want all of my students, especially my female students, to leave each day wanting to know more about energy while being able to provide their own families with some practical ways to conserve energy in their own homes.

Rationale

I will base this curriculum unit about energy on the 2009 North Carolina Essential Standards for Science for third grade students that were implemented by CMS in the school year of 2012-13. I am creating this curriculum unit about energy in order to provide students with a basic foundation about the different kinds of energy sources, how energy is transferred from one object to another, and the importance of conserving energy whenever possible.

The third grade essential science standards have only one main standard that is directly connected to energy, I feel compelled to provide additional knowledge about energy for my third grade students that will serve as a springboard for further investigation into the concept of energy in the fourth and fifth grades. In 4th and 5th grade, students explore how energy is transferred from one object to another, the various forms of energy that we use in our everyday lives, and what we can do as individuals to conserve and preserve energy sources for future generations.

This unit, "You, Me, and Energy Makes Three!" will be a fun, exciting exploration of light (solar), hydropower (water), and wind energy. While all of this can be very new concepts for a third grader, I plan to provide engaging student activities and realistic models that will bring all of these topics into focus for my third graders and provide the catalyst for creative and critical thinking that will leave them wanting to learn more! I want my students to become very literate about energy concepts so as they are developing and growing into responsible citizens, they will have a working knowledge extensive enough to make wise choices about energy alternatives that they may be presented with in their own lives.

Objectives

Since CMS has now implemented the new 2009 North Carolina Essential Standards for Science in this school year, I am compelled to provide as much rigor, relevance, and reliable information as possible for my third grade students this school year. I want my students to leave my classroom each day thinking about what I've taught them that day in science, and wanting to eagerly share this information with their families. Some parents may even find that their child has come up with some unheard of ideas about this unit that will spark even their own interests and curiosity to learn more about a particular concept or idea. I plan to teach this unit for three weeks in order to have ample time to give students their basic foundation about energy and allow a couple of days for students to conduct research for a culminating project that they will share with the class. Due to having to follow the pacing guide's timeframe for this unit of about three weeks, students will have to conduct some of their research outside of the regular school's hours in order to complete their projects within a reasonable deadline that will be given to them.

These are the specific science standards that will be taught within this unit:

3.P.3 Recognize how energy can be transferred from one object to another.

3.P.3.1 Recognize that energy can be transferred from one object to another by rubbing them against each other.

3.P.3.2 Recognize that energy can be transferred from a warmer object to a cooler one by contact or at a distance and the cooler object gets warmer.[1]

While I will utilize the concepts of friction, convection, and conduction to show students how energy can be transferred from one object to another, I will also provide students with basic principles about solar, wind, and hydropower energy. Since these forms of energy are being utilized more and more to actually provide electrical energy for homes and businesses today, I would like for my students to discover the practicalities and challenges that our society faces in using these alternative sources of energy.

Since I also teach literacy to my students, I plan to incorporate the following writing standards into this science unit in order to enhance what my students will learn about energy and to give them the opportunity to conduct their own research and present their findings about energy, especially about solar energy, hydropower energy, and wind energy.

Third Grade Writing Standards:

W.3.7 Conduct short research projects that build knowledge about a topic.

W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.

Teaching Strategies

I will use a variety of teaching strategies including technology to deliver my lessons to my third grade students. Here are some examples of how these lessons will be delivered to them within my self-contained classroom: teacher lecture/discussion, guided practice, group facilitation when inquiry-based activities are completed in small groups, technology integration using iPads, a Smart Board, and classroom computer terminals, use of related videos from Discovery Education, EduSmart on the CMS Instructional Web, YouTube, outside exploration of the environment, classroom experiments, projects given as culminating activities, independent practice, sharing of ideas through oral responses and presentations, and the opportunity for interested students and families to conduct further research as enrichment activities. I believe that while I will provide substantial teacher-directed lessons, it is important for students to have the opportunity to perform their own student-oriented, hands-on activities and investigations that will allow them to really have ownership in their own minds of their learning. The students will be able to work independently and with each other in heterogeneous groups so that struggling and moderate learners will have the opportunity to learn from students who are stronger and possibly more confident in their learning abilities. Realizing that differentiated instruction needs to be provided for as well in the classroom since all students do not have the exact same learning modality, I plan to incorporate different ways that students will be able to interact with this unit in order to learn the material to their best capabilities. Students will be able to use their creativity through the avenues of art, music, writing, speaking to the class through oral presentations, and synthesizing information to create a culminating project on various forms of energy.

Each of my science classes has created their own science notebooks based upon the current unit of study that I will teach them. When we start this unit on energy, each student will design their own creative, unique cover for this unit entitled “You, Me, and Energy Makes Three!” Within their notebooks, the students will be able to create a Table of Contents that will be added to as they are working on their own independent practice work as well as cooperative grouping work that they will record in their notebooks. The students will keep their notes taken from lectures, videos, procedures and data obtained from science experiments, reflections about their work, and teacher commentary in their notebooks. When preparing for assessments, students find by reviewing their science notebooks as well as reading their Science textbooks and other reference material given to them, they become much more prepared for taking their assessments. I, as their teacher, actually take tremendous joy in reading their notebooks for interesting comments that I frequently find about what they have been studying in class as I often provide them time to reflect upon their current work. The students often write side comments to interesting discoveries made during class and even come up with other ideas that they find they would like to find out more about as certain concepts seem to naturally trigger their curiosity button. Additionally, I am able to assess their understanding of their science units by not only what I observe my students actually putting into practice within the classroom, but also by what my students leave as evidence of their learning in their science notebooks.

As I begin this unit on energy, I want to be able to deliver instruction on not only upon the above-mentioned Essential Science Standards, but also incorporate the Writing Standards within my instructional delivery. In order to accomplish this task, my students will definitely have to spend at least a minimum of twenty minutes of Science instruction devoted to writing about Science in some specific way. This could be in a KWL chart (What I Know, What I Want to Know, and What I Learned), a FQR (Facts, Questions, and Responses), a comparison T-Chart for similarities and differences of certain ideas, and even creating stories that have a scientific base to their plots. I will not only teach relevant scientific vocabulary and definitions to my students, but I will ask my students to use their newly found vocabulary in scientific conversations when speaking to their peers about whatever they may working on together at their science class. I want them to get a real sense of using science as a “way of life” as opposed to something they just study at certain intervals during the week. I want them to engage in meaningful discussions with me and with each other at the onset of the unit so that I can ascertain what they may already know about energy and build upon this knowledge while weeding out any misconceptions that they may have. I often use anchor charts in my Reading and Writing Workshops that allow me to conduct mini-lessons with my students just before I give them a direct task to accomplish in class. Finding this a very effective tool for instruction, I will also use anchor charts in Science wherein I can place ideas and concepts directly in front of the class, use these ideas for teacher/student discussion, allow my students to interact in scientific talk with each other, and then return to their particular stations within

the room for either guided practice or independent work that they should be able to complete on their own or possibly with a partner if necessary.

Students will need to know that energy is not a one-time, give-it-to-me-now thing. Energy is not a "thing" that can be counted. Energy is neither created nor destroyed, but energy can be converted from one form to another. As energy can be divided into different categories, the teacher will need to provide students with a basic knowledge about kinetic and potential energy, light energy, solar (radiant) energy, hydropower (water) energy, and wind energy. Fossil fuels such as oil, natural gas, and coal will need to be discussed as well because these are important energy sources that have been produced by the reaction of sunlight with plants, algae, and decomposed materials from millions of years ago. Once students have a basic grasp about renewable and nonrenewable forms of energy, then the teacher will be able to have students understand the importance of such forms of energy as solar, wind, and hydropower energy. Since most students will have an idea about solar energy coming from the sun, the teacher will not need to spend a great deal of time expounding upon this idea, but yet, the teacher should let students know that solar radiation is a direct effect of the sun's rays as they are shone upon the Earth, and that too much radiation upon the human body is definitely harmful to one's cells. The teacher may have to break this concept down even further by explaining about how cells are the building blocks of our bodies. Showing pictures of animal and plant cells may help students to place this idea firmly in their minds, but not to worry, as they will delve even deeper into the concepts of cells in the fifth grade. Getting back to solar energy, the teacher will need to find out what the students may already know about solar energy and using the KWL chart definitely helps the teacher find this out within a short period of time. Introduce the terms of photovoltaic cells, turbines, generators, and solar panels to the students. Provide actual images of these concepts as third graders' attention span is still relatively short – (20-25 minutes for new concepts), yet excellent visuals will allow the students to grasp the concepts somewhat easier, especially for the visual learner. Paying close attention to the questions being raised by students will help the teacher guide the instruction about what should be learned about solar energy. The teacher can use the above essential questions to provide a focus upon what should be answered by the unit's end after the students have been given direct instruction and inquiry-based activities that will provide opportunities for the students to gain a real-world understanding of each of the energy forms (solar, wind, hydropower) being intensely studied during the unit. The students may be very surprised to learn about the wind and water as being ways to produce energy for our society. Third graders love asking to go get water at all times of the day, and when they find out that this very familiar liquid can also be used to generate energy, don't be surprised when they may say "I really need some water so that I can have more energy today!" Wind farms is a very cool thing to show students as most students will know what a traditional "farm" looks like, but when you add the word "wind" to "farm", this is definitely a whole new topic for students. Having visited California several times in recent years, I have seen some real wind farms, and I must confess that I was really astounded by the visual effect of

these wind farms before I even realized what these wind farms are actually supposed to be doing for the surrounding area. Once students realize that the wind can produce energy powerful enough to run electricity for cities, they will never think of the wind in quite the same way again. Last, but not least, have some fun with teaching the students about convection and conduction. I love to cook, so I plan to have a video that introduces the ideas about convection and conduction when it comes to heating kitchen appliances such as a stove and not to mention the pot on the stove used for cooking hot dogs, for example. Then, I plan to have a method of cooking some hot dogs right there in the classroom to share with the students as we talk about how convection and conduction plays a part in how these hot dogs were cooked! Students will definitely get these terms right on their science assessment as their taste buds will remember what these words mean even if their brain cells have a sudden lapse of memory.

Technical background

The following outline is needed to provide instruction within this curriculum unit:

- What exactly is energy?
- Transfer/Conservation of Energy
- Renewable/Nonrenewable Forms of Energy
- Solar Energy – Where exactly does it come from, how does it work, and why is it used as energy?
- Hydropower Energy – What is it and how is it used to provide energy?
- Wind Energy – Can the wind really give us energy to use everyday?

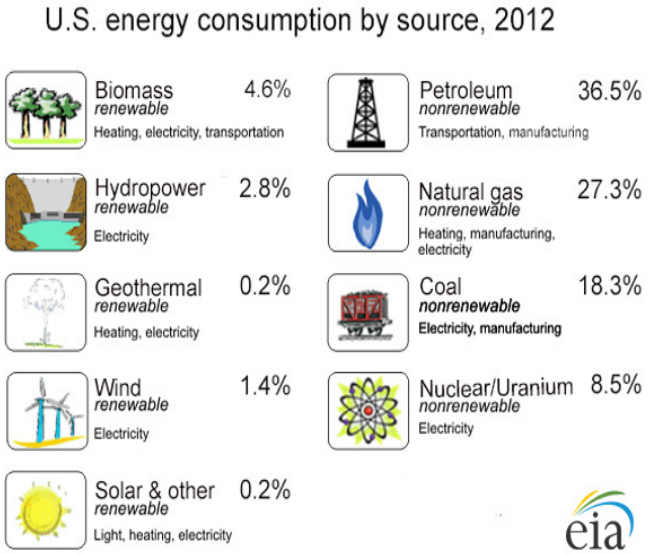
Energy has been defined by scientists as the ability to do work. We must have energy to do everything that we need to do in life. Our bodies need energy to function, and this energy comes from the food that we eat everyday. But is all energy the same? Does it all come from the exact same source? Energy can first be placed into two basic categories – potential and kinetic.[2]

Potential energy is energy that is stored up and hasn't yet been used. Potential energy comes in various forms such as chemical energy which is stored in atoms and molecules, mechanical energy which is stored in objects by tension, nuclear energy which is stored in the nucleus of an atom, and gravitational energy which is stored in the height of an object. The higher and heavier the object, then more gravitational energy is stored for that object. Once the object is released, the gravitational energy will be converted to motion energy. Think about a bicycle that is sitting still at the top of a very tall hill. While the bicycle is at rest, it has potential energy that is being stored up. Once the rider decides to go down the hill, all of the potential energy that has been stored up will be converted to motion energy which will allow the rider to speedily get to the bottom of the hill.

Kinetic energy or the energy of motion is actually what allows the bicycle and its rider to get to the bottom of that hill. Kinetic energy comes in the forms of light, heat, motion, electrical, and sound. All of these energy forms will need movement of some kind in order to be used as a form of kinetic energy. Radiant energy comes in the form of visible light, gamma rays, x-rays, and radio waves. Heat or thermal energy comes from the movement of atoms and molecules of objects that have been heated up somehow. Motion energy is energy stored in the movement of objects. Once the object has moved, the energy that was stored is now released, thus having caused the movement. Electrical energy comes about as a result electrons being charged along a wire. Sound energy is basically sound coming from the result of vibrations of a substance along waves that have come from a force that has caused the vibration to occur upon the object.

Sources of energy are thought of as renewable and nonrenewable. Renewable sources of energy will be available for our use in society for a very long time. These sources of energy should be able to be replenished for consumption and never run out. These include wind energy from the wind, solar energy coming from the sun which is harnessed as concentrated solar power or as photovoltaic (solar cells, PV cells) used to convert light into electricity, geothermal energy coming from the heat inside the Earth, biomass which is any organic (plant or animal) material which is available on a renewable basis, including agricultural crops and agricultural wastes and residues, wood and wood wastes and residues, animal wastes, municipal wastes, and aquatic plants, and hydropower which is energy coming from moving water, especially around dams.[3]

Nonrenewable sources of energy come from the direct formation of fossil fuels from millions of years ago, and these fossil fuel byproducts can no longer be replenished upon the Earth. Fossil fuels such as natural gas, oil, and coal came about as the heat from the earth and rocks compressed upon the decomposed remains of plants and animals over millions of years. Once the world has consumed all of the natural gas, oil, and coal that is in supply, these nonrenewable sources of energy will be no longer in existence. Even uranium has been allocated as a nonrenewable source of energy that we currently use to produce electricity. The following table shows the various forms of energy consumption used by the United States in the year 2012.[4] Notice that we are using up our nonrenewable sources by far more than our renewable sources which means that we must start to find ways to innovatively create more renewable sources of energy before we use up our nonrenewable resources forever.



Solar radiation or the energy that is derived from the sun is what we commonly call solar energy. This solar energy can be converted to thermal or heat energy to use in our homes and businesses to heat water, spaces, or fluids or converted to electrical energy to heat extremely high-temperature water to generate electricity from turbines and generators. Solar energy can also be converted to electricity through the use of solar cells or PV cells that are grouped as either individual solar panels or large arrays of solar panels that use this sunlight for direct forms of electricity. How solar radiation can be used effectively and cost-efficiently is an ongoing debate in our society today as there is always a drawback for using solar energy as well as a positive reason for its use. Since the earth's rotation around the sun is constant, depending upon the location, the time of day, the time of the year, and weather conditions, solar energy may not be the best deliverer of solar radiation to any one place at all times. Also, the sun's rays may be diffused or prevented from direct contact upon the Earth for several reasons, such as clouds, precipitation, air pollutants, water vapor, forest fires, and volcanoes.[5] This means that a very large surface area will be needed in order to really be useful when it comes to harnessing this solar radiation. The panels being placed on the top of buildings and homes to collect the solar radiation does not always look aesthetically pleasing to a neighborhood or business district, and may, therefore, not be used at all.The reasons that solar panels are used by so many different consumers are that it does not produce carbon dioxide or other air pollutants, and it provides minimal effects upon our environment. Power plants use thermal energy or solar energy. In 2011, solar thermal-power generating units were the main source of electricity at 13 power plants in the United States: 11 in California, one in Nevada, and one in Arizona.[6] The world's largest thermal solar plant is located on 3,500 acres in Ivanpah, California. The Ivanpah Solar Electric Generating System is a solar thermal power plant built in the Mohave Desert containing a 459-foot tower of mirrors to

reflect the sun's rays wherein the tower uses water to generate enough heat to turn turbines to produce enough electricity for over 200,000 homes in the nearby area. Three separate power plant units comprise this vast solar energy project, and the electricity will be sold to three utility companies for their ability to provide electricity through this renewable source of energy for the next twenty-five to thirty years.[7]

Hydropower energy is energy that comes from the movement of water. The faster the movement of the water, the more energy the water will have created for use. Water can either come from the flow of its current in a river, a stream, or even an ocean's current. This water can be harnessed or stored at a reservoir or dam and then released as needed to turn a turbine and/or generator of a power plant to produce the electricity needed for homes, businesses, and other structures. Usually, a hydro-powered power plant has to be built near a river or lake due to the nearby availability of the water that will be needed to flow through the penstock or pipe leading to the turbine which has blades to turn the generator that will convert the water into electricity. Now that there is technology to transmit electricity over very long distances, the hydroelectric power plant can supply electricity to cities that are hundreds of miles away from the power plant itself. Hoover Dam located near Boulder City, Nevada, provides electricity for not only Nevada, but Arizona, and California making it the largest hydroelectric power plant in the United States.[8]

Representing a clean, environmentally-friendly renewable power source, hydropower projects can provide several benefits to the immediate area surrounding these types of hydroelectric plants. First, not all hydropower plants or dams are designed to produce electricity, but some are used for irrigation, flood control, transportation, recreational activities such as fishing and boating, as well as any combination of these activities including the production of electricity. Depending upon whether or not the hydroelectric plant is being used primarily as a storage facility of water through its reservoir that releases water as the demand for electricity increases or as a run-of-the-river plant wherein the water passes at about the same rate as the river's current when making electricity, a hydroelectric plant's impact upon the environment can be a complexity of factors including the existing climate, the type, size, and design of the hydropower plant, the size and rate of the flow of the river where the dam exists, and the location of the hydropower plant being either upstream or downstream of the river.[9]

Wind energy or the wind power is another method of providing a renewable source of energy for today's society. Where does the wind come from in the first place? As the sun's energy passes over land and water around the globe at different times, the daily wind cycle comes from the earth's uneven absorption of the sun's radiation. Warm air over land rises and expands, and as it does so, cool air rushes in to replace the warm air, and thus, the wind is the result.[10]This wind is now harnessed by wind machines or wind turbines that can turn the kinetic energy of the wind into something very useful that can create electricity. Wind turbines contain blades much like those of an airplane that lift the

wind causing the blades to turn and the blades' connection to a shaft attached to a generator produces the resulting electricity.[11]

Wind farms are locations that have been constructed around the United States where power plants that use wind energy to generate electricity can be found in operation. These wind farms are often in wide, open areas that have very little obstruction to the wind so that the wind's energy can be used at its fullest potential for the production of electricity. Depending upon the projected use of the wind turbines needing construction, the size and quantity of turbines vary anywhere from small, residential onsite-scaled turbines, larger commercial scaled turbines that can be used to power businesses, hospitals, farms, ranches, schools, to extremely large utility-scaled turbines that are built to sell the electricity back to power companies to provide energy for thousands of homes and businesses. The costs for wind turbines can be anywhere from about the price of a moderately-sized home built in the United States to millions of dollars for utility-scaled turbines that are supplying electricity to the power company's grid for powering thousands of consumers who purchase their electricity from the power company.[12]Currently, Texas and California have the largest installed wind-powered plants found in the United States today. This is a direct result of the many acres of wide, open plain spaces found in these states that are ideal locations for wind energy conversion to electrical energy via power plants operated from the wind. Since 1999 up to 2012, many states have tremendously increased their use of wind energy as a viable source of electricity for their consumers as depicted by the map of the U.S. wind capacity.[13]Wind turbines are not only being built on land, but some are being built offshore in the ocean just off the coastlines. Opponents to having wind turbines built offshore don't care for the obstructive view these turbines bring to the ocean and all of its beauty. An advantage to having wind farms actually located on some traditional farms and ranches has been the economical boost to the landowner who may have been experiencing financial difficulties due to the seasonal nature of farming as a business. The rancher or farmer can now sell the electricity back to power companies all throughout the year, and thus, provide additional income for his household.

Classroom Activities

Day One – Students are to create their own science journals with the title of "You, Me, and Energy Makes Three!" The students will be given construction paper for the front and back cover of the journal, crayons and markers to create their own artwork on the cover, and then place notebook paper in the middle of the covers that will be used for their reflections, classroom assignments, science artwork, notes on this unit, etc. The teacher will conduct a warm – up activity for the unit using a KWL chart with the class on the topic of energy. The chart is K for What I Know, W for What I Would Like to Know, and L for What I Learned about energy. The students are to place the chart in their science journals and they are to fill out the first two columns, but leave the third column

for the end of the unit to be filled out by the students once they have learned much information about energy.

Day Two–The teacher will introduce vocabulary to the students that they will need in order to fully understand the energy concepts being taught during this unit. Since we will study this unit by sectional topics, the teacher will introduce vocabulary that will need to be taught per section of study. The first topic of discussion is "What is Energy?" and the vocabulary that will be taught is the following: **energy, kinetic energy, potential energy, convection, conduction, transfer, heating, cooling, insulator, positive charge, negative charge.** The students will be divided into groups of four and they are to place their vocabulary lists in their science journal, and then use the dictionaries (online and hard-bound books) to look up the definitions of the vocabulary terms. Once they have written the definitions in their notebooks, they are to work with their team members to find an illustration either in their textbook or online of each term and draw an illustration of the term and write a sentence that uses the term in a way that describes the illustration or captures the essence of its meaning.

Day Three – The teacher will review with the students what they have written in their notebooks about the definition of the vocabulary words given the day before and ask for volunteers to share their illustrations and sentence captions with the rest of the class. (We will take no more than 15 minutes to complete this brief introduction to today's lesson). The teacher will then pass out an activity book entitled "Energy Fun with Energy Ant" taken from the Department of Energy's Energy Kids website to use as an fun way to introduce students to energy.[14] The students will be able to read about how energy comes from the sun, decide what objects move from having a catalyst to move whether it's another object or from the energy derived from a person's actions, and they will be able to play an energy game using a game board that comes in the energy activity book. The students can share at least one thing they have learned about energy as a "Ticket Out the Door" when they are to transition to their next class.

Day Four – The teacher will use EduSmart, a CMS instructional website to deliver direct instruction about the concept of convection/conduction today in class. The students will be able to see a visual model of what these terms mean and be able to discuss the differences between the two methods of transference of heat. The students will also observe a video about electrical energy and the transfer of energy from one source to another. The students will create a Venn diagram that compares convection to conduction and also write in their science journals notes about the transference of energy from one source to another.

Day Five–The teacher will divide the class into two separate groups. Each group will review the definition of kinetic and potential energy. Then each group is to come up with two demonstrations each for kinetic and potential energy. The teacher will give each group several items to use in their demonstration and each group will work cooperatively as they come up with a plan to use these materials to demonstrate kinetic and potential

energy. The materials are the following: a rubber ball, a rubber band, pictures of a car, and a ruler. After talking together to come up with the plan for their demonstration, each student group will give a demonstration of their ideas about kinetic and potential energy. After each group has given their demonstration the students will use a large teaching chart and draw and label the two demonstrations that their group has made for kinetic and potential energy. These charts will be left in the classroom for future reference by the students.

Day Six – The teacher will introduce the terms of renewable and nonrenewable energy sources to the class with the use of a video called "Sources of Renewable Energy" taken from Discovery Education.[15] The students will see several examples of different types of renewable energy sources such as hydroelectric power, solar energy, geothermal energy and wind energy. The students will also see how coal and natural gas are nonrenewable sources of energy that scientists realize that will need to be replaced with renewable sources of energy that won't run out for our consumption. After viewing the video, the students will be placed in groups to talk about what they believe are the advantages of renewable of sources of energy and create a chart that list these sources, a picture that represents the source, and where these renewable sources come from in our world. The charts will be made on large teacher chart paper so that they may be displayed in the room and used for later reference in the unit.

Day Seven – The teacher will take the students outside to conduct a solar energy activity. (Hopefully, it will be enough sun shining outside to complete this activity). The students will need to have made a solar oven out of a pizza box outside of class.[16] (I will provide them with the directions for making the solar oven before today.) The students will place some hot dogs in their oven, record the time they are placed in there, and wait at least fifteen minutes, and then recheck the hot dogs to see if they have fully cooked in the sun. The students will take their science journals with them to record their data about the hot dogs, and once they are done, they will bring their hot dogs back into the classroom where they will be able to enjoy them with buns, potato chips, and a juice drink. While the students are enjoying their hot dogs, the teacher will make a display of solar energy vocabulary words that the students will learn about while studying solar energy. The vocabulary words on display will be the following: **solar energy, solar panels, photovoltaic cells (PV cells), radiant energy.**

Day Eight – The students will be divided into three groups of five to make solar houses.[17] The students will use the directions and materials provided to them at their table to construct their houses, and the teacher as well as the teacher assistant will go around helping them follow the directions. Once their solar houses are completed, the students will take them outside to see how the sun's rays are actually captured and can really heat the solar house up from the temperature that it had in the classroom. When they return to class, the students will write in their science journals their thoughts about solar energy and how it can actually be used to heat up real homes in today's society, and

why this form of energy may just be less costly than using electricity or natural gas to heat homes.

Day Nine – The teacher will conduct a read aloud with her students using the book "Wind Power" by Josepha Sherman.[18] She will preview the book by showing the students the cover, title page, and giving the students the following vocabulary and definitions before reading excerpts from the book: **turbine, wind farm, generator, drive shaft, pollution, efficient, pollution, kilowatt.** Once the students have been given this preview of the lesson on wind energy, the teacher will have the students to "turn and talk" to a partner about what they believe that this lesson on wind energy could possibly be about. The teacher will give each partner group an index card and the partners are to write at least three predictions about wind energy and what they will possibly find out about wind energy. Given the ample amount of time to complete this initial activity, the teacher will call on several partner groups to come to the front of the room to share their ideas. The teacher will have the other students to write on chart paper their ideas and we will place them on the front of our closets in the classroom as a reminder of what they believed they would be learning about. We will revisit these charts in several days.

Day Ten – The teacher will start out with a video for the students to look at about how wind turbines work at http://energy.gov/eere/videos/energy-101-wind-turbines.[19] While viewing the video, the students are to take notes about the wind turbines that they are viewing. They are to write down interesting facts and any particular questions that they may have thought of while observing the video. The teacher will have a "Parking Lot" chart paper in the room wherein the students may write down any questions they have on a sticky note and place the sticky notes on the "Parking Lot" chart. Once all of the students have had a chance to do this, the teacher will have each student to come select a note from the "Parking Lot" that another student has written and take it back to their seat to write the question down in their Science journal. Once they've written the question down, they are to return the sticky note back to the "Parking Lot" chart so that we will have a visual of all the questions that have been asked. The students' task will then be to find out the answer to the question by the end of the unit.

Day Eleven – The students will be given an opportunity to see and use a model of a wind turbine in class. The teacher will bring in a model of the wind turbine for the students to actually touch and use in class. We will connect it up to a power source and also a meter that will tell us how much electricity this turbine is generating if any, and then use the wind turbine to try to turn on a small light bulb or move a fan blade on a hobby motor. The students will try to see which speeds help the wind turbine produce more electrical output and what speed generates no electrical output at all. The students may also build their own windmill in class using the following directions. When this has been completed, the students will be taken to the computer lab to log on to an interactive website, http://ecards.greenlearning.ca/docs/trc-wind-animation.php[20] to control the speed and wind direction of an interactive wind turbine online. The students will be able

to really gain an understanding of how speed, wind direction, and blade rotations all play an instrumental role in the output of a wind turbine.

Day Twelve – The teacher will introduce the concept of hydroelectric power with a book entitled "Hydroelectric Power" by Josepha Sherman.[21] We will observe and talk about the cover which is a picture of Scrivener Dam on the Molonglo River in Canberra, Australia. The teacher will also introduce some vocabulary and definitions for the students in order to have all of the students have a familiar background from which they can build their knowledge about hydroelectric power. The vocabulary words are the following: **dam, evaporate, penstock, reservoir, drought, run-of-the-river, fish ladder, generator, turbines.** The teacher will also show the students diagrams and images so they can become more aware of how these terms relate to each other. The students may select some diagrams to actually draw and label in their Science journals.

Day Thirteen – The students will view a video online at http://www.pbslearningmedia.org/resource/phy03.sci.phys.energy.hooverelec/hoover-dam-and-hydroelectric-power/[22] about Hoover Dam. Once the students have watched the video in its entirety, the teacher will divide the students into learning teams to write down their thoughts about the video and to come up with at least three questions to ask someone else in the group about what they have seen in the video. The interviewer may write the questions down on index card and then use the cards to ask the questions to the person being interviewed. Once they have decided whether or not the other student has been able to answer the questions correctly or not, the first student can give the card to the interviewee to keep in place in their notebook. They will need to decide what questions may need more investigating as they either were not answered correctly or the answers led to other questions that need to be investigated.

Day Fourteen – The teacher will show the class a model of a water mill that was once used centuries ago to actually grind grain into flour. Now that these water mills are no longer in existence, hydroelectric power plants are the primary source of electricity produced from the extreme strong forces of moving water. The students will be able to work in teams to bring the model over to the sink where the water source is for our classroom, and after turning on the water to run over the wheel, they are to make the whole contraption produce enough current to try to turn on a small light bulb. If we are not able to have all of the students use the water wheel today, we will continue with this activity on the following day. If we are able to complete this activity with all of the students, the students will write about their experience with the water wheel in their science journals. They may draw pictures of the water wheel, label the drawing, and write a short paragraph about how much water it took to actually generate enough power to get the light bulb to come on.

Day Fifteen – The students will work in five groups of three members to produce a Power point presentation about all of the concepts they have learned in this unit. Each power point must have a minimum of three slides for each of the following topics: Types

of Energy, Transference of Energy, Solar Energy, Wind Energy, Hydroelectric Power, and Non-renewable vs. Renewable Energy Sources. The students will gather their notes from their Science journals, online resources, their teaching charts that they've created themselves in class, and the nonfictional texts that have been presented to them during the teacher's read-aloud sessions to synthesize their information into a student-friendly, clearly understandable format. The students will work on their presentations during their Literacy and Science classes so they may integrate these subjects very well in their presentations. They will give their final presentations in class right before we leave for our Christmas holidays.

Endnotes

[1]North Carolina Essential Standards 3-5 Science." State Board of Education Department of Public Instruction. http://www.ncpublicschools.org/docs/acre/standards/new-standards/science/3-5.pdf

[2]Energy Basics."EIA Energy Kids -. http://www.eia.gov/kids/energy.cfm?page=about_home-basics

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[4]Sources of Energy."EIA Energy Kids -. http://www.eia.gov/kids/energy.cfm?page=about_sources_of_energy-basics

[5]Energy.gov." Energy.gov. http://energy.gov/eere/energybasics/articles/solar-energy-resources

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[7]World's biggest solar thermal power plant fired up in California." Grist. http://grist.org/news/worlds-biggest-solar-thermal-power-plant-fired-up-in-california/

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[9]Hydropower."EIA Energy Kids -. http://www.eia.gov/kids/energy.cfm?page=hydropower_home-basics

[10]Wind."EIA Energy Kids -. http://www.eia.gov/kids/energy.cfm?page=wind_home-basics

[11]How Do Wind Turbines Work?" Wind Program: http://www1.eere.energy.gov/wind/wind_how.html

[12]What Is Wind Power?" Stakeholder Engagement and Outreach: http://www.windpoweringamerica.gov/what_is_wind.asp

[13]Installed Wind Capacity." Stakeholder Engagement and Outreach: U.S. http://www.windpoweringamerica.gov/wind_installed_capacity.asp

[14]"Things to Do."EIA Energy Kids -. http://www.eia.gov/kids/energy.cfm?page=things_to_do

[15]Summer Productions. *TLC Elementary School: Earth's Energy*from Discovery Education. Full Video. 2005 . http://www.discoveryeducation.com/

[16]Making a Pizza Box Solar Oven." al-solar.org. http://www.al-solar.org/newsletters/2009-03/Making%20a%20Pizza%20Box%20Solar%20Oven.pdf

[17]"National Energy Education Development Project."National Energy Education Development Project. http://www.need.org/

[18]Sherman, Josepha. *Wind power*. Mankato, Minn.: Capstone Press, 2004.

[19]"How Do Wind Turbines Work?." *Wind Program:*.N.p., n.d. Web. 9 Nov. 2013. <http://www1.eere.energy.gov/wind/wind_how.html.

[20]"eCards | GreenLearning." eCards | GreenLearning. http://ecards.greenlearning.ca/docs/trc-wind-animation.php

[21]Sherman, Josepha. *Hydroelectric power*. Mankato, Minn.: Capstone Press, 2004.

[22]"Hoover Dam and Hydroelectric Power | Science | Classroom Resources | PBS Learning Media."Hoover Dam and Hydroelectric Power | Science | Classroom Resources | PBS Learning Media.http://www.pbslearningmedia.org/resource/phy03.sci.phys.energy.hooverelec/hoover-dam-and-hydroelectric-power/

Appendix 1: Implementing Common Core Standards

These are the specific North Carolina Essential Science standards that will be taught within this unit:

3.P.3 Recognize how energy can be transferred from one object to another.

3.P.3.1 Recognize that energy can be transferred from one object to another by rubbing them against each other.

3.P.3.2 Recognize that energy can be transferred from a warmer object to a cooler one by contact or at a distance and the cooler object gets warmer.[1]

Third Grade Writing Standards:

W.3.7 Conduct short research projects that build knowledge about a topic.

W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.[2]

While I will utilize the concepts of friction, convection, and conduction to show students how energy can be transferred from one object to another, I will also provide students with basic principles about solar, wind, and hydropower energy. Since these forms of energy are being utilized more and more to actually provide electrical energy for homes and businesses today, I would like for my students to discover the practicalities and challenges that our society faces in using these alternative sources of energy.

Since I also teach literacy to my students, I plan to incorporate the following writing standards into this science unit in order to enhance what my students will learn about energy and to give them the opportunity to conduct their own research and present their findings about energy, especially about solar energy, hydropower energy, and wind energy. The students and their families will be able to work together at home if they decide to so while creating their own energy projects such as building a solar house and a solar oven that they can use to test how solar energy can be used in their own household.

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