

The Effects of Climate Change on Aquatic Environments

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Introduction

Conrad Schools of Science is a grades 6-12 biotechnology and allied health magnet school. Located in Wilmington, Delaware, Conrad is one of the two magnet schools in the Red Clay Consolidated School District. In the 2014-2015 school year Conrad enrolled 1,215 students, with 545 students making up the middle school, and 670 students making up the high school. Besides being a science magnet school, Conrad has also been one of the two middle schools that house the bilingual programs in our district. English Language Learners (ELL) in the bilingual program makes up 8.2% of our school. This year, the Red Clay Consolidated School District is moving to full inclusion. With their decision to move to full inclusion, the ELL program will no longer exist at Conrad. The ethnicity of Conrad's student population is 63.5% white, 18.4% Hispanic/Latino, 12.4% African American, 4.9% Asian, 0.7% Multi-Racial and 0.1% American Indian.

Conrad is unique in that it is a bioscience magnet school. Exploratory programs such as forensics, plant and animal science, anatomy, emergency response skills, etc. are used to prepare middle school students for the rigor of the high school programs. The pathways within the high school, which are three-year programs, include biotechnology research, biomedical science, veterinary science, nurse tech, and physical therapy/athletic healthcare. Our goal at Conrad is to ensure college and career readiness.

I am a seventh grade science teacher at Conrad. The five sections of seventh grade science that I teach have a total of 155 students. Each section is made up of 28-34 students. At Conrad, we utilize the block scheduling which allows me to meet with my students every other day for 85 minutes at a time. My seventh grade students at Conrad are extremely diverse learners, but they all seem to have one thing in common: they love a challenge.

The middle school science curriculum at Conrad is unique compared to the remainder of the state. Throughout the state of Delaware the science curriculum is integrated for each grade (6, 7 and 8). At Conrad, we use the state curriculum units, but in an altered sequence. Instead of having integrated science for each grade in the middle school, we divided the units into biology, physical science, and Earth and space science. In 6th grade students are taught the biology units. In 7th grade students are taught the physical science units. In the 8th grade students learn the Earth and space science units. Since I am a seventh grade science teacher at Conrad, my curriculum focuses on physics and chemistry. I am creating this unit for my seventh grade science students, although it can be used for middle school students in grades 6-8.

Rationale

Since my 7th grade students like to be challenged, I often find supplementary material that is not in my suggested curriculum. The 7th grade suggested science curriculum at Conrad School of Science includes a transformation of energy unit, properties of matter unit, and a forces and motion unit. While teaching the energy unit, my students are always very curious, and they want to discover more on this topic. Last year, at the end of the energy unit, my students engaged in research and critical thinking to answer the question: “How can we build a secure energy future?” My students learned where the energy they use each and every day comes from. We focused a lot on the burning of fossil fuels, and how moving towards the use of renewable energy sources would help to build a secure energy future. This year, I would like to ask my students: “Can saving energy save our aquatic environments?” I want my students to dig deeper this year. I want students to find the disadvantages of burning fossil fuels. I want my students to learn how the burning of fossil fuels leads to climate change. I also want my students to learn how climate change is affecting organisms in our aquatic environments. Finally, I would like my students to learn how they can reduce their carbon footprint, and create an action plan to do so.

Students will participate in a Problem Based Learning project where they will learn the effects of climate change on aquatic environments. Also through this project, students will research and create an action plan for reducing their carbon footprint. At this point, my students don't know anything about climate change. This content is brand new to the majority of them. At Conrad, in 7th grade, students know very little about ecosystems, aquatic environments, and organisms in aquatic environments. Students should have been exposed to a little of this content in elementary school, but they will learn it more in depth in the 8th grade ecosystems unit. Through this unit I would like my students to think about their energy use on a daily basis. I'd like my students to understand where the energy to power their home comes from. I want my students to learn where the energy comes from to power everything in our school, from the lights, to the computers, to the projectors and SMART Boards. Once students have an understanding of the amount of energy they use daily, I'd like to teach them the difference between renewable and non-renewable energy sources. I want my students to learn the advantages and disadvantages to both renewable energy use, and non-renewable energy use. My 7th grade students will then learn the impacts of non-renewable energy use on our climate. Through this unit, my students will learn how climate change negatively impacts our aquatic environments. Ultimately, through this unit, I would like my students to learn how the changing climate affects aquatic environments, and how we as humans can reduce our carbon footprint. Throughout this unit I would like students to work both collaboratively and independently. I see my students doing portions of research, and working together to make plans to reduce their carbon footprints in order to help save our aquatic environments.

Essential Questions/Standards

- What is climate change?
- What is the difference between renewable and non-renewable energy sources?
- How does the use of non-renewable energy lead to climate change?
- What are the negative effects of climate change on aquatic environments?
- How can we reduce our carbon footprint?

Background

Non-Renewable vs. Renewable Energy

Non-renewable energy sources are sources that cannot be replenished in a short period of time and come from sources that will not be replenished in our lifetime. Non-renewable energy sources such as coal, petroleum, and natural gas are also known as fossil fuels. Fossil fuels were all formed in a similar manner; plants, algae, and plankton grew in ancient wetlands where they absorbed sunlight and created energy through a process called photosynthesis. When these organisms died, they sank to the bottom of the body of water. When these organisms died, there was energy stored in them. “Over time, the dead plants were crushed under the seabed. Rocks and other sediment piled on top of them, creating high heat and pressure underground. In this environment, the plant and animal remains eventually turned into fossil fuels (coal, natural gas, and petroleum).”¹ These fossil fuels are extracted and burned to generate energy all over the world.²

The advantages of using fossil fuels as sources of energy are that they are easily extracted and shipped just about anywhere in the world. Even though fossil fuels are comparatively easily obtained and shipped, there are, however, many disadvantages to burning these fossil fuels. As fossil fuels are burned they release a gas called carbon dioxide into the atmosphere. Too much carbon dioxide released into the atmosphere is troublesome for our Earth. Carbon dioxide is known as a “greenhouse gas,” and global temperatures are rising since too much carbon dioxide gas is being released into Earth’s atmosphere. “Earth’s carbon budget is out of balance. This contributes to temperatures rising faster than organisms can adapt.”³ The rise in global temperatures is leading to climate change, which is affecting organisms here on Earth.

Renewable energy sources are sources that are naturally replenished. Renewable energy sources include solar energy, wind energy, geothermal energy, biomass energy, and hydroelectric energy. Solar energy is using the sun’s rays to generate electricity. Photovoltaic cells are used to capture and harness the sun’s rays in order generate electricity that can be used to power lights, heating systems, and so much more. Wind energy is captured using wind turbines. The blades of a wind turbine are turned by the wind that turn a generator inside which generates electricity. A group a wind turbines is

called a wind farm. These wind turbines or wind farms use the wind to generate electricity for nearby buildings, homes, or schools. Geothermal energy is using heat deep within the Earth's surface. Using geothermal heat can be done several ways: "One way of using geothermal energy is with 'geothermal heat pumps.' A pipe of water loops between a building and holes dug deep underground. The water is warmed by the geothermal energy underground and brings the warmth above ground to the building. Geothermal heat pumps can be used to heat houses, sidewalks, and even parking lots."⁴ Another way to use geothermal energy is with steam. In some areas of the world, there is underground steam that naturally rises to the surface. The steam can be piped straight to a power plant. The use of geothermal energy can be used to heat homes, and other buildings such as businesses and schools. Biomass energy is the use of once living organisms that are burned to create heat or generate electricity. Common sources of biomass include plants, trees, and branches. Other sources of biomass may include manure, crops, and garbage. Hydroelectric energy uses flowing water to turn turbines, which generates electricity. Dams are used to force water through tunnels in order to turn the turbines to generate the electricity. By using these renewable energy sources, energy is captured in various ways and used to generate electricity without releasing carbon dioxide.⁵

The advantages of using renewable energy sources are that they are sustainable, and are naturally replenished. When renewable energy sources are used to generate power, there is little to no negative impact on the Earth. The use of renewable energy sources does not emit excessive gases, such as carbon dioxide, into Earth's atmosphere causing a change in Earth's global temperature. Relatively cheap, readily available, and a potentially infinite supply are just a few of the advantages of using renewable energy sources.⁶

What is Climate Change?

"In just the past few months, record-setting heat waves in Pakistan and India each killed more than 1,000 people. In Washington State's Olympic National Park, the rainforest caught fire for the first time in living memory. London reached 98 degrees Fahrenheit during the hottest July day ever recorded in the U.K.; *The Guardian* briefly had to pause its live blog of the heat wave because its computer servers overheated. In California, suffering from its worst drought in a millennium, a 50-acre brush fire swelled seventyfold in a matter of hours, jumping across the I-15 freeway during rush-hour traffic. Then, a few days later, the region was pounded by intense, virtually unheard-of summer rains. Puerto Rico is under its strictest water rationing in history as a monster El Niño forms in the tropical Pacific Ocean, shifting weather patterns worldwide."⁷ These are a few snapshots of the effects of climate change on our Earth. According to NASA, climate change is a change in the usual weather that is typically found in a certain place, and a

change in the Earth's climate. Unlike daily local weather, it takes hundreds to millions of years for the climate to change on a global scale. Earth's climate is changing at an outstanding rate. In the last 100 years Earth's average temperature has increased one degree. Although it may not seem like much, even the smallest change in Earth's temperature can lead to the extremely large effects at the local level, and as I noted above, these effects are already happening here on Earth. From rising sea levels, to record setting temperatures in certain areas, to snow and ice melting, Earth is already feeling the effects of rising global temperatures.⁸

The changing of Earth's climate is due to the fact that fossil fuels are being burned, emitting greenhouse gases into our atmosphere. Fossil fuels are being burned in order to generate power. The typical daily routine of humans requires a great deal of energy, and most humans get this energy from the burning of fossil fuels. Driving cars, cooking, using lights, the use of computers and technology, heating and cooling homes are just a few examples of things that consume energy on a daily basis in human lives.⁹ Continuing to burn fossil fuels in order to generate energy to power the daily routines of humans is negatively impacting our Earth. As more greenhouse gases are emitted into our atmosphere, the global temperatures are increasing leading to a change in climate on Earth. As of 2015, Earth is definitely feeling the effects of climate change.

The Effects of Climate Change on Aquatic Environments

As the climate on Earth is rapidly changing, ocean water temperatures are also increasing. Many marine species may have to find new homes due to changing ocean temperatures. Just this summer there have been an incredible number of whale sightings close to the coast. Researchers say that the whales are coming so close to shore because, "Exceptionally warm water has concentrated the krill and anchovies they feed on into a narrow band of relatively cool coastal water."¹⁰ Over the summer there were enough whales sighted to issue a boating warning. In order to adapt to the warming ocean, other marine life is moving north. Rising ocean temperatures are not only forcing organisms to move north, but are also altering lifestyles in other aspects. Many species depend on temperature as an indication for reproduction. The increase in temperatures may affect breeding for some species. The marine turtle is one such animal. "The number of male and female offspring is determined by temperature."¹¹ This fact is also true for terrestrial turtles, as well as some fish and copepods, meaning the changing climate could very well affect the ratios of males to females. Skewed sex ratios due to rising water temperatures can adversely affect breeding success which, in turn, can lead to the extinction of certain populations in local aquatic environments.¹²

As temperatures increase, there is an expansion in the volume of water, causing a very troubling sea level rise. This disquieting sea level rise is also due to melting of polar ice and glaciers. Sea levels are predicted to rise by about half a meter by 2100. With the increasing sea levels, many aquatic species will be threatened to a degree that some of them will be listed under the categories of threatened or extinct species. Along with species being listed as threatened, rising sea levels will also lead to coastal flooding, eroding shorelines, and an increase in the salinity of estuaries just to name a few negative impacts.¹³

The changing climate is also responsible for the increase in ocean acidification. Oceans are becoming acidic due to the fact that they are absorbing some of the carbon dioxide being released by the burning of fossil fuels. “As the oceans absorb carbon dioxide from the atmosphere, it's converted into carbonic acid — and the pH of seawater declines.”¹⁴ The basis of the ocean’s food chain has seen a dramatic decrease. There has been a striking decline in the number of plankton due to acidifying oceans, and because of this there may be an enormous change in the food chain. Mollusks and other oceanic animals with hard external shells are really feeling the effects of ocean acidifying, and the loss of these organisms will most likely lead to radical changes in the ecosystem. According to researchers, acidifying oceans will be the cause of a mass extinction.¹⁵

Reducing Carbon Footprints

A carbon footprint is the amount of carbon dioxide (and other carbon compounds) being released due to consumption of fossil fuels by an activity, person, group, organization, etc. It is very difficult for one to calculate their carbon footprint and determine their individual impact on the environment. Your carbon footprint depends on so many factors, such as, but not limited to, where you live, the type of house you live in, the amount and type of food you eat, how you recycle and compost waste, your transportation choices, and energy consumption. Students will not need to learn how to calculate their carbon footprints, but rather how they can begin to reduce their individual impact on climate change. Students will need to learn that they and their families can reduce their carbon footprints by making a few different choices in their daily routines. Students and their families can reduce their carbon footprints by choosing fuel efficient vehicles, or choosing to join carpools, walk, bike, or take public transportation. Students and families can choose to install energy-saving thermostats, light bulbs, and appliances in their homes, along with turning off lights and electronics at home when they are not used or needed. Choosing to eat locally produced and organic food is another way that students and families can reduce their carbon footprints. Students can learn to reuse and recycle. Finally, students and families can monitor and reduce their water usage at home in order to reduce their carbon footprints. Students will learn that a larger carbon footprint is

leading to climate change on Earth and is negatively impacting our aquatic environments. Students will learn that every effort made to reduce their carbon footprint will make a difference in the amount of carbon dioxide emissions on Earth.

Teaching Strategies

Think-Pair-Share

Think-Pair-Share is a strategy I use frequently in my science class. Students are given a question, or scenario that they need to think about independently to construct a solution. After students thought independently, they are to pair up with a student next to them, and share their responses. The two students have a conversation regarding their individual responses they came up with. This strategy promotes a high level of engagement and participation for all students. This strategy allows students to think to themselves, but also allows them to share their response with at least one other student. After students have the opportunity to think to themselves, and share with a partner, I then have a whole class discussion regarding the topic.

Jigsaw

Jigsaw is strategy that promotes cooperative learning. Students are grouped and each group is given a specific topic. Students research and discuss the topic with their group members. These groups are considered “expert groups” and I tell students that they are becoming experts in these topics, because they will have to share their findings. I then take one student from each expert group to form new groups. The new groups should have one expert from each topic. Within the new groups students share their findings with each other. The idea of the new group is to have each expert teach their group members about their topic. This strategy encourages students to take responsibility and ownership in their work. Students are able to teach their peers using the jigsaw strategy. After students are done teaching their expert topics to one another, I bring the entire class together and have a class discussion. The class discussion is essential at this time in order to confirm that all students have accurate information.

Stations

Students work in small groups to rotate through stations set up around the classroom. I use stations in many lessons. Using stations allows students to get up and move around, and to engage in various tasks. Stations can be created and set up for a variety of topics and lessons. Using stations allows students to work on different tasks such as hands-on

activities, reading activities, use of technology, and many more. The use of stations allows me to differentiate the lesson.

Activities

Renewable vs. Nonrenewable Energy

What is the difference between renewable and non-renewable energy sources? How does the use of non-renewable energy lead to climate change?

This lesson is intended to give students a clear understanding of the difference between renewable energy and nonrenewable energy. This lesson is also intended to teach students how the use of nonrenewable energy leads to climate change.

Anticipatory Set: In order to have students start thinking about graphs, I will ask them to respond to the following question: “In your own words, what is energy?” I will use the Think-Pair-Share strategy where students will construct their own answer, then pair up with the student next to them, and share their responses. I will have an entire class conversation where I will ask students what a graph is in their own words. I will then ask: “What do you think the difference between renewable and nonrenewable energy is?” I will again use the Think-Pair-Share strategy for students to share their responses with their partners and the rest of the class.

Directed Instruction: Students will fill in the “Renewable vs. Nonrenewable Energy” graphic organizer found in Appendix 2 throughout the short lecture to start the lesson. I will teach students that non-renewable energy sources are sources that cannot be replenished in a short period of time and come from sources that will not be replenished in our lifetime. I will teach my students that non-renewable energy sources such as coal, petroleum, and natural gas are also known as fossil fuels. I will tell my students that fossil fuels are extracted from the Earth and burned to generate energy all over the world. Students will need to know the advantages and disadvantages of burning these fossil fuels. I will teach my students that the advantages of using fossil fuels as sources of energy is the fact that it is easily extracted and shipped just about anywhere in the world. The disadvantages of burning fossil fuels are that as fossil fuels are burned they release a gas called carbon dioxide into the atmosphere. Too much carbon dioxide released into the atmosphere is troublesome for our Earth. Students will need to know that carbon dioxide is known as a “greenhouse gas,” and global temperatures are rising since too much carbon dioxide gas is being released into Earth’s atmosphere. I will teach my students that this rise in global temperatures is leading to climate change, which is affecting organisms here on Earth. I will then teach students that renewable energy sources are sources that are naturally replenished. Renewable energy sources include solar energy,

wind energy, geothermal energy, biomass energy, and hydroelectric energy. Students will also learn that the advantage of the use of renewable energy sources is the fact that it is sustainable, and is naturally replenished. When renewable energy sources are used to generate power, there is little to no negative impact on the Earth. The use of renewable energy sources does not emit excessive gases, such as carbon dioxide, into Earth's atmosphere causing a change in Earth's global temperature. Students will use what they learned from the lecture to complete the middle portion of the graphic organizer where they will write down how renewable and nonrenewable energy sources are similar.

Activity: I will introduce students to the “Renewable Energy Commercial Project” – students will follow along using their handout found in Appendix 3. Students will work with one other person to create a commercial to promote a product they have made that is powered by a renewable energy source. Students will choose one renewable energy source (I will make sure that not all groups are using one source – I want to be sure that the sources that are chosen are equal throughout the class). Students will work together to think of a product that will be powered by the renewable energy source they chose. Students will be given class time to brainstorm and create a commercial that promotes their product powered by a renewable energy source. Through this commercial students will also need to discuss the advantage of the renewable energy source they chose on us and on the Earth. Students will also need to include the disadvantages of powering their product using fossil fuels. I will allow students three entire class periods to work on the project (85 minutes each). Students will first need to do research on the renewable energy source they chose. Students will then need to create a product that will be powered by this renewable energy source. Finally, students will need to create their commercial that will be presented to the class. Students will have the option of recording a commercial outside of school and presenting it to the class via video. Students also have the option of recording their commercial video during the allotted class time and presenting it via video. Finally, students also have the option of presenting their commercial live to the class.

Assessment: I will add closure to this lesson and project by having students complete the post assessment found in Appendix 4.

Climate Change

What is climate change?

This lesson is intended to introduce students to the topic of climate change. Students will learn what climate change is, and what is causing the changing climate here on Earth.

Anticipatory Set: As a review from the previous lesson, I will ask students to answer two questions. First question will be “What is the difference between renewable and nonrenewable energy?” My second question will be “What are the disadvantages of nonrenewable energy sources?” We will use these responses to begin the lesson.

Directed Instruction: I will review the differences between renewable and nonrenewable energy sources, and the advantages and disadvantages of each. With this review, I let the students know that through the activity today they will learn what climate change is, what is causing the climate to change, and the evidence of climate change. I teach my students that climate change is a change in the usual weather that is typically found in a certain place, and a change in the Earth’s climate. I will teach my students that it takes hundreds to millions of years for the climate to change on a global scale, unlike daily local weather.

Activity: In this lesson activity students will be learning what climate change is, what causes climate change, and they will research the evidence of climate change. Students will be rotating through three different stations where they will work in small groups to do research on laptops. The three stations will include “What is Climate Change?” “What are the Effects of Climate Change?” and “What is Evidence of Climate Change?” Students will complete the graphic organizer found in Appendix 5. Students will then use their research to create a poster of their findings. On the poster the students will need to visually represent climate change, one effect of climate change, and one piece of evidence of climate change. Once complete, groups will give a one-minute presentation to the class on their poster. They will explain their drawings and explain how they represent climate change, effects of climate change, and evidence of climate change.

Assessment: I will use the posters created by students in order to assess student learning.

The Effects of Climate Change on Aquatic Environments

What are the negative effects of climate change on aquatic environments? How can we reduce our carbon footprint?

This lesson is intended to teach students how climate change is affecting our aquatic environments. Students will also learn what they can do to reduce their carbon footprint.

Anticipatory Set: To start the lesson I will ask students the following question: “From the previous lesson, what did you learn about the effects of climate change on our Earth?” Students will share out their answers with the rest of the class. I will then ask the question “What effects does climate change have on our aquatic environments?” I will tell

students that this is what they are going to learn through this lesson. I will tell students that they will also think about how much energy they use on a daily basis, and how they can decrease is amount of energy.

Directed Instruction: I will tell students what they will use that they learned in the previous lesson to dig deeper, and research the effects of climate change on our aquatic environments here on Earth. I will tell students that their research should focus on the following: increasing water temperatures, sea level rise, and increase in ocean acidification. Students will learn about each topic through a Problem Based Learning (PBL) project in the activity. I will tell my students that not only are they researching the effects of climate change on our aquatic environments, but also they will be taking an energy survey of their homes, and through the project they will come up with a plan to conserve energy at home, and to reduce their carbon footprints.

Activity: Students will participate in a PBL project where they will be challenged to learn about the effects of climate change on aquatic environments though engagement in a real problem. Students will work collaboratively to research this real problem, and they will work together to come up with a plan for reducing their carbon footprint. The problem that students will be researching is “How is the changing climate affecting our aquatic environments?” Students will work in groups of three. The first portion of the PBL project will be a jig saw, where students will leave their original group, and each will be part of an expert group. One student will be part of the increasing water temperatures expert group. Another students will be part of the sea level rise expert group. The final student will be part of the increase in ocean acidification expert group. While in the expert groups, students will work together to research and discuss each issue. Students will use the Internet to research answers to questions found on the handout in Appendix 6. One research in complete, all students in the expert group will have a discussion of their findings. Students are to contribute to the discussion, and add to their notes as the discussion takes place. I will tell my students that they need to know as much as possible, and be an expert in their topic in order to go back and teach their group members about their issue. Students will then report back to their original group. In these groups students will share with their group members what they learned about their expert group topic/issue. Students will use what they found in their research to work together to research and create a plan to reduce their carbon footprints. Students will be asked to take an energy survey of their homes in order to prepare for this activity. Students will discuss how they use energy at their homes, and they will also use this information to collaboratively create their plans. Once students have a plan for reducing their carbon footprint they will present them to the “Town Council” (the rest of the class) and the mayor of the town (me). I will tell the students that they are trying to persuade the mayor

of the town that their plan is the best. I will tell them that their plans for reducing their carbon footprints must be creative, yet manageable.

Assessment: I will monitor and observe each expert group discussion to assess what each student has learned through his or her research during the jigsaw portion of the activity. I will also use the presentations of reducing carbon footprints to assess student learning from this activity.

Appendix 1

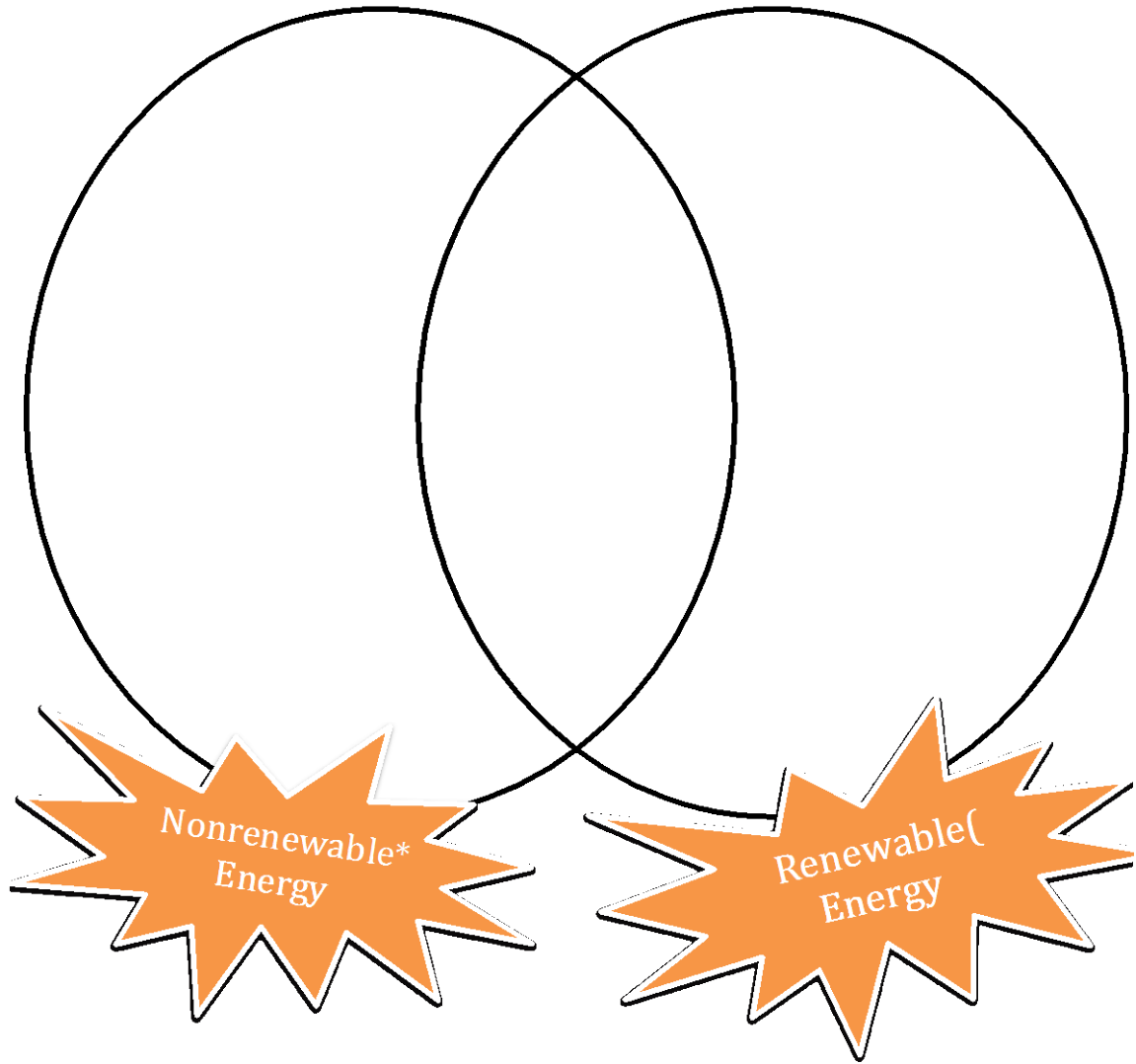
| Standards | | | |
|--|---|--|---|
| Delaware Science Standards | <p>3.5.A Energy sources can be renewable or finite. Most energy used by industrial societies is derived from fossil fuel sources. Such sources are inherently limited on the Earth and are unevenly distributed geographically. Renewable energy sources vary in their availability and ease of use.</p> <p>3.5.B Technological advances throughout history have led to the discovery and use of different forms of energy, and to more efficient use of all forms of energy. These technological advances have led to increased demand for energy and have had both beneficial and detrimental effects on society.</p> <p>3.5.C Responsible use of energy requires consideration of energy availability, efficiency of its use, the environmental impact, and possible alternate sources.</p> <p>5.2.G The climate at a location on Earth is the result of several interacting variables such as latitude, altitude and /or proximity to water.</p> <p>5.2.M Heat energy stored in the oceans and transferred by currents influence climate. A disruption of the circulation and temperature of the world’s oceans would foster climate change and have environmental and economic consequences.</p> <p>8.2.2 Over time, matter is transferred repeatedly from one organism to another and between organisms and their physical environment. As in all material systems, the total amount of matter remains constant, even though its form and location change.</p> <p>8.2.3 All organisms, including humans, are part of and depend on food webs. Food webs recycle matter continuously as organisms are decomposed after death to return food materials to the environment where it re-enters a food web.</p> | | |
| Next Generation Science Standards | <p>MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.</p> <p>MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century</p> | | |
| Common Core Standards | <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> <p><i>ELA/Literacy –</i></p> <p>RI.7.8 Trace and evaluate the argument and specific claims in a text, assessing</p> </td> <td style="width: 50%; border: none; vertical-align: top;"> <p><i>Mathematics –</i></p> <p>6.NS.C.5 Understand that positive and negative numbers are used together to</p> </td> </tr> </table> | <p><i>ELA/Literacy –</i></p> <p>RI.7.8 Trace and evaluate the argument and specific claims in a text, assessing</p> | <p><i>Mathematics –</i></p> <p>6.NS.C.5 Understand that positive and negative numbers are used together to</p> |
| <p><i>ELA/Literacy –</i></p> <p>RI.7.8 Trace and evaluate the argument and specific claims in a text, assessing</p> | <p><i>Mathematics –</i></p> <p>6.NS.C.5 Understand that positive and negative numbers are used together to</p> | | |

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|--|---|--|
| | <p>whether the reasoning is sound and the evidence is relevant and sufficient to support the claims.</p> <p>RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts.</p> <p>RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.</p> <p>WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.</p> <p>SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.</p> | <p>describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.</p> |
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Appendix 2

Name _____ Date _____ Block _____

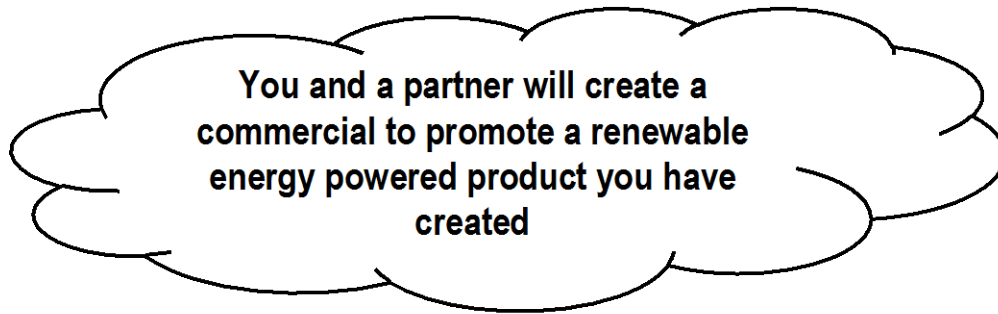
Renewable vs. Nonrenewable Energy



Appendix 3

Name _____ Date _____ Block _____

Renewable Energy Commercial Project



| Project Requirements | | |
|----------------------|---|--|
| Time | Content | Presentation |
| ~ 1-2 minutes | <ul style="list-style-type: none">• Choose one renewable energy source• Create a product that uses this energy source• Explain how your renewable energy source works to power your product• Explain the benefits of the renewable energy source you chose<ul style="list-style-type: none">- On us- On the Earth• Explain the disadvantages (<i>in regards to climate change</i>) of burning fossil fuels | <ul style="list-style-type: none">• Record outside of school & show in class through a video• Record during class time & show in class through a video• Live (in front of the class) |

Appendix 4

Name _____ Date _____ Block _____

Renewable Energy Sources

Post Assessment

1. What is renewable energy?
2. List the renewable energy sources.
3. In regards to climate change, why is using renewable energy good or beneficial to the Earth and us?
4. In regards to climate change, why should we move away from burning fossil fuels?

Appendix 5

Climate Change Research

STATION 1

Climate Change?

| |
|--|
| What is Evidence of Climate Change? |
|--|

Appendix 6

HOW IS CLIMATE CHANGE AFFECTING OUR AQUATIC ENVIRONMENTS?

Expert Group Issue

(increasing water temperatures, sea level rise, or increase in acidification):

How is climate change
leading to your issue?

found ch

Bibliography

"Renewable Energy." *National Geographic Education*. 2013. Accessed 2015. <http://education.nationalgeographic.com/encyclopedia/renewable-energy/>.

This source is used to explain and give examples of renewable energy sources.

"Non-renewable Energy." *National Geographic Education*. 2013. Accessed 2015. <http://education.nationalgeographic.com/encyclopedia/non-renewable-energy/>.

This sources gives an explanation of nonrenewable energy sources.

"The Point of No Return: Climate Change Nightmares Are Already Here." *Rolling Stone*. 2015. Accessed 2015. <http://www.rollingstone.com/politics/news/the-point-of-no-return-climate-change-nightmares-are-already-here-20150805>.

This is a great sources that explains the impacts of climate change on aquatic environments. This source discusses acidification of the waters, impacts on organisms, and warmer waters expanding in volume.

"Marine Problems: Climate Change." *Marine Problems: Climate Change*. Accessed January 13, 2016. http://wwf.panda.org/about_our_earth/blue_planet/problems/climate_change/.

This is a great source that explains how climate change is affecting homes of many organisms. This source explains the impacts of climate change on many aquatic organisms.

Dunbar, Brian. *NASA*. Accessed 2015. <http://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-is-climate-change-k4.html>.

Great source for an explanation of climate change, how the Earth's climate is changing, and what we can do to help.

Eissa, Alaa E., and Manal M. Zaki. "The Impact of Global Climatic Changes on the Aquatic Environment." *Procedia Environmental Sciences*: 251-59.

This source is used to explain how the changing climate is impacting the aquatic environments.

¹ "Non-renewable Energy," *National Geographic Education*, 2013, accessed 2015, <http://education.nationalgeographic.com/encyclopedia/non-renewable-energy/>.

² "Non-renewable Energy."

³ Ibid.

⁴ "Renewable Energy," *National Geographic Education*, 2013, accessed 2015, <http://education.nationalgeographic.com/encyclopedia/renewable-energy/>.

⁵ "Renewable Energy."

⁶ Ibid.

⁷ "The Point of No Return: Climate Change Nightmares Are Already Here," *Rolling Stone*, 2015, accessed 2015, <http://www.rollingstone.com/politics/news/the-point-of-no-return-climate-change-nightmares-are-already-here-20150805>.

⁸ Dunbar, Brian, *NASA*, accessed 2015, <http://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-is-climate-change-k4.html>.

⁹ Dunbar.

¹⁰ "The Point of No Return: Climate Change Nightmares Are Already Here."

¹¹ "Marine Problems: Climate Change," *Marine Problems: Climate Change*, accessed January 13, 2016, http://wwf.panda.org/about_our_earth/blue_planet/problems/climate_change/.

¹² "Marine Problems: Climate Change."

¹³ Eissa, Alaa E., and Manal M. Zaki, "The Impact of Global Climatic Changes on the Aquatic Environment," *Procedia Environmental Sciences*: 251-59.

¹⁴ "The Point of No Return: Climate Change Nightmares Are Already Here."

¹⁵ Ibid.

Curriculum Unit
Title

The Effects of Climate Change on Aquatic Environments

Author

Monica Corrigan

KEY LEARNING, ENDURING UNDERSTANDING, ETC.

This unit will be used to give students an understanding of how climate change is impacting aquatic environments. Students will learn the difference between renewable and nonrenewable energy sources, along with the advantages and disadvantages of each. Students will understand what climate change is, why the climate is changing, and the effects of this climate change. Students will specifically look at the effects of climate change on aquatic environments. Students will learn how their daily routines contribute to climate change, and will create a plan to reduce their carbon footprint.

ESSENTIAL QUESTION(S) for the UNIT

- What is climate change?
- What is the difference between renewable and non-renewable energy sources?
- How does the use of non-renewable energy lead to climate change?
- What are the negative effects of climate change on aquatic environments?
- How can we reduce our carbon footprint?

CONCEPT A

Climate Change

CONCEPT B

Effects of Climate Change on Aquatic Environments

CONCEPT C

Reducing Carbon Footprints

ESSENTIAL QUESTIONS A

What is climate change? What is the difference between renewable and nonrenewable energy sources? How does the use of nonrenewable energy lead to climate change?

ESSENTIAL QUESTIONS B

What are the negative effects of climate change on aquatic environments?

ESSENTIAL QUESTIONS C

How can we reduce our carbon footprint?

VOCABULARY A

Weather, Climate, Climate Change, Energy, Renewable Energy, Nonrenewable Energy, Fossil Fuels

VOCABULARY B

Organisms, Aquatic Environments, Acidification, Expansion

VOCABULARY C

Fossil Fuels, Carbon Dioxide, Emissions, Carbon Footprint, Energy,

ADDITIONAL INFORMATION/MATERIAL/TEXT/FILM/RESOURCES

Through this unit students will do a great deal of research using the internet.