Back to the Future: A Need for Change to Create a Better Tomorrow

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This curriculum unit is recommended for:
(Middle School/Science/6th -9th)

Keywords: Population Growth, Energy Challenge

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

Synopsis: My curriculum goal is to have students understand why there is an energy crisis. Human lifestyles affect the amount of energy consumed. Energy is a survival tool for everyday living. Energy is used for growing and shipping food, transportation of goods, manufacturing, housing, etc. The human use for energy is vast. Population growth is a concern because there is not enough energy for everyone to maintain a comfortable cozy lifestyle that most Americans take for granted. It is projected that oil can be depleted within the next 50 years. The crisis is real and we have to implement immediate changes for conservation. As a science teacher, it is my job to educate and create a social awareness of our energy consumption. Students will be taught what is a carbon foot print and calculate their carbon footprint. This will allow students to understand their role in today's society. The activity will get students vested in the world's energy crisis. The calculation of their carbon footprint will lead into group discussions. The students will then project there knowledge acquired on energy consumption, coupled with population growth to create a future with limited resources.

I plan to teach this unit during the 2015/2016 school year to 180 students in Middle School Science 7th Graders. This curriculum is appropriate for 6th-9th graders.

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Delanie Reavis-Bey

Introduction

Crestdale Middle School is located in Matthews, NC. Crestdale has been designated a school of distinction. At Crestdale teachers are encouraged to implement various instructional strategies to promote and ensure academic achievement. The student demographics are 67% Caucasian, 17.2% African American, 7.2% Hispanic, and 4.6% Asian. My strategy for creating this curriculum unit is to prepare the 21st century learner to understand why there is an energy crisis. My 21st century learners are the future leaders of tomorrow. My goal is for my students to apply the lessons learned from this curriculum unit to help create a brighter future with cleaner energy options.

Background

In the 21st Century, natural resources are being used at an alarming rate because of the human need for energy. Energy drives our economy, transportation, consumer needs and supplies. Human consumption of energy increases yearly. As a middle school science teacher, it is my duty as well as responsibility to teach students about energy. The students will learn about the two categories of energy sources, renewable energy and nonrenewable energy. Renewable energy is a source of energy that currently cannot be exhausted. Renewable energy consist of wind power, solar power, hydroelectric power, and biomass. All students will learn about the ingenuity of the various renewable energies and how it generates energy for human activity. The pros and cons of the energy source vs. nonrenewable energy will also be discussed.

Nonrenewable energy is an energy source that was created in the prehistoric era. Nonrenewable energy is created from decomposed organic matter that has been embedded between layers of rock. The decomposed organic material have formulated into fossil fuels. Fossil fuels are oil, natural gas, and coal. Students will learn why nonrenewable sources are currently exhausted at an alarming rate due to population growth and the price the earth is paying for human activity.

Energy is measured by a unit CMO which is a cubic mile of oil. A CMO is used as a global scale for energy consumption and resources. A cubic mile of oil can be explained to students as a mile long, mile deep, and mile wide of energy. Currently the world consumes approximately 3.6 CMO's a year.

Population growth is a concern regarding energy. Energy is applied to all aspects of our lives. There are approximately 7.2 billion people living on the Earth. The human

population is expected to grow to 9.6 billion by the year 2050. The numbers are staggering when you think of sustainability and the amount of resources available to survive. According to the article written by Colin Sullivan "Human Population Growth Creeps Back Up", for the United Nations the human population will increase to 10.9 billion by 2100. Sustainability is the initial issue that comes to mind when thinking about the human race.

Many of the developing countries such as Africa will be driving the human population growth. In some countries in Africa the average family has 4 to 5 children per household. In comparison to countries such as Western Europe, the average family is around 2 children per household. The trend of births in developing countries will depend upon the standard of living and if their government enforces policies to decrease the population growth. Countries such as India had extraordinary population growth. The majority of their population increase has occurred amongst the poorest socio-economically disadvantaged families living in poverty. The states in India that have a thriving economy have decreased in population growth. According to the World Factbook, India's fertility rate average currently is 2.51 children per family. India's population appears to be decreasing. News of a declining population is great. However consideration must be taken on how to sustain India's population with energy. According to the IEA, International Energy Agency, nearly one quarter of the population in India is without power. India's current consumption of energy as of 2013 is approximately .170 CMO. The United States currently uses .65 CMO. India's use of energy is approximately ¼ of the energy consumption of the US. This is obviously relative to the economic disadvantage of being a developing country. Currently the energy consumption of India is minimal. The concern arises when developing countries become developed countries needing as much energy as we do, yet resources for easy energy become harder to find. Many of the non-renewable energy sources will begin depleting within the next 50 years. Teachers have to educate students on energy use and consumption.

Activity 1

What is energy?

Energy is the ability to perform work. Energy is found in various forms. There is mechanical energy, electrical energy, chemical energy, thermal energy, radiant energy, and nuclear energy. These different forms of energy are used daily. Energy makes everything happen. The ability to perform work is broken into kinetic energy and potential energy. Work is the ability to put something in motion. Energy that is stored is potential energy. Energy that is moving is called kinetic energy.

The teacher will introduce kinetic and potential energy. A great way to demonstrate kinetic and potential energy is to use the classic roller coaster example. If technology is

available, you can play a quick video from YouTube showing people on a roller coaster ride.

Students can complete a chart, as shown below, by providing 5 examples demonstrating work. For each example the students provides, they will have to identify how potential and kinetic energy are being applied.

Example	Kinetic Energy	Potential Energy

Activity 2

Energy Foldable

Students will create an Energy foldable. This foldable will represent chemical energy, electrical energy, thermal energy, radiant energy, and nuclear energy.

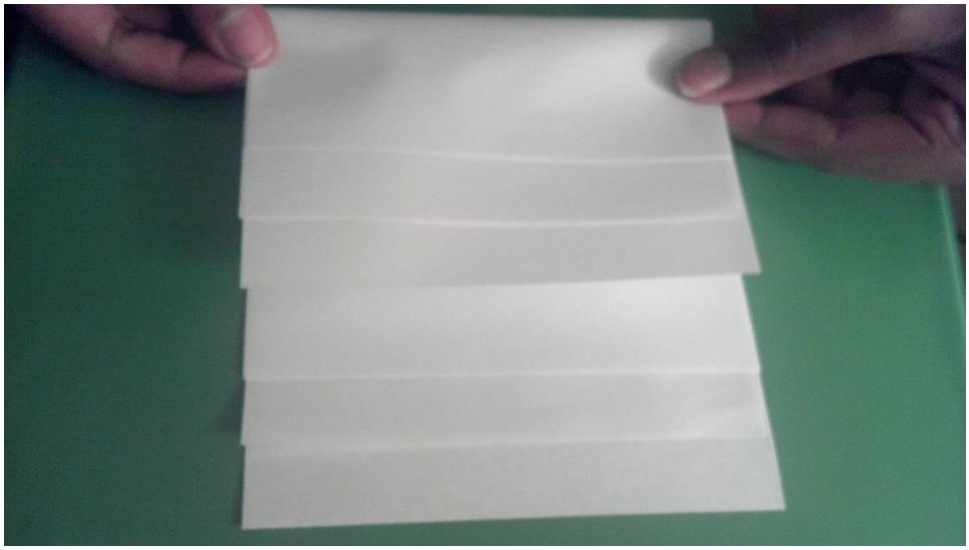
Instructions:

Students will be given 3 pages of legal size computer or construction paper.

Step 1: Stagger each of the 3 pages approximately a centimeter apart.

Step 2: The students should fold the pages down. Remind the students all of the pages should be a centimeter in length before folding a crease in the paper.

Step 3: Students will have to staple the foldable adjacent to the creased line on both sides.



Students will label the bottom of each page accordingly:

Page 1 Energy Foldable (The Cover of the Booklet)

Page 2 Chemical Energy

Page 3 Electrical Energy

Page 4 Nuclear Energy

Page 5 Radiant Energy

Page 6 Thermal Energy

For each energy tab, students will write the definition for that energy. Students will get a picture to represent that form of energy. Please direct students to draw, look through magazines, or search the internet for pictures. Students will then have write an explanation about the picture and how that form of energy is demonstrated by the diagram.

Activity 3

Renewable vs. Nonrenewable Energy

1. Energy is the ability to perform work. Work is needed to accomplish most physical things and a source is required to provide fuel for the work. Hook: Show students a battery operated toy. Have a class discussion asking the students

the following: Describe the motion of the object. What type of energy is being demonstrated? Explain, the energy source for the toy.

2. Divide the class into groups of three or four. Students will list various energy sources that are used to power the lifestyles of the 21st Century. Once students list the energy sources, they should briefly explain each one of the following: biomass, coal, geothermal, hydroelectric, nuclear, solar, wind, petroleum, wood, natural gas.

3. Teacher will then ask students what does renewable mean. How does renewable apply to energy? Class creates a definition and teacher will write the definition on the board for renewable energy. The class will now be directed to define nonrenewable energy.
   Students should be directed to create a T chart listing the energy sources into one of two categories, renewable energy and non-renewable energy.

4. Teacher will go to this link http://www.cleanlineenergy.com/sites/cleanline/media/resources/students/renewable/Renewables_Activity_1_Middle_School.pdf from the website clean line energy.com. Students will complete the worksheet.

Activity 4

Carbon Foot Print

Today students will learn, what is a carbon footprint? Below are a list of questions which could be distributed to students before watching the following video: "Carbon Footprint Animation" https://www.youtube.com/watch?v=AGRlo87oAUg. The teacher can use the Chunking method to distribute 1 or 2 questions, statements to each students, or a group. Chunking will allow the students to focus on the main idea of the video, yet provide students factual information from the text to contribute to the discussion.

How much CO2 is emitted from cars per 1,000 miles? Answer: Cars emit 1,300lbs of carbon dioxide per 1,000 miles.

According to the video text, airplanes release how many tons of CO2 per 2,062 miles? Answer: 1 ton.

When a bus or train travels 7 miles, how many kg of CO2 are emitted? Answer: 1kg of CO2.

If a computer is used for 32 hours, how much carbon dioxide is emitted? Answer: 1kg of CO_2.

How many plastic bags and bottles are equivalent to the release of 1kg of CO_2? Answer: 5 bags and 2 plastic bottles.

Eating an American cheeseburger costs 3.1kg of CO_2, explain why? Answer: Energy used to make the burger and transport it to the place of purchase.

What is a carbon footprint? Answer: The emission of CO_2 gas as a result of humans burning fossils fuels for energy.

How is the carbon cycle explained in the video? Answer: Plants absorb CO_2 from the air, Animals eat plants, when animals and plants die (decomposing bacteria transform CO_2) to be released back into the ground, or atmosphere.

In what way has human activity effected the carbon cycle? Answer: Cutting trees decreases the amount of CO_2 absorbed and the combustion of fossils fuels for energy releases CO_2. The atmosphere has an abundant amount of CO_2. Carbon dioxide is a greenhouse gas. The purpose of greenhouse gases is to warm the earth. An excessive amount of greenhouse gases causes global warming.

How does the video imply the needed change to make a better tomorrow? Answer: Creating new habits with transportation. The video shows cars and then a bus, walking, biking, and growing plants. New technologies using solar panels and wind turbines for energy. The need for new habits, technologies and ideas.

After viewing the video and reviewing the answers from the questions, the teacher should ask the students: How does global warming effect the Earth?

Responses should include:

-Climate changes which is causing an increase in temperature.

-Violent weather. (Teacher should clarify the difference between climates vs. weather.)

- Oceans warming resulting in the death of marine life.

-Glaciers melting, rise in sea level.

- Decreasing the air quality.

Students will now calculate their carbon footprint. Teachers will direct students to the nature.org website, http://www.nature.org/greenliving/carboncalculator/index.htm. This activity will allow students to understand how their lifestyle creates an imprint on the environment.

Constructed Response:

The majority of human activities create a carbon footprint. In the constructed response students should answer the objective, what is a carbon footprint? Explain, why carbon footprints are so important in the 21st century? How are carbon footprints effecting the Earth's environment? Students should make a claim, and use evidence from the text provided in the lesson to back up there claim, and the reasoning for their point of view.

Activity 5

The Energy Challenge: 15 years into the Future**.**

The world is facing an energy crisis. Nonrenewable energy provides immediate power to sustain our economy. The human population has increased from 7 billion in 2014 to 7.5 billion in 2030. Fossil fuels are diminishing at an alarming rate. Fossil Fuels will nearly be depleted in 35 years which would be in the year 2065.

The local energy companies have intergraded into one powerful corporation that rules the world. All energy is controlled by the System Operating Center. The System Operating Center has become extremely powerful. The System Operating Center is a central main frame computer that communicates with local network computers called the Smart Grid. The Smart Grid decides how the energy will distributed to the people and the amount of energy.

The government wants to improve the quality of life for the people and conserve nonrenewable energy. The government wants to conserve energy and decrease the amount of energy used per household. Campaign ads are posted everywhere for energy conservation.

Directions:

Video:

Since you are the future leaders and scientist of the world, it is your job to write a narrative script and video the story on society norms in the year 2030. Here are some of the things that must be in the video:

You are to create a video narration about an energy crisis and the society norms in that day. Students should be divided into groups consisting of 3 or 4 members. The video

should be at a minimum of 5 minutes but no more than 10 minutes. As a group, you have to figure out how the Smart Grid distributes energy to the average household.

You must include government regulations on housing, food, transportation, healthcare, telecommunications, and entertainment.

Inventions need to be invented by you to improve the energy lifestyles of the people.

Here are some of the restrictions I want to include in this brainstorming activity:

- Currently renewable energy accounts for a ¼ of the energy used per household.
- The average household max's out at 800 Kwh per month utilizing nonrenewable energy. (Kwh – kilowatts per hour)
- You have to account for all energy used. A budget sheet is described below.
- All energy used are assigned a Kwh per month.

Transportation – 400 Kwh per household. Includes train, car, bus, and or plane for the month.

Food- 200 Kwh for food purchased at a restaurant, grocery store, cooking at home.

Telecommunications- 100 Kwh

Entertainment- 100 Kwh

Healthcare- 120 Kwh (any visit during the month)

Housing- .25 Kwh per square foot.

The inventions have to be specific in detail. You will need to create an alternative way of providing energy that is not calculated on the smart grid.

Ideally you want budget your energy to rollover extra Kwh per month that are not used. Kwh is like having money in the bank. If energy is rolled over from your monthly budget, you have to explain on video how you were able to conserve energy.

Energy Budget Graphic Organizer

Energy	KWH Used per Month	KWH Saved per Month
Apartment		
House		
Transportation		
Food		
Telecommunication		
Healthcare		
Entertainment		
Total		

Software

Mac users should use I-Movie. A link is listed below on how to use the software.

https://www.msu.edu/course/tc/243/iMovie%20Tutorial.pdf

Window users may want to use Movie Maker. Below is a website link on how to use movie makers.

http://etc.usf.edu/techease/win/images/how-do-i-create-a-movie-in-windows-movie-maker/

Here is the rubric I will use to evaluate the video.

Rubric

Categories	Description	Points
Creativity	The producers of the film should be innovative and show creativity.	20 points.
Time	The film must be completed within 5-10 minutes.	10 points.
Energy Budget	A written plan explaining the average square footage for an apartment vs. a residential home.	25 points
Inventions	Inventions that solve the energy crisis. There should at least 2 inventions per group. Students will provide details on the inventions and how it helps impact the lives in 2030.	10 points
Government Regulations	Groups will need to have regulations on how energy is used. Explain, what happens when energy has to be re-routed to another Smart Grid. How do you prevent power outages? What are your Conservations campaigns to decrease kwh per household?	35 points

Activity 6

Make a Difference Now for a Better Future

Students will write a constructed response addressing the issues faced today with nonrenewable energy and how they plan to make an immediate change to create a better tomorrow. In your essay you need to address the following:

Explain the differences between renewable vs. nonrenewable energy. What are the current downfalls of both types of energy? Why is it important to reduce your carbon footprint? How do you plan on reducing your carbon footprint today to create a better tomorrow? Think and write about ways you could demonstrate stewardship in your community.

Rubric:

Students need to address the statement and answer each question. Students should access the knowledge acquired from the unit. The response should be specific and detailed.

- Explain the differences between renewable vs. nonrenewable energy. 20 points
- What are the current downfalls of both types of energy? 20 points
- Why is it important to reduce your carbon footprint? 20 points
- How do you plan on reducing your carbon footprint today to create a better tomorrow? 20 points
- Think and write about ways you could demonstrate stewardship your community. 20 points.

Key Terms

Biomass – Organic material such as plants, or wastes that are renewable and can be converted into energy.

CMO - Cubic Mile of Oil. An energy unit that is used to understand a global scale of energy consumption. A CMO is a mile wide, mile long and deep.

Climate – The weather averaged of a region as temperature, air pressure, humidity, precipitation, sunshine, cloudiness and winds, throughout the year, which is then averaged over a series of years.

Electric Energy - is energy that's stored in charged particles within electric field. The energy is carried by moving electrons in an electric conductor.

Ethics- Moral principles that deals with making decisions that are right or wrong.

Energy – The ability to perform work.

Fission- The dividing or splitting of splitting something into two or more parts.

Chemical Energy- a type of potential energy that is stored and released when a substance is transformed through a chemical reaction.

Carbon Foot Print – greenhouse gases emitted into the atmosphere due to human consumption of energy.

GDP- Gross Domestic Product. The monetary value of goods and services produced within a country's border within a specific time period. Typically the GDP is calculated yearly.

Geothermal – Energy that is derived from the thermal energy of the Earth's core.

Globalization - is a process of interaction and integration among the people, companies, and governments of different nations, a process driven by international trade and investment and aided by information technology.

Greenhouse Effect- Earth's atmosphere traps solar radiation with the use of greenhouse gases. The gases trap enough solar radiation that the earth environment becomes warm enough to support life.

Greenhouse Gases- gases found in the atmosphere such as carbon dioxide, methane, water vapor, nitrous oxide and other gases that absorb solar energy to warm the Earth.

Oil – a nonrenewable viscous combustible liquid that is derived from petroleum.

Petroleum - a liquid mixture of hydrocarbons that is present in certain rock strata and can be extracted and refined to produce fuels including gasoline, kerosene, and diesel oil; oil.

Mechanical Energy-is the sum of kinetic and potential energy in an object that is used to do work.

Nuclear Energy- Energy that is released during nuclear fission.

Population- the habitats of a specific group such as animal or human that lives in a town, city, or country.

Radiation – Energy that moves in the form of rays, waves, or particles.

Radiant Energy- Energy of electromagnetic waves.

Renewable Energy – An energy source that is not exhausted and easily replenished.

Solar Energy – Radiant energy from the sun that produces light and heat.

Thermal Energy- Energy that comes from the temperature of matter.

Transformation of Energy – Energy that can be transferred from one form to another.

Wind Energy - the process by which the wind is used to generate mechanical power or electricity.

Work – A way to increase or decrease an object's energy by using a force to change position, and or motion.

Appendix

North Carolina Essential Standards 6th – 9th Grade Science

Physical Science (P) Earth Science (E) Earth/Environmental (EE)

6th Grade Essential Standard

6. P.3 Understand characteristics of energy transfer and interactions of matter and energy.

The curriculum unit applies to this standard with Activity 2. Students creating an energy foldable allows them to understand how energy is transferred from one object to another. The energy transferred allows the object to perform work.

6th Grade Clarifying Objectives

6. P.3.1 Illustrate the transfer of heat energy from warmer objects to cooler ones using examples of conduction, radiation and convection and the effects that may result.

6. P.3.3 Explain the suitability of materials for use in technological design based on a response to heat (to include conduction, expansion, and contraction) and electrical energy (conductors and insulators).

7th Grade Essential Standard

7. P.2 Understand forms of energy, energy transfer and transformation and conservation in mechanical systems.

7. E.1 Understand how the cycling of matter (water and gases) in and out of the atmosphere relates to Earth's atmosphere, weather and climate and the effects of the atmosphere on humans.

The unit can be used for these standard with Activity 1 through 6.

Essential Standard 7.P.2 can be used for Activity 1. This teaches students about work, kinetic and potential energy. Activity 2 allows students to create the energy foldable which provides them knowledge of the various forms of energy.

Essential Standard 7.E.1 will apply to Activity 3 through 6. Activity 3 allows students to understand the difference between renewable vs. nonrenewable energy. The emissions produced from nonrenewable energy releases carbon dioxide into the atmosphere.

Activity 4 students calculate their carbon footprint. Students will calculate how much carbon dioxide they are emitting into the atmosphere. Activity 5 allows the students to be creative by finding solutions for the energy crisis. Activity 6 is a written assessment for the knowledge learned throughout the unit.

7th Grade Clarifying Objectives

7.P.2.3 Recognize that energy can be transferred from one system to another when two objects push or pull on each other over a distance (work) and electrical circuits require a complete loop through which an electrical current can pass.

7 .E.1.1 Compare the composition, properties and structure of Earth's atmosphere to include: mixtures of gases and differences in temperature and pressure within layers.

7 .E.1.6 Conclude that good health of humans requires: monitoring the atmosphere, maintaining air quality and stewardship.

8th Grade Essential Standard

8. P.2 Explain the environmental implications associated with the various methods of obtaining, managing, and using energy resources.

Activity 3 applies to this standard by teaching students about nonrenewable and renewable energy. Activity 4 gives students the opportunity to understand their role in contributing to the excessive release of carbon dioxide into the atmosphere. Activity 5 allows students to deal with budgeting energy because of the depletion of nonrenewable energy.

8th Grade Clarifying Objectives

8. P.2.1 Explain the environmental consequences of the various methods of obtaining, transforming and distributing energy.

8. P.2.2 Explain the implications of the depletion of renewable and nonrenewable energy resources and the importance of conservation.

9th Grade Essential Standard

EEn.2.8 Evaluate human behaviors in terms of how likely they are to ensure the ability to live sustainably on Earth.

Activities 4 and 5 apply to these standards. Activity 4 allows students to calculate their carbon footprint. Students will understand how their lifestyle contributes to the release of carbon dioxide into the atmosphere. Activity 5 promotes conservation and the ability to reduce, reuse and recycle natural resources.

9th Grade Clarifying Objectives

EEn.2.8.3 Explain the effects of uncontrolled population growth on the Earth's resources.

EEn.2.84 Evaluate the concept of "reduce, reuse, and recycle" in terms of impact on natural resources.

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