Lesson Plan Title: Renewable Resources

Teacher Name: Jennifer Tetrick

School: Cardinal Ritter High School

Subject: Life Sciences

Grade Level: Middle School

Problem statement, Standards, Data and Technology

<table>
<thead>
<tr>
<th>Asking questions and defining problems</th>
<th>Essential Questions:</th>
</tr>
</thead>
</table>
| Establish driving question for the lesson plan or define problem students will be solving. | 1. Why is it our duty to maintain available resources?  
2. In what ways could we sustain/improve the management of resources? |

<table>
<thead>
<tr>
<th>Day 1: (90-minute period)</th>
<th>Day 2: (90-minute period)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do Now Day 1: (10 minutes with discussion):</td>
<td>Day 2: Good morning, please go to the website provided (WATER FOOTPRINT) (20 minutes total). Complete the survey. We will discuss work with the findings of the survey after it is completed. This should take you 15 minutes to complete.</td>
</tr>
</tbody>
</table>
| Good morning, we will visit Air and Water Resources. Remember to label your science journal correctly. Today is________________________. | 1. Where do you use the most water according to your survey?  
2. In what ways can you reduce the amount of energy used on your water footprint? |
| Answer the following questions using RACE format. |  |
| 1. What are the names of atoms or molecules found in air and water?  
2. What are some uses of water inside of the human body? |  |
### Incorporating Next Generation Science Standards, Common Core, or State Standards
State the standards that will be covered during this lesson plan. Include all standards which may apply (NGSS, Common Core, or State Standards).

| MS-LS2-1 Ecosystems: Interactions, Energy, and Dynamics | Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem |
| MS-ESS3-1 Earth and Human Activity | Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. |
| MS-ESS3-3 Earth and Human Activity | Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.* |
| MS-ESS3-4 Earth and Human Activity | Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. |

### Obtaining and evaluating information
How will students be obtaining and/or collecting the information?

By the end of the lesson, students will identify the importance of sustaining/improving renewable resources by conducting an investigative research lab; and, by exploring various types of renewable/nonrenewable resources in collaborative groups.

<table>
<thead>
<tr>
<th>Day 1: (90-minute period)</th>
<th>Day 2: (90-minute period)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Introduce common ideas to scholars</strong> (5 minutes): Day 1</td>
<td>1. <strong>Think and Ink</strong>: (10 minutes) <strong>Day 2</strong></td>
</tr>
</tbody>
</table>

### Day 1: (90-minute period)

1. **Introduce common ideas to scholars** (5 minutes): Day 1

### Day 2: (90-minute period)

1. **Think and Ink**: (10 minutes) **Day 2**

### Questions

1. How does the earth use air and water?
2. Where does water come from? Can we make it artificially?
It’s important that students know that oxygen is an essential component of water but not as important in air. Nitrogen makes up about 76-78% of the atmosphere but oxygen is nearly 21% of the air. Although 76% of the earth is made up of water, it is not readily available for use due to the high levels of sea salt.

2. Air Notes: Smog (How is it created? What does it represent?) Smog is the result of a poorly balanced nitrogen cycle which affects the majority of the air humans/animals breathe; Acid Precipitation (What is it? How can this be harmful?) If it is at 5.6, it can offset the biochemical reactions of organisms living on the surface or within water.

3. Notes Day 1: What are the different types of resources? What are the pos/cons of resource management? (See Appendix D)

4. Check for understanding of the notes: Natural Resource Manipulatives (20 minutes) (See Appendix C)

Students will work in groups of four to review the questions on manipulatives. Each student will be responsible for answering the questions on their own worksheet. The questions are tiered in different levels. The first level asks the students to recall concepts they should know. The second tier asks students to identify or explain what they’ve just learned. The third tier pushes students to explain how they intend to use the

a. What are some other things that affect available air and water resources?

b. Students should state previously discussed ideas. They may say, “Running water; leaky faucets; taking long baths.” Provide additional example such as irrigation systems can cause available water sources (remember that 3% of available, usable water resources) to become contaminated with harmful chemicals.

c. Think about our school campus? Do you think we are being careful with our water and air resources? You must be specific and EXPLAIN your reasoning.

2. Day 2: Student notes will come from the following site (20 minutes) http://www.gracelinks.org/media/pdf/nexus_guide_finalforweb.pdf

a. Students will review the document and choose a specific energy resource to evaluate during their labs.

b. Students will use this information to create informative posters.
### Analyzing and interpreting data

How will students be analyzing and interpreting the collected data?

<table>
<thead>
<tr>
<th>Day 1: (90-minute period)</th>
<th>Day 2: (90-minute period)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Day 1 Activity: Renew A Bean</strong> (See Appendix C) (45 minutes)</td>
<td><strong>Day 2 Activity:</strong> What’s my impact? (90 minutes or more total)</td>
</tr>
<tr>
<td>This activity explores the difference between renewable and nonrenewable resources. It shows students that nonrenewable sources will be exhausted over time. Student learn that conservation measures along with increased use of renewables can slow the depletion of fossil fuels. Through the activity, students will gain an increased understanding of: • the eventual depletion of fossil fuel resources • the effect of changing rates of energy use on the future • the need to conserve as well as the need to develop renewable resources</td>
<td>Students will collect data on the school community after choosing an area to focus on based on the Nexus document. They may focus on how food impacts the school’s energy use; water consumption; waste systems; building infrastructure…etc.</td>
</tr>
</tbody>
</table>

### Use of technology and software

Indicate the type of technology and software students will be using in order to implement this lesson plan.

- Computers, graphing sheets, calculators, and internet access

### Collaboration, critical thinking and communication
Collaboration
Indicate how students will be collaborating during the implementation of the lesson plan.

Students have multiple opportunities to collaborate.

When engaging in a new topic, it is best that are separated into audio, visual and kinesthetic learners. Each learning group will have the same objective but different the materials will be scaffolded to meet the individual learning needs of each group. By creating materials that are particular to a learning style, students enjoy learning the material and recognize the teacher’s efforts to support them. Environments where students feel respected are more likely to succeed and have high-achieving students (Metropolitan Center for Urban Education, 2014).

Cooperative learning groups are beneficial to educators and students. According to UNSW Faculty of Medicine (2009), small group instruction serves students through increased levels of individual involvement, and through developing different skill sets (p. 3). Grouping students to work collaboratively in labs exposes students to critical thinking interactions. This type of collaboration is referred to as “information seeking” where students discuss assigned topics (p. 5). Cooperative learning group goals should ease students into independent practice.

Critical Thinking
How will the students evaluate the question or defined problem to reach an objective conclusion? How will the students being using the learned content and collected data to be able to critically think about the established question and/or problem on this lesson plan?

<table>
<thead>
<tr>
<th>Day 1: (90-minute period)</th>
<th>Day 2: (90-minute period)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflection questions on Renew-A-Bean:</td>
<td>Part 1: Students will read the following article independently: <a href="http://www.gracelinks.org/blog/7858/beef-has-a-big-water-footprint-here-s-why">http://www.gracelinks.org/blog/7858/beef-has-a-big-water-footprint-here-s-why</a></td>
</tr>
<tr>
<td>FOLLOW-UP:</td>
<td>Students will then answer the following questions based from the power point presentation and the information they obtained in their readings. (See Appendix E)</td>
</tr>
<tr>
<td>1. When did each group run out of energy? How did this relate to how quickly they used energy? Which groups ran out of energy first?</td>
<td></td>
</tr>
<tr>
<td>2. Have students look at their graphs. During which decade did each group start using more renewables than nonrenewables? How is this represented on the graph? Which kind of energy will people probably use more of in the future?</td>
<td></td>
</tr>
<tr>
<td>3. Introduce the concept of “sustainable use.” A</td>
<td>Day 2 Big Project: Students will read the following resource within their groups: <a href="http://www.gracelinks.org/media/pdf/nexus_guide_finallforweb.pdf">http://www.gracelinks.org/media/pdf/nexus_guide_finallforweb.pdf</a> (This should be adapted to meet the...</td>
</tr>
</tbody>
</table>
sustainable rate of energy use ensures that there will always be enough energy for the next year’s needs. Ask groups when, if ever, their energy use was sustainable during the game.

4. Ask students if they think energy use can keep increasing indefinitely. Why or why not? If students answer that the rate of energy use can keep increasing because renewable energy will never run out, discuss limits on the growth of renewable sources of energy (e.g., available land for biomass crops and wind turbines, water sources for hydro).

5. Ask students what they think the ratio of renewable to nonrenewable energy use in the United States is in the current year (see “What Is Renewable Energy?” activity for 2001 figures). Ask how they think the rate at which we use energy changes each year. Is our current use of energy sustainable? What do we need to do to make it sustainable?

| learning needs of your scholars. I will present this to my students during a PowerPoint presentation. See (Appendix F). |
### Communication
How will the students communicate their findings and conclusion regarding the established question and/or problem?

To communicate their findings, students will create informative posters to demonstrate ways the school community can be more cognizant of sustaining the available resources in the school.

### References

#### Teacher’s References
Include all references used to develop and implement this lesson plan.

- Renewable Resources: *Renew A Bean Activity*  
- Stephanie Elkowitz- Natural Resource manipulatives  
  [http://www.nextgenscience.org/search-standards?keys=natural%20resources&tid%5B0%5D=106&page=1](http://www.nextgenscience.org/search-standards?keys=natural%20resources&tid%5B0%5D=106&page=1)
- Metropolitan Center for Urban Education. *Culturally responsive classroom management strategies*. (n.d.) Retrieved September 18, 2014 from:  
  [https://mail.google.com/mail/u/0/#inbox/15fc66d51bf5aebf?projector=1](https://mail.google.com/mail/u/0/#inbox/15fc66d51bf5aebf?projector=1)

#### Student’s References
Include all references students will need to complete this lesson plan.

- [https://www.watercalculator.org/education/water-resources-for-educators/](https://www.watercalculator.org/education/water-resources-for-educators/) (Water Footprint Calculator)
- [www.epa.gov/](http://www.epa.gov/) (State environmental organizations/federal government/standards)

Guided notes (See Appendix A)

### Assessment Plan
**Assessment Plan**

How will the students be assessed during and/or at the end of the lesson plan?

Include resources that will be used to assess the students for the lesson plan.

<table>
<thead>
<tr>
<th><strong>Day 1: (90-minutes)</strong></th>
<th><strong>Day 2: (90-minutes)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exit Ticket Questions to be answered in RACE format (10 minutes)</strong></td>
<td>Name: ______________________________</td>
</tr>
<tr>
<td>1. What is the difference between a natural resource and synthetic product?</td>
<td>Natural Resources Exam</td>
</tr>
<tr>
<td>2. Compare and contrast renewable and nonrenewable resources.</td>
<td>Directions: Answer the following questions.</td>
</tr>
<tr>
<td>3. Give at least 3 examples of a renewable and nonrenewable resource.</td>
<td>1. What is a natural resource?</td>
</tr>
<tr>
<td>4. How would life on Earth be different if we didn’t make synthetic products from natural resources?</td>
<td>a. A synthetic product made from substances or materials on Earth</td>
</tr>
<tr>
<td></td>
<td>b. A material or component found in the natural environment</td>
</tr>
<tr>
<td></td>
<td>c. A material made by manipulating resources in Earth’s crust</td>
</tr>
<tr>
<td></td>
<td>d. A waste product made as result of manipulating resources on Earth</td>
</tr>
<tr>
<td></td>
<td>2. Which of the following is NOT a natural resource?</td>
</tr>
<tr>
<td></td>
<td>a. A grasshopper</td>
</tr>
<tr>
<td></td>
<td>b. Grass</td>
</tr>
<tr>
<td></td>
<td>c. A rock</td>
</tr>
<tr>
<td></td>
<td>d. Cotton fabric</td>
</tr>
<tr>
<td></td>
<td>3. How can we use natural resources?</td>
</tr>
<tr>
<td></td>
<td>a. We can use energy from natural resources to generate electricity</td>
</tr>
<tr>
<td></td>
<td>b. We can use natural resources for food</td>
</tr>
<tr>
<td></td>
<td>c. We can use natural resources to construct houses and buildings</td>
</tr>
<tr>
<td></td>
<td>d. All of the above</td>
</tr>
<tr>
<td></td>
<td>4. What kind of resource can be regenerated or replenished by biochemical cycles?</td>
</tr>
<tr>
<td></td>
<td>a. A renewable resource</td>
</tr>
</tbody>
</table>
b. A nonrenewable resource
c. A synthetic product
d. A fossil fuel

5. Which of the following is a nonrenewable resource?
a. Sunlight
b. Trees
c. Minerals
d. Water

6. Which of the following would you never find naturally in the environment?
a. Water
b. Minerals
c. Plastic
d. Cotton

7. Which of the following is a synthetic product made from petroleum (crude oil)?
a. Gasoline
b. Styrofoam
c. Polyester
d. All of the above

8. What is the difference between a renewable and nonrenewable resource?

9. What can happen in a renewable resource is used up faster than it can be replenished?

10. What is one synthetic product that is made from plants?
## Resources and Costs

### Resources Needed
List all the resources needed (equipment, facilities, materials or any other resources).

<table>
<thead>
<tr>
<th>100 beans (or poker chips, or different colored pieces of paper)</th>
<th>Paper Bags/Opaque containers</th>
</tr>
</thead>
</table>

### Costs
List the estimated cost of implementing this lesson plan.

- $10-$20 (all items will be reusable for future classes)

Include all costs related to equipment, materials and any resource critical to the implementation of the lesson plan.

## Implementation Plan

### Implementation Plan Timeline
Establish the timeline to implement the lesson plan.

Provide an estimate of time and days in order to complete the lesson plan.

This lesson plan will last 2-3 days in total. Please see the bold print headings throughout the lesson plan.

<table>
<thead>
<tr>
<th>Day 1: (90-minutes)</th>
<th>Day 2: (90-minutes)</th>
</tr>
</thead>
</table>
| 1. Do Now
2. Notes on Renewable Resources
3. Manipulatives on Renewable Resources. Students will answer the questions on their worksheets
4. Renew-A-Bean Activity
5. Debrief Renew-A-Bean
6. Closing discussion on how we are affecting our natural resources. | 1. Do Now (Water Footprint) with reflection questions
2. Think and Ink
3. Discussion of Think and Ink- How do air and water resources impact our school community?
4. Students review the Nexus PDF and discuss the different types of energy used throughout a community. Students should then create a list of energies used within the school.
5. Use the information collected to determine how the school can maintain or improve its energy efficiency. |
6. Create an informative poster using the information analysis from the survey lab.
7. Post findings (posters) around the school.

Appendix A

NATURAL RESOURCES
• What is a natural resource?

Natural resources exist “____________” or innately in the world. They are not the result of ____________ manipulation or creation.
• Natural resources can be ____________ or ____________.
• ____________, ____________, ____________ and minerals are natural resources.
• The ____________, fossil fuels, ____________, ____________ and wind are natural resources as well.
• What are three ways we use natural resources?
  1. ____________________________________________________________________________________
  2. ____________________________________________________________________________________
  3. ____________________________________________________________________________________
• There are two kinds of resource:
  1. ______________________________
  2. ______________________________

RENEWABLE RESOURCES
• ____________ resources can ____________ if they are living or ____________ by biochemical cycles in they are nonliving.
• Theoretically, there is an “______________” amount of renewable resources.
NONRENEWABLE RESOURCES

- Nonrenewable resources cannot be renewed or replaced by natural processes.
- There is a limited amount of nonrenewable resources - once used up, they are forever depleted.
- Fossil fuels (coal, oil, and natural gas), metals, and minerals are nonrenewable resources.
- Renewable resources can become nonrenewable if they are used up faster than they can be replenished.
- Example: If we cut down trees faster than we replant them, trees can become a nonrenewable resource because there are no trees to regenerate.

SYNTHETIC PRODUCTS

- Humans use nonrenewable resources to make synthetic products.
- What is a synthetic product?
  - A synthetic product is made through chemical reactions.
  - Natural resources are changed or modified during chemical reactions to make synthetic products.
  - Humans can change or modify all kinds of nonrenewable resources to make synthetic products.
  - We can make synthetic products from fossil fuels and minerals as well as from plants.

PLANT-BASED PRODUCTS

- What kind of synthetic products can we make from plants?
  - __________________
  - __________________
  - __________________
ANIMAL-BASED PRODUCTS
• What kind of synthetic products can we make from animals?

PETROLEUM-BASED PRODUCTS
• ____________-based products are synthetic products made from ____________ or ____________ oil.
• ____________ oil (simply called oil) is a fossil fuel. We use crude oil as a major source of ____________. It is refined to make ____________. We use crude oil to make many other ____________ products as well.
• What kind of synthetic products can we make from petroleum?

Appendix B

Note: The numbers used in this game are approximate and do not reflect actual depletion rates. The actual figures are difficult to estimate. The intent is only to simulate depletion of nonrenewable resources.

GRADES: 7–12
Note: The difficulty of this activity can be adjusted for different grade levels. Junior high teachers may want to end the activity with step 6, or continue subsequent rounds with each group using the same variation.

SUBJECTS: math, science, social studies
TIME: one to two 45-minute class periods
MATERIALS: Divide students into groups of five. Each group will need:
• a paper bag containing 100 beans (or poker chips, or different colored pieces of paper): 94 of one
color, six of another color
• extra beans of both colors: 10 of first color, 40 of second color
• five copies of the student
  handout
• extra graph paper

PREPARATION: Fill each bag with 94 beans of one color, six beans of another. This represents the ratio of nonrenewable
to renewable energy use in the United States today. Mix the beans well.

Renew-A-Bean
12 UNION OF CONCERNED SCIENTISTS Renewables Are Ready Teacher’s
PROCEDURE:

1. If you have not done the “What Is Renewable Energy?” activity, review with students the difference between renewable
and nonrenewable resources and what those resources are. Ask them how much of each type of resource
they think we are using in the United States today. Do they think the world will use more or less energy in coming
years?

2. Discuss rates of energy use. Ask students whether they use the same amount of energy all day, or if the amount
of energy they use varies at different times. Does energy use vary with the season? Do today’s students use more
or less energy than their parents did when they were in school? Explain how increases and decreases in energy
use each year can be expressed in percentages.

3. Tell the students that they will participate in a game called “Renew-A-Bean.” Explain that the beans in the paper bag
represent nonrenewable and renewable resources. They will draw beans from the paper bag in order to simulate
energy use over time. The class will play the game twice.

4. Divide the class into groups of five. In the games, students in each group will take turns drawing a given number
of beans from the bag. When they pick a “nonrenewable” bean, they should set it aside—it is “used up.” When
they pick a “renewable” bean, they should return it to the bag. Each drawing represents one decade.
5. Distribute bags. In the first game, have students in each group take turns drawing 10 beans per decade out of the bag. Have them record the number of renewable and nonrenewable beans they drew on their student data sheet. Groups should stop picking beans when all the nonrenewable beans are “used up.”

6. Ask groups how many decades it took to “run out” of nonrenewable energy. When the nonrenewable energy ran out, was there enough energy to meet the next decade’s energy needs (10 beans)? Graph energy use over time. (Sample graph provided on pg. 14.) Ask students how they could make the energy supply last longer. They should come up with two answers—use less energy (conservation) and use more renewables.

7. In the next game, give each group a different variation to simulate. You can use the variations and charts on the teacher information sheet (pg. 14) to tell students how many beans to pick each year, or you can have students make up variations and calculate the numbers on their own. Some groups should increase the rate of energy use, some should conserve energy, and others should increase the percentage of renewable beans in their mix. Have each group chart and graph their results.

8. At the end of the second game, list the different variations on the blackboard. Ask the class to guess which variation produced the longest-lasting energy supply. Then, have one student from each group copy its chart of results on the board.

Appendix C
What is a natural resource?
A. A nonliving substance found in the environment
B. A living thing found on Earth
C. A living or nonliving thing that exists "naturally" in the world
D. A material that is not normally found in the environment

What are THREE ways we use natural resources?
1. **Food**
2. **Fuel**
3. **Housing**

Complete the statement, __________ resources are made from natural resources.
A. Living
B. Synthetic
C. Organic
D. Nonrenewable

Which of the following is NOT a natural resource?
A. Clothing
B. Cotton
C. Water
D. Rocks

What type of resource can be regenerated or replenished by biochemical cycles?
A. All natural resources
B. Synthetic resources
C. Renewable resources
D. Nonrenewable resources

Which of the following is a nonrenewable resource?
A. Bacteria
B. Minerals
C. Plants
D. Water

What synthetic products can be made from petroleum (crude oil)?
A. Plastic
B. Polyester
C. Nylon
D. All of the above

Recycling means to discard a product in a way so that it can be used again (for the same or new purpose). Why should we recycle products such as plastic containers and metal cans? How would life on Earth change if we didn’t recycle these products?

There is growing concern that we are using fossil fuels at such a fast rate that there won’t be any left for future generations. If we lessen our use of fossil fuels, could we “save” fossil fuels for future generations? Argue why we should or should not curb (lessen) our use of fossil fuels. Defend your argument with scientific facts.

Compare and contrast natural and man-made resources.

What is the difference between a renewable and nonrenewable resource?

How are natural resources distributed on Earth?
A. They are most often found near the equator
B. They are concentrated in temperate climates
C. They are evenly distributed over Earth’s continents
D. They are unevenly distributed across the planet

Give an example of at least one synthetic product made from:
- Plants
- Animals
- Petroleum (crude oil)

Minerals and metals are most often found:
A. near large bodies of water
B. in the ocean
C. near tectonic plate boundaries
D. at high elevations

What can happen if a renewable resource is used up faster than it can be replenished?
Fertile soil is most often found:
A. along the equator
B. where temperatures are relatively mild and precipitation is relatively high
C. where it’s hot and dry
D. in higher elevations

What are biodiversity “hotspots?”
A. Where biodiversity is very low, such as in deserts
B. Where biodiversity is very high, such as in tropical rain forests
C. Warm regions that are “unstable” due to lack of biodiversity
D. Locations that are unstable despite having high biodiversity

How can uneven distribution of resources lead to conflict or wars?

Explain how distribution of resources impacts the economic activities of a country and a country’s wealth or prosperity.

Can a country compensate for having very little natural resources? How would a country compensate for lack of resources in the past? How can they “compete” with countries that have abundant reserves of natural resources today?

In the past, countries have fought with other countries for regions that were rich in resources such as fertile land and metals or minerals. What natural resource(s) do you think countries might fight over in the future? Where might these conflicts take place?
Appendix D

- **POWERPOINT OUTLINE**
  - Natural Resources
  - Renewable vs. Nonrenewable Resources
  - Man-Made Products
  - Distribution of Natural Resources
  - Effects of Uneven Distribution

- **NATURAL RESOURCES**
  - **Natural resources** are things, materials, substances and components found in the natural environment.
  - Natural resources exist “naturally” or innately in the world. They are not the result of human manipulation or creation.
  - **NATURAL RESOURCES**
  - Natural resources can be living or nonliving.
  - Plants, animals, rocks and minerals are natural resources
  - The sun, fossil fuels, soil, water and wind are natural resources as well
• **NATURAL RESOURCES**
  • We use natural resources for many things:
    – We use energy from natural resources for transportation, to generate electricity and to manufacture products.
    – We use natural resources for food. These resources – specifically plants and animals - provide energy that “fuels” our bodies.
    – We use natural resources to construct houses, buildings and roads.

  – **NATURAL RESOURCES**
  • There are two kinds of natural resources:
    – Renewable resources
    – Nonrenewable resources

  – **RENEWABLE RESOURCES**
  • Renewable resources can regenerate if they are living or replenished by biochemical cycles if they are nonliving.
  • Theoretically, there is an “infinite” amount of renewable resources.
  • Water, sunlight, plants, animals and wind are renewable resources.

  • **NONRENEWABLE RESOURCES**
  • Nonrenewable resources CANNOT be regenerated or replenished by natural processes.
  • There is a finite amount of nonrenewable resources - once used up, they are forever gone.
  • Fossil fuels (coal, oil and natural gas), minerals and metals are nonrenewable resources.

  – **NONRENEWABLE RESOURCES**
  • Renewable resources can become nonrenewable resources if they are used up faster than they can be replenished.
  • If the resource no longer exists, there is nothing to regenerate or be replenished.
  • Example: If we cut down trees faster than we grow them, trees can become a nonrenewable resource because there are no trees to regenerate.

  • **SYNTHETIC PRODUCTS**
  • Human use natural resources to make synthetic products.
  • Synthetic products are man-made materials and substances.
  • Synthetic products are artificial - they do NOT exist naturally in the environment.

  • **SYNTHETIC PRODUCTS**
  • A synthetic product is made through chemical reactions.
  • Natural resources are chemically changed or modified during chemical reactions to make synthetic products.
  • Humans can chemically change or modify all kinds of natural resources to make synthetic products.
  • We can make synthetic products from plants and animals as well as from metals, minerals and other natural resources found within Earth.

  • **PLANT-BASED PRODUCTS**
  • Plant-based products are synthetic products made from plants.
Plants can be used to make food. Wheat, corn and sugar cane are plants. We use parts of these plants as ingredients to make food such as bread, chips and cookies.

Plants can be used to make medicine. Many medicines that treat pain, acne and infectious diseases are made from plant parts and plant oil.

Plants can be used to make lotions and cosmetics.

- **ANIMAL-BASED PRODUCTS**
  - Animal-based products are synthetic products made from animals.
    - Animals can be used to make clothing. We use fibers from animals, such as wool from sheep and cashmere from goats to make sweaters, coats and other items.
    - Animals can be used to make food. We use eggs from chickens and milk from cows as ingredients to make all sorts of food items.
    - Gelatin is a natural substance obtained from animals. Gelatin is used as a gelling agent in foods such as ice cream and marshmallows. It can be used to make the shell of medical capsules in order to make swallowing pills easier.

- **PETROLEUM-BASED PRODUCTS**
  - Petroleum-based products are synthetic products made from petroleum or crude oil.
    - Crude oil (simply called oil) is a fossil fuel. We use crude oil as a major source of energy. It is refined to make gasoline.
    - We use crude oil to make many other synthetic products as well.
      - Crude oil is used to make different kinds of plastics, including PVC, vinyl and styrofoam.
      - Crude oil is used to make nylon and polyester, which are often used in clothing.
      - Crude oil is used to make lubricants, waxes and tar.

- **DISTRIBUTION OF RESOURCES**
  - Earth’s natural resources are not distributed evenly across the planet.
  - There are several factors that cause natural resources to be unevenly distributed. The three most important factors are:
    - Climate
    - Earth’s History
    - Geological Processes

1. **DISTRIBUTION OF RESOURCES**
   - Plants and animals require certain environmental conditions to survive. Latitude, ocean currents, wind currents and other factors determine the temperature and precipitation (climate) of a region.
   - Plants and animals are found in regions where temperature is just right and there’s enough precipitation to survive.

2. **DISTRIBUTION OF RESOURCES**
   - Some of Earth’s resources, such as fossil fuels, formed from the remains of ancient plants and animals.
   - Where these plants and animals lived in the past determines where reserves of these resources are found today.
• DISTRIBUTION OF RESOURCES
  3. Geological Processes
     – Many metals and minerals are found where new crust is being formed and/or destroyed. This occurs at tectonic plate boundaries or where volcanic activity is taking place or took place in the past.

• DISTRIBUTION OF RESOURCES
• Let’s take a look at five important natural resources that are unevenly distributed on Earth:
  – Fertile Soil
  – Biodiversity
  – Fossil Fuels
  – Uranium
  – Metals & Minerals

• FERTILE SOIL
• Humans depend on fertile soil for agricultural purposes. We use fertile soil to cultivate crops and animals.
• Fertile soil is most often found in temperate climates, where temperature is mild and precipitation is relatively high. Temperate climates are most often in mid-latitudes.
• FERTILE SOIL
  - The most fertile soil on Earth is found in the United States, Europe, India and China.

• BIODIVERSITY
• Biodiversity is the diversity of life.
• Biodiversity is one of Earth’s greatest resources because:
  – It maintains equilibrium or balance in ecosystems.
  – It is a source of new medications. Many medicines are derived from plants and animals.
  – It promotes (improves) water and soil quality.
• Biodiversity is richest (greatest) in the tropical rainforests. We call these regions biodiversity hotspots.

• BIODIVERSITY
• The richest biodiversity is found in South America, Africa and Southeast Asia.

• FOSSIL FUELS
• Fossil fuels are major source of energy.
• There are 3 major fossil fuels: coal, oil and natural gas.
• Fossil fuels are found deep within Earth. They accumulate in large pools or reserves.
• The organisms that lived long ago determine where reserves of fossil fuels are found.
  – Coal reserves are found where ancient swamps used to be located on Earth.
  – Oil reserves are found where the remains of marine organisms were buried.
  – Natural gas reserves are often found near oil reserves.

• FOSSIL FUELS
The largest coal reserves are found in the United States. Russia and China have large coal reserves as well.

**FOSSIL FUELS**

The largest oil reserves are found in the Middle East. Large oil reserves are also found in Canada, Mexico and Russia.

**FOSSIL FUELS**

The largest natural gas reserves are found in Russia. Large natural gas reserves are also found in the Middle East, the United States and China.

**URANIUM**

Uranium is a naturally radioactive metal. It is found in Earth’s crust.

Uranium is important to nuclear power. Uranium atoms are split apart (in a process called fission). This releases huge amounts of thermal energy. This energy is captured and used to produce electricity.

**URANIUM**

The largest uranium reserves are found in Australia. Large reserves are also found in Kazakhstan, Russia and Canada.

**METALS & MINERALS**

Most of Earth’s metals and minerals are found near plate boundaries or faults.

Gold and diamonds are two of the most desired substances on Earth.

– Gold is a precious metal most often found near faults and inactive volcanoes.
– Diamonds are minerals. They are often found near ancient volcanoes, specifically in old volcanic pipes that carried magma from inside Earth to Earth’s surface.

**GOLD**

The largest gold deposits are found in the United States and Europe (specifically Germany).

**DIAMONDS**

The largest diamond deposits are found in Australia and Africa (specifically South Africa).

**UNEVEN DISTRIBUTION EFFECTS**

There are consequences to uneven distribution of resources:

– Human Settlement
– Jobs
– Trade
– Conflict & War
– Wealth & Quality of Life

**UNEVEN DISTRIBUTION EFFECTS**

People tend to settle in regions that have resources they need to survive. Most important to survival is water and fertile land, which is used for cultivating crops and animals.

Humans thrive in temperate climates with relatively mild conditions and high precipitation. This explains why countries with the high populations are in North America, Europe and Asia.

**UNEVEN DISTRIBUTION EFFECTS**
• The economic activities of a country often depend on the resources in that country. In other words, people tend to have jobs that involve harvesting or using the resources abundant in that country.
• Countries abundant in fossil fuels will have more jobs related to oil and gas production or coal mining. Countries with fertile land will have more jobs related to farming and ranching.
• **UNEVEN DISTRIBUTION EFFECTS**
  • If a country does not have certain natural resources, the country can trade with other countries that have those resources in order to obtain what it wants or needs.
  • The country can exchange resources it has for the resources it needs.
• **UNEVEN DISTRIBUTION EFFECTS**
  • Countries sometimes fight with each other over control of resource-rich regions. Countries have fought with each other over gold, diamonds and fertile land. More recently, countries have fought over regions rich in oil.
• **UNEVEN DISTRIBUTION EFFECTS**
  • The wealth of a country and the quality of life of people that live in that country are determined by the country’s economic activities.
• Economic activities often depend on the abundance of natural resources in that country. Therefore, wealth of a country and quality of life *often* depend on the abundance of natural resources in that country.
• **UNEVEN DISTRIBUTION EFFECTS**
  • The abundance of natural resources is not the only factor that determines whether a country is prosperous.
  • Many wealthy countries rely on manufacturing products and technology to make up for lack of resources.

**Appendix E**

**Purpose:** *The purpose of this lab is to identify the different types of renewable energy resources in your school by collecting a survey and analyzing the results.*

**Answer the following pre-lab questions with your team:**

1. **What are the different types of renewable energy resources?**

2. **What are some of the advantages and disadvantages of using renewable resources?**

**Use the table below to gather data about your school community:**
<table>
<thead>
<tr>
<th>Renewable Energy Resource</th>
<th>Is this resource being used efficiently? Y/N</th>
<th>Where is the energy resource used?</th>
<th>Why is this resource used? Can the school use an alternative resource? If so, which one?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Critical Thinking Questions:

1. What energy does the school utilize most? How do you know?

2. What are the nonrenewable resources the school uses?

3. How can the school manage the nonrenewable resources more wisely?

4. How do you contribute to the school’s energy use? Ex: Do you drink all the water in your water bottle before filling up?
Appendix F

**Purpose:** Energy is used to sustain the needs and demands of humans. We need lots of it to power all our electronics, heat our homes, fuel for our cars, and industries. You are going to explore one type of renewable or non-renewable form of energy by conducting a lab that surveys the way our school uses different types of energies.

**Task Definition:** Create visual presentation (poster, photo-story, PowerPoint, etc...) which will be displayed to teach others about different types of energy. Partners/groups have been assigned.

**Criteria:** You must have the following information on your project...

**For Types of Energy**
- The source of the energy.
- Explain how the energy is changed into a form of energy we use.
- Explain how this type of energy affects the environment.
- Explain reasons why this type of energy is good or bad?
- Identify the type of energy as renewable or non-renewable.

**For Energy Conservation or Energy Transportation**
- Explain why people need to conserve energy.
- Explain ways to conserve energy you have researched; you can’t just list ideas you have.
- Explain alternative methods of producing electricity.

**Project due date:** _________________________________