There is a Place for Every Type of Energy
By Jenny Hoffmann

Background Information

*Power Point *see attached Power Point*

The current global population is 7 billion people. By 2050, the global population will exceed 9.6 billion people. The need for energy will double. In the past 100 years, the Industrial Revolution has led us to use almost all of the natural resources that can be used for energy. There are many ways to generate electricity. Efficient use of a blend of energy will help meet the demands of increased population growth and work towards sustainability.

Types of energy used in the United States

*Individual Work *see attached scoring guide*

Students will research on the internet to find out what types of energy are used in the United States and what percentage each type of energy represents out of the total energy used. Students will use the information and create a graph using Excel. Students will email the graphs to the teacher.

Exploring Different Types of Energy

*Groups of 2-4, graded on completion*

Each group will be given a large piece of chart paper. The teacher will assign one of the following types on energy to each group: coal, tidal, solar, wind, nuclear, biofuel, natural gas. Groups will research the type of energy and write their findings on the chart paper. The chart should contain four sections: Background Info, Pros, Cons, Summary. Once completed, the groups will post their chart paper on the wall somewhere. One at a time, a group will stand near their poster and explain their findings. Each student must speak in the explanation of the chart paper.

The Power Plant

*Groups of 2 *see attached rubric*

Each group will use their own materials to create a 3-D model of an energy plant. Students can choose from: coal, tidal, solar, wind, nuclear, biofuel, natural gas. Each group will also create a key that will allow for each main component of the plant to be labeled. Students will take notes on their research and record the notes in their laboratory journals. Students will sketch the layout of the plant in their laboratory journals. The models will be presented in class with a slide show and then on display at lunch.
Beta Particle Emission

*Groups of 2, graded on completion* *see attached lab sheet*

Set up the radiation counter lab. Each student group should have: radiation counter tower, isotope sample, Geiger counter machine, plastic tray, 2 sheets of graph paper with room to draw a data table, pencil, calculator, 1/8” thick square of Al, ¼” square of Al, 3/8” square of Al, 5/8” of Al. This lab will demonstrate how beta particle emission is controlled with the use of distance and shielding. Students will record their data in a data table, and then plot the data on a line graph. On the first graph, beta particle counts will be on the y axis and distance will be on the x axis. On the second graph, beta particle counts will be on the y axis and thickness will be on the x axis.
Reflection Questions

*Individual Work, graded on completion* *see attached worksheet*
## Types of Energy Graph Scoring Guide

### Student Information:
- **Student Name:** ________________________________
- **Hour:** _____
- **Date:** ______

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Points Possible</th>
<th>Points Earned</th>
</tr>
</thead>
<tbody>
<tr>
<td>All energy types are represented</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Graph has a title</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Graph contains accurate information</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Graph has x axis and y axis labeled correctly</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Graph contains different colors</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

Total Points earned  /100

### Comments:

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**Notes:**
- Check that all energy types are represented accurately.
- Ensure the graph has a clear title.
- Confirm that the information displayed is accurate.
- Verify that the x and y axes are labeled correctly.
- Confirm that different colors are used to distinguish data types.

**Grading Criteria:**
- All criteria must be met to receive full points.
- Partial credit may be awarded for partial fulfillment of criteria.
- The total points earned should not exceed 100.
# 3D Model Rubric

Student Name: ___________________________   Hour: _____  Date: _____

<table>
<thead>
<tr>
<th>Category</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>Points Earned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>Appropriate materials, all features represented</td>
<td>Materials are functional, features are not represented</td>
<td>Materials function poorly, some features are left out</td>
<td>Falling apart, missing a lot of features</td>
<td></td>
</tr>
<tr>
<td>Key</td>
<td>All items of importance are clearly labeled</td>
<td>Almost all items of importance are clearly labeled</td>
<td>Several items of importance are clearly labeled</td>
<td>Labels are not clear or no important items are labeled</td>
<td></td>
</tr>
<tr>
<td>Research</td>
<td>4 pages of notes</td>
<td>3 pages of notes</td>
<td>2 pages of notes</td>
<td>1 page of notes</td>
<td></td>
</tr>
<tr>
<td>Sketch</td>
<td>All features are represented clearly and drawn to scale</td>
<td>All features are represented clearly, but scale is not considered</td>
<td>Features are left out, information is hard to identify, and there is no scale</td>
<td>Design is not effective, sketch is not well thought out, not drawn to scale</td>
<td></td>
</tr>
<tr>
<td>Slideshow Presentation</td>
<td>5-10 slides Audience is engaged</td>
<td>Less than 5 slides Audience is somewhat engaged</td>
<td>5-10 slides Audience has little interest</td>
<td>No audience interest and less than 5 slides</td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>The display included required elements as well as additional information</td>
<td>The display included some of the required elements as well as additional information</td>
<td>The display included few of the required elements as well as additional information</td>
<td>The display was missing many required elements and had no additional information</td>
<td></td>
</tr>
</tbody>
</table>

**Total Points Earned** /24

**Comments:**
Radiation Lab

Background Information
Read about radiation by visiting https://orise.orau.gov/reacts/guide/define.htm
After reading the homepage, click on “Safety around Radiation Sources” to read about how too much exposure to radiation can cause health problems.

Materials
radiation counter tower
Geiger counter machine
Sr-90 source to use as the isotope sample
plastic tray
2 sheets of graph paper with room to draw a data table
Pencil
Calculator
1/8” thick square of Al
1/4” square of Al
3/8” square of Al
5/8” of Al

This lab is based on a lab presented by Missouri University in Columbia, MO. The image below is an image of the equipment used and owned by Missouri University.

In this lab, you see how distance and shielding can be used with beta particles. The number of particles emitted will be measured in counts. You will record the counts per two minute period for different conditions. You will record your data in a data table, and then plot the data on a line graph. First, you will create a data table and line graph for counts versus distance. Then, you will create a data table and line graph for counts versus thickness of shield. Be sure to put the dependent variable and the independent variable on the correct axis.
Procedure
1. Connect the tower to the Geiger meter.

2. With the tower completely empty, use the Geiger meter to get a measurement of the background radiation present in the tower.

3. Make a note of that data in your lab journal.

4. Get an isotope sample from your teacher. Set the sample in the square plastic tray. Slide your sample into the top slot on the tower. Notice that each slot on the tower represents one centimeter distance away from the Geiger meter. You will do a practice run first. Place the sample face up in the tray and get a two minute count. Next, face the sample down in the tray and get a two minute count. Whichever position the sample was in when you got the most counts will be the position that you should use for this lab.

5. Use a two minute time period to get a count reading for every shelf in the tower. Record your data on a data table. Subtract the background from the data and then plot that number of counts versus distance on your graph. Increase the distance away from the meter (top of tower) as you go.

6. Using the same sample, place the sample on the 6th slot. The sample is now 6cm from the Geiger meter. Use a two minute time period to get a reading of the counts of beta particle emission for that distance. Record this information as zero thickness. Be sure to subtract the background data later.

7. One at a time, place squares of material in slot(s) that are located between your sample and the Geiger counter. Increase in thickness as you go. Take a counter reading for each of the following: 1/8” thick shield, ⅛” shield, 3/8” shield, 5/8” shield. You will need to use fraction addition to combine shields and get the desired thickness of shielding. Record your data on a data table. Subtract the background from the data and then plot that number of counts versus thickness on your graph.

8. Clean up your lab station and then answer the conclusion questions 1-6, which are listed below.
Conclusion Questions

1. What was being measured by the Geiger meter?

2. Define radiation.

3. How did distance affect the counts of beta particles emitted?

4. How did shielding affect the counts of beta particles?

5. What are two ways to reduce the penetration of beta particles?
   1) 
   2) 

6. Has this lab changed your opinion of nuclear energy? Why or why not?
Reflection Questions

Student Name:_______________________________  Hour:_____  Date:_________

1. What was the topic of the unit?

2. How much did you know about this topic before we started?

3. What problems or issues did you discover that relate to the topic?

4. What ideas do you have to create a solution to the problems or issues?

5. Sketch a pie graph to represent your own energy portfolio for the United States of America.
6. What resources did you use while you worked on this topic?

7. Which resources were extremely helpful? Why?

8. How do you now feel about the topic of this unit?
Next Generation Science Standards

4-ESS3-1.
Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

Disciplinary Core Ideas

ESS3.A: Natural Resources
Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1)

ETS1.A: Defining Engineering Problems
Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (secondary to 4-PS3-4)

PS4.B: Electromagnetic Radiation
When light or longer wavelength electromagnetic radiation is absorbed in matter, it is generally converted into thermal energy (heat). Shorter wavelength electromagnetic radiation (ultraviolet, X-rays, gamma rays) can ionize atoms and cause damage to living cells. (HS-PS4-4)

Common Core State Standards Connections:

W.4.7
Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-PS3-2),(4-PS3-3),(4-PS3-4),(4-ESS3-1)
**Sources**

**Lesson Information & Assignments**
Radiation information used as Radiation Lab background information
https://orise.orau.gov/reacts/guide/define.htm

Radiation Lab obtained from Missouri University
This lab is based on a lab presented by Missouri University in Columbia, MO. The lab includes equipment used and owned by Missouri University.

Reflective Questions influenced by

Project and Problem Ideas influenced by PLTW styles
My assignment design has been influenced by my Project Lead the Way teaching experience.

Next Generation Science Standards retrieved from
http://www.nextgenscience.org/search-standards

**Power Point Images and Information**
PowerPoint Slide 1 image retrieved from

Power Point Slide 2 & 3 images retrieved from
http://fti.neep.wisc.edu/neep602/lecture24.html

Power Point Slide 4 image retrieved from

Power Point Slide 5 image retrieved from
http://www.futuretimeline.net/21stcentury/2011.htm#.VYjavblFDIU

Power Point Slide 6 image retrieved from
eia.gov

Power Point Slide 7 image retrieved from
http://mashable.com/2012/04/03/compare-energy-use-with-opower-facebook-app/

Information in the Power Point presentation was obtained through lectures at Duke Energy Academy.
Energy Use

The amount of energy that is created by a power plant is determined by the people using the energy.

If there are a lot of people using a lot of the energy, then the power plant will need to make a lot of energy.
Population

The current global population is 7 billion people. By 2050, the global population will exceed 9.6 billion people.
Population Demands

With this increase in the global population, the need for energy will double.
What happened?
The Industrial Revolution Began in 1790
In the past 100 years, the Industrial Revolution has led us to increase our global population. In turn, we have used almost all of the natural resources that can be used for energy. We did this in 100 years.
Meeting the Demands

There are many ways to generate electricity. Efficient use of a blend of energy will help meet the demands of increased population growth & work towards sustainability.
Diversified Energy Plan

In this unit, we will learn how to use different types of energy to meet the increasing demand for energy.
Sources

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