

Energy Exploration: Beans!

- Overview:** Learn about renewable and non-renewable resources and identify issues related to the environment from using them.
- Keywords:** Renewable, Non-renewable, Environmental Impact
- Age / Grade Range:** 5th-6th Grade students
- Background:** Renewable resources can be categorized by resources that regenerate in a human lifetime. Wind, solar, geothermal, hydroelectric, and biomass are examples of renewable resources.
- Non-renewable resources cannot be regenerated in a human lifetime. Examples of non-renewable resources are coal, natural gas, crude oil, and uranium.
- There are pros and cons to each resource used for energy. It is important to understand that there is no easy solution to fulfill the energy demands of a growing population.
- It is important to understand that there is no easy solution to fulfill the energy demands of the people.
- See Energy Exploration: Tag on page ___ for a detailed overview of energy resources.
- Next Generation Science Standards**
- 5-ESS2-1:** Develop a model using an example to describe ways to geosphere, biosphere, hydrosphere, and/or atmosphere interact.
- 5-ESS3-1:** Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
- MS-ESS3-4:** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
- Common Core:**
- RI.5.9:** Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.
- MP.2:** Reason abstractly and quantitatively

- Goals:** Students will participate in a resource harvesting simulation to learn about renewable and non-renewable resources while exploring the benefits and drawbacks of each resource.
- Students will be able to compare and contrast renewable and non-renewable energy sources.
Students will be able to distinguish the benefits and drawbacks from using specific types of energy.
- Objectives:** Students will be able to compare and contrast renewable and non-renewable energy sources.
Students will be able to distinguish the benefits and drawbacks from using specific types of energy.
- Materials:** 7-9 visually distinct variety of beans or beads
For each mining field, one container to hold the beans and one container as collection
Energy Resource info cards (summarized background information)
Energy extraction recording sheet
Stopwatch
- Set up:** How to create energy fields if not done so already:
- Creating a Non-renewable energy field:
Take one type of bean, red or pinto, and that bean type will represent soil. Identify which beans will represent non-renewable resources and renewable resources. Record those down before you run the activity.
- For coal, oil, natural gas and nuclear mix up 1/3 cup of those beans and add them into 1lb of soil beans. Add the entire mix into a narrow container. You can add a few renewable beans, but this field is meant to focus on non-renewable resources.
- Equal parts Renewable/Non-renewable
Add renewable and non-renewable beans until 1/3 cup is filled. Place an equal amount of all resources in the field.
- Renewable Energy field
Add 1/3 cup mixture of renewable energy beans. Add the same number of non-renewable beans to this field as the renewable beans in the non-renewable energy field.
- Classroom Time:** One 30 minute community

Overview

1. Gather materials
 - a. Bean tubs and recording sheets
2. Play until at least each student has gone once
 - a. Identify beans to gather
 - b. Review recording sheet
 - c. Each student has one year which equals 15 seconds
 - d. Students can only use fingers or tweezers
 - e. Don't shake the tubs after each year
3. Record the number of beans gathered after each student
 - a. Split pea green/yellow and black eye beans are renewable resources and go back into the tub at the end of each year
 - b. Garbanzo, pinto, black and lima beans are non-renewable and stay out of the tub
 - c. Ask students to come up with a reason why certain beans go back into the tub and others don't
4. Total the renewable/non-renewable beans
 - a. Graph on the other side the total renewable/non-renewable beans gathered for each year
5. Debrief
 - a. What is different in each tub?
 - b. Why did some beans go back into the tub and others didn't?
 - c. Review each type of renewable/non-renewable resource

Introduction (Engage):

Note: Text in "quotations" signifies suggested dialogue to engage students in and is not intended to be a script. Use your best judgment when delivering these lessons.

"What do you use at home that requires electricity?" (Field answers)

"Where does that electricity come from?" (Field answers)

"Energy is not easy to gather and we're doing to do an energy harvesting simulation"

Activity (Explore):

(Split your field group into 2-3 smaller groups with a maximum of 4 students per group. Pass out the energy harvest recording sheet and have them create a team name)

"You will be harvesting energy from each field. Since this is a simulation of how we mine/harvest energy there are a couple of rules we'll need to follow. First, it takes specialized equipment to harvest resources and your specialized equipment will be your fingers, index and thumb to use like pinchers. You will only be able to pick up one bean at a time. We don't have the equipment to really shake up the soil so please don't grab handfuls of beans or shake the container. It's easy to do, try and avoid the temptation. _____ beans are soil. Each bean represents a unit of energy. Place gathered beans in your processing cup. Each person harvesting will have a simulated

year, or 15 seconds. At the end of 15 seconds, count out how many of each bean time you had and record that information. Figure out in your team who is going first."

"Ok, ready...go!" (Time for 15 seconds, have them record the beans they harvested. before moving to the next round, place all renewable beans back into the container, non-renewables stay out. Ask students to come up with their own reason why some beans are being placed back and others aren't. Some beans represent renewable resources and others represent non-renewable resources)

OPTIONAL:

To add complexity to this activity you can have some of the renewable beans on a time delay. Instead of being placed back into the container every round, one gets placed back every 2 rounds, or every 3 rounds. This could be used to explain how different resources have different regeneration time frames.

You could increase the technology available for students to use. First students could use tweezers, then fingers, then claw fingers, to scooping, and finally multiple hands. Tweezers cannot grab certain beans such as garbanzo while fingers would be able to.

Explanation

"Before we analyze this data, why do you think some beans were placed back into the field and others weren't? (Field answers, students should come to the conclusion that some beans are renewable and others aren't)

"These beans (Show them) represented renewable energy sources, what are a few you know?" (Field answers)

"These beans (Show them) represented non-renewable energy sources, what are a few you know?" (Field answers)

"With that in mind let's see how many of each renewable and non-renewable energy sources you harvested over time? " (Either have each group graph their resources over time or you can create the graph for all harvesting teams)

"Looking at both groups, is there a trend that you can see?" (Field answers, if there isn't a trend in non-renewable and renewable energy sources bring up the concept that not all plots of land are different. Make sure you include in your discussion that the plots the students were mining were different)

"At any point in during the simulation did you decide to change the harvesting strategy you previously planned?" (Field answers, did any student change the beans they were going for from non-renewable to renewable)

"Why? Was it difficult?" (Field answers, this question is meant for gain insight into how students felt about trying to go for renewable sources and not finding enough at their site)

**Elaboration/
Content Tie-in:**

"Some areas are better for some renewable sources than others. Of all the sources that we talked about which would you want to use? Why?(Field answers) What could affect your choice to use your energy source? (Field answers, this is a good point to talk about geography of areas and how each energy source has benefits and drawbacks. Place emphasis on greenhouse gases)

"Energy is a complex issue, however you might be the ones who solve it. You have the tools to do so, information!"

This activity can be tied-in with Greenhouse Gas activity, Energy Audit, and Value of a tree.

The Greenhouse Effect: Some sources of energy produce greenhouse gases, what do greenhouse gases do again?

What's a Watt Worth: Toil for oil was what types of energy sources are out there, Energy audit reviews what the energy sources produce, electricity and how we use it.

Value of a tree: Slash piles release carbon dioxide, how could we turn that "waste" into biofuel.

(Depending on time, you could have each student go once or twice. With your data collected you should see a decrease in the number of non-renewable sources captured over time and an increase in renewable sources captured over time)

Evaluation:

Working with a partner, come up with an energy plan for the future and what types of resources they would want to use and why. Present to the whole group.

Additional resources:

See Appendix D for materials