Lesson Overview

Title (30 characters)

Alternative Energy

Short Description (50 characters)

Students explore sustainable energy systems.

Student Ages

8-10 11-13 14-18

Subjects

- [x] Math
- [x] Science
- [ ] World Languages
- [ ] Government and Politics
- [ ] Art and Design
- [x] Technology
- [x] Geography
- [ ] Reading and Writing
- [ ] Animals
- [ ] Business & Entrepreneurship
- [x] Climate & Environment
- [ ] Digital Literacy
- [ ] Dramatic Arts/Theater
- [ ] Gaming
- [ ] History
- [ ] Music
- [ ] Physical Health & Wellness
- [ ] Religion & Philosophy
- [ ] Safe & Civil Schools
- [ ] Service Learning & Social Good
- [ ] Social and Emotional Health
- [ ] Computer Science
- [ ] Careers and Management
- [ ] Special Education
- [ ] Leadership

Skills

- [ ] Character
- [ ] Citizenship
- [ ] Collaboration
- [x] Communication
- [ ] Creativity
- [x] Critical Thinking
- [ ] Project Based Learning

Lesson Plan

Learning Objectives (3000 characters)

Students will…

- explore hydropower, wind power, and waste-to-energy.
- understand how **mechanical** and **electrical energy** play a part in alternative energy.
- explore how the energy created at the power plant gives energy back to the community.
- learn how landfills can be sustainable using garbage.
- explore what happens to recyclable and non-recyclable materials once they leave the home.
- understand how non-recyclables can be turned into energy.

Guiding Ideas and Questions (3000 characters)

Introduction

Students will begin their exploration in the school. They will click on Lesson 6 on the teacher. The first stop will be the alternative power plant by way of the city bus. After entering, they will first learn about hydropower from the NPCs they pass. Once they have passed through the plant, they will climb a ladder to explore wind power and even have a chance to restart one of the wind turbines for one of the plant's workers! Students will then spawn a minecart to travel on the power lines, learning about how the electricity is used. One stop will be at the Landfill

Bioreactor (NPC) to explore how items in the landfill can be used for energy. Students will then get off to explore the Waste-to-Energy Plant. Once completed, students will hop back on the bus and head back to town!

Guiding Questions

- What is hydropower?
- What is wind power?
- How is alternative energy different than using **fossil fuels**? (*introduce the terms* ***renewable*** *and* ***non-renewable***)
- What is electricity used for?
- What is **mechanical energy**?
- What is **potential energy**?
- What is **kinetic energy**?
- What is **electrical energy**?
- Why should people choose hydropower or wind power over fossil fuels?
- What happens to items that are not recyclable?
- How can non-recyclable items be made into energy?
- How can a landfill be **sustainable** if it is just filled with garbage?

Teacher Preparation & Notes

- Possible NGSS standard(s):
    - **4-ESS3-1:** Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.
    - **4-PS3-2:** Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
    - **4-PS3-4:** Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
- The teacher should create a Flipgrid topic for students to use during the closing of this lesson. Students will act as governors of a state and argue the point of using alternative energy in their state. They will need to include what alternative power they chose, what the benefits are, and what the drawbacks are.
- The following vocabulary will be used in this lesson and the teacher may want to introduce these to the students beforehand.
    - fossil fuels

- renewable
- non-renewable
- penstock
- reservoir
- turbine
- mechanical energy
- potential energy
- kinetic energy
- electrical energy
- sustainable
- electromagnets
- conductors
- recalibrated
- electromagnet
- bottom ash
- heat conductive
- vaporize
- byproducts
- contaminates
- condenser
- leaches
- bioreactor
- accelerates
- decomposition
- contamination
- leachate

Student Activities

Note: Performance expectations (PE) are mentioned in parentheses throughout the activities and connected to the expectations listed after the activities.

Introduction:

- The teacher will ask students what they know about alternative energy, landfills, and waste-to-energy plants (*PE1*). The answers should be placed on a K-W-L chart on the board. Students should then share what they want to know about these energy sources.

The teacher will remind students that they will need to take notes during their Minecraft world exploration in order to fill in the "L" part of the chart after.

- The teacher will then explain what fossil fuels are and the fact that they are non-renewable resources that will eventually run out. She will ask the class what kind of resources hydropower, wind power, and waste-to-energy are and why they are renewable (*PE2*).
- To give some background on waste-to-energy plants, the teacher will show the video about one (*linked*) (*PE6*).
- Next, the teacher will explain that both hydropower and wind power require mechanical energy and that is turned into electrical energy. To help students understand mechanical energy and electrical energy, students will complete two PhET simulations (*see links*) (*PE3*).
    - **Energy Skate Park:** Once opened, click on "Pie Chart" in the upper right-hand corner. Then, place the skater at the top of the half pipe. With the pie chart chosen, students will be able to see how much kinetic and potential energy the skater has at different points. When the skater is paused at the top, she has a lot of potential, or stored, energy. At the bottom, the skater is using a lot of kinetic energy, or energy while in motion.
    - **Signal Circuit:** In this simulation, students will understand how electricity runs from a switch to a light. On the bottom, click the button that says, "Show Inside Switch." The moving blue dots represent the electricity (*electrons*).
- After exploring the PhET simulations, students will explain what they learned about mechanical energy and electrical energy. For older students, the teacher may want to ask them to make the connection between the two—how mechanical energy gets transformed into electrical energy.

Minecraft World Exploration:

Students should take notes on what they learn as they complete this exploration.

- Students will begin their exploration at the front of the Hydro-electricity Plant after getting on the bus (*Lesson 6*). Once the student enters, they will stop at multiple NPCs that explain how water is turned into electricity. When they reach the NPC that talks about mechanical and electrical energy, students should pause and talk to a neighbor about how what they learned in the simulations helps them to understand the process in the hydropower plant (*PE3*).

- Once the students have finished learning about hydroelectricity, they will be able to head upstairs to find out about another alternative source of energy: wind power (*PE3*).
- To continue the exploration about alternative energy, students will spawn a minecart and travel the power lines across the city. Students should write down the various places the electricity is used and for what. At the Bioreactor Landfill NPC, the students will go down a ladder and over to the landfill. Here they will learn how methane gases are kept out of the air and used to heat buildings, run equipment, and power collection vehicles (*PE5*).
- Once back on the minecart, they should continue traveling the power lines until they find the "end" of the power lines (*the waste-to-energy plant*).
- To conclude the exploration, students will head to the waste-to-energy plant. This is where they will learn how non-recyclable items can be made into energy (*PE6*). Students should think about the video they watched before this world exploration to see how similar the two experiences are. They will continue outside of the plant to learn about bottom ash and how it can be used elsewhere in the city.

Closing:

- Students will be placed in small groups. Using the notes that they took during the Minecraft world exploration, students will discuss the difference between the various options of alternative energy.
- After they finish their small group discussions, the teacher will gather students in a large group. In the large group, students will share out what they learned about the various alternative sources of energy. These points will be recorded by the teacher on the K-W-L chart. The "what do you want to know" questions on the chart should be addressed at this time as well. Are students able to answer any of them or do they require more research?
- To complete the activity, the teacher will tell students the following scenario:
    - They are governors of a state and their constituents have been writing letters to them expressing how displeased they are that the state continues to rely on non-renewable resources for power. They would like an alternative source of power to be offered.
    - Students, acting as state governors, should decide which alternative source of power they think would be best to use in their state. Students should think about their geographical area and which source would work well.

- Each student will prepare a 2-minute-*maximum* argument on Flipgrid that includes the following (*PE4*):
    - what alternative source of power they chose
    - what the benefits of that source are
    - what the drawbacks of that source are

Performance Expectations

Students will be able to…

- explain what various sources of alternative energy are and how they work (PE1).
- explain the difference between a renewable and non-renewable resource (PE2).
- understand how mechanical and electrical energy is used in the production of alternative energy sources (PE3).
- argue why people should use an alternative energy source instead of relying solely on fossil fuels (PE4).
- understand how landfills can use garbage to be sustainable (PE5).
- explain how non-recyclable items can be turned into energy (PE6).

External References

- Energy Skate Park (*PhET simulation for mechanical energy*)
- Signal Circuit (*PhET simulation for electrical energy*)
- Trash to Energy Plant (*video*)

Supporting Files

Supporting File (recommend no more than five, file formats supported are DOC/DOCX, GIF, JPG, MP3, PDF, PNG, PPT, PPTX, TXT, WMA, XLS/XLSX, XPS, and ZIP)

- Make PDF rubric