



LESSON PLAN

RENEWABLE RESOURCES GRADES 3-5

SUMMARY

Students will discuss and analyze the types of fuel that are used to generate energy. In teams, students will design, build and present a renewable energy device. The class will list the pros and cons of non-renewable and renewable energy and discuss how and where renewable energy can be found and used in today's society.



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-PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

Science & Engineering Practices	Connections to Classroom Activity
<p>Obtaining, Evaluating, and Communicating Information (4-ESS3-1) Constructing Explanations and Designing Solutions (4-PS3-4)</p>	<ul style="list-style-type: none"> • Conduct research on the different types of energy generation devices can do, and the environmental impacts of those devices. • Design water wheels that generate their own energy. • Write and draw explanations of design strategies.
Disciplinary Core Ideas	Connections to Classroom Activity
<p>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</p>	<ul style="list-style-type: none"> • Discuss environmental impacts of various types of energy resources. • Determine fuels that are sources of energy.

time, and others are not. (4-ESS3-1) (4-ESS3-1)

PS3.D: Energy in Chemical Processes and Everyday Life

The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use. (4-PS3-4)

- Recognize the impacts of certain energy generation technologies on the environment and the need for change to minimize impact.
- Generate new ideas to meet energy demands that minimize impacts on the environment.

Crosscutting Concepts

Cause and Effect (4-ESS3-1)
Energy and Matter (4-PS3-4)

Connections to Classroom Activity

- Explain reasons for constructing water wheels in particular ways and what effect different designs have on the water wheels themselves.
- Discuss what types of energy devices are used in their initial functions, what transformed energy is, and what it is used for.

DURATION

Three 50-minute class periods.

PRE-ASSESSMENT QUESTIONS

Please see Discussion Questions. These can be discussed as a group or answered individually in student science notebooks.

MATERIALS

- Science notebooks
- Pencils
- **DIY Water Wheel Materials: see the materials list in the DIY Water Wheel Activity**
- Other materials as needed or wanted to allow for modification of the DIY waterwheel design



ENGAGE

Ask the class:

- How did you arrive to school today? Show of hands for the bus, a car, walking, biking, other. (Other options include hang-glide, swim, helicopter, pushed in a wagon, teleportation in a machine, other ridiculous ideas for fun.)
- Would you say that all those ways of getting to school took energy? (yes)
- What kinds of energy? (Gas for cars, buses, and helicopters; food energy for walking, biking and swimming; wind energy for hang-gliding; electricity for the teleportation machine; not much energy for sitting in a wagon.)

Introduce the topic of energy, types of fuel, renewable energy, and non-renewable energy.



PLAY THE GENERATION GENIUS RENEWABLE ENERGY VIDEO. Alert the class to watch for the terms and definitions of energy, types of fuels, non-renewable energy, and renewable energy. Also to pay attention to the types of energy-producing devices the video shows.

Using the information from the video, create class definitions for energy, fuels, non-renewable energy, and renewable energy on the board or on large piece of paper.

Create a class list with two columns: non-renewable and renewable, and list the types of fuels and energy that the video showed in their appropriate columns.



EXPLORE



RE-WATCH THE DIY WATERWHEEL SEGMENT OF THE GENERATION GENIUS RENEWABLE ENERGY VIDEO.

Discuss and analyze the hydropower device that Zoe built, pointing out how and why it works. Discuss the form of energy it uses (hydropower/moving water) and the forms of energy it transforms hydropower to (mechanical energy/spinning wheel and axle).

Ask:

- What can we use the transformed energy for?
- What kind of work can the device do for us? (The spinning axle can be attached to a generator to produce electricity, or the spinning axle can be attached to a device to lift objects.)

Introduce the assignment that students are going to work in teams using the Engineering Design Process to build their own renewable energy device, using moving water as an energy source. Divide students into teams of 2 to 4 people.

- Students may build a waterwheel similar to the DIY waterwheel, or they may experiment with the materials and come up with their own designs.
- They will need to explain their design strategies: why they made the changes they did, what type of work the device will do, and how it will do that work.

Students need to have their designs and materials lists approved by the teacher before they begin construction. With an approved design and materials list, teams gather their construction materials and begin assembly of their hydropower device. Allow enough time for all teams to finish construction and test-run their devices. (approximately 30 minutes)



EXPLAIN

When all the teams have completed construction, have a class gallery walk. The whole class moves from team to team, observing each team's demonstration of their device, hearing their explanations of their design strategies, and asking questions. When finished, set the hydropower devices in a place where the students can refer to them later.



RE-WATCH THE GENERATION GENIUS RENEWABLE RESOURCE VIDEO, stopping at each energy-generating device, discussing how it functions and what kind of work it does (what it is used for).

Ask:

- Where does the device get its initial energy from? (types of fuel, wind, water, sun, biomass)
- What kind of energy is the device transforming the initial energy into? (electricity, movement (vehicles), mechanical energy to lift something, heat)
- How does the device transform the energy? (generators; simple machines like gears, levers, and pulleys; turbines; photovoltaic cells)

- How do the devices in the video compare to the waterwheels you just built? What is similar and what is different about each one?
- Does this device use a renewable energy source? Why did you choose your answer?

Have each team research one type of work their own waterwheel could be used for. Have the team create drawings and describe how they would modify their design to allow their device to do that type of work. Ask each team to present their findings to the class. Discuss where those types of work take place in the world.



ELABORATE

Lead a class discussion about the environment impact made by each type of fuel and energy-producing device from the video. Generate a class list of the types of impacts that could occur with each type of fuel and device. You may want to ask students whether they see advantages to renewable energy over non-renewable energy, and why or why not? Or if they could create anything to help provide energy in the world, with little or no impacts, what would it be?

Have each student write and/or draw at least one idea they have in their science notebooks. Have them turn to their shoulder buddies or table partners and describe their own idea. If they come up with new ideas after their discussions, have them write or draw the ideas in their science notebooks.



EVALUATE

- Exit tickets: At the end of the last period, hand out an exit ticket asking students to define *non-renewable energy* and *renewable energy* in their own words.
- Science notebooks: assess each student's entries



EXTENSIONS

Students can develop a class renewable energy device that provides power to a useful element in their classrooms. Students can research specific renewable energy devices, record their technologies and environmental impacts, and present their findings to the class.

Students can research and propose renewable energy options for their school, such as solar heating or photovoltaic cells, or a wind turbine.

