



Energy Explorers: A Third Grade Adventure

Duke Farms Lesson Plan

Elementary School:
Third Grade

Age Range: 8–9

Standards

Next Generation Science Standards

3-ESS3: Earth and Human Activity

- ESS3-1: Make a claim about the merit of a design solution that reduces the impacts of climate change and/or a weather-related hazard.



Energy Explorers: A Third Grade Adventure

Guiding Question

- How can we start to use new kinds of energy that are good for our planet?

Learning Goals

Objectives

Students will be able to

- Define energy, renewable energy, and nonrenewable energy.
- Understand different types of energy and how energy can be transferred.
- Describe types of energy use that don't negatively impact our planet.

Materials

- Lesson plan
- Energy at Duke Farms Handout
- Map of Duke Farms with locations for this activity highlighted

Background Information

In this lesson plan, youth learn about energy.

Energy is the ability to do work and is essential for many processes in our daily lives. Types of energy include wind, water, solar, nuclear, coal, food, electrical, chemical, natural gas, and petroleum.

These types of energy can be classified into renewable and nonrenewable resources. Renewable energy, including solar, wind, and water, is naturally replenishing and can be harnessed continuously with the right tools. Nonrenewable energy, like coal and natural gas, is limited and takes a long time to form, making it finite.



Duke Farms

For this and other lesson plans, go to:
dukefarms.org/education-resources/

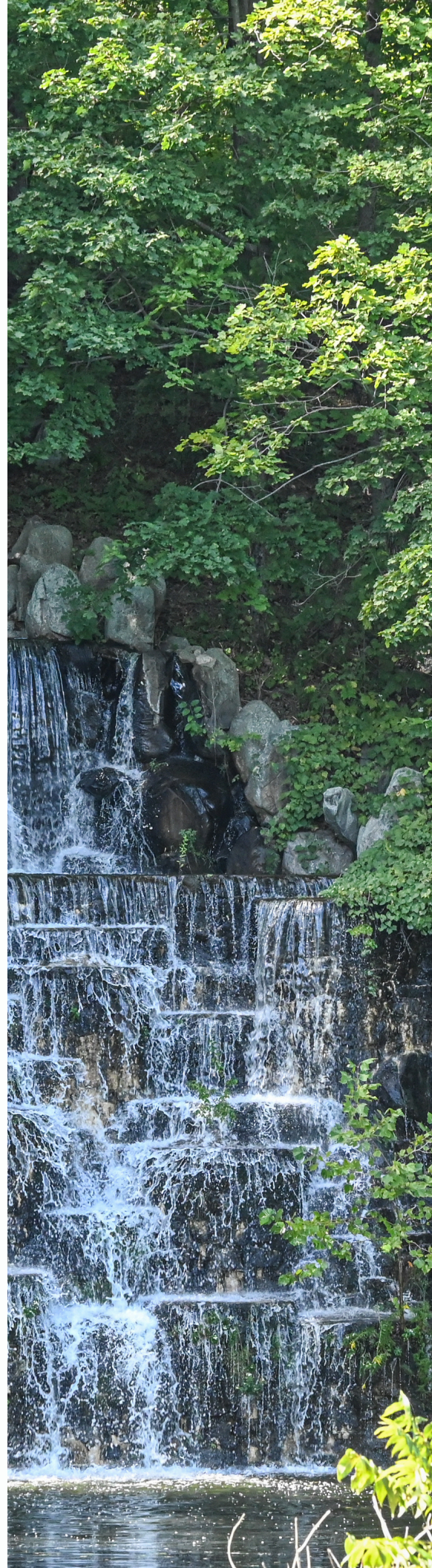
Teaching This Activity

Preparing for your trip to Duke Farms

- Print or save a copy of the Map of Duke Farms with locations for this activity highlighted.
- Make copies of the handout for students to use while at Duke Farms.
- Bring pencils for each student to use.

Engage in the Classroom

- Read aloud about energy (first two pages of [Energy Transfer | Reading Material | Grades 3-5](#)) and watch "[Bill Nye The Science Guy on Energy](#)."
- Write the definition of energy on the board: energy is the ability to do work
- Write the different types of energy on the board: wind, water, solar, nuclear, coal, food, electrical, chemical, natural gas, petroleum, potential
 - Ask students to explain what energy transfer means using the reading.
 - Ask students what three ways energy can be transferred.
 - Ask students what you would need for these different kinds of energy to transfer the energy and make it useable. (Hint: some of them are described in the reading and the video)
 - Wind – turbines; water – turbines; solar – solar panels or plants to transfer sun into food; nuclear – reactors; coal – fireplace or fire-burning plant
- Ask students which of these kinds of energy they've seen in school, at home, and other places they go regularly (sports fields, afterschool center, stores, community organizations).



- Explain that some energy sources are renewable, which means they naturally replenish within a short time and are only limited by the availability of resources to harness those types of energy. Renewable energy includes solar, wind, and water—as long as you have the tool to collect energy from the sun, you can continue to collect it on sunny days. Some energy sources are nonrenewable, which means the energy source, like coal or natural gas, is limited because it takes so long for that fuel to form. Once all of that source is used up, it's gone. Not only do these types of energy use resources from nature, they also give off extra heat and release chemicals into the air and water sometimes that can be harmful.
- Ask students to list any problems they've noticed around their school that might make it more difficult to power, or use more power than needed, or a problem that seems like it would take a lot of energy to solve.
- Generate a list of their ideas on the board.
- Help students get ready for their visit to Duke Farms.
 - Tell students that you'll be going on a trip to Duke Farms. Explain that the property is a special place that protects nature and provides spaces for children to learn about nature while in nature.
 - Let them know that on the visit to Duke Farms, they will have a chance to learn more about energy and ways to create and use energy with less harm and impact on the environment.
- Duke Farms also provides a place where children can learn to be scientists and practice the scientific process. Older children sometimes even help the staff at Duke Farms to study the plants and animals there!
 - During the visit to Duke Farms, they'll be able to make observations about what they see and hear and feel and connect those back to our conversation from today about types of energy.
 - Then after the trip, they'll use their observations to think about something that can help the school reduce its energy use.
- Be sure to tell them that it will be fun and exciting to see different grasses, plants, leaves, flowers, and trees, but it's very important that they learn to be good observers, or lookers with their eyes. To be good protectors of nature, we don't want to pick any flowers or plants. And we definitely don't want to touch any birds or animals.





Teaching This Activity (continued)

Explore at Duke Farms

Orientation

- Gather at the Orientation Center. Remind students that Duke Farms is a special place that protects nature and provides spaces for children to learn about nature while in nature.
- Remind students they'll be using the scientific process today. And today's assignment will be to observe and ask questions about different types of energy.
- Remind the children about being good observers with their eyes. And that while it's exciting to see different grasses, plants, leaves, flowers, and trees, to be good protectors of nature, we don't want to pick any flowers or plants. And we don't want to touch any birds or animals.



Duke Farms

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Stop One: The Hay Barn

- Walk with students to the area around the Hay Barn.
- Give students time to explore and experience their surroundings.

Making observations:

- Remind students about the conversations in class about different kinds of energy.
 - Ask them what types of energy they remember.
- Give students the handout and have them work in pairs or teams depending on class size.
 - Explain they will be looking for evidence of energy being used in this part of Duke Farms.
 - Tell them to list things in this area that probably needed energy to create and maintain.
 - Monitor the students as they work on this handout and encourage them to use their observations—they may talk about the sculptures and the building, but the plants and flowers here also take energy to create and maintain. Encourage them to talk about the different kinds of energy they see evidence of in the area around them.

Stop Two: Research Woods

- When students are ready, move on to the Research Woods area around the corner.
- Explain that this fence keeps deer out of the Research Woods, where local college and university students are doing experiments on carbon capture with the trees in this area.
 - Ask a student to explain how nonrenewable energy sources like fossil fuels can be harmful to the environment as a reminder from the discussion in class.
 - Explain to students that trees can help to offset that harm by absorbing the extra carbon in the air. So this is an example of people exploring a solution to a problem that can cause harm to the environment.
- Ask students what appears different between the area inside the fence and outside the fence.
 - Remind them if needed that the fence keeps deer out of the Research Woods.
 - Explain that deer eat saplings and seedlings (young plants). Many of the newly growing plants would be eaten by deer.



Explore at Duke Farms (continued)

- Explain that much of the work in the Research Woods is also about removing invasive plants, planting native plants, and observing and keeping track (monitoring) of the growth of native plants over time.
- Give students time to walk around the Research Woods area and record their observations.
 - Prompt students to think and talk about what looks different between the area inside the research woods and outside.
 - Prompt students to think and talk about how keeping the deer out, planting and monitoring native species, maintaining the trees, and studying carbon capture relate to the class discussions about energy.
- Explain that they will now walk back toward the orientation center and look for clues of where Duke Farms have purposefully made choices to offset energy use.
- Walk with students to the Orientation Center area.
 - Ask if any students came here in kindergarten or second grade and learned any examples of energy-saving features, and if so, to share or point them out.
- Give students time to walk around the area to make observations and record them on the handout.

Stop Three: The Orientation Center

Becoming Energy Detectives

- Explain to students that they will now explore another example of people observing problems and trying to design solutions. Tell students that Duke Farms is committed to offsetting both their energy use from people working there every day and maintaining the grounds, as well as offsetting the fossil fuel use for school groups who come here.



Explore at Duke Farms (continued)

- Be sure to point out the following examples:
 - Farm Barn is LEED certified and uses geothermal wells to heat and cool the building passively (building had stone walls and was oriented east to west to make it easier to heat and cool, which is why it was chosen as the main building to retrofit for LEED)
 - Constructed wetlands to sanitize waste from visitors - Explain that when people flush the toilets in the visitor center, the waste goes into a filtration system and then the water that comes out of that is fed into this human-made wetlands, where is filtered naturally.
 - Bioswales in parking lot to filter pollutants from vehicles.
 - The runoff from the parking lot would lead directly into Dukes Brook, so the parking lot was constructed on an angle for runoff to go in the opposite direction.
 - Permeable pavement on the path into the park area
 - Geothermal wells to stabilize the temperature in the Farm Barn
 - Solar panels with battery storage
 - Electric vehicle chargers, electric lawn mowers powered by the solar panels
- Ask students why they think it's so important to the staff at Duke Farms to offset their nonrenewable energy usage and use renewable energy whenever possible.

A Design Challenge

- Tell students you're giving them a design challenge like what the staff at Duke Farms have done.
- Remind students of the list you generated in the classroom of any problems they've noticed at school that might make it more difficult to power, or use more power than needed, or a problem that seems like it would take a lot of energy to solve.
- Tell students to choose one of the design problems from that list.
- Give students time to brainstorm and sketch ideas for a tool that could solve the problem.
 - Encourage students to use their notes and observations of examples of how staff at Duke Farms have approached their energy needs to help them get started.





Teaching This Activity (continued)

Elaborate and Extend Back in the Classroom

- Have students get into groups of four to five, or group them yourself, and present their design solution sketches to each other, explaining how their tool design solves the problem.
- Have each group decide on a design solution tool they want to prototype.
- Provide the class with scrap or crafting materials (preferably from a creative reuse center if there is one available near you) like pipe cleaners, recycled magazines and papers, fabric, beads, yarn or thread, sponges, etc.
- Give them time in class to build a prototype of their proposed tool.
- Have each group present their problem and the tool they've designed to the class and explain how the tool would work to solve the problem. Give other students time to ask questions or give feedback.
- If you have time, you could have students present their sketches and get feedback before they build their prototype so they can use the feedback to improve their tools.

Elaborate and Extend Back in the Classroom (continued)

- Have each group create a label for their tool, giving it a name and explaining the problem and how their tool solves it.
- Take photos of their designs and share them in the class newsletter or post them in the classroom or hallway.
- Ask students what their favorite part was about going to Duke Farms.

Optional Extension: Classroom Exhibition or Gallery Walk

- Display the tool designs with their labels in the library or other common area of the school.
- Invite other classes and/or parents and caregivers to attend the exhibition and have students explain to visitors about their work.

After This Activity

Measurement

- Student handouts, sketches, share outs, participation in discussions, tool prototypes, and labels.

Feedback for Duke Farms

- Scan student sketches and/or take photos of the prototypes to share with Duke Farms
- Invite Duke Farms staff to attend the classroom exhibition or gallery walk if you take that option
- Complete feedback survey

Energy at Duke Farms Handout

The Hay Barn Area



What do you see in the Hay Barn area that takes energy to maintain?	Why do you think so?

What kinds of renewable energy could be used to help maintain this area?

Energy at Duke Farms Handout



The Research Woods

The problem: Use of fossil fuels releases chemicals into the air, causing the atmosphere to get warmer over time.

Potential solutions: Trees can capture excess carbon.

Observations:

What other problems are Duke Farms trying to solve in the Research Woods?

What observations (data) are Duke Farms staff monitoring to evaluate their solutions?

Energy at Duke Farms Handout



Orientation Center Area

What kinds of nonrenewable energy has the class used today?	What kinds of energy have you and your group used today?

The Problem:

Visitors, staff, plants, and animals at Duke Farms need to use energy. Sometimes that energy use can be harmful for the environment and nature they want to protect.

Potential Solutions:

Use the chart below to gather your clues about what the staff at Duke Farms have designed to solve this problem.

Type of Renewable Energy	Example	Example	Example