

Discover!

General Science 2



INSTRUCTOR
GUIDE

Lesson Objectives

By the end of this chapter, your student will be able to:

- investigate emerging electricity and magnetism technologies, such as advanced energy storage systems, superconductors, and wireless power transmission, in terms of their practical applications
- predict the potential impact of advancements in electricity and magnetism technologies on the future of energy production and consumption, considering sustainability and efficiency
- investigate innovative solutions that harness the principles of electricity and magnetism to address specific energy-related challenges, demonstrating an understanding of the potential benefits

Supporting Your Student

Apply (*Maglev Trains*)

If your student is struggling with this activity, refer them back to the reading and encourage them to focus on the image in the reading. A maglev train is a train that uses a superconductor to move people from place to place. A superconductor uses electricity that has no resistance or friction to its power, which is why the train can go so fast. In fact, it uses a very powerful electromagnet that keeps the train hovering, or levitating, on the track instead of a traditional train track. If your student struggles to understand the difference between maglev trains and traditional trains, watch some videos together and discuss with your student what they learn.

Read (*Energy Efficiency*)

As your student reads this section, encourage them to stop and discuss the vocabulary words. There may be some words they have heard before but are not actually familiar with what it means. Remind them that renewable energy is energy acquired from sources that can be constantly replenished. Have them provide examples of resources that can and cannot be replenished. This is a good time to talk about how most energy is generated and why a change is necessary. Explain that there is a process

that goes into generating the power at a power plant, transmitting that power into a type of power that we can use, and then distributing it out to people's homes and businesses. This network of connections involved with this process is called a grid. There are several different systems used to connect to the grid, but the ultimate goal is to transition to a smart grid to conserve energy, along with several other benefits.

Practice (*Your Local Government*)

In this activity, your student will make a case for change in their own community. Encourage your student to do a little research using a reliable search engine to learn more about the kinds of projects and ways their community is using energy. Then, have them come up with a plan to propose in their speech or letter that could use more of a renewable energy source. Have them answer the questions within the speech or letter, and refer them back to the reading to incorporate vocabulary that makes sense for their proposal and to support their case.

Learning Styles

Auditory learners may **enjoy** having the content read to them or listening to music as they work.

Auditory learners may be **challenged** by writing a letter about ways they can lessen their carbon footprint in their own homes and families. They may prefer to record their thoughts.

Visual learners may **enjoy** reading and looking at new technology that uses renewable energy.

Visual learners may be **challenged** by listening to the content and verbally describing new technologies that are being engineered using renewable energy sources. They may prefer to draw a diagram of renewable energy sources.

Kinesthetic learners may **enjoy** drawing pictures or making posters to hang up around the community to encourage ways to reduce their carbon footprint.

Kinesthetic learners may be **challenged** by long sessions of research information without moving or taking breaks.

The Future of Energy

Booster Activity

Build a Windmill

This activity will help your student visualize the power of renewable wind energy. Gather the following materials: scissors, tape, a toothpick, four pennies, a bendable straw, and two small paper cups. On the bottom of each cup, draw a dot in the center. Then, using the toothpick, poke a hole through the center of the dots. In one of the cups, make the hole large enough to put the straw through it. Holding onto the bendy part of the straw, put the other end of the straw into the cup. Inside the cup with the straw, tape the four pennies and spread them out along the wall of the cup. In the cup without the straw, cut slits around the cup about $\frac{1}{4}$ inches apart. Then, fold down each strip to make the blades of the windmill. Put the toothpick into the bottom of the windmill cup, and then insert the toothpick into the bendy part of the straw. Blow the windmill to see the blades spin, or take it outside to catch the wind on its own. Ask your student how windmills could be used to generate energy.

Extension Activities

Solar Oven

The sun is another renewable energy resource. Help your student understand the power of the sun by having them build a solar oven. Using a cardboard pizza box, cover the inside flap and the interior of the box with aluminum foil. Glue it down as smoothly as possible. Then, with the lid open, tape two layers of plastic wrap over the opening of the lid. Use a stick or some other method to keep the lid propped open.

On a sunny day, prop open the box in direct sunlight for 30 minutes to preheat your pizza box oven. Then, place several square pieces of graham crackers on a pie pan. On top of each graham cracker, place a piece of chocolate and a marshmallow. Place the pie pan inside the oven and reposition the plastic wrap. Keep the food in direct sunlight for 30 minutes, then shut the lid and let the food continue to heat for a few minutes more.

Renewable Energy Charades

To familiarize themselves with the renewable energy vocabulary, have your student write the vocabulary words on scrap pieces of paper. Then, have them mix them up in a small bowl and pull them out individually. Last, they can try to act out the vocabulary word and have a family member or instructor try to guess the word.

Answer Key

Closer Look (*Energy Sources*)

The two renewable energy sources include solar energy and wind energy. Answers will vary. Possible answer: Using windmills or wind turbines, the wind moves the blades of the windmill and technology is able to capture that energy and convert it into power that people can use. The solar panels are able to capture sunlight energy as DC and then convert it into AC that consumers can use.

Apply (*Maglev Trains*)

A maglev train is a train that uses a superconductor to move people from place to place very quickly. The electromagnet is so strong that the train can move without resistance, allowing it to move very fast.

Mini-Lab (*Water Experiment*)

The cork wheel began to spin. This spinning motion could be harnessed and used as renewable energy.

Write (*Essay*)

Answers will vary. Possible answer: A regular power grid is a network of connections that generates, transmits, and distributes power for people to use, whereas a smart grid is a technologically-advanced power grid that can conserve energy, use renewable energy sources, and allow power to be monitored more quickly to solve problems.

Online Connection (*Carbon Footprint Calculator*)

Answers will vary. Possible answer: I use a lot of water when I take a long shower, and my parents drive me to school.

Practice (*Your Local Government*)

Answers will vary. Possible answer:

Dear Local Officials,

I am here to talk about renewable energy and the need for our community to get involved. Renewable energy is energy made from resources that nature can replenish, such as wind, water, sunshine, and organic matter. In order for life on Earth to be sustainable, each community needs to find ways to do their part and become more energy efficient. One way I propose we do that is to encourage and promote composting. Composting is putting items that are completely biodegradable into a bin and allowing them to decompose. The heat produced may be used as biomass energy, which is a form of renewable energy. This system would not work alongside our current grid system, but until that point, I suggest a hybrid energy system to help in the transition. This idea will definitely lower our carbon footprint, because any reason to lessen our use of fossil fuels is moving in the right direction. Planet Earth is home to 8 billion people, and if we want it to last, we have to take care of it.

Review (*The Big Question*)

Answers will vary. Possible answer: To make electricity more energy efficient, it should be produced using a renewable energy source that can be replenished quickly.

Show What You Know

1. The energy collected during the day is stored for later use when sunlight is not plentiful, such as when it is cloudy, rainy, or at night.
2. A
3. C
4. True
5. True
6. False
7. Answers will vary. Possible answer: A pro is lower cost to the consumer. A con is bottleneck on the grid.
8. sustainability

In Focus (*Conduct Research*)

The warmest box is the black box. The coolest box is the white box. A white house would be cooler because white reflects more sunlight, reducing heat absorption.