

Discover!

General Science 2



A

Chapter 51

The Future of Energy

By the end of this chapter, you 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

Chapter Review

If you need to review electromagnetism, please go to the chapter titled “Electricity and Magnets.”

Academic Vocabulary

Read the following vocabulary words and definitions. Look through the chapter. Can you find each vocabulary word? Underline the vocabulary word in your chapter, and write the page number where you found each word on the blanks here.

- **carbon footprint:** the amount of carbon dioxide released into the air based on the energy needs of an individual or group of people (p. ____)
- **distributed energy resources (DERs):** small-scale electricity sites that can supply resources through connections with the electric power grids (p. ____)
- **energy efficiency:** using a technology that will do the same job but require less energy (p. ____)
- **energy storage:** capturing energy and saving it to use at a later time (p. ____)
- **grid:** a network of connections that generates power, transmits power, and distributes power for people to use (p. ____)
- **hybrid energy systems:** a combination of many different types of energy generation and storage or a generator powered with different types of fuel (p. ____)
- **renewable energy:** energy made from resources that nature can replenish, such as wind, water, sunshine, and organic matter (p. ____)
- **smart grid:** technologically-advanced power grid that can conserve energy, use renewable energy sources, and allow power to be monitored more quickly to solve problems (p. ____)
- **sustainability:** being able to support and maintain the ongoing processes of our planet (p. ____)

Materials Needed

- | | |
|----------------------|---------------|
| ■ construction paper | ■ shoeboxes |
| ■ cork | ■ skewer |
| ■ funnel | ■ tape |
| ■ glue | ■ thermometer |
| ■ 2-liter bottle | ■ water |
| ■ paper clips | ■ scissors |

THE BIG QUESTION

How can electricity be made more energy efficient?

EXPLORE

Today has really been interesting and full of surprises. You knew that electricians had to know a lot about electricity, but you had no idea how much they had to know about magnetism! As you move on to the next house, Uncle John tells you that he is going to do some measurements to install solar panels on their roof. This family is planning on having their very own DER, connecting to the grid on their own. What are solar panels? Why would someone need them on their roof? And what is a DER?

As you get to the house, Uncle John pulls out the plans for the solar panels. He tells you that solar panels capture energy from the sun to power their home. This kind of technology uses renewable energy because the sun is a continual source of energy right here in nature. That is pretty amazing! The family will use sunshine to turn on their lights and charge their phones. But how does it all work? What happens if it is rainy or cloudy some day? Does that mean they don't have electricity? These solar panels seem like a really interesting idea, and you are intrigued to find out more.



Solar panels on a roof harness sunlight to generate electricity for a building.

CLOSER LOOK

Energy Sources

There are two different renewable energy sources being used in this image. What are they? How do you think they produce electricity? Discuss the image with your instructor.



Energy is being produced by two sources of renewable energy.

Energy Advancements

Scientists have been working on advancements in electric and magnetic technologies. What are they trying to do? Their goal is to generate **energy efficiency** by using technology that will do the same job as other methods but expend less energy. They do this by using a number of technologies, one of which is advanced energy storage systems. **Energy storage** systems can take many forms, but their job is to collect energy with the intent to use it at a later time. For example, on sunny days, the solar panels on the roof of the house can capture sunlight and then store extra for a time when the sun is not out.

Electricity produces heat, and it can cause issues to arise. Some electronic devices have to take periodic breaks or use other devices, like fans, to cool down. Scientists are experimenting with superconductors because they run at very low temperatures and do not produce any electrical resistance. A superconductor is a special material that can conduct electricity with zero resistance, allowing an electric current to flow through it without losing any energy as heat. This means that the electric current can continue on and on without friction to heat it up or slow it down. You can see this in action with Asia's extremely fast maglev trains. They use superconductors to generate magnetic fields, allowing a train to levitate above the rails.

Wireless technology is also becoming extremely popular. Technology that used to require a cord is now wireless. Think about a laptop computer, which can be taken anywhere, compared to desktop computers, which used to have to be plugged into the wall to work. So many tools and everyday devices transmit energy by using electromagnetic fields. A transmitter works with a receiver to use electromagnetic energy instead of being connected to a cord in a power outlet. This can be seen in charging pads for your smartphone, handheld heart monitors, and more!

Magnetic Levitation Trains



Magnetic levitation trains hover above tracks, eliminating friction for faster, smoother travel.



Maglev Trains

How does a maglev train use electricity and magnetism? Discuss with your instructor.

MINI-LAB

Water Experiment

For this activity, you will use hydropower!

Materials: cork, funnel, 2-liter bottle, paper clips, scissors, skewer, tape, water

Directions:

1. Cut off the top and bottom of a 2-liter bottle, leaving an 8 cm long cylindrical part in the middle.
2. Cut them equally into four strips.
3. Cut the four strips in half to make eight curved strips (4 cm by 2 cm).
4. With an adult's help, make eight evenly-spaced slits in a cork.
5. Place all eight curved strips into cork slits, making sure they are all curved in the same direction.
6. Place a skewer on each side of the cork.
7. Unfold two paper clips so that they act as hooks or loops for the skewer to fit inside.
8. Tape the paper clips to a funnel, which will hold your cork wheel above it.
9. Place the funnel inside an empty bottle.
10. Pour water over the cork wheel and into the funnel.

What happened? Why? How could this be useful in real life?

Pull out your General Science 2 Lab Book and record your answers and reflections in the space provided for the Chapter 51 Mini-Lab or make the appropriate notes in a regular notebook and share with your instructor.

Energy Efficiency

How do you get power to your home anyway? Power plants generate power which then travels through the grid. A **grid** is a network of connections that generates, transmits, and distributes power for people to use. There are nearly 8 billion people on Earth. It is essential to think about sustainability when thinking about getting power to 8 billion people. **Sustainability** is being able to support and maintain the ongoing processes of the planet. The **carbon footprint**, or the amount of carbon dioxide released into the air based on the energy needs of an individual or group of people, has gotten out of control. Scientists are finding **renewable energy** sources, which supply energy made from resources that nature can replenish, such as wind, sunshine, water, and organic matter.

The problem with installing new energy systems is the upfront cost. **Hybrid energy systems** are a combination of many different types of energy generation and storage or a generator powered by different types of fuel. It helps to transition from the existing system to the newer technology. **Distributed energy resources (DERs)** are small-scale electricity sites that can supply resources through connections with the electric power grids, like the home Uncle John is working on. DERs can help lower the cost of energy for a person and conserve energy. One problem with DERs is that they can sometimes create a bottleneck in the grid during peak times. The grid itself needs to be more energy efficient and become a smart grid. 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.

WRITE

Essay

What is the difference between a regular power grid and a smart grid?

[illegible]

ONLINE CONNECTION

Carbon Footprint Calculator

Using a reliable search engine, search for a carbon footprint calculator. This will give you a chance to answer some questions about how much energy you use on a daily basis. When was your home built? Do you leave the lights on when you are not using them? What kind of carbon footprint are you leaving on Earth?



A carbon footprint measures the total amount of greenhouse gases produced, reflecting individual or organizational impact on the environment.

PRACTICE

Your Local Government

Looking around your community, you realize there are many opportunities to use more renewable energy sources. You decide to write a letter or prepare a speech to share with your local community government. What would you say to help persuade them to seriously consider becoming more renewable?

Include the following in your speech or letter:

- What is renewable energy?
- What is a small way to start using renewable energy?
- How would your proposed plan work with the current grid system?
- How would it lessen the carbon footprint of the community?
- Why should your government officials care?
- Include vocabulary from the chapter in the letter.



Renewable energy sources, like solar or wind power, harness natural resources to generate sustainable electricity without depleting limited reserves.

REVIEW

In this chapter, you learned:

- Renewable energy uses resources from nature to replenish what is used, such as wind, water, sunshine, and organic matter.
- A grid is a network of connections that generates power, transmits it, and then distributes it for people to use.
- Scientists are working on electrical and magnetic technology that is more energy efficient and more sustainable for the environment.

Can you answer The Big Question?

How can electricity be made more energy efficient?

SHOW WHAT YOU KNOW

Answer the following question.

1. If a home is powered by solar panels, what allows them to have electricity at night?
-

Choose the correct answer for each question.

2. Which of the following is an example of a superconductor?
- A. maglev trains
 - B. solar panels
 - C. laptop computer
 - D. power grid
3. Which of the following is NOT an advantage of using a smart grid?
- A. It can conserve energy.
 - B. It uses renewable resources.
 - C. It requires a high cost.
 - D. It recognizes problems quickly.

Read each sentence. Circle True or False.

- | | |
|------------------|--|
| 4. True or False | Using renewable energy will lessen the carbon footprint. |
| 5. True or False | Wireless technology uses electromagnetic fields. |
| 6. True or False | Superconductors produce heavy electrical resistance. |

Answer the following question.

7. What is one pro and one con for a distributed energy resource (DER)?
-
-

Fill in the blank to complete the sentence.

8. Being able to support and maintain the ongoing processes of our planet is called _____.

IN FOCUS

Conduct Research

Have you ever wondered if the color of your house could impact how much you spend on energy? Conduct a little research to find out. Follow the directions provided:

1. Cover a shoebox with white construction paper and glue it in place.
2. Cover another shoebox with gray construction paper and glue it in place.
3. Cover a third shoebox with black construction paper and glue it in place.
4. Place a thermometer inside each box and close the lid.
5. Place each box in a sunny location for 30 minutes.
6. After 30 minutes, remove the thermometers and quickly record the temperature reading for each one.

Which box was the warmest? Which box was the coolest? In the summer, which color house would you choose? Why?

Discover!

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