

Lesson 1: Electricity is All Around You

OBJECTIVE

Students will understand how electricity is made, delivered, and linked to natural resources.

KEY CONCEPTS

- Electrons
- Natural Resources
- Distributed Renewable Generation (DRG)
- Electric Generation
- Electric Grid

LESSON RESOURCES

- Green Link.....2
- Power Grid Scramble..... 5
- Career Connections..... 6-7

LIMITED ENGLISH PROFICIENT, AT GRADE, AND ADVANCED

In this lesson, there are three versions provided for the Power Grid Scramble. Each version is designed for a particular ability level. The color-coded outlet in the upper right-hand corner indicates the ability level on the activity:



**LIMITED ENGLISH
PROFICIENT LEVEL**



AT GRADE LEVEL



**ADVANCED
GRADE LEVEL**



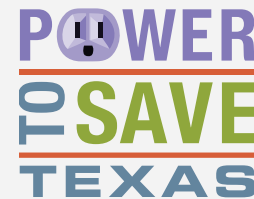
LESSON 1:

Electricity is All Around You

There aren't a lot of places that you can see electricity. The most common form of electricity you may know is lightning. Lightning is a big spark that occurs when lots of electrons move from one place to another very quickly. An **electron** is a tiny piece of electricity, too small to see even with a powerful microscope.

Even though we may not realize it, electricity is everywhere. There is even electricity everywhere in space. There are electrons inside stars and on all planets. Lightning is just one expression of natural electricity. Inside your body, even your thoughts are very small bursts of electricity traveling along your nerves and between cells in your brain.

Without electricity, you would not be able to read this article right now. Your nervous system sends



1 Lesson 1: Electricity Is All Around You

Power to Save Texas School Program © 2014 Public Utility Commission of Texas

LESSON 1 ENRICHMENT

Interactive Links

[Power to Save Texas Enrichment – Grid Conditions](#)

This link displays the grid condition in order to help consumers manage their energy usage. Conditions from “normal” to “power emergency” are explained.

[London Array](#)

This link features the beauty of the London Array, which is arguably the most widely known offshore wind farm. The wind turbines are 12.5 miles out to sea. Its sheer scale and proximity to Greater London make it very popular.

[Cape Wind](#)

This link provides information about America's first proposed offshore wind farm in coastal waters. The farm is to be located in Nantucket Sound, off of Cape Cod.

Green Link

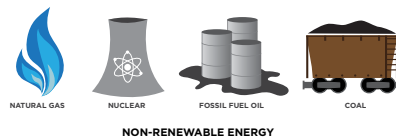
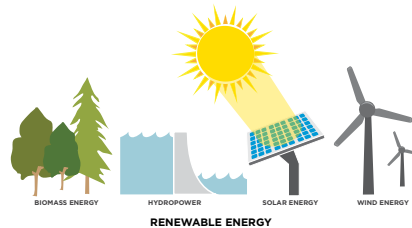
Click on the green word “resources” in the student lesson to link you to information about four renewable resources.

Students can learn the basics of renewable energy and energy efficiency technologies. For enrichment, go to the left-hand side bar and click on one of the four renewable energy types: solar, geothermal, wind, and water.

“signals” to the brain, telling our eyes to follow the words on the page. These signals are little bursts of electricity that carry messages from one point to another within our body. With so much electricity jumping around, it may seem like the body is a really great power source. But, the human body generates only about 0.1 volts—not even enough to power your TV remote.¹

It’s easy to see the uses of electricity around you. When electricity is captured, it is constantly flowing through insulated wires. These wires bring power to your home and your town. As the population of Texas grows, so does the need for electricity. Texas currently creates and uses more electricity than any other state.²

The good news is Texas has a variety of climates and natural resources.



Texans can take advantage of these resources to help generate electricity. When we talk about using **renewable resources** to create energy, we mean using they power created from the use of natural resources, which replace themselves quickly and dependably. These energy sources can never be used up, like sunlight and wind. Renewable energy is clean and is considered unlimited. When we use these resources, we reduce the demand for **non-renewable sources** of energy. The non-renewable resources are formed deep within the earth from plant and animal remains and are millions of years old, like coal and oil. These resources can only be used once for energy.³



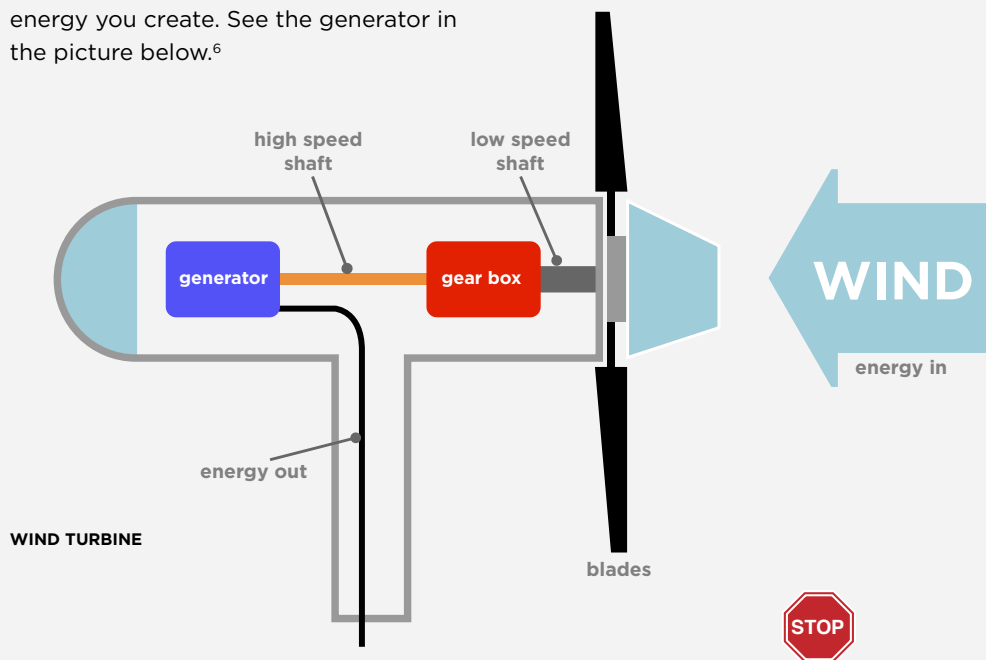
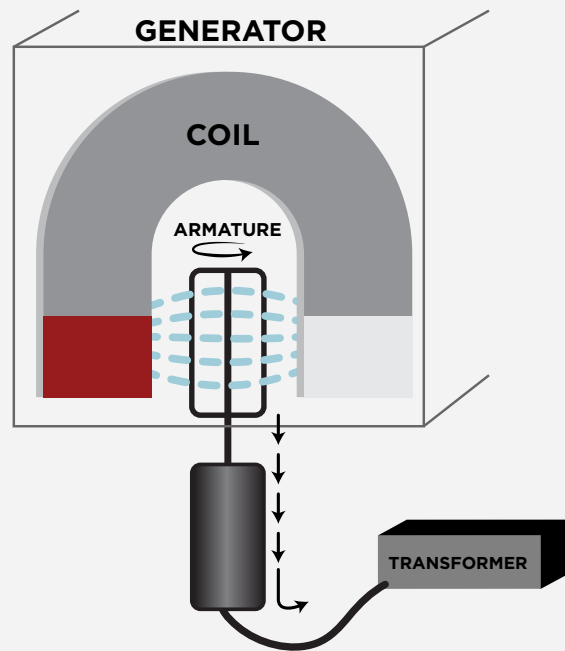
Everyone can enjoy renewable energy, and some even install their own solar panels or wind turbines to generate power for themselves. This is called **Distributed Renewable Generation**, or a DRG system.⁴ At times, these customers produce more power than they can use. Depending on where the customers live, this extra power may be sold back to an electric company.

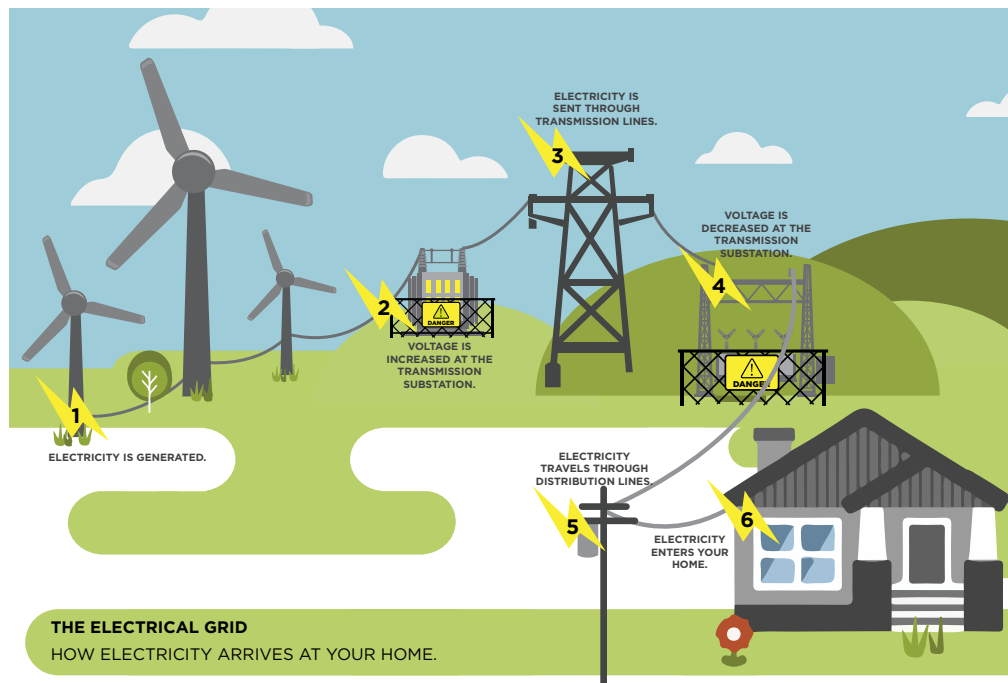
When we talk about electrical power, you may wonder how electricity was captured and forced to travel through the power lines. We really depend on this form of energy, and without it our world would be very different; we would be much less comfortable. If we were without electricity for a long time, water could not be pumped into our homes.

NOTES:

When you think about ways to create or make electricity, you are talking about **electric generation**. Most of the ways to do this involve a machine called a **generator**. The generator transfers the energy of motion into electricity. Take a look at the picture on the right.⁵ A magnetic coil is located inside the generator. An armature spins in between the magnetic coil. This spinning action creates electricity.

You might wonder if it is hard to make the armature spin. The good news is, it's not hard at all. In fact, there are many ways of spinning the armature that you may already know about! These include using the power of the wind, water, or sun, and also by using something called biomass. We will learn about biomass in Lesson 4. The bigger the generator, the faster the armature spins, and the more energy you create. See the generator in the picture below.⁶





In the case of a wind turbine, these turbines work the opposite of a fan. Instead of using electricity to make wind, these turbines use wind to make electricity. The wind turns the blades, which spin a shaft, which connects to a generator and makes electricity.

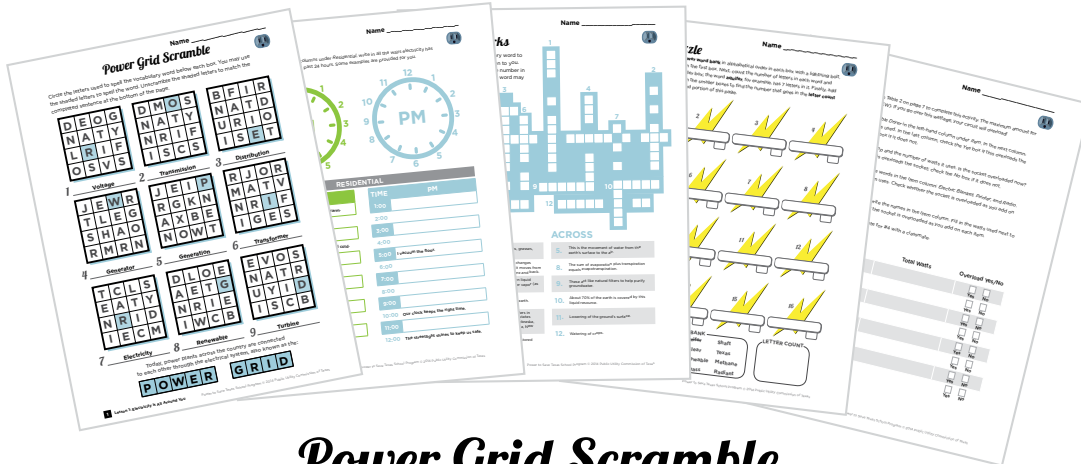
The state of Texas is unique. Texas is able to rely on many sources for generating its own electrical power. We will read about these in the next lesson.

Electricity is an enormous part of our lives. It makes our lives comfortable and safe. Electricity is so important that most of the time we simply take it for granted. Do you know how electricity reaches your home or school? Actually, it travels a long way. The power plant where your electricity is made

or generated might be hundreds of miles away!

First, (1) the electricity is generated by using either renewable or non-renewable resources. Second, (2) the voltage is increased at a transmission substation. Then, (3) the electricity is sent through uninsulated transmission lines on very high poles or structures to a distribution substation (4) where the voltage is decreased. Next, the electricity is carried to individual neighborhoods by distribution lines that are held up on power poles or buried deep underground. Before reaching your home, (5) smaller transformers decrease the voltage one more time. Finally, (6) electricity safely arrives at your home for you to use.⁷









Power Grid Scramble

Ask your teacher for the Power Grid Scramble activity. You will receive one of three versions. The Power Grid Scramble uses vocabulary words from a word bank to spell, unscramble, match, or complete sentences.

Long-Term Savings for Homes Tips

COMPUTERS, APPLIANCES & ELECTRONICS

-  Set your computer and monitor to sleep when idle for more than a few minutes.
-  Don't use screen savers. They prevent computers and monitors from going into power-saver mode.
-  Make sure the dryer air vent outside your house is properly sealed.
-  When buying a new appliance, look for ENERGY STAR® qualified products. These options use 10-50% less energy than standard models.

See more at www.powertosavetexas.org.

Scan this QR Code with your smartphone to visit the program website.



Focus on 5

Use these five questions for reflective journaling, short paragraph essays, or class discussion:

Reflective Journaling

1. List at least three positive attributes about this career that you found interesting or appealing.
2. List at least three negative attributes about this career that you thought did not apply or appeal to you.

Short Essays

3. Why do you think the future of this job is predicted as it is shown?
4. In your city, who would be an employer you could contact to ask for more information about this career choice?

Class Discussion

5. Why do you think this job was featured as a part of this lesson?

Career Connection / Job Profile:



*Do you like helping people?
Are you interested in how electrical equipment works?
Are you good at fixing things?*

If you answered, "Yes," to these questions, you might like to be a line installer and repairer, also known as a lineman. Line installers and repairers build, maintain, and repair electrical power systems and cables. Some install and fix the power lines that move electricity from power plants to customers. Others work on the lines and cables that carry telephone service, television, and the Internet.

As a line installer and repairer you would:

- Install, maintain, and fix power lines, cables, and poles.
- Set up cable service for customers and explain how it works.
- Drive work trucks to job sites and coordinate jobs with other workers.
- Dig holes, set poles, and climb poles or use lifts to reach equipment.
- String lines and cables between poles, towers, and buildings.
- Dig trenches and lay cable into trenches.
- Inspect and test lines, electric parts, and signal strength.
- Check lines and poles from helicopters or airplanes to get clear views.
- Use power tools and equipment to install and fix poles and lines.
- Follow rules to keep workplaces safe and keep tools in good repair.

Will There Be Jobs in the Future?

In Texas, this occupation has high growth potential. Nationally, this occupation is growing at an average rate.

Education Required:

To work as a line installer, you typically need to:

- Have a high school diploma or GED; and
- Complete an apprenticeship program or long-term, on-the-job training.

Provided courtesy of: www.onetonline.org

NOTES:

Focus on 5

Use these five questions for reflective journaling, short paragraph essays, or class discussion:

Reflective Journaling

1. List at least three positive attributes about this career that you found interesting or appealing.
2. List at least three negative attributes about this career that you thought did not apply or appeal to you.

Short Essays

3. Why do you think the future of this job is predicted as it is shown?
4. In your city, who would be an employer you could contact to ask for more information about this career choice?

Class Discussion

5. Why do you think this job was featured as a part of this lesson?

Career Connection / Job Profile:



Are you good at math?
Are you interested in helping keep people safe?
Are you organized and able to focus on tasks?

If you answered, "Yes," to these questions, you might like to be an environmental scientist. Environmental scientists study problems in the natural world. They measure electromagnetic fields; do research about how these problems affect the health of people, plants, and animals in order to protect them. Many environmental scientists work for federal, state, and local governments. Others work for companies that help clients plan projects and solve problems.

As an environmental scientist you would:

- Study how what people do affects the world around them.
- Do research and create programs that limit harm to land, water, and air.
- Collect water, soil, or air samples and test them.
- Suggest ways to use land that will help clean and protect it.
- Prepare permits and codes to protect the land, water, and air.
- Inspect sites and decide what to do if codes have not been followed.
- Give advice to clients, the government, and the public.
- Train students, other scientists, or staff.
- Meet with clients, staff, or the public to explain research findings.
- Write reports and make charts or graphs to help explain research.

Will There Be Jobs in the Future?

In Texas and nationally, this occupation is growing at an average rate.

Education Required:

- To work as an environmental scientist, you typically need to:
- Have a high school diploma or GED; and
 - Have a college degree in science.

Provided courtesy of: www.onetonline.org

NOTES:



Stop Directions - Page 2

Objective:

Students will become acquainted with new vocabulary.

Instructions:

Write the words in the **Word Bank** on the board, or say them aloud, and ask students to sort these words into the appropriate category.

Word Bank

Water	Corn	Oil
Geothermal Energy	Natural Gas	Uranium
Sun	Water	Biomass
Coal	Fossil Fuels	

Renewable Resources - *Answers*

Corn	Biomass	Sun
Water	Geothermal Energy	

Non-Renewable Resources - *Answers*

Coal	Fossil Fuels	Uranium
Natural Gas	Oil	

Stop Directions - Page 3

Objective:

Students will reflect on information presented regarding the wind turbines discussed in Lesson 1 on pages 3 and 4.

Instructions:

Discuss the illustrated wind turbine on page 3. Once the discussion is finished, ask students to reflect on the information presented thus far with the **Learn and Know** questions below. The reflection may take place in written or group discussion format.

Learn and Know

Q: What is the minimum wind speed required to turn the blades of wind turbines and convert wind energy into electricity?

A: An average wind speed of 14 miles per hour is needed to convert wind energy into electricity.

Q: Do you think wind farms can exist on water?

A: Yes, they can and do exist on water. The world's largest wind farm is the London Array; 175 turbines provide energy to half a million homes in the United Kingdom. Cape Wind in Massachusetts is soon to be the first offshore farm in the United States. Even floating structures can send energy generated from turbines back to shore by undersea cables.

Stop Directions - Page 4

Objective:

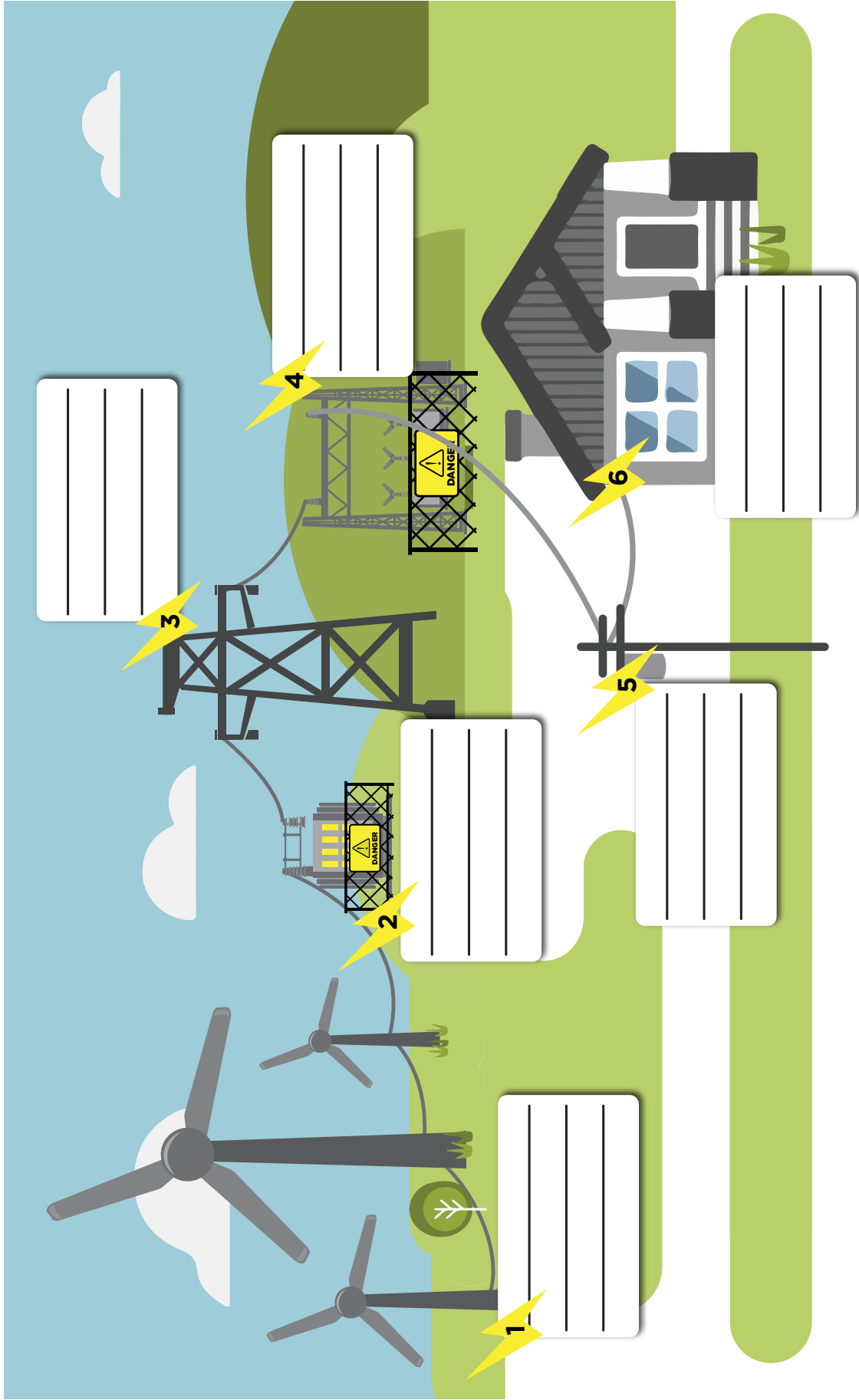
Students will reflect on information presented regarding the electrical grid discussed in Lesson 1 on page 4.

Instructions:

Students will create their own version of the electrical grid using an image of one with blanks, such as the one found below. A full-size electrical grid with blanks can be found to print for your students on the next page. Students are to fill in the blanks, numbered 1 through 6, with the steps electricity takes from generation to the home. This exercise may be conducted in groups or individually.



Name _____



Stop Directions - Page 5

Visit the [Teacher Portal](#) to access all three versions of the Power Grid Scramble activity and distribute to your students. Directions for this activity are listed below.

Objective:

Students will become familiar with the spelling of new vocabulary words and reinforce their knowledge of electrical generation.

Instructions:

Provide each student with one version of the Power Grid Scramble activity. Distribute the appropriate level(s) for your class.



Limited English Proficient

Circle the letters used to spell the vocabulary word below each box. You may use the shaded letters to spell the word. Unscramble the shaded letters to complete the sentence at the bottom of the page.



At Grade Level

A word bank for each row of boxes can be found to the right of each row. Match each word to the appropriate grid and spell it correctly on the line below. Unscramble the shaded letters to complete the sentence at the bottom of the page.



Advanced Grade Level

Vocabulary words from the word bank can be found in each grid. Match each word to the appropriate grid and spell it correctly on the line below. Unscramble the shaded letters to complete the sentence at the bottom of the page.