

# Cobblestone™

## GET PLUGGED IN ABOUT ELECTRICITY

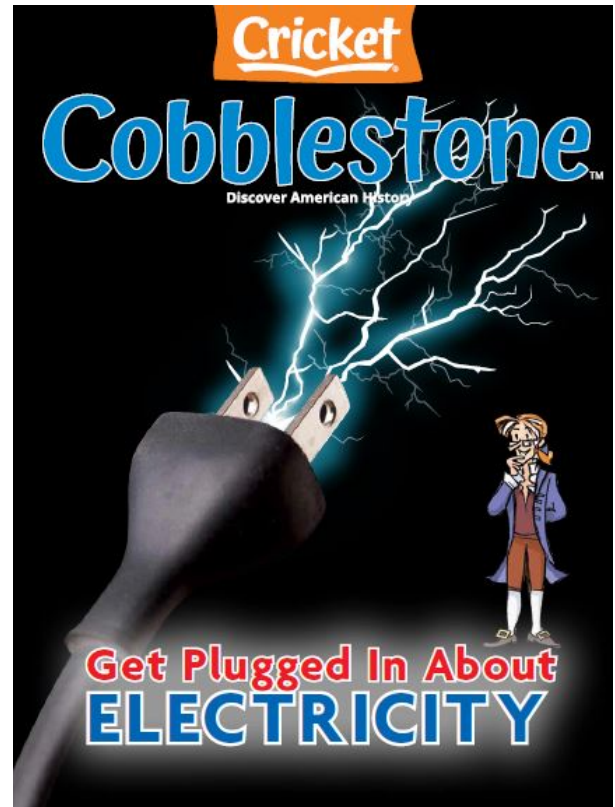
When people hear the term “electricity,” they often think of the outlets that they plug various devices into. But the electrical grid that supplies that electricity requires many different machines, technologies, and resources to operate efficiently. Use the articles, lessons, and activities in this teacher guide to help your students learn about how electricity is produced and distributed to people.

## CONVERSATION QUESTION

Why is electrical power challenging to produce and distribute?

## TEACHING OBJECTIVES

- Students will learn about the history of electrical power.
- Students will ask and answer questions about historical events.
- Students will explain how people modify their environments.
- Students will identify examples of the variety of resources that are used to produce services.
- Students will conduct short research projects.
- Students will give a presentation.
- Students will hold a debate.



In addition to supplemental materials focused on core Social Studies skills, this flexible teaching tool offers vocabulary-building activities, questions for discussion, and cross-curricular activities.

## SELECTIONS

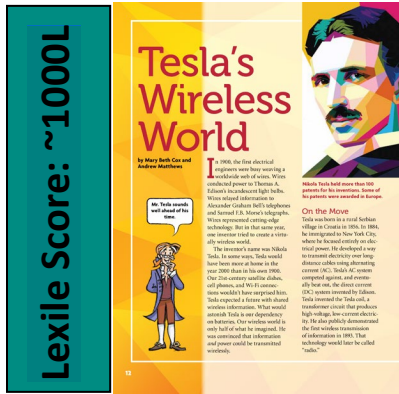
- **Tesla’s Wireless World**  
Expository Nonfiction, ~1000L
- **On the Grid**  
Expository Nonfiction, ~1020L
- **Energy Sources**  
Expository Nonfiction, ~940L

# Cobblestone® Teacher Guide: November/December 2021

## Tesla's Wireless World

pp. 12–15, Expository Nonfiction

Use this short history of Tesla's discoveries to evaluate how human modifications cause natural ecological consequences.



## RESOURCES

- Question Cube

## OBJECTIVES

- Students will read and analyze a nonfiction text.
- Students will ask and answer questions about historical events.
- Students will conduct short research projects.

## KEY VOCABULARY

- **transformer circuit** (p. 12) a device that transfers electric energy from one alternating current circuit to one or more other circuits, either increasing or reducing the voltage
- **battery** (p. 14) a container consisting of one or more cells in which chemical energy is converted into electricity and used as a source of power
- **inductive charging** (p. 15) a type of wireless power that uses electromagnetic induction to provide electricity to portable devices

## ENGAGE

**Conversation Question:** Why is electrical power challenging to produce and distribute?

Name some sources of electricity (e.g., phone battery, AA battery, wall outlet or plug, power line, etc.) and discuss what they know about how they work. Explain that the ways that people have produced and distributed electrical power has undergone several major periods of technological change.

## INTRODUCE VOCABULARY

Read the vocabulary words and definitions. Then display the sentences below and have students use the vocabulary words to complete them. Finally, remind students to look for the vocabulary words as they read.

1. The \_\_\_\_\_ helps to balance the electrical load carried by each power line.
2. A \_\_\_\_\_ uses a different method for producing electricity than devices that use \_\_\_\_\_.

## READ & DISCUSS

Have students answer these questions after reading the article.

1. How did Tesla's vision differ from technology used to send telegraphs?
2. What did Tesla believe about how information and power could be transmitted?
3. What problems did the invention of batteries solve?
4. What is a major shortfall of battery technology?

## SKILL FOCUS: Ask and Answer Questions

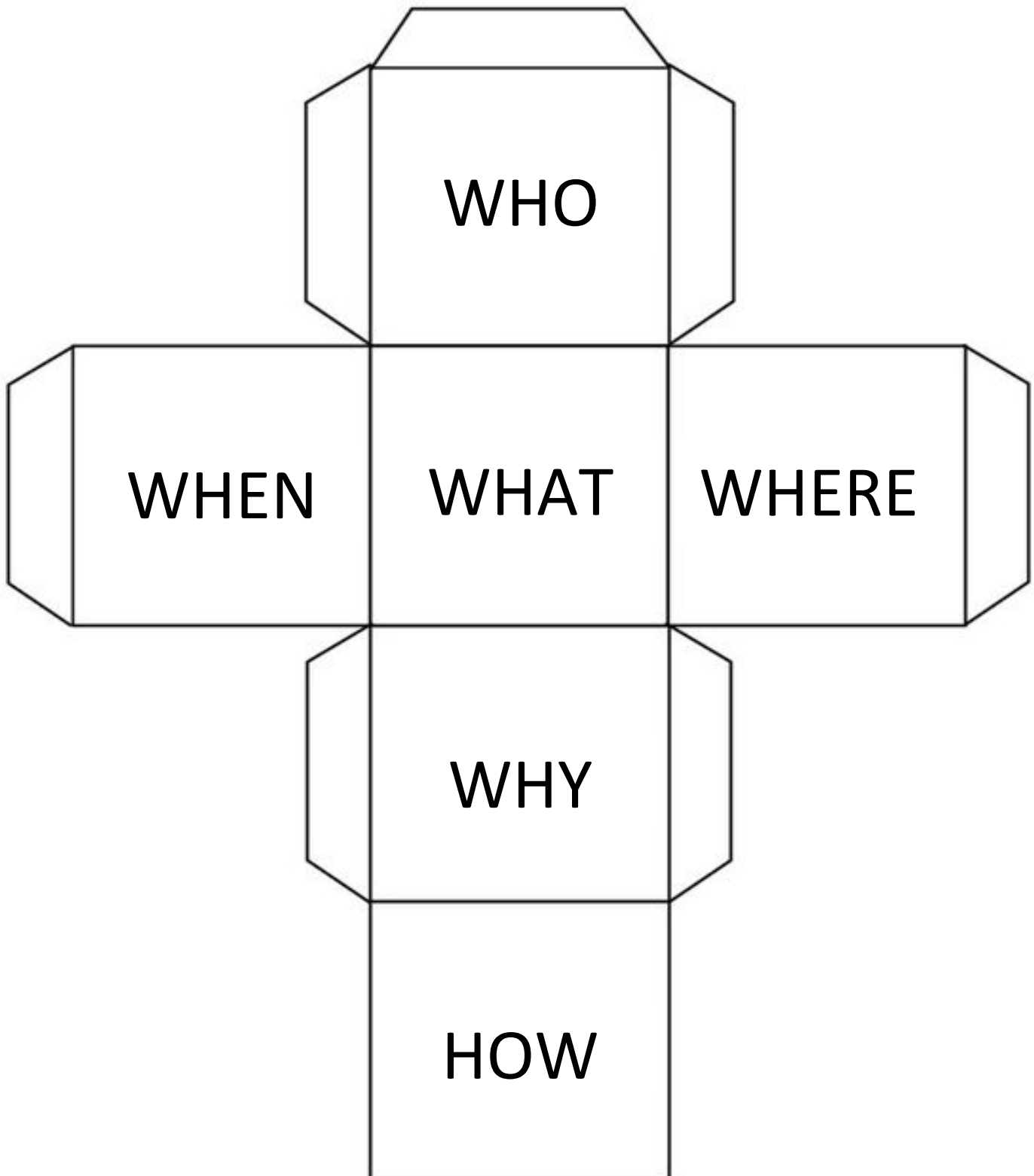
**INSTRUCT:** Point out that the article introduces some of the people, technologies, and inventions that have changed how electrical power is produced and distributed. Have students work in small groups to create a three-column chart to list the people, technologies, and inventions mentioned in the article. Then distribute the *Question Cube* to groups and have them assemble it and use it to help generate questions about the items in their chart. Groups should generate five to ten questions.

**ASSESS:** Have each group member choose a different question to research and answer. After groups have answered their questions, have them explain to each other how their different questions/topics are connected. Finally, have groups create a slide to present to the class.

## EXTEND

**Science** Explain to students that making long-lasting batteries is a major goal for many modern businesses. Have them use print and digital sources to research recent innovations with batteries. Last, have them give a one-minute presentation to the class about their findings.

## Question Cube



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## On the Grid

pp. 16–17, Expository Nonfiction

Use this article about how electrical grids produce and distribute electricity to give students an opportunity to conduct research and give a presentation.



## OBJECTIVES

- Students will read and analyze a nonfiction text.
- Students will explain how people modify their environments.
- Students will give a presentation.

## KEY VOCABULARY

- **transmission (p. 16)** the process of passing electricity from one place to another
- **transformers (p. 16)** a device that transfers alternating current from one circuit to another (or multiple circuits), either increasing (stepping up) or decreasing (stepping down) the voltage
- **turbine (p. 17)** a machine with a wheel that is spun using a flow of gas, water, air, or steam, which in turn produces power by converting the energy in the substance used to spin the wheel

## ENGAGE

**Conversation Question:** Why is electrical power challenging to produce and distribute?

Ask students to name some of the things they use every day and would have trouble living without. Then, ask them how many of those things run on electricity. Have students hypothesize how that electricity is produced and distributed, so they can use it. Have them check their predictions as they read the article.

## INTRODUCE VOCABULARY

Read the vocabulary words and definitions. Then display the sentences below and have students use the vocabulary words to complete them. Finally, remind students to look for the vocabulary words as they read.

1. Before \_\_\_\_\_ transfer electricity to the grid, a \_\_\_\_\_ must first be used to generate electrical energy.
2. \_\_\_\_\_ are placed at the beginning and end of \_\_\_\_\_ lines to ensure the voltage of the electricity being supplied is appropriate.

## READ & DISCUSS

Have students answer these questions after reading the article.

1. How does a turbine work?
2. How do transformers help keep transmission lines from overheating?
3. What is the role of a step-down transformer?
4. What are some of the problems that can disrupt the flow of electrical power?

## SKILL FOCUS: Evaluate Modification

**INSTRUCT:** Explain to students that people modify or change the environment for a variety of reasons, such as to create housing, to build industry, and to harvest natural resources. Continue by explaining that as a result of these human modifications, environments may be damaged or destroyed. Discuss issues in your town or region related to human modification of the environment.

**ASSESS:** Have students work in pairs to review the article and list the negative and positive ways that humans have modified landforms and water sources in order to provide electrical power to people. Then have students gather in groups to share and discuss responses.

## EXTEND

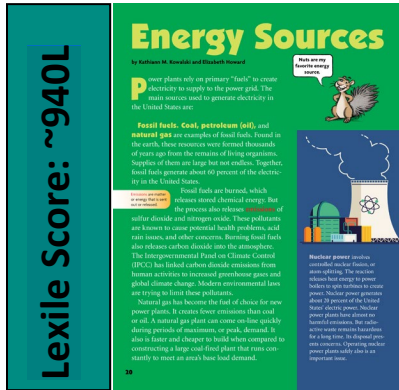
**Social Studies** Explain to students that providing a reliable source of power is challenging. Tell them to pick one of the types of problems that may disrupt the flow of power and conduct research to find out how governments and businesses are trying to solve that problem. Ask them to summarize their findings in a multi-media presentation for the class.

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## Energy Sources

pp. 20–21, Expository Nonfiction

Help students to analyze the benefits and costs of different ways of producing electricity.



## OBJECTIVES

- Students will read and analyze a nonfiction text.
- Students will identify examples of the variety of resources that are used to produce services.
- Students will hold a debate.

## KEY VOCABULARY

- **fossil fuels (p. 20)** a natural fuel, such as coal or gas, formed in the geological past from the remains of living organisms
- **chemical energy (p. 20)** energy stored in the bonds of chemical compounds that is released when those compounds undergo a chemical reaction and transform into other substances
- **base load demand (p. 20)** the minimum amount of electrical power needed to be supplied to the electrical grid at any time

## ENGAGE

**Conversation Question:** Why is electrical power challenging to produce and distribute?

Explain to students that there are many different types of natural resources used in the production of electrical energy. Define natural resources as “materials that occur in nature and can be used for economic gain.” Then, ask students to list examples of natural resources that they think are used in the production of electricity. Tell them to check their predictions as they read.

## INTRODUCE VOCABULARY

Read the vocabulary words and definitions. Then display the sentences below and have students use the vocabulary words to complete them. Finally, remind students to look for the vocabulary words as they read.

1. The United States has a high \_\_\_\_\_ due to the relatively high standard of living of most of its population.
2. People burn \_\_\_\_\_ to release \_\_\_\_\_, which can then be converted into electricity.

## READ & DISCUSS

Have students answer these questions after reading the article.

1. What are the different natural resources used to produce electricity?
2. How much electricity in the United States is provided by renewable energy resources?
3. What are some of the costs of using fossil fuels to produce electricity?
4. What are some of the costs of using renewable energy sources to produce electricity?

## SKILL FOCUS: Identify Resources

**INSTRUCT:** Explain that different types of resources – human, physical, and natural – are needed to produce electricity. Have students re-read the article for 5 minutes to find examples – explicit or inferred – of the three types of resources used in the production of electricity. Ask students to share their ideas.

**ASSESS:** Have student pairs list each method of producing electricity discussed in the article. Tell students to take notes on the benefits and costs of each method.

## EXTEND

**Speaking and Listening** Point out that the public debate over the best way for our society to meet its electrical needs is currently ongoing. Many people believe we must balance economic and environmental factors. Moderate a debate where you challenge students to arrive at a consensus about the ideal energy production system for the United States.