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Power Up

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Literacy Overview

Reading Selections
• Fossil Fuels (reference article)
• Renewable Energy Tour (science article)
• Debating Wind Power (opinion piece)
• A Fuel of the Future (science article)

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS

CC.5.RInfo.2 Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.

CC.5.RInfo.3 Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.

CC.5.RInfo.5 Compare and contrast the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in two or more texts.

CC.5.RInfo.6 Analyze multiple accounts of the same event or topic, noting important similarities and differences in the point of view they represent.

CC.5.RInfo.8 Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s).

CC.5.RInfo.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.

Writing Standards (page 17)

CONTENT GOAL

Students will read four selections in Power Up. They will learn about fossil fuels and alternative energy sources. Students will also be introduced to the advantages and disadvantages of each, including their environmental impact, and learn about how communities are currently utilizing these energy options.

COMPREHENSION GOAL

Remind students that as thinking-intensive readers they must listen to their inner voice to monitor and repair comprehension as they read. Find opportunities to model and teach active thinking strategies to help students access content. You may want to focus on the following strategies for Power Up.

• **Activate and Connect to Background Knowledge:**
Readers use what they know or have experienced to help them understand new information. However, they must be prepared to reverse any misconceptions in light of new learning or new evidence.

• **Summarize and Synthesize:** Readers synthesize and summarize information to see the bigger picture. They piece together the parts to come up with the whole. They integrate new information with what they already know to get a more complete understanding of the ideas in the text.
ACTIVATE & BUILD BACKGROUND

Draw the graphic organizer shown above. Ask: What are some different sources of energy and how do people use them? Write students’ responses in the graphic organizer.

Model for students by describing a power station or energy source you have observed. Say something similar to the following: Once when I was on a trip I saw a field of wind turbines. They had huge blades that spun like a fan and were hundreds of feet tall! I know from watching the news that wind turbines can provide electricity for thousands of homes and that the energy comes from the wind that turns the blades. I think it’s amazing that the electricity we use every day could have originally come from the wind.

Explain that there are many different energy sources on Earth and that people use different energy sources in various ways. You might say: Some people have cars that run on electricity, but most people have cars that run on gasoline. Gasoline is a fuel that is made from oil found deep in the ground. Oil is also used to make many other products, like tires and plastics.

BUILD SCIENCE BACKGROUND

Pages 4–6 of this teacher’s guide address how certain science concepts relate to each selection in Power Up. This information will provide you with science background knowledge as you plan your teaching for this book.

Help students access background knowledge related to the science concepts. Support the concept of renewable energy in ways that are familiar to your students.

- renewable energy: Show pictures of different renewable energy sources (such as sunlight, wind, and water) and examples of how energy from them is harnessed (solar panels, wind turbines, hydroelectric dams). Explain that renewable resources are constantly being replaced and will not run out, unlike nonrenewable fossil fuel resources (such as coal, gasoline, and natural gas).
Science concepts are a critical part of each selection in Power Up. These pages will help you build content knowledge so that you may more effectively have discussions with students as they read each selection in the book.

The following big idea science concept applies to several selections in the book.

• **Renewable energy** (student book, pp. 11, 24, 29) is energy that comes from resources such as the sun, wind, and water, which are replaced continuously and will never run out.

Nearly all renewable energy resources are powered by the sun. Solar energy not only provides a source of heat but also drives the water cycle and wind patterns on Earth. The sun’s energy causes water to evaporate. The water then condenses and falls to Earth, providing the liquid water resource for hydropower. Solar energy also creates wind patterns by heating Earth unevenly, setting up areas of higher and lower air pressure; and wind is simply the movement of air from areas of higher pressure to areas of lower pressure.

Pages 5–6 in this teacher’s guide describe how the science concept above relates to each selection. Additional science background information is given for each selection.
FOSSIL FUELS

Student Book, pp. 2–9
Teacher’s Guide, pp. 7–8

In this selection, students will learn about how fossil fuels are formed and how people use them for energy. Burning fossil fuels like coal, oil, and natural gas starts a chemical reaction that produces carbon dioxide and water and releases energy in the form of heat. In a typical electric power plant, this heat is used to boil water and create steam. The steam, under high pressure, moves quickly through pipes and hits the blades of a turbine, causing them to spin. The spinning blades turn a shaft connected to a generator, causing coils of wire to spin near powerful magnets. The motion in the magnetic field causes electrons to move through the wire. This flow of electrons is electricity. Wires from the power plant eventually carry this electricity to homes and businesses.

Oil is a liquid that is easy to store and transport. It is easier to burn than coal. It also burns more cleanly than coal but releases harmful sulfur dioxide gas, which causes acid rain. Burning oil also releases carbon dioxide, which contributes to global climate change.

Natural gas is cleaner to burn than oil or coal because it produces the least amount of carbon dioxide. It also produces much less carbon monoxide, sulfur dioxide, and soot than other fossil fuels. But natural gas is highly flammable and needs to be produced and transported carefully, which can make it more expensive.

Coal is a very reliable source of energy and is safe and easy to store and transport. It is less expensive than oil and natural gas, but burning coal releases lots of harmful carbon dioxide, sulfur dioxide, nitrogen oxide, and ash that cause pollution and acid rain.

Oil, natural gas, and coal are all nonrenewable energy resources with a limited supply on Earth. They will eventually be used up faster than natural processes can replace them.

RENEWABLE ENERGY TOUR

Student Book, pp. 10–21
Teacher’s Guide, pp. 9–10

In this selection, students will learn about different ways people use renewable energy (student book, p. 11) resources.

People have been using energy from the wind and water for thousands of years. Windmills and waterwheels use the force of moving water or air (wind) to turn a wheel and power machinery. Throughout history people used such machines to perform useful tasks like grinding grain, pumping water, and cutting lumber.

A majority of today’s renewable energy resources function on the same principles as historic windmills and waterwheels by converting one type of energy to another. A wind turbine, for example, works when wind turns the blades, which spins a shaft connected to a generator. In this way, the mechanical energy of the wind transfers to the blades and shaft and converts into electrical energy, or electricity.

Many renewable energy resources are limited as to where they can be used since not all renewable resources are found everywhere on Earth. Hydroelectric power, for example, can be used only near a source of moving water, such as a river or dam (when water is allowed to move through the dam). Wind power can be used on a large scale only in places where it is often windy and there is space to set up an array of large wind turbines known as a wind farm. Solar power, on a large scale, is most effective in places that get lots of intense sunshine. Geothermal power can be used most successfully to make electricity in places where hot water underground is relatively close to the surface, such as at hot spots near plate boundaries, like the Great Rift Valley in Kenya.
DEBATING WIND POWER

Student Book, pp. 22–27
Teacher’s Guide, pp. 11–12

In this selection, students will learn about advantages and disadvantages of wind power.

The advantages of wind power are many. It is a source of renewable energy (student book, p. 24) with an unlimited supply. It is free to use and does not release any harmful gases or other pollutants, unlike the burning of fossil fuels. Wind turbines do not have a large “footprint” on the land and can be set up on land used for other purposes, such as agriculture. They also may be located off the coast where they can take advantage of stronger winds away from the shore. People can use wind power in remote and rural areas, and even just a single turbine can provide power for a household or small community. New turbines have been improved so that they are quieter and less expensive to construct.

However, wind power also has disadvantages. Electricity from wind can be generated only when the wind is blowing. The amount of energy produced by wind turbines can vary greatly, depending on wind patterns. Large wind turbines can produce as much noise as a small jet engine. Residents in some areas think wind turbines are ugly and disrupt the natural landscape. Construction can damage the environment because the turbines require lots of steel and concrete buried deep in the ground to keep them anchored securely in high winds. Wind turbines can also be harmful to wildlife. Low frequency vibrations produced by offshore wind farms can disturb whales and other aquatic life, impairing their ability to communicate and navigate safely. A recent study by the U.S. Fish and Wildlife Service indicates that wind farms have significantly contributed to deaths of eagles and other birds because the birds do not see the spinning blades of the turbine in front of them while they are scanning the ground below for prey.

A FUEL OF THE FUTURE

Student Book, pp. 28–31
Teacher’s Guide, pp. 13–14

In this selection, students will learn how hydrogen is a type of renewable energy (student book, p. 29) that may provide another option to power our vehicles in the future.

There are lots of challenges to producing hydrogen fuel cell vehicles that need to be overcome before they can be a widely available form of transportation. Hydrogen rarely occurs naturally on Earth as a gas by itself but is commonly found in combination with other elements. For example, water is a combination of hydrogen and oxygen. Hydrogen needs to be separated from other elements to be used as a fuel. Currently this separation is achieved by burning natural gas to heat the elements. This action releases carbon dioxide into the environment. Hydrogen can also be separated using electricity; however, most of our electricity today is generated by using fossil fuels. As a result, using electricity to produce hydrogen fuel can actually cause more pollution than using traditional gasoline-powered vehicles.

The cost of producing hydrogen fuel cell vehicles is more than conventional vehicles, and the fuel cells are not as durable as combustion engines. There are currently very few fueling stations for hydrogen vehicles, making it impractical for many people to own one of these vehicles. Hydrogen is also difficult to store because most fuel cell vehicle designs use hydrogen from high-pressure tanks, which are heavy and take up more space than gasoline tanks.

Scientists and engineers are hard at work at improving fuel cell technology and overcoming the challenges of this abundant, clean energy source.
Summary  "Fossil Fuels" is a reference article that describes the three major types of fossil fuels (coal, oil, and natural gas), how they formed, and how people use them.

BUILD BACKGROUND FOR THE GENRE

Ask students to turn and talk and then share what they already know about reference articles. Tell them that “Fossil Fuels” is a reference article with the following elements:

• Its purpose is to provide concise, easy-to-scan information, which includes different types of descriptive data.
• Facts and information are conveyed through photos, captions, illustrations, and other graphics.
• The content does not have to be read sequentially. Readers can dip in and out of the article as needed over time.

BUILD VOCABULARY & CONCEPTS

• peat

Remind students that Using Context Clues is a strategy to infer the meaning of an unfamiliar word. They can “read around” the word, or read a few sentences before and after it, to make meaning from the context. Remind them to look at the photographs and illustrations, too.

Another strategy to try is Creating a Content Word Wall. Designate a wall or area of the classroom to use as the Content Word Wall. Have student pairs write peat on a notecard, and invite them to add a definition, a sentence using the word, and an illustration of the word on the card, which can then be placed on the Word Wall.

Point out other important words or terms in the selection, such as crude oil, bacteria, and sediment. Have pairs create cards or use context clues to determine the meaning of these and any words or terms that might be challenging or unfamiliar to students.
READ

The content goal for Power Up is for students to learn about different energy resources and some advantages and disadvantages of different energy options. Explain that “Fossil Fuels” tells about the processes that formed oil, natural gas, and coal and about some products people make using fossil fuels. Point out the Read to find out statement at the top of page 2 in the student book: Read to find out how fossil fuels formed and how people use them. Help students with the comprehension goal of accessing content by summarizing and synthesizing. Model by reading page 2 aloud, then saying: The text says that most of the energy we use for power comes from burning fossil fuels. I know how difficult it can be when we lose power sometimes during a storm. I can’t use the computer or the microwave. If it’s dark, I can’t even turn on a light to read. I can combine this information and summarize that fossil fuels are very important for people to accomplish everyday tasks.

Before students begin reading, say: As you read, think about the ideas in the text and connect them to what you already know about fossil fuels. Put all those ideas together to help you summarize what you read.

TURN & TALK

Revisit the Read to find out statement. Have students turn and talk to tell about how fossil fuels are formed and how people use them. (Possible response: Oil and natural gas were formed when tiny animals died hundreds of millions of years ago and settled on the floor of ancient, shallow seas. Over time, they turned into crude oil and natural gas, which are used to power cars and heat homes.) To check understanding, have students turn and talk about the Check In question: Why are oil, natural gas, and coal called fossil fuels? (Possible response: They all formed from the remains of plants and animals that died hundreds of millions of years ago and changed into oil, natural gas, and coal as a result of bacteria, temperature, and pressure.)

Summarize Explain that summarizing the main ideas in an article can help readers remember the author’s most important points, as well as deepen their understanding. Model by pointing out the time line on pages 4 and 5. Say: The author uses this time line to give me information about how people have used oil over time. I can summarize the information by saying that oil has been important to people for thousands of years but developments in the last hundred years or so have made oil easier to get and use. Have students turn and talk to summarize the time lines for gas and coal on pages 7, 8, and 9.

Explain Relationships Tell students that considering how information in an article is related will help their understanding. Guide students to see the relationship between the sun’s energy and oil and natural gas. Have student pairs re-read the process of oil and natural gas formation on pages 6 and 7. Model explaining the relationship between these fossil fuels and the sun’s energy. Say: This graphic describes how oil and natural gas formed. As I read, I see that energy first came from the sun and was turned into food by algae that were eaten by other single-celled animals. Over time their remains were heated and compressed and eventually become the oil and gas we drill for today. There are a lot of details here, but I can see the relationship between oil and natural gas and the sun’s energy. The energy we use today from oil and natural gas originally came from the sun! Have pairs read page 9 and find the relationship between coal and the sun’s energy. Then encourage them to compare and contrast the formation of oil, natural gas, and coal.

WRITE & ASSESS

You may want to have students do a “quick write” to assess understanding. It’s always helpful to have students reflect on both the content of the selection and their thinking process.

• How did fossil fuels form?
• What more would you like to learn about this topic?
**Summary**  “Renewable Energy Tour” is a science article that introduces students to the major types of renewable energy used today. Students will read about cities and countries that are currently taking advantage of these energy sources, as well as some of the disadvantages of using these options.

**BUILD BACKGROUND FOR THE GENRE**

Ask students what they expect to see and read in a science article. Then tell them that “Renewable Energy Tour” is a science article with the following elements:

- It uses facts, details, examples, and evidence to convey information about a science topic.
- The text is organized using headings and has specialized vocabulary.
- Facts and information are conveyed through photos, captions, and maps.

**BUILD VOCABULARY & CONCEPTS**

- renewable energy
- hydroelectric energy
- biomass
- geothermal energy
- biofuel

Remind students that Using Context Clues is a strategy to infer the meaning of an unfamiliar word. They can “read around” the word, or read a few sentences before and after it, to make meaning from the context. Remind them to look at the photographs, too.

Another strategy to try is Creating an Online Image Bank. Select several images related to biofuels from an Internet image site and show them to students as you present the word biofuel. Give students a chance to anchor the meaning of the word with the images. Follow the same steps for the words biomass, geothermal energy, hydroelectric energy, and renewable energy.

Point out other important words in the selection, such as turbines, refineries, and flammable. Create online image banks or have students use context clues to determine the meaning of these and any words that might be challenging or unfamiliar to students.
READ

The content goal for Power Up is for students to learn about different energy resources and some advantages and disadvantages of different energy options. Explain that “Renewable Energy Tour” describes examples of how renewable energy resources are being used around the world today. Point out the Read to find out statement at the top of page 10 in the student book: Read to find out about alternative energy resources.

Help students with the comprehension goal of accessing content by activating and connecting to background knowledge. Model by reading the text at the bottom of page 10 aloud. Then say: I know electricity is important to power things like lights and computers and that most of our electricity is generated by burning fossil fuels, like oil and coal. But I also know that some people use solar panels as a different way to generate electricity. I’ll keep these things in mind as I read about alternative energy resources, or energy that doesn’t come from fossil fuels, such as solar power and wind power.

Before students begin reading, say: As you read, think about what you already know about alternative energy resources. Use that information to help you understand new information that you read in this selection.

TURN & TALK

Revisit the Read to find out statement. Have students turn and talk about what they learned about alternative energy resources. (Possible response: People can use energy from the environment around them, such as wind, water, sun, and even organic waste, like potato peels, to produce electricity.) Have students turn and talk about the Check In question: Which of the alternative energy resources would work the best where you live? Why do you think so? (Answers will vary, but students should name an appropriate resource in their area and explain why it would be more effective than other options.)

Describe Text Structure

Remind students that text structure refers to the way information is organized in a text. Point out that this article has a problem/solution text structure. Model how to describe this structure using the Danish island of Samso on page 14 as an example. Say: The people of Samso had a problem—how to use their own energy resources and less fossil fuel. They decided that, since the island sits in a windy sea, the best solution was to use energy from wind turbines instead of fossil fuel. The people of Samso solved their energy problem by coming up with a solution that took advantage of the natural environment. Have student pairs scan the text for other examples of how communities have solved energy problems with solutions that take advantage of the natural environment.

WRITE & ASSESS

You may want to have students do a “quick write” to assess understanding. It’s always helpful to have students reflect on both the content and their thinking process.

- What are some advantages and disadvantages of different renewable energy resources?
- What surprised you about what you just read?
**Summary**  “Debating Wind Power” is an opinion piece that presents two sides of an argument over a proposed wind power project on Lāna‘i, an island of Hawai‘i.

**BUILD BACKGROUND FOR THE GENRE**

Ask students to describe what they expect to read in an opinion piece. Have them turn and talk to share their ideas. Tell them that “Debating Wind Power” is an opinion piece with the following elements:

- The writer presents facts about a topic in an organized way and states an opinion.
- Reasons, evidence, or personal experiences support the opinion.
- The piece includes both pro and con sides of an issue.

**BUILD VOCABULARY & CONCEPTS**

- renewable energy

Remind students that **Using Context Clues** is a strategy to infer the meaning of an unfamiliar word. They can “read around” the word, or read a few sentences before and after it, to make meaning from the context. Remind them to look at the photographs, too.

Another strategy to try is **Becoming Wordkeepers**. Explain that a wordkeeper is in charge of knowing a word’s meaning, spelling, and part of speech. But remind students that the meaning of the word is the most important thing to remember. Write the term **renewable energy** and its part of speech on a sticky note and ask if anyone knows its meaning. Jot the meaning on the back of the note and invite a student to be the wordkeeper. If no one knows the term, ask a volunteer to learn it and be the wordkeeper. Other students can ask the wordkeeper if they forget its meaning or spelling.

Point out other important words in the selection, such as **turbines**, **endanger**, and **migration**. Designate wordkeepers for these and any words or terms that might be unfamiliar to students.
READ

The content goal for Power Up is for students to learn about different energy resources and some advantages and disadvantages of different energy options. Explain that “Debating Wind Power” describes two different viewpoints on a planned wind power project on the island of Lāna‘i. Point out the Read to find out statement at the top of page 22 in the student book: Read to find out about a wind farm controversy.

Help students with the comprehension goal of accessing content by summarizing and synthesizing. Model by reading page 22 aloud. Then say: I know there are a lot of benefits to wind power, but it says here that some of the people living on Lāna‘i are against it. I wonder why? Maybe there are disadvantages that I don’t know about. As I’m reading, I can synthesize my previous knowledge with new information and decide which opinion I think is more convincing. Maybe I will feel differently about wind power by the end of this article!

Before students begin reading, say: As you read, think about the ideas in the text and connect them to what you already know about wind power. Put all those ideas together to help you summarize what you read.

TURN & TALK

Revisit the Read to find out statement. Have students turn and talk about the advantages and disadvantages of wind farms. (Possible response: Wind farms don’t cause pollution, but they could endanger wildlife.) To check understanding, have students turn and talk about the Check In question: Which opinion piece is more persuasive? Explain why you think so. (Answers will vary, but students should identify which piece they find more convincing and give details to support their choice.)

Summarize Explain that summarizing can help readers understand the most important ideas and deepen their understanding. Tell students that an author might use signal words like first and second to arrange the main points, which makes it easier for the reader to summarize their argument. Model by using pages 24 and 25. Say: The first paragraph makes it clear what the author’s overall opinion is—she thinks the wind farm is a good idea. After that she explains her reasons, which I can summarize in a numbered list by looking at the words first, second, and so on. Split up student pairs into two groups, on the pro- and con sides, and have them make their own list of the main points the author makes.

Identify Points of View Explain that the opinion an author gives in a persuasive piece can be influenced by the author’s point of view, or perspective. To illustrate this, read the first three paragraphs on page 26, then say: The first paragraph tells me the author thinks turbines are a bad idea for the people of Lāna‘i. The author goes on to describe how a wind farm could hurt local wildlife and mostly benefits people living on a different island. It’s clear that the author is thinking from the point of view of the people and animals that live on Lāna‘i. Have students read pages 24 and 25 and contrast the point of view in this pro section with the opinion in the con section on pages 26 and 27. (Possible response: In the pro section, the author has a general perspective, describing ways wind power is good for people overall. In the con section, the author has a more local perspective.)

Explain Author’s Reasoning Tell students that in opinion pieces, authors use relevant facts and logical, clear reasoning to persuade readers. Ask student pairs to re-read the pro and con opinions and determine which one they agree with, providing examples of where they think the author used strong or weak reasoning.

WRITE & ASSESS

You may want to have students do a “quick write” to assess understanding. It’s always helpful to have students reflect on both the content and their thinking process.

• What are some advantages and disadvantages of wind power?
• What connections do you have to your reading?
Summary  "A Fuel of the Future" is a science article about the advantages and disadvantages of using hydrogen as a source of fuel for vehicles. It also gives examples of how hydrogen fuel cells are being used now as well as how they may be used in the future.

BUILD BACKGROUND FOR THE GENRE

Ask students what they expect to see and read in a science article. Then tell them that "A Fuel of the Future" is a science article with the following elements:

- It uses facts, details, examples, and evidence to convey information about a science topic.
- Ideas and concepts are explained by pointing out problem/solution relationships.
- The text is organized using headings and has specialized vocabulary.

BUILD VOCABULARY AND CONCEPTS

- fuel cells
- renewable energy

Remind students that Using Context Clues is a strategy to infer the meaning of an unfamiliar word. They can “read around” the word, or read a few sentences before and after it, to make meaning from the context. Remind them to look at the photographs, too.

Another strategy to try is Using Background Knowledge. Ask students to turn and talk about what they think the term fuel cells means. Then have them read the term in context. Foster a collaborative discussion about the term and allow students to co-construct the meaning of the term as their ideas emerge. Follow the same steps with the term renewable energy.

Point out other important words and terms in the selection, such as hovercraft and water vapor, for which students may be able to use their background knowledge or context clues to determine meaning.
READ

The content goal for Power Up is for students to learn about different energy resources and some advantages and disadvantages of different energy options. Explain that "A Fuel of the Future" tells how hydrogen may be used to fuel vehicles in the future. Point out the Read to find out statement at the top of page 28 in the student book: Read to find out about hydrogen-fueled vehicles.

Help students with the comprehension goal of accessing content by activating and connecting to background knowledge. Model by reading the captions on pages 28 and 29 aloud. Then say: I know that the gasoline that fuels most cars and buses comes from fossil fuels, which produce lots of pollution. I also know that using alternative energy sources like wind and solar power can produce electricity with much less pollution. I’ll keep these things in mind as I read about hydrogen-fueled vehicles.

Before students begin reading, say: As you read, think about what you already know about alternative energy. Use that information to help you understand new information that you read in this article. Be ready to revise your thinking based on new information.

TURN & TALK

Revisit the Read to find out statement. Have students turn and talk about what they learned about hydrogen-fueled vehicles. (Possible response: Hydrogen is a clean-burning fuel and is made using electricity. Some hydrogen-fueled vehicles are being tested on the road in Europe.) To check understanding, have students turn and talk about the Check In question: What are some of the advantages and disadvantages of using hydrogen as a fuel? (Possible response: By itself, hydrogen is a clean fuel that does not produce harmful pollution when used. But hydrogen fuel is made using electricity, and most electricity comes from burning fossil fuels, which does produce pollution.)

Explain Relationships and Interactions Tell students that considering how information in an article is related will help them understand what they read. Model for students as you point to the illustrations and read the captions on pages 28 and 29. Say: The pictures show two possible outcomes related to the use of hydrogen fuel. The future could be either cleaner or dirtier than it is now. How is this possible? How can the way we use the same type of fuel have different outcomes in the future? Have students refer to pages 28 and 29 as they turn and talk, using what they know about finding relationships between ideas to answer the question: How does the way hydrogen is made affect how clean it is? (Possible response: If electricity to make hydrogen is produced using renewable resources, using hydrogen vehicles will help decrease pollution. If electricity to make hydrogen is produced using fossil fuels, using hydrogen is still causing pollution in the environment.)

Describe Text Structure Tell students that text structure refers to how information in a text is organized and that identifying the structure of a text or part of a text can help them understand information. Point out that the text on pages 30 and 31 is structured to compare information about three vehicles. Model by reading the blue subheadings and saying: These subheadings help me compare the number of wheels on each vehicle. As I read on, I can find more information to compare, such as the type of surface the vehicles travel on. Have students turn and talk, using information under each subheading to compare the three vehicles. You might also ask which vehicle they think has the most exciting features, based on their comparison.

WRITE & ASSESS

You may want to have students do a “quick write” to assess understanding. It’s always helpful to have students reflect on both the content and their thinking process.

- What are some problems and solutions related to using hydrogen fuel for vehicles?
- What questions do you still have after reading?
READNG OBJECTIVES
• Use evidence from a text when explaining what the text says.
• Write or speak about the topic by using information from the four selections.

SCIENCE OBJECTIVES
• Describe*** advantages and disadvantages of different energy resources.
• Describe how different energy resources are used.

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS

CC.5.RInfo.3 Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.

CC.5.RInfo.6 Analyze multiple accounts of the same event or topic, noting important similarities and differences in the point of view they represent.

CC.5.RInfo.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.

A FRAMEWORK FOR K–12 SCIENCE EDUCATION

Core Idea ESS3: Earth and Human Activity
How do Earth’s surface processes and human activities affect each other?

Core Idea PS3: Energy
How is energy transferred and conserved?

CONTENT & COMPREHENSION GOALS

Foster a discussion about the selections in Power Up. Ask: In this book, what did you learn about different energy resources? (Possible responses are given in the chart. Students may have different information.)

<table>
<thead>
<tr>
<th>Resource</th>
<th>How It Is Used</th>
<th>Advantages and Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil</td>
<td>Pumped up from underground and burned as a fuel in cars and other vehicles; used to make plastics and artificial fibers</td>
<td>Convenient to use, but is a fossil fuel that creates lots of pollution</td>
</tr>
<tr>
<td>Coal</td>
<td>Mined from underground and burned to produce electricity</td>
<td>Abundant on Earth and inexpensive to burn, but is a fossil fuel that creates lots of pollution</td>
</tr>
<tr>
<td>Solar</td>
<td>Heats water to produce steam, turns turbines to generate electricity; generates electricity using solar cells</td>
<td>Renewable energy source, but only works well in sunny regions</td>
</tr>
<tr>
<td>Wind</td>
<td>Turns turbines to generate electricity</td>
<td>Renewable energy source, and turbines do not use much land, but people may find them ugly or noisy</td>
</tr>
</tbody>
</table>

The four selections in Power Up are one reference article, two science articles, and one opinion piece. Earth science concepts (renewable and nonrenewable energy resources) thread through the selections. Guide a discussion about these science concepts.

What makes these articles especially interesting to read, though, is the interdisciplinary context—real-life stories that include not only Earth science but physical science, geography, and history. After you explain what interdisciplinary means, have students turn and talk about the interdisciplinary nature of the selections. You might ask: How is reading Power Up different from reading a textbook about Earth’s energy resources? Also ask them to consider the differences in the ways the selections were written (such as genre, text structure, and point of view) and how the writing style helps them come alive.
Have students collaboratively answer the questions on page 32 as you move about the room and listen in to support and scaffold student conversations and clarify misconceptions.

1. What do you think connects the four pieces that you read in this book? What makes you think that? (Possible response: They all talk about different energy resources on Earth and how people use them. Each piece discusses renewable or nonrenewable resources and presents advantages and disadvantages of each energy source.)

2. Choose one fossil fuel and explain how it formed. (Possible response: Hundreds of millions of years ago, when single-celled animals died, their remains fell to the sea floor. Over time, they partly decomposed and were quickly buried under layers of sediment. Under the right pressure and temperature conditions, they turned into crude oil and natural gas.)

3. Use the information in the text to describe some of the pros and cons of each alternative energy resource in the second piece. (Possible response: Using hydroelectric power from moving water helps decrease pollution, but people may have to move when dams are built and flood the land. Wind farms can produce lots of energy without using much land, but the wind turbines only work when the wind is blowing. Biogas reduces waste by burning organic waste to produce electricity and create biofuel, but not all vehicles can run on biofuel produced from biomass. Solar power is another renewable resource that can be used to produce electricity, but solar panels do not work at night. Geothermal power is inexpensive and always available, but it gives off a smelly gas; some forms of geothermal energy can only be used where magma is close to Earth’s surface.)

4. In “Debating Wind Power,” what are the main reasons given for the wind farm? What are the main reasons given against the wind farm? (Possible response: The main reasons for the wind farm are that wind power is reliable and affordable, is a source of renewable energy that will not run out, and will lower electricity costs and that the construction of the wind farm will create jobs. The main reasons against the wind farm are that it would encourage people to use more electricity instead of less, that wind turbines will harm local wildlife and an important archaeological site, and that the wind farm will not bring permanent jobs to the community.)

5. Explain what is meant by the phrase “two possible futures” in the last piece. (Possible response: The environment of the future will have increased or decreased pollution depending on what type of energy sources people choose to use. Burning fossil fuels will increase pollution, even if they are used to produce other clean-burning fuels like hydrogen. Using more renewable energy resources will help decrease pollution.)

6. What do you still wonder about energy resources? What would be some good ways to find more information? (Answers will vary, but students should mention ideas and concepts related to the topic of energy resources that they would like to know more about and should describe a variety of references, such as books and magazine articles, reliable Internet sites, and talking with experts.)

DISCUSS

POWER UP | DISCUSS
Research & Share

In small groups or individually, offer students the chance to explore questions they have or ideas they still wonder about, based on their reading in Power Up. Use question 6 on the Discuss page of the student book as a springboard for student questions and ideas for further research.

EXPLORE

Encourage students to express their curiosity in their own way. The questions students have matter. You might have students talk with peers, write about what they wonder, or create drawings based on what they learned from reading the different selections in Power Up. Guide them to immerse themselves in resources related to what they are most interested in learning more about. They might ask questions or make statements about their interests, for example:

- What products that we use every day are made from oil?
- How are people using renewable resources in my area? Are there resources that are not being used that could be used in the future?
- Besides powering vehicles, how else could hydrogen fuel cells be used in a cleaner future?

GATHER INFORMATION

After students explore, they should arrive at a question that will drive their research. Students may want to read, listen to, and view information with their question in mind. Guide students to use resources, such as reliable sites on the Internet, science texts and articles, library books, and magazines, that address the question they posed. Collecting information may lead students to revise or narrow their question.

You may want students to follow a specific note taking system to keep track of their thinking and findings as they gather information. In addition to taking notes, ask students to make a list of their sources. You may want to model how to take notes by interacting with text and demonstrating how to summarize the most important information. Remind students that their question will drive their research and note taking.
ANALYZE & SYNTHESIZE

Guide students to carefully and thoughtfully review their notes to determine the big ideas related to their question. As students prepare to use the information they’ve gathered to formulate an answer to their question, support them as they analyze and synthesize. Be sure they do the following:

• Revise any misconceptions.
• Notice any incongruities in their information.
• Evaluate all the various pieces of information.
• Pull together the most pertinent information that addresses their question.

While analyzing and synthesizing their research, students may realize that the more they learn, the more they wonder. To help focus their thinking, students may want to talk with classmates or write in a research notebook. Remind them that just as in real-world scientific research, there may not be a final answer to the question they posed.

SHARE

When students share their research, they become teachers, consider how their ideas were shaped by the investigation, and pose new questions. Students may express their knowledge by writing, speaking, creating a visual piece, or taking action in the community. The best culminating projects are those with authentic purposes. For example, the student who is interested in learning about how people are using alternative energy resources in the local area may want to research or visit a site that uses renewable energy in or near his or her hometown. The student may want to use pictures or diagrams to help give a presentation explaining how the renewable energy resource is converted into electrical energy and how it is used.

When students are given time to gather information about a topic that interests them, they find unique and individual ways to share what they learned. Some options you can suggest might include the following:

• An eBook with photos and text to share with other students who are building background on the topic of renewable and nonrenewable resources
• A slide presentation that shows advantages and disadvantages of renewable and nonrenewable resources
• A public awareness campaign to educate people on the importance of using renewable resources to decrease pollution
## Grade 5 Common Core State Standards for English Language Arts and A Framework for K–12 Science Education correlated to National Geographic Ladders Science

### Common Core State Standards for English Language Arts, Grade 5

#### Reading Standards for Informational Text

<table>
<thead>
<tr>
<th>Key Ideas and Details</th>
<th>Power Up Teacher’s Guide</th>
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<tbody>
<tr>
<td>1. Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.</td>
<td></td>
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<tr>
<td>2. Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.</td>
<td>Pages 7-8, 11-12</td>
</tr>
<tr>
<td>3. Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.</td>
<td>Pages 7-10, 13-16</td>
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#### Craft and Structure

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<tr>
<td>4. Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area.</td>
<td></td>
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<tr>
<td>5. Compare and contrast the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in two or more texts.</td>
<td>Pages 9-10, 13-14</td>
</tr>
<tr>
<td>6. Analyze multiple accounts of the same event or topic, noting important similarities and differences in the points of view they represent.</td>
<td>Pages 11-16</td>
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#### Integration of Knowledge and Ideas

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<td>7. Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.</td>
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<tr>
<td>8. Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s).</td>
<td>Pages 11-12</td>
</tr>
<tr>
<td>9. Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.</td>
<td>Pages 15-16</td>
</tr>
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#### Range of Reading and Level of Text Complexity

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<tr>
<td>10. By the end of the year, read and comprehend informational texts, including history/social studies, science, and technical texts, at the high end of the grades 4–5 text complexity band independently and proficiently.</td>
<td>If the entire NG Ladders Science grade 5 program is used throughout the year, students will have had exposure to multiple genres, multiple levels, and appropriate scaffolding.</td>
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### Writing Standards

#### Text Types and Purposes

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<tr>
<td>1. Write opinion pieces on topics or texts, supporting a point of view with reasons and information.</td>
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<tr>
<td>2. Write informative/explanatory texts to examine a topic and convey ideas and information clearly.</td>
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<tr>
<td>3. Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.</td>
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*(cont. on p. 20)*
### Production and Distribution of Writing

4. Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

5. With guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.

6. With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of two pages in a single sitting.

### Research to Build and Present Knowledge

7. Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

8. Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

### Range of Writing

10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

### A Framework for K–12 Science Education

**Core Idea PS3: Energy**
*How is energy transferred and conserved?*

**Core Idea ESS3: Earth and Human Activity**
*How do Earth's surface processes and human activities affect each other?*

**Power Up Teacher’s Guide**

Pages 4-10, 13-16

Pages 4-16
biofuel  (noun) any fuel made from plant material or animal waste

biomass  (noun) plant material and animal waste used as fuel

fuel cell  (noun) a battery-like device that uses a fuel, such as hydrogen, to produce electricity

geothermal energy  (noun) heat energy from within Earth

hydroelectric energy  (noun) electricity produced by the energy in moving water

peat  (noun) a spongy organic material that formed from decayed plants and may be burned as fuel

renewable energy  (noun) energy produced with resources, such as sunlight and wind, that are continually replaced and will not run out

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ISBN: 978-12853-5997-7

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