

Lessons 23–24

Renewable and Nonrenewable Energy Resource Use

Prepare

In Lessons 21 and 22, students discovered that dams can cause changes to the environment. Now, in Lesson 23, they explore why people build dams and learn that hydroelectric dams generate electricity. In Lesson 24, students compare a variety of energy resources, including hydroelectric power, solar power, and fossil fuels. They interpret information from multiple texts to differentiate between renewable and nonrenewable energy resources and describe the effects of using each resource.

Student Learning

Knowledge Statement

The environment is impacted by human use of energy resources.

Concept 4: Human Interactions with Earth

Focus Question

How do humans interact with Earth's features and processes?

Phenomenon Question

Why do people build dams on the Colorado River?

Objectives

- Lesson 23: Interpret information to determine uses of dams.
- Lesson 24: Describe how the use of renewable and nonrenewable energy resources impacts the environment.

Texas Essential Knowledge and Skills Addressed

- 4.2D **Analyze data and interpret patterns to construct reasonable explanations from data that can be observed and measured.** (Addressed)
- 4.7C **Identify and classify Earth’s renewable resources, including air, plants, air, water, and animals, and nonrenewable resources, including coal, oil, and natural gas, and the importance of conservation.** (Addressed)

English Language Proficiency Standards Addressed

- 2E Use visual, contextual, and linguistic support to enhance and confirm understanding of increasingly complex and elaborated spoken language.
- 4G Demonstrate comprehension of increasingly complex English by participating in shared reading, retelling or summarizing material, responding to questions, and taking notes commensurate with content area and grade level needs.
- 5G Narrate, describe, and explain with increasing specificity and detail to fulfill content area writing needs as more English is acquired.



Materials

		Lesson 23	Lesson 24
Student	Science Logbook (Lesson 23 Activity Guides A, B, and C)	●	
	Science Logbook (Lesson 24 Activity Guides A, B, and C)		●
Teacher	Additional Theodore Roosevelt Dam Photographs (Lesson 23 Resource A)	●	
	Excerpts from “The Hoover Dam: Controlling Water in the West” (Adapted) (Lusted 2016) (Lesson 23 Resource B)	●	
	Driving question board	●	●
	Anchor chart		●
Preparation	Secure texts (see Lesson 24 Resource) or open free educator account to access Epic! digital texts (http://phdsci.link/1007).		●

Lesson 24

Objective: Describe how the use of renewable and nonrenewable energy resources impacts the environment.

Launch 5 minutes

Ask students to consider what they learned about hydroelectric power in the previous lesson.

Ask students whether they think they now have an answer to the Phenomenon Question **Why do people build dams on the Colorado River?** Display the driving question board for students to refer to as they determine whether enough evidence has been gathered to support their thinking, or whether there may be another aspect they have not yet considered.

Ask students whether they have thought of any other possible energy sources the people living in the states identified in the previous lesson could use to get the rest of the energy they need. As students brainstorm additional ideas, record the ideas in a visible place.

Sample student responses:

- *Wind power*
- *Solar power*
- *Power plants*

Tell students that in this lesson they will read about other types of energy sources.

Agenda

Launch (5 minutes)

Learn (38 minutes)

- Read about Energy Resources (10 minutes)
- Categorize Energy Resources (10 minutes)
- Discuss Similarities and Differences among Energy Resources (10 minutes)
- Conceptual Checkpoint (8 minutes)

Land (2 minutes)

Learn 38 minutes

Read about Energy Resources 10 minutes

Explain that each student will read about an energy resource. Later, they will share their knowledge of that resource with other students in a Jigsaw discussion. 



English Language Development

As in most class discussions, allow students to consider each question and develop responses individually or with peers before whole-class sharing. This support may be particularly beneficial to English learners. For example, after posing the questions about where resources come from and what their effects are, invite students to share responses in pairs through a collaborative conversation routine, such as Think–Pair–Share.

Show students the text excerpts for five resource topics: fossil fuels, coal, oil/natural gas, solar, and hydroelectric power. (See Lesson 24 Resource for texts and page assignments.) While showing the excerpts from *Finding Out about Coal, Oil, and Natural Gas* (Doeden 2015a), clarify that coal, oil, and natural gas are all types of fossil fuels.

Assign students to one of the five topics. Students should read the specified excerpt of the text about that topic.  As they read, students should take notes on two index cards in response to the following questions: Where does the resource come from (source)? What are the effects of using the resource (effects)? 



Teacher Note

In the Jigsaw protocol, students study one section of a text or task and then share with students who studied other sections. This technique gives students access to the knowledge in the full text without requiring them to read the full text closely. It also encourages collaborative learning.



Content Area Connection: English

As students read text excerpts, they can apply strategies for understanding complex informational texts. For example, students can read the assigned section once and note what they notice and wonder, including unknown words. Then they can reread to determine the section's main idea and supporting key details and write notes on a Boxes and Bullets chart. Finally, they can reread and take notes on their index cards about the resource's source and effects.



Teacher Note

Ensure that students take notes about the resource's source and effects on separate index cards. Doing so will facilitate sorting the resources later in the lesson and help students see similarities and differences among the resources. Consider using a different color index card for each resource to reinforce relationships visually (5G).

Sample notes:

Topic		Source: Where does the resource come from?	Effects: What are the effects of using the resource?
Fossil Fuels	General	<ul style="list-style-type: none"> ▪ Dead plants and animals from millions of years ago formed peat ▪ Peat turned into coal, oil, or gas ▪ Buried underground 	<ul style="list-style-type: none"> ▪ Dig holes in the ground ▪ Make energy by burning the fuel
	Coal	<ul style="list-style-type: none"> ▪ Underground, either near surface or very deep 	<ul style="list-style-type: none"> ▪ Dig holes or tunnels underground ▪ Make energy by burning the fuel
	Oil and Natural Gas	<ul style="list-style-type: none"> ▪ Underground deposits 	<ul style="list-style-type: none"> ▪ Drill holes in the ground ▪ Take shale rocks out of ground ▪ Break shale rocks underground ▪ Make energy by burning the fuel
Hydroelectric Power		<ul style="list-style-type: none"> ▪ Moving water ▪ Dams block a river to make a reservoir 	<ul style="list-style-type: none"> ▪ People can use electricity ▪ Reservoir changes how a river flows ▪ Problems for wildlife
Solar		<ul style="list-style-type: none"> ▪ Sunlight 	<ul style="list-style-type: none"> ▪ Have heat and electricity to use ▪ Spend money on materials ▪ Cover large surfaces with solar panels

Categorize Energy Resources 10 minutes

When students complete their reading notes, regroup students for a Jigsaw discussion. Each small group should include one member representing each resource.

Students should describe their resource topic to peers, including details about its source and effects. As students share, others can ask questions or compare the resources. Students should record similarities and differences among resources in their Science Logbook (Lesson 24 Activity Guide A).

Next, ask students to categorize the resources based on similarities and differences. Students can sort their index cards into groups to develop categories. Once categorized, instruct students to label each category and record the lists in their Science Logbooks (Lesson 24 Activity Guide A). Students should repeat this categorization process at least two more times.

Sample categorizations:

<u>From the Ground (Fossil Fuels)</u>		<u>From Sun</u>	<u>From Water</u>
<ul style="list-style-type: none"> ▪ Coal ▪ Oil ▪ Natural gas 		<ul style="list-style-type: none"> ▪ Solar 	<ul style="list-style-type: none"> ▪ Hydroelectric power
<u>Solid</u>	<u>Liquid</u>	<u>Gas</u>	<u>Not Sure</u>
<ul style="list-style-type: none"> ▪ Coal 	<ul style="list-style-type: none"> ▪ Oil ▪ Hydroelectric power (water) 	<ul style="list-style-type: none"> ▪ Natural gas 	<ul style="list-style-type: none"> ▪ Solar (sunlight)
<u>Will Run Out (Fossil Fuels)</u>		<u>Won't Run Out</u>	
<ul style="list-style-type: none"> ▪ Coal ▪ Oil ▪ Natural gas 		<ul style="list-style-type: none"> ▪ Solar ▪ Hydroelectric power 	
<u>Changes Land</u>		<u>Changes Rivers</u>	
<ul style="list-style-type: none"> ▪ Fossil fuels (coal, oil, natural gas) ▪ Solar ▪ Hydroelectric power 		<ul style="list-style-type: none"> ▪ Hydroelectric power 	

Discuss Similarities and Differences among Energy Resources 10 minutes

Ask students to share their categories with the class. Facilitate a discussion to highlight the difference between renewable and nonrenewable resources. As needed, ask questions to elicit students' thoughts.



English Language Development

The terms *renewable resource* and *nonrenewable resource* are used repeatedly in this module and subsequent modules. Introduce these terms explicitly. It may be useful to break the words into parts, explaining that *non-* means unable to and *renew* means to use again.

► How did fossil fuels form?

- *Fossil fuels come from plants and animals that lived millions of years ago.*
- *The dead plants and animals were buried underground. They slowly turned into coal, oil, or natural gas.*
- *It sounds like how rock layers form from the sediment in an environment.*

► How are fossil fuels different from solar and hydroelectric power?

- *Fossil fuels will run out if we keep using them. It took millions of years for them to form.*
- *Using solar panels doesn't change how much the sun shines.*
- *Building a dam on a river can slow down the water, but I don't think it makes the water go away.*

Building on students' thoughts, introduce the terms *renewable* and *nonrenewable*. If a resource may run out over time, or it does not have an unlimited supply, scientists classify it as a **nonrenewable resource**. If a resource will not run out over time, or it does have an unlimited supply, scientists classify it as a **renewable resource**.  Students should group their index cards into renewable and nonrenewable resources then record those categories in their Science Logbook (Lesson 24 Activity Guide B).



Content Area Connection: English

Use the words *renewable* and *nonrenewable* to explore the prefixes *re-*, which often means “again” or “back,” and *non-*, which often means “not.” Studying morphology deepens students' understanding of words and increases their ability to determine the meaning of unknown words. Break down *renewable* into *re-*, *new*, and *-able*, and discuss how each part relates to the word's meaning. Have students brainstorm other words that start with *re-*, such as *refresh*, *restore*, and *repair*, and compare the meanings of those words with *renew*. Challenge students to create sentences using forms of *renew* in both scientific and everyday contexts.



Teacher Note

As students compare renewable and nonrenewable sources of energy, encourage them to think about the advantages and disadvantages of each. For example, solar energy is unlimited, but the amount that can be harnessed at a given time varies with the weather or the seasons. Encourage students to research how these factors affect the energy resources used by their town, state, or country.

Next, ask students how all the resources are similar. If needed, follow up with more specific questions.

► **Why do people use each resource?**

- *All the resources are used for electricity. We can do a lot with electricity, like power lights and machines.*
- *Some of the resources can be used to heat buildings when it's cold.*
- *People use energy from the resources to do things.*

► **How does the use of each resource affect the environment?**

- *Hydroelectric dams block river flow, which can hurt animals that live near the river.*
- *Solar panels take up a lot of space. That could change life for plants and animals that live near them.*
- *Fossil fuels come out of the ground. It might be hard for plants and animals to live in an area like that.*
- *I have heard about pollution from oil, gas, and coal.*

During the discussion, highlight student responses that include the ideas that all the natural resources described cause some changes in the environment and are used to generate energy. As students share, paraphrase their ideas into statements and add them to the anchor chart.

Sample anchor chart:

Earth Features
<p>Rock Layers</p> <ul style="list-style-type: none">• <i>Fossils in the rock layers provide evidence of past environments, revealing changes over time.</i>• <i>The oldest layers are at the bottom, and the youngest layers are at the top.</i>
<p>Weathering</p> <ul style="list-style-type: none">• <i>Weathering is a natural process that breaks rock into smaller pieces.</i>• <i>Natural materials, including moving water, ice, wind, and plants, cause weathering.</i>

Erosion

- Erosion is the process of moving weathered rock from one place to another. It can occur quickly or slowly.
 - Wind, water (both solid and liquid), and gravity are causes of erosion.
 - The rate of erosion is how quickly or slowly erosion occurs.
- The weathered rock that is moved by wind, water, or ice is called sediment.

Patterns in Earth's Processes and Features

- Natural processes shape Earth's features.
- Some of Earth's processes and features occur in patterns.
 - Mountain ranges (feature) often occur along the edges and in the middle of continents.
 - Earthquakes (process) often occur in bands along the edges of continents and in the middle of oceans.
 - Volcanoes (feature) often occur in bands along the edges of continents and in the middle of oceans.

Human Interactions with Earth's Features

- Humans use natural resources for energy.
- Resource use impacts the environment.
- Some resources are renewable; they will not run out. Some resources are nonrenewable; they will run out.

Have students respond to the following question in their Science Logbook (Lesson 24 Activity Guide B).

► How are all of the resources similar?

- *All the resources are used for energy.*
- *Collecting and using the resources changes the environment.*

Conceptual Checkpoint 8 minutes

Tell students they will now complete a Conceptual Checkpoint to demonstrate their knowledge of the Concept 4 Focus Question: **How do humans interact with Earth's features and processes?**

Students should write their responses to the Conceptual Checkpoint in their Science Logbooks (Lesson 24 Activity Guide C).

- ▶ **Our school wants to reduce the nonrenewable energy resources we use to generate electricity. What resource could the school use instead? How could the school obtain the resource in a way that limits the impact on the environment?**

Sample student response:

- *Our school could reduce the nonrenewable energy resources used to generate electricity by placing solar panels on the roof of the school to get solar energy. Since we live where there is a lot of sunlight, there should be enough sunlight to give our school some electricity. Placing the solar panels on the roof means they won't be placed somewhere where plants or animals already live.*



Conceptual Checkpoint

This Conceptual Checkpoint assesses students' understanding of the Concept 4 Focus Question: **How do humans interact with Earth's features and processes?** Students should demonstrate understanding that humans change Earth's features by using natural resources for energy and fuel (to generate electricity).

Evidence

Look for evidence that all students

- identify at least one renewable resource that would be available in your area, and
- describe a method of obtaining the resource that has minimal impact on the environment.

Next Steps

If students do not recognize the environmental impacts humans can have on Earth, stimulate further conversation on the topic by presenting additional readings. (See Lesson 23 Resource A.)

Land

2 minutes

Revisit the driving question board and draw students' attention to each of the Focus Questions. Ask students to explain how their work throughout the module has led to an understanding of the Essential Question: **How did the Grand Canyon's features form?** Explain that students are ready to complete an End-of-Module Assessment as a summary of their new knowledge.

Optional Homework

Students can continue to research the energy sources they investigated in this lesson.