



# Research Unit

Teacher Guide

Grade 4

## Energy: Past, Present, and Future

English

Grade 4

Research Unit

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# **Energy:** Past, Present, and Future

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## **Teacher Guide**

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# Introduction

## ENERGY: PAST, PRESENT, AND FUTURE

This introduction includes the necessary background information to teach the *Energy: Past, Present, and Future* unit. This unit contains 15 daily lessons, each composed of a reading and writing segment and requiring a total of 90 minutes. Lesson 15 is devoted to celebrating student work and does not contain a reading segment.

The texts in this unit include a Read-Aloud and a collection of trade books. This text sequence follows a timeline of energy development. They begin with a look at the discovery of oil at the turn of the 19th century and move forward in time to include modern energy innovation stories across the world. In addition, the texts explore the variety of energy sources used today and invite the students to become empowered energy leaders of tomorrow.

## INSTRUCTIONAL MATERIALS

Along with this Teacher Guide, which includes answer keys and other Teacher Resources located in the back pages, you will need:

- activity pages for *Energy: Past, Present, and Future*
- research materials to investigate a variety of fuels, including fossil fuels and renewable fuels. (More details are available in Lesson 6, where you will first use these materials.)
- computer access for each student or art supplies, such as large format paper and coloring materials

You will also need a classroom copy of each of the following trade books, which are available at physical and online bookstores:

- *Buried Sunlight: How Fossil Fuels Have Changed the Earth* by Molly Bang and Penny Chisholm
- *Energy Island: How One Community Harnessed the Wind and Changed their World* by Allan Drummond
- *The Boy Who Harnessed the Wind: Picture Book Edition* by William Kamkwamba and Bryan Mealer

In addition to the trade books used in this unit, you will need access to copies of the following digital texts:

- ReadWorks Passage: “Clean Energy”
- ReadWorks Passage: “Houston Affects the Earth”
- ReadWorks Passage: “Energy for Life”



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## WHY ENERGY: PAST, PRESENT, AND FUTURE IS IMPORTANT

Students will become tomorrow's problem solvers in this study of energy in the United States. Analytical reading skills are developed by examining the challenges of early energy innovators. The students will then read about current energy practices, and young energy change makers across the world. Throughout the unit, students will conduct research into different sources of energy and present a proposal, putting them in the shoes of future energy innovators.

The students will use the knowledge sequence in this unit to:

- collaboratively analyze texts to identify causes-effect and problem-solution relationships,
- generate questions and conduct research about energy,
- write an opinion essay making their case for a fuel of the future,
- create energy proposals using primary and secondary resources.

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## WHAT STUDENTS HAVE ALREADY LEARNED

The following domains, and the specific core content that was targeted in those domains, are particularly relevant to the lessons in *Energy: Past, Present, and Future*. This background knowledge will enhance your students' understanding of the texts they will read:

**Kindergarten, Plants**

**Grade 1, The History of the Earth**

**Grade 4, Eureka! Student Inventor**

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## CORE CONTENT OBJECTIVES

The following Core Content Objectives are addressed in this domain:

- Identify main ideas and key details in the text.
- Identify cause/effect and problem/solution relationships in the text.
- Make and defend a claim using textual evidence.
- Make inferences in texts and draw conclusions.
- Identify and gather primary and secondary source information.
- Draft, revise, and publish an opinion essay.

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## WRITING

In the writing lessons, students will engage in a research and writing process to produce opinion essays and multimedia presentations. Students will use background knowledge from the readings to generate research questions that investigate the essential question “What are the fuels of the future?” Throughout the unit, students use the Internet and classroom resources to identify and gather information from a variety of sources. They will learn about paraphrasing and summarizing through note taking and work with primary sources as they interview classmates and family members. The culminating essay may be added to students’ writing portfolios to showcase student writing.

## CORE VOCABULARY FOR ENERGY: PAST, PRESENT, AND FUTURE

The following list contains all of the core vocabulary words in *Energy: Past, Present, and Future* in the forms in which they appear in the Read-Alouds, independent reading, and partner readings. In some instances, the words are included because they are integral to the knowledge building within a lesson. The inclusion of the words on this list does not mean that students are immediately expected to be able to use all of these words on their own. However, through repeated exposure throughout the lessons, they should acquire a good understanding of most of these words and begin to use some of them in conversation.

<p><b>Lesson 1</b></p> <ul style="list-style-type: none"> <li>carbon</li> <li>energy</li> <li>fuel</li> <li>oil</li> <li>oil well</li> <li>petroleum</li> <li>propellers</li> <li>valuable</li> </ul>	<p><b>Lesson 4</b></p> <ul style="list-style-type: none"> <li>demand</li> <li>contaminating</li> <li>barges</li> <li>modifying</li> <li>goods</li> <li>conveyor belt</li> <li>synthetic</li> </ul>	<p><b>Lesson 7</b></p> <ul style="list-style-type: none"> <li>currents</li> <li>transmitted</li> <li>friction</li> <li>gravitational</li> <li>converting</li> <li>harness</li> <li>generator</li> <li>turbines</li> <li>ebb and flow</li> <li>converting</li> <li>denser</li> <li>submerged</li> </ul>
<p><b>Lesson 2</b></p> <ul style="list-style-type: none"> <li>ancient</li> <li>bacteria</li> <li>carbon dioxide</li> <li>evolved</li> <li>fossil fuels</li> <li>oxygen</li> <li>photosynthesis</li> <li>sequence</li> </ul>	<p><b>Lesson 5</b></p> <ul style="list-style-type: none"> <li>renew</li> <li>abundant</li> <li>impermeable</li> <li>vertically</li> <li>horizontally</li> <li>fractured</li> <li>innovative</li> <li>fermentation</li> <li>biogas</li> <li>potential</li> </ul>	<p><b>Lesson 8</b></p> <ul style="list-style-type: none"> <li>visualize</li> <li>trenches</li> <li>derrick</li> <li>boiler</li> <li>rotary drill</li> <li>bit</li> <li>blunt</li> <li>debris</li> <li>buggies</li> </ul>
<p><b>Lesson 3</b></p> <ul style="list-style-type: none"> <li>decomposition</li> <li>depressions</li> <li>film</li> <li>extract</li> <li>deposit</li> <li>flammable</li> <li>excavations</li> <li>ambitious</li> <li>investor</li> <li>compressed</li> </ul>	<p><b>Lesson 6</b></p> <ul style="list-style-type: none"> <li>ultraviolet</li> <li>electrodes</li> <li>photovoltaic</li> <li>selenium</li> <li>solar power</li> <li>solar cell</li> <li>solar panels</li> <li>solar arrays</li> <li>power grid</li> <li>printed solar panels</li> <li>3D printer</li> <li>efficient</li> </ul>	<p><b>Lesson 9</b></p> <ul style="list-style-type: none"> <li>dependence</li> <li>generate</li> <li>nonrenewable</li> <li>renewable</li> </ul> <p><b>Lesson 10</b></p> <ul style="list-style-type: none"> <li>counterclaim</li> <li>defend</li> <li>support</li> </ul>
		<p><b>Lesson 11</b></p> <ul style="list-style-type: none"> <li>edit</li> <li>revise</li> </ul>



## 1

# Banana Bread and the Story of Oil

## PRIMARY FOCUS OF LESSON

### Core Connections

Students will identify inventions that are vital to modern conveniences in a group discussion. [SL.4.1c]

### Reading

Students will explain the connection between oil and innovation based on key details from the Read-Aloud. [RI.4.2]

### Writing

Students will recall information from their experiences to generate connections and seeds for research questions. [W.4.8]

## FORMATIVE ASSESSMENT

### Activity Page 1.5

**Think About It** Students answer the prompt “Name three important uses of energy in your daily life.” [W.4.8]

## LESSON AT A GLANCE

	Grouping	Time	Materials
<b>Core Connections (10 min.)</b>			
Making Connections	Whole Group	5 min.	<input type="checkbox"/> Activity Pages 1.1, 1.2
Introducing Oil	Whole Group	5 min.	
<b>Reading (35 min.)</b>			
Read-Aloud	Whole Group	15 min.	<input type="checkbox"/> KWL chart <input type="checkbox"/> enlarged projection of the text on Activity Page 1.3 <input type="checkbox"/> Image Cards 1A-1-9 <input type="checkbox"/> chart paper <input type="checkbox"/> markers
Revisiting the Text	Partners	10 min.	
Making Predictions	Whole Group	10 min.	
<b>Writing (45 min.)</b>			
Brainstorming Activity	Whole Group	10 min.	<input type="checkbox"/> Activity Pages 1.3, 1.4, 1.5 <input type="checkbox"/> chart paper <input type="checkbox"/> markers
Brainstorming in Groups	Small Group	10 min.	
Using a Sorting Organizer	Small Group	10 min.	
Responding to the Prompt	Independent	15 min.	

## ADVANCE PREPARATION

### Core Connections

- Prepare groups of two or three students to complete Activity Page 1.1.

### Reading

- Prepare an enlarged copy or projection of the Read-Aloud text on Activity Page 1.3.
- Prepare images of key vocabulary words for use with ELL students.
- Display a blank KWL chart on chart paper or a digital whiteboard.

Know	Wonder	Learn

### Writing

- Prepare a word bank with common fuel-run machines for ELL students' use with Activity Page 1.4.
- Group students purposefully, providing peer models as well as peers with similar needs. Some students may benefit from homogenous groupings with adult support, as needed.

### Universal Access

#### Reading

- Students following along on their copy may benefit from a visual aid, such as a straight edge, to assist with tracking on the page.
- Allow adequate thinking time for students to respond during the discussion. Post your guiding questions on the board and refer to them as you ask the questions.

#### Writing

- Provide access to a word processor with voice to text software or browser extension.

## CORE VOCABULARY

**carbon, n.** a naturally occurring chemical element found in living things

**energy, n.** power needed to run a machine

**n.** power needed for physical activity

**fuel, n.** a substance that can be burned as a source of energy

**n.** a substance, such as food, that is used to give the body energy

**v.** to supply power or energy

Example: fuel an argument

**petroleum, n.** liquid found inside the earth that is removed and processed to create different products such as fuels and plastics

**propellers, n.** a device with spinning blades that creates a force which moves something forward, often a boat or plane

**oil, n.** slippery liquid made from petroleum used for fuel

**oil well, n.** a shaft drilled into the ground to extract petroleum

**valuable, adj.** of high worth

**Vocabulary Chart for “Banana Bread and the Story of Oil”**

Vocabulary Type	Tier 3 Domain-Specific Words	Tier 2 General Academic Words
Core Vocabulary	petroleum carbon oil well oil	valuable
Multiple-Meaning Core Vocabulary Words	energy fuel	
Sayings and Phrases		



## Lesson 1: Banana Bread and the Story of Oil

## Core Connections



**Primary Focus:** Students will identify inventions that are vital to modern conveniences in a group discussion. [SL.4.1c]

### MAKING CONNECTIONS (5 MIN.)

- Explain that many everyday tasks are easier thanks to modern inventions. Display an enlarged chart, as seen on Activity Page 1.1.
- Show students the examples on their copy of the chart in their activity page. Allow students to write and ask a question they have about the categories on the chart: Communication, Health and Medicine, Food, and Transportation. In groups of two or three students, direct the students to complete the activity page.
- Bring the students back together and share the ideas they generated in their groups. Record these on the chart being displayed.
- Explain that together you will explore what powers these inventions later in the lesson.

### INTRODUCING OIL (5 MIN.)

- Introduce oil as a fuel that gives us energy.
- Direct students to Activity Page 1.2. Review the definitions and ask students to complete the exercise on the page.

#### Activity Page 1.1



#### Activity Page 1.2



## Lesson 1: Banana Bread and the Story of Oil

# Reading



**Primary Focus:** Students will explain the connection between oil and innovation based on key details from the Read-Aloud. [RI.4.2]

### READ-ALoud (15 MIN.)

- Remind students of the key words for the lesson (*oil, fuel, and energy*).
- Display the Read-Aloud and show students where these words appear in the text.
- Ask students to identify which of the words' definitions apply in the text.
- Display the KWL chart. Tell students that the class will fill this in throughout the unit. Today we will begin by filling out the Know column using existing knowledge and what is read in the text.
- Read the text to the students.
- As ideas are added to the chart, color code by key vocabulary word. For example, write all ideas related to oil in green, and ideas related to fuel and energy in two different colors.
- Stop at the marked points in the text to check for understanding through the discussion questions.

### “BANANA BREAD AND THE STORY OF OIL”



#### Show Image 1A-1: Banana Shopping

Suppose you're watching a cooking show you really love. There's a recipe for banana bread, a type of sweet bread. "Hmm," you think. "I'd like to try cooking that!"

So you and your grandmother get on the bus, and you go to the supermarket. All kinds of fruits are on sale there, including bananas.

You pick up a bunch, along with flour, butter, and eggs. Then you take the bus home, and you make your banana bread.

### Challenge

Ask students to prepare definitions of the additional bolded vocabulary in the text to be shared during the Read-Aloud.

### Support

When encountering key vocabulary in the text, prompt students to refer to the definitions on Activity Page 1.2 to promote comprehension.



### Show Image 1A-2: Banana Travels

What does baking banana bread have to do with the story of oil? Well, have you ever asked yourself where bananas come from? In much of the United States, the answer is: somewhere else! We grow a few bananas in the United States, but most of them come to us from Asia and South America. It's a long way from there

to here. If we didn't have boats that could make the trip fast enough, all the bananas would spoil, or become unhealthy to eat. There'd be no banana bread for anyone. *Why is the author discussing bananas in a story about oil? What kind of energy do bananas use to grow? (sun or solar)*



### Show Image 1A-3: Ship Diagram

To get the speed they need, the people who make boat engines use a special source of fuel. Fuel is any kind of material that releases energy when you burn it. (For example, when you make a campfire, the wood you burn is the campfire's fuel.) One kind of fuel in boat engines—and in many kinds of engines, in

fact!—is called oil. (There are other kinds of oils besides the kind we burn in engines, like olive oil or vegetable oil. The kind of oil in engines is based on a fluid called **petroleum**.) Engine oil is very easy to set on fire! When it burns inside an engine, it releases gas that pushes up and down on a part called a piston. When the piston pumps, it starts to turn the gears of the engine very fast. And those gears turn a boat's **propellers** fast enough to get the bananas to a port, where a truck drives them to your supermarket. *What do you think turns the wheels on the truck?*



### Show Image 1A-4: World Without Gas

Our world would be very different without oil. In the days before oil, it really was very different! People ate different foods, traveled less, and worked in different ways. Before oil, you might never meet anyone from outside your hometown, unless you made a very special effort. Now people travel the world. We know more about

one another than we ever did. And in many ways, that's because of oil. *Do you know anyone who comes from a different town, or a different city, or a different country? Are you someone who comes from one of those places?*



### Show Image 1A-5: Gasoline Pump

Oil is a big part of the story of our world. But what's the story of oil? Where did it come from? How did we come to start using it? Will we keep using it forever? And if not, what's going to come next?

In this unit, we'll answer some of these questions. We'll look at how far back the story of oil goes: all the way to prehistoric times and the age of the dinosaurs! Oil began with living beings, especially prehistoric animals and plants. Over time, these living creatures died and were sealed underground. There, their bodies broke down and were slowly transformed into the oil we burn. (One reason oil burns so well is that it's made up of **carbon**, a key part of the cells of all living organisms.)



### Show Image 1A-6: Spindletop

We'll also look at one of the most important discoveries of oil in modern times. That discovery happened in Texas with an **oil well**, or a hole dug in the ground to extract oil, called Spindletop, in a city called Beaumont. People had discovered oil before in many places around the world, but the Spindletop well was

just the start of a huge supply of oil coming from the United States. Oil was useful to many businesses for all the reasons we talked about, and that made it **valuable**, or something people wanted to pay a lot of money for. Soon, lots of oil was flowing out of Texas, and lots of money was flowing back into it.



### Show Image 1A-7: The Oil Industry

The oil business made Texas one of the richest states in the United States and created many jobs. Oil was important to the world economy, or the way goods and services are bought and sold around the world. Over time, the oil industry developed more technology and machines for oil extraction. The oil industry

also attracted many immigrants to the United States from countries like Cambodia, Vietnam, India, Pakistan, and Iran. *Could you retell some of the ways the United States was transformed by the oil business?*



### Show Image 1A-8: Scientists

That's all part of the story of oil. And the story is still being written: no one knows yet exactly how it's going to end! These days, scientists are also discovering lots of new kinds of energy sources, including renewable energy sources. Scientists are exploring how to use sources of renewable energy that will do everything oil

did, but without running out. We'll look at some of the ideas they've had. And then we'll each become a scientist and decide which of those ideas seems like the best choice for the start of the next story our society tells. *Can you think of other sources of energy that we might learn about? (wind, solar or sun, hydropower or water).*



### Show Image 1A-9: Looking to the Future

So listen carefully as we explore the story of energy! After all, one of you may be the person who writes the end of it.

## REVISITING THE TEXT (10 MIN.)

- Refer to the KWL chart you have prepared.
- Ask students what the main idea was in “Banana Bread and the Story of Oil.”
- Ask students to turn and talk to a neighbor about what they now know about oil, based on key details in the Read-Aloud. Ask students to share what their neighbor said.
- Encourage students to refer to the text when adding key details they heard in the Read-Aloud.
- Ask students to share a question they have about oil after listening to the text.
- Record student suggestions, continuing to utilize color-coding.

## MAKING PREDICTIONS (10 MIN.)

- Ask students, “Based on what we read today, what do you predict we will learn about in this unit?”
- These may be displayed on a chart paper or other classroom display for future reference.
- Introduce the culminating activity. Tell students that oil is one of several fuels in this unit. They will be conducting their own research about fuels that give us energy. At the end of the unit they will create a proposal sharing what they believe will be a fuel of the future. First, they will learn about the fuels of the past and today. Just as in the end of the story, the students will get to tell what comes next in the story of oil.



### Check for Understanding

Ask students to use a key vocabulary word in a sentence or restate the definition in their own words.



### Speaking and Listening Discussion

#### Entering/Emerging

Post images of key vocabulary as a pre-reading support. Phrase questions in a yes/no format during class discussion.

#### Transitioning/Expanding

Provide the following sentence starters as a pre-reading support:

I know that oil . . .

I predict we will learn . . .

#### Bridging

Preview key vocabulary prior to the lesson. Help the students make personal connections to the vocabulary to build contextual understanding.

## Lesson 1: Banana Bread and the Story of Oil

# Writing



**Primary Focus:** Students will recall information from their experiences to generate connections and seeds for research questions. [W.4.8]

### BRAINSTORMING ACTIVITY (10 MIN.)

- Remind students that the Read-Aloud text mentioned how engines in cars and boats are fueled by the energy created by oil.
- Show where this appears in the text using the enlarged class copy or by referring students to their own copies.
- Prompt students to think about other inventions in our everyday life that need fuel to run.
- Allow students to have a minute of thinking time, then turn and share with a neighbor.
- Record a few student answers on a large piece of chart paper or other display such as a digital white board. The display used should preserve the work for later reference. (*Responses may include cars or home appliances, such as refrigerators, lights, television, and toys. Any energy source is appropriate, including oil-based fuels, such as heating oil, gasoline and natural gas, batteries, solar power, or wind turbines.*)

### BRAINSTORMING IN GROUPS (10 MIN.)

- Transition students into their small groups.
- Have students continue to generate contributions in small groups. Student work may be added to the class chart by sharing out verbally following time to work or by placing them directly on the chart with sticky notes or another preferred method.

### Challenge

Ask students to categorize all of the contributions to the class chart. The students may add additional columns on a separate sheet of paper to accommodate additional categories due to the increased number of items to be sorted.

### Support

Supply the students with an example in each category of the sorting organizer as a model.

## USING A SORTING ORGANIZER (10 MIN.)

- Remaining in the small groups, direct students to Activity Page 1.4.
- Assist students in categorizing the contributions by the type of fuel used as the energy source for each.
- Conferences with individual groups as they finish brainstorming. Assist students with categorizing their ideas and labeling the columns of their sorting organizer. Useful labels include: fossil fuels (gasoline, heating oil, propane), batteries, sun, and wind.
- Direct students to sort their ideas using the columns' titles on their sorting organizer.
- Transfer categories generated in the groups to the class chart.

## RESPONDING TO THE PROMPT (15 MIN.)

- Direct students to answer the prompt "Name three important uses of energy in your daily life." on Activity Page 1.5. Remind students to use the work from their groups or the class chart for ideas. Collect the page when the students are finished.



### Check for Understanding

Ask students to use the key vocabulary words from "Banana Bread and the Story of Oil," *oil* and *fuel*, in a sentence and restate the definitions being used in their own words. Remind students that both *oil* and *fuel* have more than one meaning.

End Lesson

## Activity Page 1.4



### Speaking and Listening Discussion

#### Entering/Emerging

Ask the students if they agree or disagree with each idea as they are brainstormed rather than expecting additional contributions.

#### Transitioning/Expanding

Provide the following sentence starters for participating in small group discussion:

I think that . . .

I agree with you because . . .

I disagree with you because . . .

#### Bridging

Encourage the use of the key vocabulary words during group discussion.

## Activity Page 1.5





## 2

# Hidden Energy

## PRIMARY FOCUS OF LESSON

### Speaking and Listening

Students will listen to a review of the main idea from the previous lesson's text and explain key details using visual aids. [SL.4.2]

### Reading

Students will determine the main idea and key details of the text through guided note-taking. [RI.4.2]

### Writing

Students will recall relevant information from experiences or gather relevant information from print and digital sources, take notes and categorize information, and provide a list of sources. [W.4.8]

## FORMATIVE ASSESSMENT

### Activity Page 2.2

**Retell** Students will retell the key events in the creation of oil in a partner sequencing activity. [W.4.8]

## LESSON AT A GLANCE

	Grouping	Time	Materials
<b>Speaking and Listening (5 min.)</b>			
Making Connections from Lesson 1	Whole Group	5 min.	<ul style="list-style-type: none"> <li><input type="checkbox"/> class-generated KWL chart from Lesson 1</li> <li><input type="checkbox"/> class-generated Sorting Organizer chart from Lesson 1</li> </ul>
<b>Reading (25 min.)</b>			
Model Note-Taking	Whole Group	25 min.	<ul style="list-style-type: none"> <li><input type="checkbox"/> <i>Buried Sunlight: How Fossil Fuels Have Changed the Earth</i></li> <li><input type="checkbox"/> chart paper</li> <li><input type="checkbox"/> markers</li> <li><input type="checkbox"/> Activity Page 2.1</li> </ul>
<b>Writing (60 min.)</b>			
Guided Practice: Taking Notes	Small Group	35 min.	<ul style="list-style-type: none"> <li><input type="checkbox"/> model notes from the <i>Buried Sunlight</i> reading segment demonstration, created during the reading segment</li> <li><input type="checkbox"/> student access to pages 6–18 of <i>Buried Sunlight</i>; one copy for each group's assigned portion.</li> <li><input type="checkbox"/> enlarged version of the T-chart found on Activity Page 2.1, copied onto chart paper or reproduced in a digital display</li> <li><input type="checkbox"/> Activity Pages 2.1 and 2.2</li> </ul>
Writing with Transition Words	Whole Group	15 min.	
Arranging a Sequence	Partners	10 min.	<ul style="list-style-type: none"> <li><input type="checkbox"/> chart paper</li> <li><input type="checkbox"/> markers</li> <li><input type="checkbox"/> sentence strips for each student (index cards or large sticky notes may also be used)</li> </ul>

## ADVANCE PREPARATION

### Speaking and Listening

- Display the KWL chart and class Sorting Organizer from Lesson 1.

### Reading

- Prepare and display a piece of chart paper or digital whiteboard with a model T-chart, as seen on Activity Page 2.1.
- Post sentence starters for ELL students to use when contributing to the whole class note-taking demonstration.

### Writing

- Prepare small groups of three or four students.
- Divide pages 6–18 among the groups. Number of pages will vary depending on the number of student groups.
- Prepare to distribute a portion of the text for each group, depending on the size and needs of each group.
- Make *Buried Sunlight* or only the images from the book available to ELL students and their partners during the sequencing activity.
- Prepare to distribute sentence frames to ELL students as they begin group work.

### Universal Access

#### Reading

- Provide access to copies of the T-chart model, to assist with tracking and copying, as necessary.

#### Writing

- Provide access to a word processor to use with a digital version of the Activity Page 2.1 and Activity Page 2.2.

## CORE VOCABULARY

**photosynthesis, n.** the process in which plants convert light into energy and release oxygen

**fossil fuels, n.** natural fuels created from carbon stored in the remains of living things

**sequence, n.** an order or arrangement in which one thing follows another

**ancient, adj.** very old, from a long time ago

**carbon dioxide, n.** a gas created by burning fossil fuels that is also absorbed by plants

**oxygen, n.** gas found in the air and produced by plants during photosynthesis

**bacteria, n.** microscopic organisms that were some of the first to appear on Earth

**evolve, v.** to change over time from simple to more complex

**Vocabulary Chart for “Hidden Energy”**

Vocabulary Type	Tier 3 Domain-Specific Words	Tier 2 General Academic Words
Core Vocabulary	photosynthesis fossil fuels carbon dioxide oxygen bacteria	sequence ancient evolved
Multiple-Meaning Core Vocabulary Words		
Sayings and Phrases		

## Lesson 2: Hidden Energy

# Speaking and Listening



**Primary Focus:** Students will listen to a review of the main idea from the previous lesson's text and explain key details using visual aids. [SL.4.2]

## MAKING CONNECTIONS FROM LESSON 1 (5 MIN.)

- Display the whole class KWL chart and whole class Sorting Organizer from Lesson 1.
- Draw the students' attention to the whole class Sorting Organizer. Remind students that during the last class they worked together to think of ways oil is important in their daily lives. Ask students to name some of these ways using the chart as a memory jogger.
- Draw the students' attention to the KWL chart. Remind students that last class's reading taught them some information about oil and how it shapes communities. Ask students, "What are some things we know about oil from that story?" (Responses may include that oil comes from underground, engines run on oil, distant travel was made possible, workers from around the world come to work jobs in oil, etc.)
- Have students write a question they have about oil on the Wonder column of their KWL, and allow a few student volunteers to share their questions with the class.
- Tell the students that they will read more about oil today and add to the Know column of the KWL chart.

## Lesson 2: Hidden Energy

# Reading



**Primary Focus:** Students will determine the main idea and key details of the text through guided note-taking. [RI.4.2]

### MODEL NOTE-TAKING (25 MIN.)

- Draw the students' attention to the layout of Activity Page 2.1. Explain that this is called a T-chart and that T-charts have a column on the left for the main idea and a column on the right for details. It is called a T-chart because the lines make a T at the top. Explain to students that a main idea can be determined by identifying key ideas in the text.
- Draw the students' attention to the words already printed in the central idea column. Point to them on the enlarged copy of Activity Page 2.1 being displayed. Tell the students that some of the work has already been done for them: the main ideas are filled in.
- Explain to the students that they will be using T-charts to conduct research later in the unit. They will be in charge of their own research and will get to decide the key ideas for their notes. Today we will only practice gathering details.
- Display page 1 of *Buried Sunlight*. Read the text aloud.

“I am your sun, your golden star. Even from 93 million miles away, I warm your land, your seas, your air, and chase the darkness from your days. My energy gives light and life to your tiny Earth.”
- Ask the students what the key idea of the page is. (*Correct responses should include the word energy, the sun's energy or an equivalent.*)
- Ask the students to look for the key idea on their T-chart. When they find it, direct students to point to it on their paper and give a thumbs up. Ask a student to show where to place the correct answer, *energy* or *the Sun's energy*, on the model notes.

### Activity Page 2.1



## Challenge

Direct students to avoid using any direct quotations from the text. All sentences on Activity Page 2.1 should be paraphrased in students' own words.

## Support

Provide a copy of the assigned portion of *Buried Sunlight* that has been highlighted to assist in locating details and key words.

- Demonstrate how to find the relevant details in the text. Say, “The next thing I would do when taking notes is ask myself, ‘What details about the central idea do I see here?’ The main idea is energy, so I am looking for details about energy.”

- Model rereading the page to yourself aloud.

Say, “I think I see a detail here, where it says ‘My energy gives light and life.’ Would you agree that this detail matches my main idea? Give me a thumbs up or thumbs down. You can give me a thumb in the middle if you aren’t sure.”

Say, “At the start of the page it told me the narrator is the sun. I can also see that from this picture. So, I know ‘my energy’ means the sun’s energy. When I add this detail to my notes I will write *the sun* instead of *my*. This will help me remember where energy comes from when I look back at my notes.”

- Write “the sun gives light and life” in the details column of the chart paper prepared with a model T-chart. Ask the students to add this detail to their own T-charts on Activity Page 2.1 as well.
- Turn to pages 2–3 in *Buried Sunlight*. Read the text to the students.  
“Yes, living things—including YOU—need energy to stay alive and grow...”
- Ask the students if the main idea is still energy. Ask students to show their response with a thumbs up, down, or in the middle. Confirm that the central idea is still energy and that you will continue to write beside that main idea on the model T-chart.
- Ask students to turn to a neighbor and find a detail on this page that could be added to the notes. Pause for partners to discuss. Invite the students to share their partner’s response. Add these details to the class model.
- Turn to page 4–5 on the enlarged copy. Read the text to the students.  
“Most of it comes from coal...”
- Ask the students if the main idea is still energy. Ask students to show their response with a thumbs up, down, or in the middle. Confirm that the central idea is no longer about energy.
- Ask the students to point to the new main idea on their T-charts. Direct students to give a thumbs up when they think they have found the next central idea. Ask for a volunteer to share the new main idea (fossil fuels). Add this to the model T-chart.

- Ask students where fossil fuels come from. Correct responses should include ancient plants. Address any confusion about whether dinosaurs are a source of fossil fuels (*they are not but are used in the text as an example of ancient life*).
- Tell the students that you will reread these pages. They should listen for at least one detail about the new main idea, fossil fuels.
- Reread pages 2–3.
- Ask students to turn to a neighbor and find a detail on this page about fossil fuels. Pause for partners to discuss. Invite the students to share their partner's response. Add these details to the class model.



### Check for Understanding

Ask students to show their readiness to work with a group by giving a signal: thumb up = ready, thumb in the middle = ready but may need some help, thumb down = I am not ready. Take note of students who did not give a thumbs up and check on them as they work in their groups. At the end of the lesson, examine those students' work for misunderstanding related to note taking. Reteaching can take place in lesson seven when there are additional opportunities for practicing note taking.



### Speaking and Listening Discussion

#### **Entering/Emerging**

Preview the T-chart model 1:1 or in a small group before reading. Ask students to use a non-verbal cue to show if they agree when their classmates add a detail.

#### **Transitioning/Expanding**

Preview sentence starters before reading that students will use when responding during the whole class note-taking demonstration.

#### **Bridging**

Preview the words used for the main ideas on Activity Page 2.1. Provide a copy of the definitions for students to reference during the lesson.



## Lesson 2: Hidden Energy

# Writing



**Primary Focus:** Students will recall relevant information from experiences or gather relevant information from print and digital sources, take notes and categorize information, and provide a list of sources. [W.4.8]

### Challenge

Provide a blank T-chart during “Guided Practice: Taking Notes” and ask the students to find both the central idea and details of their assigned passage.

### Activity Page 2.2



### Support

Before beginning Activity Page 2.2, direct the students to label the transition words in the word bank with “beginning,” “middle,” and “end” as applicable.

### GUIDED PRACTICE: TAKING NOTES (35 MIN.)

- Tell the students that they will now continue to take notes in small groups.
- Assign a portion of *Buried Sunlight* pages 6–18 to each group.
- Direct students to read their assigned text together and add the relevant details to their T-chart notes on Activity Page 2.1.
- Provide time for groups to share their work after completion. This may be done verbally, using a jigsaw format, or by asking students to write their notes on the class model when ready to do so. Proofread notes before they are shared to avoid errors on the class model.

### WRITING WITH TRANSITION WORDS (15 MIN.)

- Tell the students that today’s story was about the steps it takes to turn the sun’s energy into energy people can use. One way to retell a list of steps is to use transition words. These words will be useful when writing the fuel of the future proposal. Explain that they are going to practice using transition words by retelling how the sun’s energy becomes fossil fuel.
- Ask students to turn to Activity Page 2.2.
- Direct the students’ attention to the word bank at the top of the page. Tell students that these are some common transition words that are used to tell the order in which something happens. Sequence is another word for order.

Sequence Transition Words			
first	third	then	last
second	next	finally	afterwards

- Ask the students which word to use for the first step. Direct students to point to that word on their activity page in the word bank.

- Ask students, “What is the first step to the sun’s energy becoming a fossil fuel?” First, tell students to turn to a neighbor and share an answer. Then, ask students to share with the class. (*Correct answers should include a reference to the sun shining on plants, plants storing sunlight, or photosynthesis.*)
- Using a think-aloud, refer to the model notes and tell the students, “I see in our class notes that the first step is plants storing the light from the sun using photosynthesis. Let’s record that on our papers using the transition word *first*.”
- Display the enlarged Activity Page 2.2 and write the sentence “First, plants store the light from the sun using photosynthesis.”
- Ask the students, “What transition words might we use for the middle of our sequence?” (*Correct responses include second, third, next, and then.*)
- Then ask the students what transition words might be used for the last step. (*Correct responses include finally, last, and afterwards.*)

### ARRANGING A SEQUENCE (10 MIN.)

- Direct students to complete Part 1 of Activity Page 2.2. When finished, direct the students to find a nearby partner and complete Part 2 of Activity Page 2.2. Remind the students to use the transition words and their new knowledge from *Buried Sunlight* to complete the exercise. When finished, ask the students to check their partner’s work and then hand in the completed page to you or a central location in the classroom.



#### Check for Understanding

Visit each small group as they work and ask students to share the key ideas and details they have identified and written on their charts. Ask each group to explain why they chose those details.

End Lesson



#### Writing

##### Using Transition Words

##### Entering/Emerging

Use picture clues from *Buried Sunlight* to accompany the sentences in the partner sequence activity. Ask the student’s partner to point to the illustrations that match the sequence sentences before the exchange.

##### Transitioning/Expanding

Provide sentence frames for group work.

##### Bridging

Distinguish the transition word bank word *then* from the word *than*. Explain that these words look and sound very similar but have different meanings and uses.

## 3

# A Discovery

## PRIMARY FOCUS OF LESSON

### Reading

Students will identify key events in the discovery and drilling of Spindletop using supporting text details. [RI.4.2]

### Writing

Students will make and defend opinion-based claims using supporting evidence from the reading as their reasons. [W.4.1c]

## FORMATIVE ASSESSMENT

### Activity Page 3.1

**Writing** Students will retell the events from the Read-Aloud “The Beginnings of Oil in the United States” including supporting text. [RI.4.2]

## LESSON AT A GLANCE

	Grouping	Time	Materials
<b>Reading (45 min.)</b>			
Close Reading	Small Group	15 min.	<ul style="list-style-type: none"> <li><input type="checkbox"/> students' access to the Read-Aloud text "The Beginnings of Oil in the United States"</li> <li><input type="checkbox"/> Activity Page 3.1</li> <li><input type="checkbox"/> students' responses to Activity Page 3.1</li> <li><input type="checkbox"/> Teacher Resources: Activity Page 3.1 Answer Choice Bank (optional)</li> </ul>
Presenting Activity Page 4.1	Small Group/ Whole Group	30 min.	<ul style="list-style-type: none"> <li><input type="checkbox"/> materials to create students' presentations:               <ul style="list-style-type: none"> <li>• computers with the capability of making a digital slide, or</li> <li>• poster board and markers</li> <li>• images from magazines, or</li> <li>• printed images from the Internet</li> </ul> </li> </ul>
<b>Writing (45 min.)</b>			
Writing and Defending a Claim	Independent	45 min.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Activity Page 3.2</li> </ul>

## ADVANCE PREPARATION

### Reading

- Prepare copies of the Read-Aloud “The Beginnings of Oil in the United States” for each student.
- Prepare and display an enlarged copy of Activity Page 3.2, without labels, and get markers or highlighters for annotating the model during the lesson. Locate the Opinion Essay Model (Labeled) to use as an answer key and to assist with instruction.
- Seat students so that a neighbor is accessible for Turn and Talk breaks.
- Obtain dictionaries (digital or printed) for vocabulary support.

### Writing

- Prepare a completed claim statement with key words removed and accompanying words bank for use by Entering/Emerging ELL students.
- Prepare a list of claim statements for use by Transitioning/Expanding ELL students.

### Universal Access

#### Reading

- Group students purposefully in heterogeneous or homogeneous groups, depending on students’ needs.
- Divide the reading into manageable parts. Direct students to read one part and answer the matching questions before moving on to the next part.
- If possible, make an audio recording of the text or scan digital copies for use with text-to-voice software.

#### Writing

- Seat students next to peers for support during turn and talk activities throughout the lesson.

## CORE VOCABULARY

**decomposition, v.** to break down into more basic parts

**depressions, n.** spots lower than the surrounding area

**film, n.** a very thin layer

**extract, v.** to pull out or remove

**deposit, n.** an accumulation of material in one place

**flammable, adj.** easily set on fire

**excavations, n.** careful or purposeful digging to uncover something

**ambitious, adj.** a strong desire to be successful

**investor, n.** someone who gives money in order to earn more money in the future

**compressed, v.** squeezed or pressed together

**Vocabulary Chart for “A Discovery”**

Vocabulary Type	Tier 3 Domain-Specific Words	Tier 2 General Academic Words
Core Vocabulary	decomposition depressions film extract deposit flammable excavations compressed	ambitious investor evidence claim
Multiple-Meaning Core Vocabulary Words		
Sayings and Phrases		

## Lesson 3: A Discovery

# Reading



**Primary Focus:** Students will identify key events in the discovery and drilling of Spindletop using supporting text details. [RI.4.2]

### CLOSE READING (15 MIN.)

- Assign students to groups of three or four. Direct students to read “The Beginnings of Oil in the United States” and answer the accompanying comprehension questions on Activity Page 3.1. Explain that, for the timeline at the bottom of the page, they may add more events to the timeline than there are printed marks. Students may also choose to complete this on a separate sheet to provide more room. Review with students how to read and use a timeline, as needed.
- When students have completed their work, tell them to hand it in to you or at a central location in the classroom.

### PRESENTING ACTIVITY PAGE 4.1 (30 MIN.)

- Assign each group a portion of the questions to present to the class. Make sure all questions have been assigned to a group.
- Distribute materials to create a presentation sharing the groups’ assigned questions. Presentations should include both text and images. Encourage students to create their own images (drawing or collage) based on their visualization of the chapter and supporting text evidence.
- While students work, circulate and monitor the content of their presentations to ensure accurate responses will be shared.
- After the groups have created their presentations, give each group a turn to present their work. Prompt the group that is sharing to include the text evidence they used to support the images in the presentation.
- After each presentation, encourage students in the audience to ask clarifying questions.

### Challenge

Assign the additional critical thinking question to accompany Activity Page 3.1, “What problems were solved by the discovery of large amounts of oil?” to inform their diagram.

### Support

Indicate to students where in the text they can find the information to answer their assigned questions, as seen in the answer key.

### Activity Page 3.1



## THE BEGINNINGS OF OIL IN THE UNITED STATES



### Show Image 3A-1: The First Oil Well

Hello. I'm Professor Pietro Leo and I'm going to tell you about an incredible discovery that changed history: a gigantic black gush that came out of the depths of the earth.

### The Formation of Oil

Today we know that oil was formed from sea plants and animals that lived millions of years ago. When these living creatures died, they sank to the bottom of the oceans. Over the years, their remains were buried under multiple layers of rocks and sand. The **decomposition** of these remains raised the temperature of the place where they were buried. The high temperatures, combined with the weight of the countless layers that accumulated, caused a chemical reaction that turned the remains into oil. So when the ancient seas dried up, the oil was trapped under tons of earth at great depths.

However, the strange oily liquid seeped through rocks and sand to the earth's surface in small quantities. Sometimes it accumulated in **depressions** in the ground. Other times it floated as an oily **film** on the water of lakes and streams.

### Oil in History

Over time, people around the world discovered different ways to use the oil that appeared on the surface of Earth. For example, the ancient Egyptians used it to make their mummies. Centuries later, medieval knights used oil to shine their metal armor. Native Americans used it in the preparation of skin ointments. Later, oil proved useful for sealing cracks in wooden boats. It was also used to grease the wheels of buggies and it was even burned in lamps for light. There was no doubt that oil was very useful. However, until the 19th century, no one knew how to **extract** it from underground.

Lighting was one of the main uses that oil seemed to offer. In the 19th century, the main product used by Americans to light their lamps was whale oil. Gradually, whales became scarce and, consequently, their oil became more and more expensive. As a result, many businesspeople began to think about obtaining oil in larger quantities.



Samuel Kier was an American chemist who owned a salt **deposit** in Titusville, Pennsylvania. One of the nearby streams was leaking oil, which made salt production difficult. Kier decided to study the strange oily and **flammable** compound. After several experiments, he succeeded in refining oil into kerosene, a material that could be used to light lamps without the smoke and odor produced by crude oil. Upon seeing the usefulness and economic potential of the strange black liquid, a businessman named George Bisell partnered with others to found an oil company.

### **Sprouting Oil**

Bisell needed men of action to investigate the sprouting crude oil that was very common in Pennsylvania. He met Edwin Drake, who knew nothing about mining or geology but had a great ability to handle all kinds of tools, possessed a very stubborn character, and liked challenges. Bisell didn't think twice: Drake was the perfect candidate.

Drake began to work in Titusville in early 1858. At first he made small **excavations** in the form of trenches. After several months without results, Drake realized that he had to think of a more **ambitious** project. In mid-1858, he planned to drill a well several meters deep, similar to those made to extract salt. He built a wooden derrick and bought a tool to strike the rock, which was powered by a steam machine. The rotary drill had not been created yet, and his men worked for almost a year with no results. Bisell and his partners decided to stop funding the project. But Drake didn't want to give up. So, with money from his friends and a loan, he kept working to fulfill his dream. No one believed he could make it. But Drake didn't pay attention to the doubts or ridicule of others and continued to work tirelessly.

In August 1859, when the well was 69 feet deep, the drilling crew encountered a strange crack. The next morning, on August 27, Drake and his workers smelled the unmistakable odor of crude oil. They had found the first oil well in history!

### **After the Discovery**

The discovery attracted countless businesspeople who dug hundreds of wells in Pennsylvania, Ohio, West Virginia, and Indiana. Most of the oil was refined into kerosene. While oil was refined, gasoline also appeared in small quantities. But gasoline couldn't be used for lighting because it produced explosions. (No one yet imagined the use it would have many years later.) As a result, most of the gasoline was dumped into lakes and streams near the refineries.

## Spindletop Hill

In the 1890s, workers searching for water in Corsicana, Texas, accidentally discovered a small oil deposit. Meanwhile, on the outskirts of Beaumont, another Texas town, a man named Pattillo Higgins became interested in a small hill called Spindletop. Higgins had noticed that Spindletop was leaking natural gas, and he knew that natural gas and oil are often found in the same place.

One day, he saw a sign advertising land for sale at Spindletop at a very good price: six dollars an acre. He started buying land with the purpose of searching for oil. Higgins had big plans. However, his excavations between 1883 and 1886 were unsuccessful.

When Higgins ran out of money, he posted an ad looking for an **investor**. Only Captain Anthony Lucas responded. After finding a small amount of oil in 1899, Lucas also ran out of money and went out to look for investors in Pennsylvania. Rockefeller's company turned him down because they didn't believe there was oil in that hill. However, other oil exploration businessmen, Guffrey and Galey, decided to take the risk.

Lucas told them that no one had ever been able to dig wells over 400 feet on Spindletop Hill because of the sandy ground. Back then, a chisel drill was used to search for oil. A chisel drill was a very big tool that was used to break through the rocks. But that only worked in rocky, hard areas. In sandy ground, the chisel drill just **compressed** the earth. Guffrey and Galey told him not to worry because they knew the Hamill brothers. Jim, Al, and Curt Hamill were using a new tool, the rotary drill, to dig wells over 1,200 feet deep. Rotary drills were able to turn and go through the soil, something a chisel drill could not do as easily. The businessmen called Jim, the oldest of the brothers, who was working at Corsicana, to hire him. Jim sent Al and Curt to take on the new job.

Little did those men know that they would discover the largest oil well ever seen up to that time. That "black gold" marked the beginning of a new era in the history of oil.



## Reading Reading Information

### Entering/Emerging

Allow students to answer questions 7–10 orally and using sketches.

### Transitioning/Expanding

Provide the bank of answer choices found in the Teacher Resources for students to choose from when working on the assigned questions.

### Bridging

Provide access to a dictionary, or an online dictionary resource, to look up unfamiliar vocabulary while reading.

### Challenge

Ask students to provide multiple pieces of evidence to support their claim, writing a paragraph instead of a single sentence.



## Check for Understanding

As small groups reveal the answers to the comprehension questions, ask the audience to indicate whether they agree with the answer giving a thumbs-up or a thumbs-down. Ask students who disagree to defend their answer.

## Lesson 3: A Discovery Writing



**Primary Focus:** Students will make and defend opinion-based claims using supporting evidence from the reading as their reasons. [W.4.1c]

### WRITING AND DEFENDING A CLAIM (45 MIN.)

- Tell students that when they write a fuel of the future energy proposal they will be arguing that their idea is best. The main idea of that genre, or type of writing, is called a *claim*.
- Explain the concept of a *claim* further by giving an example, such as:  
“If I thought that chocolate ice cream was the best flavor, I might say, ‘I *claim* that chocolate ice cream is the best possible flavor you could order.’”
- Write the example used on the board and circle the word *claim*.
- Invite the students to share a claim, reminding them to use the sentence starter “I claim that. . .”
- Explain that a claim is different from an idea because it is based on facts. Tell the students that now they will defend claims about what happened in this story. Defending a claim is similar to trying to prove your point is correct. You use facts to support your claim.
- Ask the students to think about the question “Why was there an oil gusher on that day?” Direct the students to turn to a neighbor and share a claim based on fact from the text.
- Write the following sentence starter on the board or chart paper: “I claim the oil gusher occurred because. . .” Direct the students to turn to a neighbor and share their claim again, but this time use the sentence starter on the board.

- Write the following sentence starters on the board: “In fact. . .,” “Did you know that. . .,” and “For instance, the text says. . .”
- Direct the students to turn to a neighbor and share a fact from the text that supports their claim using one of the posted sentence starters.
- Instruct students to practice making a claim by completing number 1 on Activity Page 3.2. Remind the students that they will be writing opinion essays later on, and these sentence starters will come in handy as writers. Tell the students they may integrate the sentences starters posted in their work if they would like to try writing with them today.
- Ask the students to add text evidence to support their idea. Remind them that this is similar to what they just did with their sketches. They may reuse evidence used in the visualization activity if it matches their claim.
- When finished, share the students’ work in small groups or as a whole class.



### Check for Understanding

Ask the students to verbally explain why they chose their text evidence for the claim.

End Lesson

### Support

Direct the student to highlight the evidence in the text before copying it onto the activity page.

### Activity Page 3.2



### Writing Stating a Claim

#### **Entering/Emerging**

Provide this claim statement with the key words deleted.

I \_\_\_\_\_ that \_\_\_\_\_ make the \_\_\_\_\_ pets.

Ask the student to complete the statement using this word bank of missing key words.

#### **Word Bank:**

best	claim	dogs
------	-------	------

#### **Transitioning/Expanding**

Provide a list of claim statements to choose from and then defend using text evidence.

#### **Bridging**

Tell the students to use key words from the text in the claim statement.

## 4

# A New Fuel

## PRIMARY FOCUS OF LESSON

### Reading

Students will use text-based evidence to make inferences about the discovery of oil and its resulting innovations. [RL.4.1]

### Writing

Students will label the parts of an opinion text's organizational structure in a teacher model. [W.4.1a]

## FORMATIVE ASSESSMENT

### Activity Page 4.1

**Writing** Students will respond to the following prompt: "How did the discovery of oil impact the lives of people after the large discovery of oil at Spindletop?" [W.4.1a]

## LESSON AT A GLANCE

	Grouping	Time	Materials
<b>Reading (45 min.)</b>			
Close Reading	Small Group	45 min.	<ul style="list-style-type: none"> <li><input type="checkbox"/> copies of “A New Fuel”</li> <li><input type="checkbox"/> Activity Page 4.1</li> <li><input type="checkbox"/> student responses to Activity Page 4.1</li> </ul>
<b>Writing (45 min.)</b>			
Modeling the Opinion Essay	Whole Group	35 min.	<ul style="list-style-type: none"> <li><input type="checkbox"/> an enlarged copy of Activity Page 4.2, without labels</li> <li><input type="checkbox"/> Activity Pages 4.2, 4.3</li> </ul>
Labeling the Opinion Essay	Partners	10 min.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Teacher Resource: Opinion Essay Model (Labeled)</li> </ul>

## ADVANCE PREPARATION

### Reading

- Make copies of “A New Fuel” for each student.
- Arrange small groups of three to five students for close reading.

### Writing

- Pre-label the Activity Page 4.3 for Entering/Emerging ELL students.
- Prepare a word bank, with and without definitions with the words *claim*, *introduction*, *body paragraph*, and *conclusion*.
- Prepare multiple answer choices to the questions assigned to Transitioning/Expanding ELL students.

### Universal Access

#### Reading

- Group students purposefully in homogenous groups for additional support or in heterogeneous groups based on students’ needs.

#### Writing

- Provide a word bank containing the parts of the essay during the labeling portion of the lesson.

## CORE VOCABULARY

**demand, n.** the desire for a product or service

**contaminating, adj.** soiled or unfit for use

**barges, n.** large, flat-bottomed ships used to transport goods

**modifying, v.** changing for a specific purpose

**goods, n.** products

**conveyor belt, n.** a thin surface that moves along a looped track for the purpose of transporting an object

**synthetic, adj.** artificial, not made by nature

**Vocabulary Chart for “A New Fuel”**

<b>Vocabulary Type</b>	<b>Tier 3 Domain-Specific Words</b>	<b>Tier 2 General Academic Words</b>
Core Vocabulary	contaminating barges conveyor belt	demand modifying goods synthetic
Multiple-Meaning Core Vocabulary Words		
Sayings and Phrases		



## Lesson 4: A New Fuel

# Reading



### Activity Page 4.1



### Challenge

Ask students to infer an additional solution for one of the problems on Activity Page 4.1, based on key details in the text.

### Support

Group students in need of support homogeneously and guide the group through additional examples, gradually releasing the students to continue on their own.

**Primary Focus:** Students will use text-based evidence to make inferences about the discovery of oil and its resulting innovations. [RL.4.1]

### CLOSE READING (45 MIN.)

- Ask students to recall the problems that arose when extracting the oil from the ground. (*Answers may vary, but should include the amount of oil the workers had collected.*)
- Remind students that this was the first time it was collected in such a large amount.
- Tell students that the chapters they will read are about how oil led to changes, or innovations, in the fueling of machines.
- Ask students what a prediction is. After hearing their responses, explain that a prediction is a guess about what will happen next. Ask students if they can make a prediction.
- Ask students to predict what uses for oil may appear in the text. Ask them, “Which uses do you think we still give to oil today?”
- Assign students to groups of three to five. Direct students to read the Read-Aloud “A New Fuel” and to complete the accompanying Activity Page 4.1.
- After the groups have completed their work, shuffle the groups’ members to create new groups and ask students to compare their responses to Activity Page 4.1.
- After students have compared their work, direct them to turn in the activity page to you or at a central location in the classroom.

## A NEW FUEL



### Show Image 4A-1: The 1903 Automobile

#### The Oil Industry Grows

During the year following the discovery of Spindletop, the oil industry grew enormously. The United States became the world's major oil producer. Many of the country's most important oil companies were born and grew thanks to this discovery.

However, the oil extracted from Spindletop wells was more than the **demand**. At that time, the main product manufactured from oil was kerosene to light lamps. Far more oil was being produced than was needed for that purpose. And what do you think was done with the oil that wasn't used? It was stored in tanks, which weren't well made, **contaminating** the soil and freshwater sources.

Wooden and metal tanks were built throughout Spindletop Hill to store the oil. Tanks were also built into trains and **barges** to transport the extra oil to be sold across the country. Although it was known that oil could be a good fuel for steam-powered forms of transportation, train and ship engines were still using coal. Do you know why? Because oil was more expensive and it was hard to get.

#### Changes in Transportation

The first type of transportation to switch from coal to oil were trains in the southwest. The coal that fueled those trains was bought far away on the East Coast, at very high prices since it had to be transported over hundreds of miles. But the discovery of Spindletop changed this situation greatly. From then on, oil became an abundant, cheap, and local resource in the southwest.

The train experiment was so successful that other train companies also made the change from coal to oil. Ship companies that transported goods to other regions of the country and the world also joined.

The change from coal to oil didn't require **modifying** the engines. Both train and ship engines were powered by boiling water to make steam. All that was needed was to change the boilers' fuel from coal to oil.

Oil offered great advantages over coal. Coal took up much more space, especially for ships that made long trips. Many men were needed to load the coal onto the ships for several days. Once the coal was on board the ship, other men had to take turns shoveling the coal into the furnaces, where the water for the boilers was boiled. The boiler rooms, located below deck, were very hot places to work!

On the other hand, oil was loaded by a few men in a few hours. Once on board, the oil was stored in tanks. The oil furnaces were also smaller and didn't need shovelers.

The replacement of coal with oil, both on trains and ships, freed up much of the space that was previously used to store fuel and power engines. This was an added advantage for companies, because now there was more room to transport **goods** and they could make more money.

### **The Automobile Is Born**

The U.S. oil market continued to grow steadily during the early 20th century. New uses for oil spurred new exploration and successful drilling in other parts of the country. The oil business was growing, just in time to welcome a new invention: the automobile!

In the late 19th century, many inventors experimented with the use of engines to realize the dream of building a “horseless buggy,” that is, a buggy capable of moving on its own.

One of the first automobile manufacturers in the United States was Henry Ford. Ford built a four-wheeled bicycle in 1896, powered by a small engine, but without brakes or reverse gear. In 1903, when his designs had improved, Ford founded his famous automobile company. But his breakthrough came in 1908 with the creation of the Model T.

The Model T, which reached speeds of 25 miles per hour, was the first American automobile built using the assembly line method. The assembly line was a **conveyor belt** with workers stationed at different locations. Each worker performed a specific task and then passed the product to the worker next to them. This made it possible to produce automobiles at a low cost and very quickly. The production of automobiles boosted the U.S. oil industry.

World War I further strengthened the country’s oil industry. Many U.S. ships had oil-fueled boilers. Military vehicles and aircraft ran on gasoline too. By the end of the war, the use of automobiles had increased in every city. This led to the construction of highways throughout the country.

However, gasoline wasn’t the only important use of oil. Gradually, oil became a necessary material for many other comforts of modern life. The plastic used today to make toys or to package food is also made from crude oil. So are **synthetic** fabrics, such as polyester and nylon. Oil is also used for heating homes, paving roads, waterproofing roofs, and in many other products. Today we have become so used to these and many other comforts that it’s difficult to imagine a world without oil.



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### Check for Understanding

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Post the definition of *innovation* on the board. Ask students to underline or highlight solutions in the chart on Activity Page 4.1 that could be considered innovations.

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## Lesson 4: A New Fuel

# Writing



**Primary Focus:** Students will label the parts of an opinion text's organizational structure in a teacher model. [W.4.1a]

### Activity Page 4.2



Reading

Reading for Information

#### Entering/Emerging

Allow students to answer questions 7–10 using sketches and oral response.

#### Transitioning/Expanding

Provide the bank of answer choices found in the Teacher Resources to choose from when working on the assigned questions.

#### Bridging

Provide access to a dictionary, or online dictionary resource, to look up unfamiliar vocabulary while reading.

### MODELING THE OPINION ESSAY (35 MIN.)

- Display the enlarged copy Activity Page 4.2. You will be modeling the parts of an opinion essay in the following steps. Refer to the labeled model in the Teacher Resources to assist you.
- Tell the students that this is an example of a genre called opinion writing. Ask the students what familiar word they hear in that name. The students should identify the word argue.
- Explain that in this case, *opinion* does not mean fighting; instead, it means defending a main idea or claim. Mark this on the class model as shown on Activity Page 4.2.
- Tell the students that you will read the first paragraph, or introduction, to them. Label the introduction on the class model. Ask the students to listen for the main idea or claim that the essay will be defending.

“On a hot day, there is nothing like an ice cream cone covered in your favorite toppings. When you step up to the counter, the choice is clear. The best flavor of ice cream is chocolate.”
- Ask the students to turn to a neighbor and share what they believe is the claim or main idea of this essay. (*Correct responses should include “the best flavor of ice cream is chocolate” or an equivalent.*)
- Highlight or underline the claim on the enlarged model.
- Tell the students that you will now read the first body paragraph. Explain that this is where the writer gives evidence to support or defend the claim we read in the introduction. Mark this on the class model as shown on Activity Page 4.2.

“To start, chocolate is one of the most popular flavors, not just of ice cream, but all kinds of desserts. Every restaurant has a chocolate treat. Stores are filled with chocolate on holidays like Halloween and Valentine’s Day. Chocolate is even known to have some health benefits!”

- Ask the students to turn to a neighbor and share what they believe is evidence the author is using to support or defend the claim in this paragraph and why. (*Correct responses should include “chocolate is one of the most popular flavors” and “chocolate is even known to have some health benefits” or equivalents.*)
- Mark this on the class model as shown on Activity Page 4.2.
- Tell the students that you will now read the second body paragraph. Explain that this is where the writer continues to give evidence to support or defend the claim we read in the introduction. Mark this on the class model as shown on Activity Page 4.2.

“Some people might say that chocolate ice cream has its downsides. For instance, it can stain your clothing. On the other hand, who doesn’t want to see the wonderful memory of that chocolate banana split sundae the next time you wear those shorts? There is no downside to chocolate ice cream that isn’t made better by that delicious flavor melting over your tongue.”

- Ask the students to turn to a neighbor and share what they believe is evidence the author is using to support or defend the claim in this paragraph and why. (*Correct responses should include “there is no downside to chocolate ice cream that is not made better by that delicious flavor melting over your tongue” or an equivalent.*)
- Explain that you will now read the final paragraph, called the conclusion. Mark this on the class model as shown on Activity Page 4.2.
- Ask the students what familiar word they hear in that name. Students should identify the word *conclude*. Explain that conclude means to finish. This paragraph finishes the argument by reminding the reader of the claim and why it is true, from the writer’s point of view.

“Ice cream is great and chocolate is great, so why don’t we put them together? Chocolate ice cream is popular for good reason. It is the best. Chocolate can even be good for your health when added to your diet in small amounts. So the next time the scooper asks what flavor, say chocolate.”

- Ask the students to turn and tell their partner where they see the claim and evidence the author has restated in the conclusion. Ask for volunteers to share their findings on the class copy being displayed.

## Challenge

Before labeling in the activity page, give the student a duplicate copy of the student model that has the paragraphs cut apart or jumbled. Ask the student to first reassemble or reorder the paragraphs before labeling.

## Support

Highlight sentences of the essay, as seen in the marked teacher model, for the student. Ask the student to label the highlighted portions.



Writing  
Using Vocabulary

**Entering/Emerging**

Instead of labeling the essay, ask the student to point out and verbally name each part of the essay on a pre-labeled copy of Activity Page 4.3.

**Transitioning/Expanding**

Provide the following word bank with definitions to assist in labeling the essay:

Word Bank:	
<b>claim, n.</b>	an idea said to be true
<b>essay, n.</b>	a short piece of nonfiction writing
<b>introduction, n.</b>	the beginning of a piece of writing
<b>conclusion, n.</b>	the ending of a piece of writing
<b>paragraph, n.</b>	a group of sentences in a piece of writing that share the same main idea

**Bridging**

Preview the words *introduction*, *body paragraph*, and *conclusion* prior to the start of the lesson.

**LABELING THE OPINION ESSAY (10 MIN.)**

- Ask students to turn to Activity Page 4.3, the student model opinion essay. Direct the students to label the model with the help of their partner.



**Check for Understanding**

While modeling the opinion essay, ask students to show their answers to the teacher prompts by pointing to the essay before turning to a neighbor during the turn and talk activity.

End Lesson





## 5

# What's Next?

## PRIMARY FOCUS OF LESSON

### Reading

Students will explain why the demand for oil changed over time using specific information in the text. [RI.4.3]

### Writing

Students will write an introduction paragraph for their opinion essay that introduces their opinion about the prompt, "What are the fuels of the future?" [W.4.1a]

## FORMATIVE ASSESSMENT

### Exit Ticket

**Writing** Share one or more effects from the lesson and defend it as a positive or negative event using evidence from the text in the response. [W.4.1a]

## LESSON AT A GLANCE

	Grouping	Time	Materials
<b>Reading (30 min.)</b>			
Read-Aloud	Whole Group	15 min.	<input type="checkbox"/> Read-Aloud: “The Future of Energy” <input type="checkbox"/> KWL chart
Discussing the Read-Aloud	Whole Group	15 min.	
<b>Writing (60 min.)</b>			
Guided Writing: Introduction	Whole Group Independent	60 min.	<input type="checkbox"/> chart paper <input type="checkbox"/> writing paper or word processor

## ADVANCE PREPARATION

### Reading

- Prepare an enlarged copy of “The Future of Energy” for display while reading.

### Writing

- Prepare to display Activity Page 4.2.
- Prepare chart paper or a digital whiteboard for model writing. The model should be preserved for students to refer to later.

### Universal Access

#### Reading

- Provide a visual of the text, either an enlarged display or an individual copy, to follow while reading.

#### Writing

- Make word processors and/or wide lined paper available as students write their drafts.

## CORE VOCABULARY

**renew, v.** to make new

**abundant, adj.** a large amount, plenty

**impermeable, adj.** cannot be passed through

**vertically, adj.** in an up-and-down position

**horizontally, adj.** in a side-to-side position

**fractured, v.** broken

**innovative, adj.** having the quality of something new created for a purpose

**fermentation, n.** the chemical breakdown of a substance

**biogas, n.** a mixture of gases created by the breakdown of organic substances

**potential, n.** the existence of a possibility

**Vocabulary Chart for “What’s Next?”**

<b>Vocabulary Type</b>	<b>Tier 3 Domain-Specific Words</b>	<b>Tier 2 General Academic Words</b>
Core Vocabulary	impermeable fractured fermentation biogas	abundant vertically horizontally innovative potential renew
Multiple-Meaning Core Vocabulary Words		
Sayings and Phrases		

## Lesson 5: What's Next?

# Reading



**Primary Focus:** Students will explain why the demand for oil changed over time using specific information in the text. [RI.4.3]

### READ-ALoud (15 MIN.)

- Explain to students that today's reading tells what happened in the story of oil in the decades following the discovery at Spindletop. Ask students to listen for new facts that can be added to the KWL chart as the text is being read.
- Read "The Future of Energy."

### THE FUTURE OF ENERGY



#### Show Image 5A-1: Wind Turbines Energy

Energy is very important to our lives. Cars, trucks, airplanes, trains, and buses need energy to run. Cell phones, computers, sound equipment, and televisions are some of the devices we use daily that run on energy. Energy is used to light, heat, and

cool homes, schools, or workplaces and to manufacture all kinds of products, from toothpaste and clothing to sidewalks. Today it's almost impossible to imagine a world without energy! *What does the term fossil fuels mean?* (The sources of this energy come from decomposed living things from long ago.)

#### Fossil Fuels

Much of the energy we use comes from fossil fuels, such as oil, coal, and natural gas. Fossil fuels are called that because they were formed from the remains of living things that died millions of years ago. Those remains were buried in very deep layers of the planet, under many other layers of earth and rocks that accumulated over time. *What does renewable mean and what does it have to do with scientists looking for new sources of energy?* (*Renewable* means that more of the energy can be created over and over and it does not run out. Scientists are interested in this kind of energy because fossil fuels are not renewable.)

There's a limited amount of fossil fuels that are buried underground. Once they run out, we would have to wait millions of years for them to form again. That's why we say that fossil fuel energy is not renewable: we can't **renew** it on our own. Some scientists estimate that the world will run out of fossil fuels in less than a century. That's why there is an interest in developing renewable sources of energy. Today we're going to talk about this, but first I want to tell you about other things happening today with fossil fuels. *Pause after reading this paragraph. Read the first sentence again and explain the meaning of the word limited: "When we say there is a limited amount of fossil fuels, it means that one day they're going to run out." Then ask, "According to the author, what should we do to solve that problem?" (develop renewable sources of energy)*

The fossil fuels that still exist in the world are very difficult to find and remove from the earth. Much of the oil we have used so far came from **abundant** deposits, such as Spindletop. A deposit is a place where minerals or fossils exist naturally. There aren't many large deposits left. Most of the new oil discovered in the world is trapped in layers of almost **impermeable** rocks, which don't let the oil out. Until recently, it was impossible to extract the oil trapped in these rocks.

But this situation changed in the early 21st century, when a new technology was discovered: hydraulic fracturing (or fracking). Hydraulic fracturing involves breaking rocks with the force of water. First a well is drilled **vertically** until the rocks containing the oil are reached. Then a hole is drilled **horizontally** along these rocks, and water is injected at high pressure, mixed with sand and chemicals. This is how the rocks are **fractured** to let the trapped oil out. *Ask, "What is hydraulic fracturing used for?" (It's used to extract the oil that is trapped in rocks.)*

Hydraulic fracturing has made it possible to reach and remove major oil deposits discovered in recent years. One of the most important is the Wolfcamp deposit in West Texas, because it contains enormous amounts of oil. You already know that even the largest fossil fuel deposits will run out one day. So . . . the time has come to tell you about some of the renewable sources of energy that are being developed!

## Renewable Energy Sources

**Renewable** sources have an endless supply of energy. They are based on natural elements such as sunlight, wind, water, and the breakdown of organic waste (e.g., food scraps). They're also known as clean sources of energy. Using them doesn't require drilling big holes or burning fuel. *Ask, "Taking into account what this paragraph says, what are some advantages of alternative energies over fossil fuels?"* (They are renewable and don't pollute.)

Energy from the sun, or solar energy, is obtained by using special panels—called solar panels—that collect light and heat from the sun during the day. That light and heat are used to generate electricity. This type of energy is ideal for places or during seasons with a lot of sunshine.

Wind energy, or wind power, is generated by machines similar to giant windmills that rotate with the wind. These machines are called wind turbines. The movement of the wind turbines converts energy from the wind into electricity. Wind energy is ideal for places that are very windy for most of the year, such as the coastal areas.

Hydropower, or energy from water, is obtained in various ways. One of the most **innovative** harnesses is the movement of the tides. Tides are movements of the sea that push and pull water towards or away from the coast. Hydropower is produced with turbines similar to those used for wind energy, except that they don't rotate with the wind. They move with the movement of the sea. This energy is used to generate electricity.

Biofuels are another way of generating energy. They are produced by the breakdown of organic waste (animal manure, garden waste, food waste) in the process of **fermentation**. This process takes place in special plants, where, on the one hand, **biogas** is used to produce energy. *What are some examples of renewable energy?* (solar, wind, hydropower, biofuel) *Encourage students to explain how they work. Ask, "What does this tell us about the demand for oil since the discovery at Spindletop?"* (It slowed down significantly.)

## Challenges for the Future

All these energy sources have great **potential**, but for now they can't replace fossil fuels. Why? First, because right now they're more expensive than fossil energy sources. Second, some of them can only be used in places close to their source. However, many scientists are working on new technology to produce renewable energy that is cheaper and can be used further away.

Ask, “What is the claim the author is making in this paragraph? (Oil will continue to be used until renewable energy becomes inexpensive enough to replace it.) This section is titled ‘Challenges for the Future.’ What are some of these challenges? Do you have ideas for solving some of them?”

Can you imagine a future when you will use renewable sources of energy to light your houses, work with your computers, or drive your electric cars? Wouldn't that be fantastic?

### DISCUSSING THE READ-ALoud (15 MIN.)

- Ask students to consider what questions this new knowledge brings up. For example, the text says, “The fossil fuels that still exist in the world are increasingly difficult to find and remove from the earth.” In a think-aloud, explain that this makes you wonder. Tell students, “A question that comes to mind is, how do they search for new deposits in the earth?” Ask students what questions come to their minds.
- Add students’ suggestions to the “Wonder” column of the chart. Allow time for students to skim the text and have some time to think before responding.



#### Check for Understanding

Tell students to turn and talk with a neighbor to share one research question that was generated from a “Wonder” item on the class’s KWL chart.



#### Speaking and Listening Finding Cause/Exchanging Information and Ideas

##### Entering/Emerging

Have students pull out only key words from the text to include in the KWL chart.

##### Transitioning/Expanding

When adding a thought to the KWL chart and referring to the text, prompt students to reread directly from the text instead of paraphrasing.

##### Bridging

When students are contributing to the KWL chart, provide teacher support for paraphrasing by restating the student’s idea. For example, “So what you are saying is . . . ?” (Restate the student’s idea, modeling effective paraphrasing.)



## Lesson 5: What's Next?

# Writing



**Primary Focus:** Students will write an introduction paragraph for their opinion essay that introduces their opinion about the prompt, “What are the fuels of the future?” [W.4.1a]

### GUIDED WRITING: INTRODUCTION (60 MIN.)

- Display Activity Page 4.2. Ask the students to identify which paragraph is the introduction. (*Students should identify the first paragraph.*)
- Ask students to identify how the paragraph begins. (*Correct responses should include reference to a main idea or claim.*)
- Tell the students that they will be writing an essay that answers the question, “What are the fuels of the future?” Explain that today’s demonstration will use the question, “What is the clothing of the future?”
- Using chart paper or a digital projection, demonstrate how to write an introduction paragraph using a think aloud while the writing is being modeled. The following text may be used in this demonstration:

“Fashion and clothing have changed a great deal over the course of history. It is clear that a photograph is from the past simply by looking at what the subjects are wearing. What will be the clothing of the future? I claim that the clothing of the future will be as high-tech as the gadgets we put in our pockets today.”
- Explain that the students will be learning more about oil and other fuels during the unit to help them generate a claim about their topic, what are the fuels of the future? Invite the students to take a few minutes of thinking time to consider what their claim may be.
- Direct students to write a rough draft of an introductory paragraph for their essay. Remind students that they will revise this later on and may even change their claim as they learn more about fuel.
- After completing the draft of the introductory paragraph, direct students to complete and hand in the following Exit Ticket.

### Challenge

Have students exchange paragraphs with another student and give feedback to each other. Direct the students to ask each other, “Did you understand my claim?” and “Did I back up my claim?” Remind the students that yes/no responses are not helpful feedback for their classmates.

### Support

Provide the following sentence starters for the introduction paragraph:

I believe that . . .

In my opinion . . .

My claim is . . .



### Exit Ticket

Share one or more effects from the lesson and defend it as a positive or negative event using evidence from the text in the response.



### Check for Understanding

Ask students to underline the claim in their introduction paragraphs.

End Lesson



## Writing Writing an Introduction Paragraph

### **Entering/Emerging**

Provide the following cloze model of an introductory paragraph as a starting point for writing:

\_\_\_\_\_ is an important topic. It is important because \_\_\_\_\_. In fact, did you know \_\_\_\_\_? That is why I believe \_\_\_\_\_.

### **Transitioning/Expanding**

Allow the students to verbally rehearse the paragraph before writing with a partner.

### **Bridging**

Read the student's writing aloud, without any corrections, to the student. Ask the student to identify any areas that did not sound clear as a listener.

## 6

# The Sun's Energy

## PRIMARY FOCUS OF LESSON

### Reading

Students will draw diagrams of text details to explain and make inferences about solar energy. [RI.4.1]

### Writing

Students will take notes for use in their opinion essay body paragraphs. [W.4.8]

## FORMATIVE ASSESSMENT

### Activity Page 6.1

### Text Details: Explaining and Making

**Inferences** Write 2–3 sentences explaining what you understand about a detail from the text. Then create a diagram of an inference you made about that detail during the reading. [RI.4.1]

## LESSON AT A GLANCE

	Grouping	Time	Materials
<b>Reading (35 min.)</b>			
Purpose for Reading	Whole Group	5 min.	<input type="checkbox"/> Read-Aloud: “The Search for the Secret of the Sun” <input type="checkbox"/> Activity Page 6.1
Presenting the Read-Aloud	Whole Group	15 min.	
Comprehension Questions	Whole Group	5 min.	
Activity Page 6.1	Independent	10 min.	
<b>Writing (55 min.)</b>			
Student Research	Independent	30 min.	<input type="checkbox"/> KWL chart <input type="checkbox"/> student research materials
Writing a Body Paragraph	Independent	25 min.	

## ADVANCE PREPARATION

### Reading

- Prepare an enlarged copy of “The Search for the Secret of the Sun” for display while reading.
- Prepare a copy of “The Search for the Secret of the Sun” for each student.
- Prepare and distribute blank copies of the note-taking T-chart.

### Writing

- Consider arranging a visit to the library in advance of this lesson to familiarize students with research materials. A school or local librarian can be a helpful resource.
- Gather resources, including books, magazines, and online articles and databases regarding energy and fuels. School and local libraries will be the best resources.
  - These materials may take the form of what is available on the subjects of renewable and nonrenewable energy in your classroom, school library, or public library. Materials can range from digital resources such as online databases and reputable websites to traditional materials such as books, magazines, and encyclopedias. Be mindful to make materials varied and text complexity at all levels available to meet the diverse learning needs of your students. Include some materials that include visual supports such as illustrations, photographs, and diagrams. Digital materials may also have audio to accompany them, which makes the text accessible to more students. Display the materials so they are organized and easily accessible to students.
- Prepare blank copies of T-charts, which can be found in the Teacher Resources section, for student note-taking.
- If using the model T-chart notes provided, it is recommended that they be handwritten for additional instructional opportunities to model note-taking.
- Prepare sentence frames for students to use while taking notes, as needed.
- Prepare to locate and provide access to additional audio/multimedia research sources.

## Universal Access

### Reading

- Provide a visual of the text, such as an enlarged display or an individual copy, for students to follow during the reading.

### Writing

- Provide the following sentence frames for students to use while taking notes.

\_\_\_\_\_ was discovered by \_\_\_\_\_.

\_\_\_\_\_ comes/is made from \_\_\_\_\_.

\_\_\_\_\_ is used for \_\_\_\_\_.

The advantage of \_\_\_\_\_ is \_\_\_\_\_.

The disadvantage of \_\_\_\_\_ is \_\_\_\_\_.

## CORE VOCABULARY

**ultraviolet, adj.** (light) that cannot be seen and can produce radiation

**solar power, n.** energy generated by converting sunlight

**efficient, adj.** able to accomplish a task without waste

**electrodes, n.** an object designed to conduct, or help move, electricity

**photovoltaic, adj.** the ability to change light into energy

**selenium, n.** an element with photovoltaic effects

**solar cell, n.** a device that converts sunlight into electricity

**solar panels, n.** a flat device that converts sunlight into electricity, often used on a build's roof

**solar arrays, n.** large collection of solar panels

**power grid, n.** a system that holds and distributes power

**printed solar panels, n.** solar panels created using a 3D printer

**3D printer, n.** a printer that uses a special material to create three-dimensional objects

Vocabulary Chart for "The Sun's Energy"		
Vocabulary Type	Tier 3 Domain-Specific Words	Tier 2 General Academic Words
Core Vocabulary	ultraviolet electrodes photovoltaic selenium solar power solar cell solar arrays solar panels power grid printed solar panels 3D printer	
Multiple-Meaning Core Vocabulary Words		
Sayings and Phrases		

## Lesson 6: The Sun's Energy

# Reading



**Primary Focus:** Students will draw diagrams of text details to explain and make inferences about solar energy. [RI.4.1]

### PURPOSE FOR READING (5 MIN.)

- Read the first two paragraphs of the Read-Aloud “The Search for the Secret of the Sun.”
- Explain that we can tell the sun gives off energy with our own observations. Ask the students, “For example, what can you observe when you open a car parked in the sun on a hot day?” (*Answers may vary, but should include descriptions of the heat inside the car.*)
- Ask students what would be different if the car was parked in the shade and there was less of the sun’s energy on it. (*Answers may vary, but could include descriptions of a cooler temperature. If needed, explain that the more the sun’s energy is on the car, the hotter it becomes.*)
- With this observation, we can infer, or draw a conclusion, that the sun’s energy creates the heat. Tell students that the hot car is the evidence that helps them make this inference.
- Ask students what other evidence they can think of that helps them make an inference, or draw a conclusion, about the sun’s energy. (*Answers may vary, but could include that noticing something melting in the sun or getting a sunburn is evidence that the sun has energy. We can infer that the sun’s energy involves heat.*)

### PRESENTING THE READ-ALoud (15 MIN.)

- Tell students to listen for details or text evidence in the Read-Aloud that helps them make an inference about the sun’s energy.
- Read the Read-Aloud to the students, modeling guided thinking at the prompts.
- After the fourth paragraph, ask students to practice making inferences from text details in a Pair-Share.



- Ask the students to pick a detail from the text and, taking turns, explain it to their neighbor in their own words.
- Then, the neighbor should make an inference about that fact. Remind students that an inference is a conclusion you draw based on the facts. For example, the class figured out the sun had energy by the fact that it heats up a parked car.
- Provide the following sentence frames for support:
  - Student 1: What I understand about \_\_\_\_\_ is \_\_\_\_\_.
  - Student 2: An inference that I can make about that detail is \_\_\_\_\_.

## THE SEARCH FOR THE SECRET OF THE SUN

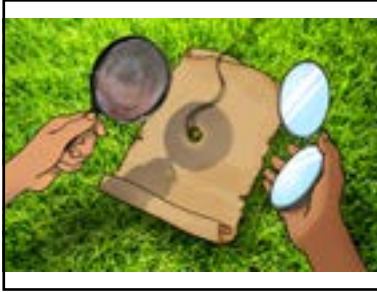


### Show Image 6A-1: Solar Power

Have you ever watched a sunrise or sunset in the sky? Most people would probably agree that these are magnificent sights to witness in nature. However, staring directly at the sun is actually not recommended by the scientists who have studied this star positioned at the center of the Solar System.

You may notice that some people wear sunglasses to protect their eyes from direct exposure to the sun. Direct exposure to the sun, over time, can be harmful. This is because the sun's radiant energy is very powerful. The sun is also huge—over 100 times the size of the earth—and it gives off intense heat, over 10,000 degrees Fahrenheit. All that heat and energy also gives off radiation, including **ultraviolet (UV)** radiation that can cause permanent damage to our eyes if we stare at the sun without protective eyewear.

But those potentially harmful qualities of the sun also make it a great source of power. The sun's heat creates the warmth we need to live, and the sun's light is an important part of photosynthesis in plants. (Photosynthesis, you may remember, is what happens when plants use sunlight to help them change carbon dioxide and water into food and oxygen.) Are there better ways to use all that energy the sun sends to our planet? That question holds the basic idea behind **solar power**, or power we generate by using the energy of the sun. That's the secret of the sun that ancient scientists have been trying to learn for thousands of years.



### Show Image 6A-2: Ancient Solar Experiment

Just for a moment, let's join those ancient scientists in their search. Think a little bit about the sun. What seems to you like the most powerful thing about the sun? And how would you try to bring that power down to earth so people can use it?

Maybe you focused on the sun's warmth, or thought about how warm a ray of sunlight feels on your arm. If you could somehow focus and concentrate that sunlight, maybe you could generate a lot of heat! Some of the earliest experiments in solar power explored this idea. In the third century BCE, over two thousand years ago, Greek and Roman writers recorded stories about mirrors and pieces of glass that people used to concentrate sunlight into narrow beams. By using these "burning mirrors," they could produce enough heat to start small fires. This is an ancient experiment that you may have already performed with an ordinary magnifying glass. *Pause to model recalling a detail from the paragraphs, explaining it in your own words, and making an inference about the detail. Then, ask the students to share about a detail they heard in the text.*

But heat alone isn't a very useful form of power. A fire isn't **efficient**, or well organized and without waste: much of its energy goes up in smoke! It's only when we burn fuel inside an engine that turns heat into mechanical energy, like a car motor, that we can get useful power from it. To make useful solar power, it's not enough just to use the sun's heat. We have to find a way to turn that heat into mechanical or electrical power. And for many, many centuries, no one could think of a really good way to do that.

So instead of thinking of the sun's heat, maybe we should focus on its light. Plants use sunlight to start photosynthesis. Maybe we can also find a way to use the light of the sun, rather than its heat, to generate power for ourselves.

This was the idea that led to the first working solar power in 1837 CE, two thousand years after the Greeks. In France, there lived a young man named Edmond Becquerel (BECK-er-ell). Edmond was the son of a scientist who studied electricity. One day, while experimenting in his father's lab, Edmond painted two **electrodes**, or devices that allow electricity to flow into or out of something, in a silver solution. Then he placed one of the electrodes in a shaft of light. An electrical current soon formed. Edmond wasn't sure just

why this happened, and it would take scientists years to find an explanation. But his experiment proved that light and electricity were connected, a discovery called the **photovoltaic** effect. *Ask the students to share about a detail they can make an inference about.*

### Challenge

Ask students to include terminology found in the text in their diagram labels. For example, students could use *sun beam* versus simply *light*.

### Support

While adding captions to their drawings, have students find and include supporting key words in the text instead of copying direct quotes.

Another step toward modern solar power came in 1873 with the discovery that the element **selenium** had photovoltaic effects. (Strange fact: selenium is named after the Greek word for moon!) By 1883, the American engineer Charles Fritts had used selenium to build the first working **solar cell**, a machine that turns sunlight into electrical power. It was the motor for sunlight at last.



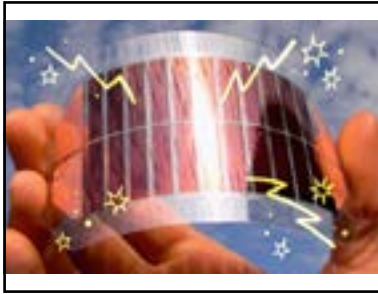
### Show Image 6A-3: Solar Panels

Early solar cells were very weak. It wasn't until the 1950s, when engineers at Bell Labs learned how to make solar cells that used silicon and gold instead of selenium, that solar cells became strong enough to use for everyday electricity. Today, solar power is being used in more and more situations. You

may have seen heavy glass **solar panels** on the roof of houses or apartment buildings near you, or **solar arrays**, large collections of solar panels, out in the country. Anywhere there's sunlight, you might find people generating solar power. *Pause to model visualizing a detail from the paragraph, explaining it in your own words, and making an inference about the detail. Then, ask the students to make an inference about a detail they heard in the text.*

There are huge advantages to solar power. One, of course, is the cost: the sun, unlike an oil well, is free! Another is portability. Many forms of power are created in large power plants that send electricity to many buildings at once through a **power grid**. But what do you do if you want to use electricity in a building that's far away from a power grid? What if you want to use electricity somewhere that's far from any building at all? Solar panels can help bring electricity to rural buildings without other sources of power. Even campers deep in the woods can use pocket solar cells to charge phones or light up tents. *Ask the students to share about a detail they can visualize.*

But there are also big drawbacks to solar power. For one, you need to have steady sunlight, and some parts of the world that have fewer daylight hours or heavy rain and clouds are less good for solar power. Solar panels that generate enough power for a whole house are also heavy and expensive, which can make them hard to afford in rural areas that really need the power.



### Show Image 6A-4: Printed Solar Panel

To help solve some of those problems, scientists and engineers today are exploring the idea of **printed solar panels**. Using new materials, these engineers have developed a way to print solar cells using an ordinary inkjet printer. That means they can place solar cells on much lighter and more flexible

surfaces than glass! The solar cells of the future might be mounted on cloth, or ordinary paper, or plastic shaped with a **3D printer**, a machine that melts and arranges coils of plastic and other materials into a variety of shapes. Printed solar cells are still in the early stages of development, but when they become powerful enough, they'll be both cheaper and easier to place than traditional glass panels, solving many of the problems with solar power today.

From giant magnifying glasses to printable solar cells, the story of the quest for solar power has had many chapters. In the moment you took to think about how you'd bring the sun's power down to earth, you also took part in that search. One day, maybe you will again. And if you do, the sun will be waiting for you, still keeping its secrets even as it shines. *Ask the students to turn to a partner and share a detail they can visualize and make an inference about.*

### COMPREHENSION QUESTIONS (5 MIN.)

- After handing in their work, gather students to debrief the text.
- Ask students the following questions:
  1. **Literal.** What do we need to do with the sun's heat to create useful energy?" (*turn it into mechanical or electrical power*)
  2. **Inferential.** After reading the text, what can you infer about silicon and gold versus selenium? (*Silicon and gold have stronger photovoltaic effects and create more efficient solar cells.*)
  3. **Inferential.** What can we infer about the type of weather needed to use solar panels? (*Answers may vary, but could include that weather with steady sunlight would be most effective on solar panels.*)
  4. **Evaluative.** What are some reasons why someone might choose to use solar power over another source of energy? (*Answers may vary, but should be based on facts from the text, such as distance from a power plant, climate, and cost.*)



### Speaking and Listening Exchanging Information and Ideas

#### Entering/Emerging

Ask students to express whether they agree or disagree with their partner's inference by providing the following phrases, "I agree when you say . . ." or "I disagree when you say . . ."

#### Transitioning/Expanding

Have students underline key words in the text that helped them make their inferences.

#### Bridging

Ask students to explain what key words in the text support their inferences to a partner.

## ACTIVITY PAGE 6.1 (10 MIN.)

### Activity Page 6.1



- Distribute Activity Page 6.1.
- Explain to students that they will be drawing a diagram of the details they visualize. Remind them that a diagram is a drawing used to explain or demonstrate how something works.
- Have students spend a few minutes sketching a diagram on Activity Page 6.1. Remind them that a diagram is often very simple and includes labels.
- Direct students to draw a diagram based on the text after paragraphs 8 and 11.
- Ask students to add the text evidence that helped them create their diagrams. Model one example.
- Explain that at the bottom of Activity Page 6.1 they will use their diagrams to make an inference. Tell students to think about what they learned and what that tells them about energy from the sun.
- After students have finished the activity page, direct them to add any questions they have about solar power to the KWL chart. Remind students that they can answer those questions as they continue to research for their fuel of the future proposals.
- Ask students to hand in their work to you or at a central location in the classroom.



### Check for Understanding

During the Turn and Talk activities, ask students to explain the difference between a text detail and an inference.

## Lesson 6: The Sun's Energy

# Writing



**Primary Focus:** Students will take notes for use in their opinion essay body paragraphs. [W.4.8]

### STUDENT RESEARCH (30 MIN.)

- Show students the available research materials. If possible, a visit to the library or a classroom visit from a librarian is recommended. Explain how the materials are organized (by topic, by title, by type of media, etc.) and how to access any digital resources. Post any necessary login information in an easy-to-access location. Model how to access materials with multistep directions, such as a library database or a password-protected website.
- Distribute blank note-taking T-charts. Display the model T-chart from Buried Sunlight in Lesson 2. Remind students that they have used these kinds of notes before. Ask them what is written in each column. (*Correct answers should include the main idea in the left column and details in the right column.*)
- Ask students what they are looking for as they take notes. The goal is to answer the question “What are the fuels of the future?” Ask students, “What do you want to know that could help you?” (*Answers may vary, but should include different types of fuel or energy and details relevant to those central ideas. For instance, a student may want to know about machines that generate energy, such as windmills, or what kind of energy runs items in their home. If students have difficulty generating ideas, review the types of energy that are mentioned in the texts so far.*)
- Display the KWL chart that was started earlier in the unit. Remind students that the ‘W’ stands for wonder. Tell them that someone might wonder about making solar panels. They would add the things they wonder about in the form of a question to the chart. It may sound like, “How do you make a solar panel?”
- Ask students for things they wonder about when they think of different sources of energy to fill in the “Wonder” column.
- Tell students that the questions in the “Wonder” column are the research questions that should guide them in their research.

### Challenge

Tell students to add subheadings in the central idea column of the T-chart notes based on the text being used. For example, if a student is taking notes on a text about wind power, in addition to that main idea, a subheading from the text may include turbines, locations, or energy output.

### Support

When adding details to the note-taking T-chart, tell students to copy direct quotes of one sentence or less in length.



### Writing Using Research Questions

#### Entering/Emerging

Have students take turns with you orally dictating and writing notes.

#### Transitioning/Expanding

Allow students to work with a partner to brainstorm key words to look for to focus their research. For example, if a student is researching fossil fuels, they may look for words like *carbon*, *oil*, or *gas*. Encourage students to look back at Read-Aloud texts to find relevant key words.

#### Bridging

Allow students to use a print or digital dictionary to assist with unfamiliar vocabulary during note-taking.

- Ask students to research the questions that they believe will support the claim they wrote in their introduction paragraph. Explain that, for example, if the claim was “Hydropower is a fuel of the future,” then they might research the locations of rivers or how hydropower plants work.
- Remind students that, even if the details they find today do not fit those questions exactly, they can still be written down. They may come in handy later.
- Release students to browse and take notes. Display the model T-char from *Buried Sunlight* in Lesson 2 as a reference. Assist students with selecting resources, as needed.

### WRITING A BODY PARAGRAPH (25 MIN.)

- Display a page of model notes. Notes that may be used for this demonstration are included as follows:

Main Idea	Details
<b>Zippers</b>	Used on leather jackets in 1925 Popular on kids clothes in the 1930s
<b>Velcro</b>	Called hook and loop fastener A brand name Invented after seeds stuck to inventor's jacket
<b>Dry fabrics</b>	Moisture wicking fabric patented in 1998 Under Armor first to market it Pulls moisture away from the skin Prevents smell Comfy when sweating
<b>Medical sensors</b>	MIT invention Clothing with sensor that tell vital signs like temperature Baby monitors in socks Watch oxygen and breathing

- Demonstrate a think-aloud as you model how to convert pertinent notes into sentences for a body paragraph. Text that may be used in this demonstration is provided as follows:

“There is so much to learn about the technology in clothing worn today. For example, pants have zippers and shoes close with velcro. These innovations make clothing easier to put on and more comfortable to wear. Some clothing has more advanced technology, like special materials that wick away moisture or contain high-tech features such as speakers or oxygen monitors. It is difficult to predict what the future of apparel technology has in store. Eventually, people may carry phones and other gadgets that will be sewn into their clothing.”

- Ask students to look at the notes they have gathered so far. Tell them to ask themselves, “Do any of these details support my claim?” If so, direct students to turn those details into sentences to use in their essay on the back of their T-charts.
- Before ending the lesson, ask who wrote a sentence they are proud of during this activity. Invite students to share their best sentence with the class. After sharing, ask a student volunteer what makes their sentence a strong example. Record characteristics of strong sentences on the whiteboard or chart paper as the students share. Leave this list visible for students to refer to throughout the writing process.



### Check for Understanding

After taking notes, ask students to indicate whether they gathered information that supports their claim giving a thumbs-up, a thumbs-down or a thumbs-middle.

End Lesson



## 7

# Water: A Renewable Energy Source

## PRIMARY FOCUS OF LESSON

### Reading

Students will identify the main idea and key details of a text about water as a renewable energy source. [RI.4.2]

### Speaking and Listening

Students will use key ideas and text details to explain their own understanding of the advantages and disadvantages of water as a renewable energy source. [SL.4.1d]

### Writing

Students will generate research questions and begin taking notes from sources to integrate into their essays. [W.4.8]

## FORMATIVE ASSESSMENT

### Exit Ticket

**Writing** Share one of your research questions and explain how a source or your notes has helped you gather relevant information. [W.4.8]

## LESSON AT A GLANCE

	Grouping	Time	Materials
<b>Reading (30 min.)</b>			
Purpose for Reading	Whole Group	5 min.	<input type="checkbox"/> Read-Aloud: “Hydropower” <input type="checkbox"/> T-chart
Presenting the Read-Aloud	Whole Group	10 min.	
Identifying Main Idea and Key Details	Independent	15 min.	
<b>Speaking and Listening (5 min.)</b>			
Discussing the Read-Aloud	Whole Group	5 min.	<input type="checkbox"/> KWL chart
<b>Writing (55 min.)</b>			
Writing Research Questions	Whole Group	10 min.	<input type="checkbox"/> KWL chart <input type="checkbox"/> Activity Page 7.1 <input type="checkbox"/> Student Research materials
Student Research	Independent	30 min.	
Adding to the Essay	Independent	15 min.	

## ADVANCE PREPARATION

### Reading

- Prepare an enlarged copy of “Hydropower” for display while reading.
- Prepare a copy of “Hydropower” for each student.
- Prepare and distribute blank copies of the note-taking T-chart.

### Writing

- Prepare research materials. If not still in place from Lesson 6, set up your display of research materials for students to use.
- Display additional blank copies of the note-taking T-chart with the research materials or distribute to students directly.

### Universal Access

#### Reading

- Provide a visual of the text, an enlarged display or individual copy, to follow during the reading.

#### Writing

- Locate and provide access to audio/multimedia versions of research materials and digital copies of the note-taking T-chart.

## CORE VOCABULARY

**currents, n.** water that moves in a particular direction within more water that is moving with less force or in a different direction

**transmitted, v.** transferring from one location to another

**friction, n.** the resistance between things that are rubbing together

**gravitational, adj.** having the ability to pull or apply force using gravity

**converting, v.** changing from one thing to another

**harness, v.** to take and use for a purpose

**generator, n.** a machine that produces power

**turbines, n.** a machine that rotates to create energy

**ebb and flow, v.** moving gently back and forth

**denser, adj.** containing more matter than something else

**submerged, adj.** surrounded by a liquid substance, often water

**Vocabulary Chart for “Hydropower”**

Vocabulary Type	Tier 3 Domain-Specific Words	Tier 2 General Academic Words
Core Vocabulary	currents transmitted friction gravitational harness generator turbines	converting denser submerged
Multiple-Meaning Core Vocabulary Words		
Sayings and Phrases	ebb and flow	

## Lesson 7: Water: A Renewable Energy Source

# Reading



**Primary Focus:** Students will identify the main idea and key details of a text about water as a renewable energy source. [RI.4.2]

### PURPOSE FOR READING (5 MIN.)

- Tell the students that today you will read to them about another source of energy, hydropower.
- This Read-Aloud explains how the energy in moving water can be changed into electricity.
- Ask students to listen for new facts that you can add to the KWL chart as the text is being read.

### PRESENTING THE READ-ALOUD (10 MIN.)

- Read the text aloud.
- Stop at the points marked in the text. Discuss the prompts, focusing on identifying the main idea and details of the text.
- Remind students that they will be collecting details from the text to use in their writing.

### HYDROPOWER

What do you notice when you go to a beach and look at the ocean? You might notice that the water is beautiful, endless, and fun to swim in. Do you notice that the water is never still? It froths and churns. Waves crash and recede. Tides pull the water in and push it out throughout the day. You can feel the tremendous energy of the ocean when you stand in the water and a wave hits you. It can be great fun--but sometimes the waves and **currents** are so powerful that even getting in the water is dangerous. The force of the ocean can be overwhelming.

The beautiful, curving surface waves that are so much fun to play in or surf on aren't created at the beach. They start very far out in the ocean before they arrive thundering at your feet. A wave that carries a surfer on a great

run might have travelled for thousands of miles before she catches it on her board. These waves are caused by the **friction** of the wind against the surface of the water. When a wave travels, there is energy transmitted across the ocean that causes the water to move in a circular motion.



### Show Image 7A-1: Tidal Waves

Aside from wind waves, there are other waves, caused by tides. Tides are the gradual rise and fall of the ocean caused by the **gravitational** pull of the moon and the sun. Tides usually rise and fall twice a day. The long, slow, twice-a-day waves caused by tides are called “tidal waves.”

The energy of waves extends below the surface of the water. If you were to put on a snorkeling mask and go exploring beneath the water’s surface, you would see lots of things. You might see fish, coral and seaweed. You would also see and feel the energy of waves moving the water back and forth. The push and pull of massive amounts of water would shift the paths of fish and make the seaweed bend and wiggle. You would feel the waves tugging you as they moved. It’s not just fish that live beneath the water. There’s energy that exists there too. *What are some ways we can observe the energy in moving water, like the ocean?* (current, waves, tides, the movement of plants underwater, the tugging of waves [also called undertow])



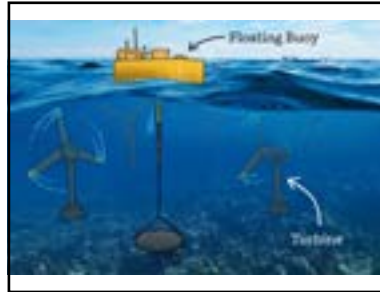
### Show Image 7A-2: Energy of the Ocean

What if human beings could **harness** the energy of the ocean and bring it into our homes? What if we could take the enormous power of waves and turn it into electricity to power our light bulbs and computers? It could be a clean, earth-friendly source of energy.

As a matter of fact, people are already at work on this. Scientists and engineers have developed ways of **converting** the energy in waves to energy that powers our homes.

One way of converting wind waves to electricity is to use floating buoys that are fixed to the sea floor with a hydraulic pump. The buoys move up and down along with the motion of the waves, rising up with the crests—or

the tops—of the waves, and sinking down with the troughs—or low points. This up and down motion activates the hydraulic pump, which pushes air or water through a turbine, which rotates a **generator**. The generator produces electricity.



### Show Image 7A-3: Harnessing Energy

The waves caused by tides can also be harnessed to produce power. In fact, as far back as the 6th century, humans devised ways of converting the push and pull of the tides into power. The motion of the tides was used to turn a big wheel in the water that powered a mill that would grind up grain.

Today, we have devised ways to convert the motion of the tides into electricity, using **turbines** installed on the sea floor. As the tides **ebb and flow**, the blades on the turbines rotate. The rotations of the turbine blades power electrical generators, which produce electricity that is then sent out through wires.



### Show Image 7A-4: Tidal Turbines

Do these tidal wave turbines remind you of something? They look and operate very much like wind turbines. However, tidal turbines have some advantages over their wind-powered counterparts. Because water is **denser** than air, it carries more energy when traveling at the same speed. And the

tides rise and fall at the same time every day--so they generate power on a more predictable schedule than wind energy. And if you're worried about boats running into the **submerged** turbines, they've thought of a way to prevent that. This design of tidal turbines has a tower that rises above the water, with a light attached to it. *What are some similarities between wind power and hydropower that the author discussed? (can be used to produce electricity, use turbines to power a generator)*



### Show Image 7A-5: Hydroelectric Power Plants

You can see that water is an excellent resource when it comes to producing power. But it's not just oceans. Rivers and other moving bodies of water are potential sources of electricity. Hydroelectric power plants take advantage of the movement of water

in a body like a river, particularly where there is a large drop in elevation to aid the flow. Hydroelectric plants use a dam to hold back a large volume of water. The pressure builds up and the water is channeled into a pipe, with the help of gravity. The flowing water turns an electricity-generating turbine.



### Show Image 7A-6: The Beach

The ocean is beautiful and going to the beach is lots of fun. But there's a lot more to the ocean. It's also a vast, renewable source of power, whether through wind waves, tidal waves, or the flow of rivers. Generating power from the movement of water can help the earth by replacing

costlier, dirtier sources of power. What other, new ways might we discover to generate power in the future? *What is the claim the author is making in this paragraph?* (Hydropower is a good source of renewable energy, perhaps better than wind power.)

## IDENTIFYING MAIN IDEA AND KEY DETAILS (15 MIN.)

- Distribute blank T-charts.
- Direct students to reread the Read-Aloud and record useful information for their research on their blank T-charts.



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**Lesson 7: Water: A Renewable Energy Source**

# Speaking and Listening



**Primary Focus:** Students will use key ideas and text details to explain their own understanding of the advantages and disadvantages of water as a renewable energy source. [SL.4.1d]

## Challenge

Encourage students to generate higher order thinking questions with sentence starters such as “What is the advantage/disadvantage of...?”, “What would happen if...?”, “What is an alternative to...?”, etc.

## Support

Encourage students to generate higher order thinking questions with sentence starters such as “What is the advantage/disadvantage of...?”, “What would happen if...?”, “What is an alternative to...?”, etc.

### DISCUSSING THE READ-ALoud (5 MIN.)

- Ask students to consider what questions this new knowledge brings up. For example, the text says, “Hydroelectric plants use a dam to hold back a large volume of water.” In a think-aloud, explain that this makes you wonder about something. Tell students, “A question that comes to my mind is ‘What happens if there is a drought?’” Ask students what questions come to their minds.
- Add students’ questions to the W column of the chart. Allow time for students to skim the reading and have some thinking time before responding.
- Allow a few student volunteers to explain their own understanding of advantages and disadvantages of water as a renewable resource.



### Check for Understanding

Tell students to turn and talk with a neighbor to share one research question that was generated from a W item on the class KWL chart.

## Lesson 7: Water: A Renewable Energy Source

# Writing



**Primary Focus:** Students will generate research questions and begin taking notes from sources to integrate into their essays. [W.4.8]

### WRITING RESEARCH QUESTIONS (10 MIN.)

- Remind students that during the last lesson you added to the W column of the KWL chart. Explain that during this lesson they will write their own questions to guide their research.
- Direct students to look at the notes taken during the last class and ask themselves what else they want to know about the main ideas discovered. What do they need to know to support their claims? In addition, some students may want to adjust their claim based on this new knowledge.
- Tell students to write the research questions they will use to guide them on Activity Page 7.1. Remind students that useful questions will start with “What is,” “Why,” or “How.” Ask students to avoid yes/no questions.



Speaking and Listening  
Exchanging

Information and Ideas

### Entering/Emerging

Have students pull out and discuss key words from the text to include in the KWL chart.

### Transitioning/Expanding

When adding a “wonder” to the KWL chart, prompt students to reread and refer directly from the text, using a sentence frame: When I read the following sentence: \_\_\_\_\_, I wondered about \_\_\_\_\_.

### Bridging

When students are contributing to the KWL chart, provide teacher support for paraphrasing by restating the student’s idea. “So, what you are saying is . . .” (Restate the student’s idea, modeling effective paraphrasing.)

### Activity Page 7.1



## Challenge

After working for fifteen to twenty minutes browsing research materials and gathering notes, tell students to look back at their research questions. Ask students to revise their questions to better match the information they are finding in the materials. Students may choose to make their questions more specific, more general, or add "Explain why." to existing questions.

## Support

Individually or in a small homogeneous group, model changing one of the notes that a student took from their reading into sentences. Then observe the student converting a note into a sentence before allowing the student to continue independently.

### Research Guide

Your Claim: \_\_\_\_\_

What do you need to learn to support your claim?

Research Questions:

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

To turn your research into an essay you need to change your notes into sentences. Use the chart below to help you.

Facts from Research	Sentence Form
Example: <u>Moisture wicking fabric</u> patented in 1998 <u>Speakers sewn into headband</u> for exercising <u>Baby monitors in socks</u> to watch oxygen and breathing	Some clothing has more advanced technology, like <u>special materials that wick away moisture</u> , or contains high-tech features such as <u>speakers</u> or oxygen monitors.

\*This chart should extend for two or three pages for students to continue adding notes during their research.

### STUDENT RESEARCH (30 MIN.)

- Direct students to browse the research materials that you set up in Lesson 6 purposefully, selecting resources that are likely to address the research questions they have selected from the KWL chart and Activity Page 7.1. After choosing their selected research materials, tell students to take notes using the available T-charts. Copies of these may be displayed with the research materials or distributed to students directly.

## ADDING TO THE ESSAY ( 15 MIN.)

- Ask students to review the notes they have taken so far. Rewrite facts that support their claim into sentences on Activity Page 7.1. Then remind students that some of them wrote sentences from their T-chart note during the last class (Lesson 6). Tell students to add those sentences to the essay as well.
- After adding their sentences, direct students to complete the following Exit Ticket on paper, a sticky note, or a notecard. Students should hand in their work when completed to you or a central location in the classroom



### Exit Ticket

Share one of your research questions and why you chose it.



### Check for Understanding

Ask students to indicate if the questions they generated support their claim with a thumbs up, down, or in the middle.

End Lesson



## Writing

### Using Research Questions

#### **Entering/Emerging**

Tell students to use illustrated research materials as their first choices for information. Direct students to add information to their notes based on the images and their captions.

#### **Transitioning/Expanding**

Pair students with a peer, and ask them to generate research questions after viewing or listening to a multimedia resource and take notes from research materials together.

#### **Bridging**

Tell students to share their questions before beginning research. Check the questions to ensure they are not opinions and will not result in yes/no answers.

## 8

# Energy Innovators

## PRIMARY FOCUS OF LESSON

### Reading

Students will compare the challenges faced by early oil innovators with today's solar, wind, and hydro energy innovators using information from "Spindletop Gusher" and other texts. [RI.4.9]

### Writing

Students will prepare and conduct an interview to build knowledge of their research topics through a primary source. [W.4.7]

## FORMATIVE ASSESSMENT

### Exit Ticket

State the definition and provide an example of primary and secondary sources. [SL.4.1c]

## LESSON AT A GLANCE

	Grouping	Time	Materials
<b>Reading (45 min.)</b>			
Visualizing Spindletop	Whole Group	15 min.	<input type="checkbox"/> fifty feet of string or yarn <input type="checkbox"/> large area such as a gymnasium or playing field
Close Reading	Small Group	30 min.	<input type="checkbox"/> Read-Aloud: "Spindletop Gusher" <input type="checkbox"/> Activity Page 8.1
<b>Writing (45 min.)</b>			
Identifying Primary and Secondary Resources	Whole Group	15 min.	<input type="checkbox"/> Activity Pages 8.2, 8.3
Collecting Primary Sources Information	Independent	30 min.	

## ADVANCE PREPARATION

### Reading

- Prepare a piece of string or yarn measuring fifty feet.
- Locate a large area to measure fifty feet using a piece of string. Suggestions include a playing field or gymnasium. If available, a regulation size basketball court, typically measuring fifty feet wide, will work well.

**Note:** If teaching virtually, instead obtain a paper or digital map of the community and images of the Eiffel Tower and the Golden Gate Bridge.

- Prepare small groups of three to five students for the reading activity.
- Prepare one copy of the Read-Aloud text for each small group of students.
- Create or find audio of the text to assist struggling readers.

### Writing

- Prepare an enlarged copy of the model interview.
- Prepare sentence frames for ELL students.

### Universal Access

#### Reading

- Provide a visual reference for one foot and one meter.
- Provide access to an audio copy of the text or preview the text prior to class.

#### Writing

- Encourage the use of sentence starters such as:
  - What do you know about . . . ?
  - Can you tell me more about . . . ?

## CORE VOCABULARY

**visualize, v.** create a mental image

**trenches, n.** a long hole dug in the ground

**derrick, n.** a large wooden frame used to support drilling equipment for the extraction of oil

**boiler, n.** a tank used for heating or holding heated water

**rotary drill, n.** a tool that works by turning a sharpened bit

**bit, n.** the part of a tool that cuts, often used in drills

**blunt, adj.** dull

**debris, n.** small pieces of scattered material

**buggies, n.** small, often open top, vehicles pulled by horses

**Vocabulary Chart for “Energy Innovators”**

Vocabulary Type	Tier 3 Domain-Specific Words	Tier 2 General Academic Words
Core Vocabulary	trenches derrick boiler rotary drill bit debris buggies	visualize
Multiple-Meaning Core Vocabulary Words		
Sayings and Phrases		



## Challenge

Ask the students to use text-based evidence to explain why energy workers—past and present—are similar and different.

## Support

Read the text with the students in a small homogenous group setting.



Reading  
Reading for Information

### Entering/Emerging

Have students read aloud the questions on Activity Page 8.1 to you, monitoring their own oral language production and self-correcting as needed.

### Transitioning/Expanding

Allow the students to read aloud and complete Activity Page 8.1 with a partner. Monitor partner reading for appropriate self-corrections.

### Bridging

Invite the students to orally rehearse responses before completing Activity Page 8.1.

### Activity Page 8.1



## Lesson 8: Energy Innovators Reading



**Primary Focus:** Students will compare the challenges faced by early oil innovators with today's solar, wind, and hydro energy innovators using information from "Spindletop Gusher" and other texts. [RI.4.9]

### VISUALIZING SPINDLETOP (15 MIN.)

- Ask students whether they recall where oil is found. Prompt them to think about the Read-Aloud "Banana Bread and the Story of Oil" in Lesson 1 and *Buried Sunlight* in Lesson 2. (*Answers may vary but should include that oil is found underground.*)
- Tell students that oil is found very deep underground. Explain that, in this story, they will learn that oil is found 311 meters—or 1,020 feet—underground.
- Ask students how big this is and if it could be compared to something of a similar size. Allow students to share a range of ideas, without reference to how accurate they may be.
- Acknowledge that a size this large is hard to imagine or visualize. Tell students that visualizing means to imagine a picture in your head.
- Explain that the class is going to measure this distance to help visualize how deep underground the people in today's story had to dig to find oil.
- Lead students to a large area, with as much open space as possible, ideally with fifty contiguous feet (the width of a basketball court). Suggestions include a playing field, a long driveway or sidewalk, or a gymnasium. Using string or yarn, measure out fifty feet. Tell students that they would need almost twenty and a half more pieces of string to measure the depth of the hole dug to reach the oil underground in today's story. Display the string or yarn in the classroom upon returning as a reference for students while reading the story. For classes learning virtually, recreate this activity using a paper or a digital map and images of famous landmarks, as described in the following directions.
- Show students a map of a familiar place, such as the school or playing field. Draw a line on the map measuring 1,000 feet (to scale the map). Point out familiar landmarks at the start and end points of the line.
- Ask students to think of other examples of objects of distances that measure 1,000 feet. Then, show images of the Eiffel Tower and the Golden Gate Bridge.
- Explain that 1,000 feet is a little less than the Eiffel Tower (1,060 feet at the tip) and more than the Golden Gate Bridge (745 feet above the water).

## CLOSE READING (30 MIN.)

- Ask the students what they remember about the working conditions for oil workers about 100 years ago, like those at Spindletop.
- Tell the students that in today's Read-Aloud they will learn about what it was like to be an early energy innovator.
- In small groups, direct the students to read the text using the following procedure:
  - The student whose birthday is next starts reading one page.
  - After reading the page, the student to the reader's left tells the group what the page was about in their own words.
  - The student who just summarized the page reads the next page.
- After all the pages have been read and summarized, tell the group to work together to complete Activity Page 8.1.

## THE SPINDLETOP GUSHER



### Show Image 8A-1: The Spindletop Gusher

Today's energy innovators are using their creativity to find new ways to access energy from renewable sources. New technologies are being developed to make renewable power, such as solar and hydropower, available to use. Do you remember the Hamill brothers in Beaumont, Texas? They

were early energy innovators who had to solve a similar problem at the turn of the twentieth century.

### The Hamill Brothers Arrive at Spindletop

It was a cold winter morning on January 10, 1901, on a small hill called Spindletop, on the outskirts of Beaumont, Texas. For years, many people had been unsuccessfully digging the ground of the hill in search of oil. Then came an incredible discovery that changed history: a gigantic black gush that came out of the depths of the earth.

At that time, a group of drillers was working on the hill under the command of two men: brothers Curt and Al Hamill. They had arrived at Spindletop on October 1, 1900, after being hired by the owner of that land, Patillo Higgins.

## Challenge

Tell the students to write an additional follow-up question for at least one of their interview questions. Explain that you may not get all the information you are looking for from the first question. Provide the following sentence starters to generate ideas:

"How did you first learn about . . . ?"

"Why do you think that about . . . ?"

"Would it change your mind if I told you that . . . ?"

## Support

Encourage thinking backwards. Ask the student what kind of answers they are looking for and then reverse engineer the question together. Say to the student:

"What do you want to learn from the interview?" (For example: *I want to learn if this person uses renewable energy.*)

"Pretend the person you are interviewing gave you the exact answer you are looking for, what would they say?" (For example: *I may hope for someone to say "Yes, we have solar panels on our house."*)

"Turn that answer around to form a question." (For example: *Do you use some kind of renewable energy in your home?*)



## Writing Generating Interview Questions

### Entering/Emerging

Provide the following sentence frames to generate interview questions:

What do you know about . . .

Do you use . . . ? Why?

How does . . . work?

Where could I find . . . ?

### Transitioning/Expanding

Give the students sentence frames to generate questions and allow the students to collect written responses from the interview subject or record the interview.

### Bridging

Preview the terms *primary* and *secondary*, emphasizing the connections to *first* and *second*. Ask the students to explain the difference between the two.

As soon as they got there, they looked for a place to put their equipment. They found an abandoned hut, full of rusty tools among armies of spiders and cockroaches. The men looked at one another. This was better than nothing! They all worked together to clean the hut as best they could because that would be their new home until they finished the job. For how long? No one knew. It all depended on luck.

Once they were settled in, the men got down to work. They dug **trenches** to bring water from a nearby swamp. They built a wooden **derrick** over what would be the future well. That derrick would hold the metal pipes that they would put into the ground as they dug a deep hole. Once the derrick was finished, the men mounted a **boiler** on top of it to power the steam engine that would run their digging tool.

The team planned to use a special tool called a **rotary drill**. Until then, oil had been searched for using a different tool, which did not rotate or turn. It pounded the earth to dig the wells. But the Hamill brothers knew that the rotary drill was best for sandy soils like the one on that hill. The tool consisted of a rotating tube driven by a motor. At the lower end of the tube there was a piece with sharp teeth, called a **bit**. The bit rotated to cut through the sand, rock, and mud in the ground.

### The First Attempts

At first, the progress had been slow because the bit would get stuck in the first sandy layers of the ground. The men poured water into the well to carry the sand out, but the sand absorbed much of the water and settled back at the bottom. After twenty days into the job, the team had reached 400 feet deep. But there were still several problems to solve. Sand was still accumulating in the hole. The drill bits were already **blunt**. They had run out of wood to feed the boiler. The men were exhausted and hopeless.

Curt Hamill thought that if they poured mud instead of water into the well, the sand wouldn't absorb it as much, and the mud would help carry it out. The idea worked and the team moved forward. At the end of the year, the men stopped work for a few days to celebrate the holidays with their families. But on January 1, 1901, they were all back.

On the morning of January 10, the drill bit got stuck in a layer of hard rocks. The men removed the tool to change the bit. Once the new one was in place, they put the drill down into the well, which had already reached 700 feet deep. And here's what I wanted to tell you about . . .

## A Dark Surprise

When the drill reached the bottom, a strange hissing sound filled the air on the hill. Immediately, a thick column of mud gushed from deep in the earth, carrying with it the very heavy pieces of pipe placed inside the well. The men ran in a hurry, trying to dodge the huge pieces of metal falling from the sky toward their heads! After the mud and the pieces of pipe landed all over the place with a loud noise, the place fell silent. The men slowly and cautiously approached the derrick, ready to run away again if anything else happened.

The first thing they saw was the terrible state of the area around the well. The ground was covered by a thick layer of mud, with huge pieces of pipe sticking out. Shaking their heads, the workers began to remove the **debris** with their shovels. But while they were focused on the task, knee-deep in mud, they felt the ground begin to shake with a deafening roar. Then a gigantic greenish-black jet gushed from inside the hole! What was it? Nothing less than oil!

The immense gush reached 100 feet high above the derrick. The men were covered in oil from head to toe. Dazed, they tried to wipe the oil from their eyes to see what was happening. The first thing they saw, besides the huge black column, was a fire in the boiler they used to activate the drill. The air was filled with the natural gas and oil spewing from the well. If they didn't put out the fire soon, they all ran the risk of being blown into the air in a loud explosion! So the men began to work to put out the flames until the fire was extinguished.

## Meanwhile . . .

What was going on around Spindletop as the drillers worked to put out the fire, and the gush kept going out and roaring nonstop? First, the animals ran away when they heard the loud noise. Farmers watched in awe and terror as the thick black liquid rained down. A carpenter building a barn dropped his tools, mounted his horse, and galloped off to nearby Beaumont to report the news.

The townspeople crowded on the roofs of their houses to catch a sight of the gigantic black column. Hundreds of others wanted to have a closer look and set out immediately, in **buggies** or on horseback, to travel the four miles to the site. Soon, the area around Spindletop was filled with onlookers.

## A New Era

The roaring jet that began to gush out at 10:30 a.m. on that cold, clear winter morning continued to flow nonstop for nine days. A sea of oil flowed down the hillside, flooded nearby streams, and covered animals and houses in a

black greasy film. The drillers built mud dams to contain the oil. Plows were used to bury the oil-soaked ground to decrease the risk of fire. But nothing was able to fully contain the oil flowing from the well. Workers became ill breathing the oil and fumes that filled the air as they worked. The gusher had to be cut off. Finally, the Hamill brothers succeeded in shutting it off with a risky (but effective) system of pipes and valves.

When silence returned, the men realized what had happened: they had just discovered the largest oil well ever seen up to that time. That “black gold” marked the beginning of a new era in the history of energy.



### Check for Understanding

Ask students to choose whether they would prefer to be an energy worker in the past or present and why.

## Lesson 8: Energy Innovators

# Writing



**Primary Focus:** Students will prepare and conduct an interview to build knowledge of their research topics through a primary source. [W.4.7]

### IDENTIFYING PRIMARY AND SECONDARY RESOURCES (15 MIN.)

- Direct students to the information about primary and secondary sources at the top of Activity Page 8.2
- Review the definitions of primary and secondary sources and uses for primary and secondary source information.
- Direct students to practice identifying primary versus secondary sources in the “Practice” section of the Activity Page 8.2. When finished, ask the students to compare their work with a neighbor and then review the correct responses with the whole group. Tell the students to wait to complete the “Try it out!” section until told to do so.

### COLLECTING PRIMARY SOURCES INFORMATION (30 MIN.)

- Tell the students that they will collect primary source information, using interviews, as part of their research. Remind students that most people are experts on energy because we all use it. Their classmates, families, even teachers can all be useful sources of primary source information.

### Activity Page 8.2



- Tell the students that they will collect primary source information to use in their essays by conducting an interview. An interview is when you ask a person questions and collect their answers. You will be interviewing a classmate about energy.
- Tell the students to think about their research questions and ask themselves, “Which one could you find out more from an interview?”
- Point to the KWL chart. Ask the students, “Which of these could you find out more from an interview?”
- Ask the students if they have a research question in mind that could be answered with information from an interview of someone they know. For example, if your friend’s claim is about wind power, that is a good person to interview about that topic because they have been researching it. Tell the students to respond with a thumbs up or down.
- Ask for volunteers to share who they might interview to gather more information. When sharing, prompt the students to include what question they are trying to answer through the interview.
- Direct the students to write their interview questions in the “Try it out!” section of the Activity Page 8.2.
- When ready, students should conduct interviews with classmates using Activity Page 8.3. This may also be conducted during Conducting Research in the writing segment of Lesson 9. Some students may choose to bring Activity Page 8.3 home to interview a family member at home.
- At the end of the class, tell the students to complete the following Exit Ticket:
  - Tell the meaning of primary and secondary sources in your own words and give an example of each.



### Exit Ticket

State the definition and provide an example of primary and secondary sources.



### Check for Understanding

Label one side of the room as primary and the other as secondary. Hold up or project primary and secondary source information examples. Ask students to move to the side of the room that matches the example.

End Lesson

## 9

# New Energy

## PRIMARY FOCUS OF LESSON

### Reading

Students will explain the benefits and drawbacks of different forms of energy production using specific information of the text. [RI.4.3]

### Writing

Students will gather information on different energy sources and add details to the body of the essay. [W.4.1b, W.4.8]

## FORMATIVE ASSESSMENT

### Activity Page 9.3

**Writing** Add information from your sources to your writing and reflect upon which resources are useful for your research topic. [W.4.8]

## LESSON AT A GLANCE

	Grouping	Time	Materials
<b>Reading (55 min.)</b>			
Preview Key Vocabulary	Small Group	5 min.	<ul style="list-style-type: none"> <li><input type="checkbox"/> whiteboard</li> <li><input type="checkbox"/> KWL chart</li> <li><input type="checkbox"/> ReadWorks article: "Energy for Life"</li> <li><input type="checkbox"/> Activity Pages 9.1, 9.2</li> </ul>
Close Reading	Independent	30 min.	
Creating a Presentation	Independent	20 min.	
<b>Writing (35 min.)</b>			
Conducting Research	Independent	20 min.	<ul style="list-style-type: none"> <li><input type="checkbox"/> student selected texts</li> <li><input type="checkbox"/> student essay, teacher models</li> <li><input type="checkbox"/> Students' previous work on Activity Pages 3.2, 4.3, and 7.1</li> <li><input type="checkbox"/> Activity Page 9.3</li> </ul>
Writing the Essay	Independent	15 min.	



## ADVANCE PREPARATION

### Reading

- Display the KWL chart in progress for easy reference during the lesson.
- Provide access to computers and software for creating digital slides, or art supplies for creating poster presentations.
- Obtain images that support the types of energy sources described in the ReadWorks article: solar, wind, and hydropower.
- Plan to use strategic partnering of students as an option for additional support during the “Creating a Presentation” portion of the lesson.

### Writing

- Provide continued access to research materials and blank T-charts for taking notes.
- Prepare sentence frames for use when writing paragraphs.

### Universal Access

#### Reading

- Provide computer access to the ReadWorks site which offers audio of the article’s text.

#### Writing

- Provide access to a word processor for drafting text of the essay.

## CORE VOCABULARY

**generate, v.** to create or make

**renewable, adj.** able to make more of something

**nonrenewable, adj.** not able to make more of something

**dependence, n.** the reliance on something

**Vocabulary Chart for “New Energy”**

<b>Vocabulary Type</b>	<b>Tier 3 Domain-Specific Words</b>	<b>Tier 2 General Academic Words</b>
Core Vocabulary		generate renewable nonrenewable dependence
Multiple-Meaning Core Vocabulary Words		
Sayings and Phrases		

## Lesson 9: New Energy

# Reading



**Primary Focus:** Students will explain the benefits and drawbacks of different forms of energy production using specific information of the text. [RI.4.3]

### PREVIEW KEY VOCABULARY (5 MIN.)

- Tell the students that they have learned a lot about oil, the fuel that powers many essential things in our lives (refer to KWL chart). Explain that one of the things we know is that oil is a nonrenewable resource. Explain that we will examine the word's parts to decode its meaning.
- Display the following on the board:
  - (non): not / (renewable): able to make more
- Have students unpack the definition of the word by examining the parts of the word.
- Display the definition of *nonrenewable*.
- Tell the students that the article they are going to read today is about renewable sources of energy.
- Ask students what the word *renewable* means.
- Ask students to think about what they just learned about the word *nonrenewable* to help them.
- Display the definition of *renewable*.

### CLOSE READING (30 MIN.)

- Direct students to read the ReadWorks article “Energy for Life” individually. Allow five or six minutes for students to read. Audio is also available for this article at ReadWorks.org.
- Preview Comparing Energy Sources: Activity 9.1.
- Tell students that they will be filling in a chart that shows the pros and cons of different types of renewable energy.
- Direct the students to reread the article, making notes about the text-based details needed to complete Activity 9.1.
- Direct students to complete Activity 9.1 using information from the article.

## CREATING A PRESENTATION (20 MIN.)

- Tell the students that they will share their opinion essays by making a fuel of future proposal. Their proposal will be made up of a slide deck (or other hard copy product, depending on accessibility).
- Explain that during this lesson the students will practice by creating a slide that shows what they now know about a source of renewable energy from reading “Energy for Life.”
- Place students with their predetermined strategic partner if you have opted to use this strategy for additional support.
- Review the checklist on Activity 9.2
- Explain that the information you collected on Activity 9.1 will be the text of the presentation. Pictures may be cut and pasted into the slides (or drawn for hard copy products).
- As students finish their work, display them around the room to prepare for a museum walk. These trial presentations are the model for the energy proposals students will create later in the unit.
- When most of the students are ready to present, explain that they will practice a museum walk. This will be how they present their final projects later on. Explain that just like in a museum, they will walk around looking at each display. They may talk in quiet museum voices about what they see with their fellow visitors.
- As the students view the displays, circulate with them as a visitor. While standing side-by-side with students at a display, ask them what they find interesting in the display they are viewing. Remind them that if they see a creative idea in their classmate’s display, they might choose to use that idea in their “Fuel of the Future” presentation later on.
- After viewing the displays, about ten minutes, move the displays to an unobtrusive area of the classroom where they can still be seen for the students to reference during the remainder of the unit.



### Check for Understanding

Designate one side of the room “Pro” and the other side “Con.” Read energy facts from the article and ask students to categorize the fact by choosing a side of the room. Ask students to defend their choice using information from the article.

## Activity Pages 9.1 and 9.2



### Challenge

After completing Activity Page 9.1, ask the students to use the classroom research materials to find additional pros and cons of at least two of the four types of energy sources discussed in the ReadWorks article (fossil fuels, solar, wind, and hydropower).

### Support

Tell the students to color-code the article energy source (fossil fuels, solar, wind, and hydropower) using highlighters or colored pencils to underline. Direct the students to highlight or underline the first column of Activity Page 9.1 to match the colors used in the article. For example, if the solar energy source is yellow in the article, solar would be yellow on the activity page. Explain to the students that they should use the colors to help place the information in the correct part of the chart.



Reading  
Reading for Information

### Entering/Emerging

Provide additional images as visual supports for the article.

### Transitioning/Expanding

Allow the students to read with a partner.

### Bridging

Preview the prefixes re- and non- to assist with key vocabulary.

### Challenge

Assign additional independent research on renewable energy topics using keywords from the reading as search terms in an online database or library catalogue. The students may integrate this information into their own presentation, if relevant.

### Support

Provide the following sentence frames to assist in forming the body paragraphs:

One reason why . . .

Did you know that . . .

\_\_\_\_\_ is important because . . .

## Lesson 9: New Energy Writing



**Primary Focus:** Students will gather information on different energy sources and add details to the body of the essay. [W.4.1b, W.4.8]

### CONDUCTING RESEARCH (20 MIN.)

- Explain to the students that they will continue taking notes using the T-chart format. Encourage the students to begin by taking notes about the energy sources introduced in the article “Energy for Life.” Then, tell the students they should continue to take notes from the research materials available in the classroom (library, or other location in which class is taking place).
- Midway through this segment, remind the students that the answers to their interviews from the last class can also be used in their notes. Tell the students that adding primary source information, like from their interviews, is a way to strengthen their essays.
- At the end of the research time, direct the students to put away their research materials, but leave their notes out.

### WRITING THE ESSAY (15 MIN.)

- Tell the students to reread their notes and identify useful facts they have collected. Remind them to think about whether each fact supports their claim.
- Some students may want to change their claim based on their new knowledge of renewable fuels. Refer these students back to Activity Page 3.2 to review writing a new claim, as needed.
- On Activity Page 7.1, direct students to convert their notes into sentences.
- Some students may have gathered enough details and converted them into sentences to write a body paragraph.
- For students who are ready to begin writing paragraphs, refer them to the class model and the model they labeled on Activity Page 4.3.
- Remind the students that all the sentences in a paragraph have the same idea.

- Have students group sentences that share the same main idea.
- If enough students are ready to begin at the same time, consider gathering, in a small group to review these guidelines.
- Before ending the class, ask the students to read what they have written so far. Then ask them to compare what they have written to the notes they have taken. Tell the students to highlight or underline in their notes the facts that have been used in their essay so far.
- Tell the students to use what they just highlighted or underlined to complete Activity Page 9.3. Direct the students to hand in this work to you or a central location in the classroom when complete.



### Check for Understanding

Ask students to orally express a detail that supports the claim in their essay.

End Lesson



## Writing Writing Paragraphs

### **Entering/Emerging**

Have the students read their notes, one at a time. Model the drafting process by restating the note as a sentence for the student's essay, while the student jots it down. After modeling two sentences, switch roles with the student.

### **Transitioning/Expanding**

Read the student's notes back to the student. After each note is read, ask the student if they would like to use it in their essay. If so, ask which paragraph. Color-code the notes by paragraph (introduction, body paragraph, and conclusion) before telling the students to add those notes to their essay. Highlighting will be the most effective as visual aid when color-coding, but colored underlines will suffice if multiple highlighter colors are not easily accessible.

### **Bridging**

Tell the students to color-code their notes by paragraph (introduction, body paragraph, and conclusion) before adding the notes to the essay.

## Activity Page 9.3



## 10

# *Energy Island,* Part 1

**PRIMARY FOCUS OF LESSON****Reading**

Students will identify the main idea of the opinion text and its key details.

[RI.4.2]

**Writing**

Students will gather information relevant to their research topic and add details to the body of the essay. [W.4.8, W.4.1b]

**FORMATIVE ASSESSMENT**

**Activity Page 10.3**

**Checklist** Students will complete a checklist of opinion essay features, including an identified claim for their research. [W.4.1b]

## LESSON AT A GLANCE

	Grouping	Time	Materials
<b>Reading (45 min.)</b>			
Read-Aloud	Whole Group	15 min.	<ul style="list-style-type: none"> <li><input type="checkbox"/> <i>Energy Island: How One Community Harnessed the Wind and Changed their World</i> by Allan Drummond, pp. 1–12 (excluding sidebars)</li> <li><input type="checkbox"/> student (partners) access to Activity Page 10.1</li> </ul>
Identifying Claim/Counterclaim	Partners	30 min.	
<b>Writing (45 min.)</b>			
Modeling a Counterclaim	Whole Group	15 min.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Opinion Essay Model: High Tech Clothing (Teacher Resource)</li> <li><input type="checkbox"/> Activity Pages 10.2 and 10.3</li> <li><input type="checkbox"/> student selected research materials</li> </ul>
Adding to the Essay	Independent	30 min.	



## ADVANCE PREPARATION

### Reading

- Assign students a partner for completing Activity Page 10.1.
- Prepare access to trade book: *Energy Island* by Allan Drummond, pp. 1–12, for student pairs.

### Writing

- Prepare to display the Teacher Resource Opinion Essay Model: High Tech Clothing.

### Universal Access

#### Reading

- Pair students purposefully to provide peer support.

#### Writing

- Provide access to audio of research materials or digital materials on a computer with text to voice software or browser extensions.

## CORE VOCABULARY

**counterclaim, n.** an idea meant to disprove a claim

**support, v.** to provide evidence of truth

**defend, v.** to protect against

**Vocabulary Chart for *Energy Island*, Part 1**

Vocabulary Type	Tier 3 Domain-Specific Words	Tier 2 General Academic Words
Core Vocabulary		counterclaim support defend
Multiple-Meaning Core Vocabulary Words		
Sayings and Phrases		

Lesson 10: *Energy Island*, Part 1

## Reading



**Primary Focus:** Students will identify the main idea of the opinion text and its key details. [RI.4.2]

### READ-ALoud (15 MIN.)

- Tell the students that in today’s story they will read about an island that decided to use renewable energy. Some people thought it was a good idea, but not everyone. This book includes a claim (prompt student to recall the definition of claim) and a counterclaim.
- Write on the board:
  - counter = opposite
  - claim = a statement that says something is true
- Ask the students to look at the parts of this word. Ask them what they think each means. After hearing students’ ideas, write on the board:
  - Counterclaim, n. an argument against a claim
- Explain that as you read the first part of *Energy Island*, the students should listen for the claim and the counterclaim of the renewable energy argument.
- Read *Energy Island*, pp. 1–12, excluding the sidebars.
- Tell the students that authors think about who their audience is when coming up with a claim so that it is as convincing as possible. Ask, “Who is the author’s audience in *Energy Island*?” (*Expected responses include the people on the island or people who did not want to switch to another kind of energy.*)

### IDENTIFYING CLAIM/COUNTERCLAIM (30 MIN.)

- Ask the students to turn to Activity Page 10.1. Explain to the students that they will find the claim and counterclaim used in the story they just read.
- Tell the students that some of the work has already been done for them. Ask the students to share what they see already printed on the page.

#### Activity Page 10.1



- Explain that in the first column labeled “Problem” they will find details about the problem being solved in the story. We already know from the page that tankers delivering oil to the island was one cause for the Ministry of Energy to select Samsø to stop using nonrenewable energy. Tell the students that in this section they need to fill in a second cause beside the empty bullet point.
- Ask the students to point to the column labeled “Solution” on their paper. Explain that this section will contain the details about how the island solved the problem—a request from the Ministry of Energy to stop using nonrenewable energy.
- Tell the students that in this section, some of the counterclaims have been given to them, but they need to find the claim. In other words, what does the story’s author claim is the solution to ending the island’s use of nonrenewable energy?
- Ask the students what they think the claim is, based on what they just heard. Accept all answers, but if they do not include that information in their response on their own, ask the students, “What in the text tells you that?” Then tell the students that they will work with a partner to find the answers in the text and complete the chart on Activity Page 10.1.
- While the students are working, circulate around the room to ensure both students in each partnership are actively engaged with the work and with their partner. Remind the students to refer to the text as they work, even if they are confident they recall the story accurately. Tell the students they should use the text to find and confirm their responses.
- When partners finish the page, ask them to pair up with another set of partners. Explain that their answers should match, but they do not have to be exactly the same, word-for-word. If they find answers that are different, the two sets of partners should return to the text to find the correct answer. If they are still in disagreement, the group should ask for assistance.

## Challenge

Have the students include the page numbers of the book where the claim and counterclaim information was found next to the chart on Activity Page 10.1.

## Support

Have the students verbally rehearse the claim and evidence before writing the responses.



### Check for Understanding

Ask the students to explain claim and counterclaim in their own words, providing an example of each.



Lesson 10: *Energy Island*, Part 1

# Writing



**Primary Focus:** Students will gather information relevant to their research topic and add details to the body of the essay. [W.4.8, W.4.1b]

**Entering/Emerging**  
Create a bank of correct responses for Activity Page 10.1. Have the students insert answers into Activity Page 10.1 from the bank in a cooperative group.

**Transitioning/Expanding**  
Pair students to write the page numbers where the correct response can be found next to each box on Activity Page 10.1.

**Bridging**  
Pair the student with a partner and tell them to take turns rereading the text, as needed.

### Challenge

Tell the students to generate more than one counterclaim statement (two to four, depending on the speed the student works). After a brief amount of additional research, ask the students to choose a counterclaim option for their essay, one which can be best defended against with the facts the students found.

### Activity Page 10.2



### MODELING A COUNTERCLAIM (15 MIN.)

- Explain that in the article “Energy for Life” the students learned that renewable energy sources have good and bad things about them. In *Energy Island* they saw that when someone presents a claim, others present a counterclaim, or an argument against the main idea.
- Tell the students that strong opinion essays include facts that support the claim AND facts that defend against any counterclaims.
- Display the Teacher Resource Opinion Essay Model: High Tech Clothing. Draw the students’ attention to the third paragraph containing the counterclaim.
- Explain to students that they have gathered facts that support their fuel of the future claims. Now, they need to make sure they also include a counterclaim paragraph. Read the third paragraph aloud to the students.

“Technology is not always affordable, especially when it is new. Some may say that high-tech clothing will never become popular because it will be too expensive. However, as technology develops, it usually comes down in price. Worry about ruining expensive, high-tech clothing might also be a downside to consider. The solution is the same. Over time, technology is improved and any delicate clothing innovations will eventually become more durable to help improve sales.”

- Point out the counterclaim statements to the students.
  - Some may say that high-tech clothing will never become popular because it will be too expensive.
  - Worry about ruining expensive, high-tech clothing might also be a downside to consider.

The defense against the counterclaims:

- However, as technology develops, it usually comes down in price.
- Over time, technology is improved and any delicate clothing innovations will eventually become more durable to help improve sales.

- Using Activity Page 10.2 and their research notes, direct the students to write a counterclaim for their essays. Tell the students to conduct additional research to gather any necessary information, as needed. Explain that they now know which sources have information on their topic and they can return to those for information that helps them write a counterclaim.
- Tell students that in Lesson 12 they will also be discussing wind and solar sources of energy. If they don't already have information on these in their notes, it should be added today.

### ADDING TO THE ESSAY (30 MIN.)

- Direct the students to the Activity Page 10.3. Tell the students to fill in the activity page based on the current status of their essay. Remind students that they are still drafting and may not have everything on the checklist yet. Students will likely be able to add their introduction and two body paragraphs.
  - The students may notice that they have not drafted their conclusion. Tell the students that they will draft this during the next lesson.
- Tell the students to add to their essay based on what is missing from the checklist.
- Direct the students to hand in their work to a central location in the classroom, collect the work from students after they are finished. Alternatively, you can conduct a tableside check of Activity Page 10.3, described as follows:
  - Be mindful that the students will need this page back for the next lesson. It should be reviewed and returned as promptly as possible. One strategy would be a tableside check in which you can check this page at the student's seat rather than collecting and returning the papers.



#### Check for Understanding

Verbally review each item on the checklist. As you read each item, ask students to give a thumbs up or down to show they have included that in their writing so far. This is an excellent opportunity for students to mark their checklist with the outstanding items for future reference.

End Lesson

### Support

Ask the students the following prompts to assist in verbally generating a counterclaim, before recording it on the activity page.

- How could you say the opposite of your claim statement?
- What downsides are there to your claim, even if you do not agree?
- Have you heard of different points of view about your claim? Could one of those be a counterclaim?

### Activity Page 10.3



### Writing Writing

#### Entering/Emerging

Allow the students to dictate the essay text.

#### Transitioning/Expanding

Before writing, ask the students to highlight keywords in their notes. Remind the students to integrate those keywords into the essay.

#### Bridging

Allow students to verbally review what each paragraph should contain before using the Opinion Essay Checklist.

## 11

# *Energy Island,* Part 2

**PRIMARY FOCUS OF LESSON****Reading**

Students will explain the author's use of an anecdote to support the text's claim. [RI.4.8]

**Writing**

Students will be guided through writing a conclusion paragraph. [W.4.1d]

**FORMATIVE ASSESSMENT****Activity Page 11.1**

**Checklist** Students will evaluate their essay development using a revising and editing checklist. [W.4.5]

## LESSON AT A GLANCE

	Grouping	Time	Materials
<b>Reading (30 min.)</b>			
Close Reading	Whole Group	30 min.	<ul style="list-style-type: none"> <li>❑ an enlarged chart, as seen on Activity Page 10.1, tracking the claim/counterclaims in <i>Energy Island</i></li> <li>❑ <i>Energy Island</i> by Allan Drummond, pp. 13–31, including the sidebars on pp. 6, 8, 25</li> </ul>
<b>Writing (60 min.)</b>			
Completing the Essay	Whole Group	40 min.	<ul style="list-style-type: none"> <li>❑ Activity Page 4.2</li> <li>❑ student work from Activity Page 10.3</li> </ul>
Using Revision and Editing Checklists	Independent	20 min.	<ul style="list-style-type: none"> <li>❑ Activity Page 11.1</li> <li>❑ Teacher Resource Opinion Essay Model: High Tech Clothing</li> </ul>



## ADVANCE PREPARATION

### Reading

- Prepare a display of the chart seen on Activity page 10.1 on chart paper or a digital whiteboard, leaving the “Counterclaim” section blank.
- Display the Opinion Essay Model: High Tech Clothing.
- Post sentence frames for class discussion on the board or other visible location.

### Writing

- Continue to Display the Opinion Essay Model: High Tech Clothing while students work on their own essays.

### Universal Access

#### Reading

- Seat students purposefully to maximize their attention during the Read-Aloud.

#### Writing

- Provide access to a word processor or voice to text software or browser extension.

## CORE VOCABULARY

**revise, v.** change a piece of writing to improve style, form, and purpose

**edit, v.** change a piece of writing to correct errors

**Vocabulary Chart for *Energy Island, Part 2***

<b>Vocabulary Type</b>	<b>Tier 3 Domain-Specific Words</b>	<b>Tier 2 General Academic Words</b>
Core Vocabulary		revise edit
Multiple-Meaning Core Vocabulary Words		
Sayings and Phrases		

Lesson 11: *Energy Island*, Part 2

## Reading



**Primary Focus:** Students will explain the author's use of an anecdote to support the text's claim. [RI.4.8]

**CLOSE READING (30 MIN.)**

- Tell the students that today they will finish the story of *Energy Island*. In the last lesson, they heard the book's claim.
- Ask the students to recall the claim. (*The island should convert to renewable power/wind power.*)
- Tell the students that the last page they read introduced some counterclaims, reasons against the claim. Ask the students to listen and see if they can hear them.
- Read pages 11–12.
- Ask the students, “What are some counterclaims to the claim the island should convert to renewable energy?” (*cost, time, prefer the old way—truck—, too much trouble— let others do it—, too old for changes*) Allow students to look back at Activity Page 10.1, as needed.
- Record these counterclaims on the chart as shown.
- Explain that in a piece of opinion writing, you give evidence that refutes, or disproves, any counterclaims. Ask the students to listen for evidence that disproves the counterclaims (show on the displayed chart) as you listen to the rest of the story.
- Read each page of the story—pausing after each— to record evidence the students observe in a column of the chart being displayed.
- Tell students that as they conduct their research they should look for facts that can be used to disprove the counterclaims they wrote on Activity Page 10.2 during the last class.


**Check for Understanding**

Verbally or in a written form, ask the students to rate the quality of the argument made for wind power on the island of Samsø and support their answer with their knowledge of energy.

## Lesson 11: Energy Island, Part 2

# Writing



**Primary Focus:** Students will be guided through writing a conclusion paragraph. [W.4.1d]

### COMPLETING THE ESSAY (40 MIN.)

- At this point in the unit, many students will have collected a sufficient amount of details from their research. Begin by asking students to consult their Activity Page 10.3. Ask the students, based on their checkmarks from the last class, what they need to add during class today. Some students will need to add a counterclaim paragraph to strengthen your essay. All students will need to add a concluding paragraph.
- Display the Opinion Essay Model: High Tech Clothing.
- Draw the students' attention to the last paragraph and ask the students what this part of the essay is called (*conclusion*).
- Explain that the purpose of the conclusion is to restate the claim. Ask the students where they see that in the example. (*The clothing of the future will be high-tech.*)

“Wouldn't it be exciting not to worry about putting down your smartphone and losing it? Well, in the future you will not need to because it may already be built into your outfit. Tomorrow's fashion innovations will not just make our pants and shoes more comfortable, they will make them more useful. The clothing of the future will be high-tech.”
- Explain that in addition to the claim, an effective conclusion will also have sentences meant to remind the reader of the evidence and make a final attempt to sway the reader.
- Direct students to work on their essays, finding and adding details and completing their checklists. Remind students to use the transition words they learned in Lesson 2.

### Challenge

Ask the students to think of additional counterclaims that could apply, beyond what is included in the story.

### Support

Ask the students to contribute to the discussion based on a specific page of text being displayed.



### Speaking and Listening Discussion

#### Entering/Emerging

Ask the students multiple choice questions such as, “Should this go in the ‘Claim’ or ‘Counterclaim’ column?”

#### Transitioning/Expanding

Post sentence frames for class discussion.

#### Bridging

Use a visual signal to let the students know they will be called on next to contribute to the class discussion. This will provide adequate time to plan the response.

## Challenge

Direct students to exchange their essays and provide feedback based on the Revising and Editing Checklists.

## Support

Break the Revising and Editing Checklists into more manageable chunks, assigning one or two items to look for at a time.



## Writing Revision

### Entering/Emerging

Assign a partner to assist with reviewing the essay draft using the checklist.

### Transitioning/Expanding

Mark the end of lines in the essay that contain errors to assist the student in locating them.

### Bridging

Review the meaning of revising and editing, asking the students to give a verbal example of each before using the checklists.

## Activity Page 11.1



## USING REVISION AND EDITING CHECKLISTS (20 MIN.)

- After forty minutes of work, or as a large number of students complete their checklist on Activity Page 10.3, introduce the next steps, revising and editing.
- Explain that after the essay has all its parts, the next step is to improve and correct the draft using Activity Page 11.1.
- Display both checklists. Ask, “What differences do you see between these?” Invite students to make suggestions. If not suggested, tell the students that one way to describe revision is improving your writing and one way to describe editing is fixing your writing. Improving is using your author’s voice to make your writing the best it can be. Fixing is correcting any mistakes in your spelling, grammar, and punctuation.
- After you have included everything on your Opinion Essay Checklist, move on to your Revising and Editing Checklists.
- Direct students to continue working on their essays.
- With five minutes left to work, remind students to revisit the Opinion Essay Checklist to ensure their writing is complete.
- As the students work, conduct a tableside check (as described in Lesson 10) to review the students’ Revising and Editing Checklists. Note the students’ progress towards completing their essay within the next few lessons.



### Check for Understanding

Review the list of items to check for on the Revising and Editing Checklists. As you read each item, ask the students to indicate if they are clear on what they are looking for in their writing with a thumbs up, down, or in the middle.

End Lesson



## 12

# Renewable Energy

## PRIMARY FOCUS OF LESSON

### Reading

Students will explain details about renewable energy. [RI.4.2]

### Writing

Students will strengthen the organization and details in their writing through revision. [W.4.5]

## FORMATIVE ASSESSMENT

### Activity Page 12.2

**Checklist** Students will identify revisions made to the essay to improve organization and detail clarity. [W.4.5]

## LESSON AT A GLANCE

	Grouping	Time	Materials
<b>Reading (45 min.)</b>			
Close Reading	Independent	15 min.	<input type="checkbox"/> ReadWorks Article: "Clean Energy" <input type="checkbox"/> Activity Page 12.1 <input type="checkbox"/> chart paper <input type="checkbox"/> markers <input type="checkbox"/> student work from Activity Page 12.1
Debate	Small Group	30 min.	
<b>Writing (45 min.)</b>			
Revising the Essay	Independent	30 min.	<input type="checkbox"/> Activity Page 12.2 <input type="checkbox"/> access to the student's partner's work on Activity Page 12.2
Partner Feedback	Independent	15 min.	



## ADVANCE PREPARATION

### Reading

- Label one side of the classroom “Claim” and the other side “Counterclaim.” Post a piece of chart paper on both sides. Whiteboard space may also be used.
- Post sentence starters for verbal debate in a location easily visible from both sides of the room.

### Writing

- Arrange a partner for Entering/Emerging ELL students while working on the Activity Page 12.2.

### Universal Access

#### Reading

- Provide access to the audio that accompanies the ReadWorks article: “Clean Energy.”

#### Writing

- Provide access to a digital copy of the Activity Page 12.2 with voice to text software or browser extension.

## Lesson 12: Renewable Energy

# Reading



**Primary Focus:** Students will explain details about renewable energy. [RI.4.2]

### CLOSE READING (15 MIN.)

- Direct students to read the ReadWorks article “Clean Energy.” As they read, ask students to take notes on Activity Page 12.1.
- While the students are working, the teacher should help individual students or pull together a small group of students who need similar supports to complete this activity page.
- After completing the activity page, tell students to turn to a neighbor and compare notes. Explain that each person’s notes will be slightly different, but should contain most of the same information. If the students notice a big difference between their notes and their partner’s, discuss why they chose to include that information.
- Before ending this segment of the lesson, ask the whole group to share any information they learned that they found interesting or surprising.

### DEBATE (30 MIN.)

- Label one side of the room “Claim” and the other side “Counterclaim.” Begin by asking the students, “Suppose you thought that oil is a fuel of the future. How could you state that claim in the form of a sentence?” Invite students to share their ideas.
- Write a sentence frame on chart paper or whiteboard for students to access and use for additional support if needed, such as \_\_\_\_\_ is a fuel of the future, because \_\_\_\_\_.
- Write the student-generated statements large enough to see from a distance on a piece of paper or whiteboard. Post it on the claim side of the room.
- Invite students who want to defend this claim to stand on that side of the room. Remind students that this does not need to match the essay they are writing.

### Activity Page 12.1



### Challenge

Encourage students to make inference statements using facts from their notes during debate.

### Support

Allow the students to jot down speaking notes before sharing during the debate.



## Speaking and Listening

### Offering and Supporting Opinions

#### Entering/Emerging

Pair with a buddy to participate in the debate together.

#### Transitioning/Expanding

Post sentence starters for debate where they are visible from either side of the room.

#### Bridging

Take a few minutes while the class begins to take notes on the ReadWorks article to preview the debate activity.

- Invite students who would like to make counterclaims to stand on the “Counterclaim” side of the room. Invite students to state their counterclaims. Record these statements on the chart paper or a whiteboard posted on the counterclaim side of the room.
- Invite students on the claim side of the room to defend against those counterclaims.
- Repeat this process for the wind and solar power claims; state a claim, move to the chosen side of the room, state counterclaims, and defend counterclaims.
- Allow and encourage students to refer to their notes on Activity Page 12.1 as they make their cases.



### Check for Understanding

Direct students to answer the “Ask Yourself “ question at the bottom of Activity Page 12.1, “Does any of the information in this article support your essay’s claim or connect to your essay’s counterclaim? Why or why not?”

## Lesson 12: Renewable Energy

# Writing



**Primary Focus:** Students will strengthen the organization and details in their writing through revision. [W.4.5]

### REVISING THE ESSAY (30 MIN.)

- Ask the students to turn to the checklists on Activity Page 11.1 they used during the last class.
- Direct the students to revisit their work from the last class and add a checkmark next to items on the Activity Page 11.1 that are now complete.
- After updating their checklist, invite the students to trade essays with a partner. Partners should read their classmate's work and complete the Activity Page 12.2.
- Explain that when listing the evidence for the partner's essay, there may not be the same number of pieces of evidence as spaces on the checklist. They should leave lines blank or add lines as needed.

### PARTNER FEEDBACK (15 MIN.)

- After returning the essay to the writer, direct students to ask any clarifying questions about the feedback. Remind students that revision is improving our writing. Writing can always be better. Even if both the writer and partner checked off all the items on the list, students should choose three areas to revise during the next class.
- Conduct tableside checks of Activity Page 12.2 while the students work.



### Check for Understanding

Ask the students to share their compliments at the bottom of Activity Page 12.2. Ask each volunteer the follow-up question, "What details did you add that earned you that compliment?"

End Lesson

### Challenge

Direct the student focus on changes to word choice, selecting specific words to create a reaction in the reader.

### Support

Ask the students to highlight or underline the claim and counterclaim in their writing.

### Activity Page 12.2



### Writing Peer Review

### Entering/Emerging

Allow the students to preview the peer review checklist and discuss it with a partner before reading the partner's essay.

### Transitioning/Expanding

Have the students fill in the checkmarks and provide the rest of the feedback verbally, while the essay's author records it on paper.

### Bridging

Have the students refer to the Activity Page 4.2 as a visual aid for help finding parts of the partner's essay.

## 13

# Houston Makes a Change

**PRIMARY FOCUS OF LESSON****Reading**

Students will identify key details that support the passage's main idea. [RI.4.2]

**Writing**

Students will strengthen the conventions in their writing through editing. [W.4.5]

**FORMATIVE ASSESSMENT**

**Activity Page 13.2**

**Rubric** Students will self-evaluate their work using a rubric. [W.4.5]

## LESSON AT A GLANCE

	Grouping	Time	Materials
<b>Reading (40 min.)</b>			
Close Reading	Independent	10 min.	<ul style="list-style-type: none"> <li><input type="checkbox"/> ReadWorks Passage “Houston Affects the Earth”</li> <li><input type="checkbox"/> Activity Page 13.1</li> </ul>
Analyze the Reading	Partner	30 min.	
<b>Writing (50 min.)</b>			
Revising and Editing the Essay	Independent	15 min.	<ul style="list-style-type: none"> <li><input type="checkbox"/> student essays</li> <li><input type="checkbox"/> Peer Feedback from Activity Page 12.2</li> <li><input type="checkbox"/> Revising and Editing Checklist from Activity Page 11.1</li> <li><input type="checkbox"/> Activity Page 13.2</li> <li><input type="checkbox"/> student selected research materials that include images</li> <li><input type="checkbox"/> supplies for capturing digital images (such as a camera app) or methods of obtaining paper images (such as a color printer or magazines for clipping or tracing paper)</li> <li><input type="checkbox"/> access to computers with the ability to create a slide deck or</li> <li><input type="checkbox"/> large format paper or poster board and coloring materials</li> <li><input type="checkbox"/> Teacher Resource: Opinion Essay Model (Labeled)</li> </ul>
Creating the Presentation	Independent	35 min.	

## ADVANCE PREPARATION

### Reading

- Obtain images that support the comprehension of the ReadWorks article for Entering/Emerging ELL students. Ideas include images of solar panels, oil refineries, the Houston ship channel, a map of Texas showing where Houston is located, Bike to Work Day, Lake Houston Dam, etc.
- Create sentence starters for Transitioning/Expanding ELL students to use on Activity Page 13.1.

### Writing

- Prepare a model, showing students how the teacher would like the presentations set-up. This may be a desk with a model display or diagram displayed on the board.
  - Display the Opinion Essay Model (Labeled) from Lesson 4 alongside either chart paper or space on a whiteboard for drawing a model presentation layout.
- Gather necessary materials for the students to create their presentations.
  - Necessary materials for student presentations will depend on whether the students will make digital or paper products. For digital products, students will need access to computers with a slide-making program, such as PowerPoint or Google Slides. To create paper products, students will need four pieces of paper, markers, scissors, glue or tape, and access to a printer or magazines that may be cut up.
  - Both digital and paper presentations will need access to images. Ideally, students should have access to a computer and printer to search for and print online images that connect to the students' writing. If that is not possible, students may use images cut from discarded magazines or trace images found in books.
  - Invite students to collect primary source images by taking and bringing in their own pictures. Subjects may include power lines, gas pumps, or examples of alternative energy that can be found in the student's community.

### Universal Access

#### Reading

- Provide audio of the text or Read-Aloud, as needed.

#### Writing

- Chunk the tasks to create the presentation into smaller pieces with teacher check-ins in between.

## Lesson 13: Houston Makes a Change

# Reading



**Primary Focus:** Students will identify key details that support the passage's main idea. [RI.4.2]

### CLOSE READING (10 MIN.)

- Tell the students that today they will read about a real place in Texas that made some changes to how they use energy, including trying some renewable sources.
- Tell students that they will be synthesizing, or combining the knowledge they have learned in this unit as they read this text closely.
- Instruct students to jot down questions, thoughts, or details from this text that makes them think about other knowledge they have learned in this unit.
- Tell students to underline details in the text that are similar to a detail that they have read in a prior lesson's text, or circle details that make them think differently about what they have learned in a prior text.
- Finally, tell students that they need to be able to identify and explain the passage's main claim after reading.
- Direct the students to do a first read of the ReadWorks article "Houston Affects the Earth" independently.

### ANALYZE THE READING (30 MIN.)

- Allow a few student volunteers to share their synthesis of text evidence and the main claim of the passage.
- Ask the students to preview the questions on Activity Page 13.1
- Partner students to complete Activity Page 13.1. Remind the students to look back and reread the text as needed.



### Check for Understanding

After students have completed the first question on Activity Page 13.1, ask the class to pause their work. Ask the students to share what they wrote as the claim of the article. Then, ask students to share how they wrote the same claim using different words.

### Challenge

Assign the students to conduct independent research into other major cities that have made similar steps to change their energy usage as Houston has done.

### Support

Chunk the text by dividing it into shorter portions for the students to read. Tell the students to answer the questions they are able to answer before moving on to the next section of the article.



### Reading Reading for Information

#### Entering/Emerging

Provide images to support comprehension of the text.

#### Transitioning/Expanding

Provide sentence starters for use on Activity Page 13.1.

#### Bridging

Encourage verbal rehearsal before writing responses to Activity Page 13.1.

### Activity Page 13.1





## Lesson 13: Houston Makes a Change

# Writing



**Primary Focus:** Students will strengthen the conventions in their writing through editing. [W.4.5]

### REVISING AND EDITING THE ESSAY (15 MIN.)

- Remind students that in Lesson 12 they used a revising checklist to check their own work and a partner's work. Today they will improve their essays by making the changes based on that feedback and any other goals they set for themselves.
- Ask the students to turn to Activity Page 13.2. Tell the students that this is another tool they can use to evaluate their work.
- Direct students to make changes using the checklist and rubric. If a student does not believe that changes are needed, repeat from the last lesson, "Remind students that revision is improving our writing. Writing can always be better. Even if both the writer and partner checked off all the items on the list, students should choose three areas to revise during the next class."
- After students have revised their work, direct students to the editing checklist to correct any errors in English language conventions that may have been added in the course of revision.
- While the students are working, conduct tableside checks of Activity Page 13.2. Make note that there is a response for each row. Ask students who have marked developing in any row what their plan is for fixing that part of the essay.

### Activity Page 13.2



### CREATING THE PRESENTATION (35 MIN.)

- Model how to transfer the text of their essay, breaking it up by paragraphs (introduction, claim, counterclaim, conclusion) onto four slides or pages, respectively.
  - Display the Opinion Essay Model (Labeled) from Lesson 4.
  - Point to each labeled part of the essay and explain that each paragraph will go on its own slide with pictures that connect to the text in that paragraph.

- Draw a rectangle representing a slide on the chart paper or whiteboard. Explain that the text from a paragraph would be copied onto the slide as you either copy the text of the paragraph or draw a placeholder like a line onto the rectangle.
- Tell the students that pictures would be arranged around the text to add visuals that both capture the audience’s attention and add extra visual information to the slide. Draw small rectangles on the slide to demonstrate.
- Tell the students that their slides do not need to be arranged exactly like the model, but they should include the text of their paragraph and accompanying pictures.
- Model how to create a bibliography page.
  - Explain that the last page of the presentation will be a bibliography, or list of sources used for information. Remind the students that as they have been conducting research, they have been recording their sources at the top of their notes. Explain that images must be cited for the same reason words need to be cited. Credit must be given for anything you did not create, text or images.
  - Write the model bibliography entry shown below on chart paper or a whiteboard below the model slide.

	Example
Title	“Clean Energy”
Author	By: ReadWorks.org
Type of Resource	Online article

- Give the students directions for creating their presentations.
  - Tell students to copy their paragraphs onto their slides or paper, one paragraph to each page.
  - Show the students what is available to them for obtaining images. This will depend on what materials you have access to based on your advance preparation for this lesson. Model how to access any online resources, such as logging on to the computer or using login credentials to go online to search images. Set guidelines for using paper resources such as what they may or may not cut apart to capture images.

### Challenge

Tell the students to label their images as primary or secondary images in the presentation.

### Support

Tell the students which resources to use based on where they will be able to locate images pertinent to the student’s essay text. For example, if a student is writing about solar as a source of energy, direct the student to resources mainly about solar or radiant energy versus resources that cover a wide range of renewable energy. This will reduce the amount of time the student spends browsing for usable images.



## Writing Creating Presentations

### Entering/Emerging

Allow students to use keywords as captions for images.

### Transitioning/Expanding

Assign a partner to work side by side. Tell the students to ask their partners for help defining words or tasks on the activity page, as needed.

### Bridging

Have students orally explain items on the Activity Page 9.2 before beginning.

- For students creating hard copy products, provide tracing paper to assist in copying challenging images. For students creating digital products, encourage the use of multimedia such as moving GIFs, photographs, or short video clips.
- Remind the students to include their bibliography on the last page. Tell the students that if they are including a primary source image that they created themselves (such as a picture they took) or information from an interview they conducted, it should still be included in the bibliography with themselves as the photographer or author.



### Check for Understanding

Ask students to share one common error they found while editing as a whole class. If they shared the error with their classmate, use an agreed upon visual signal.

End Lesson



## 14

# *The Boy Who Harnessed the Wind*

**PRIMARY FOCUS OF LESSON****Reading**

Students will identify cause and effect structures in the story's plot that lead to the character's solution to the problem. [RI.4.5]

**Writing**

Students will prepare to report on their topic by creating a presentation, including a visual display and descriptive details to support their main idea. [W.4.4, SL.4.5]

**FORMATIVE ASSESSMENT**

**Activity Page 14.2**

**Checklist** Students will complete a presentation checklist to assess progress and determine final steps. [W.4.4]

**LESSON AT A GLANCE**

	<b>Grouping</b>	<b>Time</b>	<b>Materials</b>
<b>Reading (45 min.)</b>			
Read-Aloud	Whole Group	15 min.	<input type="checkbox"/> <i>The Boy Who Harnessed the Wind</i> by William Kamkwamba and Bryan Mealer
Analyzing the Story	Partners	30 min.	<input type="checkbox"/> Activity Page 14.1
<b>Writing (45 min.)</b>			
Creating the Presentation	Independent	30 min.	<input type="checkbox"/> Activity Page 14.2
Evaluating the Presentation	Independent	15 min.	

## ADVANCE PREPARATION

### Reading

- Arrange partners for completing Activity Page 14.1.

### Writing

- Arrange partners for completing Activity Page 14.2.

### Universal Access

#### Reading

- Seat students close during the Read-Aloud or provide copies for the students to follow along.
- Prepare to read aloud the trade book *The Boy Who Harnessed the Wind*, by William Kamkwamba and Bryan Mealer. As you preview the book, you may wish to add page numbers and reference the Guided Reading Supports included in this lesson. This trade book does not have numbered pages, but for ease of use, we have referred to page numbers in our materials. We begin with page 1, which is opposite the text “In a small village. . .” and number each page in order after that.

#### Writing

- Divide the checklist into smaller, more manageable portions with a teacher check-in between portions.

Lesson 14: *The Boy Who Harnessed the Wind*

## Reading



**Primary Focus:** Students will identify cause and effect structures in the story's plot that lead to the character's solution to the problem. [RI.4.5]

### READ-ALoud (15 MIN.)

- Tell students that today's story is about a boy from Malawi, a country in Africa, who had an energy problem in his community.
- Direct the students to preview the comprehension questions on Activity Page 14.1. Tell students to listen to this information as they enjoy the story.
- Read *The Boy Who Harnessed the Wind* to the students. Begin on the first page of the story, saving the author's note for the end. As you read, incorporate the following information and Guided Reading Supports:
  - p. 7: "William thinks a lot about magic. What else does he wonder about?" (*Answers will vary but the most accurate answers will reference how things or machines work.*)
  - p. 14: "What does William mean when he says 'electric wind'?" (*Answers may vary, but students should include wind power, turbines, or things like a fan.*)
  - p. 20: "William's village did not have many resources. How did he manage to build his windmill?" (*Answers may vary, but should include gathering supplies from the junkyard, assembling the parts, receiving help from friends and family.*)
  - p. 28 (last page of text): "What do you predict William will build next?" (*Answers may vary, but some students may include a water pump or well.*)

### Activity Page 14.1



### Challenge

Have students conduct independent research on how to make a homemade wind turbine.

### Support

Provide the page numbers where the responses to Activity Page 14.1 can be found. See the answer key for details.





## Reading

### Reading for Information

#### Entering/Emerging

Point to the illustrations in the book as it is being read. Use prompts, such as “What do you see happening here?” or “What does the face/body language tell you in the picture?” to support comprehension.

#### Transitioning/Expanding

Pair up students purposefully to provide language support while completing Activity Page 14.1.

#### Bridging

Remind the students that they learned about wind turbines earlier in the ReadWorks article from Lesson 12. Help the students make a connection between the wind turbine seen in this text and those seen earlier by recalling facts from that earlier article or looking back at the notes taken on Activity Page 12.1.

## ANALYZING THE STORY (30 MIN.)

- Explain that in this story, something happened—a cause—that created a negative effect for the village. Ask the students, “What was the setting of *The Boy Who Harnessed the Wind*?” (*central Malawi, Africa*). Ask the students, “How did the setting influence the plot of the story?” (*Answers will vary but may include the dry climate in Malawi caused a lack of water in the village.*) Ask the students, “What happened that affected the village?” (*Correct student responses should include that a drought caused a food shortage.*)
- Explain that the next step in the story was to find a solution to the problem. Ask the students, “What problem was William trying to solve?” (*Correct student responses should include a way to get water to the fields to grow food.*)
- Ask the students for the solution William found for this problem. (*Correct answers should include building a wind turbine and/or creating power to pump water into the fields.*)
- Ask students for ideas about what they could do to help others in their community or school. (*Answers will vary.*)
- In partners, direct the students to Activity Page 14.1. Make the book available for partners who need to revisit the text as they work.
- Direct the students to complete Activity Page 14.1 with a partner. After completing the activity page, ask the partners to compare their work with another pair of students. After completing their work, direct the students to hand in the completed page to you or a central location in the classroom.



### Check for Understanding

Ask students to make and explain their claim about wind energy after reading the text.

Lesson 14: *The Boy Who Harnessed the Wind*

# Writing



**Primary Focus:** Students will prepare to report on their topic by creating a presentation, including a visual display and descriptive details to support their main idea. [W.4.4, SL.4.5]

## CREATING THE PRESENTATION (30 MIN.)

- Remind the students that during the last lesson they completed their essays and began turning them into their “Fuel of the Future Energy Proposals.”
- Direct students to the presentation checklists on Activity Page 14.2.
- Explain that this is the same checklist they used earlier in the unit. There is one checklist for the author and one for partner feedback.
- Explain that the students should complete the top portion (My Presentation Checklist) first.
- Instruct students to use this time to check for and add anything that is missing from their presentation.
- Direct students to work on their presentations, adding what is needed.

## EVALUATING THE PRESENTATION (15 MIN.)

- Remind the students to trade with a partner when they are finished with their presentation. The partner should use the “Partner Checklist” column on Activity Page 14.2 to check that work is complete. After completing their checklist, students should hand in their checklist to you or other central location used for collecting work.
- Circulate around the classroom checking that the student’s work is almost ready to be presented during the next class. They will have fifteen minutes to revise their work on the essay and presentation before setting up a museum walk. If students have more than fifteen minutes of work to complete, conference with these students to make plans for completion. This may include modifying the assignment, planning additional work time, or assigning a portion of the work that does not require assistance to be done at home.

## Activity Page 14.2



### Challenge

Add the item “primary and secondary source images” to the presentation checklist.

### Support

Break the checklist into chunks and provide a teacher check-in between pieces.



## Writing Peer Review

### Entering/Emerging

Allow students to complete the checklist collaboratively with your help instead of a peer partner.

### Transitioning/Expanding

Pair students purposefully and direct them to complete the checklists collaboratively instead of trading work.

### Bridging

Remind the students that the items on this checklist are the same as those in Lesson 9 and looking back at the previous checklist may help with identifying components of the presentation.



---

## Check for Understanding

Ask the students, “If you had time to add one more thing to your presentation, what would it be and why?” Tell the students to share their answers with their partners.

---

End Lesson



## 15

# What are the fuels of the future?

**PRIMARY FOCUS OF LESSON****Writing**

Students will revise and edit the final changes of their presentations. [W.4.5]

**Presentation**

Students will report on their topic using a presentation containing supporting details and a visual display. [SL.4.4, SL.4.5]

**FORMATIVE ASSESSMENT**

**Activity Page 15.2**

**Reflect** Students will complete a reflection of their published work. [W.4.5]

## LESSON AT A GLANCE

	Grouping	Time	Materials
<b>Writing (30 min.)</b>			
Editing the Essay	Independent	15 min.	<input type="checkbox"/> Activity Page 13.2 <input type="checkbox"/> Activity Page 14.2
Editing the Presentation	Independent	15 min.	
<b>Presentation (60 min.)</b>			
Museum Walk	Whole Group	40 min.	<input type="checkbox"/> Activity Pages 15.1, 15.2 <input type="checkbox"/> KWL chart from Lesson 1
Self-Reflection	Independent	15 min.	
Close KWL Chart	Whole Group	5 min.	

## ADVANCE PREPARATION

### Presentation

- Prepare and post sentence starters for the museum walk feedback form, Activity Page 15.1, Audience Feedback.

### Writing

- Arrange partners for completing Activity Page 14.2.

### Universal Access

#### Presentation

- Provide sentence starters for use on the feedback form during the museum walk.

Start Lesson

## Lesson 15: What are the fuels of the future?

# Writing



**Primary Focus:** Students will revise and edit the final changes of their presentations. [W.4.5]

## EDITING THE ESSAY (15 MIN.)

- Direct the students to consult their Activity Page 13.2. Compare it to their essay and make any necessary changes.
- Remind students to hand in their work according to your directions. You may choose to have students hand in their work to a central location in the classroom or collect the work from students yourself.

## EDITING THE PRESENTATION (15 MIN.)

- Direct students to consult their Activity Page 14.2. Compare it to their presentation and make any necessary changes.

## Lesson 15: What are the fuels of the future?

# Presentation



**Primary Focus:** Students will report on their topic using a presentation containing supporting details and a visual display. [SL.4.4, SL.4.5]

### MUSEUM WALK (40 MIN.)

- Direct students to set up their proposal as a display. Hard copy products should have all parts visible. Students presenting digital products may print out their work, if appropriate, or display the work on a screen.
- At each presentation station, students should have Activity Page 15.1 available for peer feedback. The page may be removed from the Activity Book while being displayed.
- Explain that the museum walk is about celebrating the work, not criticizing it. Remind the students that the feedback is for positive comments only. Write these sentence frames in a place that is visible from where the students are conducting the museum walk.
  - I like the \_\_\_\_\_ that you included because \_\_\_\_\_ .
  - I thought it was interesting when you wrote \_\_\_\_\_ .
  - Your \_\_\_\_\_ in the presentation look great.
- Tell the students they may use these frames to help them or write their own positive comments.
- To promote an equitable amount of comments for all students, tell the students that if a page is full, they should not add to it. If a page has an empty space for a compliment, add one before moving on to the next exhibit.
- Stagger the starting point of students as they circulate through the exhibits to ensure an even distribution of comments on the feedback forms.
- As students visit the exhibits, they should leave feedback on at least three of their classmates' feedback pages.

### Activity Page 15.1



### Challenge

Post an additional piece of blank paper at the students' displays. Write a counterclaim statement on the paper in a bubble at the center of the paper. Ask students to defend against that counterclaim, using information found in the display, as they visit the exhibit by adding a bubble to the paper. The result will look similar to a word cloud. Be sure to make the original counterclaim stand out by using markers to distinguish it from the student responses.

### Support

Give the students the sentence starters being displayed for Audience Feedback on individual pieces of paper for students to carry with them while viewing their classmates' exhibits. A bookmark or paper strip that can be wrapped around the student's wrist are useful ways to make these prompts portable.





## Writing Writing

### Entering/Emerging

Arrange for a student to jot down the compliments from their group at each exhibit.

### Transitioning/Expanding

Have the students select one sentence frame to use consistently on each Audience Feedback form.

### Bridging

Have students verbally rehearse responses before completing the reflection form.

## Activity Page 15.2



## Check for Understanding

Ask for examples of positive comments before beginning the museum walk.

## SELF-REFLECTION (15 MIN.)

- After viewing the exhibits and leaving feedback for at least three classmates, the students should return to their seats (or alternate work space while the presentations are being displayed).
- At their workspace, direct students to complete Activity Page 15.2.
- After completing their reflections, gather the students for a project debrief. Ask the students the following:
  - What was a favorite part of this project?
  - What was challenging about this project?
  - What would you recommend to students working on this project in the future?
- Collect Activity Page 15.2 from the students.

## CLOSE KWL CHART (5 MIN.)

- As a whole group, ask the students to share what they now know about energy. Add student contributions to the L column of the KWL chart.

End Lesson

# Teacher Resources

Grade 4	Research Unit
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## Teacher Guide



# Teacher Resources

**In this section you will find:**

- Opinion Essay Model: High Tech Clothing
- Blank Note-Taking T-Chart
- Model T-Chart Notes
- Activity Page 3.1 Answer Choice Bank
- Activity Page 4.2 Labeled Opinion Essay Model
- Exit Ticket Suggested Answers
- Activity Book Answer Key

## OPINION ESSAY MODEL: HIGH TECH CLOTHING

Fashion and clothing have changed a great deal over the course of history. It is clear that a photograph is from the past simply by looking at what the subjects are wearing. What will be the clothing of the future? I claim that the clothing of the future will be as high-tech as the gadgets we put in our pockets today.

The clothing worn today is already full of technology that we take for granted. Pants have zippers and shoes close with velcro. These innovations make clothing easier to put on and more comfortable to wear. Some clothing has more advanced technology like special materials that wick away moisture or contain high-tech features such as speakers or oxygen monitors. Eventually people will carry their phones and other gadgets and will expect them sewn into their clothing.

Technology is not always affordable, especially when it is new. Some may say that high-tech clothing will never become popular because it will be too expensive. However, as technology develops it usually comes down in price. Worry about ruining expensive, high-tech clothing might also be a downside to consider. The solution is the same. Over time technology is improved and any delicate clothing innovations will eventually become more durable to help improve sales.

Wouldn't it be exciting not to worry about putting down your smartphone and losing it? Well, in the future you will not need to because it may already be built into your outfit. Tomorrow's fashion innovations will not just make our pants and shoes more comfortable, they will make them more useful. The clothing of the future will be high-tech.

**BLANK NOTE-TAKING T-CHART**

**Topic/Research Question:** \_\_\_\_\_

**Source:**

**Main Idea**

**Details**

## MODEL T-CHART NOTES

**Topic/Research Question:** \_\_\_\_\_

**Source:**

<b>Main Idea</b>	<b>Details</b>
Zippers	Used on leather jackets in 1925 Popular on kids clothes in 1930s
Velcro	Called hook and loop fastener A brand name Invented after seeds stuck to inventor's jacket
Dry fabrics	Moisture wicking fabric patent in 1998 Under Armor first to market it Pull moisture away from the skin Prevent smell Comfy when sweating
Medical sensors	MIT invention Clothing sensor that tell vital signs like temp Baby monitors in socks Watch oxygen and breathing

## ACTIVITY PAGE 3.1 ANSWER CHOICE BANK

Each answer found here is in sequential order and matches the answer key. When using this with students, adjust the number of choices to fit the needs of the students, taking care to include the correct answer for the questions assigned.

- Ancient Egyptians used petroleum to prepare mummies for burial.
- Knights used oil to shine their armor, shields, and swords.
- Native Americans used oil in medicine and ointments.
- Oil was used to seal cracks and seams in wooden boats.
- Oil helps wagon wheels turn more easily.
- Petroleum was burned in lamps for light.
- Petroleum was mixed in sand and gravel to pave roads.
- Whale oil was overused and in short supply, making it expensive.
- It was discovered that crude oil could be refined into kerosene.
- There was money to be made in selling oil.
- He knew natural gas could be found in the hill and that natural gas and oil (both fossil fuels) are often found together.
- Jim Hamill was hired to help dig a hole deep enough to extract the oil. He used a rotary drill instead of a chisel drill to dig through the sandy ground.
- A rotary drill cut through the sand instead of compacting it like a chisel drill.



## I Scream for Chocolate Ice Cream

### Introduction

On a hot day there is nothing like an ice cream cone covered in your favorite toppings. When you step up the counter the choice is clear. The best flavor of ice cream is chocolate.

Claim

### Body Paragraph: Defend the Claim

To start, chocolate is one of the most popular flavors, not just of ice cream, but all kinds of desserts. Every restaurant has a chocolate treat. Stores are filled with chocolate on holidays like Halloween and Valentine's Day. Chocolate is even known to have some health benefits!

### Body Paragraph: Counterclaim Defense

Some people might say that chocolate ice cream has its downsides. For instance, it can stain your clothing. On the other hand, who doesn't want to see the wonderful memory of that chocolate banana split sundae the next time you wear those shorts? There is no downside to chocolate ice cream that isn't made better by that delicious flavor melting over your tongue.

Counterclaim

### Conclusion

Ice cream is great and chocolate is great, so why don't we put them together? Chocolate ice cream is popular for good reason. It is the best. Ice cream is great and chocolate is great. So why don't we put them together? Chocolate ice cream is popular for good reason. It is the best. Chocolate can even be good for your health when added to your diet in small amounts. So the next time the scooper asks what flavor, say chocolate.

Restate Claim

## Exit Ticket Suggested Answers

QUESTION	ANSWER
<b>Lesson 5</b>	
Describe one or more effects from the lesson and defend it as a positive or negative event using evidence from the text in the response.	Answers will vary
<b>Lesson 7</b>	
Write and submit one of your own research questions.	Answers will vary
<b>Lesson 8</b>	
Define and provide an example of primary and secondary sources.	Answers will vary
<b>Lesson 9</b>	
<ol style="list-style-type: none"><li>1. How many different sources have you used to take notes, so far?</li><li>2. Do you find certain types of sources more useful than others? (circle one) Yes/No (circle one) What makes a source useful for your research?</li><li>3. How many facts from your notes have been included in your essay so far?</li></ol>	Answers will vary

# ACTIVITY BOOK ANSWER KEY

NAME: \_\_\_\_\_ DATE: \_\_\_\_\_ **1.1** Activity Page

### Modern Inventions Make Life Easier

Directions: Think about the machines and inventions you use every day to make your life easier. List as many as you can in the chart below. Use the examples to get you started.

Communication	Health and Medicine	Food	Transportation
telephone	x-ray machine	stove	trains
Answers may vary.			
<b>Other</b>			
Answers may vary.			

Research Unit Energy: Past, Present, and Future 1

NAME: \_\_\_\_\_ DATE: \_\_\_\_\_ **1.2** Activity Page

### Vocabulary

**oil, n.** slippery liquid made from petroleum used for fuel  
**fuel, n.** substances that can be burned as a source of energy  
**fuel, n.** substances, such as food, that are used to give the body energy  
**fuel, v.** to supply power or energy  
 Example: fuel an argument  
**energy, n.** power needed to run a machine  
**energy, n.** power needed for physical activity

Directions: Connect the sentence on the left to the definition on the right that matches the way the word is being used.

The mechanic added <b>oil</b> to the car's engine.	• <b>fuel, v.</b> to supply power or energy Example: fuel an argument
Make sure we have enough <b>fuel</b> in the tank before the big trip.	• <b>fuel, n.</b> substances that can be burned as a source of energy
Breakfast is your <b>fuel</b> for the day.	• <b>oil, n.</b> slippery liquid made from petroleum used for fuel
My first goal <b>fueled</b> my victory.	• <b>energy, n.</b> power needed for physical activity
The battery was too low on <b>energy</b> to turn on the toy.	• <b>fuel, n.</b> substances, such as food, that are used to give the body energy
By the end of the day my body is out of <b>energy</b> .	• <b>energy, n.</b> power needed to run a machine

Research Unit Energy: Past, Present, and Future 3

NAME: \_\_\_\_\_ DATE: \_\_\_\_\_ **1.4** Activity Page

### Sorting Organizer

Directions:  
 Brainstorm with your group, "What inventions in everyday life need fuel to run?" Write your group's ideas in the space below.

Responses may vary.

Sort your ideas by type of fuel. Rewrite the ideas in the box above into the chart below using the categories listed. Use the blank column for a type of fuel not already listed, if needed.

Fossil Fuels (gasoline, heating oil, propane)	Batteries	Wind Power	Solar Power	
Responses may vary.				

Research Unit Energy: Past, Present, and Future 9

NAME: \_\_\_\_\_ DATE: \_\_\_\_\_ **1.5** Activity Page

### Lesson 1: Think About It

Directions: Using what you learned in this lesson, answer the prompt below in complete sentences.

Name three important uses of energy in your daily life.

Responses may vary, but should be in complete sentences  
with correct start of sentence capitalization and end of  
sentence punctuation.

Research Unit Energy: Past, Present, and Future 11

NAME: \_\_\_\_\_  
DATE: \_\_\_\_\_

**2.1** Activity Page

**T-Chart Notes**  
*Buried Sunlight*

Main Idea	Details
The Sun's Energy	Answers may vary but could include: <ul style="list-style-type: none"><li>• comes from far away</li><li>• gives light and life to Earth</li><li>• need sun's energy to stay alive and grow</li><li>• use energy for heat, cooking, transportation, machines</li></ul>
Where does the sun's energy come from?	Answers may vary but could include: <ul style="list-style-type: none"><li>• buried underground</li><li>• called fossil fuels</li><li>• ancient plants captured light energy using photosynthesis</li></ul>
Cycle of Life	Answers may vary but could include: <ul style="list-style-type: none"><li>• people (animals) eat stored carbon.</li><li>• breathe oxygen from plants</li><li>• plants make extra carbon and oxygen.</li><li>• extra amounts create oxygen to breath and fossil fuels</li></ul>
Fossil Fuels	Answers may vary but could include: <ul style="list-style-type: none"><li>• stayed underground for a very long time</li><li>• took millions of years to create</li><li>• people burn fuel.</li><li>• coal</li><li>• oil</li><li>• gas</li></ul>

Research Unit: Energy, Past, Present, and Future

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NAME: \_\_\_\_\_  
DATE: \_\_\_\_\_

**2.2** Activity Page

**Sequence Transition Words**

first	third	then	last
second	next	finally	afterward

Directions:

**Part 1:** Rewrite the steps needed to turn the sun's energy into energy people can use. In each sentence, begin with a transition word from the word bank above. Use the text *Buried Sunlight* and your notes from *Buried Sunlight* T-chart notes, Activity Page 2.1 to help you.

Answers may vary but should include:

• a logical sequence of steps,

• a transition word from the word bank at the start

of each step,

• transition words used in a logical order (for example, *then*

should not be used).

Research Unit: Energy, Past, Present, and Future

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**Part 2:** Rewrite your sentences as directed by your teacher. Mix up the order of your sentences and exchange them with a partner. Can you put your partner's sentences back in the right order using their transition words?

Students may write their sentences on this page and cut

them apart or use another material such as sticky notes or

notecards.

Sentences that have been rearranged into the correct order

should match the original order created by the student's

partner or correct any errors made, as needed.

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Research Unit: Energy, Past, Present, and Future

NAME: \_\_\_\_\_  
DATE: \_\_\_\_\_

**3.1** Activity Page

**"The Beginnings of Oil in the United States"**  
**Comprehension Questions**

1. What are some ways people used oil in the past?  
Answers may vary but should include specific evidence as found in the "Oil in History" section of "The Beginnings of Oil in the United States."
2. What was the problem with using whale oil for light in the nineteenth century?  
Whale oil was overused and in short supply, making it expensive.  
("Oil in History" from "The Beginnings of Oil in the United States.")
3. What solution was found to solve the problem with affordable lighting fuel?  
It was discovered that crude oil could be refined into kerosene.  
("Oil in History" from "The Beginnings of Oil in the United States.")
4. After Edwin Drake drilled an oil well in 1859, why were hundreds more wells drilled throughout the country?  
There was money to be made in selling oil. ("Oil in History" from "The Beginnings of Oil in the United States.")
5. Why did Patillo Higgins suspect that he would find oil in the small hill outside of Beaumont, Texas?  
He knew natural gas could be found in the hill and that natural gas and oil (both fossil fuels) are often found together. ("Spindletop Hill" section of "The Beginnings of Oil in the United States.")
6. What problem was Jim Hamill hired to solve? How did he solve it?  
Jim Hamill was hired to help drip a hole deep enough to extract the oil. He used a rotary drill instead of a chisel drill to dig through the sandy ground. ("Spindletop Hill" section of "The Beginnings of Oil in the United States.")

Research Unit: Energy, Past, Present, and Future

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7. Why was the rotary drill a successful tool at Spindletop?  
 A rotary drill cut through the sand instead of compacting it like a chisel drill. ("Spindletop Hill" section of "The Beginnings of Oil in the United States.")

Retell the events at Spindletop by placing them on the timeline below. Include the page number where the event occurs below the event.

Higgins buys the land

\_\_\_\_\_

page #      Responses may vary but should be in an accurate sequence.

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NAME: \_\_\_\_\_      3.2      Activity Page

DATE: \_\_\_\_\_

**Make a Claim**

Example:  
 I claim that chocolate ice cream is the best flavor ever. It is the best because chocolate and ice cream are two great desserts and together make the best ice cream choice.

Directions: Make two claims about the events in the text you read. Defend your claim with evidence from the text.

1. I claim that \_\_\_\_\_  
 \_\_\_\_\_  
 because \_\_\_\_\_  
 \_\_\_\_\_

2. I claim that \_\_\_\_\_  
 \_\_\_\_\_  
 because \_\_\_\_\_  
 \_\_\_\_\_

Answers may vary but should include an opinion-based claim statement and supporting details.

Research Unit: Energy: Past, Present, and Future      19

NAME: \_\_\_\_\_      4.1      Activity Page

DATE: \_\_\_\_\_

**"A New Fuel"**

Directions: Read "A New Fuel" and consider the challenges being faced for the new oil industry. Using the chart below, record how the problems occurred and the solutions that solved them. Use the example to help you.

Problem		Solution
Cause	Effect	Claim
A large amount of oil gushed from the ground.	Oil flooded the area and caused hazardous conditions.	The workers created a pipe with a valve to cap the oil well.
Answers will vary but should include 1-3 additional entries in each column.		

Think About It  
 After discovering such a large amount of oil at Spindletop, how were the lives of everyday people across the country impacted?  
 Answers may vary but should include information about transportation.  
 \_\_\_\_\_  
 \_\_\_\_\_

Research Unit: Energy: Past, Present, and Future      21

NAME: \_\_\_\_\_      4.3      Activity Page

DATE: \_\_\_\_\_

**Label the Opinion Essay**

Directions: Read the opinion essay below. Label each paragraph with the correct part of the essay. Use the model on Activity Page 4.2 to help you.

**Introduction**      Getting a pet is a big decision. Which kind of animal to get is an easy decision. Dogs make the best pets for anyone who wants an animal pal.      Claim statement

**Body Paragraphs**      Dogs come in many sizes, shapes, and personalities. There is a dog for every person. Not only will they give you endless love and companionship, they are fun! Dogs can learn all kinds of tricks. Having a dog will also make you healthier because you will exercise each time they need a walk.      Details defending the claim

**Conclusion**      Lots of parents try to say that a dog is not a good idea for a pet. They say that it is too big. Well, good news. Some dog breeds are so small they can fit in a purse. Allergies are another worry. There are breeds of dogs that have hair instead of fur and are great for people who get the sniffles from other furry pets like cats.      Counterclaims

    If you want to be happy and healthy you should get a dog. You will take plenty of walks and get a ton of cuddles everyday. Dogs are by far the best pets.      Claim restated

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NAME: \_\_\_\_\_ DATE: \_\_\_\_\_ **6.1** Activity Page

### Using Diagrams to Make Inferences

Directions:

**Part 1:** Listen as your teacher reads the text. Imagine what you are hearing as pictures in your mind. At each pause in the text, stop and sketch a diagram of what you visualized.

**Part 2:** Write at least one sentence to add evidence from the text below each diagram to support your work.

Sketch 1	Sketch 2	Sketch 3
Answers may vary but should include quoted or paraphrased text that matches the illustration with a page number.		
Text Evidence:	Text Evidence:	Text Evidence:

**Part 3:** Using a sentence, explain an inference you can make about the sun's energy based on the diagrams you drew.

\_\_\_\_\_

\_\_\_\_\_

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Research Unit Energy: Past, Present, and Future **27**

NAME: \_\_\_\_\_ DATE: \_\_\_\_\_ **8.1** Activity Page

### Innovation Challenges

#### Comparing Early Oil Innovators to the Energy Innovators of Today

1. Answer each question in both columns. Remember to support your answer.

	Spindletop Workers	Modern Energy Workers
Where do energy workers do their job?		
How is energy extracted from its source?		Answers may vary but should include information from the correct text to support answers.
What are the dangers of working with energy?		

2. What else did you learn about modern energy workers and innovators that you did not include above? Share at least three more pieces of information. Remember to use your research notes to help you.

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

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NAME: \_\_\_\_\_ DATE: \_\_\_\_\_ **8.2** Activity Page

### Primary and Secondary Sources

When researchers are collecting information they often use primary sources. A primary source is a person who knows about a topic firsthand. They are either an expert on a subject or a witness to an event. These sources are useful because they are very accurate.

Secondary sources are created using information from a primary source, like books and articles. These sources are useful because they are easy to find.

Information or Event → Primary Source (1) → Secondary Source (2)

Primary sources are ONE step away from the information or event. Secondary sources are TWO steps away from the information or event.

**Practice**  
Show whether a source is primary or secondary by circling the correct term.

Encyclopedia	Primary Source / <u>Secondary Source</u>
Blog	<u>Primary Source</u> / Secondary Source
News website	Primary Source / <u>Secondary Source</u>
Journal entry	<u>Primary Source</u> / Secondary Source
Interview	<u>Primary Source</u> / Secondary Source
Photograph	<u>Primary Source</u> / Secondary Source

**Try it out!**  
One method to collect primary source information is through interviews. Think about who may know about the topic you are researching. Write your interview questions below.

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

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NAME: \_\_\_\_\_ DATE: \_\_\_\_\_ **10.1** Activity Page

### Energy Island

Directions: After reading *Energy Island*, pages 1–12, complete the chart and answer the question below.

Problem		Solution	
Cause	Effect	Claim	Counterclaim
<ul style="list-style-type: none"> <li>Oil tankers have to travel to deliver oil to the island.</li> <li>Electricity was sent from the mainland.</li> </ul>	<ul style="list-style-type: none"> <li>The Ministry of Environment and Energy selects Samso to become independent of nonrenewable energy.</li> </ul>	<ul style="list-style-type: none"> <li>Wind energy could be used to power the island.</li> </ul>	<ul style="list-style-type: none"> <li>too expensive</li> <li>too busy</li> <li>too bothersome</li> <li>prefer trucks to bicycles</li> <li>it won't make a difference.</li> <li>too old for change</li> </ul>

• Who is the audience the author of *Energy Island* is writing for? How can you tell?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Research Unit Energy: Past, Present, and Future **43**

NAME: \_\_\_\_\_ DATE: \_\_\_\_\_ **12.1** Activity Page

**“Clean Energy”**

Directions: Use the T-chart below to take notes as you read “Clean Energy.”

Main Idea	Details

**Ask Yourself**

Does any of the information in this article support your essay’s claim or connect to your essay’s counterclaim? Why or why not?

**Answers may vary but should answer the questions with reasoning.**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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NAME: \_\_\_\_\_ DATE: \_\_\_\_\_ **13.1** Activity Page

**“Houston Affects the Earth”: Analysis Activity**

Directions: Answer the questions below for the article “Houston Affects the Earth.” Remember to support your answer with details from the text.

- What is the main idea or claim the article is making?  
**Houston should reduce pollution.**  
 \_\_\_\_\_  
 \_\_\_\_\_
- What are some changes that Houston put in place?  
**Increased the use of solar energy; created “Bike to Work Day” to reduce gasoline use and “Lights Out Houston” to encourage businesses to turn off lights at night, etc.**  
 \_\_\_\_\_
- Did the changes have the impact the mayor hoped for? Why or why not?  
**Answers may vary but should include supporting evidence from the text.**  
 \_\_\_\_\_  
 \_\_\_\_\_
- How are Houston’s efforts the same or different from the efforts for change on the island of Samsø? Explain.  
**Answers may vary but should contain supporting evidence from BOTH texts.**  
 \_\_\_\_\_  
 \_\_\_\_\_

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NAME: \_\_\_\_\_ DATE: \_\_\_\_\_ **14.1** Activity Page

***The Boy Who Harnessed the Wind***

Directions: Explore the challenge faced by William in his village. Complete the chart below by answering the questions in each box.

Problem: What problem does the village face? <p style="text-align: center;"><b>drought</b></p>	
Cause: What caused this problem? <p style="text-align: center;"><b>drought</b></p>	Effect: What effects does this have on the village? <p style="text-align: center;"><b>food scarcity</b></p>
Claim: What does William believe will fix the problem? <p style="text-align: center;"><b>creating his own energy using a windmill</b></p>	What challenges does he face? <ul style="list-style-type: none"> <li>• finding materials</li> <li>• learning to build the windmill</li> <li>• doubt from community”</li> </ul>
Solution: How is the problem solved? <p style="text-align: center;"><b>William perseveres and teaches himself how to build the windmill. He got help from friends and family.</b></p>	
Think About It: How does a wind turbine work? Can any be found where you live? Use your research skills to find out! <p style="text-align: center;"><b>Answers may vary.</b></p>	

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