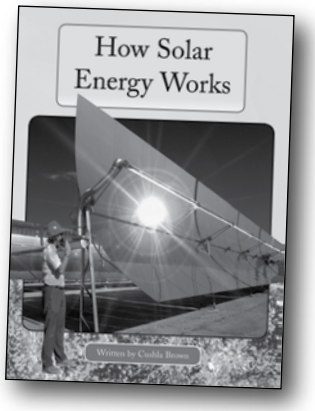
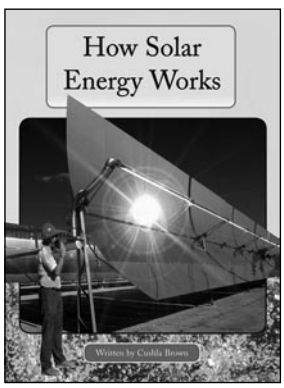


How Solar Energy Works

	Text Type	Lower 1500–1800 words RA 8.8–9.2	Middle 1900–2400 words RA 9.3–9.7	Upper 2500–3000 words RA 9.8–10.2
Fact	**Procedure**	Build Your Own Easel	Making a Cheesecake	So You Want to Be a Cartoonist?
	Recount (Explanation)	Ten Milestones in Space	Rail Accidents	Three Terrible Hurricanes
	Information Report (Description)	Mythical Creatures	The World of Caves	Top Towers
	Information Report (Explanation)	A Weather Counting Book	Two Polar Regions	Seven Ancient Wonders
	Interview	Food Science FAQs	Hobbies	Fireflies and Glow-worms
	Biography	Ned Kelly	Mother Teresa: Saint of the Gutters	Edmund Hillary
	Explanation	How Forensic Scientists Work	How Musical Instruments Work	How Solar Energy Works
	Procedural Recount	How I Learned to Be a Nipper	How I Trained for the Junior Triathlon	How I Learned to Snowboard
Fiction	**Realistic Fiction** (Out of School)	Junkyard Treasure	Outback Betty's	Harry's Dream
	Realistic Fiction (In School)	On the Case	The Real-Life School Project	Ms McMahon
	Historical Fiction	The Wooden Horse Trick	Cheung Saves the Day	The Slave
	Fantasy	The Cloud Washerwoman	Sammy Stevens Sings	Finbar and the Long Trek
	Science Fiction	A New Source of Power	The Intergalactic Race	Eighth Moon
	Humour	The Upstairs Dragon	My Rhyming Grandpa	Catty Bimbar and the New-Age Pirates
	Mystery	Mystery Under the Big Top	The Mystery of Autoplane 500	The Mystery of the Missing Food
	Folktales	The Wicked Witch of the Singing Sands	Gulnara	Momotaro, Little Peachling

MACMILLAN

We have designed these lesson plans so that you can have the plan in front of you as you teach, along with a copy of the book. Suggestions for teaching have been divided into questions and discussion that you may have with students before, during, and after they read. You may prefer to explore the meaning and the language in more detail before students read. Your decisions will depend on the gap between students' current knowledge and the content, vocabulary, and language of the book they are about to read. The more information students have up front, the easier it will be for them to read the text.



HOW SOLAR ENERGY WORKS

Upper level fact
Text type: Explanation
Reading age 10.2
Word count 2,722

Before Reading

Activate prior knowledge by asking students what an explanation is. Write the word on the board.
What does the word explain *mean*? Invite discussion. Tell students it means to *give clear information about a subject, which enables someone else to understand it*.

Ask students to take turns explaining to a partner how to get to their homes from the school. Tell students to explain the easiest, most direct route.

After the partners have both taken their turn, discuss the factors that made the explanations easy to understand, and those that made the explanation difficult to understand.

Ask students what is important about giving an explanation. Assist them to understand that an explanation should be clear, concise and accurate.

COVER

Before Reading

Read the title and examine the cover photograph. Discuss what the book may be about. *What do you think solar energy is? How do you think it works? What does this image tell you?*

Ask students if they have heard of solar energy. They may have a panel on their roof or may have seen a solar-powered watch or calculator. Discuss how these are powered to work.

Read the blurb. What additional information does this give you? What do you expect to find inside this book? Guide the discussion to build understandings that this book will provide information about how solar energy works.

What is energy?

What gives us solar energy?

How do you think we can collect and use this kind of energy?

What does the word harness *mean?*

What do you expect to learn from this book?

What is the purpose of this book?

CONTENTS PAGE

Open the book. Tell me what you know about this page. Discuss features of the contents page. *Where would I go to learn about How Solar Energy is Stored?* Students should quickly respond with the page number. Repeat for other pages. Encourage quick responses. *What do you know about information books?* Students should indicate that the reader can choose where they'd like to start.

Students should also mention the terms *glossary* and *index*. Ask students to explain what each term means. Visit each of these pages to clarify that the glossary provides meanings for new or tricky words about the topic, and the index provides the page numbers to help the reader locate particular things in the book.

Revisit the contents page. Discuss the term *introduction*. *What does this mean?* Lead students to acknowledge that an introduction will provide background information about the topic that will help us read the book.

INTRODUCTION

During Reading

What do you notice about the illustration on this page? Ask students to read the caption. *How old is the sun? How much longer will the sun's energy last? How do you think scientists know this?* Discuss.

Prompt students to notice that the word *energy* is in the text. Students should indicate that they need to visit the glossary. Ask students to predict the meaning of the word *energy* and then instruct them to navigate quickly to the glossary to read the definition.

Read the introduction and find out some general information about solar energy. Find out what it is and how much solar energy the sun can give us. How long could we use the sun's energy before it runs out?

After Reading

What is solar energy? How does it get to us? Prompt students to locate the text that says it reaches us as heat and light.

How long does it take the sun to produce enough energy to power everything on Earth for a year? What does this tell you about solar energy?

What does the term renewable *mean? How does this make solar energy a useful energy to use?*

When will the sun run out of energy?

How do you think solar energy could be harnessed and stored?

HOW THE SUN'S ENERGY REACHES EARTH

During Reading

Read the title. What do you notice about pages 6 and 7? Discuss this diagram and flowchart. Tell students that the diagram and the flowchart help to explain the information that is written on page 6. Ask students to label the parts of the sun. *Have you heard of these words before? Read the flowchart on page 7. What does this explain?*

Read page 6. As you read, take note of some interesting facts about the sun. For example, how far is the sun from Earth and how long does it take the sun's energy to reach Earth? Find out what happens on the sun to release energy. Be ready to share your answers with the group.

After Reading

How far is the sun from Earth?

How long does it take the energy to reach Earth? What does this tell you about the sun's energy?

What is the centre of the sun called? Build understandings that the core is the central part of Earth, the sun, an apple, etc.

How is energy released from the sun? How does the energy reach Earth?

HOW PEOPLE USE NATURAL SOLAR ENERGY

During Reading

Read the title, look at the photos, and read the captions. What do you know about solar energy? Walk through the photos and captions up to page 15. Prompt students to observe for words in the glossary along the way.

Read pages 8 to 15. As you read, find out how people use solar energy. Make a list of ways it is used and find out why solar energy works so well for each of these things.

Be ready to explain how a solar water heater and a solar still work. Recheck the diagrams after reading.

After Reading

What are the different ways people use solar energy? Discuss the following uses of solar energy, and direct students to the text to locate specific information. It may be useful to reread sections of the text aloud to extend conversations and build understandings.

- Light and heat for day to day survival of animals and plants (page 8)
- Greenhouses (page 8)
- Preserving foods (page 9)
- Drying laundry (page 9)
- Design and direction of houses (page 10)
- Heating water (page 12)
- Making fresh water (page 14)
- Making a solar still (page 14)

Discuss the diagrams on pages 13 and 15 to build knowledge of how solar heating and solar stills work and to assist students to unlock the visual literacies.

HOW SOLAR CELLS WORK

During Reading

Read the title and look at the illustration. What do you think a solar panel is? How do you think they work to harness solar energy? What do you think it would be like to stand in front of these and look at them? What do you think a solar farm would be? Can you imagine what 57,600 solar panels would look like? How big do you think the farm is?

Ask students what they notice about the writing on page 16. Discuss the word electricity *and then navigate quickly to the glossary to check the definition.*

Read pages 16 and 17. Be ready to explain how solar energy can be turned into electricity. Is the material that the cells are made of important for this process to occur? Why?

How else can solar cells store energy?

After Reading

Ask students what electricity is used for. Brainstorm the daily uses of electricity in the home, school, and community. Discuss the way solar energy is turned into electricity. What are most solar cells made from? *Why is silicon a good material for making solar cells?* Revisit page 16 to reread this section of the text. *What*

causes electricity?

How does solar power enable a pocket calculator to work? How long could it keep working for?

How can solar cells be arranged in order to provide more energy? Revisit page 17 to reread and discuss.

HOW SOLAR POWER STATIONS WORK

During Reading

Look at the photo and read the caption. What do you think the purpose of the tube is? What do you think the curved mirror does? Invite inferences.

Walk through the photos and captions on pages 20 and 21. What do you think a receiver *is? What does the word* receive *mean?*

Prompt students to notice the word generator. Invite predictions about the meaning of this word, then direct students to navigate to the glossary to check.

Read pages 18 to 21. As you read, take note of how mirrors are used to trap and focus the sun's energy. Find out how solar power stations change the solar energy into electricity.

You will read that there are three main ways in which solar power stations trap and focus the sun's energy. Jot down some notes about these and be ready to explain how they work.

After Reading

What is a solar power station? How do they trap and focus the sun's energy? Reread this section of the text aloud (page 18), and discuss the process of changing solar energy into electricity by boiling water. Discuss what a turbine is and revisit the word *generator* in context.

What are the three main ways in which solar power stations trap and focus the sun's energy? Direct students to the last sentence on page 18 to check if needed.

Ask students to explain how each of the following work: using curved mirrors, dish engine systems, and power towers. Direct them to revisit the text to clarify details.

HOW SOLAR ENERGY IS STORED

During Reading

Look at the illustration on page 23. What is a pond? What might a solar pond be? Invite discussion about the different zones and the term *heat-absorbing bottom*.

Read pages 22 to 24. As you read, jot down how solar energy can be stored. Be prepared to discuss how energy is stored in a solar pond, and also in a solar tower.

As you are reading, note any words that you need to clarify. Think about what these words may mean, and be ready to share your thoughts during discussion.

After Reading

Clarify any new or unusual words that students identify. Reread the sentences around each word and discuss possible meanings. Guide students towards the correct meanings and clarify where needed. Words to discuss may include: *polythene, brine,* and *molten salt.*

Ask students how solar energy can be stored. Discuss solar ponds and solar towers in turn. Ask students to explain how solar ponds work. Revisit parts of the text to reread and clarify. Encourage students to attend to the detail in

the book, reading slowly and thoughtfully. Do the same for solar towers.

MORE WAYS TO USE SOLAR POWER

During Reading

Look at the photographs on pages 26 to 29. Discuss what students learn from the captions. For example, ask what it means for a satellite to be in orbit around Earth. *How is this satellite using solar energy?* Prompt students to the solar cells. *When you read this part of the book, find out how the satellite is being powered and be prepared to share what you learn.*

From what you have seen, what other uses could there be for solar power? Invite predictions.

As students are walking through the photos, prompt them to notice any words that need to be discussed and checked in the glossary.

As you read pages 25 to 29, jot down the examples of other ways to use solar power. You will also learn of how scientists see solar energy being used in the future. Record some of these interesting predictions.

After Reading

Discuss how the satellite and some of the instruments on board are being powered by solar energy. *What is the advantage of this?*

What other ways are there for using solar energy? Discuss the use of solar energy for remote equipment, such as radio stations, public telephones, streetlights, and household generators.

How will solar power be able to assist with powering transport? What are the easiest vehicles to power with solar energy? Why? How could solar power be an advantage for powering transport? Invite inferences.

WHY USE SOLAR ENERGY?

During Reading

Look at the photo and read the caption. What is unusual about this telephone? Ask students to predict why it might be useful to use solar energy.

As you read page 30, jot down the advantages to using solar energy over other sources of energy.

Of the reasons for using solar power, what do you think is the most important reason? Be ready to explain your answer.

After Reading

What are the most important reasons for changing to solar power?

Discuss these points:

- the term renewable – assist students to take this word apart to build meaning
- solar energy does not cause pollution
- solar energy is versatile? can be used for small items as well as large items

What do you think the most important advantage is to using solar energy?

Discuss students' opinions. Encourage them to validate their thoughts and opinions with information from the text.

CODE BREAKER

Explain that knowing what parts of words mean can make it easier to read, write, spell, and understand them. For example, the word *renewable* is used to describe solar power. Tell students that this word has three parts. If you know what the three parts of this word mean, you can work out what the word *renewable* means.

Demonstrate how to take this word apart to unlock its meaning.

Explain that the base word is ***new.***

Discuss the meaning of the word ***new.***

- the part at the beginning, *re-*, means *back* or *again*
- the part at the end, *-able*, means *capable of being* or *able to be*

Using these meanings, talk students through putting this word together and unlocking the meaning:

re-new-able = able to be made new again

So what does it mean that solar energy is renewable?

MEANING MAKER

Discuss all the ways that solar power could be used at home and in the school. Make a list of students' ideas on the board.

After brainstorming, go through the list, and next to each idea, have students explain how each item is currently powered in most homes and schools. Discuss the pros and cons of each type of energy. Make students aware that solar energy can be costly to set up and this is a disadvantage for many people. Explain that solar cars are very expensive. Ask students to infer why. *What may assist to make them more affordable in the future?* Discuss.

Discuss the use of non-renewable fuels such as coal, oil, and gas. *What is a disadvantage over time of using these fuels? What will happen when they run out? When might they run out? Do you think it is a good idea to look for alternative sources of power now, before this happens? Why?*

TEXT USER

Discuss the way photographs in books often have a caption. *What is the purpose of the caption?* Guide the discussion to build knowledge that the caption describes the photograph, but the purpose of the caption and the photograph together is to help readers understand the text, or writing, in the book.

Look at the photo on page 4. What does the photo tell you? What does the caption tell you about the sun? How does this information help us to understand the rest of the text on page 4?

Explain that the introduction provides background information that helps readers understand the topic. *Why do people reading about solar power need to know that it will be at least 4.6 billion years before the sun runs out of energy? How does that help us to understand solar power?* Discuss.

Ask students to walk through the book with a partner. Instruct students to jot down the way each photo and caption helps the reader gain knowledge of solar energy in this book.

TEXT CRITIC

Who do you think knows the most about solar power? Students should report that scientists who work in this area may be the most knowledgeable*. Do you think it would have been a scientist that wrote this book? What makes you think that? If the author of this book is not a scientist working in the area of Solar Energy, what other job could she have? Discuss.*

If the author writes about lots of topics, and not just solar power, how might she have acquired the information for this book? Could you write a book like this if you learned enough about a topic? What do you think you would need to learn? How could you ensure that you didn't make any mistakes?

If you were writing a book that explains *how solar energy works, what would you need to be able to do well? Why would you need to be good at explaining things?*

USING MULTIPLE INTELLIGENCES

Group students in pairs or small groups.

Solar energy is clean and therefore does not pollute the environment.

Design: a community that is completely solar powered. Walk through the book and write a list of things to include; for example, washing on clothes lines, solar cars, greenhouses, etc. (N, S, B, P)

Create: a three-dimensional model of your design. (S)

Record: everything in your model that uses solar power. (N, V)

Write: some tunes to play with your instruments. (M)

MULTIPLE INTELLIGENCES

The theory of multiple intelligences was developed by Howard Gardner, a professor of education at Harvard University. Howard Gardner's theory suggests that the current view of intelligence, as measured by IQ tests, is far too limited and discriminates against students who think in different ways. He proposes taking a broader perspective and has identified eight different intelligences. These are:

- verbal-linguistic intelligence – word smart
- logical-mathematical intelligence – number/reasoning smart
- visual-spatial intelligence – picture smart
- bodily-kinaesthetic intelligence – body smart
- musical-rhythmic intelligence – music smart
- interpersonal intelligence – people smart
- intrapersonal intelligence – self smart
- naturalist intelligence – nature smart

Multiple intelligences have enormous potential as a tool in furthering reading and language development. Traditionally, the teaching of language and reading has focused mainly on two intelligences: logical-mathematical and verbal-linguistic. This means that many students who possess different intelligences do not receive the necessary opportunities, encouragement, instruction, or reinforcement to succeed with reading as well as they might.

How Solar Energy Works Name _____

How people use natural solar energy

How the sun's energy reaches Earth

How solar cells work

Solar Energy

Why use solar energy?

How solar power stations work

More ways to use solar power

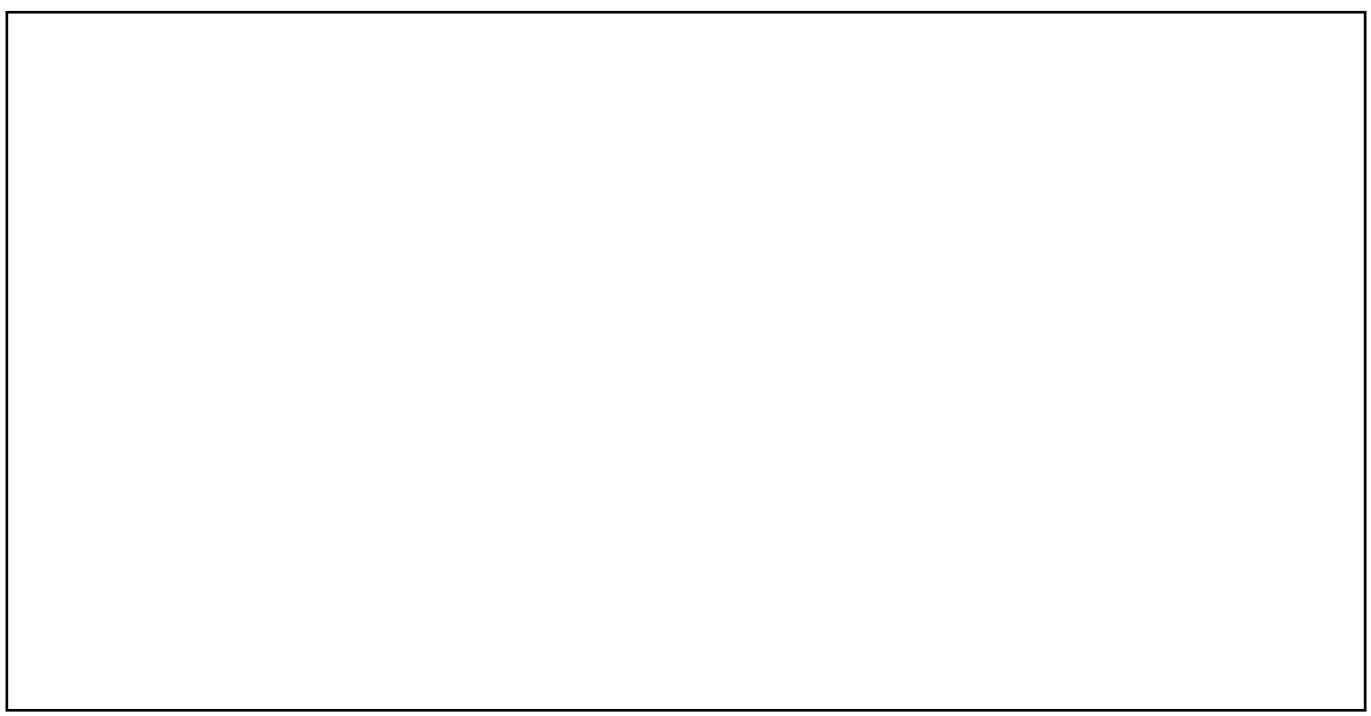
How solar energy is stored

MACMILLAN

How Solar Energy Works Name _____

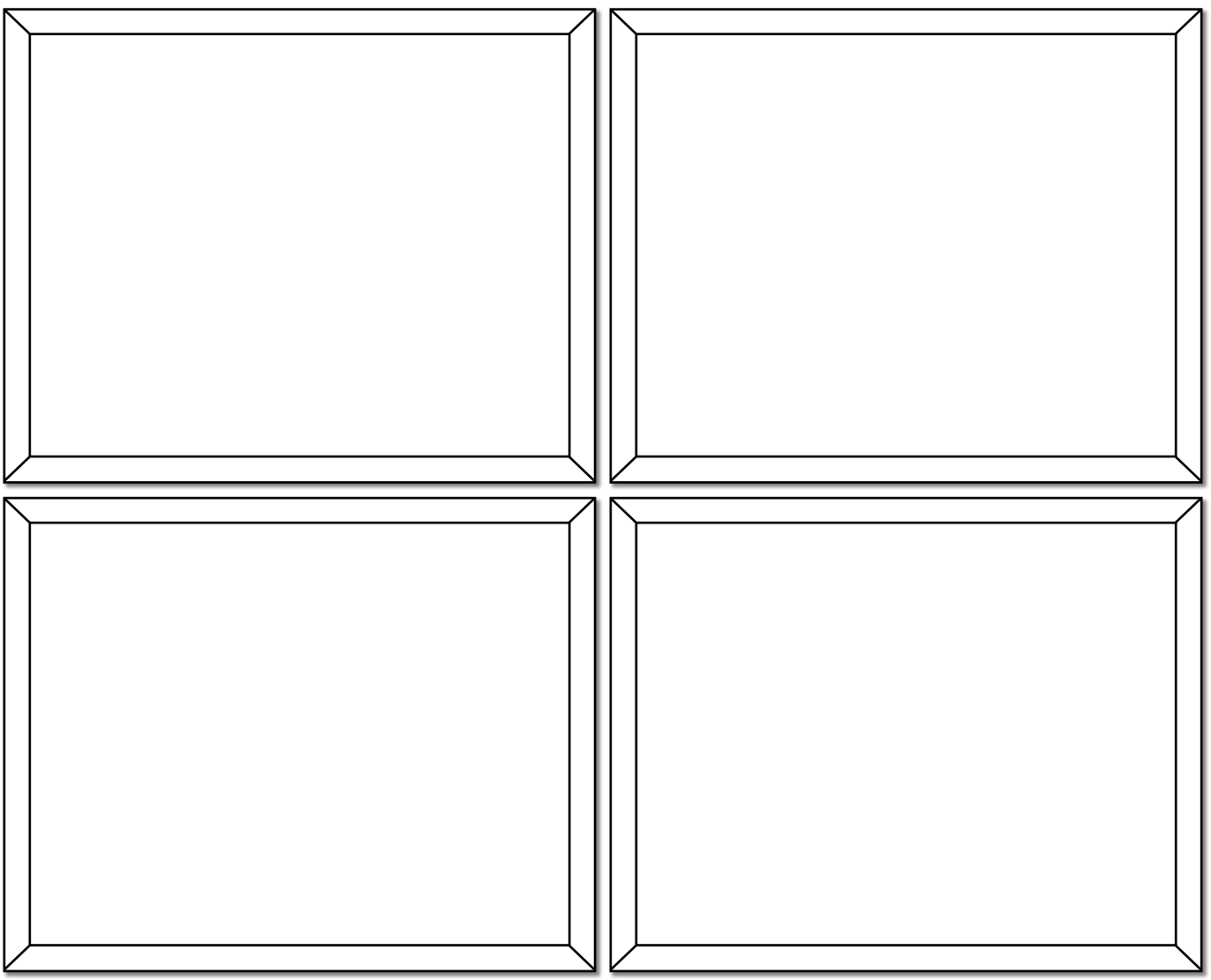
Multiple Intelligences (naturalist, visual-spatial)

Design a solar-powered vehicle. Draw it below and on the lines underneath, describe how it works, what it looks like, how fast it goes, and any other interesting information about its features.



How Solar Energy Works Name _____

What do you like to do on a sunny day? Look out the windows below and draw what you might see happening on a sunny day.



Record all the things you can think of to do on a sunny day.

_____

_____

_____

_____

How Solar Energy Works Name _____

Punctuation makes reading easier. Full stops tell us when to take a breath, capital letters tell us that we are starting a new sentence or reading a proper noun (name), commas tell us to pause, and question marks tell us that the previous sentence is a question.

Rewrite each sentence and add punctuation to make it easier to read. Reread each sentence at the end to check.

solar energy is energy from the sun it travels through space and reaches earth as heat and light

it is easy to see the light and feel the heat the sun is a powerful source of energy the sunıs energy

is also renewable meaning that it does not run out

people know how to harness store and use solar energy

people use solar energy all the time without even realizing it

they use the heat and light of the sun to survive

how do plants use solar energy

How Solar Energy Works Name _____

Write new captions for the photos on these pages of the book. The caption needs to tell about the photo and also link to the writing on the page.

page 8 _____

Page 9 _____

Page 17 _____

Your choice _____

How Solar Energy Works Name _____

You have learned that solar power has some big advantages:

- The fuels we use to run our cars are not renewable, which means they will eventually run out. Also, it costs a lot of money for families to buy fuel for their cars. Since the price of fuel is so high, some families need to be careful that they have enough money left to buy food and other essentials.
- Solar energy is clean and does not pollute the environment.

Write a letter to your local member to explain how it would help your family and others, both now and in the future, if our community began to switch to solar energy.

How would less pollution benefit all life on Earth?

How Solar Energy Works

Name _____

Explaining something clearly can be tricky. A picture or diagram can help make an explanation clear. Draw a picture for each stage of this flowchart to help readers understand how the sun's energy reaches Earth.

1 Explosions in the sun's core release energy.

2 Energy travels from the core to the surface of the sun.

3 Energy moves through space as rays.

4 Energy in the sun's rays reaches Earth.