

Learning Guide



Renewable Energy

We hope you enjoyed learning all about renewable energy and are excited to help your community use more of it. Extend your learning with this print-ready Learning Guide!



What's in this Learning Guide?

Get Set to Listen:

Check your knowledge before and after listening to the episode by determining if statements are TRUE or FALSE.

Vocabulary

Discussion Questions

CCSS.ELA-Literacy.SL.3-8.1; CCSS.ELA-Literacy.SL.3-8.3

Writing Prompts

CCSS.ELA-Literacy.W.3-8.1; CCSS.ELA-Literacy.W.3-8.2; CCSS.ELA-Literacy.W.3-8.3

Types of Renewable Energy: Pros & Cons, Research Resources, Design Mission

CCSS.ELA-Literacy.W.3-8.7; CCSS.ELA-Literacy.RI.4-5.9; CCSS Speaking & Listening elementary and middle school standards; 4-ESS3-1 Earth and Human Activity

Renewable Energy and Energy Justice

CCSS.Math.3.MD.B.3 Represent and interpret data; 4-ESS3-1 Earth and Human Activity; NMSSS Theme 5: Global Diversity and Identity 3.28; NMSSS Theme 3: Trade and Industry 4.15; NMSSS Theme 2: Inequality and Injustice 5.12

Math Project: Does Solar Pay Off?

CCSS.Math.Content.4.OA.A.3

Additional Resources and Book List



The Children's Hour
kids public radio



Get Set to Listen

1. Before listening!

Read each statement and write TRUE or FALSE based on what you already know.

2. After listening!

Based on what the experts said in the episode, write TRUE or FALSE.

Before Listening	TRUE or FALSE?	After Listening
	1. One of the benefits of renewable energy is that it has the potential to be cheap or even free.	
	2. Burning fossil fuels have negative effects on the environment because they put gasses into the atmosphere called greenhouse gasses that heat up the planet.	
	3. Solar panels were invented in the United States about 30 years ago.	
	4. Energy starts out as DC energy and then has to be converted to AC energy for us to be able to use it in our homes, schools, and businesses. ????true???	
	5. Windmills were invented in medieval times to generate electricity.	
	6. There are several countries in the world that are using nearly 100% renewable energy <i>right now!</i>	

What did you learn?



Get set to listen.

Answer key

1. TRUE
2. TRUE
3. FALSE. Solar panels were invented in laboratories in the United States about **80 years ago.**
4. TRUE
5. FALSE. While it's true that windmills were first invented in medieval times, they were not used to generate electricity (which was not invented yet). They were used as pumps to suck water up from the ground.
6. TRUE! Albania, Bhutan, Ethiopia, Iceland, Nepal, Paraguay, and the Democratic Republic of Congo all generate more than 99.7% of their electricity from renewable sources like hydro, wind, solar, and geothermal power.



Vocabulary

renewable energy	energy sources that can be used over and over examples: solar, wind, geothermal, hydroelectric, and biomass
clean energy	energy that doesn't cause global warming or pollution
firm energy	energy that's available all the time example: geothermal, but not solar
greenhouse gasses	gases in the air, like carbon dioxide, that trap heat from the sun and keep Earth warm—like a blanket around the planet. Too many greenhouse gases cause problems, like melting ice and big storms.
fossil fuels	fuels like coal, oil, and natural gas that come from plants and animals that died millions of years ago and are burned for energy. Non-renewable.
AC energy	(Alternating Current) electricity that changes direction back and forth many times each second, and it's the type of electricity we use in homes and schools
DC energy	(Direct Current) electricity that flows in one direction only, like the power from a battery
energy injustice	some communities—often low-income or communities of color—have less access to clean energy and suffer more from pollution
turbine	a machine with blades that spin when moved by water, wind, or steam, and that spinning creates energy or electricity
energy storage systems	ways to save energy so we can use it later, like batteries that store electricity from solar panels or wind turbines
electric grid	the wires that carry electricity from where it is made, stored, and used



Discussion Questions

1. What is renewable energy? Can you name some types?
2. How is renewable energy different from non-renewable energy?
3. What might happen if we only used energy that comes from oil or coal?
4. Can you think of any ways your school or home uses renewable energy?
5. How could we use more renewable energy in our community?
6. If you could invent a new way to make renewable energy, what would it be?
7. How do you think renewable energy can help animals and nature?
8. Some families don't have access to electricity or clean energy. How do you think that makes life harder for them?
9. Why is it important that all communities get clean, safe, and affordable energy?
10. Imagine a town where a big wind farm is built, but the people living nearby don't get any electricity from it. Do you think that's fair? Why or why not?
11. How can renewable energy help families save money on their electricity bills? Why does that matter?

Group Discussion Strategies

Think Pair Share:

1. Individually, student writes down their answer to a question.
2. Students pair up and tell each other their answers.
3. Teacher calls for volunteers to share with the whole class their answer (and/or their partner's answer). Teacher notes key words/phrases on board.

Round Robin:

1. Teacher poses one question (written on top of a large page) to students, who are assembled into small groups of 3 or 4.
2. Students take turns brainstorming the answers. The recorder of the group writes down all answers.
3. The leader reads the group's ideas to the entire class. Teacher moderates.



Writing Prompts

Narrative Writing Prompts:

1. What would you do if there was no electricity for a whole day? How would you stay happy and safe?
2. Imagine you are an engineer who invents a new type of renewable energy. Describe your invention and the first day it powers your community.
3. Pretend you are a solar panel on a roof. Tell your story about helping a family save energy and protect the Earth.

Opinion Writing Prompts

1. Some communities don't have access to clean energy. Do you think this is fair? Explain your opinion.
2. Big solar or wind projects are sometimes built near small communities, but those communities don't get many benefits. Do you think this is right or wrong? Why?

Extension: Read *Solar Story* from the "Book List"

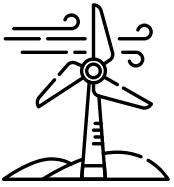
Informative/Explanatory Writing Prompts

1. Explain how one type of renewable energy works and why it is good for the environment.
2. Research a town or country that uses a lot of renewable energy. Write about how they did it and what challenges they faced.
3. Explain what energy injustice is and give examples of how renewable energy could make it fairer.
4. Describe how renewable energy can help families save money and why that is important.

Extension: Do the math project "Does Solar Pay Off?"



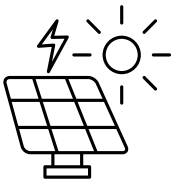
Types of Renewable Energy



Build a Mini Wind Turbine

["Windmill Project For Kids" – Little Bins for Little Hands](#)

This page offers a simple tutorial for building a windmill using basic materials like paper cups and a straw—perfect for young learners.



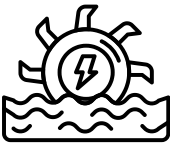
Solar Oven Experiment

["Build a Pizza Box Solar Oven" – Science Buddies](#)

Step-by-step STEM guide using household materials like a pizza box, foil, and plastic wrap to make a solar oven.

["How to Build a Solar Oven" – Wired](#)

An adult-friendly article explaining how to build a solar oven that can reach cooking temperatures over 200°F, highlighting physics concepts like insulation and reflection.



Water Power Demonstration

["Water Wheel DIY" – Generation Genius](#)

Downloadable lesson and instructions for making a small water wheel from household items like plates, skewers, and water.



[Wikipedia – Water Wheel](#)

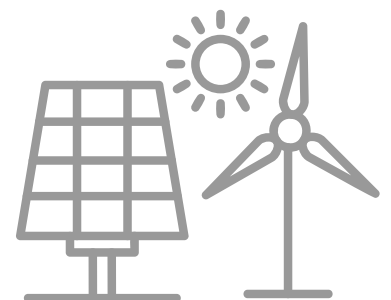
A general overview of how water wheels work, including their historical use and basic mechanics—great for understanding the science behind the demo.



Energy Hunt

["Renewable Energy Scavenger Hunt" – Hennepin County Environmental Education](#)

A PDF-based scavenger hunt activity to help students recognize local examples of renewable energy like solar and wind.





Types of Renewable Energy

Energy Type	 Pros	 Cons
solar	Uses sunlight (free & renewable), low pollution, reduces bills, lasts 25–30 yrs, can be small or large	High upfront cost, cloudy days reduce power, needs batteries, takes space, manufacturing impact
wind	Uses wind (free & renewable), low pollution, reduces bills, small or large, quick to install, creates jobs	Wind not always strong, noisy, can harm birds/bats, high initial cost, needs backup, takes space
hydro (water)	Uses water (renewable), low emissions, reliable, stores energy, controls floods, lasts long	Can harm environment, floods land, expensive, affected by drought, methane from reservoirs, risk of dam failure
geothermal	Uses Earth's heat (renewable), low emissions, reliable 24/7, small land area, long lifespan, can heat buildings	Expensive upfront, location limited, minor earthquake risk, needs water, gas release, not everywhere
biomass	Uses waste, renewable if managed, reduces landfill, widely available	Releases CO ₂ , land use for crops, can cause deforestation, pollution from processing

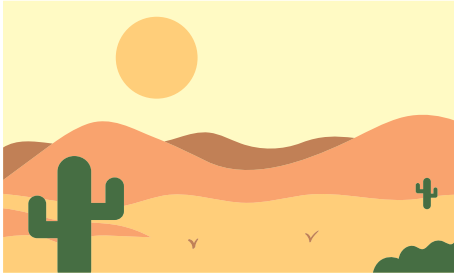


Mission: Renewable Energy Design

Mission Brief:

Your town needs clean, renewable energy. You are part of an elite team of engineers chosen to design the best energy source(s) for the community!

Step 1: Pick a scenario:



Scenario 1: Desert Town

- Sun: 300 sunny days per year
- Wind: Low
- Water: None nearby
- Extra: Lots of open land



Scenario 2: Coastal Town

- Sun: 220 sunny days per year
- Wind: High (very windy)
- Water: Ocean next to town
- Extra: Fishing is popular



Scenario 3: Mountain Village

- Sun: 180 sunny days per year
- Wind: Medium
- Water: River 3 miles away
- Extra: Farms grow lots of crops

Step 2: Learn about your options.

Use the “Types of Renewable Energy” pros and cons list and “Types of Renewable Resources” page

Step 3: Decide.

Discuss with your team:

Which energy source(s) will you use?

Why are they the best for this location?

Step 4: Show your plan.

Create a poster or drawing that includes:

- Name of your town
- Which energy source(s) you chose
- A drawing or diagram of your energy system
- A short paragraph explaining why your choice works best

Bonus Challenge:

What if the river dries up or a storm damages the wind turbines? How will your plan still work?



Renewable Energy and Environmental Justice

Learning Objectives

By the end of this lesson, students will:

1. Explain what renewable energy is and why it matters for the environment.
2. Understand that access to clean energy is not equal for all communities.
3. Identify how racism and inequality affect energy access.
4. Brainstorm solutions to make renewable energy fair for everyone.

Warm-Up

Write on the board: “What does fair access to energy mean?”

- Quick pair-share: What energy do you use every day? Who decides where energy comes from?

Mini-Lesson

- Define renewable energy (solar, wind, water, geothermal).
- Explain **energy injustice**: some communities—often low-income or communities of color—have less access to clean energy and suffer more from pollution.
- Show a quick infographic from [Energy Justice Lab](#) about energy injustice

Case Study Discussion

Choose one of the case studies listed in the “Additional Resources” section of this Learning Guide, such as:

- [Navajo Nation solar panels expanding access to energy](#)
- [Soulardarity \(Black-led solar project in Michigan\)](#)
- [Gambian Women Leverage Solar to Drive Green Transition](#) or [The Grandmas Leading Africa’s Solar Revolution](#)

Discussion Questions:

1. Why was renewable energy important for this community?
2. What challenges did they face?
3. How did community voices make a difference?
4. How does racism or inequality play a role in energy access?



Renewable Energy and Environmental Justice

Activity: Energy Justice Solutions

Students work in small groups to create a **poster** or **infographic** that answers:

“How can we make renewable energy fair for everyone?”

Include:

- ✓ At least one renewable source
- ✓ Who benefits
- ✓ Why fairness matters
- ✓ One action your group suggests

Wrap-Up & Reflection

- **Quick write:** Why is renewable energy not just a science issue but a fairness issue?
- Share 1–2 ideas from each group.

Assessment

- Participation in discussion
- Group poster or infographic quality (use of renewable energy concepts and fairness ideas)
- Written reflection on why equity matters in energy

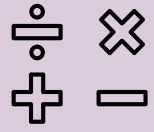
Extension Activities

- **Debate:** Should the government require that renewable energy projects benefit local communities first?
- **Research:** Find a renewable energy project in your state. Does it help everyone equally?
- **STEM Project:** Design a low-cost renewable energy solution for a community in need.





Does Solar Pay Off?



A major obstacle to adopting renewable energy sources (both for individuals and communities) is the cost. Use math to argue that solar is worth it!

Will Solar Save Money?

Problem 1:

Maria's family wants to put solar panels on their roof. The panels cost \$8,000 to install. After they are installed, the family saves \$100 on their electricity bill every month because they use solar power instead of electricity from the power company.

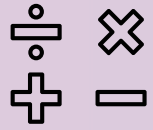
- a) **How much money will the family save in one year?** (1 year = 12 months)

- b) **How many years will it take for the savings to equal the \$8,000 cost of the solar panels?**

- c) **Challenge:** If the family keeps the solar panels for 10 years, how much money will they save after paying off the cost of the panels?



Does Solar Pay Off?



Extension Problem

Maria has two choices:

Keep paying her electric bill of \$150 each month (no solar).

Install solar panels for \$8,000 and pay \$10 per month for maintenance.

If she keeps the panels for 10 years, which option costs less, and by how much?

(Hint: Calculate total cost for each option and compare.)

Extra Practice Problems

Problem 2:

Solar panels cost \$6,000 and save \$80 a month.

a) How much do they save in 1 year? (*1 year = 12 months*)

b) How many years to pay back \$6,000?

Problem 3:

A school installs solar panels for \$20,000. They save \$250 every month.

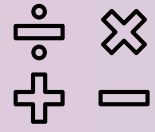
a) How much do they save in 2 years? (*1 year = 12 months*)

b) Will they pay off the panels in 8 years? Show your work.



Does Solar Pay Off?

Solution Sheet



Problem 1:

a) How much money will the family save in one year?

$$\$100 \times 12 = \$1,200 \text{ per year}$$

b) How many years will it take for the savings to equal the \$8,000 cost of the solar panels?

To pay off \$8,000:

$$\$8,000 \div \$1,200 = 6 \text{ years and 8 months (or about 7 years).}$$

c) Challenge: If the family keeps the solar panels for 10 years, how much money will they save after paying off the cost of the panels?

$$10 \text{ years} \times \$1,200 = \$12,000 \text{ total savings}$$

$$\$12,000 - \$8,000 = \$4,000 \text{ extra saved after payback}$$

Extension Problem:

Maria has two choices:

Step 1: Calculate total cost if she keeps paying the electric bill

- Monthly cost = \$150
- Number of months in 10 years = $10 \times 12 = 120$ months

$$\text{Total cost} = 150 \times 120 = 18,000$$

$$\text{Electric bill cost over 10 years} = \$18,000$$

Step 2: Calculate total cost with solar panels

- Upfront cost = \$8,000
- Maintenance = $\$10/\text{month} \times 120 \text{ months} = \$1,200$

$$\text{Total solar cost} = 8,000 + 1,200 = 9,200$$

$$\text{Solar panels cost over 10 years} = \$9,200$$

Step 3: Compare the two options

- Electric bill = \$18,000
- Solar panels = \$9,200

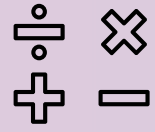
Answer: Maria saves \$8,800 over 10 years by installing solar panels.

Solar panels are the cheaper option..



Does Solar Pay Off?

Solution Sheet



Extra Practice Problems

Problem 2

Solar panels cost \$6,000 and save \$80 a month.

a) How much do they save in 1 year?

Multiply monthly savings by 12.

$$\$80 \times 12 = \$960$$

Answer: *They save \$960 in 1 year.*

b) How many years to pay back \$6,000?

Step 1: Divide the total cost by yearly savings.

$$\$6,000 \div \$960 \approx 6.25 \text{ years}$$

Answer: *It will take about 6 years and 3 months to pay back the solar panels.*

Problem 3

A school installs solar panels for \$20,000. They save \$250 every month.

a) How much do they save in 2 years?

Step 1: Determine months in 2 years.

$$2 \times 12 = 24 \text{ months}$$

Step 2: Multiply monthly savings by 24 months.

$$\$250 \times 24 = \$6,000$$

Answer: They save \$6,000 in 2 years.

b) Will they pay off the panels in 8 years?

Step 1: Determine total savings in 8 years.

$$8 \times 12 = 96 \text{ months}$$

$$\$250 \times 96 = \$24,000$$

Step 2: Compare total savings to cost.

- Cost = \$20,000
- Savings in 8 years = \$24,000

Answer: Yes, the school will pay off the panels in less than 8 years and save an extra \$4,000.



Additional Resources

[Teaching Kids About Sustainability Through Exploration](#)

The Pacific Science Center's website has tips for how to introduce kids to sustainability, including a book list.

[The Middle Schoolers' Guide to Renewable Energy](#)

This downloadable EARTHDAY.ORG guide clearly explains energy sources such as solar, wind, geothermal, and tidal power, making it an excellent resource for middle school students.

Environmental Organizations

[NAACP Center for Environmental & Climate Justice](#)

The NAACP's dedicated center focuses on environmental justice, aiming to reduce pollution and lessen the effects of climate change on Black communities.

[Red, Black & Green New Deal \(RBGND\)](#)

The first Black climate agenda in the U.S., empowering communities with sustainable solutions for climate justice.

[Climate Culture Directory of Organizations](#)

Find the organization and movement that suits your interests and skills!

[Greenbelt Alliance: Seven Intersectional Environmental Organizations You Should Support](#)

Infographics

[Energy Justice Lab](#)

Presents infographics and facts each week related to energy insecurity, poverty, and utility disconnections. Available for download.

[Climate Justice Infographic from Rights in Development](#)

Highlights some of the problems with how renewable energy is being rolled out and offers solutions for how it can be done more equitably.



Additional Resources

Case Studies: Renewable Energy Projects

[Project Profile: Navajo Nation Kayenta Solar Program \(Phase 1 & 2\), Arizona](#)

[CARES Act: Navajo Tribal Utility Authority's Off-Grid Solar Program](#)

[Native Renewables](#)

Our mission is to grow Indigenous-led solar power knowledge and solutions with Hopi and Diné (Navajo) families and communities. NRI installs off-grid solar with battery storage to provide power to families on the Navajo and Hopi Nations through our Hozho Homes Program.

Videos

[Powering a Nation with the Sun](#)

This 7 minute video from Native Renewables explains challenges and importance of getting power to many places on the Navajo Nation and how solar energy is helping fix this problem.

[Gambian Women Leverage Solar to Drive Green Transition](#)

[The Grandmas Leading Africa's Solar Revolution](#)

"The Solar Grandmas" in a small village in Madagascar install and repair 200+ solar panels, providing clean, safe energy to their community.

[Soulardarity: Community turns to solar power after traditional streetlights are removed](#)

Soulardarity advances energy democracy in Highland Park, MI, with solar projects and community-driven solutions for fair energy access.



Types of Renewable Energy Resources

Solar Energy

- [U.S. Department of Energy – Office of Energy Efficiency & Renewable Energy](#)
- [National Renewable Energy Laboratory \(NREL\) – Solar Energy Basics](#)
- [Kids Energy Guide – Solar Energy](#)

Wind Energy

- [U.S. Department of Energy – Wind Energy Basics](#)
- [National Renewable Energy Laboratory \(NREL\) – Wind Research](#)
- [Kids Energy Guide – Wind Energy](#)

Hydroelectric Energy

- [U.S. Department of Energy – Hydropower Basics](#)
- [National Renewable Energy Laboratory \(NREL\) – Hydropower](#)
- [Kids Energy Guide – Hydropower](#)

Geothermal Energy

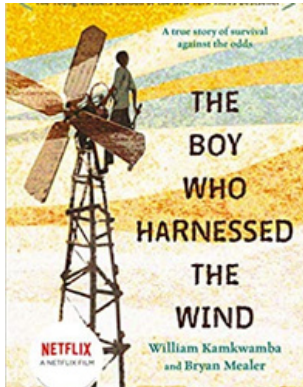
- [U.S. Department of Energy – Geothermal Basics](#)
- [National Renewable Energy Laboratory \(NREL\) – Geothermal](#)
- [Kids Energy Guide – Geothermal Energy](#)

Biomass Energy

- [DOE Bioenergy Technologies Office](#)
- [U.S. EIA Biomass Basics](#)



Book List

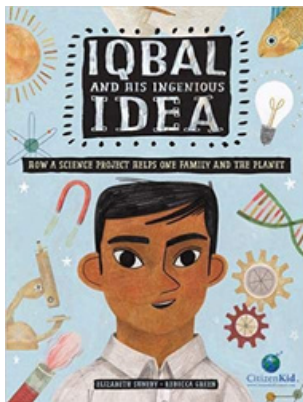


The Boy Who Harnessed the Wind

by William Kamkwamba and Bryan Mealer

A true story of a Malawian boy, William Kamkwamba, who used creativity and science to build a windmill that brought electricity and hope to his village.

ages 10+

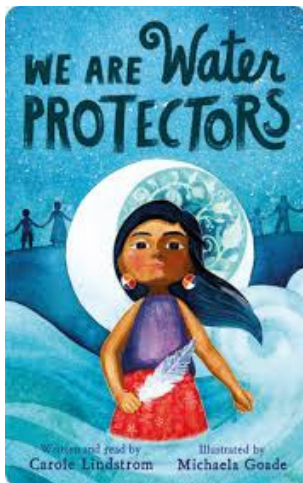


Iqbal and His Ingenious Idea: How a Science Project Helps One Family and the Planet

by Elizabeth Suneby

Iqbal builds a solar cooker for a science fair, helping his family avoid smoky fires and showing how kids can solve real-world problems.

ages 8-12



We Are Water Protectors

by Carole Lindstrom, illustrated by Michaela Goade

A Caldecott-winning picture book honoring Indigenous-led movements to protect water, telling the story of a young girl who takes a stand to defend Earth's most sacred resource.

ages 3-6



We are Better Together

by Bill McKibben, illustrated by Stevie Lewis

This book celebrates the power of human cooperation and hope, showing how working together can protect our fragile planet.

ages 4-8



Book List



Running on Sunshine: How Does Solar Energy Work?

by Carolyn CInami DeCristofano

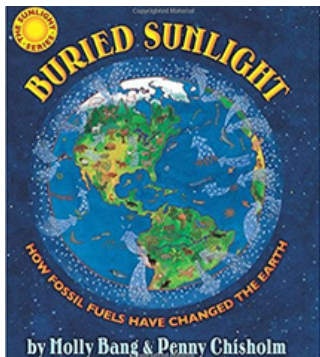
This book explains how solar energy works, its role in fighting climate change, and how people worldwide use it to live more sustainably, making the topic accessible to young students.
ages 4-8



Solar Energy: Running on Sunshine

by Amy Hansen

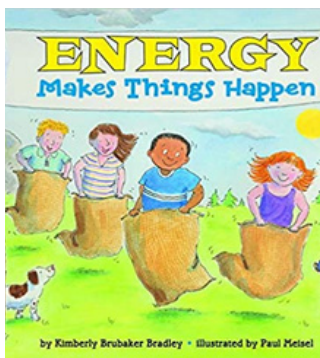
This non-fiction book introduces solar energy and its future uses, with a glossary and table of contents for late elementary to early middle school students.
ages 7-10



Buried Sunlight: How Fossil Fuels Have Changed the Earth

by Molly Bang and Sandra Chisholm

This book explains what fossil fuels are, their impact on Earth, and why finding alternative energy sources is important.
ages 4-8



Energy Makes Things Happen

by Brubaker Bradley

This illustrated book introduces how living things and machines get and use energy, highlighting the sun as the main source and sparking discussion on sustainable options.
ages 4-8



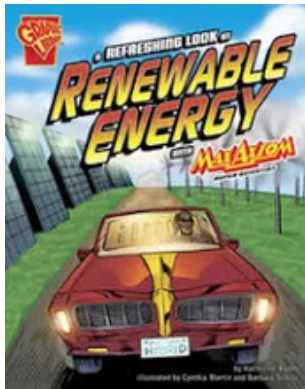
Book List



The Alternative Energy Series

by ABDO

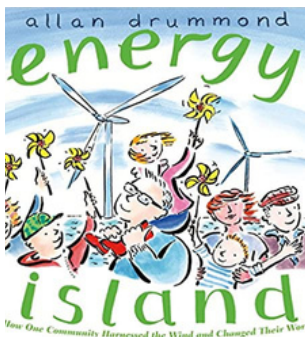
This series provides an in-depth look at renewable energy sources like solar, wind, geothermal, and hydroelectric power, exploring their history, technology, and environmental effects.
ages 9-14



A Refreshing Look at Renewable Energy with Max Axiom, Super Scientist

by Katherine Krohn

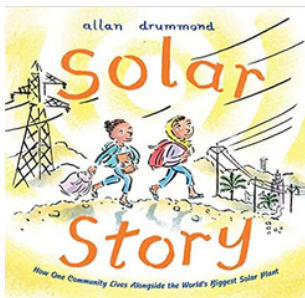
Part of the "Graphic Science 4D" series, this graphic novel offers a visually engaging and easy-to-understand introduction to renewable energy concepts for middle school students.
ages 10-14



Energy Island: How One Community Harnessed the Wind and Changed Their World

by Allan Drummond

This non-fiction book tells how a Danish island switched from fossil fuels to wind power through community teamwork. It's part of Allan Drummond's series on sustainable living.
ages 6-10



Solar Story

by Allan Drummond

This story follows two girls living near the world's largest solar plant in Morocco, showing how it works and exploring how renewable energy can benefit—and impact—local communities. It encourages discussion on including local communities in sustainable energy decisions.
ages 4-8