

Energy Conversions:

Blackout in Ergstown



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These materials are based upon work partially supported by the National Science Foundation under grant numbers DRL-1119584, DRL-1417939, ESI-0242733, ESI-0628272, and ESI-0822119. The Federal Government has certain rights in this material. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

These materials are based upon work partially supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R305A130610 to The Regents of the University of California. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education.



Developed by the Learning Design Group at the University of California, Berkeley's Lawrence Hall of Science.

Amplify Science Elementary is based on the *Seeds of Science/Roots of Reading*[®] approach, which is a collaboration between a science team led by Jacqueline Barber and a literacy team led by P. David Pearson.

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Grade 4
Energy Conversions: Blackout in Ergstown
ISBN: 978-1-64089-210-1
AMP.NA18

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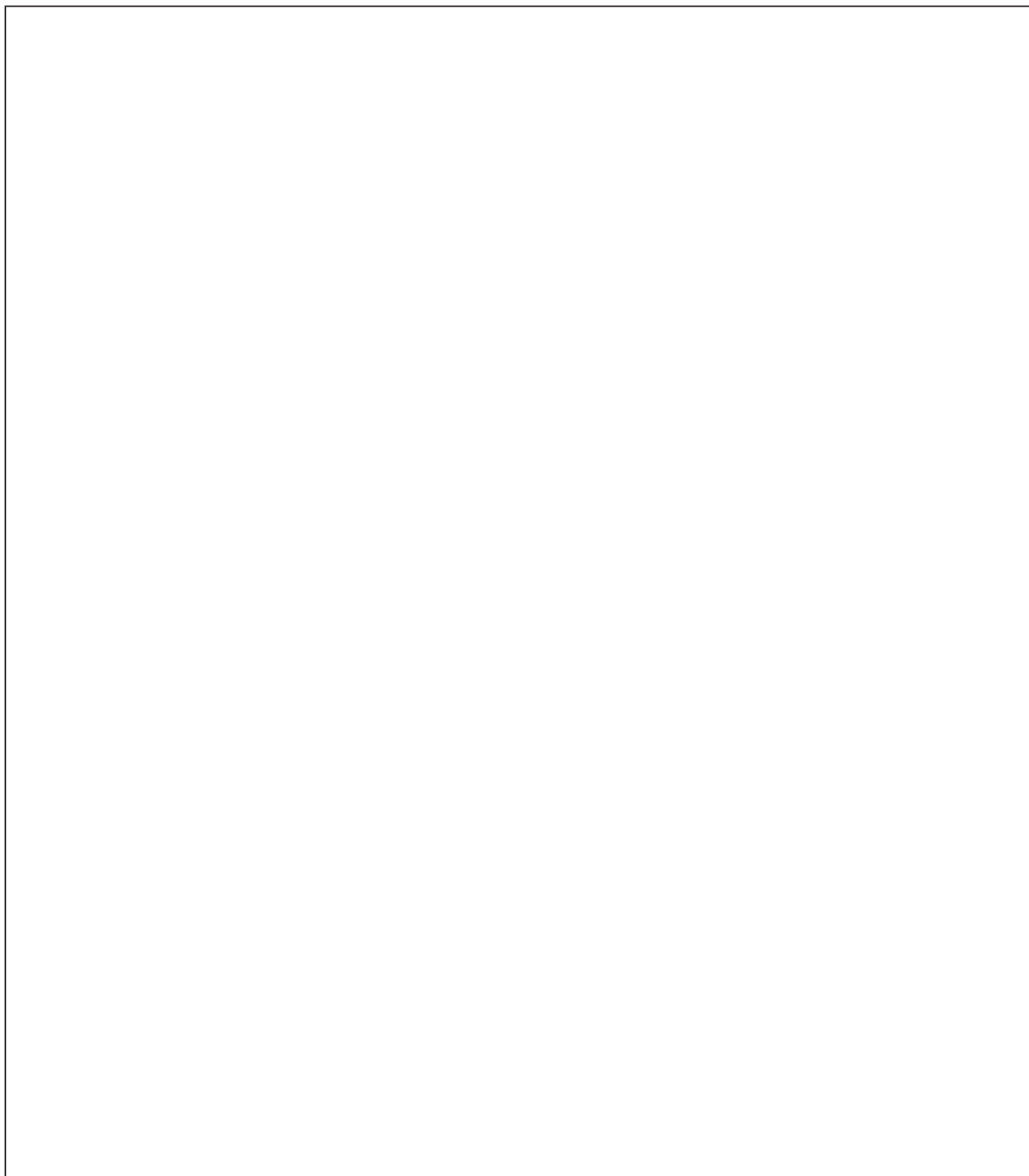
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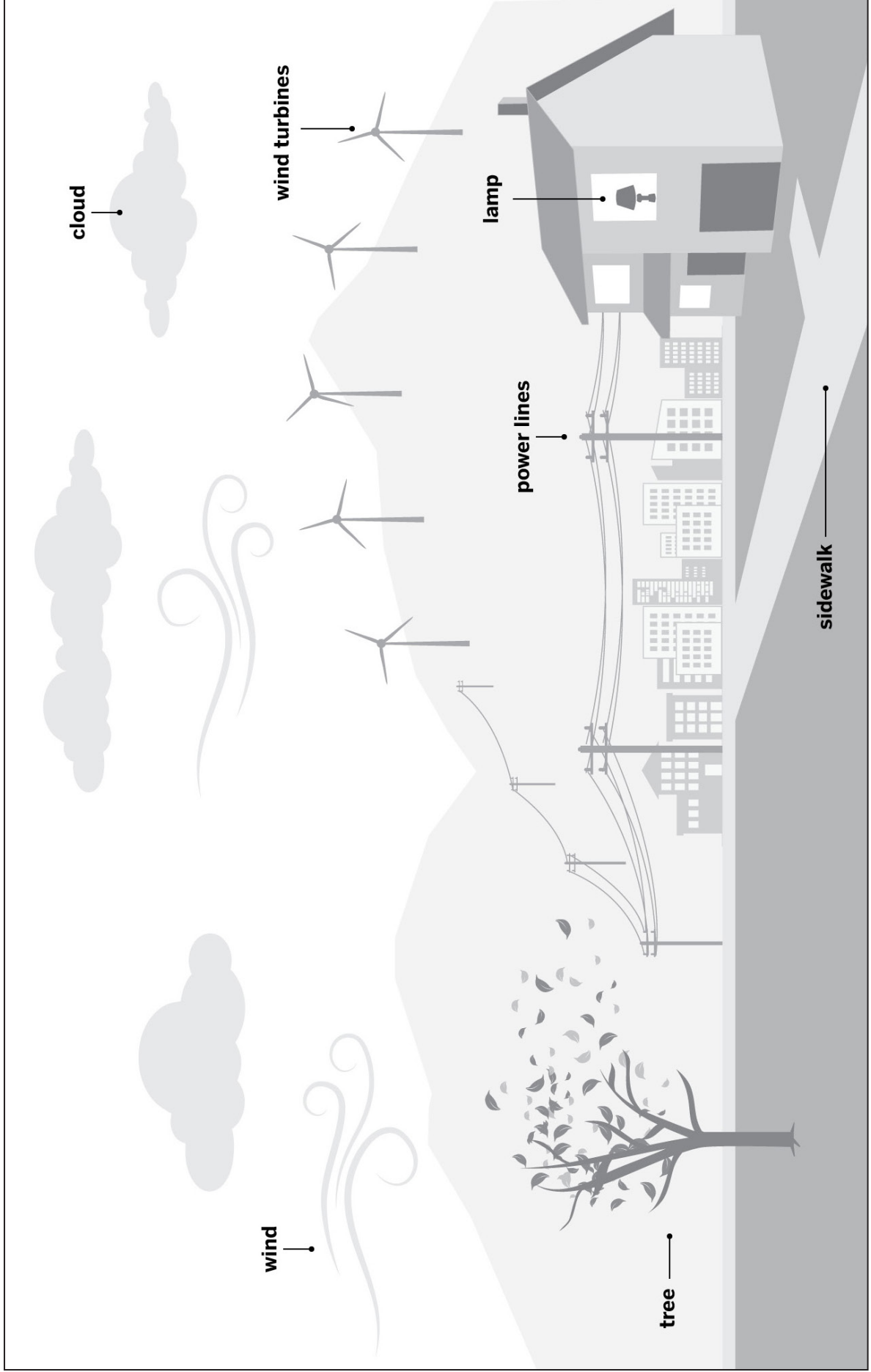
Name: _____ Date: _____

Pre-Unit Writing:
Explaining Why the Lamp Won't Turn On (continued)

Make a drawing if it helps you explain your thinking.

A large, empty rectangular box with a thin black border, intended for a student to draw a diagram or picture that explains their thinking about why a lamp might not turn on.

Pre-Unit Writing: Explaining Why the Lamp Won't Turn On (continued)



Name: _____ Date: _____

Chapter 1 Home Investigation: Blackout Interview

Directions:

1. Find two friends or family members who have been in a blackout.
Interview each of them about their experiences.
2. Write each person's name and then ask the two questions shown below.
3. Record each person's responses on the lines below each question.

Person's name: _____

What happened when the blackout occurred?

What do you think caused the blackout?

Person's name: _____

What happened when the blackout occurred?

What do you think caused the blackout?

Name: _____ Date: _____

Chapter 2 Home Investigation: Converters and Forms of Energy

Directions:

1. Look for energy converters (electrical devices) in your home. See how many you can find. List them in the first column of the table below.
2. In the second column, record the output energy form for each energy converter. (Remember: Output energy is the form of energy that an electrical device converts electrical energy into.)

Energy converter	Output energy forms
toaster	thermal energy, light energy

Name: _____ Date: _____

Design Argument About Reducing the Number of Blackouts in Ergstown

1. Read the question and the two possible solutions.
2. Read the criteria and think about which solution will best meet them.
3. Write a claim that answers the question.
4. Record your evidence. Explain how your evidence shows that the solution meets all of the criteria.

Question:

Which is the best solution for reducing the number of blackouts in Ergstown?

Possible solutions:

Get people to stop using some devices.

Replace older streetlights with LED streetlights.

Criteria:

Converts less energy from the grid. (Uses less energy.)

Doesn't change how people use their devices.

Claim

Changing old streetlights to LED streetlights is the best solution because

Name: _____ Date: _____

Design Argument About Reducing the Number of Blackouts in Ergstown (continued)

What is your evidence? How does it show that the solution meets all the criteria?

The evidence for this from the Sim is _____

The evidence for this from *It's All Energy* is _____

Chapter 3 Home Investigation: Renewable and Nonrenewable Energy Sources

Directions:

1. An energy source is called **renewable** if nature will always provide more of it, even after people have used what nature has already provided.
2. Decide if each energy source in the first column of the table below is or is not renewable. Circle "yes" or "no" in the second column.
3. Write the name of a friend or family member at the top of column three.
4. Ask them if they think each energy source in the first column is renewable. Circle the person's answers in the third column.
5. If you disagree about any energy sources, discuss your ideas.
6. Check the answers in *It's All Energy*. Share your findings.

Energy source	Is the source renewable? I think . . .	Is the source renewable? _____ thinks
Fossil fuels (oil and gas, for example)	yes no	yes no
Wind	yes no	yes no
Sun	yes no	yes no
Water	yes no	yes no
Nuclear fuel (energy from atoms)	yes no	yes no
Geothermal (energy from inside Earth)	yes no	yes no
Biofuels (mostly made from plants)	yes no	yes no

Ergstown Climate Report

	<p>Ergstown has mild weather most of the year.</p>
	<p>It is sunny approximately 300 days per year.</p>
	<p>It is often windy or breezy.</p>
	<p>Severe winds and storms often occur during the winter months.</p>

Name: _____ Date: _____

Questions About Energy Sources

1. With a partner, discuss the questions about each energy source in the table. Refer to pages 28–37 in *It's All Energy* for more information.
2. Record your answers in the table.

Energy source	What is one problem that using this energy source can cause?	What do you think would be a good rule to help prevent this problem?
fossil fuels		
wind		
sun		
water		
nuclear fuel		

Design Argument About Reducing Blackouts in Ergstown

1. Read the question and the two possible solutions.
2. Read the criteria and think about which solution will best meet them.
3. Think about the evidence you have been gathering and discussing with the class. Circle the sources of evidence you will use.
4. Write a claim that answers the question.
5. Support your claim with evidence.
6. Describe any limitations of the solution you chose.

Question:

Which is the best solution for reducing the number of blackouts in Ergstown?

Possible solutions: (Circle one.)

Install new solar panels.

Install new wind converters.

Criteria:

Increases the amount of energy in the electrical system.

Isn't too expensive.

Is safe for the environment.

Sources of evidence: (Circle the ones you use.)

designing a wind converter

It's All Energy

building a simple electrical system
with a solar panel

Energy Conversions Simulation

Climate Report

Name: _____ Date: _____

Design Argument About Reducing Blackouts in Ergstown (continued)

The best solution is _____

I know this solution meets the criterion of _____

because _____

One limitation of this solution is _____

Analyzing a Failing System

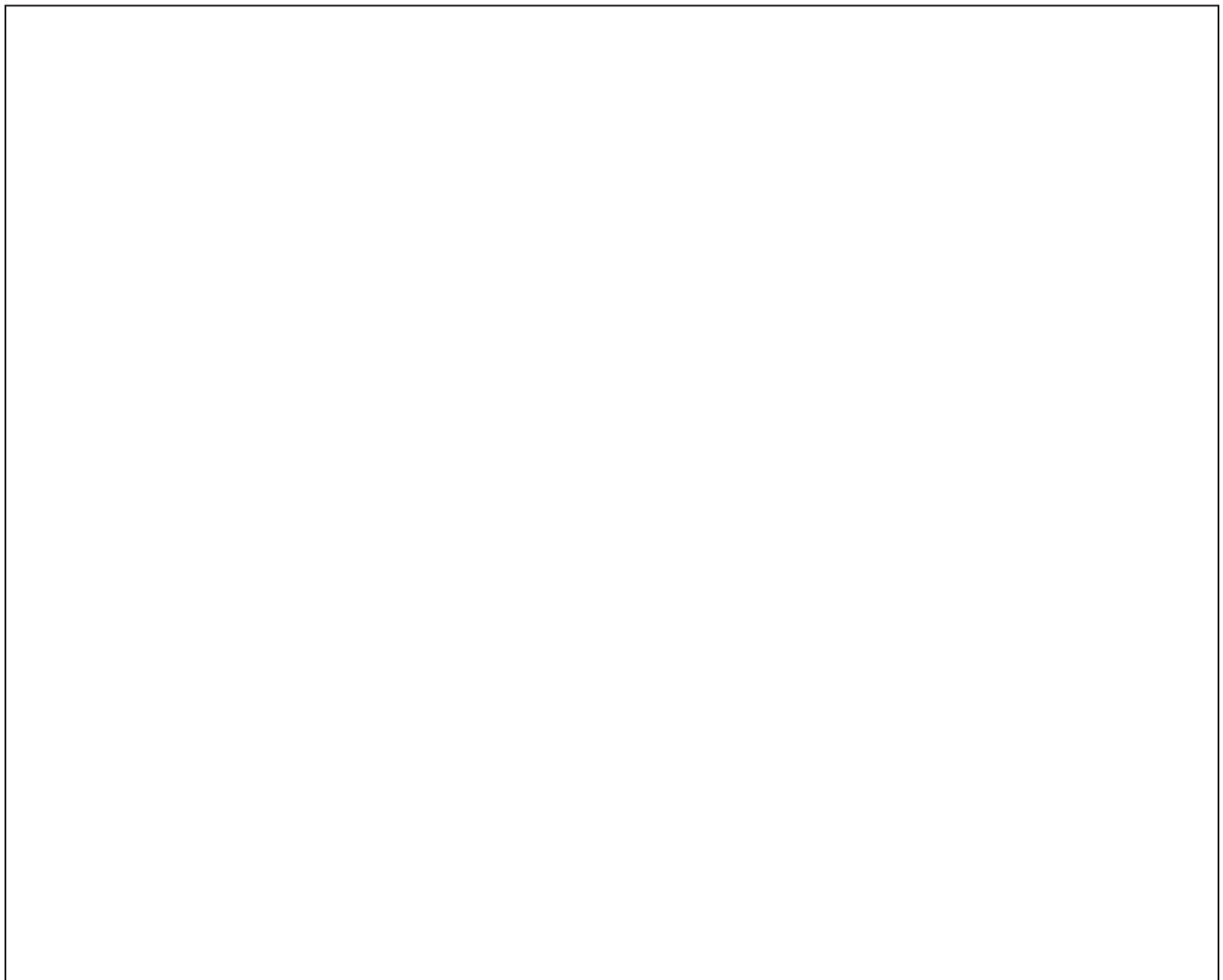
1. **Team A** shows their failing system to **Team B**. (**Team A** holds the system. Team B should look at it but not touch it.)
2. **Team B** discusses what might be wrong with the system. (**Team A** should not give away what is wrong!)
3. If **Team B** can't tell what is wrong by looking, **Team A** can let them hold the system.
4. **Team B** decides what they think is wrong with the system. **Team A** tells them if they are correct. If they aren't, **Team B** should keep trying to figure out what's wrong.
5. **Team B** predicts what change will make the system function. They make the change to test their prediction. They can make another prediction if the system still doesn't work.
6. Teams switch roles and repeat these steps.

Name: _____ Date: _____

Chapter 4 Home Investigation: Observing the Electrical Grid

Directions:

1. With an adult family member or other trusted adult, stand in front of your home or look out a window. Look for evidence of the electrical grid. Do you see utility poles, wires, or other evidence of the grid?
2. Discuss what you observe with the adult.
3. Then, draw a diagram of the neighborhood. Include all the parts of the electrical grid you can see. Label houses, stores, utility poles, wires, and other parts of your community.
4. Record your answers to the two questions on the next page.



Name: _____ Date: _____

**Chapter 4 Home Investigation:
Observing the Electrical Grid** (continued)

Look at the wires you drew. What do you think their function is?

What else do you think the wires connect to?







System Improvements Report:

Ergstown Region

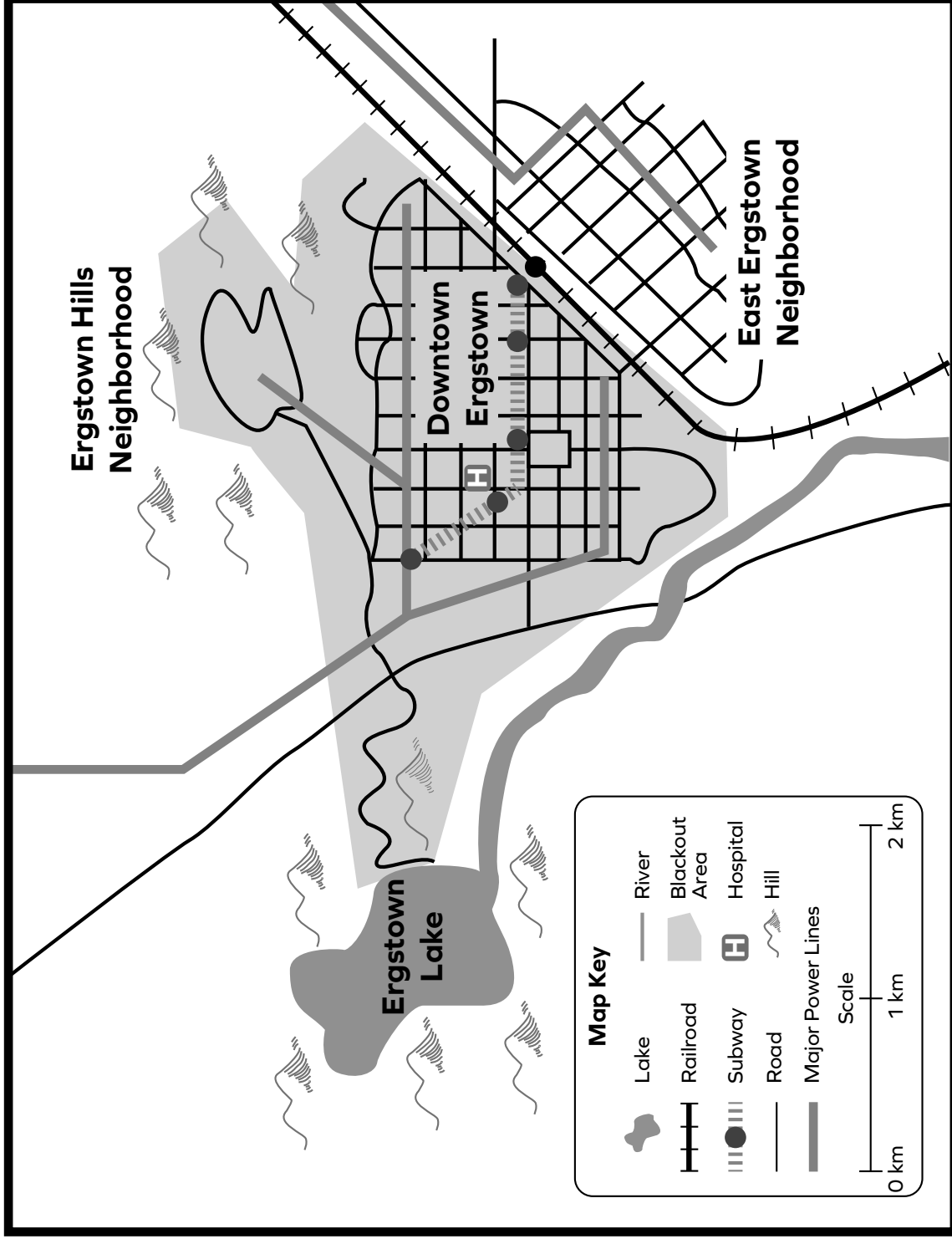
Improvement	City	Cost	Improvement Project Description
Strengthen the grid connections.	Wattsville	\$ \$	<ul style="list-style-type: none"> The work was completed in just a few weeks. Streets were closed for a short time. Residents were not very bothered by the project.
Move the grid wires underground.	Riverton	\$ \$ \$ \$	<ul style="list-style-type: none"> The work was completed in one year. Streets were closed often. Residents complained because the digging machines made a lot of noise.
Add a set of backup wires to the grid.	Zephyr City	\$ \$ \$	<ul style="list-style-type: none"> The work was completed in a few months. Streets were not closed for the project. Residents complained because trees had to be cut down to make space for the wires.

Report: Ergstown Weather on Day Blackouts Occurred

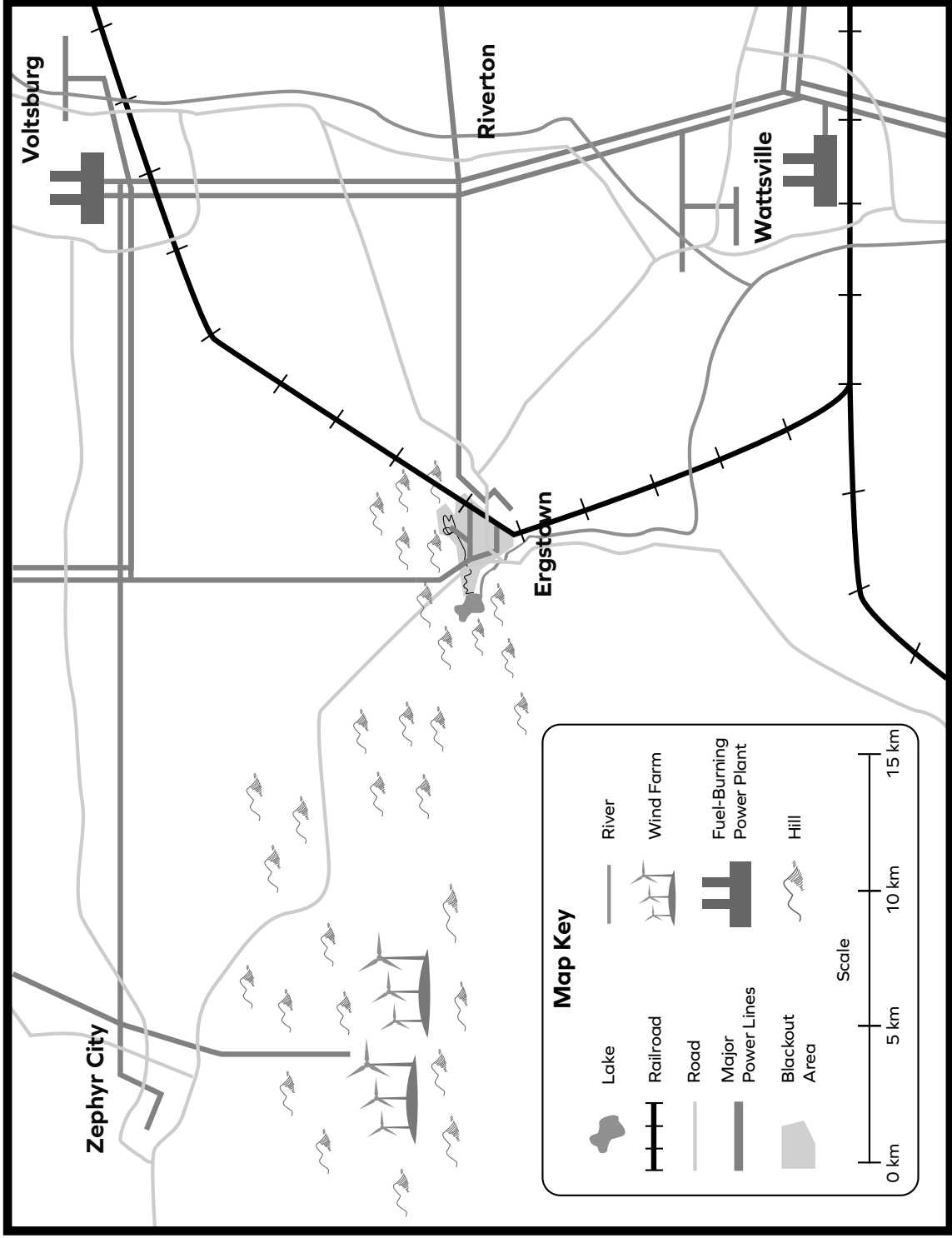
Prepared for Mayor Joules by meteorologist J. Greenn

Date of Blackout	Temperature	Weather Conditions—Morning	Weather Conditions—Afternoon
September 28	High: 62°F Low: 54°F	Morning rain. 	Cleared in the afternoon. Heavy winds in the afternoon and evening. 
November 17	High: 50°F Low: 40°F	Heavy rain and winds. 	Heavy rain and winds. 
December 30	High: 32°F Low: 26°F	Some snow. 	Winds picked up in the afternoon. Heavy snowstorm. 

Ergstown Blackout Map



Ergstown Regional Map



Name: _____ Date: _____

Possible Solutions for Improving Ergstown’s Electrical System: Grid Improvements

Possible Solution	Description	Cost	Energy Saved	Limitations	Additional Evidence
Add backup wires	If one wire breaks, the other wires will still work.	\$\$\$	none	Storms can still damage backup wires above the ground.	
Strengthen grid onnections	Stronger grid connections will help wires stay up even in storms.	\$\$	none	Stronger connections will not help if there is a problem with the wires.	
Move the grid underground	This will protect the wires from storms.	\$\$\$\$	none	It is more difficult to fix wires that break underground.	

Name: _____ Date: _____

Possible Solutions for Improving Ergstown’s Electrical System: Saving Energy

Possible Solution	Description	Cost	Energy Saved	Limitations	Additional Evidence
Encourage people to switch to newer LED lightbulbs.	LEDs are energy efficient. They save people money on their electrical bills. Most businesses already use these bulbs. Most homes do not.	0	a little	LED light bulbs are more expensive than regular light bulbs.	
People could limit the use of air conditioners.	Reward people and businesses who use their air conditioners less.	\$	some	People will have to put up with warmer buildings during hot weather.	
Shut down the electrical system from 2–3:00 a.m.	Many places in the world save energy by shutting down the system for an hour or more each night.	0	a lot	Electric clocks without batteries would have to be reset every day.	

Name: _____ Date: _____

Possible Solutions for Improving Ergstown’s Electrical System: Energy Source and Converter Solutions

Possible Solution	Description	Cost	Energy Saved	Limitations	Additional Evidence
Install more wind turbines near Ergstown.	Ergstown is often windy so turbines would work well near the city.		none		
Install new solar panels near Ergstown.	Ergstown could build solar panels to convert light energy into electrical energy.		none		
Build another fossil fuel plant close to Ergstown.	Power plants near Ergstown already convert fossil fuels to electrical energy.		none		
Build a hydroelectric power plant near Ergstown.	A hydroelectric power plant could be built on a nearby river.		some		

End-of-Unit Writing: Arguing About Solutions for Ergstown’s Electrical System

Part 1

1. Read the question and the possible solutions below.
2. Read the criteria and think about which solution will best meet them.
Remember that it is often not possible to meet all criteria equally well.
3. Circle the solution you think is best.
4. Write a claim that answers the question and support your claim with evidence. Describe any limitations of the solution you chose.

Question:

What is the best solution for improving Ergstown’s electrical system and why?

Possible solutions: (Circle one.)

Add backup wires.

Move the wires to a safer, more secure location (underground).

Encourage people to switch to newer LED lightbulbs.

Limit the use of air conditioners.

Shut down the electrical system from 2:00 a.m. to 3:00 a.m.

Strengthen grid connections.

Install more wind turbines near Ergstown.

Install new solar panels near Ergstown.

Build another fossil fuel plant near Ergstown.

Build a hydroelectric power plant near Ergstown.

Criteria:

They aren’t too expensive.

They are safe for the environment.

They save energy or convert more energy.

They are reliable—they will work most of the time.

They won’t bother the people of Ergstown.

Name: _____ Date: _____

**End-of-Unit Writing: Arguing About Solutions
for Ergstown's Electrical System (continued)**

Name: _____ Date: _____

End-of-Unit Writing: Arguing About Solutions for Ergstown’s Electrical System (continued)

Part 2

Look at the picture of the town. A person in this town plugged a lamp into the wall and then turned the lamp switch to “on.” Nothing happened! The lamp did not light up. What are all of the possible ways in which the four parts of the electrical system could cause the lamp to not light up?

How could the problem be related to the energy source?

How could the problem be related to the source converter?


How could the problem be related to the wires?

How could the problem be related to the lamp?

Name: _____ Date: _____

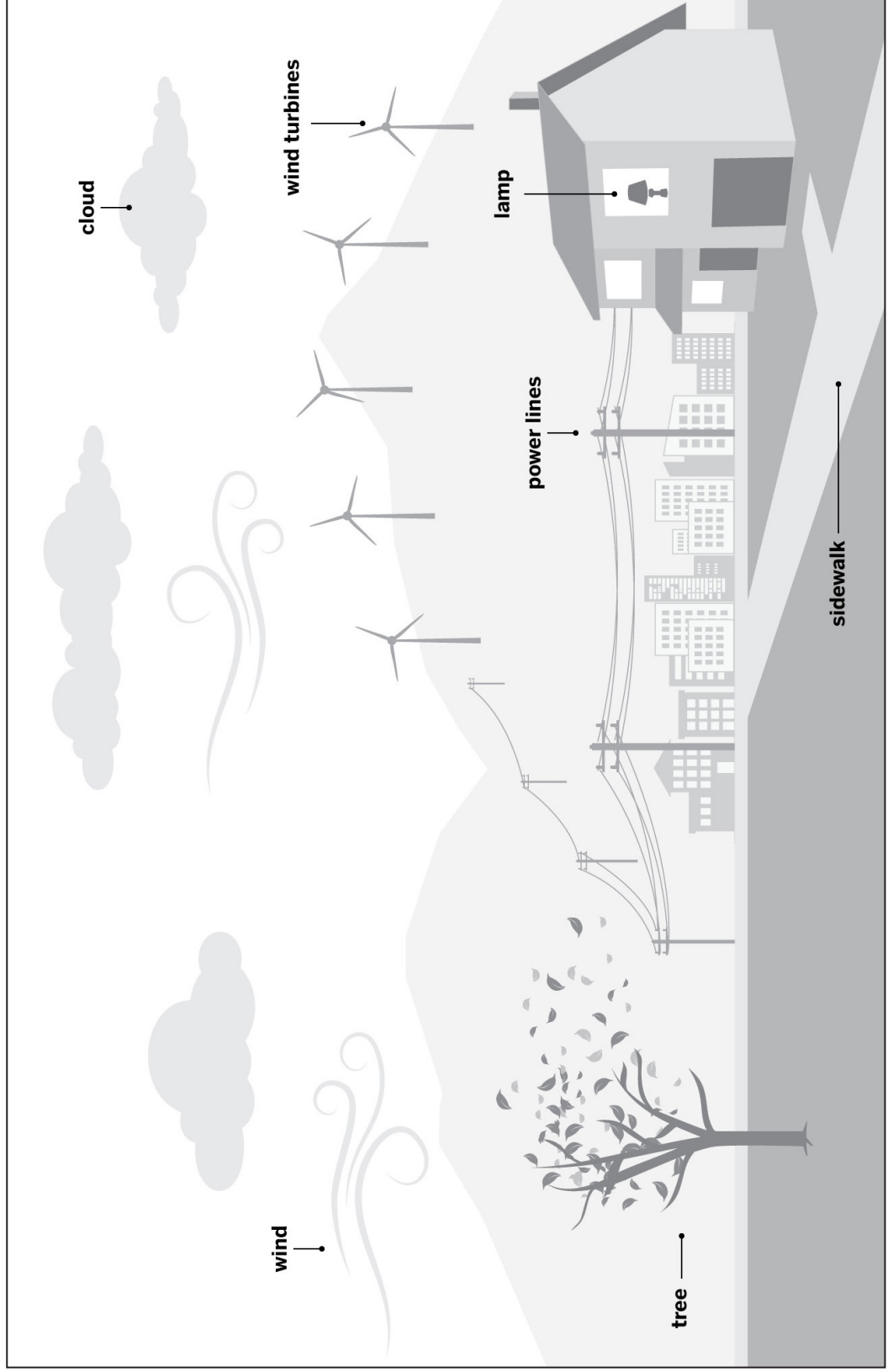
End-of-Unit Writing: Arguing About Solutions for Ergstown’s Electrical System (continued)

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Name: _____ Date: _____

End-of-Unit Writing: Arguing About Solutions for Ergstown's Electrical System (continued)



End-of-Unit Writing: Arguing About Solutions for Ergstown’s Electrical System

Part 1

1. Read the question and the possible solutions below.
2. Read the criteria and think about which solution will best meet them.
Remember that it is often not possible to meet all criteria equally well.
3. Circle the solution you think is best.
4. Write a claim that answers the question and support your claim with evidence. Describe any limitations of the solution you chose.

Question:

What is the best solution for improving Ergstown’s electrical system and why?

Possible solutions: (Circle one.)

Add backup wires.

Move the wires to a safer, more secure location (underground).

Encourage people to switch to newer LED lightbulbs.

Limit the use of air conditioners.

Shut down the electrical system from 2:00 a.m. to 3:00 a.m.

Strengthen grid connections.

Install more wind turbines near Ergstown.

Install new solar panels near Ergstown.

Build another fossil fuel plant near Ergstown.

Build a hydroelectric power plant near Ergstown.

Criteria:

They aren’t too expensive.

They are safe for the environment.

They save energy or convert more energy.

They are reliable—they will work most of the time.

They won’t bother the people of Ergstown.

Name: _____ Date: _____

End-of-Unit Writing: Arguing About Solutions for Ergstown’s Electrical System (continued)

The best solution for improving Ergstown’s electrical system is _____

I know this solution meets the criterion of _____

because _____

The limitations of this solution are _____

Name: _____ Date: _____

End-of-Unit Writing: Arguing About Solutions for Ergstown’s Electrical System (continued)

Part 2

Look at the picture of the town. A person in this town plugged a lamp into the wall and then turned the lamp switch to “on.” Nothing happened! The lamp did not light up. What are all of the possible ways in which the four parts of the electrical system could cause the lamp to not light up?

How could the problem be related to the energy source?

How could the problem be related to the source converter?

How could the problem be related to the wires?

How could the problem be related to the lamp?

Name: _____ Date: _____

End-of-Unit Writing: Arguing About Solutions for Ergstown’s Electrical System (continued)

Make a drawing if it helps you explain your thinking.

A large, empty rectangular box with a thin black border, intended for a student to draw a diagram or illustration to support their argument.

Name: _____ Date: _____

End-of-Unit Writing: Arguing About Solutions for Ergstown's Electrical System (continued)

