



Smithsonian

**SCIENCE**  
*for Global Goals*

***ENERGY!***



**Part 2:**

**Sources  
of  
Energy**

**SUSTAINABLE DEVELOPMENT GOALS**

developed by



**Smithsonian**  
*Science Education Center*

in collaboration with

**iap** **SCIENCE**  
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## PART 2: SOURCES OF ENERGY

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### *Find out More!*

For additional resources and activities, please visit the *Energy!* StoryMap at <http://bit.ly/3Kx41Jy>.



## Planner

Activity	Description	<u>Materials and Technology</u>	<u>Additional Materials</u>	<u>Approximate Timing</u>	<u>Page Number</u>
<b>Task 1: What do I know about energy sources on Earth?</b>					
<b>Discover</b>	Make <u>Energy Source Cards</u> with information, thoughts and feelings about sources of energy on Earth.	<ul style="list-style-type: none"> <li>• Paper, cardstock, or another durable material</li> <li>• Pens or pencils</li> <li>• Art or craft materials (optional)</li> </ul>		15 minutes	35
<b>Understand</b>	Create a <u>Perspectives Chart</u> to organize important characteristics of energy sources on Earth.	<ul style="list-style-type: none"> <li>• Paper</li> <li>• Pens or pencils</li> </ul>	<u>Energy Source Cards</u>	25 minutes	38
<b>Act</b>	Decide what is most important about energy sources for your community, and create a <u>Sustainable Energy Statement</u> .	<ul style="list-style-type: none"> <li>• Paper</li> <li>• Pens or pencils</li> </ul>	<u>Futures Mood Board</u>  <u>Effects on Our Community</u> chart  <u>Perspectives Chart</u>	20 minutes	40



Activity	Description	Materials and Technology	Additional Materials	Approximate Timing	Page Number
<b>Task 2: Which energy sources could help my community create a sustainable energy future?</b>					
<b>Discover</b>	Add social, environmental, economic, and ethical perspective characteristics to your <u>Energy Source Cards</u> .	<ul style="list-style-type: none"> <li>• Paper</li> <li>• Pens or pencils</li> </ul>	<u>Sustainable Energy Statement</u>  <u>Energy Source Cards</u>	25 minutes	42
<b>Understand</b>	Research the benefits and concerns of each source of energy on Earth.	<ul style="list-style-type: none"> <li>• Pens or pencils</li> <li>• Computer or other research tools (optional)</li> <li>• Art or craft materials (optional)</li> </ul>	Community Energy Observation  Community Effects Investigations  Part 1 Survey results  <u>Energy Source Cards</u>	20 minutes	47
<b>Act</b>	Arrange your <u>Energy Source Cards</u> to show which would be best at meeting the needs of your community.	<ul style="list-style-type: none"> <li>• Pens or pencils</li> <li>• Art or craft materials (optional)</li> </ul>	<u>Futures Mood Board</u>  <u>Energy Source Cards</u>	10 minutes	50



## Meet Your Research Mentor

Meet Dr. Arielle Miller. Arielle (pronounced *AIR-ee-el*) will be your research mentor to help you understand more about nuclear power and **sustainable** sources of **energy**.

Arielle is a professional nuclear **engineer**, PhD coach, educator, consultant, and former nuclear-trained surface warfare officer in the United States Navy. She has a master's degree in nuclear engineering and a PhD in mechanical engineering. However, she also has knowledge and **perspectives** that came from other parts of her **identity**. Since Arielle is now working with you, it is important to understand who she is.

### Arielle's Identity Map

Female

41 years old

Black

Jewish, Italian, and multi-racial

Lives in Washington, D.C.

Interested in space and nuclear engineering and power

Like reading science-fiction and fantasy books

Is a dog mom

Enjoys watching streaming shows

Enjoys cooking

Likes trying to keep her plants alive

Likes working on her car and her house

Wears glasses

Has curly brown hair

"I embrace challenges and pushing myself."

"I love helping other people in the STEM community."

"I can be extroverted in public but need time to myself."

"I'm very organized and like to have a plan and a routine."



## Task 1: What do I know about energy sources on Earth?

You probably use energy to meet your needs every day. You might light a fire for cooking, turn on a lamp, get on a bus, or charge an electronic device like a mobile phone. Where does that energy come from?

In this task you will **discover** what you and your team already know, think, and feel about energy sources on Earth. You will analyze different perspectives to **understand** characteristics of energy sources. Finally, you will **act** to share what you think about **sustainable energy** with someone else.

Before you begin Part 2, think quietly to yourself about Arielle's identity map.

- Are there things you have in common with Arielle?
- Are there ways in which you are different from Arielle?
- Can you see anything about Arielle's identity that helps her understand different perspectives or ideas about sustainable energy?

Throughout Part 2 you will notice Arielle sharing ideas and experiences with you. She may help you understand better ways to do your research or share some of the research she has done. If she uses words you don't understand, you can use the glossary to help you.



### **Discover:** *What do I know, think, and feel about energy sources on Earth?*

You might already know about one of the biggest sources of energy on Earth: the sun. Certain living things on Earth are able to absorb sunlight and convert it into **chemical energy** that they and other living things can use. Plants, algae, and certain kinds of bacteria are some of the living things that can use sunlight for energy.

Apart from sunlight, there are several other sources of energy on Earth. This activity will help you explore what you already know about these sources.



1. With your team, discuss: What are the sources of energy we can think of?
2. Work with your team to create a set of nine cards. These *Energy Source Cards* will help you collect and organize information about different sources of energy as you use this guide.
  - a. Create the cards from a sturdy material that you can keep safe and add to as you complete more parts of the guide, such as paper, cardstock, poster paper, or cardboard.
  - b. Leave plenty of room on each card to add more information later. Consider using a half or full sheet of paper for each card.
3. Read *Sources of Energy on Earth*. Divide up the blank cards among your team and write the name of one type of energy source on the top of each card. Underneath, add the description of the energy source.

### Sources of Energy on Earth

People use the following sources of energy to help them meet their needs:

- **Solar energy:** converts light energy from the sun into electricity using solar panels
- **Wind energy:** converts wind, or the movement of air, into electricity using a wind **turbine**
- **Hydropower and ocean energy:** converts energy from moving water, such as a river or the tides of the ocean, into electricity
- **Nuclear energy:** converts the energy created by breaking apart the center of **atoms** in **uranium** into electricity
- **Biofuel energy:** uses the energy found in living things, such as wood, algae, or animal poop, to generate electricity or produce heat
- **Geothermal energy:** uses heat from underground to produce electricity or heat
- **Petroleum (also called oil):** a liquid made of fossilized living things that were buried millions of years ago; it can be burned to generate electricity or provide heat
- **Coal:** a solid made of fossilized living things that were buried millions of years ago; it can be burned to generate electricity or provide heat
- **Natural gas:** a gas formed from living things that were buried millions of years ago; it can be burned to generate electricity or provide heat

If any of these sources are not familiar to you, don't worry. You will learn more about them later.





4. With your team, sort your Energy Source Cards. If you are familiar with a source of energy, place it in one pile. If you are not, place it in another pile.
5. Discuss with your team:
  - a. Are there any energy sources that everyone is familiar with?
  - b. Are there any energy sources only some people know about? If so, have them share what they know with the rest of the team.
6. Using the pile of Energy Source Cards you know, work with your team to sort them into three piles:
  - a. In the first pile, place any energy sources you think have a positive effect on people and the environment.
  - b. In the second pile, place any energy sources you are unsure about or you think might have a mixed effect.
  - c. In the third pile, place any energy sources you think have a negative effect.
7. Discuss with your team:
  - a. Does anyone disagree? Have each teammate share why and pay close attention.
8. Turn to a partner and share how you feel about each source of energy. Pay attention as they share their feelings with you.
9. Come back together as a team. On each Energy Source Card write “feelings.” Next to it, write any feelings team members had about that energy source that they want to remember.
10. As a team, try to place your Energy Source Cards in order from the energy source you think is used the most often in your **community** to the energy source that is used the least. If you disagree, keep discussing your ideas until you can come to **consensus**.
11. On each card write “community energy use:” Then write the number showing the order in which you placed your cards. Write “1” for the energy source used most often and “9” for the one used least often. Write the other numbers that show the rest of the rankings.
12. Discuss with your team:
  - a. Which energy sources do you think you need to learn more about?
  - b. Which energy sources are you most worried about? Why?
  - c. What surprised you about your team’s answers?
  - d. What question did you disagree on the most?





**Understand:** *What are some different perspectives related to energy sources?*

In the Discover activity, you might have realized that you already know a lot about some energy sources. Others might have been totally new to you. To help your team and your community create a more sustainable energy future, it's important to learn about all the energy sources on Earth and things to consider when using them.

1. Divide your team into four groups and assign each group one perspective: **social**, **environmental**, **economic**, or **ethical**.
2. With your group, discuss questions you think are important to consider about different energy sources from that perspective. For example:
  - a. Social: How is energy used by people to help with social interactions, education, and health? Are there things in our culture that make us want to use certain types of energy? Is this energy reliable? Can we count on it when we need it, such as keeping power on in a hospital?
  - b. Environmental: What are the ways using different energy sources can affect the environment? Be sure to consider the local environment, like noise, smoke, or changing land or waterways. Also consider the global environment, such as releasing gases into the atmosphere.
  - c. Economic: Is the source of energy expensive or affordable? Do many people in your community have jobs related to one type of energy? Does it cost a lot of money to build the **infrastructure**, such as a dam or **power plant**, for the energy source?
  - d. Ethical: How fair is the use of energy? Are there dangers? Are some people or other living things more at risk than others? Does everyone have access to energy?
3. Take a large piece of paper or a class board and divide it into four sections. Label each section with one of the perspectives. Title the paper "Perspectives Chart."
4. With your group use the perspective section you were assigned and add the characteristics of energy you discussed related to that perspective.
5. As a team, examine all the sections in your *Perspectives Chart*. If you can think of anything that is missing, add it now.
6. Read *Energy and the Global Environment*. Add anything you think is important from this list to your *Perspectives Chart*.



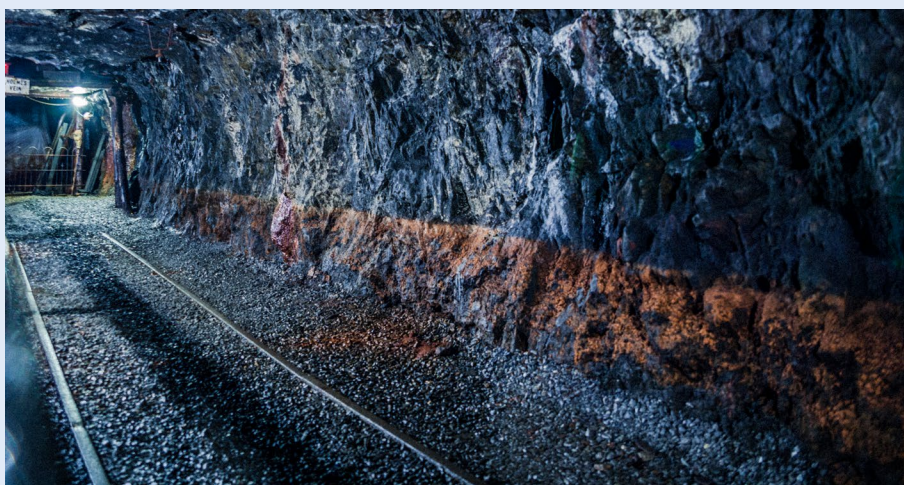
## Energy and the Global Environment

The relationship between energy and the global environment can be complex. There are different ways to describe this relationship, and you may not be familiar with all of them.

### Renewable and Non-Renewable Energy

**Renewable** and **non-renewable** describe the type of materials used as energy sources.

- **Renewable:** Energy sources that are not likely to run out for a very long time or that are replaced faster than they are used. An example is solar energy. The life span of the sun is much, much longer than a person's life span and the sun **emits** far more energy than people can use.
- **Non-renewable:** Energy sources that run out faster than they can be replaced. A common non-renewable energy source is **fossil fuels**. A fossil fuel is an energy source that formed millions of years ago from living things that died and were buried under deep layers of **sediment**. One example is coal. It takes millions of years for coal to form and it cannot be replaced in a person's life span. Other examples of fossil fuels include natural gas, and petroleum (oil).



*Figure 2.1: Coal is formed when layers of earth are compressed. Coal mine tunnels like this one allow people to access the layers of earth that contain coal.*



## Greenhouse Gases

Another way to think about the effect of energy sources on the global environment is to consider **greenhouse gases**. Greenhouse gases are gases such as carbon dioxide or methane that cause the atmosphere to get warmer.

- **Low-carbon or zero-carbon:** An energy source that releases very little or no carbon dioxide gas into the atmosphere.
- **High-carbon:** An energy source that releases a lot of carbon dioxide gas into the atmosphere. Fossil fuels are one example of a high-carbon energy source.

7. Read Arielle's ideas about nuclear energy. She is telling you that nuclear energy is not renewable but it is low-carbon to zero-carbon. Are there any other sources of energy you can think of that are also low- to zero-carbon?

### Arielle Says . . .



I would classify commercial nuclear power plants as low- to zero-carbon, because carbon dioxide is not emitted by nuclear power plants.

Currently nuclear power is not renewable. As long as we are continuing to mine for uranium instead of using the fuel we have left over, nuclear is not going to be renewable. We will still be creating an unnecessary impact on the environment because uranium mining is no different than any other type of mining. It's incredibly harsh to the environment.

8. Keep your *Perspectives Chart* to refer back to in the Act activity.



### **Act:** What are the characteristics of sustainable energy?

You and your team have gathered information about energy sources and perspectives. Now you will decide what is most important about energy sources for your community.



1. By yourself, think about the perspectives on energy that you believe matter most to your community. You can use:
  - a. Your *Futures Mood Board*. What are your community's **hopes** and **concerns** about the future?
  - b. The results from your **survey** from the Part 1, Task 1, Understand activity. What seemed important to the people in your community?
  - c. Your class's observations from the *Effects on Our Community* chart in Part 1, Task 2, Understand. What did you notice that made you worried? Happy?
2. Take out your *Perspectives Chart*. Is there anything important to your community that is not listed? If so, add it now under the appropriate perspective.
3. Within each perspective section, have each person on your team make a mark, such as a checkmark or a plus sign, next to the three things they think are most important.
4. After your team has finished, examine each perspective section. Circle the three characteristics from each perspective that have the most marks next to them.
5. With your team, take out a piece of paper and title it "Sustainable Energy Statement." Then write, "We think sustainable energy needs to be . . ." Then fill in the rest of the statement using the circled items on your *Perspectives Chart*. Remember, sustainable requires balancing the four perspectives. Sustainable energy is energy that can help people meet their needs now without harming or risking the future of the next generation.
6. Read over your *Sustainable Energy Statement*. Is everyone on the team comfortable with it?
7. Have each team member share your *Sustainable Energy Statement* with a friend or family member. Do they agree or do they have new ideas they want to add to the statement?
8. Bring those ideas back to your team and pay attention to any ideas your teammates gathered. Is there anything you want to add to your statement to help you remember important ideas from your community?
9. Keep your *Sustainable Energy Statement*. You will need it in the next task.



## Task 2: Which energy sources could help my community create a sustainable energy future?

You and your team are using this guide to help you create a more sustainable energy future for your community. Part of that work involves choosing sources of energy that help your community achieve that future. But how can you make the right choices for your community?

In this task you will **discover** how to analyze different energy sources from different perspectives. You will gather information to **understand** more about each source. Finally, you will **act** to rank which energy sources seem to support the sustainable energy future you've imagined for your community.



### **Discover:** *What are the characteristics of different energy sources?*

Think about the last time you remember someone discussing a source of energy. What kinds of words or did they use? They may have used words like “sustainable,” “renewable,” “clean,” or “affordable.” Experts sometimes use words like these to describe the characteristics of energy sources.

But remember that *you* are an expert in your community. You can describe energy sources using the characteristics you think are most important. Doing this can help you figure out which energy sources are the right fit for your community’s sustainable energy future.

1. Take out your Sustainable Energy Statement and your Energy Source Cards.
2. Pull out the Nuclear Energy Energy Source Card. You will do this exercise together as a team as an example.
3. Write “social,” “environmental,” “economic,” and “ethical” on the Nuclear Energy card.
4. Reread your Sustainable Energy Statement to help remind you of the most important parts of the different perspectives on energy.
5. Read Characteristics of Nuclear Energy. Pay close attention to the perspectives you notice.



## Characteristics of Nuclear Energy

Nuclear energy is a low-carbon resource. It is not considered renewable because it uses a certain kind of metal, uranium, that cannot be replaced. Nuclear power plants don't take up very much space but they produce a lot of electricity. They are reliable, meaning they produce energy 24 hours a day. Nuclear power plants are expensive and can take a long time to build. If nuclear power plants leak their materials, it can have very serious and dangerous effects on the living things in the community. This has happened a few times in the past, and people and other living things in the area around the nuclear plants have died or were harmed in other ways.

6. Write the characteristics you notice about nuclear energy next to each perspective on your Nuclear Energy Energy Source Card. For example, based on the Characteristics of Nuclear Energy you might write:
  - a. Social: reliable energy
  - b. Environmental: low-carbon, not renewable, uranium mining, doesn't take a lot of space
  - c. Economic: expensive to build
  - d. Ethical: can be dangerous to people and other living things nearby if it leaks
7. Divide the remaining eight Energy Source Cards up among your team. It is okay if one person has more than one card. It is also okay if several people have one card.
8. On each Energy Source Card write "social," "environmental," "economic," and "ethical."
9. Read Characteristics of Energy Sources to find out more about the energy source on your card.

## Characteristics of Energy Sources

### **Solar Energy**

Solar energy is renewable and low-carbon. Solar energy is most useful in parts of the world that get lots of sun, like countries near the **equator**. Solar panels can be expensive to install but can generate low-cost electricity, as long as the sun is shining. They can be installed in many kinds of spaces, such as in deserts or open



fields or on top of houses and other buildings. Sometimes the panels need large amounts of space to generate enough electricity for a community. This can take away space from other living things in the area. Solar panels are built with special minerals. Sometimes mining these minerals can cause harm to the people and communities that work or live near the mine.

### **Wind Energy**

Wind energy is renewable and low-carbon. Wind energy is best used in places that get steady and continuous wind throughout the year. Wind energy can be expensive to install but can generate low-cost electricity, as long as the wind is blowing. Some people do not like the way wind turbines look, the noise they make, or their large size, and don't want them near their communities.

### **Hydropower and Ocean Energy**

Hydropower is renewable and low-carbon. As long as water is flowing, hydropower plants can generate electricity. Hydropower can be used in places with moving water, such as rivers or oceans. Some hydropower plants use a dam to control the flow of water. Those dams can cause harm to the living things in the water or to the people in the communities nearby. Dams can also be expensive to build, although once they are built they can generate electricity for a long time.

### **Biofuel Energy**

Biofuel is a renewable resource. It comes from living things (or things that were once living), such as wood, algae, corn, or animal poop or fat. Biofuels are usually burned to generate heat or electricity. Burning biofuels produces carbon dioxide, but less than when you burn fossil fuels. Biofuels can be burned any time of day. Sometimes waste products are used for biofuel, which captures energy from something that otherwise would be discarded. Other times plants are grown to use as biofuels. Growing plants for biofuels can take up a lot of space and involve using water, fertilizers, and machinery that can have negative effects on the environment. When biofuel crops compete with food crops for space, it can make the cost of food go up. Biofuels can be transported from one place to another.





## Geothermal Energy

Geothermal energy is a renewable and low-carbon resource. It uses heat from under Earth's surface to produce electricity or to heat water for cooking or cleaning. Places with a lot of **geologic activity**, such as places with volcanoes or earthquakes, can use geothermal energy to power an entire community. But it can also be used in places with little geological activity to power smaller areas like a house or building. Geothermal energy is constant, meaning it is always available. Geothermal energy can be expensive to build, especially if you want to use it in a single home or building. But, like solar and wind, the cost over a long period of time is very small.

## Oil or Petroleum

Oil is a fossil fuel, is not low-carbon, and is non-renewable. Oil is a liquid that forms when living things die, are covered in layers of dirt and rock, and are compressed. Burning oil can generate heat and electricity. Oil can also be changed into other products, like gasoline. Oil produces a lot of carbon dioxide. It can be less expensive than some other energy sources. It can be transported from one place to another and can be burned any time of day. Getting oil out of the ground can harm the people or other living things nearby. When oil leaks into the environment it can have very serious and dangerous effects on the living things in the community.



*Figure 2.2: This oil pipeline passes very close to a national wildlife refuge.*



## Coal

Coal is a fossil fuel, is not low-carbon, and is non-renewable. Coal is a solid that forms when living things die, are covered in layers of dirt and rock, and are compressed. Burning coal can generate heat and electricity. Burning coal produces a lot of carbon dioxide. Removing coal from the ground disturbs and harms the living things nearby and can be dangerous for the people doing the mining. Coal can be less expensive than some other energy sources. It can be transported from one place to another and can be burned any time of day.

## Natural Gas

Natural gas is a fossil fuel, is not low-carbon, and is non-renewable. Natural gas is a gas that forms when living things die, are covered in layers of dirt and rock, and are compressed. Burning natural gas can generate heat and electricity. Burning natural gas produces a lot of carbon dioxide, though not as much as coal. It can be less expensive than other energy sources. It can be transported from one place to another and can be burned any time of day. Getting natural gas out of the ground can sometimes harm the people and other living things nearby. It burns very easily, and can be dangerous if it leaks from where it is stored.

10. Fill in each of the perspectives for your Energy Source Card or cards, just as you did for nuclear energy.
11. Form a circle and pass the cards around the circle. Read each card before you pass it along to the next person.
12. Discuss with your team:
  - a. Which perspectives are easiest to understand?
  - b. What information do you think is missing?





## **Understand:** How can we learn more about the characteristics of energy sources?

In the previous activity you and your team started to think about the characteristics of energy sources, based on a brief description. But you have access to more **data** than just this guide. In this activity you will research more about the different energy sources.

1. Take out your Nuclear Energy *Energy Source Card*. Write “Benefits” and “Concerns” on the card.
2. Think about any additional questions you have about nuclear energy. How could you answer those questions?
3. One way to answer questions is to ask an expert. Read Arielle’s two quotes. Add any information you learn from Arielle to the *Benefits* and *Concerns* on your card. Use other information on your card to write any additional benefits or concerns.

### **Arielle Says . . .**



One of the big criticisms I have about nuclear power is the people developing it didn’t think about the waste at first. They kept saying, “We’ll worry about it later; it will be tomorrow’s problem.” Well, eventually tomorrow came. The waste became this big problem that nobody wanted! We have to think about how to handle nuclear waste *now*,

because the cheapest, cleanest, easiest way to solve these issues is now, not later.

It’s not just the waste. Getting more fuel for **nuclear reactors** also has an effect. When you ask where we’re going to get more uranium, you hear, “Oh well, we’ll just go **mine** for more.” Okay, well that’s going to impact a community. There is currently only one active uranium mine in the United States. Most uranium mines are in Kazakhstan, Canada, and Namibia. There are a lot of environmental, social, and ethical issues with mining uranium. We should focus on finding a way to use the nuclear waste we already have generated before mining more.





Figure 2.3: This is an open pit mine. This mine is for iron. Open pit mining is one of the ways to mine uranium from the earth.

### Arielle Says . . .



One of the benefits of nuclear power is that it has the real potential of eliminating our dependence on fossil fuels for energy production. As in, *today*. We could replace the fossil fuel power plants we have with nuclear power plants.

I'm hopeful we can find a way to combine nuclear with low-carbon sources of energy, such as wind and solar.

4. Take out your remaining eight *Energy Source Cards*.
5. Divide the cards equally among your team members. Your team can decide whether each person wants to use the same cards as you did during the Discover activity or switch cards.
6. Think about any remaining questions you have about your energy source. What information from the Part 1 survey, Community Energy Observation, or Community Effects Investigation can you add to your cards?



- a. For example, suppose you are responsible for the Solar Energy Energy Source Card, and in your community energy observations you noticed that people said they liked that solar energy was renewable, but the energy was only available when it was sunny out. This is helpful information to add to the card.
7. Read At the Smithsonian. How easy would it be to replace fossil fuels with sustainable energy in your community? What might be the challenges? Add those answers to your Energy Source Cards.



### ***At the Smithsonian***

Dr. Hal Wallace is curator of the electricity collections at the National Museum of American History in the Smithsonian Institution. Hal's job is to do research that helps educate people about the past and future of energy and electricity. Remember his quote as you find out more about energy sources.

"It's easy to say, 'Change to sustainable energy!' but you have to combine sustainable energy sources into the system that already exists. That can be difficult. For example, certain kinds of sustainable energy are not available all the time. Denmark found this out a few years ago. They get a lot of wind power from the winds on the North Sea. But they had a huge storm and their wind turbines had to shut down because the wind was actually too strong. The whole country lost power for several days."

8. Work on your own or as a team to research more information to add to your Energy Source Cards. Write "Benefits" and "Concerns" on each card.
9. Research about the benefits and concerns related to the energy source you were assigned. You can use books, articles, podcasts, websites, videos, interviews with experts, conversations with people in your community, or resources on the Energy! StoryMap.
10. Come back together with your team and read Arielle's quote. Discuss as a group, what are the benefits and concerns of using nuclear energy?



## Arielle Says . . .



There are certain situations where solar and wind make sense. People should have those opportunities. I just want people to understand the limitations, too. So much energy is lost on power lines as the energy is **transmitted** to each community that needs it. In my opinion, when you need to power entire states, you need something that creates a lot of electricity, like nuclear energy, to help overcome the losses on the power lines.

Each solar panel generates an average of 2 **megawatts** of electricity. Which is great if you're powering something with relatively small energy requirements, like a home. But a nuclear power plant can generate 1,600 megawatts of electricity. Nuclear energy can deliver more power and use less land.

11. Share with the team what you have learned about your energy source. Have each team member explain the benefits and concerns about using the energy source they researched.



### **Act:** *What energy sources meet the needs of my community?*

In this part, you and your team have examined what you already know about energy sources. You have also thought about what characteristics of energy sources are most important to you and your community. Now you will use this information to help you rank each energy source according to how it might help meet the needs of your community.

1. Gather as a team.
2. Get out your *Futures Mood Board*.
3. Quickly review the hopes and concerns on the board.
4. Read what Arielle says about why someone might want to use nuclear energy. How does that relate to the hopes and concerns of your community?



## Arielle Says . . .



If young people are trying to choose an energy source for their community, a coal power plant is going to have a lot of environmental impacts right away that nuclear power just isn't. With nuclear, you aren't getting fumes and **carcinogens** into the air. You often see photos of nuclear cooling towers and people think the white substance coming out is pollution, but it isn't. That's steam and water vapor! It's not pollution!

With nuclear, there are always concerns of radiation getting into water or the living things in the community. But nuclear uses a sealed system so nothing is dumped into water sources. And because nuclear power plants produce so much energy, they can be placed farther away from where people live. Nuclear power plants are also highly **regulated** by the government and have inspectors at each power plant.

But especially given all the concerns around the safety of using nuclear, I think we need to be more **transparent** with people rather than less. It needs to be okay for someone to say, "I don't want this in my community!"



*Figure 2.4: Steam rises from the cooling towers of a nuclear power plant.*



5. Examine your other *Energy Source Cards*. Pay attention to your perspectives, benefits, and concerns. Are there any energy sources that you think might best help address the hopes and concerns of your community?
6. Arrange your *Energy Source Cards* in the order you think they would be most helpful for your community.
7. Record how you have arranged the cards using a photo, drawing, list, numbering the cards, or some other way. You will keep adding to your *Energy Source Cards* as you complete this guide. You might change your mind about which energy sources help meet the needs of your community, so it's important to be able to reflect back on what you thought in this part.

## Congratulations!

### You have finished Part 2.

#### *Find out More!*

For additional resources and activities, please visit the *Energy!* StoryMap at <http://bit.ly/3Kx41Jy>.





## Glossary

This glossary can help you understand words you may not know. You can add drawings, your own definitions, or anything else that will help. Add other words to the glossary if you would like.

**Access:** Able to reach a place, thing, or idea

**Atom:** A very tiny particle that makes up all the things on Earth

**Biofuel energy:** A renewable resource that comes from living things (or things that were once living), such as wood, algae, corn, or animal dung or fat

**Carcinogens:** Substances that cause cancer

**Chemical energy:** Energy that is stored in the connections between atoms and molecules

**Coal:** A solid non-renewable resource that forms when living things die, are covered in layers of dirt and rock, and are compressed

**Community:** A group of people who share something in common, such as a space or an identity

**Compressed:** Flattened or pressed together

**Concern:** Something that causes anxiousness, worry, or fear

**Consensus:** A balanced decision that works for everyone in the group



**Data:** Facts and statistics that have been collected about a topic

**Economic:** Concerned with money, income, or the use of wealth

**Emit:** To give off or give out something

**Energy:** Anything that gives the ability to do work

**Engineer:** A person who designs, builds, and maintains machines, structures, and technology that solves problems

**Environmental:** About the natural world

**Equator:** A line that goes around the middle of the globe dividing the northern and southern hemispheres

**Ethical:** The fairness of something

**Fossil fuel:** A type of fuel that comes from the fossilized remains of plants and animals

**Geologic activity:** The movement of Earth's tectonic plates that can cause earthquakes and the formation of volcanoes

**Geothermal energy:** Heat from the Earth that can be used to generate electricity

**Greenhouse gases:** Gases such as carbon dioxide and methane that cause the atmosphere to get warmer



**Hope:** Something that is desired, wished for, or wanted

**Hydropower and ocean energy:** A renewable and low-carbon resource that converts energy from moving water into electricity

**Identity:** The characteristics that make you you

**Infrastructure:** Built things that stay in your community(for example, bridges, buildings, train tracks)

**Low-carbon:** An energy source that releases very little carbon dioxide gas into the atmosphere

**Megawatt:** A way to measure electricity; 1 megawatt is 1 million watts

**Mine:** To remove something valuable from the ground

**Natural gas:** A non-renewable resource that forms when living things die, are covered in layers of dirt and rock, and are compressed

**Non-renewable:** Impossible or difficult to replenish

**Non-renewable energy:** Energy sources that run out faster than they can be naturally replaced

**Nuclear energy:** A low-carbon resource that works by breaking apart the center of atoms in uranium and using the energy from that reaction to generate electricity

**Nuclear reactor:** The part of the nuclear power plant that produces nuclear energy



**Petroleum (oil):** A liquid non-renewable resource that forms when living things die, are covered in layers of dirt and rock, and are compressed

**Perspectives:** The different ways we think about the world around us

**Power plant:** A place where electricity is generated for many people

**Regulated:** Controlled by law or an authority; required to follow certain rules

**Renewable:** Easily replenished

**Renewable energy:** Energy sources that are not likely to run out for a very long time or are replaced as fast or faster than they can be used

**Sediment:** Material that settles at the bottom of a body of water, or material that is deposited by wind, water, or glaciers

**Social:** The interaction of people in the community and their education, health, and well-being

**Solar energy:** A renewable and low-carbon resource that converts light energy from the sun into electricity using solar panels or uses the heat of the sun to heat water or other substances

**Social:** Relating to the interaction of people in a community

**Sustainable:** An approach that balances different perspectives and can keep working for a long time



**Sustainable energy:** Energy that can help people meet their needs now without harming or risking the future of the next generation

**Transmitted:** Moved from one place to another

**Transparent:** Easily accessed and understood

**Turbine:** A device spun by wind, water, steam, or gas that generates electricity

**Uranium:** An element of matter on Earth that is used in nuclear reactors

**Wind energy:** A renewable and low-carbon resource that converts wind, or the movement of air, into electricity using a wind turbine

**Zero-carbon:** Releases no carbon dioxide into the atmosphere

